A TRUE EXPERIMENTAL STUDY TO ASSESS THE EFFECTIVENESS OF RURAL OBESITY REDUCTION PROGRAM (BEHAVIOURAL INTERVENTIONS) ON KNOWLEDGE, ATTITUDE, PRACTICE TOWARDS OBESITY AND OBESITY REDUCTION AMONG THE OBESE ADULT POPULATION AT SELECTED RURAL COMMUNITIES OF OMAYAL ACHI COMMUNITY HEALTH CENTRE

THESIS

Submitted to

THE TAMIL NADU DR. M.G.R MEDICAL UNIVERSITY, CHENNAI

for the award of the degree of

DOCTOR OF PHILOSOPHY

IN

NURSING

By

R. PADMAVATHI

JANUARY 2014

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RESEARCH GUIDE

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I hereby declare that this thesis entitled "**A TRUE EXPERIMENTAL STUDY TO ASSESS THE EFFECTIVENESS OF RURAL OBESITY REDUCTION PROGRAM (BEHAVIOURAL INTERVENTIONS) ON KNOWLEDGE, ATTITUDE, PRACTICE TOWARDS OBESITY AND OBESITY REDUCTION AMONG THE OBESE ADULT POPULATION AT SELECTED RURAL COMMUNITIES OF OMAYAL ACHI COMMUNITY HEALTH CENTRE"** is my own work carried out under the guide ship of **Dr. REVATHY VIJAYALAKSHMI, M.D., Ph.D., Research Guide, Omayal Achi College of Nursing** which was approved by the Research Committee, The Tamil Nadu Dr.M.G.R Medical University, Guindy, Chennai.

I further declare that to the best of my knowledge the thesis does not contain any part of any work which has been submitted for the award of any degree either in this University or in any other University / Deemed University without proper citation.

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Place :

Date :

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LIST OF ABBREVIATIONS

NCDs	-	Non Communicable Diseases
DR-NCDs	-	Diet Related Non Communicable Diseases
DALYs	-	Disability Adjusted Life Years
WHO	-	World Health Organisation
GSR	-	Global Status Report
IHPS	-	International Heart Protection Summit
OECD	-	Organisation for Economic Cooperation and Developments
NHNES	-	National Health and Nutrition Examination Survey
NCHS	-	National Centre for Health Statistics
GHO	-	Global Health Observatory
NFHS	-	National Family Health Survey
GBD	-	Global Burden of Disease report
AFR	-	African Region
AMR	-	Region of the Americas
EMR	-	Eastern Mediterranean Region
EUR	-	European Region
SEAR	-	South East Asia Region
WPR	-	Western Pacific Region
SSA	-	Sub Saharan Africa
SAI	-	South Asian Indians
PCOS	-	Poly Cystic Ovarian Syndrome
OHS	-	Obesity Hypoventilation Syndrome
COPD	-	Chronic Obstructive Pulmonary Disease

DM	-	Diabetes Mellitus
GDM	-	Gestational Diabetes Mellitus
CVD	-	Cardio Vascular Diseases
HTN	-	Hypertension
CHD	-	Coronary Heart Disease
LDL	-	Low Density Lipoprotein
HDL	-	High Density Lipoprotein
SFA	-	Saturated Fatty Acids
TFA	-	Trans Fatty Acids
MUFA	-	Mono Unsaturated Fatty Acids
PUFA	-	Poly Unsaturated Fatty Acids
ICMR	-	Indian Council of Medical Research
OACHC	-	Omayal Achi Community Health Centre
SES	-	Socio Economic Status
HDI	-	Human Development Index
NCD's	-	Non Communicable Diseases
CKD	-	Chronic Kidney Disease
HD	-	Hemo dialysis
DM	-	Diabetes Mellitus
BPH	-	Benign Prostatic Hyperplacia
NASH	-	Non Alcoholic Steato Hepatitis
OA	-	Osteo Arthritis
APMBSS	-	Asia Pacific Metabolic and Bariatric Surgery Society
LAGB	-	Laparoscopic Adjustable Gastric Banding
LRAYGB	-	Laparoscopic standard Roux-en-Y Gastric Bypass

LSG	-	Laparoscopic Sleeve Gastrectomy
LMGB	-	Laparoscopic Mini Gastric Bypass
KBW	-	Knowledge Based Work
MDGs	-	Millennium Development Goals
TLC	-	Therapeutic Lifestyle Changes
METs	-	Metabolic Equivalents of Task
PA	-	Physical Activity
BMI	-	Body Mass Index
WC	-	Waist Circumference
PBF	-	Percent Body Fat
FFQ	-	Food Frequency Questionnaire
RORP	-	Rural Obesity Reduction Programe
IEC	-	Information Education and Communication
OACHC	-	Omayal Achi Community Health Centre
VHET	-	Village Health Empowerment Training
NS	-	Not Significant
SD	-	Standard Deviation

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ABSTRACT

Non communicable diseases (NCDs), also referred to as chronic diseases, are the leading causes of death worldwide responsible for 63% of the 57 million deaths that occurred in 2008. The majority of these deaths -36 million - were attributed to cardiovascular diseases and diabetes, cancers and chronic respiratory diseases, and also 80 percent of NCD deaths were in developing countries, up from 40 percent in 1990. NCDs will steadily increase the number of healthy years lost (or disability-adjusted life years—DALYs) in middle-income countries, but the loss will increase very quickly in low-income countries. By 2030, low-income countries will have eight times more deaths attributed to NCDs than high-income countries[1].

According to WHO Metabolic/physiological risk factors like raised blood pressure, overweight/obesity, hyperglycemia (high blood glucose levels) and hyperlipidemia (high levels of fat in the blood) causes key metabolic/physiological changes that increase the risk of NCDs. In terms of attributable deaths, the leading NCD risk factor globally is elevated blood pressure (to which 16.5% of global deaths are attributed) followed by tobacco use (9%), raised blood glucose (6%), physical inactivity (6%) and overweight and obesity (5%). Low- and middle-income countries are witnessing the fastest rise in overweight among young children[5].

Overweight and obesity are strongly associated with diseases such as diabetes, hypertension (HTN), cardiovascular disease (CVD) and the metabolic syndrome. Rising rates of obesity is an epidemic in most of the developed countries and is becoming a major health hazard in many developing nations as well. Rapid urbanization,

modernization, and adoption of a lifestyle with reduced physical activity and increasing intake of calories have resulted in rising rates of obesity in several developing countries[7].

Obesity level in India is on the rise. If rising trends are to be halted and reversed, current approaches to addressing obesity needs to be changed. The following are the suggested strategies to control the obesity. (i) to educate the obese clients and promote the healthy lifestyle (ii) early detection of persons with risk factors and (iii) cost–effective interventions for reducing risk.

A true experimental study to assess the effectiveness of Rural Obesity Reduction Program (Behavioural intervention) on Knowledge, Attitude, Practice towards Obesity and Obesity reduction among the obese adult population at selected rural communities of Omayal Achi Community Health Centre. The abstract was presented as introduction, method, results, analysis and discussion (IMRAD) format of writing.

The objectives of the study were

1. To assess and compare the pretest and post test level of knowledge, attitude, practice and obesity among the obese adults of experimental and control groups.
2. To determine the effectiveness of Rural Obesity Reduction Program on knowledge, attitude, practice and obesity reduction of obese adults.
3. To identify the relationship among the knowledge, attitude, practice and obesity reduction in the pre and post test of experimental and control group.
4. To associate the mean differed knowledge, attitude, practice and obesity reduction of obese adults of the experimental group with their selected demographic variables.

The null hypotheses formulated for the study were

NH_1: There is no significant difference in the pre and post test level of knowledge, attitude, practice and obesity reduction among the obese adults within and between the experimental and control group at $p<0.05$.

NH_2: There is no significant relationship among the knowledge, attitude, practice and obesity reduction in the pre and post test of the experimental and control group at $p<0.05$.

NH_3: There is no significant association of mean differed knowledge, attitude, practice and obesity reduction of obese adults of the experimental group with their selected demographic variables at $p<0.05$.

The research process for this study was guided by the conceptual framework based on the integrated Omaha System model of problem solving process and Integrated Theory of Health Behaviour Change (ITHBC).

A true experimental research design was adopted for the study. The independent variable for the study was Rural Obesity Reduction Programme and the dependent variable for the study was knowledge, attitude, practice towards obesity and obesity reduction. The study was conducted in 6 adopted villages of Omayal Achi Community Health Centre. The samples of the study were all obese adults between the age group of 20-50 years. Probability multi stage sampling technique was used to select the villages and sample for the study.

The data collection instrument was the Structured Interview Questionnaire to assess the knowledge on obesity, five point attitude scale to assess the attitude towards

obesity, three day dietary recall, food frequency questionnaire (FFQ), dietary, physical activity and lifestyle practices check list to assess the practice towards obesity and bio physiological measurements of BMI, WC and PBF to assess the level of obesity. The data collection was preceded with the obesity screening and the adults identified as obese were allocated to experimental and control group.

In the first week, pre test assessment was done. After completing the three day dietary recall in the pre test Rural Obesity Reduction Programme (RORP) was administered on the same day. RORP consisted of IEC on general aspects of obesity using flash card, low calorie diet prescription for dietary modification and recommendation on walking exercise for physical activity modification and personalised individual counselling to bring behavioural changes. Intervention was given for a period of 12 weeks. The post test 1 assessment was carried out after six weeks. Post test 2 assessment was done at 12^{th} week to assess the obesity level. Totally 12 weeks were allotted to complete the data collection process with each individual. The obtained data was analysed using descriptive and inferential statistics.

The major findings of the study were

- The analysis revealed that in the experimental group, the overall mean knowledge score in the post test was 19.81 with S.D of 2.31 whereas in control group, it was 11.19 with S.D of 2.18. The unpaired 't' test value was t = 28.47 which was greater than the table value at p=0.001 and revealed that there was a high significant difference between the experimental and control group at $p<0.001$ level.
- The analysis showed that in the experimental group, the overall mean attitude score in the post test was 80.45 with S.D of 5.18 whereas in control group, it was 48.55

with S.D of 8.42. The unpaired 't' test value was t = 33.84 which was greater than the table value at p=0.001 and revealed that there was a high significant difference between the experimental and control group at p<0.001 level.

- The analysis also revealed that in the experimental group, the overall mean practice score in the post test was 129.17 with S.D of 7.49 whereas in control group, it was 84.95 with S.D of 15.51. The unpaired 't' test value was t = 26.91 which was greater than the table value at p=0.001 and revealed that there was a high significant difference between the experimental and control group at p<0.001 level.
- The analysis found that in the experimental group, the overall mean kilo calories, carbohydrates and fat consumption in the post test was 1403.47 with S.D of 183.92, 248.03 with SD of 39.26 and 28.10 with the SD of 13.95 respectively whereas in control group, it remained the same with mild increase and decrease as 2663.28 with S.D of 330.36, 428.53 with S.D of 89.44, 69.15 with S.D of 31.77. The unpaired 't' test value was t = 33.76, t=19.38 and t=5.71 which was greater than the table value at p=0.001 for all three components and revealed that there was a high significant difference between the experimental and control group at p<0.001 level.
- Analysis of food frequency revealed that there was statistically significant difference was found in the pre and post test of experimental and also between experimental and control group in the consumption of cereals, refined cereals, pulses, salty foods, yellow vegetables, green leafy vegetables, fruits, milk and milk products, fish meat and chicken, egg, sweets and chocolates, instant foods, coffee and tea and use of palm oil between the experimental and control group in the post test.
- Regarding the Obesity reduction the analysis revealed that in the post test of experimental group, the overall mean BMI, WC and PBF was 25.52 with S.D of 2.89, 88.46 with SD of 7.20 and 32.49 with the SD of 5.35 respectively whereas in

control group, it remained the same with mild increase and decrease as 28.00 with S.D of 3.11, 90.85 with S.D of 6.84 and 34.69 with S.D of 5.44. The unpaired 't' test value was t = 6.12, t=2.52 and t=2.14 which was greater than the table value at p=0.001, p=0.01 and p=0.03 for all three components and revealed that there was a high significant difference between the experimental and control group.

- Chi-square test revealed that there was statistically significant association was found between the study variables knowledge, attitude, practice and obesity reduction and the selected demographic variables of age, gender, education, family history of NCDs, personal history of NCDs and habit of exercise.
- The evidence generated from the study revealed that for the experimental group the Rural Obesity Reduction Programme had significant impact in improving the knowledge, attitude, practice and level of obesity reduction at p=0.001 level. The calorie, carbohydrate and fat consumption also was reduced and there was statistically significant difference at p=0.001 level. There was also fair correlation among the knowledge, attitude, practice and level of obesity reduction. Hence there was statistically significant difference between the experimental and control group.

CONCLUSION

The study concluded that the RORP is an effective intervention strategy in the prevention and management of obesity. Hence, the study recommended the utilization of RORP by the Community Health Nurses, Nurse Researchers, Nurse Administrators, Nurse Educators and Primary and Secondary health care professionals to prevent and manage obesity, to increase awareness towards obesity and to change the behaviour towards the lifestyle modifications.

CHAPTER - 1

INTRODUCTION

When God created the earth he created man, animals, plants and even microorganisms in it so that everyone in his creation would live in harmony with the other. Several human activities such as destruction of forests, changes in agriculture, encroachment on wildlife habits and uncontrolled industrialization have led to the emergence of viruses, bacteria, protozoa and spread of diseases like plague, small pox, tuberculosis, typhoid, cholera, etc., When these communicable diseases were at its peak; the advent of death or illness due to accidents caused due to the carelessness of our co-human beings. Then came in an era where the poor and unhealthy daily activities of individual themselves posed a great threat to their own life and survival resulting in non communicable diseases. There has been a big shift in the health burden of the world with a change from communicable to non-communicable diseases. The situation has come now that the scientists, researchers and policy makers who work on NCD's have to formulate health care policies and prevention programs urgently.

Non communicable diseases (NCDs), also referred to as chronic diseases, are the leading causes of death worldwide responsible for 63% of the 57 million deaths that occurred in 2008. The majority of these deaths almost 36 million were due to cardiovascular diseases, diabetes, cancers and chronic respiratory diseases. Majority 80 percent of NCD deaths were in developing countries, up from 40 percent in 1990. NCDs will steadily increase the number of healthy years lost (or disability-adjusted life years—DALYs) in middle-income countries and the loss will be very rapid in low-income countries. By 2030, low-income countries will have eight times more deaths due to NCDs than high-income countries[1].

Alarmingly, NCD-related mortality occurs at earlier ages in developing countries: 29 percent of NCD-related deaths in developing countries occur before the age of 60, when compared with 13 percent in developed countries. For example, the average age of the first-time heart attack sufferer in South Asia is 53, six years younger than the world average. NCDs are now affecting more people who are in their prime economically productive years, and these deaths are frequently preceded by years of disability as reported by world population data sheet 2012[2].

Non communicable diseases (NCDs) do not spread from person to person. They are of long duration and generally slow in progression. The four main types of non communicable diseases are cardiovascular diseases (like heart attacks and stroke), cancers, chronic respiratory diseases (such as chronic obstructive pulmonary disease and asthma) and diabetes. NCDs already disproportionately affect low- and middle-income countries where nearly 80% of NCD deaths – 29 million – occur[5].

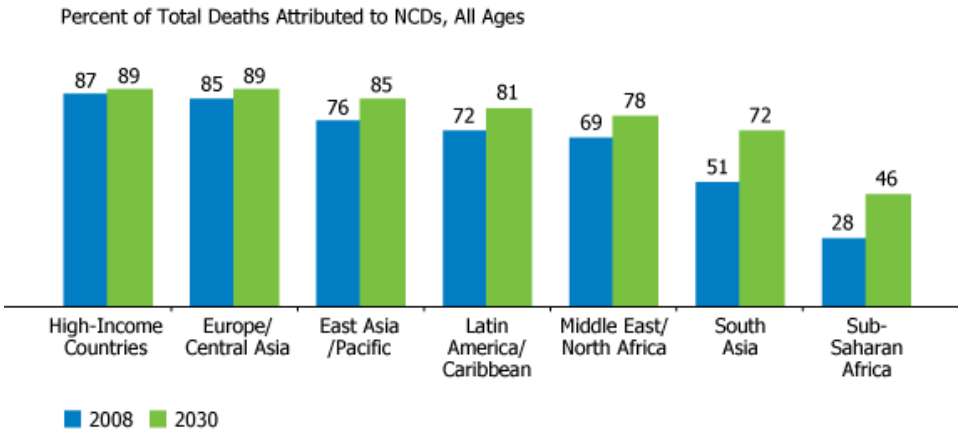


Figure: 1.1 Percentage of actual and projected total deaths attributed to NCDs in developing countries

Source: World Bank Health, Nutrition and Population Discussion Paper (2011)

NCDs are the leading causes of death in all regions except Africa, but current projections indicate that by 2020 the largest increases in NCD deaths will occur in Africa. In African nation deaths due to NCDs are projected to exceed the combined deaths of communicable, nutritional diseases and maternal and perinatal deaths as the most common causes of death by 2030[2].

Modifiable behavioural risk factors like tobacco use, physical inactivity, unhealthy diet and the harmful use of alcohol increase the risk of or cause most NCDs. Tobacco accounts for almost 6 million deaths every year (including over 600 000 deaths from exposure to second-hand smoke), and is expected to increase to 8 million by 2030. About 3.2 million deaths annually can be attributed to insufficient physical activity. Approximately 1.7 million deaths are attributable to low fruit and vegetable consumption. Half of the 2.3 million annual deaths from harmful drinking were due to NCDs. These main behavioral risk factors, tobacco use, harmful use of alcohol, insufficient physical activity, and unhealthy diet/obesity all of which will likely to escalate in developing countries[5].

According to WHO Metabolic/physiological risk factors like raised blood pressure, overweight/obesity, hyperglycemia (high blood glucose levels) and hyperlipidemia (high levels of fat in the blood) causes key metabolic/physiological changes that increase the risk of NCDs. In terms of attributable deaths, the leading NCD risk factor globally is elevated blood pressure (to which 16.5% of global deaths are attributed) followed by tobacco use (9%), raised blood glucose (6%), physical inactivity (6%) and overweight and obesity (5%). Low- and middle-income countries are witnessing the fastest rise in overweight among young children[5].

According to the World Bank, more than half of the NCD burden could be avoided through health promotion and prevention initiatives. Relying solely on treatment options to combat NCDs is very costly, particularly in developing countries where governments and health infrastructures are unprepared to respond to this growing problem. A focus on strengthening protective factors and earlier investment in prevention of NCDs among young people is therefore essential[2].

Report on Causes of Death: 2001-03, Office of Registrar General, India reported that non communicable diseases are the leading causes of death in the country, constituting 42% of all deaths. Communicable, Maternal, Perinatal and Nutritional conditions constitute another 38% of deaths. Injuries and ill-defined causes constitute 10% of deaths each. However, majority of ill-defined causes are at older ages (70 or higher years) and most of ill-defined deaths are likely to be from non-communicable diseases. Overall, the leading cause of death is cardiovascular disease (19%), followed by respiratory diseases (namely chronic obstructive pulmonary disease or COPD[8].

As of 2004, NCDs contributed half of the total mortality and were the major causes of death[10]. Among the NCDs, cardiovascular diseases are number one cause of mortality (52%). NCDs account for more than two-fifth (43%) of the DALYs and among this group, cardiovascular diseases, diabetes, cancers together account for 40% of the NCD-related DALYs in India. Regional studies have reported that even in rural India the leading cause of death (32%) is NCDs followed by injuries and external cause of deaths (12%)[11]. Projection estimates from the WHO have shown that by the year 2030, CVDs will emerge as the main cause of death (36%) in India. Since the majority of deaths are

premature, there is a substantial loss of lives during the productive years as compared to other countries.

Global Status Report on NCDs 2010 reported that In India, 52,41,400 people (29,67,600 men and 22,73,800 women) died in 2008 due to NCDs[4].

RK Srivastava, D Bachani (2011) reported that Non communicable diseases and injuries account for 52% of deaths in India. Burden of non communicable diseases and resultant mortality is expected to increase unless massive efforts are made to prevent and control NCDs and their risk factors. Based on available evidence it is visible that cancer, diabetes, hypertension, cardiovascular diseases, stroke, chronic obstructive pulmonary disease, chronic kidney disease, mental disorders and trauma are the leading causes of morbidity, disability and mortality in India.[9]

Government of India had supported the States in prevention and control of NCDs through several vertical programs since 1980s. However, during the 11th plan, there was considerable upsurge to prevent and control NCDs. New programs were started on a low scale in limited number of districts. However, there has not been any considerable change in the burden of NCDs. Based on experiences in the past, there is a need to emphasize on health promotion and preventive measures to reduce the exposure to risk factors. Facilities and capacity for screening, early diagnosis and effective management are essential within the public health care system. Public awareness program, integrated management and strong monitoring system would be required for successful implementation of the program and making services universally accessible in the country[9].

Overweight and obesity are the fifth leading risk for global deaths. At least 2.8 million adults die each year as a result of being overweight or obese. In addition, 44% of the diabetes burden, 23% of the ischaemic heart disease burden and between 7% and 41% of certain cancer burdens are attributable to overweight and obesity. WHO global estimates of 2008 reported that more than 1.4 billion adults, 20 and older, were overweight and of these overweight adults, over 200 million men and nearly 300 million women were obese. Overall, more than 10% of the world's adult population was obese. 35% of adults aged 20 and over were overweight in 2008, and 11% of them were obese[3].

In 2011, more than 40 million children under the age of five were overweight. Once considered as a high-income country problem, overweight and obesity are now on the rise in low- and middle-income countries, particularly in urban settings. More than 30 million overweight children are living in developing countries and 10 million in developed countries. Overweight and obesity are linked to more deaths worldwide than underweight. For example, 65% of the world's population live in countries where overweight and obesity kill more people than underweight (this includes all high-income and most middle-income countries)[3].

Overweight and obesity are strongly associated with diseases such as diabetes, hypertension (HTN), cardiovascular disease (CVD) and the metabolic syndrome. Rising rates of obesity is an epidemic in most of the developed countries and is becoming a major health hazard in many developing nations as well. Rapid urbanization, modernization, adoption of a lifestyle with reduced physical activity and increasing intake of calories have resulted in rising rates of obesity in several developing countries[7].

Obesity level in India is on the rise. If rising trends are to be halted and reversed, current approaches to address the obesity need to be changed. The following are the suggested strategies to control the obesity. (i) to educate the obese clients and promote the healthy lifestyle (ii) early detection of persons with risk factors and (iii) cost–effective interventions for reducing risk.[7]

1.1 BACKGROUND OF THE STUDY

Non communicable diseases (NCDs), mainly cardiovascular diseases, cancers, chronic respiratory diseases and diabetes represent a leading threat to human health and development. These four diseases are the world's biggest killers, causing 36 million deaths which constitute 63% of global death (57 million) in 2008 according to WHO statistics 2012. It is also projected that annual NCD mortality may increase up to 55 million by the year 2030[1].

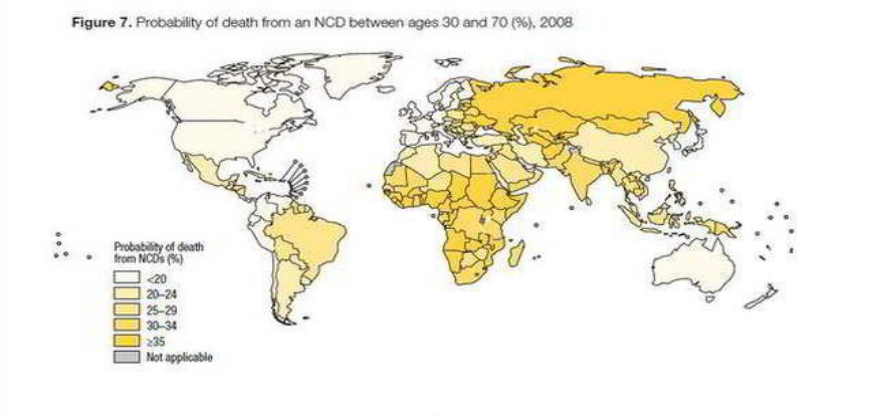


Figure: 1.1.1 Probablity of death from NCD between ages 30 and 70, 2008

Source : World Health Statistics 2012

The global burden of non communicable diseases continues to grow; tackling it constitutes one of the major challenges for development in the twenty-first century. Majority (80%) of all NCD deaths (29 million) occur in low and middle-income group countries, of which a higher proportion (48%) is estimated to occur in people under the

age of 70, compared with an estimated 26% in high income countries and a global average of 44%. Such premature death rates from NCDs are a major consideration in determining their impact[1].

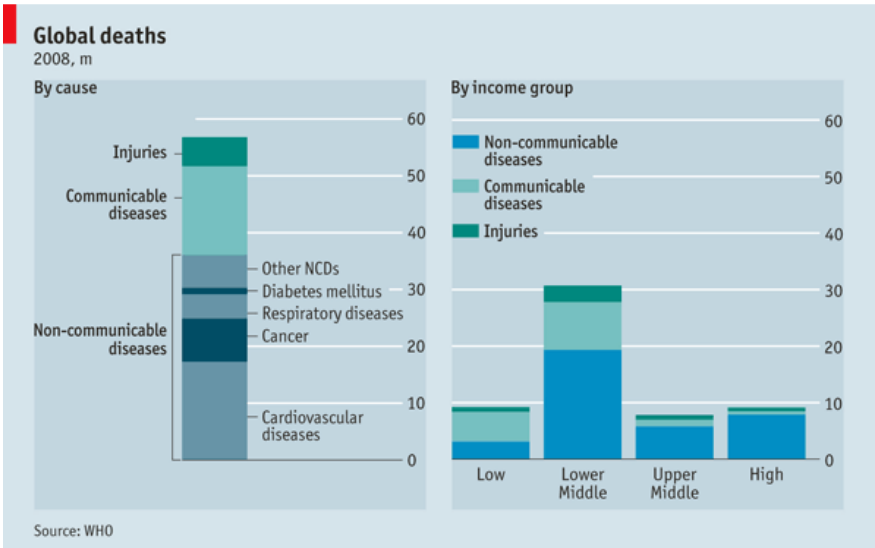


Figure : 1.1.2 Global death by cause and by income group 2008

Source : World Health Organisation

The figure highlights that the NCDs contribute to the major percentage of death and lower middle income countries contribute to higher prevalence of NCDs. Total deaths from non communicable diseases are projected to increase by a further 17% over the next 10 years. The rapidly increasing burden of these diseases is affecting poor and disadvantaged populations disproportionately, contributing to widening health gaps between and within countries. As non communicable diseases are largely preventable, the number of premature deaths also can be greatly reduced.

Figure 1. Total deaths by broad cause group, by WHO Region, World Bank income group and by sex, 2008

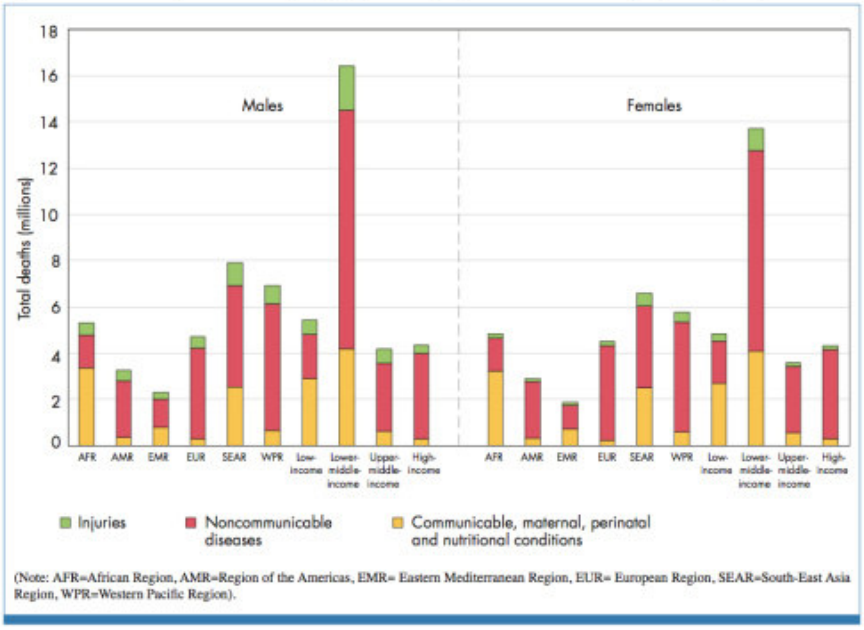


Figure : 1.1.3. Death by cause and by income group at WHO region 2008

Source : World Health Organisation, Global Status Report on NCDs 2010

The figure denotes that with the exception of the African Region, NCD mortality exceeds that of communicable, maternal, perinatal and nutritional conditions combined. For men in the European Region, deaths from NCDs are estimated to be 13 times higher than these other causes combined, and for men in the Western Pacific Region they are estimated to be eight times higher. In 2008, the overall NCD age-standardized death rates in low- and middle-income countries were 756 per 100 000 for males and 565 per 100 000 for females – respectively 65% and 85% higher than for men and women in high-income countries. Age-standardized NCD mortality rates for all ages were highest in the African Region for males (844 per 100 000) and for females (724 per 100 000). The leading causes of NCD deaths in 2008 were: cardiovascular diseases (17 million deaths, or 48% of NCD deaths); cancers (7.6 million, or 21% of NCD deaths); and respiratory diseases, including asthma and chronic obstructive pulmonary disease (COPD), (4.2million). Diabetes caused an additional 1.3 million deaths. Over 80% of

cardiovascular and diabetes deaths, and almost 90% of deaths from COPD, occurred in low- and middle-income countries. Behavioural risk factors, including tobacco use, physical inactivity, and unhealthy diet, are responsible for about 80% of coronary heart disease and cerebro vascular disease[4].

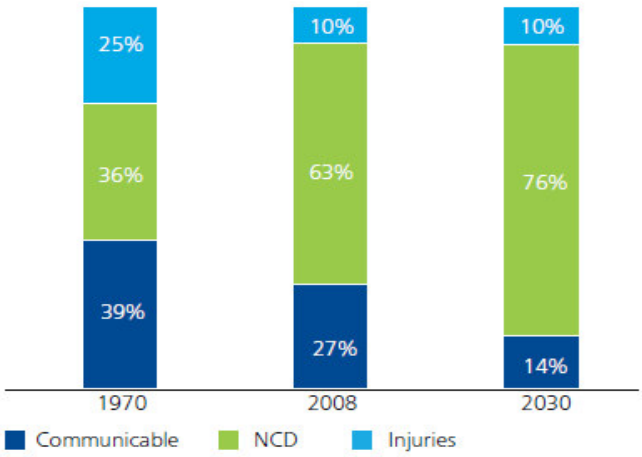


Figure: 1.1.4 Shifting disease burden – from communicable diseases to NCDs

Source: International Heart Protection Summit (2011)

The figure projects the disease burden reported by International Heart Protection Summit (IHPS) and revealed that 39% had communicable diseases and 36% were affected by NCDs in the year 1970. The communicable diseases accounted for 27% of disease burden, in contrast, 63% disease burden was due to NCDs in the year 2008, whereas a majority of 76% is expected to have NCDs by 2030[12].

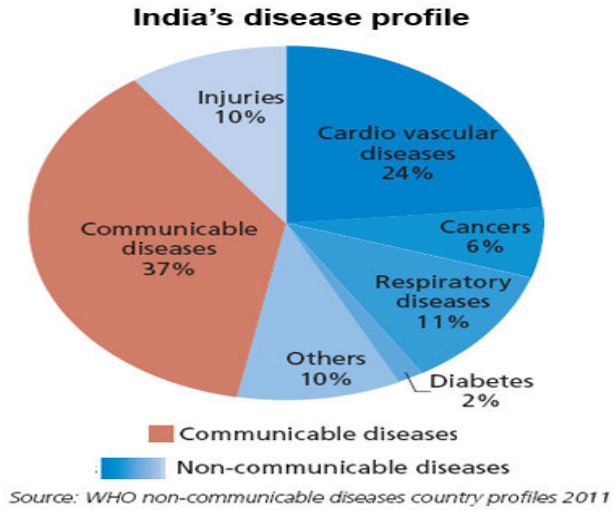


Figure: 1.1.5 India's disease profile

Source: WHO, Non Communicable diseases country profiles 2011

Figure denotes that NCDs contribute to 53% of total death in India and CVDs contribute to 24% of the total NCD mortality[13].

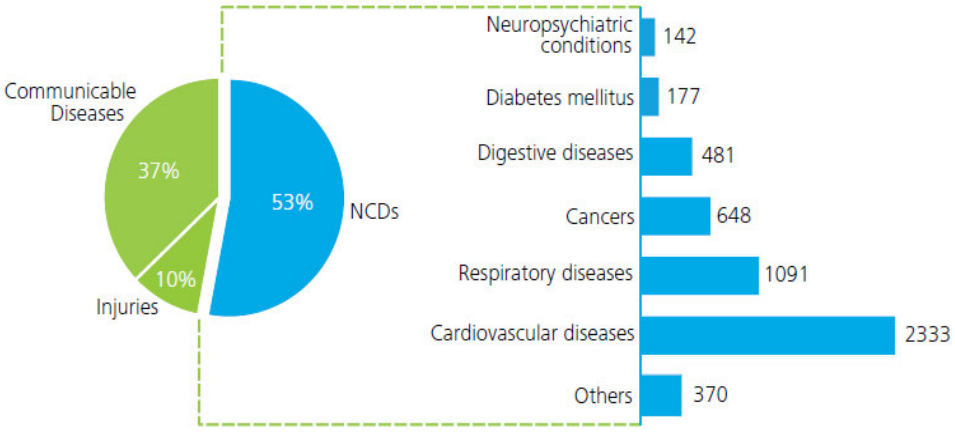


Figure: 1.1.6 Causes of death in India by 2008

Source: International health protection summit (2010)

It clearly denotes that 53% of the death was due to NCD out of which cardiovascular diseases (52%) comprised the highest proportion. Cardiovascular Disease

is estimated to be responsible for 1.5 million deaths annually. It is the largest cause of mortality, accounting for around half of all deaths resulting from NCDs, which accounts for more than two fifth (43%) of the Disability Adjusted Lost Years (DALYS)[12].

Overweight and obesity are strongly associated with diseases such as diabetes, hypertension (HTN), cardiovascular disease (CVD) and the metabolic syndrome. Rising rates of obesity is an epidemic in most of the developed countries and is becoming a major health hazard in many developing nations as well. Rapid urbanization, modernization, and adoption of a lifestyle with reduced physical activity and increasing intake of calories have resulted in rising rates of obesity in several developing countries.

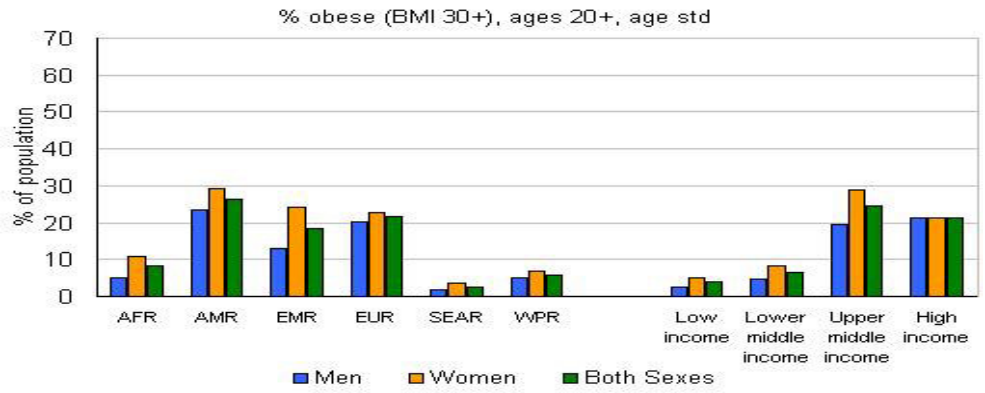
A global estimate showed that in 2005 there were nearly 1.06 billion overweight persons of age 15 years and above. Among them at least 400 million adults were obese. It is also predicted that by 2015 approximately 2–3 billion adults will be overweight and more than 700 million will be obese. Asian countries, particularly China and India are highly populous. In comparison with the developed countries such as the USA, Asian countries have considerably lower rates of overweight and obesity[7].

Obesity can be seen as the first wave of a defined cluster of non communicable diseases called "New World Syndrome," creating an enormous socioeconomic and public health burden in poorer countries. The World Health Organization has described obesity as one of today's most neglected public health problems, affecting every region of the globe[17].

WHO fact sheet on Obesity (2013) reported that in 2008 more than 1.4 billion adults, 20 and older, were overweight. Of these overweight adults, over 200 million men and nearly 300 million women were obese. Overall, 35% of adults aged 20 and over were overweight and 11% were obese. More than 40 million children under the age of five were overweight in 2011[3].

In 2008, 35% of adults aged 20+ were overweight (BMI ≥ 25 kg/m2) (34% men and 35% of women). The worldwide prevalence of obesity has nearly doubled between 1980 and 2008. In 2008, 10% of men and 14% of women in the world were obese (BMI ≥30 kg/m2), compared with 5% for men and 8% for women in 1980. An estimated 205 million men and 297 million women over the age of 20 were obese – a total of more than half a billion adults worldwide[15].

The prevalence of overweight and obesity were highest in the WHO Regions of the Americas (62% overweight in both sexes, and 26% for obesity) and lowest in the WHO Region for South East Asia (14% overweight in both sexes and 3% for obesity). In the WHO Region for Europe and the WHO Region for the Eastern Mediterranean and the WHO Region for the Americas over 50% of women were overweight. For all three of these regions, roughly half of overweight women are obese (23% in Europe, 24% in the Eastern Mediterranean, 29% in the Americas). In all WHO regions women were more likely to be obese than men. In the WHO regions for Africa, Eastern Mediterranean and South East Asia, women had roughly doubled the obesity prevalence of men[15].



AFR- African Region, AMR- American Region, EMR- Eastern Mediterranean Region, EUR-European Region ,SEAR- South East Asian Region ,WPR- Region

Figure: 1.1.7 percentage of obesity among the countries based on their income level

Source: World Health Organization, Global health observatory obesity situation and trends

The prevalence of raised body mass index increases with income level of countries up to upper middle income levels. The prevalence of overweight in high income and upper middle income countries was more than double that of low and lower middle income countries. For obesity, the difference more than triples from 7% obesity in both sexes in lower middle income countries to 24% in upper middle income countries. Women's obesity was significantly higher than men's, with the exception of high income countries where it was similar. In low and lower middle income countries, obesity among women was approximately double that among men[15]

Overweight and obesity are linked to more deaths worldwide than underweight. For example, 65% of the world's population live in countries where overweight and obesity kill more people than underweight (this includes all high-income and most middle-income countries).[3] In 2011, more than 40 million children under the age of five

were overweight. Once considered a high-income country problem, overweight and obesity are now on the rise in low- and middle-income countries, particularly in urban settings. More than 30 million overweight children are living in developing countries and 10 million in developed countries[3].

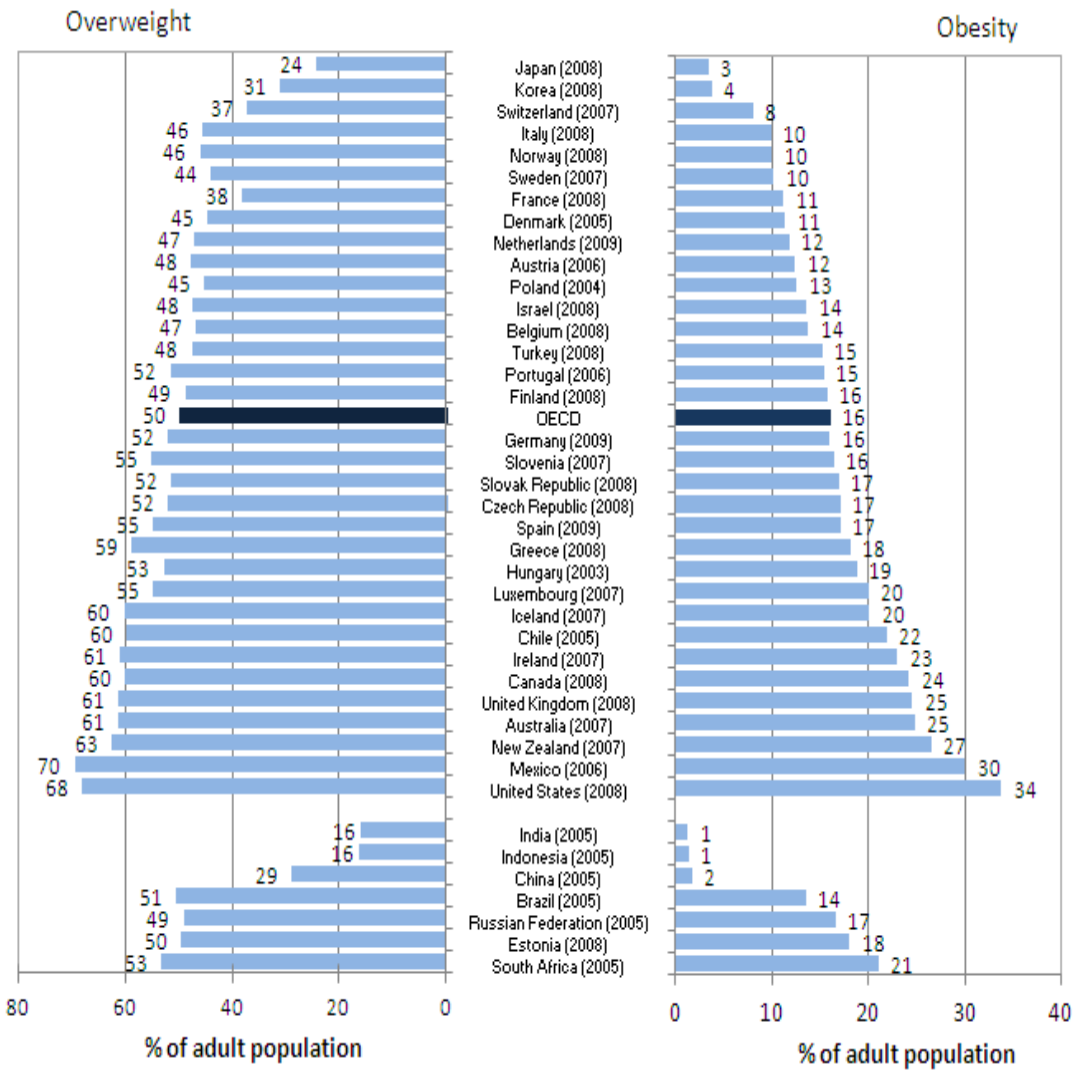


Figure: 1.1.8 percentage of population affected by overweight and obesity in the OECD countries

Source: OECD Health Data 2011

OECD (Organization for Economic Cooperation and Development) update 2012 reports that until 1980, fewer than one in ten people were obese. Since then, rates

doubled or tripled in 19 of 34 OECD countries and the majority of the population is now overweight or obese. OECD projections suggest that more than two out of three people will be overweight or obese in some OECD countries by 2020[14].

The data provide strong evidence that the progression of the epidemic has effectively come to a halt for the past ten years in countries such as Korea (where obesity rates have stabilised at (3-4%), Switzerland (7-8%), Italy (8-9%), Hungary (17-18%) and England (22-23%). There is, however, no sign of retrenchment of the epidemic, in any country. Rates remain very high in most of the countries of OECD and they continue to experience a large burden from chronic diseases associated with obesity. The prevalence of obesity today varies nearly tenfold among OECD countries, from a low of 4% in Japan and Korea, to 30% or more in the United States and Mexico[14].

The latest data show modest increases in obesity over the past decade in countries like Spain and France, in the order of 2-3%, and larger increases in Ireland, Canada and the United States (4-5%), although an even larger increase had been expected in the United States, based on previous OECD projections. These findings would seem to contradict the argument that economic recession might fuel obesity by making people's diets less healthy[14].

The OECD report also highlighted that severely obese people die 8-10 years sooner than those of normal-weight, similar to smokers, with every 15 extra kilograms increasing risk of early death by approximately 30%. Obesity is estimated to be responsible for 1% to 3% of total health expenditure in most countries (5% to 10% in the US) and costs will rise rapidly in coming years as obesity related diseases set in.

Data from the National Health and Nutrition Examination Survey, 2009–2010 of US (United States-NCHS) reported that more than one-third of adults which is 37.5% of adult population (41 million women and 37 million men) and almost 17% of youth were obese in 2009–2010. Adults aged 60 and over were more likely to be obese than younger adults. Obesity increases the risk of a number of health conditions including hypertension, adverse lipid concentrations, and type 2 diabetes[16].

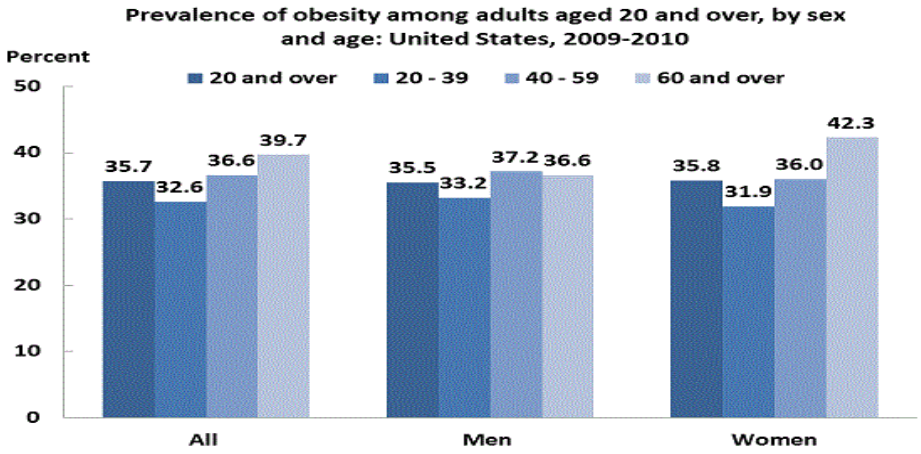


Figure: 1.1.9 prevalence of obesity among the adults in US 2009-2010 in the OECD countries
Source: National Health and Nutrition Examination Survey, 2009-2010.National Centre for Health Statistics

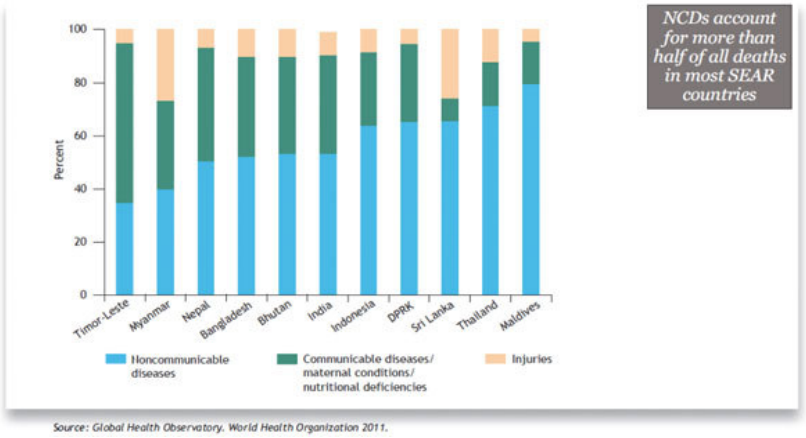


Figure: 1.1.10 Estimated percentage of deaths, by cause, in member countries of the South-East Asia Region, 2008
Source : World Health Organisation, Global Health Observatory 2011

The figure depicts that NCDs accounts for more than half of all death in most SEAR(South East Asian Region countries)[15].

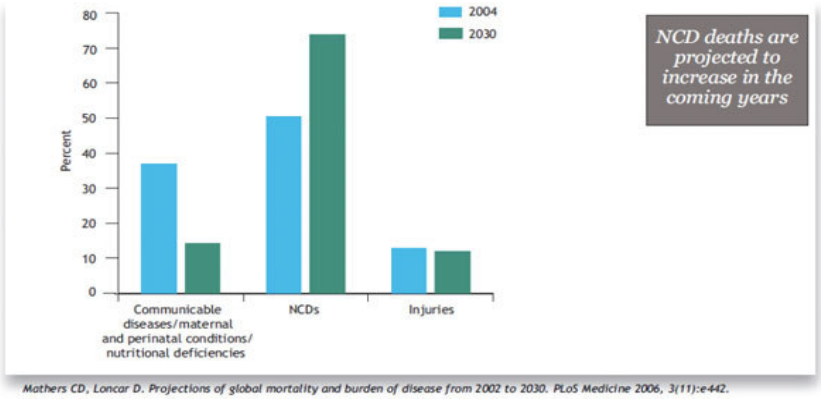


Figure: 1.1.11 Trends in estimated percentage of deaths, by cause, in South-East Asia Region, 2004 and 2030

Source : World Health Organisation, Global Health Observatory 2011

The figure explains that as per 2004 projection, NCDs deaths may increase up to 70% by 2030.[15]

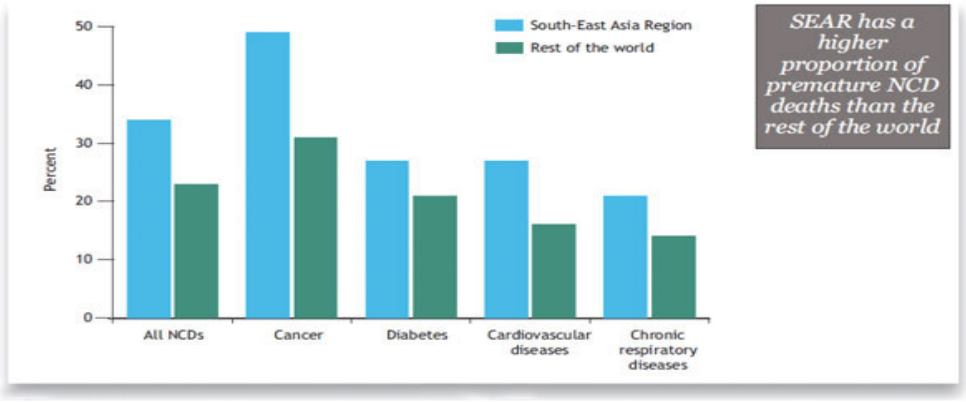


Figure: 1.1.12 Estimated percentage of premature deaths (under 60 years of age), by cause, South-East Asia Region vs rest of the world, 2008

Source : World Health Organisation, Global Health Observatory 2011

The figure shows that SEAR countries have highest percentage of deaths in all types as well as overall NCDs deaths under 60 yrs of age when compared with the rest of the world[15].

Country	All NCDs			Cancers			Diabetes mellitus			Cardiovascular diseases			Chronic respiratory diseases		
	Females	Males	Total	Females	Males	Total	Females	Males	Total	Females	Males	Total	Females	Males	Total
Bangladesh	654.7	751.2	701.7	106.2	104.5	105.0	22.1	25.6	23.8	371.0	424.2	397.2	73.7	91.7	82.5
Bhutan	667.2	801.0	735.2	119.0	131.8	124.8	18.7	26.1	22.3	372.1	444.7	409.8	73.0	93.3	83.5
DPR Korea	477.4	644.4	547.6	98.9	122.0	106.4	23.1	22.6	23.1	245.1	318.3	278.6	48.8	77.2	59.9
India	582.3	793.0	684.6	72.0	78.9	75.0	21.0	26.9	23.8	268.7	366.1	316.5	128.5	181.2	153.6
Indonesia	547.8	762.7	647.0	109.4	136.5	120.9	29.0	29.9	29.5	278.2	373.9	323.6	53.6	103.1	75.8
Maldives	564.5	621.9	593.7	228.8	290.9	261.5	8.2	3.7	5.8	214.1	215.2	214.1	66.5	60.2	63.1
Myanmar	591.5	755.6	667.1	116.3	124.5	119.8	23.4	25.6	24.4	317.8	398.0	355.0	63.0	91.6	76.0
Nepal	543.5	711.0	620.2	118.8	114.0	116.4	21.0	24.5	22.6	285.7	379.6	329.0	55.8	87.1	70.1
Sri Lanka	490.5	781.4	623.1	79.0	91.6	84.3	36.7	39.8	38.2	220.0	364.5	285.7	62.3	107.1	82.3
Thailand	563.2	811.3	675.0	97.6	115.6	105.9	64.4	46.4	56.3	229.7	304.2	265.3	30.7	119.2	68.6
Timor-Leste	476.8	649.6	559.7	95.0	121.5	107.5	19.3	21.8	20.5	258.3	336.6	296.1	50.0	77.8	63.2

Source: Global Health Observatory, World Health Organization 2011

Figure: 1.1.13 Age-standardized death rates due to non-communicable diseases (NCDs) per 100 000 population in member countries of SEAR, 2008

Source: World Health Organisation, Global Health Observatory 2011

The figure explains that among the SEAR countries bhutan and bangladesh has highest death rates and India takes third place with 684.6 deaths[15].

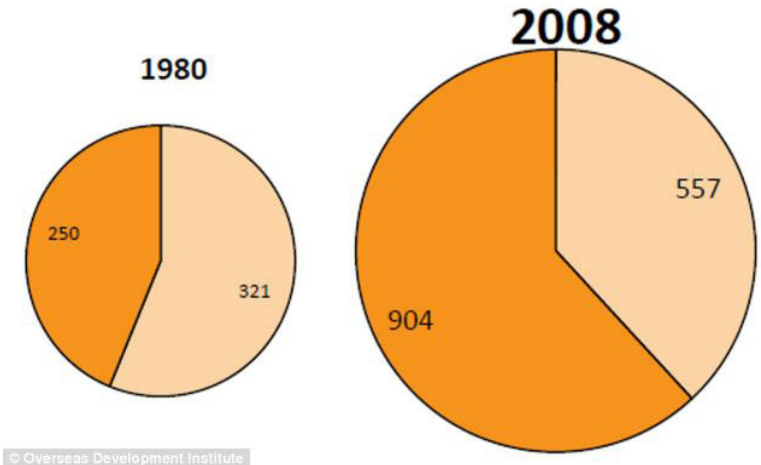


Figure: 1.1.14 Proportion of adults overweight in 1980 and 2008 among the developing and developed world countries

Source : Overseas Developments Institute UK 2012

The above figure shows that in the developing world, the number of obese and overweight adults has quadrupled from 250 million in 1980 to 904 million in 2008. By contrast, the number of people who were overweight or obese in high-income countries increased by 1.7 times over the same period[47].

India is the second most populous country in the world that comprises 17% of the world's population and contributes to 16% of the world's deaths. Totally 5% of the Indian population has been affected by obesity. Nutritional status of the Indian population varies across the regions, certain regions are associated with extremely high rates of childhood under nutrition (range from 20% to 80%), whereas others have a high prevalence of adult under nutrition (>50%), and some have both. However, Indian states are currently facing the double burden of under nutrition as well as over nutrition[17].

Asian countries have the highest burden of diabetes including India and have 33 million cases[19]. Higher BMI and especially increased abdominal fat clearly is an important determinant of blood glucose levels, insulin resistance, and the development of diabetes [20]. Intra-abdominal fat accumulation has been implicated as an independent risk factor for type-2 diabetes mellitus and in some studies it has been shown to be an even stronger predictor of type-2 diabetes mellitus than overall fatness[21]. India has diverse lifestyle pattern and ethnic variations, thus epidemiological profile of diabetes mellitus may be different in different geographical areas.

Obesity is being recognized as one of the most important risk factors for the development of hypertension. Several epidemiological studies show that the age-adjusted prevalence of hypertension increases directly with body-mass-index [22]. Central obesity,

so common in Indians is much more clearly related to cardiovascular (C.V.) and metabolic risk factors than lower body obesity. In our country also many hypertensive are either overweight or obese

Earlier, developing countries, including India, had focused scarce public health resources primarily on the high prevalence of under nutrition. However, these nations are currently facing the double burden of under nutrition as well as over nutrition. Data regarding the nutritional status of adults, as determined by body mass index (BMI), indicate that 50% of Indian adults suffer from different types of chronic energy deficiency, in that they have a BMI<18.5 kg/m ^{2} . In the same survey, it was observed that the BMI values were similar in men and women; however, there were more overweight/obese (BMI≥25 kg/m^2) women (6.6%) than men (3.5%). In certain regions, obesity and consequent diseases are posing an enormous public health problem[17].

According to the National Family Health Survey (NFHS), the percentage of ever-married women aged 15-49 years who are overweight or obese increased from 11% in NFHS- 2 to 15% in NFHS-3. Undernutrition is more prevalent in rural areas, whereas overweight and obesity are more than three times higher in urban areas. The percentage of women who are overweight or obese is highest in Punjab (37.5%), followed by Kerala (34%), Goa (27%), and Tamil Nadu (24.4%) which are relatively richer states[18].

In south India the percentage of women who are overweight or obese is highest in Kerala (34%), followed by Tamil Nadu (24.4%), Andhra Pradesh (22.7%) and Karnataka (17.3%). List of the states of south India in order of percentage of people who are overweight or obese, based on data from the 2007 NFHS[6]. Overweight and obesity

are associated with an increased burden of diabetes, hypertension, cardiovascular diseases, some types of cancers and premature mortality but also with the social and psychological effects of excess weight[23].

List of states of India ranked in order of % of people with overweight or obese

States	Male (%)	Male Rank	Female (%)	Female Rank
Punjab	30.3	1	37.5	1
Kerala	24.3	2	34.0	2
Goa	20.8	3	27.0	3
Tamil Nadu	19.8	4	24.4	4
Andhra Pradesh	17.6	5	22.7	10
Sikkim	17.3	6	21.0	8
Mizoram	16.9	7	20.3	17
Himachal Pradesh	16.0	8	19.5	12
Maharashtra	15.9	9	18.1	13
Gujarat	15.4	10	17.7	7
Haryana	14.4	11	17.6	6
Karnataka	14.0	12	17.3	9
Manipur	13.4	13	17.1	11
Uttarakhand	11.4	14	14.8	14
Arunachal Pradesh	10.6	15	12.5	19
Uttar Pradesh	9.9	16	12.0	18
Jammu and Kashmir	8.7	17	11.1	5
Bihar	8.5	18	10.5	29
Nagaland	8.4	19	10.2	22
Rajasthan	8.4	20	9.0	20
Meghalaya	8.2	21	8.9	26
Orissa	6.9	22	8.6	25
Assam	6.7	23	7.8	21
Chattisgarh	6.5	24	7.6	27
West Bengal	6.1	25	7.1	16
Madhya Pradesh	5.4	26	6.7	23
Jharkhand	5.3	27	5.9	28
Tripura	5.2	28	5.3	24
India	**12.1**	**14**	**16**	**15**

Table: 1.1.1 Indian states ranked in order of % of people with overweight or obese

Source: National Family Health Survey 2007

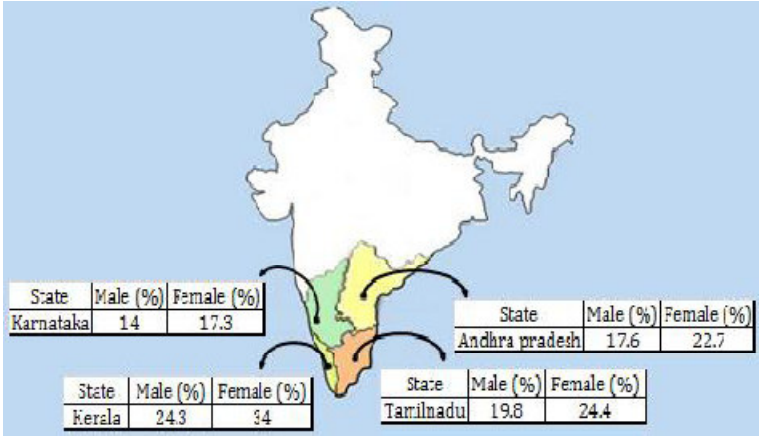


Figure: 1.1.15 Prevalence of obesity among the women in the south India

Source: National Family Health Survey 2007

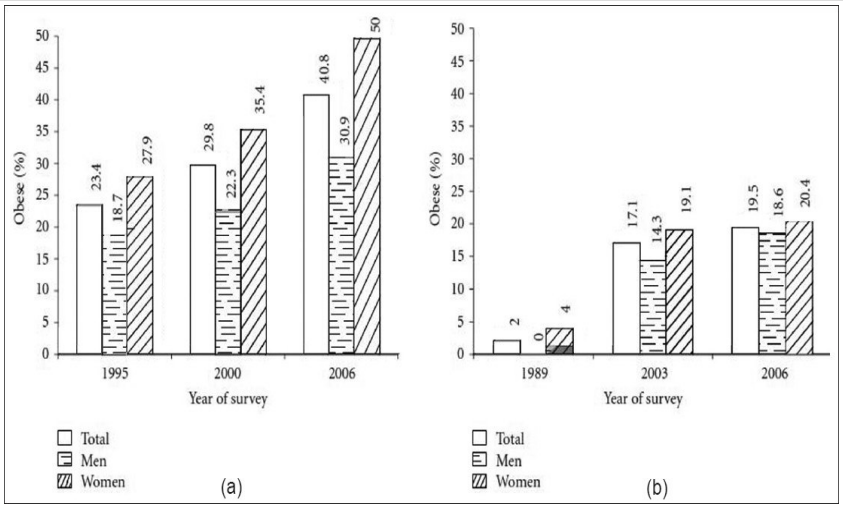


Figure 1.1.16 Temporal changes in prevalence (%) of obesity (≥25 kg/m2) among urban and rural Asian Indians. (a) The data for urban population; (b) the data for rural population

Source: National Family Health Survey 2007

The above figure shows the increasing trend in obesity among the urban and also in the rural population (>20 years) in Chennai, South India. In a decade, the prevalence of obesity had increased by 1.7-fold in the city. Obesity rates were higher among women, as reported from many other countries. The prevalence of overweight was lower among the

urbanizing rural population, than in the urban areas. However, the rural population had a more rapid change as shown by nearly 8.6-fold increase in a period of 14 years[6].

The study indicated that the living conditions in rural areas had improved considerably. Transport facilities, medical care and food habits, educational status, and family income had dramatically improved which along with easy access to city and television watching resulted in changes in life style. These eventually led to significant increase in BMI as well as abdominal obesity in both sexes as compared with a similar study conducted in the year 1989. The prevalence of overweight rose from 2% to 17.1%. The changing life style of the rural dwellers was found to be a contributory factor for the rising rates of obesity and associated metabolic diseases, such as diabetes.[6]

In India, under nutrition and over nutrition are epidemics of the impoverished and the affluent respectively and is part and parcel of the double burden of disease in this country.[24] Earlier studies used the standard criteria (developed for and by Europids) that have significantly underestimated the prevalence of obesity and metabolic syndrome in India.[26] Obesity is usually reported in terms of body mass index (BMI) and abdominal obesity in terms of waist circumference (WC) but the cut-off points differ by ethnicity.[25]

Recent studies using Indian specific criteria for overweight (BMI> 23), obesity (BMI $\geq$ 25), and abdominal obesity (WC$\geq$90 cm in men and $\geq$80 cm in women) have found the prevalence rates among Asian Indians exceeding those in the US population.[27] The age-standardized prevalence of generalized obesity in South India was 46% (women: 47%; men: 43%) compared to 35% in the US.[27] Abdominal obesity was found in 47% – 51% with higher rates in women (women: 56%; men: 35%). [28] Among 5% of

men and 14% of women, abdominal obesity was found with normal BMI (isolated abdominal obesity).[27] Abdominal obesity measured as WC is a better marker of obesity-related metabolic risk than BMI among Indians.[27]

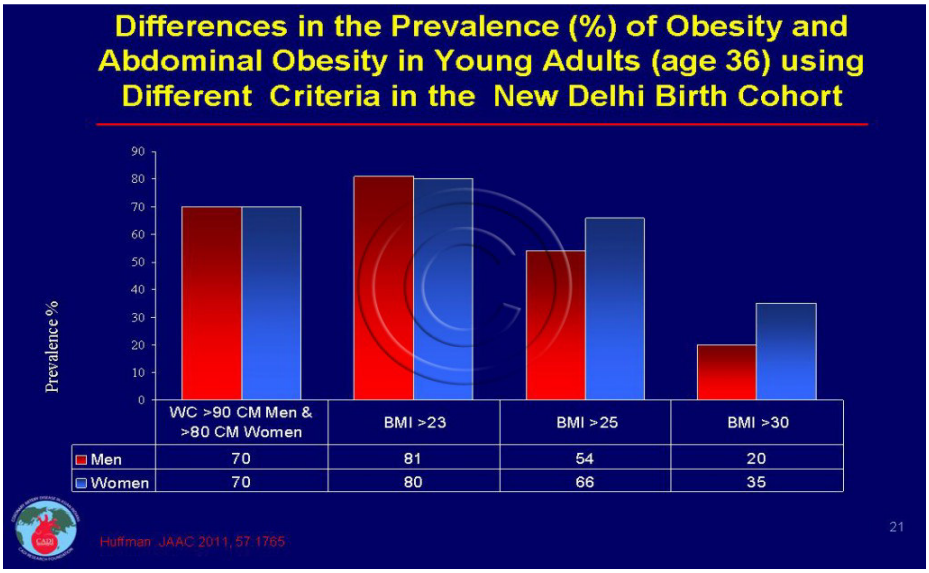


Figure: 1.1.17 Differences in prevalence (%) of Obesity using different criteria

Source: Journal of American College of Cardiology 2011

In New Delhi Birth Cohort, the prevalence of obesity was 20% in men and 35 % in women using BMI >30 as the cut-off point but increased to 54% in men and 66% in women when BMI >25 was used. More than 80% were overweight.[29] This data clearly demonstrates the significant underestimation of obesity related risk among Indians when using the standard criteria developed for the Europids.

The process of rapid urbanization and changing lifestyles in India and other developing countries has brought obesity. Prevalence of overweight/obesity is intensifying rapidly in South India population compared to other studies carried out in India with serious public health consequences. In addition it poses a serious hazard to the

basic health care delivery system and also overburden for public health sector in south India. Further, it is the need of the hour to set guidelines for detection of obesity in south Indian population to enable early detection of obesity, so that early & prompt treatment or prevention actions can be started & huge hidden burden of future obesity health consequences can be reduced[6].

In relation to the prevention of obesity, overweight and its related health risks, population-based strategies to improve social and physical environmental contexts of healthy eating and physical activity are essential. Primary prevention studies using healthy foods, sustained physical activity, and initiatives to educate the community regarding the benefits of these will help to tackle the global problem of obesity and its associated disorders[7].

1.2 SIGNIFICANCE AND NEED FOR THE STUDY

The marked increase in the prevalence of obesity, over weight and type2 diabetes largely reflects changes in diet and physical activity level as a result of economic development, industrialization and urbanization. This increase has posed enormous challenges to Asian societies and healthcare systems. There is an urgent need to create awareness among the public, health care providers and also the governments on the graveness of the problem of overweight and obesity, which is a major cause for many metabolic disorders affecting the Asian populations. The benefits of consistent physical activity and healthy diet habits from the childhood have to be stressed[7].

Examples setup by the governmental policies in Singapore should be adopted to arrest the rapid increase in overweight and obesity[30]. Singapore's 'Fit and Trim' Program

in school children has led to a remarkable drop in prevalence of obesity from 16.6% in 1992to 14.6% in 2000 among children aged 11–12 years and from 15.5 to 13.1% among children aged 15–16 years.[30]

National programmes have been initiated for prevention of non communicable diseases in many countries. Prevention of obesity is likely to be most effective when implemented in the childhood itself. Guidelines have been laid down by the WHO for formulating national policies to meet these challenges. For prevention of obesity, overweight and its related health risks, population-based strategies to improve social and physical environmental contexts of healthy eating and physical activity are essential. Primary prevention studies using healthy foods, sustained physical activity, and initiatives to educate the community regarding the benefits of these will help to tackle the global problem of obesity and its associated disorders.

At least one in two people is now overweight or obese in over half of OECD countries. Rates are projected to increase further and in some countries two out of three people will be obese within ten years. An obese person incurs 25% higher health expenditures than a person of normal weight in any given year. Obesity is responsible for 1-3% of total health expenditures in most OECD countries (5-10% in the United States). Obese people earn up to 18% less than non-obese people. Poorly educated women are two to three times more likely to be overweight than those with high levels of education, but almost no disparities are found for men. OECD countries have made no progress in tackling these disparities.

A comprehensive prevention strategy would avoid, every year, 155 000 deaths from chronic diseases in Japan, 75 000 in Italy, 70 000 in England, 55 000 in Mexico and 40 000 in Canada. The annual cost of such strategy would be USD 12 per capita in Mexico, USD 19 in Japan and England, USD 22 in Italy and USD 32 in Canada. The cost per life year gained through prevention is less than USD 20 000 in these five countries[14].

The OECD called for strong action against obesity in 2010. Analyses of the health and economic impacts of programmes to improve diet and increase physical activity led to the conclusion that comprehensive prevention strategies are needed, targeting different age groups and determinants of obesity. It is found that only a fraction of total health expenditure and a small proportion of the 3% of their healthcare budgets that OECD countries now spend on prevention[14].

Several OECD countries introduced taxes on unhealthy foods and beverages in 2011 as part of their efforts to counter obesity. Taxes, along with other measures, can improve health by changing eating habits. Several countries have introduced a tax on foods containing more than 2.3% saturated fats (meat, cheese, butter, edible oils, margarine, spreads, snacks, etc.) in 2011. Consumers pay 16 kroner (EUR 2.15) per kilogram of saturated fat on domestic and imported food, which is equivalent to up to 30% more for a pack of butter, 8% more for a bag of chips, and 7% more for a liters of olive oil. Tax revenues are expected to be over EUR 200 million per year, and saturated fat consumption is expected to decrease by 4%. Denmark had also increased its excise taxes on chocolate, ice cream, sugary drinks and confectionery by 25% in 2010[14].

Prevalence of overweight/obesity is intensifying rapidly in South India population compared to other studies carried out in India with serious public health consequences. Low levels of physical activity, long hours of watching television, and consuming junk foods are associated with a higher prevalence of overweight. Thus, participation in household activities and regular physical exercise could help in lowering the prevalence of overweight. Therefore, the role of physical activity, games, and sports should be emphasized, and facilities should be provided for outdoor games in schools, with compulsory hours of sports and games. There is an urgent need to educate the urban and rural community on the aspects of healthy food habits and desired lifestyles to prevent overweight/obesity and its associated ill effects. In addition it poses a serious hazard to the basic health care delivery system and also overburden the public health sector in south India.[31]

Further, it is the need of the hour to set guidelines for detection of obesity in south Indian population to enable early detection of obesity, so that early & prompt treatment or prevention actions can be started & huge hidden burden of future obesity health consequences can be reduced.[31]

Danielle Dellorto [32] (2012) compared health data from 1990 through 2010 for the Global Burden of Disease report, found that there is a massive shift in global health trends and there's been a huge shift in mortality. Kids who used to die from infectious disease are now doing extremely well with immunization and the world is now obese and the impact of that is seen.

H K Thakkar, S K Misra et al [33] (2011) conducted a cross sectional study and screened 400 college going girls of 15-24 yrs and measured height, weight, Waist circumference, Hip circumference and found that the prevalence of overweight and obesity was 18.5% and 4.5% respectively. When used the WHO cut-off range, it was found that 45.5% of the subjects had normal weight and 31.5% were underweight. According to revised Indian guideline, surprisingly, 42.5% were classified as overweight/obese amongst which 23% were obese. The study concluded that higher prevalence of obesity especially by Indian guidelines, calls for the prevention and control of this problem with prime attention.

Narkaiewicz K [22] (2006) had mentioned that obesity is being recognized as one of the most important risk factors for the development of hypertension. Several epidemiological studies show that the age-adjusted prevalence of hypertension increases directly with body-mass-index.

Shah S, Anand P, Maiya M, Mukherjee S, Munjal YP, et al. [39] (2007) found that central obesity which is so common in Indians is much more clearly related to cardiovascular (C.V.) and metabolic risk factors than lower body obesity. Many hypertensives in our country are either overweight or obese.

Kannana L, Satyamoorthy TS [40] (2009) conducted a study in Chennai, Tamil Nadu and found that the overall prevalence of pre-obese was 29.1% out of 189 hypertensive, 13.7% were class I obese, 5.8% were class II obese and 2 individuals were in class III obese.

Mahesar H, Khand FD and Seehar GM [41] (2011) concluded that 86.6% obese were hypertensive where as non obese respondents were only 5.4% hypertensive. The study confirmed the evolving epidemic of hypertension risk in South Indian population, since there is an increase in the prevalence of overweight and obesity.

Thangamani S , Vijayakumar A, Kalaiselvan V[42] (2012) In Tamil Nadu, younger adults patients who visited the south India teaching hospital had increased prevalence of elevated blood pressure and serum lipids more prominent in 31-40 years of age group as compared to <30 years which means the risk of dyslipidemia increases as the age advances with obesity.

Singh et al.,[43] (2011) observed that the risk of breast cancer increased with increasing levels of BMI. Overweight and obese women had 1.06 and 2.27 fold risk as compared to women with normal weight in India.

Friedenreich CM[44] (2001) concluded in his study that epidemiological evidences strongly support that weight gain in adult life with or without physical activity is associated with increased incidence of cancers in men and women. Obesity leads to increased levels of fat tissue in the body that can store toxins and can serve as a continuous source of carcinogens.

Murthy NS, Mukherjee S, Ray G, Ray A[45] (2009) conducted a review and found that studies have revealed that obesity is a major risk factor for several cancers such as colon, breast (post-menopausal), endometrium, kidney and gallbladder, ovaries and pancreas.

WHO Regional office for South East Asia[46] (2002) reported that obesity in Type II diabetic patients is very common phenomenon and often termed as "Diabesity". South East Asian countries have the highest burden of diabetes including India and have 33 million cases.

Abate N[20] (1996) identified that higher BMI and especially increased abdominal fat clearly is an important determinant of blood glucose levels, insulin resistance and the development of diabetes. Intra-abdominal fat accumulation has been implicated as an independent risk factor for type-2 diabetes mellitus and in some studies it has been shown to be an even stronger predictor of type-2 diabetes mellitus than overall fatness

Some governments have stepped-up their actions to fight against obesity in past three years. Health promotion efforts were intensified, particularly through local initiatives and further measures at the school level (e.g. in France, Spain, Italy, Mexico). Co-ordinated national programmes were launched in countries like United States (Let's Move), United Kingdom (Change 4 Life), Switzerland (Action santé), and others.

There has been an increasing reliance on partnership with the food and beverage industry (e.g. United Kingdom and Switzerland) in the design and implementation of actions to fight obesity particularly in product reformulation to avoid unhealthy ingredients (e.g. saturated fats and too much salt), in reducing excessive portion sizes and providing healthy menu alternatives, in limiting advertisment, particularly to vulnerable groups like children and in informing consumers about food contents. But the real novelty of the last three years has been a strong and increasing interest in the use of fiscal measures to limit the consumption of foods high in fat, sugar and salt. As

explained, legislation was passed by several countries and further countries are expected to follow through in the near future.[14]

Given the rapid rise in obesity in India, it is important to know the "weight of the nation." Due to the long-term consequences, the cost burden of obesity on the health care system is enormous. A better understanding of the numbers and causes can help overcome barriers to the primary prevention of obesity for youth and adults in communities, medical care and in schools.[6]

Wider recognition, acceptance and application of Indian specific cut-off points for obesity is necessary to stem the tide of twin epidemics of diabetes and cardiovascular disease in the subcontinent.[8] Despite a high prevalence of obesity (one half of men and two-third of women), most Indians do not consider themselves as obese. The acceptance of obesity is like saying OK to smoking. Mass education of both medical community and the general public regarding the dangers of obesity as well as the lower cut points for defining it is urgently needed.[31]

The investigator being the community health nurse has vast exposure and experience in working in the field. The investigator observed the changing trends in the dietary habits, physical activity habits, economic status and social relations and communication pattern of people living in the rural area. The consumption of fast food eatables, intake of carbonated beverages and bakery products, availability of two wheeler, washing machine and television in each and every home in the rural area had led to the state of unhealthy dietary intake and physical inactivity even in the rural area. The invasion of machineries in agriculture field also makes the agriculture work as

sedentary. Nowadays adult individuals spend maximum time in communicating over phone and children are occupied with video games and cartoon screen viewing.

The investigator also observed changing pattern of lifestyle habits which in turn results in life style diseases. The people in the rural area are aware of immunization, under nutrition and sanitation but they are not aware of the the impact and complication of unhealthy dietary habits, physical activity and overweight. The investigator having observed the changing trends has come across many individuals who developed their co-morbidities Diabetes and hypertension even at the earlier ages because of the obesity. So the investigator wanted to do this particular study to assess the knowledge, attitude and practice on obesity to know about their awareness and habits and to assess the prevalence of obesity in the community area and also to educate and counsel them to bring behavioural changes towards healthy life styles and prevent the complications or impact of overweight and obesity.

Governments can help people change their lifestyle by making new healthy options available or by making existing ones more accessible and affordable. Alternatively, they can use persuasion, education and information to make healthy options more attractive. This gentle approach is more expensive, hard to deliver and hard to monitor. A tougher approach, through regulation and fiscal measures, is more transparent but it hits all consumers indiscriminately, so can have high political and welfare costs. It may also be difficult to organize and enforce and have regressive effects. Dissemination of nutrition guidelines and health promotion messages such as “active transport” – cycling and walking – and active leisure can bring a lot of changes in the obesity trend in the country.

Keeping this in mind and also considering factors responsible for this silent epidemic the investigator realized the need to communicate the strategies to the community people. So the investigator constructed this Rural Obesity Reduction Program which is a group of behavioural intervention with Indian specific cut-off points for diagnosing Obesity. The present study will reflect the efficiency of Rural Obesity Reduction Program.

1.3 CONCEPTUAL FRAME WORK

1.3.1 GENERAL CONCEPTS OF INTEGRATED THEORY OF HEALTH BEHAVIOUR CHANGE (ITHBC) AND OMAHA SYSTEM MODEL OF PROBLEM SOLVING

1.3.1a Integrated Theory of Health Behavior Change

Basic assumptions

The Integrated Theory of Health Behavior Change (ITHBC) is based on the assumption that behavior change is a dynamic, iterative process. Desire and motivation are prerequisites to change and self-reflection facilitates the progress. Positive social influences sway one's interest and willingness just as positive relationships help to support and sustain change. There is growing evidence that person-centered interventions are more effective than standardized interventions in facilitating health behavior change. Engagement in healthy behavior is an outcome that can be realized in the short-term (proximal outcome), and engagement in healthy behavior influences and leads to improvement in health status (distal outcome) realized over time.

The health behavior change can be enhanced by fostering knowledge and beliefs, increasing self-regulation skills and abilities, and enhancing social facilitation. Engagement in self-management behaviors is seen as the proximal outcome, and this, in turn, influences the long-term outcome of improved health status. Person-centered interventions are directed to increase knowledge and beliefs, self-regulation skills and abilities, and social facilitation.

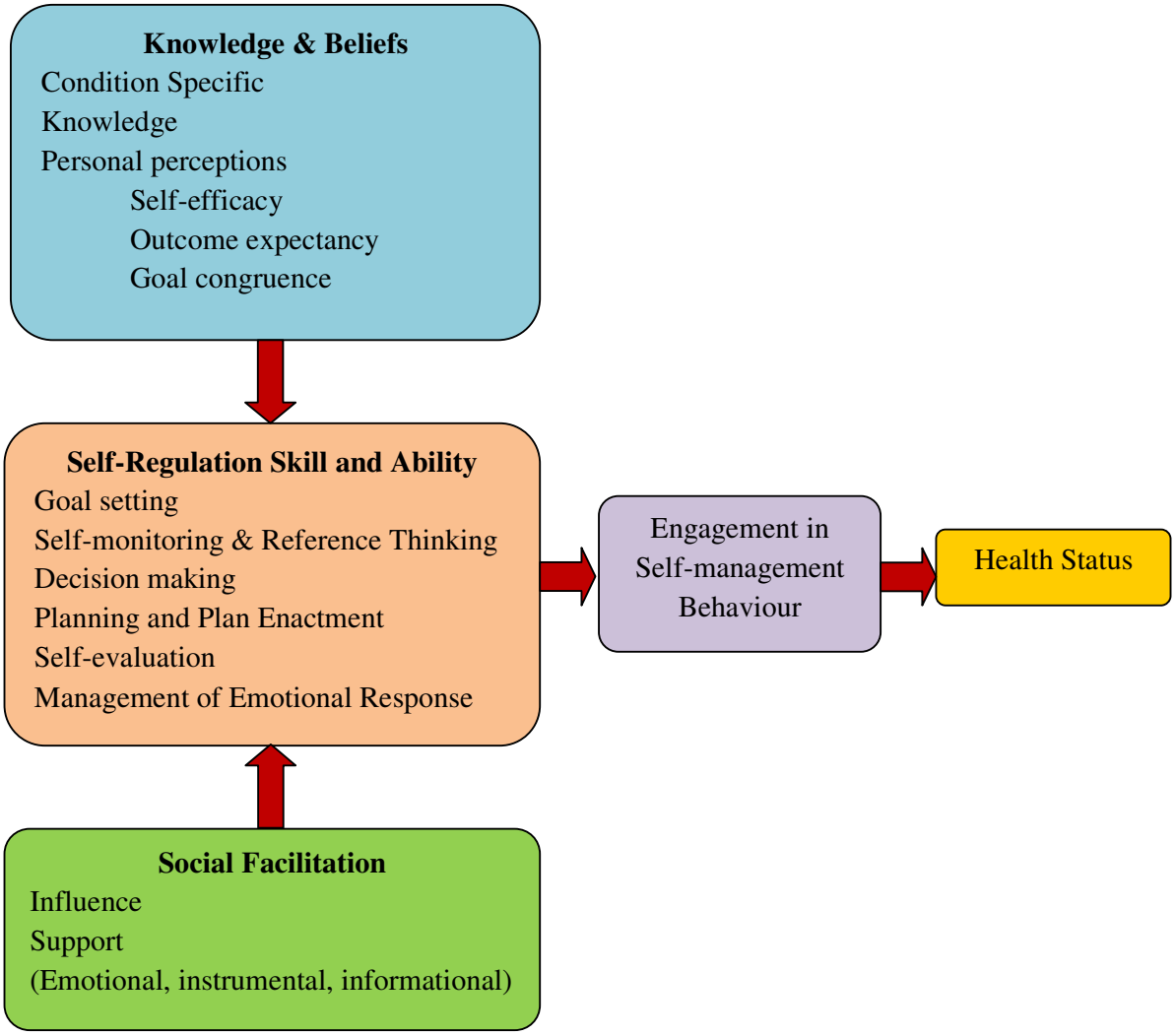


Figure 1.3.1: Integrated Theory of Health Behaviour Change model

According to this theory, persons will be more likely to engage in the recommended health behaviors if they have information about and embrace health beliefs consistent with behavior, if they develop self-regulation abilities to change their health behaviors, and if they experience social facilitation that positively influences and supports them to engage in preventative health behaviors. Knowledge and beliefs impact behavior-specific self-efficacy, outcome expectancy, and goal congruence. Self-

regulation is the process used to change health behavior and includes activities such as goal setting, self-monitoring and reflective thinking, decision making, planning for and engaging in specific behaviors, and self-evaluating and self-managing physical, emotional, and cognitive responses associated with health behavior change. Social facilitation includes the concepts of social influence, social support, and negotiated collaboration between individuals and families and health care professionals[48].

Outcomes in this theory are both proximal and distal. The proximal outcome is actual engagement in self-management behaviors specific to a condition or health behavior. Distal outcomes refer to the long-term impact of personal behavior on health status. Failure to engage in healthy behaviors may result in premature onset of disease conditions. Distal outcomes are related, in part, to successful achievement of proximal outcomes. Although achievement of distal outcomes provides data about the effectiveness of the intervention, these outcomes are generally slow to be realized. Measurement of proximal outcomes is critical to evaluate whether people have made and are maintaining change in their health behavior.

The constructs of knowledge and beliefs, self-regulation, and social facilitation are related to each other and to the proximal and distal outcomes.

Knowledge and beliefs

Knowledge is defined as condition-specific factual information, and beliefs are defined as personal perceptions about the specific health condition or health behavior. Enhancement of knowledge and beliefs results in increased understanding of a specific condition or behavior, increased behavior-specific self-efficacy (confidence in one's

ability to successfully engage in a change in normal and stressful situations), outcome expectancy (one's belief that engagement in a behavior will result in desired results), and goal congruence (resolution of confusion and anxiety occurring from apparent contradictory and competing demands associated with health goals).

Self-regulation

Self-regulation is a process that people use as they incorporate a behavior change into their daily routines and lifestyles. Self-regulation requires goal setting, self-monitoring and reflective thinking, decision making, planning and plan enactment, self-evaluation, and management of emotions occurring with the change.

Social facilitation

Social facilitation includes social influence and social support. People experience social influence when a knowledgeable person in a position of perceived authority sways their thinking and motivation, leading to engagement in behavior. Social influence comes from numerous sources, for example, healthcare providers, television and radio, family and neighbors, coworkers and printed or electronic communication. Social support consists of emotional, instrumental, or informational support, which facilitates engagement in a health behavior

Relationships among constructs of the theory

It is proposed that knowledge, in and of itself, does not lead to behavior change; however, knowledge and health beliefs are linked to engagement in self-regulation. Engagement in self-regulation skills and abilities enhances self-management behaviors. Positive social facilitation enhances self-regulation and engagement in self-management

behaviors. Engagement in self-management behaviors has a direct and positive effect on health status.

The ITHBC is intended to facilitate health behavior change related to management of chronic conditions and to health promotion. It has been developed to increase a person's ability to engage in behavior change to increase his/her self-management behaviors. Engagement in healthy behavior is essential for improvement of health and management of chronic conditions. Nurses and other healthcare providers benefit from knowing how to support the initiation and maintenance of health behavior change by individuals. Significant progress has been made in understanding behavior change, but additional knowledge is needed to meet the health goals of individuals and society.

1.3.1b Omaha system model of problem solving

Omaha system was designed to increase effectiveness and efficiency of nursing practice in the health care system (Bowles & Naylor, 1996; Martin, Leak, & Aden, 1997). This system is now finding increasing utility in facilitating evidence-based practice, documentation, and information management (Martin, 2005), all of which are critical to contemporary public health care systems. It is a comprehensive system which includes the following components (Martin, 2005): Problem Classification Scheme, Intervention scheme and problem rating scale for outcomes[49].

Problem classification scheme

Problem classification scheme offers nurses a holistic, comprehensive method for identifying client's health-related concerns. It includes domains, problems, modifiers, and signs/symptoms. Problems can be identified at the individual, family, or at community level.

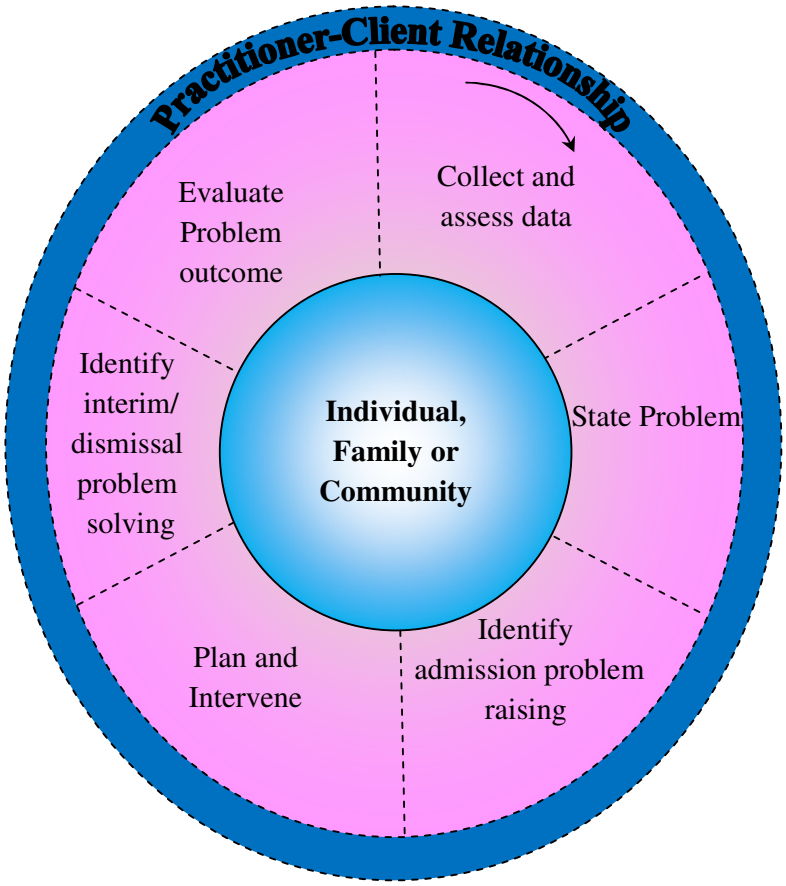


Figure 1.3.2 Omaha System Model of the Problem Solving process- General concepts

Intervention scheme

Intervention scheme provides a framework for documenting plans and interventions in the client record in the areas of health teaching, guidance and counseling, treatments and procedures, case management and surveillance.

Problem rating scale for outcomes

Problem rating scale for outcomes consists of a Likert-type scale. Central to problem rating is quantifying outcomes in three dimensions: knowledge (what the client knows), behavior (what the client does) and status (how the client is).

The Omaha System model of the problem solving process guides the nurses through the six steps in the process: Collecting and assessing data, Stating the problem, Identifying the problem rating on admission, Planning and actual interventions, Identification of interim or dismissal problem rating and finally Evaluating problem outcome. The model is applicable to individuals, families, and communities, and provides a mechanism to evaluate both individual and group change over time.

1.3.2: APPLICATION OF THE CONCEPTUAL FRAMEWORK BASED ON INTEGRATED OMAHA SYSTEM MODEL OF PROBLEM SOLVING AND INTEGRATED THEORY OF HEALTH BEHAVIOUR CHANGE (ITHBC) FOR THE PRESENT STUDY

Nurses and other healthcare professionals play a major role in identifying behaviors critical to health, assessing the needs of individuals and groups and recommending specific health behaviors, preparing and delivering interventions designed to enhance engagement in health behaviors, and evaluating the effectiveness of interventions for individuals, groups, communities, and the nation. To fulfill these role responsibilities, nurses and other healthcare professionals benefit from understanding the theory and science of health behavior change.

Based on the Integrated Theory of Health Behavior Change and Omaha system model the investigator designed the methodology for the present study since the study outcomes are entirely dependent on the behavior change of the obese adults. The major constructs in the present study are knowledge, attitude, practice and obesity reduction. Based on Omaha system model the nurse researcher identifies and rates the problem,

plans and implements the interventions and evaluates the outcome at two stages of proximal and distal outcomes.

Problem identification scheme

In this study the nurse researcher collects and assesses the data pertaining to knowledge and beliefs and self regulation skills of obese adults. The nurse researcher screened the adult population to identify the obese adults and collected the demographic variables, pretest knowledge, attitude, practice and level of obesity of obese adults of both experimental and control group. The process was supported by the peers, family members women self help group and the village health empowerment trained volunteers who are the social facilitation agencies of the present study.

Intervention scheme

In this study the actual interventions were planned and implemented. Considering the individual needs and problems individualized/personalized interventions were devised as components of Rural Obesity Reduction Programme (RORP). The RORP included IEC on aspects of obesity to improve the knowledge on obesity, individual counseling to bring desirable changes in the attitude and dietary, physical activity modification to reduce the level of obesity and risk of chronic diseases by improving the self regulation skills and ability which in turn results in engagement in self-management behavior. The RORP package was administered to only the experimental group for a period of 12 weeks after completing the pretest. The family members, the women self help group members, the VHETP volunteers and the nurse researcher herself acted as social facilitation agencies to motivate obese adults and to adhere to the RORP intervention package by means of home visits and telephonic conversations.

Problem rating scale for outcome

At this stage the nurse researcher identified the interim or dismissal problem rating and identified the outcome of the problem. After six weeks of the intervention the Nurse Researcher conducted the post test assessment I to assess the proximal outcome of the study. Here the obese adults of experimental group were found to adhere to the intervention strategies and engaged in the self management behavior of dietary and physical activity modification. There was also significant changes in their knowledge, attitude (knowledge and belief) and practice level (self regulation skill). The social facilitation agencies continued their support to the obese adults. In contrast the control group individual continued with their same habits and activities. When the post test II assessment was done for the adults of experimental group, they were found to have significant changes in their level of BMI, WC and PBF.

The outcomes of the experimental group indicates that the changes in the knowledge and belief and self regulation skill and the support of social facilitation agencies have really helped the obese adults to engage in the self management behavior of dietary and physical activity modification which in turn helped the individuals to improve their health status by reducing their BMI, WC and PBF level.

Personal behavior influences one's health. Many people can improve their health by managing their chronic condition or engaging in health promotion behaviors. Persons with chronic conditions improve their health by managing specific health behaviors, a process that requires behavior change. Thus by adopting the ITHBC model and Omaha system model the Nurse Researcher will be able to bring out the changes in the behavior of individuals and can prevent and manage the obesity and other life style diseases.

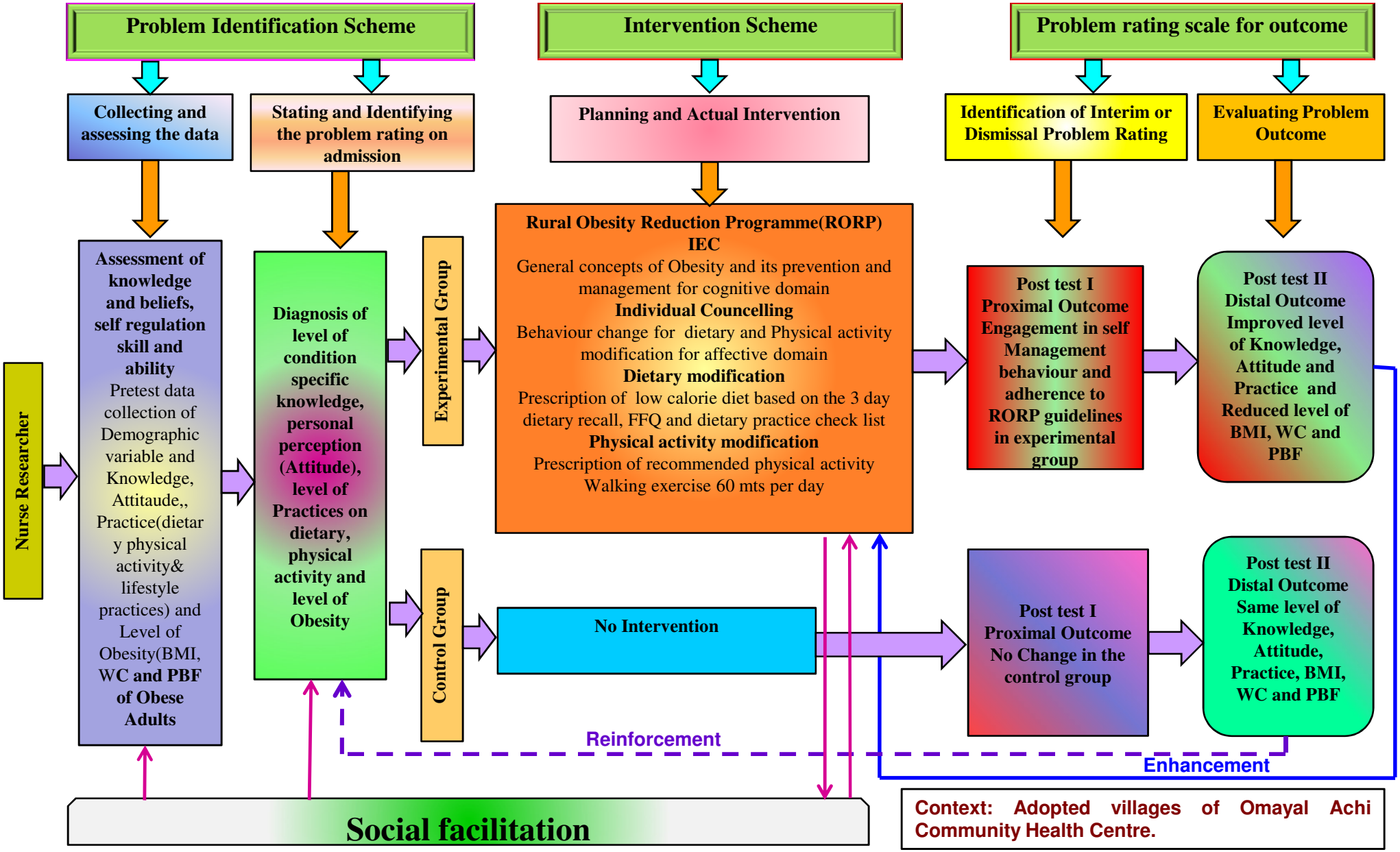


Fig. 1.3.3: Integrated Conceptual Framework based on Integrated Theory of Health Behaviour Change(ITHBC)(2009) and Omaha System Model of the problem solving (2005)

CHAPTER – 2

AIMS AND OBJECTIVES

2.1 TITLE

A true experimental study to assess the effectiveness of Rural Obesity Reduction Program (Behavioural intervention) on Knowledge, Attitude, Practice towards Obesity and Obesity reduction among the obese adult population at selected rural communities of Omayal Achi Community Health Centre.

2.2 STATEMENT OF THE PROBLEM

A true experimental study to assess the effectiveness of Rural Obesity Reduction Program (Behavioural intervention) on Knowledge, Attitude, Practice towards Obesity and Obesity reduction among the obese adult population at selected rural communities of Omayal Achi Community Health Centre.

2.3 OBJECTIVES

1. To assess and compare the pretest and post test level of knowledge, attitude, practice and obesity among the obese adults in experimental and control groups.
2. To determine the effectiveness of Rural Obesity Reduction Program on knowledge, attitude, practice and obesity reduction of obese adults.
3. To identify the relationship among the knowledge, attitude, practice and obesity reduction in the pre and post test of experimental and control group.
4. To associate the mean differed knowledge, attitude, practice and obesity reduction of obese adults in the experimental group with their selected demographic variables.

2.4 NULL HYPOTHESES

NH_1: There is no significant difference in the pre and post test level of knowledge, attitude, practice and obesity reduction among the obese adults within and between the experimental and control group at $p<0.05$.

NH_2: There is no significant relationship among the knowledge, attitude, practice and obesity reduction in the pre and post test of the experimental and control group at $p<0.05$.

NH_3: There is no significant association of mean differed knowledge, attitude, practice and obesity reduction of obese adults of the experimental group with their selected demographic variables at $p<0.05$.

2.5 OPERATIONAL DEFINITIONS

2.5.1 Effectiveness

In this study effectiveness refers to the change in the level of knowledge, attitude, practice and obesity among obese adults which was measured by using the structured questionnaire for knowledge, five point rating scale for attitude, criteria checklist for practice and bio physiological measurement of Body Mass Index(BMI), Waist Circumference(WC) and Percent Body Fat(PBF) for obesity reduction which was obtained by structured interview schedule and bio physiological measurements.

2.5.2 Rural Obesity Reduction Program

Rural Obesity Reduction Program refers to group of behavioural interventions focused to encourage obese adults to make healthier lifestyle choices which included

- **Information, Education, Communication (IEC) package** on aspects of obesity and lifestyle modification for obesity management (for cognitive domain) which

included meaning, causes and risk factors, signs and symptom, diagnosis, management, prevention, complications and its prevention, importance of adherence to dietary modification, physical activity modification and life style modification which was executed by individual teaching method with the help of flash cards and it lasted for 20 minutes.

- **Dietary modification (for physical domain)** which included the modification of dietary intake, habits and practices of obese adults. Based on the calorie requirements of obese adults individualized low calorie diet/ weight reducing diet menu was prepared in consultation with the clinical nutritionist considering the likes and dislikes of the obese adults and also available low cost food in the community. The obese adults were expected to follow the prescribed low calorie diet menu for minimum 5 days in a week. The diet was prescribed in a printed card and obese adults were asked to mark their adherence daily.
- **Physical Activity modification (for physical domain)** which insisted the obese adults to modify the activity pattern. This included the practice of walking exercise for 60 minutes every day to cover around 4 miles for 5 days in a week as per the global recommendations on physical activity for health (WHO). Obese adults were asked to mark their adherence daily.
- **Individual counseling on dietary, physical activity and life style modification (for affective domain)** was given to individuals based on their unique circumstances in various phases of rapport and relationship building, assessment/ problem definition, goal setting, initiating interventions and termination for a maximum of 3 sessions for each individual and each session lasted for 30 minutes.

2.5.3 Knowledge

Refers to the level of information received from the obese adults to the questions on meaning, causes, risk factors, impact, management and prevention of obesity which was measured by Structured Interview Schedule devised by the investigator and validated by the experts.

2.5.4 Attitude

It refers to the ideas/perceptions of obese adults towards the obesity which was measured by using the 5 point attitude scale which was devised by the investigator and validated by the experts.

2.5.5 Practice

It refers to the day to day dietary, physical activity and life style practices of the obese adults which was devised by the investigator and validated by the experts.

Dietary practices include details of food consumption, frequency of nutrients intake and dietary habits which was measured by using the 3 day dietary recall, food frequency questionnaire (FFQ) and dietary practice checklist.

Physical activity practices include physical activity pattern/habits of obese adults which were measured by using physical activity practice checklist.

Life style practices include details of habits of obese adults which were measured by using life style practice checklist.

2.5.6 Obesity reduction

Obesity reduction means the reduction in the level of BMI (Body Mass Index), WC (Waist Circumferences) and PBF (Percent Body Fat) which was measured by bio

physiological measurements and the tools were calibrated by bio medical engineering experts.

2.5.7 Obese adults

Refers to the both male and female adults between the age group of 20-50 years who were identified as obese based on their BMI and Waist Circumference.

2.6 ASSUMPTIONS

- Obesity may be more prevalent among the rural adults.
- The level of Obesity may be contributed by non – modifiable factors (age, gender, and genetic impact) and modifiable factors (dietary, physical activity and lifestyle practices- sleep, smoking, exercise and alcohol consumption).
- Rural obese adults may need assistance to cope with the problem and its management to lead a healthy life.
- The behavioural interventions may enhance the obese adult's knowledge, attitude, practice and may reduce the level of obesity, which will prevent the development of co-morbidities and its complications.

2.7 DELIMITATION

1. The study was delimited to the obese adults who were residing only at villages adopted by Omayal Achi Community Health Centre.

CHAPTER – 3

REVIEW OF LITERATURE

Conducting a literature review tends to be a multi-pronged endeavour to assess the available data with in the context of an existing base of knowledge. The most important reason for review of literature is to retrieve the existing evidence on the problem being addressed and to device the need for the new study. A research literature review is a written summary of the state of evidence on a research problem.

The review of literature is defined as a broad, comprehensive, in depth, systematic and critical review of scholarly publication, unpublished scholarly print materials, audio visual materials and personal communications. Critical review of literature refers to a process in which the investigator or reader examines the strength and weakness of the appropriate scholarly publications/literature[50]

The major steps in preparing a written research review include formatting a question, devising a search strategy, conducting a search, retrieving relevant sources, abstracting and encoding information, critiquing studies, analyzing the aggregated information, and preparing a written manuscript. Review of literature related to the present study were reviewed from books, published articles and medline search to broaden the understanding and gain insight into the selected problem under study.[50]

The review of literature is presented in two parts.

3.1 Part – 1

It presents the general concepts of Obesity.

3.2 Part – 2

It consists of research reviews

3.2.1 Reviews related to prevalence of obesity among adults.

3.2.2 Reviews related to general aspects of Obesity.

3.2.3 Reviews related to weight reducing strategies of obesity among obese adults.

3.1 PART – 1: GENERAL CONCEPTS OF OBESITY

The World Health Organization has described obesity as one of today's most neglected public health problems, affecting every region of the globe. In every region of the world, obesity doubled between 1980 and 2008 and half a billion people (12% of the world's population) are considered obese. According to the World health statistics 2012 report one in six adults were obese, one in 10 was diabetic and one in three had raised blood pressure. In 2009–2010, 35.7% of U.S. adults were obese.

The highest obesity levels are in the WHO Region of the Americas (26% of adults) and the lowest in the WHO South-East Asia Region (3% obese). In all parts of the world, women are more likely to be obese than men, and thus at greater risk of diabetes, cardiovascular disease and some cancers.

India is the second most populous country in the world that comprises 17% of the world's population and contributes to 16% of the world's deaths. Nutritional status of the Indian population varies significantly across the regions. Certain regions are associated with extremely high rates of childhood under nutrition (ranging from 20% to 80%), whereas others have a high prevalence of adult under nutrition (>50%), and some have

both. Earlier, developing countries, including India, had focused scarce public health resources primarily on the high prevalence of under nutrition.

However, these nations are currently facing the double burden of under nutrition as well as over nutrition. According to the National Family Health Survey (NFHS), the percentage of ever-married women aged 15-49 years who are overweight or obese increased from 11% in NFHS- 2 to 15% in NFHS-3. The percentage of women who are overweight or obese is highest in Punjab (30%), followed by Kerala (28%) and Delhi (26%), all of which are relatively richer states.

Indians exhibit unique features of obesity like excess body fat, abdominal adiposity, increased subcutaneous and intra-abdominal fat and deposition of fat in ectopic sites (such as liver, muscle, and others). Obesity is a major driver for the widely prevalent metabolic syndrome and type-2 diabetes mellitus (T2DM). Although this phenomenon is a global one, India is unique in that it has to grapple with both over- and under nutrition at the same time.

Causes and Risk factors of obesity

1. Lack of Energy Balance

Overweight and obesity happen when individual take in more calories than use over time.

2. Inactive Lifestyle

People who are inactive are more likely to gain weight because they don't burn the calories that they take in from food and drinks. Examples are more than 2 hours a day of regular TV viewing time, relying on cars instead of walking, fewer physical demands

at work or at home because of modern technology and conveniences and lack of physical education classes in schools.

3. Environment

Our environment doesn't support healthy lifestyle habits; in fact, it encourages obesity. Some reasons include: work schedules-long work hours, oversized food portions, lack of access to healthy foods, cost of healthy foods and food advertising for high-calorie, high-fat snacks and sugary drinks.

4. Genes and Family History

The chances of being overweight are greater if one or both the parents are overweight or obese. Because families also share food and physical activity habits, a link exists between genes and the environment and children adopt the habits of their parents.

5. Health Conditions

Some hormone problems may cause overweight and obesity, such as underactive thyroid (hypothyroidism), Cushing's syndrome and polycystic ovarian syndrome (PCOS). Underactive thyroid is a condition in which the thyroid gland doesn't make enough thyroid hormone. Lack of thyroid hormone will slow down the metabolism and cause weight gain. The individual will also feel tired and weak. People who have Cushing's syndrome gain weight, have upper-body obesity, a rounded face, fat around the neck, and thin arms and legs. PCOS is a condition that affects about 5–10 percent of women of childbearing age. Women who have PCOS often are obese, have excess hair growth, and have reproductive problems and other health issues. These problems are caused by high levels of hormones called androgens.

6. Medicines

Certain medicines may cause gain weight. These medicines include some corticosteroids, antidepressants, and seizure medicines. These medicines can slow the rate at which the body burns calories, increases appetite, or cause to hold on to extra water. All of these factors can lead to weight gain.

7. Emotional Factors

Some people eat more than usual when they're bored, angry, or stressed. Over time, overeating will lead to weight gain and may cause overweight or obesity.

8. Smoking

Some people gain weight when they stop smoking. One reason is that food often tastes and smells better after quitting smoking. Another reason is because nicotine raises the rate at which the body burns calories, so the individual burn fewer calories when stop smoking. However, smoking is a serious health risk and quitting is more important than possible weight gain.

9. Age and gender

As the individual get older, tend to lose muscle, especially if less active. Muscle loss can slow down the rate at which the body burns calories. If calorie intake is not reduced as getting older, may gain weight. Midlife weight gain in women is mainly due to aging and lifestyle, but menopause also plays a role. Many women gain about 5 pounds during menopause and have more fat around the waist than they did before. Prevalence of obesity among Indian women has elevated from 10.6% (NFHS-2 in 1998-1999) to 12.6% (NFHS-3 in 2005-2006).

10. Socio economic factors

The living conditions in rural areas had improved considerably. Transport facilities, medical care and food habits, educational status and family income had dramatically improved which along with easy access to city and television watching resulted in changes in life style. These eventually led to significant increase in BMI as well as abdominal obesity in both sexes. The prevalence of overweight rose from 2% to 17.1% in rural India. The changing life style of the rural dwellers was found to be a contributory factor for the rising rates of obesity and associated metabolic diseases, such as diabetes.

11. Pregnancy

During pregnancy, women gain weight to support their babies growth and development. After giving birth, some women find it hard to lose the weight. This may lead to overweight or obesity, especially after a few pregnancies.

12. Lack of Sleep

Research shows that lack of sleep increases the risk of obesity. For example, one study of teenagers showed that with each hour of sleep lost, the odds of becoming obese went up. Lack of sleep increases the risk of obesity in other age groups as well. People who sleep fewer hours also seem to prefer eating foods that are higher in calories and carbohydrates, which can lead to overeating, weight gain and obesity. Sleep helps to maintain a healthy balance of the hormones that make feel hungry (ghrelin) or full (leptin). When there is not enough sleep, the level of ghrelin goes up and level of leptin goes down. This makes feel hungrier than well-rested. Sleep also affects how body reacts to insulin, the hormone that controls blood glucose (sugar) level. Lack of sleep results in a higher than normal blood sugar level, which may increase risk for diabetes.[57]

Health impacts of Overweight and Obesity

Coronary Heart Disease

As body mass index rises, so does risk for coronary heart disease (CHD). CHD is a condition in which a waxy substance called plaque builds up inside the coronary arteries. These arteries supply oxygen-rich blood to your heart. Plaque can narrow or block the coronary arteries and reduce blood flow to the heart muscle.

High Blood Pressure

Blood pressure is the force of blood pushing against the walls of the arteries as the heart pumps blood. If this pressure rises and stays high over time, it can damage the body in many ways. Chances of having high blood pressure are greater with overweight or obesity.

Stroke

Being overweight or obese can lead to a buildup of plaque in arteries. Eventually, an area of plaque can rupture, causing a blood clot to form. If the clot is close to brain, it can block the flow of blood and oxygen to brain and cause a stroke. The risk of having a stroke rises as BMI increases.

Type 2 Diabetes

Diabetes is a disease in which the body's blood glucose or blood sugar level is too high. Normally, the body breaks down food into glucose and then carries it to cells throughout the body. The cells use a hormone called insulin to turn the glucose into energy. In type 2 diabetes, the body's cells don't use insulin properly. At first, the body reacts by making more insulin. Over time, however, the body can't make enough insulin to control its blood sugar level. Diabetes is a leading cause of early death, CHD, stroke, kidney disease and blindness. Most people who have type 2 diabetes are overweight.

Abnormal Blood Fats

Overweight and obesity increases the risk of having abnormal levels of blood fats. These include high levels of triglycerides and LDL (bad) cholesterol and low levels of HDL (good) cholesterol and abnormal levels of these blood fats are a risk factor for CHD.

Metabolic Syndrome

Metabolic syndrome is the name for a group of risk factors that raises risk for heart disease and other health problems, such as diabetes and stroke. Individual may develop any one of these risk factors by itself, but they tend to occur together. A diagnosis of metabolic syndrome is made if at least three of the following risk factors are present: a large waistline, a higher than normal triglyceride level, a lower than normal HDL cholesterol level, higher than normal blood pressure and higher than normal fasting blood sugar.

Cancer

Obesity raises risk for colon, breast, endometrial, and gall bladder cancers.

Osteoarthritis

Osteoarthritis is a common joint problem of the knees, hips and low back. The condition occurs if the tissue that protects the joints wears away. Extra weight can put more pressure and wear on joints causing pain.

Sleep Apnea

Sleep apnea is a common disorder in which one or more pauses in breathing or shallow breaths while sleep. A person who has sleep apnea may have more fat stored around the neck. This can narrow the airway, making it hard to breathe.

Obesity Hypoventilation Syndrome

Obesity hypoventilation syndrome (OHS) is a breathing disorder that affects some obese people. In OHS, poor breathing results in too much carbon dioxide (hypoventilation) and too little oxygen in the blood (hypoxemia). OHS can lead to serious health problems and may even cause death.

Reproductive Problems

Obesity can cause menstrual issues and infertility in women.

Gallstones

Gallstones are hard pieces of stone-like material that form in the gallbladder. They're mostly made of cholesterol. Gallstones can cause stomach or back pain. People who are overweight or obese are at increased risk of having gallstones. Also, being overweight may result in an enlarged gallbladder that doesn't work well.

Diagnosis of obesity

Obesity is diagnosed based on the BMI (Body Mass Index) and Waist Circumferences. **BMI Calculation:** BMI is calculated by dividing the subject's mass by the square of his or her height.

$$\text{BMI} = \text{Weight in kg}/(\text{Height in meters})^2$$

BMI classification (WHO)

BMI < 18.5	-	Under weight
BMI < 18.5 – 24.9	-	Normal weight
BMI < 25.0 – 29.9	-	Over weight
BMI < 30.0 – 34.9	-	Class I obesity
BMI < 35 – 39.9	-	Class II obesity
BMI > 40.0	-	Class III obesity

But according to Misra et al., 2008 this Classification is not appropriate for Asian Indian population because the Indians develop co morbidities even at the earlier stage of BMI level itself. So in this study the researcher has followed the consensus range of BMI of Misra et.al., recommendation which was also approved by ICMR.[58]

Consensus Statement:

BMI 18 – 22.9	-	Normal,
BMI 23 – 24.9	-	Over weight
BMI > 25	-	Obesity

Waist Circumference

The central obesity is diagnosed based on the WC which is measured at a level midway between the lowest rib and the iliac crest. WC cut off for men = 102cm and for women = 88cm (WHO). But according to Misra et al 2008 study WC cut-off for Asian Indians are

Action Level 1: Men 78cm Women 72 cm: Any person with WC above these levels should avoid gaining weight and maintain physical activity to avoid acquiring any of the cardiovascular risk factor. These action level 1 cut-offs need to be researched further.

Action Level 2: Men 90cm Women: 80cm: Subject with WC above this should seek medical help so that obesity-related risk factors could be investigated and managed[58]

Percent Body Fat:

Body fat is the amount of fat in the body, compared to everything else. Everything else includes organs, muscles, bones, tendons, water, and so on which will be measured by bio electrical impedance analysis. The range for percent body fat followed in this study was given by American Council on Exercise.

Percent Body Fat(American Council on Exercise)	Male	Female	
	14-17%	21-24 %	Ideal
	18-24%	25-31 %	Average
	>25%	> 32%	Obese

Management of obesity

Overweight and obesity are complex health problems. There are many health conditions associated with overweight and obesity including hypertension, coronary heart disease, and type 2 diabetes. Therefore, it is likely that health care practitioners will be advising overweight or obese individuals who also have additional health conditions. The challenge for many practitioners is choosing an appropriate weight management therapy that will simultaneously address these multiple health conditions. Fortunately, lifestyle changes including healthy eating patterns, increased physical activity, and weight management often improve the risk factors associated with obesity.

Management by dietary modification:

The first step in dietary management of obesity is to lose weight by decreasing energy intake to achieve an energy deficit that can be sustained for a sufficient period. A 5-10% weight loss over a 3-6 month period has massive health benefits. A weight loss of 0.5 to 1 kg/week is a safe and achievable target and can be achieved by a 500 to 1000kcal daily deficit. The second step, following weight loss, is to maintain weight loss by ensuring that energy intake matches energy needs[54].

The easiest way to reduce dietary energy density is to reduce fat intake. Reducing intakes of sugar-rich and alcoholic drinks is also a useful strategy for reducing energy intake. Liquid calories have low satiating properties compared with foods of similar energy content and are often consumed in addition to other foods rather than as a substitution. Sugar-rich and alcoholic drinks also have very low micronutrient content;

therefore do not contribute to the nutritional density of the diet. For these reasons sugar-rich and alcoholic drinks are often referred to as providing 'empty calories'. Reducing added sugars and increasing fruit and vegetable intake can also contribute to decreases in dietary energy density.

Decreasing portion sizes can help decrease dietary energy density. Larger portion sizes provide more energy and people don't feel full/satisfied relative to the amount eaten and they do not compensate by eating less later on in the day. Careful planning and restraint is often needed to reduce portion sizes. Increasing low energy dense foods, such as vegetables and/or fibre-rich carbohydrates will help to maintain satiety. This concept is also highlighted by TLC diet.

Therapeutic Life style Change diet (TLC) is designed by National Cholesterol Education Program (NECP) to lower cholesterol by regulating diet to elevate physical activity, reduce weight and threats of heart attacks. Although, the diet is not designed to cut down weight, it is well-liked, as it not only helps in weight loss but is also good for overall health. The diet rules daily intake of fats, carbohydrates, proteins and fiber-containing products, for a balanced diet.

TLC diet is based on a few basic guidelines as mentioned below:

- Intake of saturated fat should be kept below 7 percent of the total calorie intake
- Daily cholesterol intake should be kept below 200 milligrams
- Sodium intake must be limited to 2400 mg per day
- 25-35% of daily total calories should come from fat intake
- Calorie intake should be kept to a level needed for maintaining healthy weight and balance energy intake and expenditure

- Physical activity must be maintained regularly along with the diet, i.e. at least 30 minutes of exercise each day.
- Emphasizes grains, cereals, legumes, Vegetables, Fruits, Lean meats, Poultry, Fish and Non fat dairy products.
- Carbohydrates - Foods rich in complex carbohydrates

Strategies to reduce SFA & Trans –fatty acids are

1. Avoiding hydrogenated fats as spreads or for flavouring
2. Avoiding or reducing the consumption of meat
3. Using specially manufactured low fat foods.
4. Modifying common foods to be lower in fat (Ex: Removing skin from chicken)
5. Replacing high fat foods with low fat foods.(Substituting skim milk for whole milk)
6. Low calories diets are high in carbohydrates (55%-60% of total daily energy intake), low in fat (< 30% of energy intake).

Indian dietetic association recommends the weight reducing calorie diet(20 k.cal per kg body weight) and the calorie reduced should not be less than 1200 k.cal for women &1400 k.cal for men.

Management by Physical Activity modifications

Global strategy on physical activity for adults aged 18–64 yrs recommends that physical activity includes leisure time physical activity (for example: walking, dancing, gardening, hiking, swimming), transportation (e.g. walking or cycling), occupational (i.e. work), household chores, play, games, sports or planned exercise, in the context of daily, family and community activities in order to improve cardiorespiratory and muscular fitness, bone health, reduce the risk of NCDs and depression. It has recommended sixty

minutes of brisk walking in a day for 5 days in a week. The individual should walk 2 miles in 30 minutes as suggested by National Institute of Health.

Global Recommendations

1. Adults aged 18-64 years should do at least 150 minutes of moderate-intensity aerobic physical Activity throughout the week, or do at least 75 minutes of vigorous – intensity aerobic physical activity. Throughout the week, or an equivalent combination of moderate-and vigorous-intensity activity.
2. Aerobic activity should be performed in bouts of at least 10 minutes duration.
3. For additional health benefits, adults should increase their moderate – intensity aerobic physical activity to 300 minutes per week, or engage in 150 minutes of vigorous-intensity aerobic physical activity per week, or an equivalent combination of moderate-and vigorous-intensity activity.
4. Muscle – strengthening activities should be done involving major muscle groups on 2 or more days a week. Inactive people should start with small amounts of physical activity and gradually increase duration, frequency and intensity over time. Inactive adults and those with disease limitations will have added health benefits when they become more active.

These guidelines are relevant to all healthy adults aged 18–64 years, unless specific medical conditions indicate to the contrary, irrespective of gender, race, ethnicity or income level. They also apply to individuals in this age range with chronic non communicable conditions not related to mobility such as hypertension or diabetes. These recommendations can be applied to adults with disabilities. However they may need to be adjusted for each individual based on their exercise capacity and specific health needs. Pregnant, postpartum women and persons with cardiac events may need to

take extra precautions and seek medical advice before striving to achieve the recommended levels of physical activity for this age group.

Intensity of physical activity

Intensity refers to the rate at which the activity is being performed or the magnitude of the effort required to perform an activity or exercise. It can be thought of How hard a person works to do the activity. Metabolic Equivalents (METs) are commonly used to express the intensity of physical activities. MET is the ratio of a person's working metabolic rate relative to their resting metabolic rate. One MET is defined as the energy cost of sitting quietly and is equivalent to a caloric consumption of 1kcal/kg/hour. It is estimated that compared with sitting quietly, a person's caloric consumption is three to six times higher when being moderately active (3-6 METs- examples brisk walking, dancing, gardening, house work and domestic chores and moving moderate loads) and more than six times higher when being vigorously active (>6 METs- for example running, walking/climbing briskly up a hill, fast cycling, fast swimming, competitive sports, digging ditch and moving heavy loads).

Medical management

Weight-loss medicines approved by the Food and Drug Administration (FDA) might be an option for some people. If not successful at losing 1 pound a week after 6 months of using lifestyle changes, medicines may help. Individual should only use medicines as part of a program that includes diet, physical activity, and behavioral changes. Weight-loss medicines might be suitable for adults who are obese with a BMI of 30 or greater and for people who have BMIs of 27 or greater with risk for heart disease and other health conditions. Examples of few drugs are Orlistat, Lorcaserin Hydrochloride (Belviq®) and Qsymia™. Some prescription medicines are used for

weight loss, but aren't FDA-approved for treating obesity. They include medicines to treat depression, medicines to treat seizures and medicines to treat diabetes (Metformin).[57]

Surgical management

Two common weight-loss surgeries include banded gastroplasty and Roux-en-Y gastric bypass. For gastroplasty, a band or staples are used to create a small pouch at the top of your stomach. This surgery limits the amount of food and liquids the stomach can hold. For gastric bypass, a small stomach pouch is created with a bypass around part of the small intestine where most of the calories you eat are absorbed. This surgery limits food intake and reduces the calories your body absorbs.

Prevention of obesity

Following a healthy lifestyle can help prevent overweight and obesity. Many lifestyle habits begin during childhood. Thus, parents and families should encourage their children to make healthy choices. For example Healthy eating plan (food choices and focus on the balance of energy IN and energy OUT), Focus on portion size (Cutting back on portion size will help balance energy IN and energy OUT), Being active (Making personal and family time active), Reducing screen time (Limiting the use of TVs, computers, DVDs, and videogames because they limit time for physical activity) and Keeping track of weight, body mass index, waist circumference and children's growth.[57]

3.2 Part – 2:

3.2.1 REVIEWS RELATED TO PREVALENCE OF OBESITY AMONG ADULTS

Kanter R, Caballero B (2012)[61] conducted a review to explore the global gender disparities in obesity pandemic. The web based review revealed that there is gender disparities in the prevalence of overweight and obesity among men and women but varies greatly within and between countries, and overall, more women are obese than men. These gender disparities in overweight and obesity are exacerbated among women in developing countries, particularly in the Middle East and North Africa. Yet, in developed countries, more men are overweight than women. It was concluded that differences in food consumption, nutrition transition, physical activity and cultural values as sign of fertility, healthfulness and prosperity affects weight gain among both men and women. The study recommended more research on gender disparities in overweight and obesity which will improve the understanding of this pandemic.

Dinsa GD, Goryakin Y et al., (2012)[62] undertook a systematic web based review of studies to assess the association between socioeconomic status (SES) and obesity in low- and middle-income countries among children, men and women. They found that in low-income countries or in countries with low human development index (HDI), the association between SES and obesity appears to be positive for both men and women: the more affluent and/or those with higher educational attainment tend to be more likely to be obese. However, in middle-income countries or in countries with medium HDI, the association becomes largely mixed for men and mainly negative for women. By contrast, obesity in children appears to be predominantly a problem of the rich in low- and middle-income countries.

Uthakalla Vijaya Kumar, Kumar K.J et al., (2012)[83] conducted a study to assess the prevalence of overweight/obesity and its relationship with physical activity and morbidity patterns among adults of urban area of Andhra Pradesh (AP). In this study 400 samples from 3 slums of 41 slums were interviewed and found that the prevalence of overweight/obesity was 37%. (males 27.27% and females 44.64%). Nearly 45.45% of 51–60 yrs and 47.05% of non regular exercise were overweight/obese which indicates the significant association at $p<0.001$ for age and exercise. Morbidities among subjects with BMI >25 were HTN (12.16%), DM (13.52%), joint pains (31.08%), respiratory diseases (8.01%) and CAD (1.35%). The study concluded that as the age increases overweight/obesity also increases along a gradient till 60+yrs. High literacy, T.V. watching and low physical exercise were significantly associated with overweight/obesity. As BMI increases morbidities tend to increase in urban area.

H K Thakkar, S K Misra et al(2011)[33] conducted a cross sectional study and screened 400 college going girls of 15-24 yrs and measured height, weight, waist circumference, hip circumference and found that the prevalence of overweight and obesity was 18.5% and 4.5% respectively 45.5% of the subjects had normal weight and 31.5% were underweight based on WHO cut- off.. According to revised Indian guideline, surprisingly, 42.5% were classified as overweight/obese amongst which 23% were obese with remaining 19.5% overweight and 57.5% of subjects were either classified as normal (26%) and below normal (31.5%). The study concluded that higher prevalence of obesity especially by Indian guidelines, calls for the prevention and control of this problem with prime attention.

Fernandez R, Miranda C, et al (2011)[63] conducted a review to investigate the prevalence of obesity among migrant Asian Indians globally. All published studies (databases medline) that investigated obesity rates in migrant Asian Indians were considered for inclusion in the review. Ten studies investigating the obesity indices in Asian Indians were eligible for this review. All ten trials that reported on BMI values demonstrated significantly higher BMI values among migrant Asian Indians when compared with other migrants and the native population. A greater proportion of Asian Indians had BMIs greater than 30 compared with other ethnic groups. Up to 80% of the Asian Indian women had a waist circumference greater than the recommended value of 88 cm. This is likely to contribute to the high levels of diabetes and coronary heart disease in this population. It was recommended that culturally appropriate strategies to reduce obesity, particularly abdominal obesity, in this ethnic group are urgently needed.

Dalal S, Beunza JJ et al (2011)[64] conducted a review to identify the disproportionate burden of both infectious and NCDs compared with other world regions in Sub Saharan Africa (SSA). The literature search was done at Pub Med database on NCDs in SSA and summarized data from the World Health Organization and International Agency for Research on Cancer on the prevalence and incidence of cardiovascular diseases, diabetes mellitus Type 2, cancer and their risk factors. It was found few community-based studies and some countries (such as South Africa) were over-represented. The prevalence of NCDs and risk factors varied considerably between countries, urban/rural location and other sub-populations. The prevalence of stroke ranged from 0.07 to 0.3%, diabetes mellitus from 0 to 16%, hypertension from 6 to 48%, obesity from 0.4 to 43% and current smoking from 0.4 to 71%. Hypertension prevalence was consistently similar among men and women, whereas women were more frequently

obese and men were more frequently current smokers. It was concluded that the prevalence of NCDs and their risk factors is high in some SSA settings.

Hu D, Yu D (2010)[65] reviewed literature to present data on CVD and risk factors in Asian women. Data were obtained from available cohort studies and statistics for mortality from the World Health Organization. The CHD mortality in Indian and Central Asian women was high and it was low in southeast and east Asia. Chinese and Indian women have very high rates and mortality from stroke and it was also high in central Asian and Japanese women. Hypertension and type 2 DM were as prevalent as in western women, but rates of obesity and smoking were less common. Study recommended lifestyle interventions aimed at prevention in all these areas.

Wang Y, Chen HJ et al (2009)[66] conducted a systematic literature review using Pub Med and other data sources, aimed to examine the prevalence and trends of overweight, obesity and under nutrition in recent decades in India. The findings showed that the prevalence of overweight was low while that of under nutrition remained high. Overweight was more prevalent among female, urban and high-socioeconomic-status (SES) groups. The prevalence of overweight and obesity had increased slightly over the past decade in India, but in some urban and high-SES groups it reached a relatively high level. Study recommended that factors associated with under nutrition need closer examination, and prevention of obesity should be targeted at the high-risk groups simultaneously.

Vioque J, Ramos JM et al (2009)[67] undertook a bibliometric review to assess the publications on obesity research in Pub Med over the last 20 years. A total of 58,325

references were retrieved, 25.5% in 1988-1997, and 74.5% in 1998-2007. The growth in the number of publications showed an exponential increase. The references were published in 3613 different journals, with 20 journals contributing 25% of obesity literature. North America and Europe were the most productive world areas with 44.1% and 37.9% of the literature, respectively. The US was the predominant country in number of publications, followed by the United Kingdom, Japan and Italy. The great increase of publications on obesity during the period 1988-2007 was particularly evident in the second decade of the period which is concordant with the worldwide obesity epidemic.

Low S, Chin MC et al (2009)[68] conducted a Review to assess the prevalence and trends of obesity among adults and children. They reviewed the Global Database on Body Mass Index on the World Health Organisation (WHO) Website. Various databases were also searched for relevant reviews and these include PubMed, EMBASE, NHS CRD databases and Cochrane. The prevalence of obesity was high in many parts of the world. Generally, there is an increasing trend of prevalence of adult obesity with age. The peak prevalence is reached at around 50 to 60 years old in most developed countries and earlier at around 40 to 50 years old in many developing countries. Study concluded that obesity is a major health concern and appropriate strategies need to be adopted to tackle obesity which itself brings about significant disability and premature deaths and recommended that further observation may be needed to see if the trend of prevalence abates or increases in the near future.

Seidell JC (2005)[69] conducted a review to assess the epidemiology of obesity and found that the prevalence of obesity is increasing at an alarming rate in many parts of the

world. In White populations living in the west and north of Europe, Australia, and the United States, the prevalence of obesity is similarly high in men and women. In countries with relatively low gross national product, such as those in Central and Eastern Europe, Asia, Latin-America and Africa the prevalence was 1.5 to 2 times higher among women than among men. Within affluent societies, the rates of obesity seem to be more common among women at older ages (65 years) and in groups with relatively low socioeconomic status. It was concluded that obesity is particularly common in women living in relatively poor conditions.

Monteiro CA, Moura EC et al (2005)[70] conducted a land mark review to assess the socioeconomic status (SES) and obesity in adult populations of developing countries. Studies published prior to 1989 (SES and obesity) supported the view that obesity in the developing world would be essentially a disease of the socioeconomic elite. The present review published between 1989 and 2003, shows a different scenario for the relationship between SES and obesity. Three main conclusions were emerged from the studies reviewed that is obesity in the developing world can no longer be considered solely a disease of groups with higher SES, the burden of obesity in each developing country tends to shift towards the groups with lower SES as the country's gross national product (GNP) increases and the shift of obesity towards women with low SES apparently occurs at an earlier stage of economic development than it does for men.

3.2.2 REVIEWS RELATED TO GENERAL ASPECTS OF OBESITY

3.2.2a Reviews related to causes and risk factors of obesity

Veeraswamy S, Vijayam B et al., (2012)[71] conducted a review to assess the public health relevance of gestational diabetes mellitus (GDM) and found that gestational

programming where stimuli or stresses that occur at critical or sensitive periods of foetal development permanently change structure, physiology, and metabolism, which predispose individuals to disease in adult life. If the stimulus happens to be glucose intolerance in pregnancy, gestational diabetes mellitus (GDM) manifests. Diagnosis of GDM in a woman predisposes her and her offspring for increased risk of developing glucose intolerance and obesity in the future. The study concluded that GDM may play a crucial role in the increasing prevalence of diabetes and obesity and hence has become a public health priority issue.

Ng Sw, Popkin BM(2012)[72] conducted a review to measure the time use and physical activity. Using detailed historical data on time allocation, occupational distributions, energy expenditures data by activity, and time-varying measures of metabolic equivalents of task (MET) for activities, measured the historical and current MET by four major PA domains (occupation, home production, travel and active leisure) and sedentary time among adults. Trends by domain for the United States (1965-2009), the United Kingdom (1961-2005), Brazil (2002-2007), China (1991-2009) and India (2000-2005) were observed. Given the potential impact on weight gain and other cardio metabolic health risks, the differential declines in MET of activity and increases in sedentary time across the globe represent a major threat to global health.

Rao KR, Padmavathi IJ et al., (2012)[73] conducted a review to identify the role of maternal micronutrients in the foetal origins of adiposity. Discrepancies in maternal diet at different stages of foetal growth / development can have pronounced influences on the health and well-being of the offspring. Indeed intrauterine growth restriction induced by nutrient insult can irreversibly modulate the endocrine/metabolic status of the

fetus that leads to the development of adiposity and insulin resistance in its later life. The study concluded that understanding the role of micronutrients during the development of fetus will provide insights into the probable underlying / associated mechanisms in the metabolic pathways of endocrine related complications. Modernized lifestyle and food habits lead to the development of adiposity and world burden of obesity.

Misra A, Singhal N et al., (2011)[74] conducted a review to explore the secular trends in food groups and nutrient intake and implications for Diet-Related Non-Communicable Diseases (DR-NCDs) in India. The literature search was carried out in PubMed up to April 2011. Nutrition transition over the past 30 years (1973-2004), had resulted in a 7% decrease in energy derived from carbohydrates and a 6% increase in energy derived from fats. A decreasing intake of coarse cereals, pulses, fruits and vegetables, an increasing intake of meat products and salt, coupled with declining levels of physical activity due to rapid urbanization have resulted in escalating levels of obesity, atherogenic dyslipidemia, subclinical inflammation, metabolic syndrome, type 2 diabetes mellitus, and coronary heart disease in Indians. In view of rapidly increasing imbalanced diets, a multi sectoral preventive approach is needed to provide balanced diets to pregnant women, children and adults and to maintain a normal body weight from childhood onwards, to prevent the escalation of DR-NCDs in India.

Misra A, Khurana L et al., (2009)[75] conducted a review by literature search in the pub med published from 1966 to 2009 and found that a high prevalence of the metabolic syndrome and associated cardiovascular risk factors has been observed not only in urban South Asian/Asian Indian adults and children but also in economically disadvantaged people residing in urban slums and rural areas. The main drivers are rapid

nutrition, lifestyle, and socioeconomic transitions, consequent to increasing affluence, urbanization, mechanization, and rural-to-urban migration. Metabolic syndrome and cardiovascular risk in South Asians were high by their higher body fat, truncal subcutaneous fat, intra-abdominal fat, and ectopic fat deposition. Further, cardiovascular risk cluster manifests at a lower level of adiposity and abdominal obesity. The cut offs of BMI and WC for defining obesity and abdominal obesity, respectively, have been lowered and the definition of the metabolic syndrome has been revised for Asian Indians in a recent consensus statement, so that physicians could intervene early with lifestyle management.

Gracey M, King M (2009)[76] conducted a review to assess the determinants and disease patterns among the indigenous people. Data was collected from pub med and explored that the world's almost 400 million indigenous people have low standards of health which is associated with poverty, malnutrition, overcrowding, poor hygiene, environmental contamination, and prevalent infections.. Some Indigenous groups, as they move from traditional to transitional and modern lifestyles, are rapidly acquiring lifestyle diseases, such as obesity, cardiovascular disease, and type 2 diabetes, and physical, social, and mental disorders linked to misuse of alcohol and of other drugs. The study concluded that correction of these inequities needs increased awareness, political commitment, and recognition rather than governmental denial and neglect of these serious and complex problems.

Misra A, Khurana L et al., (2008)[77] conducted a review to assess the obesity and the metabolic syndrome in developing countries. Evidence was synthesised from literature published in pubmed and also from WHO and Food and Agricultural

Organization (FAO) reports search from 1966 to 2006 and reported that with improvement in economic situation in developing countries, increasing prevalence of obesity and the metabolic syndrome is seen in adults and particularly in children. The main causes are increasing urbanization, nutrition transition, and reduced physical activity. Furthermore, aggressive community nutrition intervention programs for undernourished children may increase obesity. The study concluded that there is an urgent need to initiate large-scale community intervention programs focusing on increased physical activity and healthier food options.

Misra A, Khurana L et al., (2008)[78] conducted a review to assess the South Asian diets and insulin resistance. Data pertaining to nutrient intake, insulin resistance and cardiovascular risk factors in Asian Indians and South Asians have been reviewed and several dietary imbalances have been reported: low intake of MUFA, n-3 PUFA and fibre, and high intake of fats, saturated fats, carbohydrates and trans-fatty acids. Some data suggest that these nutrient imbalances are associated with insulin resistance, dyslipidaemia and subclinical inflammation in South Asians. High-carbohydrate meal consumption was reported to cause hyperinsulinaemia, postprandial hyperglycaemia and hypertriacylglycerolaemia. Dietary supplementation with n-3 PUFA leads to an improved lipid profile but not insulin sensitivity. The study concluded that nationwide community intervention programmes aimed at creating awareness about the consequences of unhealthy food choices and replacing them by healthy food choices are urgently needed in urban and rural populations in India, other countries in South Asia and in migrant South Asians.

Candib LM (2007)[79] conducted a review to assess the obesity and diabetes in vulnerable populations(People from low-income and minority communities): reflection on proximal and distal Causes. The complex factors responsible were genetic, physiological, psychological, familial, social, economic, and political-coalescing to over determine these conditions. These interacting factors include events occurring during fetal life, maternal physiology and life context, the thrifty genotype, the nutritional transition, health impact of urbanization and immigration, social attributions and cultural perceptions of increased weight, and changes in food costs and availability resulting from globalization. The study concluded that better appreciation of the complexity of causation underlying the worldwide epidemic of obesity and diabetes can refocus the work of clinicians and researchers to work at multiple levels to address prevention and treatment for these conditions among vulnerable populations.

3.2.2b Reviews related to diagnosis of obesity

Chen S, Binns CW et al., (2012)[80] conducted a review to explore the importance of definition in diagnosing obesity. This article reviewed the definitions of childhood obesity used in Chinese studies published over the past 10 years. The majority (79%) of the Chinese studies used a definition of >120% of the mean value of the National Center for Health Statistics reference population to diagnose childhood obesity. Only 7 studies (9%) conducted in China measured childhood obesity using age-specific and sex-specific body mass index (BMI) cutoffs. It is important that all studies accurately define the obesity with growth reference, cutoff criteria, sample selection, and age distribution. The use of sex-specific and age-specific BMI cutoffs should be considered.

Decaria JE, Sharp C et al., (2012)[81] conducted a review to examine what is known about the diagnosis, treatment and management of obesity in older adults. A total of 492 relevant research articles were identified using Pub Med, Scirus, EBSCO, Clinical trials.gov, Cochrane Reviews and Google Scholar. The findings of this review reported that the current WHO recommended BMI, WC and waist-to-hip ratio obesity thresholds for the general adult population may not be appropriate for older adults. In conclusion, this review demonstrated the need for more research to clarify the definition of obesity in older adults, to establish criteria for evaluating when to treat older adults for obesity and to develop effective treatment strategies focused on functional outcomes in obese older adults.

Mascie-Taylor CG, Goto R (2007)[82] conducted review to assess the Human variation and universality of BMI and found that use of universal BMI cut-off points do not seem appropriate and lower cut-off points than currently recommended should be used in some populations, especially in Asia. The adult BMI in WHO database indicated that, on average, women were more obese than men, while men were more likely to be pre-obese than women. Urban rates of overweight and obesity were generally higher than rural rates in both sexes. The trend in pre-obesity and obesity over time were generally upward, with very marked increases in the USA and UK in both sexes over the last 10 years.

3.2.2c Reviews related to health impacts of obesity

Peterhänsel C, Petroff D, et al., (2013)[84] conducted a systematic review to estimate the suicide mortality after bariatric surgery. Literature researches of the databases Pub Med, Web of Knowledge, PsychInfo, Science Direct and Google Scholar

were conducted. 28 studies in the estimation of a suicide rate for the bariatric population was selected. 23885 people were included in the analysis. In the literature, it was found a total of 95 suicides when examining 190,000 person-years of post-bariatric surgery data. Little information was provided describing the reasons for suicide and the time-point of these events after surgery. Estimated a suicide rate of 4.1/10,000 person-years. A comparison with Tindle et al., demonstrated that their rate was significantly higher than the estimate (P = 0.03). Bariatric surgery patients showed higher suicide rates than the general population. Therefore, there was a great need to identify persons at risk and post-operative psychological monitoring was recommended.

Makino T, Shukla PJ et al., (2012)[85] conducted a review with the aim to evaluate the feasibility and safety of laparoscopic colectomy for colorectal diseases in obese patients compared with non obese patients. Retrieved all relevant articles from 1983-2010. A total of 33 studies were found to be eligible. Obesity was associated with longer operative times and higher rates of conversion to open procedures. Although some studies showed obesity was associated with increased postoperative morbidity including cardiopulmonary and systemic complications, or ileus leading to longer hospital stay, there was no evidence about the negative impact of obesity on intra operative blood loss, peri operative mortality and reoperation rate. The postoperative recovery of gastrointestinal function was similar between obese and non obese patients. Laparoscopic colorectal surgery appears to be a safe and reasonable option in obese patients.

Song SH (2012)[86] conducted a review to assess emerging Type 2 diabetes mellitus in young adults at the level of global epidemic driven by the increasing burden

of obesity. Evidence is accumulating to suggest that this young diabetic cohort is an aggressive phenotype which leads to the premature development of complications that not only have impact on the quality of life but also unfavorable influence on the long term outcome, raising the possibility of a serious public health challenge in the next few decades.

Ginter E, Simko V (2012)[87] conducted a review to assess the threat that the T2DM epidemic represented to mankind. The highest prevalence of T2DM was in Saudi Arabia, over 10% of adults in the USA, Switzerland and Austria. Prevalence was low in Norway, China and in Iceland. Predictions of epidemiologists for the first third of the 21st century claim up to 2.5 times increase in the prevalence of T2DM in the Middle East, Sub-Saharan Africa, India and rest of Asia and in the Latin America. In China the number of patients with T2DM will double in 2030. In the economically advanced countries the increase will be about 50% in 2030. Increasing urbanization, aging populations, obesity and falling levels of physical activity were all contributing to the rise of T2DM worldwide. The main cause of T2DM pandemic was growing prevalence of obesity in Europe and USA. In the North America and European Union countries obesity was considered to be responsible for up to 70-90% of T2DM in adult population.

Farag YM, Kari JA et al., (2012)[88] conducted a review to assess Chronic kidney disease in the Arab world and explored that Chronic kidney disease (CKD) is an emerging non-communicable disease worldwide. The Arab countries have a high prevalence of CKD risk factors, e.g. diabetes, obesity and hypertension. Unfortunately, the magnitude of CKD in the Arab world has not been studied well. This review

presented the current data on CKD in the Arab world and proposed a call for action to address this rising epidemic.

Jialin W, Yi Z, Weijie Y et al., (2012)[89] conducted a meta analysis to identify the relationship between BMI and mortality in haemodialysis patients. Four studies with a total of 81,423 patients met final inclusion criteria. Compared to individuals with non-elevated BMI, those with elevated BMI had lower all-cause mortality. In a risk-adjusted sensitivity analysis, elevated BMI levels remained protective against mortality. The study concluded that high BMI levels were associated with lower all-cause mortality rates in HD patients. It is possible that more stable hemodynamic status, cytokine and neurohormonal alternations contribute to the protective effects of BMI on mortality in HD patients. There is a need for prospective studies to elucidate mechanisms behind this relationship.

Barakat H, Barakat H, (2012)[90] conducted a review with the aim to counteract the indifference towards obesity as a threat to Syrian's health, as the country was slowly becoming a leader in CVD mortality globally. Pub Med, WHO, and official government websites were searched literature related to CVD morbidity, mortality, and risk factors. Obesity remained the prevailing CVD risk factor except in older Syrian men, where smoking and hypertension were more common. CVD mortality was more common in males due to coronary disease, while stroke dominated female mortality. The young workforce was especially impacted, with 50% of CVD mortality occurring before age 65 years and an 81% prevalence of obesity in women over 45 years. The study concluded that Syria can overcome its slow response to the CVD epidemic and curb further

deterioration by reducing obesity. This can be achieved via multilayered awareness and intensive parental and familial involvement

Zhang Y (2010)[91] conducted a review to assess the current information about the occurrence and risk factors of atherosclerotic CVD in American women. The most recent scientific publications from the American Heart Association (AHA), the Centers for Disease Control and Prevention (CDC), and the National Heart, Lung, and Blood Institutes were reviewed with regard to CVD in the US population. The findings reported that about 35% women 37.6% of men in the United States have some form of CVD. The CVD incidence for women was close to that of men 10 years younger. The gap narrowed with advancing age. Since 1984, the number of CVD deaths for women has exceeded those for men. Women represent 52.6% of CVD deaths, and CVD was the leading cause of death in US women. In both men and women risk factors such as hypertension, high blood cholesterol level, smoking, lack of physical activity and obesity increase the probability of developing CVD. Menopause, oral contraceptive use and bilateral Oopherectomy in premenopausal women also affect the risk of CVD in women.

Vikram A, Jena G et al., (2010)[92] conducted a review to assess the insulin resistance and development of benign prostatic hyperplasia (BPH). Insulin-resistance syndrome includes group of disorders, such as obesity, dyslipidemia, sympathetic overactivity, hyperinsulinemia. During insulin-resistance, hyperinsulinemia develops to combat the decreased responsiveness of the body towards insulin. Although, the compensatory hyper insulinemia prevents development of fasting hyperglycemia in insulin-resistant individuals, the increased level of circulating insulin directly and/or indirectly affects different molecular signaling and can promote prostatic growth. Each

disorder was individually reported as risk factor for the development of BPH. The present review described the inter-relationships between different insulin-resistance associated factors and their possible involvement in the pathogenesis of BPH.

Sarkar NN et al., (2009)[93] conducted a review to identify the role of sex steroids on the libido, sexual life, emotional and physiological heart of men of all ages. At puberty, testosterone increases dramatically in boys. Changes in weight and height of boys across this period were associated with increasing testosterone concentration and sex hormone binding globulin (SHBG). Romantic thoughts, fantasy, and sexual pleasure-seeking behaviour in adolescents were associated with exposure to high androgens secretion. Lower testosterone levels were associated with erectile dysfunction among other risk factors: diabetes, hypertension, heart disease, psychological stress and obesity. Men with proven coronary atherosclerosis had lower levels of testosterone and SHBG, which had negative correlation with very low-density lipoprotein, triglycerides, body mass index and body fat mass.

Gupta R (2008)[128] conducted a review to identify the recent trends in Coronary heart disease (CHD) epidemiology. Mortality data from the Registrar General of India showed that cardiovascular diseases are a major cause of death in India now. Analysis of cross-sectional CHD epidemiological studies performed over the past 50 years revealed that this condition is increasing in both urban and rural areas. The adult prevalence has increased in urban areas from about 2% in 1960 to 6.5% in 1970, 7.0% in 1980, 9.7% in 1990 and 10.5% in 2000; while in rural areas, it increased from 2% in 1970, to 2.5% in 1980, 4% in 1990, and 4.5% in 2000. In terms of absolute numbers this translates into 30 million CHD patients in the country. The disease occurs at a much younger age in

Indians as compared to those in North America and Western Europe. Rural-urban differences reveal that risk factors like obesity, truncal obesity, hypertension, high cholesterol, low HDL cholesterol and diabetes were more in urban areas. The INTERHEART-South Asia study identified that eight established coronary risk factors--abnormal lipids, smoking, hypertension, diabetes, abdominal obesity, psychosocial factors, low fruit and vegetable consumption and lack of physical activity--accounted for 89% of the cases of acute myocardial infarction in Indians. There was epidemiological evidence that all these risk factors are increasing.

Gupta R, Joshi P et al., (2008)[94] conducted a review to assess the epidemiology of CHD and stroke in India. The review of all reports and literature revealed that CVDs were the major causes of mortality in the Indian subcontinent, causing more than 25% of deaths. Coronary heart disease and stroke have increased in both urban and rural areas. Case-control studies indicated that tobacco use, obesity with high waist-hip ratio, high blood pressure, high LDL cholesterol, low HDL cholesterol, abnormal apolipoprotein ratio, diabetes, low consumption of fruits and vegetables, sedentary lifestyles and psychosocial stress are important determinants of cardiovascular diseases in India. These risk factors have increased substantially over the past 50 years and to control further escalation it is important to prevent them. National interventions such as increasing tobacco taxes, labelling unhealthy foods and transfats, reduction of salt in processed foods and better urban design to promote physical activity may have a wide short-term impact.

Allahbadia GN, Merchant R. et al (2008)[95] conducted a review to assess Polycystic ovary syndrome in the Indian Subcontinent. The study explored that the

epidemic of obesity and diabetes mellitus in most industrialized countries including China and India owing to Westernization, urbanization, and mechanization and evidence suggesting a pathogeneic role of obesity in the development of PCOS and related infertility called for active intervention to combat the malice of these disorders. Pharmacologic therapy is a critical step in the management of patients with metabolic syndrome when lifestyle modifications fail to achieve the therapeutic goals, and studies in China and India have proved to be effective.

Asia Pacific Cohort Studies Collaboration (2007)[96] conducted a review to assess the burden of overweight and obesity in the Asia Pacific region. The most recent nationally representative estimates for the prevalence of overweight and obesity in 14 countries of the region revealed that overweight and obesity was endemic in much of the region, prevalence ranging from less than 5% in India to 60% in Australia. Moreover, although the prevalence in China was a third of that in Australia, the increase in prevalence in China over the last 20 years was 40% compared with 20% in Australia. These results indicated that consequences of overweight and obesity for health and the economy of many of these countries will likely to increase in coming years.

Santoso T (2006)[97] conducted a review to assess CVDs in diabetes mellitus. WHO reported that the world statistics of DM will increase from 177 million in the year 2000 to 366 million in 2030. This is very problematical for some countries such as India, China and Indonesia where the prevention and treatment facilities are still inadequate. One of reasons why prevalence of pre-diabetic condition increased was rising obesity frequency. In the United States, over 60% of recent adult population were overweight. If diabetes mellitus occurred, cardiovascular disease (CVD) including coronary heart

disease (CHD) also may occur. It is important to prevent the diabetes mellitus as well as to prevent the risk for complication of CVD in diabetic patient.

Randi G, Franceschi S (2006)[98] conducted a review of epidemiological studies to assess the geographical distribution and risk factors of gallbladder cancer worldwide. The highest gallbladder cancer incidence rates worldwide were reported for women in Delhi, India (21.5/100,000), South Karachi, Pakistan (13.8/100,000) and Quito, Ecuador (12.9/100,000). High incidence was found in Korea and Japan and some central and eastern European countries. History of gallstone was the strongest risk factor for gallbladder cancer, with a pooled relative risk (RR) of 4.9. Consistent associations were also present with obesity, multiparity and chronic infections like Salmonella typhi and S. paratyphi pooled RR of 4.8 and Helicobacter bilis and H. pylori pooled RR 4.3. Diagnosis of gallstones and removal of gallbladder currently represent the keystone to gallbladder cancer prevention, but insisted the interventions able to prevent obesity, cholecystitis and gallstone formation need to be assessed.

Das K, Kar P (2005)[99] conducted a review to assess the therapy options for Non-alcoholic steatohepatities (NASH) which is a progressive disease in more than one in four and has spontaneous regression in less than one in six. Therapy options found in the literature include weight reduction in obese, good control in diabetics and exercise. Liver transplantation has been done in NASH but transplanted liver shows re-development in more than two thirds. Many more therapies are in the pipeline and show promise for the future.

Woolf AD, Brooks P (2008)[101] conducted a review to assess the prevention of musculoskeletal conditions in the developing world. These are an increasingly common problem across the globe due to increased longevity and increased exposure to risk factors such as obesity and lack of physical activity. The increase is predicted to be greatest in developing countries, and there is thus an urgent need for the implementation of strategies and policies that will prevent and control these conditions. The key strategy was to educate the public to know when to seek care, and health-care workers to recognize the early signs of musculoskeletal conditions.

Das SK, Farooqi A (2008)[102] conducted a review on Osteoarthritis (OA) which is a chronic degenerative disorder characterized by cartilage loss. Its prevalence was high and it was a major cause of disability. Major risk factors for osteoarthritis were age, female sex, obesity, geographic factors, occupational knee-bending, physical labour, genetic factors and race, joint trauma, vitamin D deficiency, and chondrocalcinosis. Osteoarthritis causes joint pain, stiffness and limitation of joint function. Knee involvement was the commonest presentation of this disease all over the world. Given the absence of a curative treatment, it was important to treat osteoarthritis as effectively as possible using a multidisciplinary approach tailored to the patient's needs.

3.2.2d Reviews related to management of obesity

Chugh PK, Sharma S et al., (2012)[103] conducted a review of literature published from January 1985 to December 2011 to assess the diverse targets and compounds that are in clinical development. The results revealed that Weight loss drugs in development include compounds that act centrally (neuropeptide Y, AgRP and MCH1 receptors) to limit food intake or reduce the absorption of fat from the gastrointestinal tract (lipase

inhibitors) or increase energy expenditure or reduce adipose tissue formation. Among the existing therapy, new combinations (topiramate plus phentermine, bupropion plus naltrexone) offer greater efficacy with reduced adverse effects. It was concluded that despite recent setbacks in the pharmacotherapy of obesity (withdrawal of rimonabant and sibutramine), many compounds are in phase II/III trials. The future holds promise for a new drug that alone or in combination with an existing agent could target the initial pathophysiology and morbidities associated with obesity.

Lomanto D, Lee WJ et al., (2012)[104] conducted a review to assess the Bariatric surgery rate in Asia. An e-mail questionnaire survey was sent to all the representative Asia-Pacific Metabolic and Bariatric Surgery Society (APMBSS) members of 12 leading Asian countries to provide bariatric surgery data for the last 5 years (2005-2009). Eleven nations except China responded. Between 2005 and 2009, a total of 6,598 bariatric procedures were performed on 2,445 men and 4,153 women with a mean age of 35.5 years (range, 18-69years) and mean BMI of 44.27 kg/m(2) (range, 31.4-73 kg/m(2)) by 155 practicing surgeons. Almost all of the operations were performed laparoscopically (99.8%). For combined years 2005-2009, the four most commonly performed procedures were laparoscopic adjustable gastric banding (LAGB, 35.9%), laparoscopic standard Roux-en-Y gastric bypass (LRYGB, 24.3%), laparoscopic sleeve gastrectomy (LSG, 19.5%), and laparoscopic mini gastric bypass (15.4%). Comparing the 5-year trend from 2005 to 2009, the absolute numbers of bariatric surgery procedures in Asia increased from 381 to 2,091, an increase of 5.5 times. LSG increased from 1% to 24.8% and LRYGB from 12% to 27.7%, a relative increase of 24.8 and 2.3 times, whereas LAGB and mini gastric bypass decreased from 44.6% to 35.6% and 41.7% to

6.7%, respectively. The absolute growth rate of bariatric surgery in Asia over the last 5 years was 449%.

Macpherson JL, Rasko JE (2011)[105] conducted a review to assess the Cellular therapy in the Asia-Pacific region. The study found that almost every country in the region offers at least some cellular therapies, from the highly regulated countries like Japan, Korea and Australia, through to countries where the oversight is less formal. The key healthcare drivers for this sector were the ageing population, obesity epidemic, organ donation statistics and the emergence of personalized medicine. This is a rapidly advancing field with breakthroughs announced regularly. The Asia-Pacific region is poised to become a world leader in the provision of this new generation of therapeutic options in a safe and standardised manner.

Booth CM, Moore CE et al., (2011)[106] conducted a review to assess the patient safety incidents associated with obesity**.** Totally 555 patient safety incidents were identified in the literature and 388 met inclusion criteria for analysis. 148 incidents were related to assessment, diagnosis or treatment, 213 were related to infrastructure and 27 were related to staffing. The study findings revealed that majority of incidents were classified as no or low harm. Three deaths were reported, all within the domain of anaesthesia. The study concluded that the majority of safety incidents associated with obesity was related to infrastructure, suggesting that there is inadequate provision in place for the care of obese patients. A global approach to improve the safety of care delivery for obese patients was recommended, including obesity specific training, management structures, care pathways, and equipment provisioning. Further planning

and development of operation policies is needed to ensure the safe delivery of healthcare to obese patients in the future.

Kawamura I, Ochiai T (2006)[107] conducted a review to assess the present status of Obesity Surgery and literatures revealed that obesity surgery is recently called Metabolic Surgery, intending to treat Metabolic Syndrome. Gastric Bypass, Adjustable Gastric Banding, Vertical Banded Gastroplasty, and Biliopancreatic Diversion are widely recommended in the world. Laparoscopic surgery was introduced in the field of obesity surgery around 1995, and since then, it has been exploring rapidly over the world. Two thirds of total cases were recently operated laparoscopicaly in the world. Patients who have BMI > or =35 and severe complications which need to be treated promptly should be applied to surgical treatment in Japan.

Kirk SF (1999)[108] conducted a systematic review to assess the current situation in the management of obesity in adults, and to make some suggestions as to how health professionals involved in obesity treatment can best address this growing problem. The study found that dieticians and nutritionists have long been involved in the treatment of obesity. However, the current management of obesity is far from ideal. There is evidence to suggest that in general health care, even when there are clearly effective clinical interventions, health professionals may not practise in the best way. Furthermore, some professionals may also hold negative attitudes towards the obese. A new approach to obesity is required, encompassing effective treatment and prevention strategies. A greater understanding of the problems faced by the obese individual in attempting to lose weight is also needed. Tackling the obesity epidemic requires action at the individual and population level.

3.2.2e Reviews related to prevention of obesity

Ukleja A, Kunachowicz H et al., (2007)[109] conducted a review to assess the use of glycaemic index in the prevention of cardiovascular diseases. The data resulting from epidemiological and clinical investigations show that a low GI diet facilitates body mass reduction and an improved lipid profile. However, it still need further research to learn more about many processes which influence carbohydrate and lipid metabolism and the determination of the role of various genetic and environmental factors.

3.2.3: REVIEWS RELATED WEIGHT REDUCING STRATEGIES OF OBESITY

3.2.3a Reviews related to knowledge on obesity

Savva SC, Chadjioannou M et al., (2007)[110] conducted a review to assess the policy options to respond to the growing challenge of obesity among nine participating European member states. The multi-criteria mapping technique was used. Cyprus national data, when analysed in the public health and public policy context of Cyprus, collectively indicate that no single policy option appears to be unique in combating obesity, but rather need to be combined with other policy options. Specifically, measures are needed to improve levels of knowledge and understanding regarding food, diet, health and fitness beginning from early childhood with health professionals having an important role in this regard.

Matthaei S, Munro N et al., (2007)[111] conducted a review to assess the raising diabetes awareness in the public. The findings revealed that public often perceive T2DM as a relatively mild condition and do not know that it is preventable. Improved public awareness of T2DM and its link with obesity and physical inactivity is essential for the prevention and management of diabetes. Recognising this need, the UN has issued a

resolution calling on member states to observe World Diabetes Day and implement education and mass media initiatives to raise public awareness of diabetes and its complications. By building understanding of diabetes, changing beliefs and attitudes and promoting positive behaviours, such initiatives can help combat the global diabetes epidemic and improve the health and wellbeing of people.

3.2.3b Reviews related attitude towards obesity

Boylan S, Louie JC et al., (2012)[112] conducted a review to examine consumer response to weight-related guidelines. A systematic literature search was performed using Medline, PsycInfo, ProQuest Central and additional searches using Google and reference lists, of which 1,765 articles identified and 46 relevant titles were included. Most studies examined attitudes towards content, source, tailoring and comprehension of dietary guidelines. Many respondents reported that guidelines were confusing and that simple, clear, specific, realistic and in some cases tailored guidelines are required. Further research is needed, in particular regarding responses to physical activity guidelines and guidelines in different populations. Communication professionals should assist health professionals in the development of accurate and effective weight-related guidelines.

Sikorski C, Luppa M., et al., (2011)[113] conducted a review to assess the stigma of obesity in the general public and its implications for public health. 7 articles were found in which one study reported prevalence rates of stigmatizing attitudes. About a quarter of the population in Germany displayed definite stigmatizing attitudes. Other studies reported causal attributions. While external influences on weight were considered as well, it seems that internal factors were rated to be of higher importance. Across the

studies found, regulative prevention is supported by about half of the population, while childhood prevention has highest approval rates. Results on socio demographic determinants differ substantially and concluded that further research on public attitudes towards the perception of overweight and obesity is urgently needed to depict the prevailing degree of stigmatization. The study concluded that introducing a multidimensional concept of the etiology of obesity to the lay public might be a starting point in stigma reduction.

Shephard RJ (2008)[114] conducted a review to assess whether active commuting is an effective method of controlling the current obesity epidemic. Among the many methods of active commuting, walking and cycling are the usual choices. A weekly gross energy expenditure of at least 4 MJ is recommended to reduce all-cause and cardiovascular mortality. This can be achieved by walking 1.9 km in 22 minutes twice per day, 5 days per week or by cycling at 16 km/h for 11 minutes twice per day, 5 days per week. Empirical data to date have yielded mixed results; a reduced all-cause and cardiovascular mortality has been observed more frequently in cyclists than in walkers, and more frequently in women and older men than in young active commuters. More information is needed concerning the typical weekly dose of activity provided by active commuting, and the impact of such commuting on overall attitudes towards physical activity. It is also necessary to find better methods of involving the sedentary population, through both counselling and changes in urban design.

Gibney MJ (1999)[116] conducted a review to assess the composition of dietary fat changes across the EU (Europe) with low- and high-fat diets and to explore levels of physical activity and attitudes to physical activity across the EU and found that there is a

clear trend for southern EU states to have higher MUFA intakes and lower SFA intakes than northern EU states. However, for both geographic regions, the fatty acid composition of dietary fat was similar in groups with lower or higher dietary fat intakes. Physical activity was ranked low by consumers (n= 15,000) for its importance in relation to health and the prevention of weight-gain. Some 47% agreed that their present level of physical activity is sufficient. 78% agreed that being 13 kg heavier would not be detrimental to health and 30% agreed that the main benefit of physical activity was to relieve stress.

Biddle SJ, Fox KR (1998)[117] to conduct a review to assess the motivation for physical activity and weight management. Findings revealed that the psychology of exercise initiation and adherence among the overweight is under-researched. However, it was possible to infer findings from the general population and from other health behaviours to develop effective exercise promotion strategies. Motivation and barriers to exercise, exercise-related beliefs, attitudes, self-efficacy, the formulation of self-perceptions and identity towards exercise need to be considered in interventions and campaigns to capture the interests of the general public. Readiness to change and behaviour change strategies need to be considered and incorporated into social support structures to facilitate individual behaviour change. This could be delivered through community, workplace and primary health care settings.

3.2.3c Reviews related to dietary and physical activity practice

Jain A, Paranjape S (2013)[83] did retrospective analysis of all elderly patients following up in NEERI Hospital to find the exact prevalence of T2DM in elderly. It was observed that from total 585 elderly people, 178 had T2DM (30.42%- Prevalence). The

sex ratio of Diabetic males to females was almost equal (1:0.97). Obesity was present in 114 people (64%). High prevalence of hypertension was found in Diabetic elderly population (80%). The contributing factors may be urban living, with high prevalence of central obesity and Asian ethnicity.

Praween Agrawal, Kamla Gupta, Vinod Mishra and Sutapa Agrawal (2013)[34] examined the effects of sedentary lifestyle and dietary habits on BMI change in a follow-up study of 325 women (aged 15–49 years) in Delhi, systematically selected from the 1998–1999 NFHS samples who were re-interviewed after 4 years in 2003. Found 2.0-point increase in mean BMI for high sedentary lifestyle (OR: 2.63; 95% CI: 1.29–5.35) which emerged as the main predictor. Findings suggested that a high sedentary lifestyle is a determinant of weight gain among adult women in urban India.

Baumalan AE, Reis RS et al (2012)[118] conducted a review to understand why people are physically active or inactive which contributes to evidence-based planning of public health interventions, research into correlates (factors associated with activity) or determinants (those with a causal relationship) has burgeoned in the past two decades. The studies mostly focused on individual-level factors in high-income countries. It has shown that wage, sex, health status, self-efficacy, and motivation are associated with physical activity. Ecological models take a broad view of health behaviour causation, with the social and physical environment included as contributors to physical inactivity, particularly those outside the health sector, such as urban planning, transportation systems and parks and trails. New areas of determinants research have identified genetic factors contributing to the propensity to be physically active and evolutionary factors and obesity that might predispose to inactivity, and have explored the longitudinal tracking of

physical activity throughout life. The study recommended that understanding of correlates and determinants, especially in countries of low and middle income, could reduce the effect of future epidemics of inactivity and contribute to effective global prevention of non-communicable diseases.

Misra A, Nigam P et al., (2011)[119] conducted a review to assess the available physical activity guidelines from international and Indian studies and formulated India-specific guidelines. A total of 60□min of physical activity is recommended every day for healthy Asian Indians in view of the high predisposition to develop T2DM and CHD. This should include at least 30□min of moderate-intensity aerobic activity, 15□min of work-related activity and 15□min of muscle-strengthening exercises. For children, moderate-intensity physical activity for 60□min daily should be in the form of sports and physical activity.

Daniel M, Wilbur J (2011)[120] conducted a review to analyze the correlates of lifestyle physical activity (PA) behavior of healthy South Asian Indian (SAI) immigrants. Regardless of the PA measure used, all studies reported low PA levels in at least 40% of the participants. The correlates of PA most often studied were socio demographic variables, current health, acculturation, female sex, poorer health and less time since immigration. Few studies focused on social support, environmental factors and included dynamic motivational factors. The study concluded that increased knowledge of the factors that impact lifestyle PA is needed so that public health nurses can develop targeted interventions to increase the lifestyle PA of SAI immigrants at risk for cardiovascular disease, diabetes and central obesity.

Misra A, Sharma R, et al., (2011)[121] conducted a review to develop consensus dietary guidelines for healthy living, prevention of obesity and other disorders. In which it was reported that India is undergoing rapid nutritional transition, resulting in excess consumption of calories, saturated fats, trans fatty acids, simple sugars, salt and low intake of fiber. Such dietary transition and a sedentary lifestyle have led to an increase in obesity and diet-related non-communicable diseases T2DM, CVD, etc.. predominantly in urban, but also in rural areas. In comparison with the previous guidelines, these consensus dietary guidelines include reduction in the intake of carbohydrates, preferential intake of complex carbohydrates and low glycemic index foods, higher intake of fiber, lower intake of saturated fats, optimal ratio of essential fatty acids, reduction in trans fatty acids, slightly higher protein intake, lower intake of salt and restricted intake of sugar. These guidelines are applicable to Asian Indians in any geographical setting. Proper application of these guidelines will help curb the rising "epidemics" of obesity, the metabolic syndrome, hypertension, T2DM, and CVD in Asian Indians.

Moszczyński P (2010)[122] conducted a review to assess the influence of nutrition and eatables on human being health and reported that over 60 diseases, civilization cardiovascular system diseases (hypertension, myocardial infarction, ischaemic legs and stroke), metabolic diseases (metabolic syndrome, type 2 diabetes mellitus and osteoporosis) and cancers (gastric carcinoma, prostatic carcinoma, colonic carcinoma and breast carcinoma in women) occurred as a result of the defective nutrition. Author discussed sources which caused the contamination of food by free radicals, heavy metals, glucotoxins and other chemical compounds. Author presented the newest model of the food pyramid and the role of polyunsaturated fatty acids in the prevention of civilization

diseases. Special attention was paid on the health profits of consumption of minimal processed food and marine fishes.

Astrup A (2009)[123] conducted a review to assess the dietary management of obesity and reported that the reduction of the total fat content of diets produced weight loss in both the short term and over periods as long as 7 years. A fat-reduced diet, combined with physical activity reduced almost all risk factors for cardiovascular disease and also reduced the incidence of type 2 diabetes. The combination of reduction of dietary fat and energy and increased physical activity had been shown to reduce the incidence of diabetes by 58% in 2 major trials. In post hoc analyses, the reduction in dietary fat (energy density) and increase in fiber were the strongest predictors of weight loss and diabetes-protective effects. Low-carbohydrate diets may be an option for inducing weight loss in obese patients, but a very low intake of carbohydrate-rich foods is not commensurate with a healthy and palatable diet in the long term. However, there is evidence that increasing the protein content of the diet from 15% up to 20%-30%, at the expense of carbohydrates, increases the satiating effect of the diet and induces a spontaneous weight loss and this could turn out to be a preferred option for patients with metabolic syndrome and type 2 diabetes.

Chaput JP, Tremblay A (2009)[124] conducted a review to assess the obesity and physical inactivity and the relevance of reconsidering the notion of Sedentariness. The population statistics of most countries of the world indicated that industrialization and computerization have been associated with an increase in sedentariness and more recently with a significant shift from healthy weight to overweight. In general, this change in the overweight/obesity prevalence is attributed by health professionals to

suboptimal diet and physical activity practices. Sleep time reduction and cognitive work(knowledge based work) both exert a trivial effect on energy expenditure and may thus be considered as sedentary activities. Television viewing is another example of sedentary activity that has been shown to increase the intake of high-density foods. These observations demonstrate that the modern way of living has favored a change in human activities whose impact goes well beyond what has traditionally been attributed to a lack of physical exercise. It is time to reconsider the notion of 'sedentariness' which includes several activities having opposing effects on energy balance.

Ranjana Tiwari, Dhiraj Srivastava, and Neeraj Gour (2009)[23] conducted a cross sectional study to determine the prevalence of obesity in both sexes in persons aged 30 years and findings showed that 34.4% of males and 31.3 % of females were either obese or over weight.

Cris A. Slentz, Joseph A. Houmard and William E. Kraus (2009)[36] conducted a review with an aim to highlight the effects of exercise on abdominal obesity, visceral fat, and metabolic risk. In was evident that exercise in sufficient amounts can lead to substantial decreases in body weight, total body fat, and visceral fat. The study concluded that there is a dose–response relationship between exercise amount and these changes, i.e., more exercise leads to additional benefits.

Sherina Mohd Sidik, Lekhraj Rampal (2009)[37] conducted a community based cross sectional study with the aim to determine the prevalence of obesity among adult women in Selangor and to determine factors associated with obesity among these women. Out of 1032 women, 972 agreed to participate in this study, giving a response

rate of 94.2%. The mean age was 37.91 ± 10.91. The prevalence of obesity among the respondents was 16.7% (mean = 1.83 ± 0.373). Obesity was found to be significantly associated with age (p = 0.013), ethnicity (p = 0.001), religion (p = 0.002), schooling (p = 0.020), educational level (p = 0.016), marital status (p = 0.001) and the history of suffering a miscarriage within the past 6 months (p = 0.023).

Penny Gordon-Larsen, Ningqi Hou et al (2008)[38] conducted a prospective study to evaluate the association between changes in leisure-time walking and weight gain over a 15-y period. Followed at 2, 5, 7, 10, and 15 y later and found that weight gain was ≈1 kg/y and the mean duration of walking at baseline was <15 min/d. After accounting for non walking physical activity, calorie intake, and other covariates, found a substantial association between walking and annualized weight change. The study concluded that walking throughout adulthood may attenuate the long-term weight gain that occurs in most adults

Tanumihardjo SA, Anderson C (2007)[125] conducted a review to assess the Millennium Development Goals and to monitor and assess the progress toward achieving these goals until 2015. The first goal was to "eradicate extreme poverty and hunger." The greatest responsibility was to understand the ramifications of poverty, chronic hunger and food insecurity. Food insecurity is complex and the paradox is that it can lead to under nutrition, recurring hunger and also to over nutrition which can lead to overweight and obesity. It was estimated that by the year 2015 non communicable diseases associated with over nutrition will surpass under nutrition as the leading causes of death in low-income communities. Informing current practitioners, educators and policymakers and passing this information on to future generations of nutrition students is of paramount importance.

Henriksen HB, Kolset SO (2007)[126] conducted a review to assess the sugar intake among the public health and reported that sugars in beverages and candy contribute to energy that can lead to an increased amount of fat in the body. High sugar intakes contribute to development of overweight, diabetes type 2 and dental caries. Glucose from sucrose and starch increases blood glucose levels and stimulate insulin secretion. Lack of insulin response after fructose intake can result in adverse effects on lipid metabolism and satiety regulation. Norway was one of the countries in the world with the highest intake of sweetened beverages. Preventive health measures aimed at decreasing sugar intake in pre-school and school children, increased availability of fruits and vegetables, water and better canteens. To control the increased sugar intake among adolescents requires measures from politicians and authorities.

Bloom S, Wynne K et al., (2005)[127] conducted a review to assess and understand the mechanisms of appetite regulation. An important aspect of the complex pathways involved in modulating energy intake was the interaction between hormonal signals of energy status released from the gut in response to a meal and appetite centers in the brain and brainstem. The ultimate goal of work in this field was the development of effective treatments for obesity and manipulation of these gut-brain axes offers potentially useful strategies for the conquest of this significant cause of morbidity and mortality and future burden on healthcare systems worldwide.

PK Newby, Denis Muller (2003)[35] conducted a longitudinal study to elucidate the nutritional etiology of changes in BMI and WC by dietary intake pattern. 459 healthy men and women participated in the study. The study concluded that consuming a diet high in fruit, vegetables, reduced-fat dairy, whole grains, low red and processed meat, fast food and soda was associated with smaller gains in BMI and waist circumference.

CHAPTER – 4

MATERIALS AND METHODS

The present study was conducted with an aim to assess the effectiveness of Rural Obesity Reduction Program (RORP) on Knowledge, Attitude, practice towards Obesity and Obesity reduction among the obese adults at selected villages adopted by Omayal Achi Community Health Centre, Chennai.

This chapter includes research approach, research design, setting, population, samples, variables, sampling technique, criteria for sample selection, description of instrument / tool, description of intervention tool, reliability, validity of the tool, ethical considerations, data collection procedure, pilot study and plan for data analysis

4.1 RESEARCH APPROACH

Quantitative Research Approach was adopted for this study to accomplish the objectives of the study.

4.2 RESEARCH DESIGN

In this study True Experimental design was adopted for the outcome to be validated. The effectiveness of Rural Obesity Reduction Program can be proved only if there is a comparison; hence the investigator intended to assess the effectiveness of Rural Obesity Reduction Program on knowledge, attitude, practice towards obesity and obesity reduction among the obese adults between experimental and control group giving an equal opportunity for the obese adults through random sampling allocation.

The research design adopted for the study is depicted here

	Group	Pretest O_1	X (Intervention for a period of 12 weeks)		Post test 1 O_2		Post test 2 O_3
RANDOMIZATION	EXPERIMENTAL	Assessment of knowledge, attitude, practice and obesity	Rural Obesity Reduction Program(RORP) (behavioural interventions) was administered	After 6 weeks of intervention	Assessment of knowledge, attitude, practice and obesity reduction	After 6 weeks of post test 1	Assessment of obesity reduction
	CONTROL	Assessment of knowledge, attitude, practice and obesity	-		Assessment of knowledge, attitude, practice and obesity reduction		Assessment of obesity reduction

4.3 VARIABLES

4.3.1 Background Variables

(a) General Demographic Variables consisted of age, gender, educational qualification, occupation, income, marital status, type of family, family size and family history of Non Communicable Diseases.

(b) Obesity related factor Variables consisted of personal history of non communicable disease, history of sleep, history of smoking, use of smokeless tobacco, use of alcohol, habit of exercise and women health history.

(c) Bio-Physiological Variables consisted of height, weight, BMI, waist circumference and percent body fat.

4.3.2 Independent Variable

The independent variable of the study was Rural Obesity Reduction Program (RORP) (behavioral interventions) which included IEC package, dietary modification, physical activity modification and individual counseling.

4.3.3 Dependent Variable

The dependent variables of the study were knowledge, attitude, practice and obesity reduction

4.4 RESEARCH SETTING

The investigator conducted the study in the villages adopted by Omayal Achi Community Health Centre (OACHC), Arakambakkam. OACHC is rendering the Basic Health Care services to the 43 adopted villages with 49000 people. However, the Health Centre provides door-to-door services to 18 villages intensively where the prevalence of obesity also was high according to the survey conducted by OACHC in the year 2008. Among the 18 villages the investigator had selected six villages for the present study. The villages selected for the study were Arakkampakkam (730), Gowdipuram (480), Pandeshwaram(419), Kilkondaiyar(801), Karalappakkam(461) and Koduvelli(198).

4.5 POPULATION OF THE STUDY

Population is the entire aggregation of clients with similar characteristics and on whom the researcher would generalize the study findings. The population encompasses the target population and accessible population.

4.5.1 Target Population:

This is the population that the investigator had chosen to study and make generalization. The target population for the study was all obese adults.

4.5.2 Accessible Population:

It refers to the aggregate of clients with whom the designated criteria were confirmed and accessible to the investigator. Thus the accessible population was all the obese adults who were living in 18 villages, where intensive door to door service is provided by Omayal Achi Community Health Centre.

4.6 SAMPLE AND SAMPLE SIZE

A sample is the basic element of the population about whom the information is collected to represent the concept of interest. In the present study the obese adults who fulfilled the inclusive criteria were the samples.

4.6.1 SAMPLE SIZE

The sample size was estimated by Power Analysis.

Estimation of sample size

Sample size was calculated using pilot study knowledge score (30%) and expected to increase 20% after training with α-error 5% and power of the study 80%. Estimated sample size was 93 and with 20% dropout rate, final required sample size will be 110.

$$n = \frac{[P1\,(100-P1) + P2\,((100 - P2)]\;\;(Z_\alpha + Z_\beta)^2}{(P1-P2)^2}$$

P1 = 30 %

P2 = 50 %

α = 1.96

β = 0.84

d = 20

$$n = \frac{[30 \text{ X } 70) + (50 \text{ X } 50]\;(1.96 + 0.84)^2}{20^2}$$

= 93 per group

Control	30%
Experimental	50%
Type I error	5%
Type II error(1-β=Power of study)	20%
0ne or two tailed test	Two tailed test
Sample size	93
with 20% drop out rate	110

Power analysis revealed to have 110 samples, expecting the 20% attrition. The investigator selected 113 samples for each group. After the attrition the final sample for experimental group was N=110 and for control group N= 110. Age and sex matching between the experimental and control group were done.

4.7 SAMPLE SELECTION CRITERIA

4.7.1 Inclusive Criteria:

1. Obese adults who were residing in the selected villages.
2. Obese adults who were willing to participate in the study.
3. Adults found as obese, based on BMI and Waist Circumference. Above normal level of any one or both were considered as Obese.
4. Obese adults between the age group of 20 – 50 years.
5. Obese adults concerned to adhere to the behavioral intervention regimen (RORP).
6. Both male and female obese adults were included in the study.

4.7.2 Exclusive Criteria:

1. Obese adults who were contraindicated to the RORP due to chronic diseases.
2. Obese adults those who were not co-operative.
3. Obese adults who were undergoing any kind of weight reduction program.
4. Obese adults with history of hormone therapy (steroids) and use of oral contraceptives.

4.8 SAMPLING TECHNIQUE

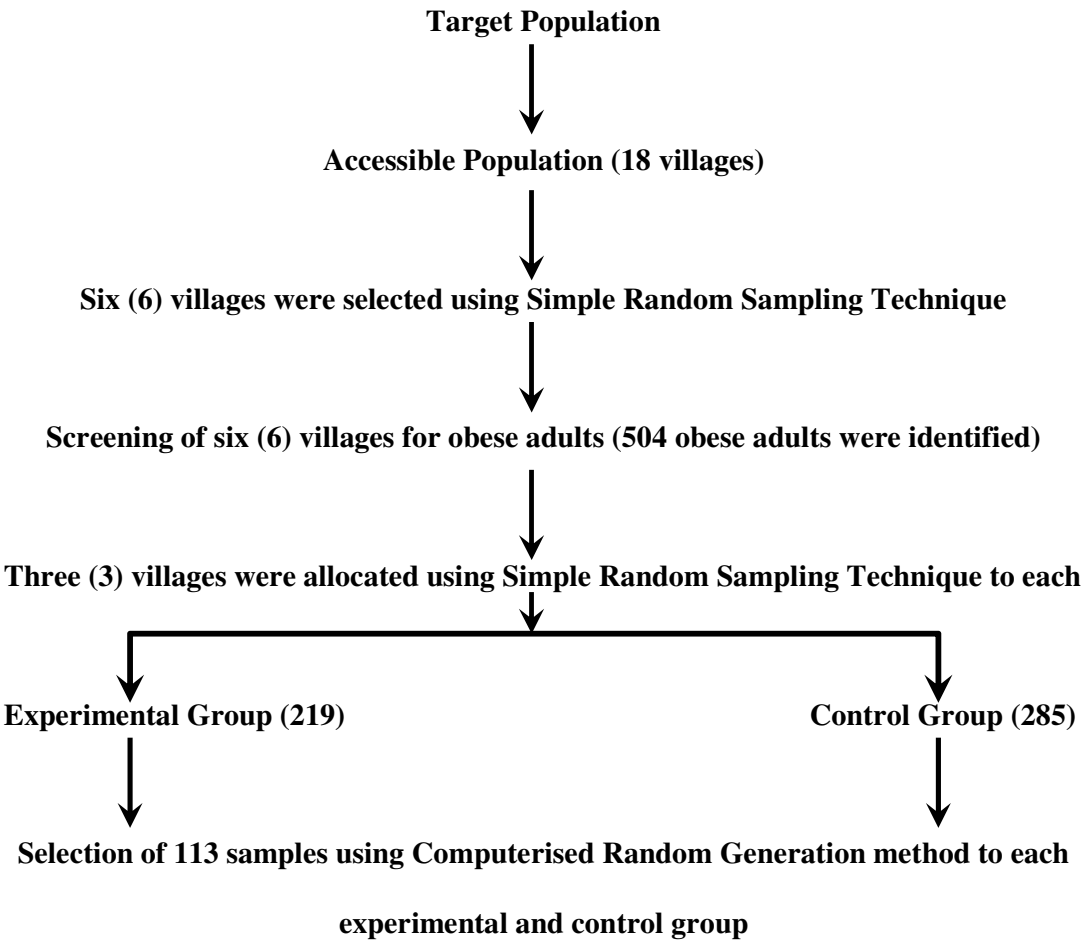
Multi Stage Sampling technique (probability sampling) was used to select the samples.

At first stage six villages were selected from 18 villages by Simple Random Sampling technique. Then the selected six villages were screened for obese adults. Totally 881 available adults were screened of which 504 adults were identified as obese from six villages.

At the second stage three villages were allocated to each experimental and control group by using Simple Random Sampling technique.

At the third stage Computerized Random Generation method was used to select 113 samples for each experimental and control group.

Since the Simple Random Sampling technique was used at various stages, it is called as Multi Stage Sampling technique.



4.9 DATA COLLECTION INSTRUMENT

The instrument was developed and compiled by the investigator with the guidance of experts and review of literature. The tool used for the present study was structured interview schedule and bio physiological measurements which had the following components:

4.9.1 SECTION A: Screening tool which was used to identify the obese adults from the general population which consisted of measurement of height, weight, waist circumference and calculation of body mass index to screen for obese adults. Information regarding age limits, history of hormonal therapy/steroid therapy, use of Oral contraceptives, presently undergoing any obesity reduction program and any contra indication to present intervention package were collected and used for the inclusion and exclusion criteria.

4.9.2 SECTION B: Assessment tool was used to collect the back ground variables, knowledge on obesity, attitude towards obesity, dietary, physical activity, life style practices towards obesity and level of obesity. The assessment tool consisted of 5 parts.

PART 1: Assessment of background variables

(a) General Demographic Variables: This included study participant's age, gender, educational qualification, occupation, income, marital status, type of family, family size and family history of NCDs. The investigator collected the responses by interview method. The questions had multiple options. The Obese adults chose the most relevant option.

(b) Obesity related factor variables: This included personal history of NCDs, history of sleep, history of smoking, use of smokeless tobacco, use of alcohol, habit of exercise and women health history. These questions were similar to "Behaviour pattern scale" where the clients responded their appropriate behaviour against the frequency / episodes per week and duration of habit etc.

PART 2: Assessment of obesity based on bio physiological measurements

Bio-Physiological Variables included in this study were BMI, waist circumference and percent body fat.

BMI: Body Mass Index was calculated using weight in kilograms divided by height in meters squared. Based on their BMI the adults were classified into four groups: under weight (BMI <18), normal (BMI -18 – 22.9), over weight (BMI - 23 – 24.9), class I obesity (BMI - 25 – 29.9), class II obesity (BMI – 30 –34.9) and class III obesity (BMI – 35 –35.9) as per ICMR and Indian Dietetic Association recommendation based on the consensus agreement of Dr. Mishra's study. The weighing scale was calibrated by bio medical experts and the standardization was done for every tenth sample.

Waist Circumference: Waist circumference was measured with a standard measuring tape, while subjects were lightly clothed, at a level midway between the lower margin of the last rib and iliac crest in centimeters (to the nearest 0.1cm). The investigator in this study used the cut-off for Asian Indians which was recommended by ICMR based on the consensus agreement of Dr. Mishra's study. WC cut-off for Asian Indians are given below

Action Level 1: Men 78cm, Women 72cm. Individuals with WC above these leves should avoid gaining weight and maintain physical activity to avoid acquiring any of the cardiovascular risk factor. These action level 1 cut-offs need to be researched further.

Action Level 2: Men 90cm Women 80cm. Individuals with WC above this level should seek medical help so that obesity-related risk factors could be investigated and managed. According to WHO WC cut off for: Men = 102cm and for Women = 88cm

Percent body fat: Body fat percentage refers to the amount of body fat mass with regard to the total body weight which is expressed in percentage. Body fat percentage = body fat mass (kg)/ body weight (kg) *100. PBF was measured by Bio electrical Impedance Analysis (BIA). Body fat analyser was used to measure the Percent Body Fat and it was calibrated by bio medical engineering department. The measurements were interpreted as below. The range for percent body fat followed in this study was given by American Council on Exercise.

	Male	**Female**	
Percent Body Fat	14-17%	21-24 %	Ideal
	18-24%	25-31 %	Average
	>25%	> 32%	Obese

PART 3: Assessment of knowledge on various aspects of Obesity

Structured Interview Questionnaire was used to assess the knowledge on general information (3), causes (7), diagnosis (2), health risks (3), management (5) and prevention (5) of obesity. Totally there were 25 questions on various aspects of Obesity. Each question had only one right answer among the four choices. Each right answer was given only one mark. So the total score was 25 for the knowledge tool. The score was interpreted as bellow:

Inadequate knowledge < 40% (< 10)

Moderate knowledge 41-70% (10-18)

Adequate knowledge 71-100% (>18)

PART 4: Assessment of attitude towards obesity

Assessment of attitude was carried out by five point attitude scale. The scale had twenty items, among which ten positive and ten negative items were present. The positively stated items were scored as strongly agree (5), agree (4), uncertain (3), disagree (2) and strongly disagree (1) and the negatively stated items were scored as strongly agree (1), agree (2), uncertain (3), disagree (4) and strongly disagree (5). The total score for the attitude was 100. The score was interpreted as below

Unfavorable attitude <40% (< 40)

Moderate Attitude 41-70% (41-70)

Favorable Attitude 71-100% (>71)

PART 5: Assessment of Dietary, Physical activity and Lifestyle practices on Obesity

PART 5a: Assessment of Dietary practices on Obesity

Dietary practices were assessed by 3 day dietary recall, Food Frequency Questionnaire (FFQ) and dietary practices check list.

1. **3 day dietary recall:** The investigator assessed the three day dietary recall for two week days and one Sunday. This was done after allocating the subjects to experimental and control group. It took nearly four to six days to complete the three day dietary recall.

2. Food Frequency Questionnaire

The frequency of intake of food groups were assessed by Modified Shin et al., FFQ which was devised with the help of clinical nutritionist.

3. Dietary practices check list

The investigator assessed the dietary practices by using the checklist. The check list consisted of 15 items with 8 positively stated items and 7 negatively stated items. The positively stated items were scored as strongly agree (5), agree (4), uncertain (3), disagree (2) and strongly disagree (1) and the negatively stated items were scored as strongly agree (1), agree (2), uncertain (3), disagree (4) and strongly disagree (5). The total score for the dietary practices was 75.

PART 5b: Assessment of physical activity practices

The investigator assessed the physical activity practices by using the checklist. The check list consisted of 10 items with 5 positively stated items and 5 negatively stated items. The positively stated items were scored as strongly agree (5), agree (4), uncertain (3), disagree (2) and strongly disagree (1) and the negatively stated items were scored as strongly agree (1), agree (2), uncertain (3), disagree (4) and strongly disagree (5). The total score for the physical activity practices was 50.

PART 5c: Assessment of life style practices

The investigator assessed the life style practices by using the checklist. The check list consisted of 10 items with 5 positively stated items and 5 negatively stated items. The positively stated items were scored as strongly agree (5), agree (4), uncertain (3), disagree (2) and strongly disagree (1) and the negatively stated items were scored as

strongly agree (1), agree (2), uncertain (3), disagree (4) and strongly disagree (5). The total score for the life style practices was 50.

The total practice score was = 175

dietary 75 + physical activity 50 + lifestyle practices 50 = 175

The practice score was interpreted as below

Poor < 40% <70

Moderate 41-70% 71-122

Good 71-100% >122

All the above tools were validated by the medical and nursing experts.

4.10: DESCRIPTION OF INTERVENTIONS

The intervention which was designed to bring the behavioural changes among the obese adults was administered by the investigator for a period of 12 weeks over a period of one year.

The intervention included the following

X_1: IEC Package for cognitive domain

X_2: Dietary modification (prescription of weight reducing/ low calorie diet) and physical activity modification for physical domain

X_3: Individual counseling for affective Domain (behavior modification)

X_1: IEC Package for Cognitive Domain

IEC package was administered to the obese adults of the experimental group after completing pre test. They were taught regarding the meaning, magnitude of the obesity problem, risk factors and causes, diagnosis, medical and surgical management, dietary, exercise and lifestyle modification and prevention of obesity. The investigator insisted on the importance of family involvement, social support, nutrition, exercise & activity,

monitoring, impact and complication by lecture and discussion with the help of flash cards.

X_2: Dietary modification (prescription of weight reducing/ low calorie diet) and physical activity modification for physical domain

The dietary and physical activity prescription for the obese adults in the experimental group was done within two days of administration of IEC package.

The investigator prescribed weight reducing calorie diet. The dietary prescriptions were based on the calorie intake calculated by the average of 3 day dietary recall and also the frequency of food group intake (FFQ). The weight reducing calorie diet was prescribed based on the formula given by IDA (20 k.cal per kg ideal body weight) which was also recommended by the clinical nutritionist. The IDA recommended that the calorie prescribed should not be less than 1200 kilo calories for women and 1400 kilo calories for men to meet the essential body functioning.

The physical activity prescription was based on the Global recommendation on physical activity (2004). The investigator prescribed 60 minutes of walking to cover 4 miles of distance for the obese adult population which is considered to be a moderate intensity physical activity. The American Heart Association also recommends the same.

X_3: Counseling for affective domain

Following the dietary and physical activity modification the investigator gave counseling in various phases as mentioned

1. Establishment of trust
2. Brief introduction about the self
3. Encouraging the client to verbalize the constraints and feelings

4. Recapitulation
5. Goal setting
6. Selection of approaches
7. Contract
8. Modality
9. Clarification
10. Termination

4.11 CONTENT VALIDITY

Content validity is the degree to which the items in the instrument adequately represent the content for the concept being measured. Content validity of the instruments were established by panel of experts comprising from the fields of Community medicine, Community health nursing, Psychology, Mental health Nursing, Nutrition and Dietetics and Statistics. The experts suggestions were incorporated in designing the final tool for the study in consultation with Guide, Co-guide, Advisory committee members and Statistician for its appropriateness.

4.12 RELIABILITY OF THE TOOL

Reliability is the degree of consistency with which an instrument measures the target attribute for which it was designed to measure. It is the major criterion for assessing the quality and adequacy of an instrument. **(Denise F. Polit & Cheryl Tatano Beck, 2008).** Reliability of the tool was established during the pilot study using split half method for attitude, test retest method for knowledge and inter rater method for practice and obesity. The reliability r' values were 0.85 for knowledge, 0.87 for attitude, 0.86 for practice and 0.94 for obesity. These values were very high thus making it a reliable tool

for assessing the effectiveness of Rural Obesity Reduction Program on knowledge, attitude, practice and obesity reduction among the adult obese population.

4.13 ETHICAL CONSIDERATIONS

The investigator considered and followed the ethical principles preceding the investigation. The investigator adhered to the following actions in order to protect the ethical rights of the obese adults.

Human Rights

1. Ethical committee approval was received from the International Centre for Collaborative Research in Primary Health Care (ICCRPHC), Omayal Achi College of Nursing.
2. To execute the study a written consent from the Head of the Institution was obtained to conduct the study at OACHC adopted villages.
3. Content validity was received from the various experts in the field of Community medicine, Community health nursing, Psychology, Mental Health Nursing and Nutrition.

Beneficence and Non-Mal efficience

1. No harm certificate was received from the Physician for dietary and physical activity compliance.
2. The investigator is certified to execute the counseling.
3. Potential benefits and risk was explained to the obese adults.

Dignity

1. Informed consent was obtained from the samples related to the study purpose, type of data, participations and procedure.
2. Pilot study was executed to check the feasibility and time requirement of the study.
3. Obese adult's right to withdraw was ensured before data collection.
4. Investigator's contact information was disseminated to all obese adults who participated in the study.

Confidentiality

1. Confidentiality and anonymity pledge was ensured.

Justice

1. The obese adults of control group were also given wait list intervention.

4.14 PILOT STUDY

Formal permission was obtained from the management of OACHC and the Presidents of the villages. Individual permission was obtained from the obese samples. Pilot study was conducted in two selected villages adopted by OACHC which was excluded from the main study. Brief introduction about the self & study was given. The confidentiality of the responses and the identity was assured. Pilot study was done on 50 samples.

The investigator selected two villages from among 18 villages using the Simple Random Sampling Technique. Initial screening was done to identify the obese adults. Nearly 437 adults were screened from two villages namely Guruvoyal (319/1183) and

Bangarapettai (118/255). Totally 273 individuals were found as obese. 175 obese adults were from Guruvoyal and 98 from Bangarapettai. One village to each experimental and control group was allocated by Simple Random Sampling Technique. Computerised Random Generation method was used to select 25 samples for each experimental and control group from these two villages.

The pre test was conducted within a week and after completing the pretest on the same day the intervention package was started. The intervention package (Rural Obesity Reduction Programme) which was administered for experimental group consisted of

X_1: IEC Package for cognitive domain

X_2: Dietary modification (prescription of weight reducing/ low calorie diet) and physical activity modification for physical domain

X_3: Individual counseling for affective Domain (behavior modification)

The IEC package was administered to the obese adults in the experimental group on the same day of completion of pretest. It took nearly 20 minutes to deliver and discuss the IEC package. The dietary and physical activity modification was prescribed within two days of completion of IEC. Followed by this individual counseling was given to obese adults within a week. Minimum of 3 counseling sessions were given during the follow up. After six weeks post test was done and at twelfth week the level of obesity reduction alone was measured. The same procedure was followed to the control group but no intervention was given after the pretest.

After the pilot study, the components of the knowledge and attitude tool were refined to get accurate information about the knowledge, attitude, dietary and physical activity practices of obese adults.

The pilot study aided the investigator to check the feasibility of conducting the main study in order to determine the method of statistical analysis and to assess the time required for data collection and intervention for the main study.

4.15 DATA COLLECTION PROCEDURE

Data collection was conducted after receiving the ethical committee approval from ICCRPHC, Omayal Achi College of Nursing. A formal written permission was obtained from the Head of the Institution, OACHC and the Presidents of the villages. Individual permission was obtained from the samples. The main study was conducted on 220 samples. Data collection was carried out in 3 phases namely screening phase, assessment phase and intervention phase.

Initially in the screening phase six villages were selected from 18 villages by Simple Random Sampling technique. Then the selected six villages were screened for obese adults. Totally 881 available adults were screened of which 504 adults were identified as obese from six villages, of which three villages were allocated to each experimental and control group by using Simple Random Sampling technique. Computerized Random Generation method was used to select 113 samples for each experimental and control group.

In the assessment phase the data collection for each sample was started with an introduction of the investigator. The samples were made to sit comfortably in a well ventilated room. After the brief introduction about the purpose of the study and obtaining the informed consent the demographic details were collected. The investigator assured the clients about the anonymity and confidentiality. After gaining the confidence of the

obese adults pretest was done (Assessment of knowledge on Obesity, Attitude towards obesity, dietary, physical activity and lifestyle practices and level of Obesity). The approximate time taken for data collection from each sample was 45 minutes. The samples were again met twice within a week to collect information on three day dietary recall as part of dietary practice.

The intervention phase started immediately after completing the pretest and the samples were given the behavioral intervention package (Rural Obesity Reduction Programme) for a period of one week on alternate days. The intervention package (Rural Obesity Reduction Programme) which was administered for experimental group consisted of

X_1: IEC Package for cognitive domain

X_2: Dietary modification (prescription of weight reducing/ low calorie diet) and physical activity modification for physical domain

X_3: Individual counseling for affective Domain (behavior modification)

The IEC package was administered to the obese adults in the experimental group on the same day of completion of pretest. It took nearly 20 minutes to deliver and discuss the IEC package. The dietary and physical activity modification was prescribed within two days of completion of IEC which took nearly 30 minutes. Followed by this individual counseling was given to obese adults within a week. Minimum of 3 counseling sessions were given with the duration of 30 minutes each during the follow up. The same procedure was followed to the control group but no intervention was given after the pretest.

Reinforcement of the interventions was given by the investigator throughout the data collection period for every 15 days once. The reinforcement was given by the investigator directly and also over telephonic conversation. The Self Help Group women and the VHETPs were also used for follow up and reinforcement. After 6 weeks post test was done and at 12th week the level of obesity reduction alone was measured. The final sample size for experimental and control group was 110 each after attrition.

Drop out analysis

Group	Wanted to withdraw	Shifted house	Not available	Total
Experimental	2	1		3
Control	-	-	3	3
Total	**2**	**1**	**3**	**6**

No. of samples taken : 226
No. of attrition : 6
Percentage of attrition : 2.65%
Final sample size after attrition : 220

FOLLOW UP

Follow up of obese adults was done by the following methods

1. Registration Card

Registration card was issued to the clients who participated in the study which contained the identification data and bio physiological measurements of pretest, sixth week and twelfth week of data collection. Two cards with yellow and white colour were made. Yellow card was given to the client and the white card was retained with the investigator for follow up and reference.

2. Self Monitored Check list to assess the dietary and physical activity compliance

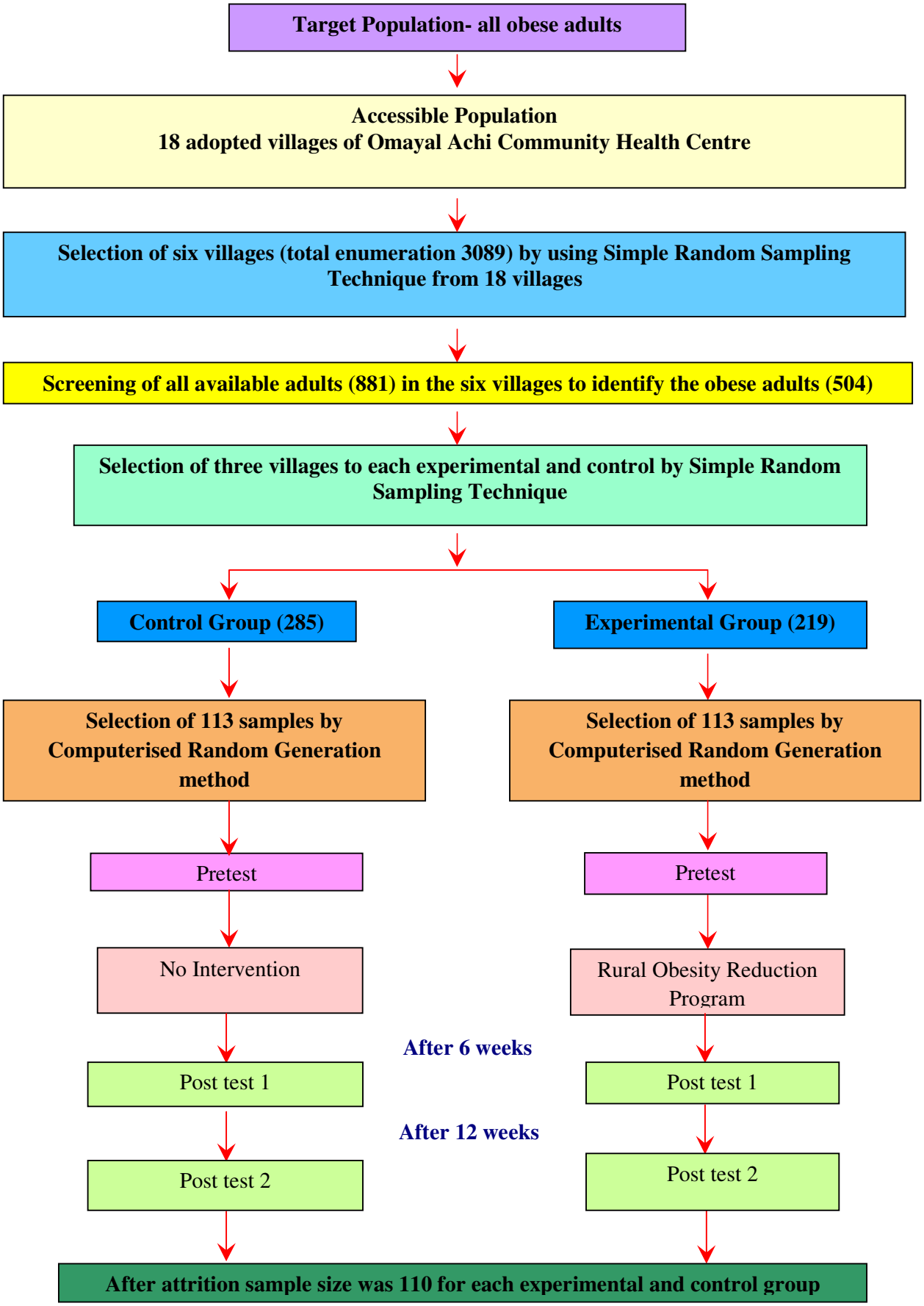
Self monitored checklist was prepared to assess the dietary and physical activity compliance. It was a printed pink card which contained information on baseline data, prescribed calorie, menu and place to mark for seven days about the dietary compliance. The information for physical activity compliance was type of physical activity, duration, distance covered and place to enter the waling compliance for seven days in the morning and evening. The obese adults were asked to maintain their adherence to the prescribed dietary and physical activity schedule. New card was given for every 15 days with total of 6 cards to each individual for a period of twelve weeks.

3. Volunteers from local village

Volunteers from local villages who had undergone training in Village Health Empowerment Training Programme (VHETP) at OAHC and members of Self Help Group were involved in the follow up activity along with the investigator. Volunteers motivated the samples for dietary and physical activity modification and also helped for recording the happening in the self monitored checklist for those who are not educated.

4. Telecommunication

The investigator used telephonic communication with the obese adults and their family members to follow up their dietary and physical activity compliance weekly twice.


Target Population- all obese adults
Accessible Population
18 adopted villages of Omayal Achi Community Health Centre
Selection of six villages (total enumeration 3089) by using Simple Random Sampling Technique from 18 villages
Screening of all available adults (881) in the six villages to identify the obese adults (504)
Selection of three villages to each experimental and control by Simple Random Sampling Technique
Control Group (285)
Experimental Group (219)
Selection of 113 samples by Computerised Random Generation method
Selection of 113 samples by Computerised Random Generation method
Pretest
Pretest
No Intervention
Rural Obesity Reduction Program
After 6 weeks
Post test 1
Post test 1
After 12 weeks
Post test 2
Post test 2
After attrition sample size was 110 for each experimental and control group

Phases of data collection procedure		
Phases of data collection	**Activity done**	**Time and duration**
Screening phase	Selection and screening of 6 villages and identification of obese adults	10 minutes for each individual 20 days was taken for all six villages
Assessment phase	Pre test assessment of level of knowledge, attitude practice and level of obesity 1st day dietary recall	45 minutes for each individual (1st visit)
	Pre test – 2nd day dietary recall	5-10 minutes for each individual (2nd visit)
	Pre test – 3rd day dietary recall	5-10 minutes for each individual (3rd visit)
Intervention phase (Experimental Group)	IEC package	20 minutes (3rd visit)
	Dietary and physical activity modification	30 minutes (4th visit)
	Individual counseling	30 minutes (5th visit)
Follow up phase (Experimental Group)	Reinforcement of interventions was given every 15 days directly by the investigator throughout the data collection period. Telephonic conversation, visit and motivation by Self Help Group women and VHETP personnel was done twice in a week.	10 – 15 minutes to each individual

Figure 4.15.1: Schematic representation of data collection procedure.

4.16 DATA ANALYSIS PROCEDURE

Data analysis is the systematic organization and synthesis of research data and testing of null hypotheses using those data. **(Denise F. Polit & Cheryl Tatano Beck, 2008).** The data was collected from 110 obese adults in experimental and 110 in control group and the data obtained was coded and edited to fit in to the master sheet. The data was analyzed by using descriptive and inferential statistics

Descriptive Statistics

1. Mean, percentage and standard deviation was used to explain the background variables and to assess the knowledge, attitude, practice and level of obesity.

Inferential Statistics

2. Paired 't' test was used to assess and compare the knowledge, attitude, dietary, physical activity, lifestyle practices and level of obesity among obese adults within the experimental and control group.
3. Unpaired 't' test was used to assess the effectiveness of Rural Obesity Reduction Program between the experimental and control group.
4. F test was used to compare the difference in level of obesity at baseline, 6^{th} week and 12^{th} week.
5. Correlation among knowledge, attitude, practice and obesity were analysed using Karl Pearson Correlation Coefficient method.
6. Chi-square test was used to measure the association of background variables in the experimental and control group.

Effectiveness score based on pretest and posttest difference score was calculated using mean difference with 95% CI method and proportion with 95% CI method Multiple bar diagram, scatter plot with regression estimate, box-plot and Pie diagram were used to represent the data. $P<0.05$ was considered statistically significant.

CHAPTER – 5

RESULTS AND ANALYSIS

This chapter deals with analysis and interpretation of data collected from the obese adults to analyse the effectiveness of Rural Obesity Reduction Programme. Data analysis begins with description that applies to any study in which the data are numerical with some concepts. Descriptive statistics allows the researcher to organize the data and to examine the quantum of information and inferential statistics used to determine the relationship and causality. The data were entered into Excel sheet and analyzed through Statistical Package for Social Science / PC^{+} Ver.17.

The findings of the study were organized and presented in following sections

Section 5.1: Description of background variables of obese adults in experimental and control group.

Section 5.2: Assessment and comparison of knowledge, attitude, practices towards obesity and obesity reduction among the obese adults in experimental and control group.

Section 5.3: Effectiveness of Rural Obesity Reduction Programe on knowledge, attitude, practices towards obesity and obesity reduction among obese adults within and between the experimental and control group.

Section 5.4: Assessment of relationship among the knowledge, attitude, practice and obesity reduction in pre and post test of the experimental and control group.

Section 5.5: Association of mean differed knowledge, attitude, practice and obesity reduction with selected demographic variables of obese adults in the experimental group.

Section 5.1: Description of background variables of obese adults in experimental and control group

5.1.1. Frequency and percentage distribution of general demographic variables of obese adults in experimental and control group.

5.1.2. Frequency and percentage distribution of family history of Non Communicable Diseases of obese adults in experimental and control group.

5.1.3. Frequency and percentage distribution of obesity related factors -personal history of Non Communicable Diseases and sleep pattern of obese adults in experimental and control group.

5.1.4. Frequency and percentage distribution of obesity related factors –smoking and use of smokeless tobacco of obese adults in experimental and control group.

5.1.5. Frequency and percentage distribution of obesity related factors –use of alcohol and habit of exercise of obese adults in experimental and control group.

5.1.6. Frequency and percentage distribution of obesity related factors –women health history of obese women clients in experimental and control group.

Section 5.2: Assessment and comparison of knowledge, attitude, practices towards obesity and obesity reduction among the obese adults in experimental and control group

5.2.1 Assessment of pre test mean, SD and percentage of knowledge components score in experimental and control

5.2.2 Assessment of post test mean, SD and percentage of knowledge components score in experimental and control group

5.2.3 Frequency, percentage and comparison of level of knowledge of experimental and control group in the pre test and post test

5.2.4 Frequency, percentage and comparison of level of attitude of experimental and control group in the pre test and post test

5.2.5 Assessment of pre test mean, SD and percentage of practice components score in experimental and control group.

5.2.6 Assessment of post test mean, SD and percentage of practice components score in experimental and control group.

5.2.7 Frequency, percentage and comparison of level of practice of experimental and control group in the pre test and post test

5.2.8 Frequency, percentage and comparison of obesity reduction - BMI of experimental and control group in the pre test and post test

5.2.9 Frequency, percentage and comparison of obesity reduction - WC of experimental and control group in the pre test and post test

5.2.10 Frequency, percentage and comparison of obesity reduction - PBF of experimental and control group in the pre test and post test

Section 5.3: Effectiveness of Rural Obesity Reduction Programme on knowledge, attitude, practices towards obesity and obesity reduction among obese adults within and between the experimental and control group

5.3.1 Comparison of pretest and post test mean knowledge components score in the experimental group.

5.3.2 Comparison of pretest and post test mean knowledge components score in the control group .

5.3.3 Comparison of pretest mean knowledge components score between the experimental and control group.

5.3.4 Comparison of post test mean knowledge components score between the experimental and control group.

5.3.5 Comparison of overall pretest and post test mean knowledge score in the experimental and control group.

5.3.6 Comparison of overall pretest and post test mean attitude score in the experimental and control group.

5.3.7 Comparison of pre test and post test mean practice components score in experimental group.

5.3.8 Comparison of pre test and post test mean practice components score in control group

5.3.9 Comparison of pre test mean practice components score between experimental group and control group

5.3.10 Comparison of post test mean practice components score between experimental group and control group.

5.3.11 Comparison of overall pre test and post test mean practice score in the experimental and control group.

5.3.12 Comparison of calories and nutrients consumption within the experimental and control group in the pretest and post test.

5.3.13 Comparison of calories and nutrients consumption between the experimental and control group in the pre test and post test.

5.3.14 Comparison of pre test and post test food frequency in the experimental group

5.3.15 Comparison of pre test and post test food frequency in the experimental group

5.3.16 Comparison of pre test and post test food frequency in the control group

5.3.17 Comparison of pre test and post test food frequency in the control group

5.3.18 Comparison of food frequency between the experimental and control group in the pre test.

5.3.19 Comparison of food frequency between the experimental and control group in the pre test.

5.3.20 Comparison of food frequency between the experimental and control group in the post test.

5.3.21 Comparison of food frequency between the experimental and control group in the post test.

5.3.22 Comparisons of overall pre and post test mean obesity reduction (BMI) in the experimental and control group.

5.3.23 Comparisons of overall pre and post test mean obesity reduction (WC) in the experimental and control group.

5.3.24 Comparisons of overall pre and post test mean obesity reduction (PBF) in the experimental and control group.

5.3.25 Overall effectiveness of Rural Obesity Reduction Program on knowledge, attitude, practices towards obesity and Obesity reduction among the Obese adults within experimental and control group in the pre and post test.

Section 5.4: Assessment of relationship among the knowledge, attitude, practice and obesity reduction in the pre and post test of the experimental and control group

5.4.1: Assessment of relationship among the knowledge, attitude, practice and obesity reduction in the pre and post test of the experimental group.

5.4.2: Assessment of relationship among the knowledge, attitude, practice and obesity reduction in the pre and post test of the control group.

Section 5.5: Association of mean differed knowledge, attitude, practice and obesity reduction with selected demographic variables of obese adults in the experimental group

5.5.1 Association of mean differed knowledge with selected demographic variables of obese adults in the experimental group

5.5.2 Association of mean differed attitude with selected demographic variables of obese adults in the experimental group

5.5.3 Association of mean differed practice with selected demographic variables of obese adults in the experimental group

5.5.4 Association of mean differed obesity reduction with selected demographic variables of obese adults in the experimental group

SECTION 5.1: DESCRIPTION OF BACKGROUND VARIABLES OF OBESE ADULTS IN EXPERIMENTAL AND CONTROL GROUP

Table 5.1.1: Frequency and percentage distribution of general demographic variables of obese adults in experimental and control group N = 220

Demographic variables		Group				Chi square test
		Experimental N=110		Control N=110		
		No.	%	No.	%	
Age in years	20-30	30	27.20	30	27.20	χ^2=0.00, p=1.00
	31 -40	40	36.40	40	36.40	
	41 -50	40	36.40	40	36.40	
Gender	Male	30	27.30	30	27.30	χ^2=0.00, p=1.00
	Female	80	72.70	80	72.70	
Education	Non literate	17	15.50	19	17.30	χ^2=3.04, p=0.69
	Primary school	18	16.40	21	19.10	
	Middle school	23	20.90	27	24.50	
	High school	35	31.80	24	21.80	
	Higher secondary	12	10.90	12	10.90	
	UG or PG	5	04.50	7	06.40	
Occupation	Semi professional	3	02.70	4	03.60	χ^2=2.96, p=0.71
	Clerical, shop owner	11	10.00	8	07.30	
	Skilled worker	7	06.40	7	06.40	
	Semi skilled worker	17	15.50	10	09.10	
	Unskilled worker	41	37.30	46	41.80	
	Unemployed	31	28.20	35	31.80	
Monthly family income	< Rs.3,300	10	09.10	12	10.90	χ^2=2.27, p=0.51
	Rs 3,301-7,300	66	60.00	55	50.00	
	Rs 7,301-14,500	26	23.60	32	29.10	
	> Rs 14,501	8	07.30	11	10.00	
Marital status	Married	95	86.40	92	83.60	χ^2=0.92, p=0.63
	Single	8	07.30	12	10.90	
	Widower	7	06.40	6	05.50	
Type of family	Nuclear	70	63.60	73	66.40	χ^2=1.63, p=0.44
	Extended	28	25.50	21	19.10	
	Joint	12	10.90	16	14.50	
Family size	Small (2-4)	55	50.00	66	60.00	χ^2=2.53, p=0.28
	Medium (5-7)	45	40.90	34	30.90	
	Large (> 7)	10	09.10	10	09.10	

The above table 5.1.1 depicts the frequency and percentage distribution of demographic variables of obese adults in experimental and control group.

Totally 220 samples participated in the study each 110 to experimental and control group. With respect to age, 40(36.4%) were in both 31-40 yrs and 41-50 yrs age group in both experimental and control group. Considering the gender maximum of the samples 80(72.7%) were females and 30(27.30%) were males in both experimental and control group.

With regard to education, 35(31.8%) had high school education and only 5 (4.5%) had undergraduate or post graduate education in the experimental group. Similarly in the control group 27(24.5%) had middle school and only 7(6.4%) had undergraduate or post graduate education.

When considering the occupation, 41(37.3%) were unskilled workers and only 3(2.7%) were semi professional in the experimental group. Similarly in the control group 46(41.8%) were unskilled workers and only 4(3.6%) were semi professional.

When analyzing the monthly family income, majority 66(60%) were below Rs 3301-7300 category and only 8(7.3%) were in the category of more than Rs 14501 in the experimental group. Similarly in the control group 55(50%) were in the Rs 3301-7300 category and only 11(10 %) had the income of more than Rs 14500.

With respect to the marital status, maximum 95(86.4%) were married, in the experimental group. Similarly in the control group also majority 92(83.6%) were married.

Regarding the type of family, the majority 70(63.6%) was in nuclear family in experimental group. Similarly in the control group majority 73(66.4%) were in nuclear family.

With respect to family size, 55(50%) were having small family size and only 10(9.1%) were in large family size in experimental group. Similarly in control group 66(60%) had small family size and only 10(9.1%) had large family size.

The above descriptions showed that there was no difference in the experimental and control group. The chi square test also revealed that there was no statistically significant difference between the experimental and control group in their general demographic variables which proved the homogeneity of the population.

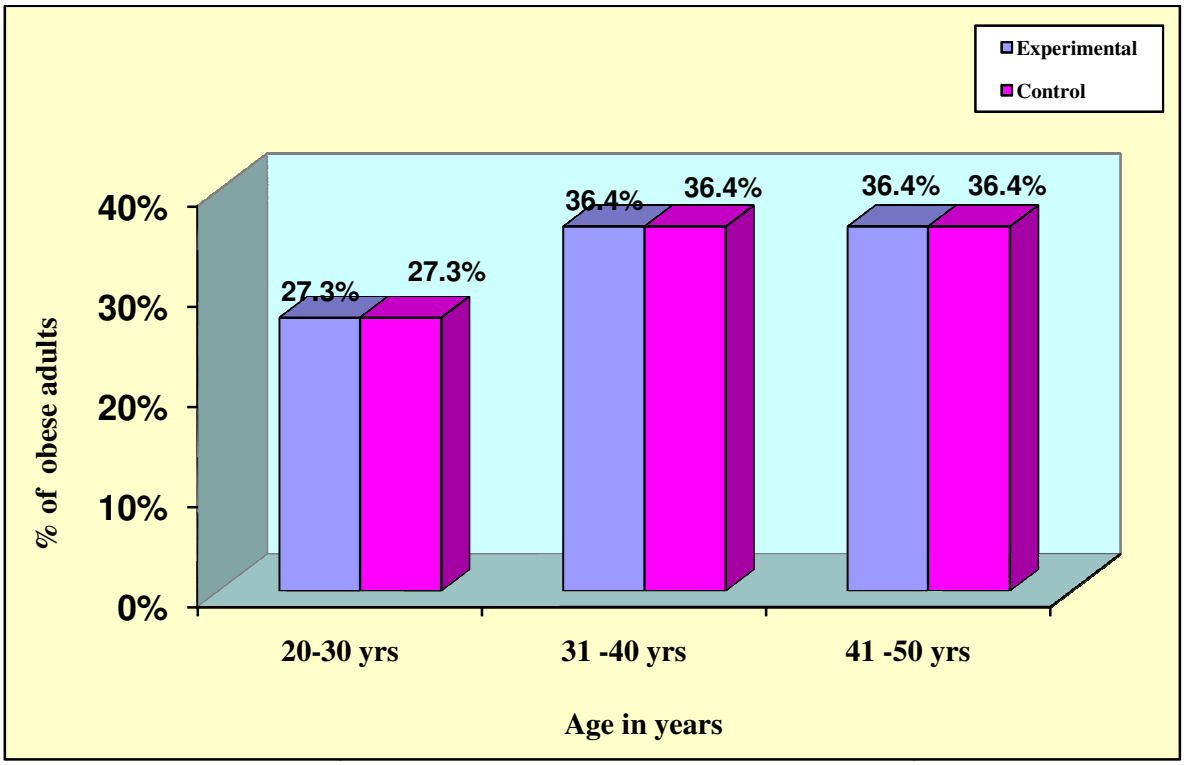


Figure 5.1.1(a): Percentage distribution of age of obese adults in experimental and control group

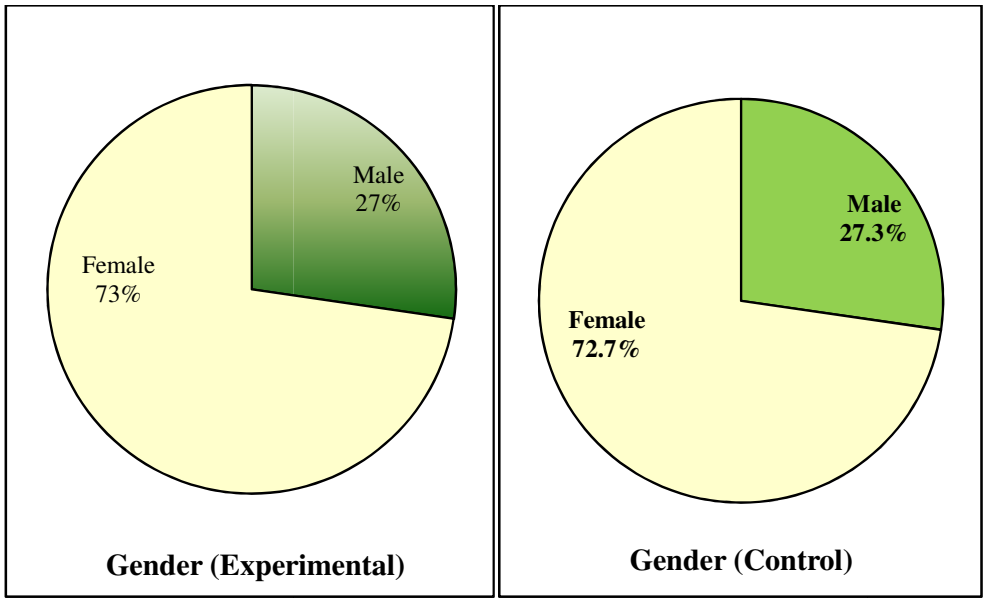


Figure 5.1.1(b): Percentage distribution of gender of obese adults in experimental and control group

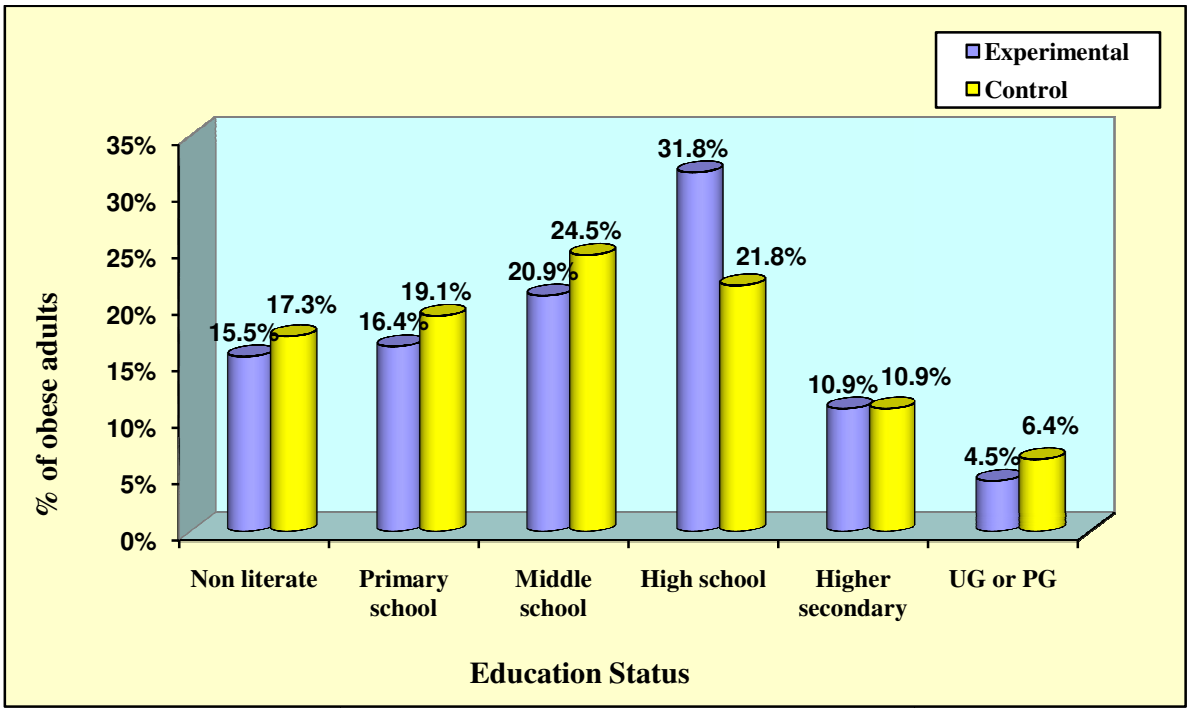


Figure 5.1.1(c): Percentage distribution of educational status of obese adults in experimental and control group

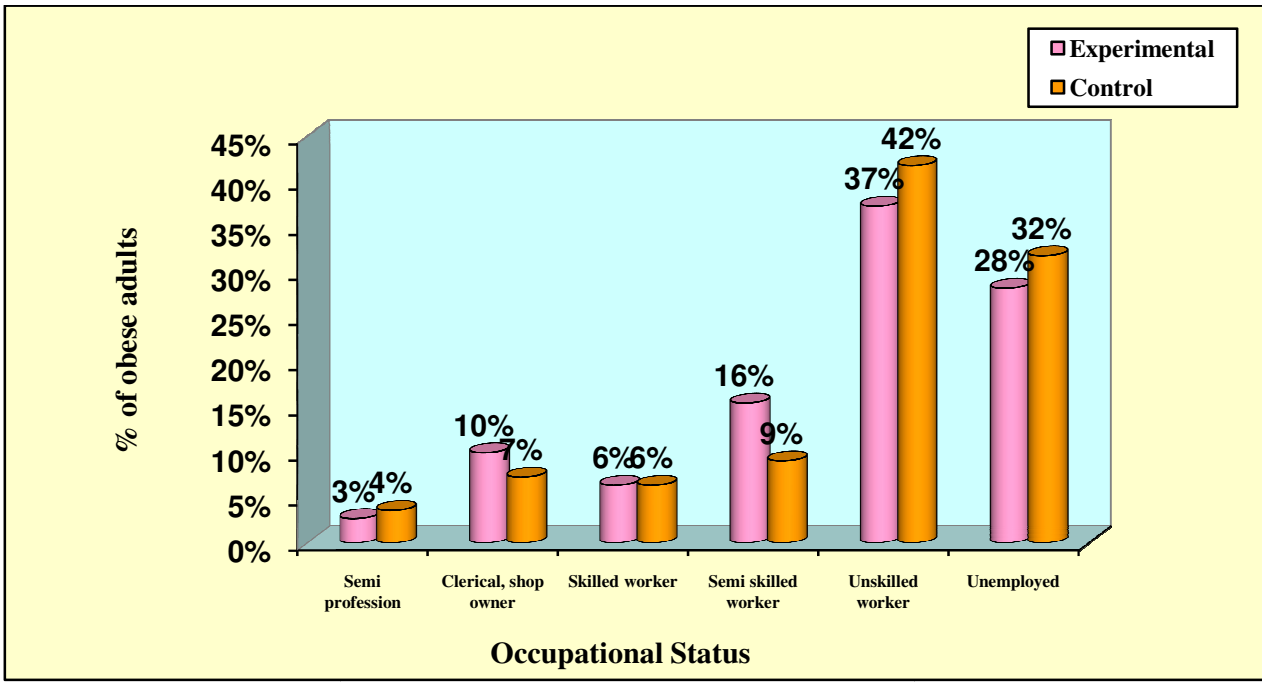


Figure 5.1.1(d): Percentage distribution of occupational status of obese adults in experimental and control group

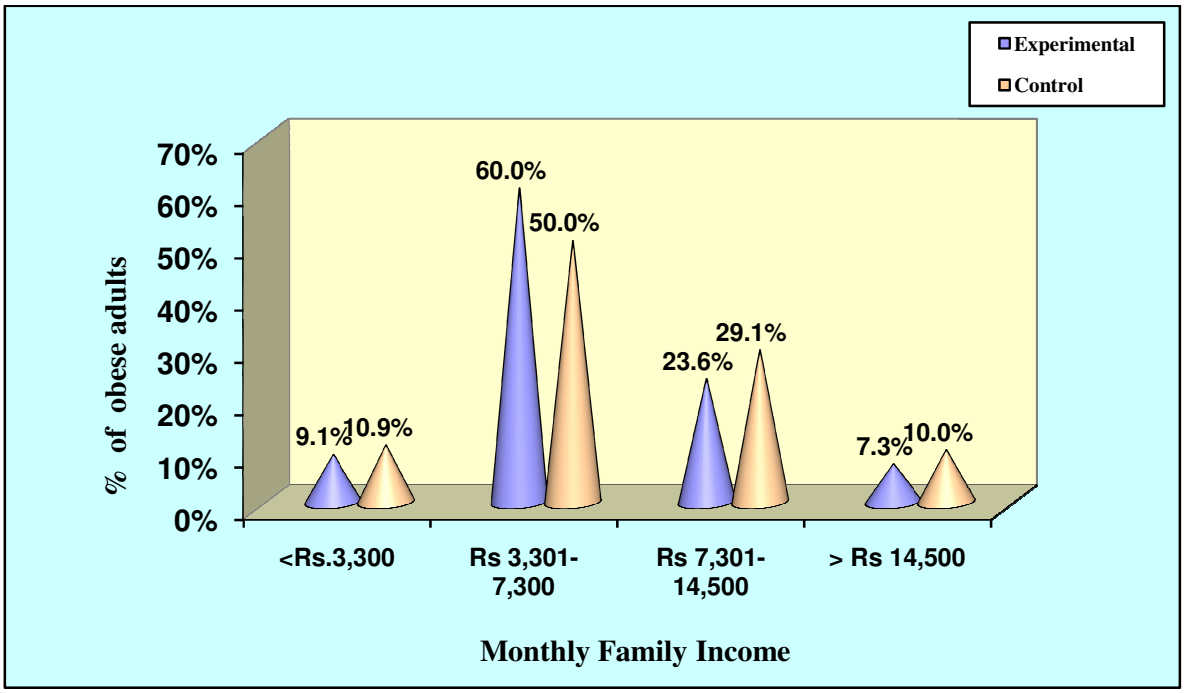


Figure 5.1.1(e): Percentage distribution of monthly family income of obese adults in experimental and control group

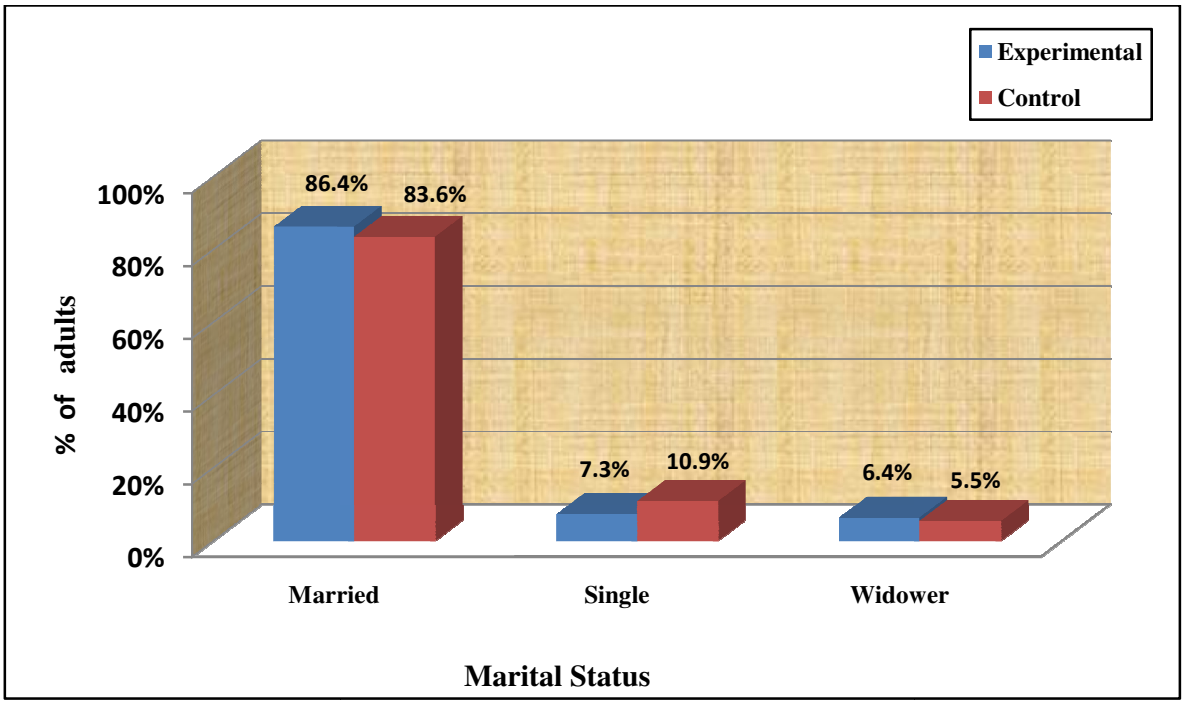


Figure 5.1.1(f): Percentage distribution of marital status of obese adults in experimental and control group

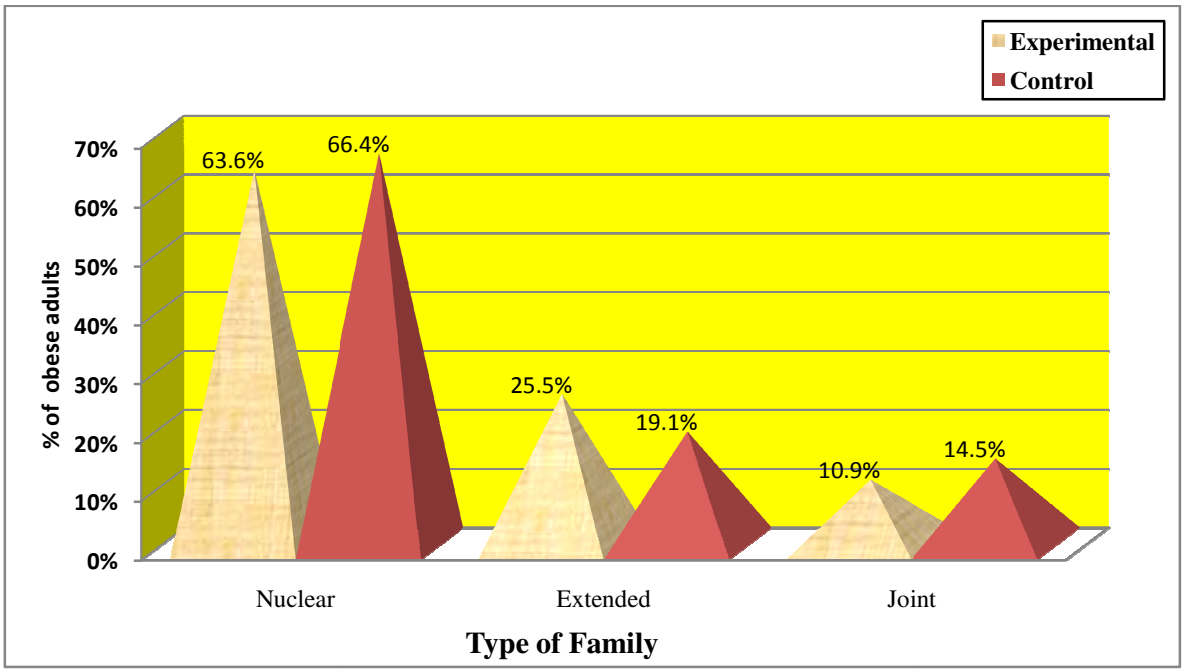


Figure 5.1.1(g): Percentage distribution of type of family of obese adults in experimental and control group

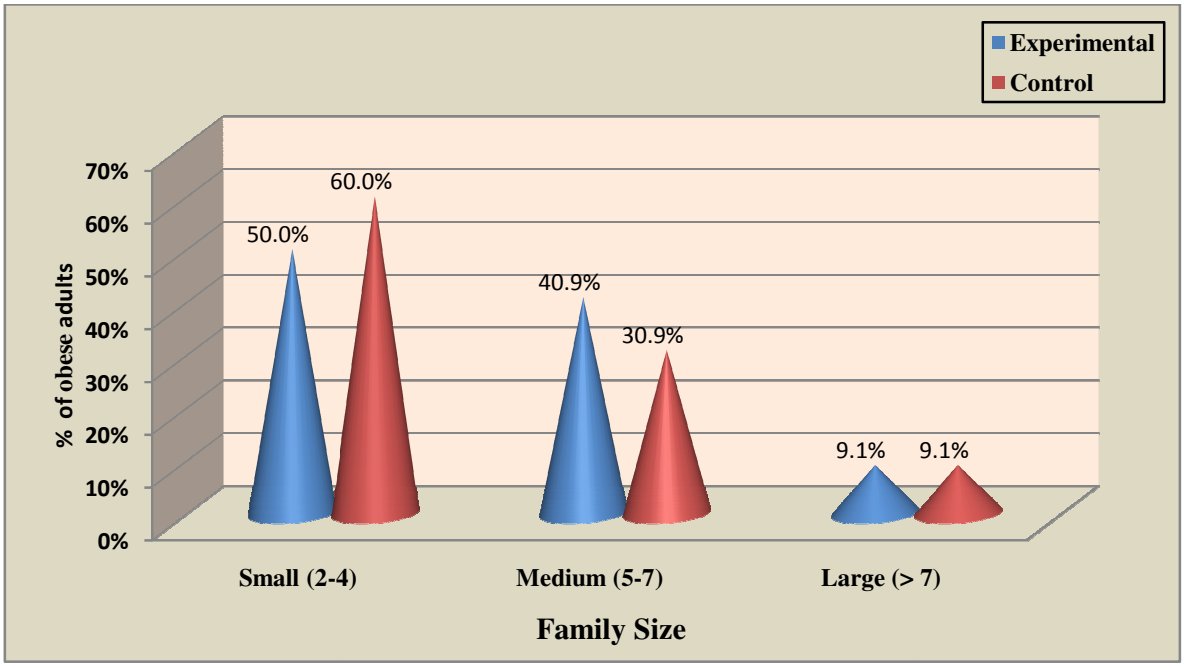


Figure 5.1.1(h): Percentage distribution of family size of obese adults in experimental and control group

Table 5.1.2: Frequency and percentage distribution of family history of Non Communicable Diseases (NCD) of obese adults in experimental and control group

N = 220

Family history of NCDs		Group				Chi square test
		Experimental N=110		Control N=110		
		No.	%	No.	%	
Family history of NCDs	Yes	50	45.50	47	42.70	χ^2=0.16 p=0.68
	No	60	54.50	63	57.30	
Father	Nil	36	72.00	31	65.96	χ^2=3.73, p=0.71
	Obesity	2	04.00	3	06.38	
	DM	7	14.00	9	19.15	
	CVD			1	02.13	
	Hypertension	1	02.00			
	DM+HTN	3	06.00	3	06.38	
	Obese+HTN	1	02.00			
Mother	Nil	10	20.00	16	34.04	χ^2=9.21, p=0.31
	Obesity	7	14.00	2	04.26	
	DM	12	24.00	15	31.91	
	Cancer	1	02.00	1	02.13	
	Hypertension	8	16.00	2	04.26	
	Thyroid disorder	2	04.00	1	02.13	
	DM+HTN	7	14.00	5	10.64	
	Obese+HTN	1	02.00	2	04.26	
	Obese+DM+HTN	2	04.00	3	06.38	
Sibling	Nil	36	72.00	36	76.56	χ^2=6.39, p=0.27
	Obesity	7	14.00	2	04.26	
	DM	3	06.00	5	10.64	
	Hypertension			1	02.13	
	DM+HTN	2	04.00	3	06.38	
	Obese+HTN	2	04.00			
Grandparents	Nil	47	94.00	43	91.49	χ^2=0.28, p=0.86
	DM	2	04.00	3	06.38	
	Hypertension	1	02.00	1	02.13	

The above table 5.1.2 depicts the frequency and percentage distribution of family history of Non Communicable Diseases of obese adults in experimental and control group.

With relevance to the presence of family history of NCDs, 50(45.5%) had the family history of NCDs in experimental group. Similarly in the control group 47(42.7%) had the family history of NCDs.

When considering the presence of family history of NCDs to the fathers, it was observed that 14(28%) had family history of NCDs. The majority 7(14%) of the sample's father had Diabetes Mellitus and 3(16%) of the sample's father had Diabetes and Hypertension. Similarly in control group 16(34%) had family history of NCDs and majority 9(19.15%) of the sample's father had Diabetes Mellitus and 3(6.38%) of the sample's father had Diabetes and Hypertension.

With regard to the presence of family history of NCDs in mothers, the majority 40(80%) had the family history of NCDs. The majority 12(24%) of the sample's mothers were having Diabetes Mellitus, 8(16%) of the sample's mothers had hypertension, 7(14%) of the sample's mother had obesity, 7(14%) of the sample's mother had Diabetes and Hypertension in experimental group. With regard to the control group, the majority 34(65.79%) had the family history of NCDs. The maximum 15(31.91%) of the sample's mother had Diabetes Mellitus and 5(10.64%) of the sample's mother had Diabetes and Hypertension.

With relevance to the presence of family history of NCDs in siblings, 14(28%) had the family history of NCDs in siblings. Among them 7(14%) of the sample's sibling had obesity, 3(6%) of the sample's siblings had Diabetes Mellitus, 2(4%) of the sample's siblings had Diabetes and Hypertension and 2(4%) of the sample's siblings had Obesity and Hypertension in the experimental group. With regard to the family history of NCDs

of siblings in the control group, 11(23.4%) had the family history of NCDs. Among them 5(10.64%) of the sample's siblings had Diabetes Mellitus and 3(6.38%) of the sample's siblings had Diabetes and Hypertension.

With regard to the family history of NCDs in grandparents, the majority 47(94%) of them did not have the family history of NCDs in grandparents and 2(4%) of the sample's grandparents had Diabetes Mellitus. Similarly in control group 43(91.49%) did not have the family history of NCDs in grandparents and 3(6.38%) of the sample's grand parents had Diabetes Mellitus.

The above description highlights that the family history of NCDs was found high with the mothers of the obese adults for both the experimental and control group. Most of them in both experimental and control were affected primarily by Diabetes Melitus, Hypertension and obesity which showed the homogeneity of the samples. The chi-square test also revealed that there was no statistically significant difference between the experimental and control group in their family history of Non Communicable Diseases.

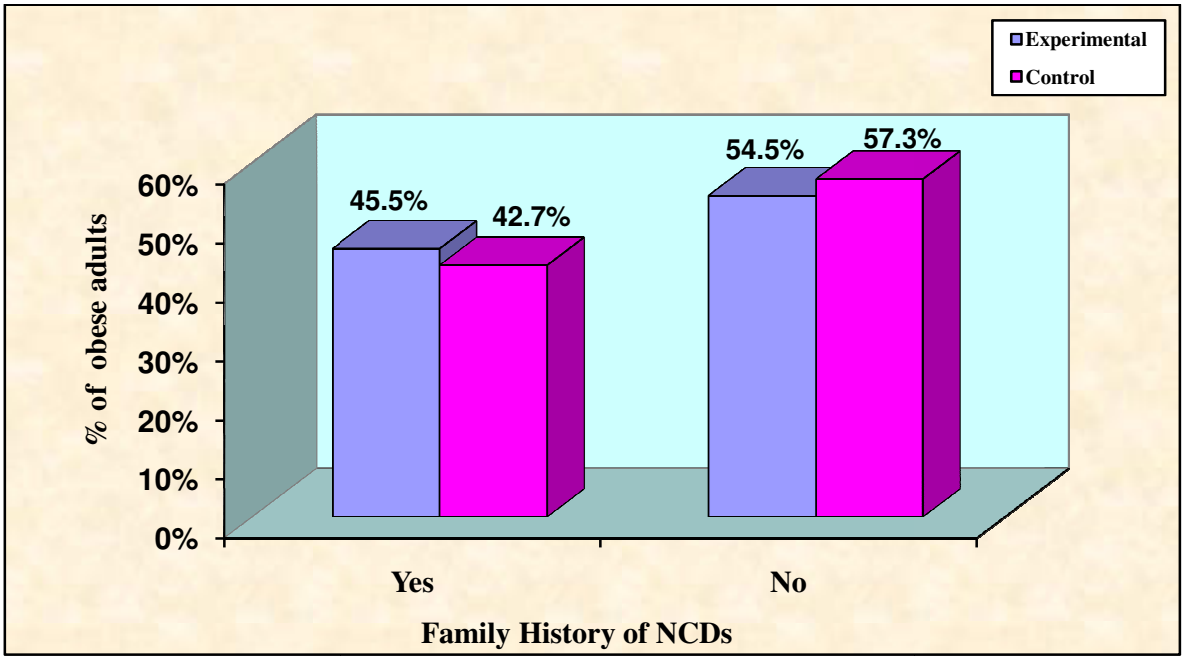


Figure 5.1.2: Percentage distribution of family history of NCDs of obese adults in experimental and control group

Table 5.1.3 Frequency and percentage distribution of obesity related factors - personal history of NCDs and sleep pattern of obese adults in experimental and control group N = 220

Obesity related factors		Group				Chi square test
		Experiment N=110		Control N=110		
		No.	%	No.	%	
Personal history of NCDs	No	78	70.90	85	77.30	χ^2=1.16, p=0.28
	Yes	32	29.10	25	22.70	
Type of disease	DM	22	68.75	18	72.00	χ^2=6.99, p=0.22
	Hypertension	4	12.50	6	24.00	
	CVD			2	08.00	
	Thyroid	5	15.63	1	04.00	
	Renal disease	2	06.25			
	Poly Cystic Ovary	15	46.88	14	56.00	
Chronicity of illness in years	0-3	21	65.63	16	64.00	χ^2=0.66, p=0.72
	4-6	3	09.38	4	16.00	
	> 10	8	25.00	5	20.00	
Treatment	Yes	24	75.00	19	76.00	χ^2=0.07, p=0.93
	No	8	25.00	6	24.00	
History of Sleep Sleep pattern	Regular	62	56.40	57	51.80	χ^2=0.46, p=0.49
	Irregular	48	43.60	53	48.20	

The above table 5.1.3 depicts the frequency and percentage distribution of obesity related factors- personal history of Non Communicable Diseases and sleep pattern of obese adults in experimental and control group.

With respect to the presence of personal history of NCDs, 32(29.1%) had personal history of NCDs and 78(70.9%) did not have the personal history of NCDs in experimental group. Considering the control group, 25(22.7%) had personal history of NCDs and 85(77.3%) did not have the NCDs.

Regarding the type of disease among the persons who had NCDs, majority 22(68.75%) had Diabetes mellitus and 4(12.50%) had Hypertension. Considering the control group, 18(72%) had Diabetes mellitus and 6(24%) had Hypertension.

With respect to Chronicity of illness, maximum 21(65.63%) were in 0-3 years, in experimental group. Similarly, in the control group maximum 16(64%) were in 0-3 years.

In relation to regularity of treatment, the maximum 24(75%) were in regular treatment and 8(25%) had irregular treatment in experimental group. Considering the control group, 19(76%) were in regular treatment and 6(24%) had irregular treatment.

When observing the history of sleep, 62(56.4%) had regular sleep pattern and 48(43.6%) had irregular sleep pattern in experimental group. Considering the control group, 57(51.8%) had regular sleep pattern and 53(48.2%) had irregular sleep pattern.

The above description highlighted that the co morbidities diabetes mellitus and hypertension have already occurred in many individuals with obesity and also the recent occurrence is more. Nearly fifty percentages of the obese adults had irregular sleep pattern which is again a risk factor for obesity. The findings were common for both experimental and control group showing the homogeneity which was also proved by chi-square that there is no statistically significant difference between the experimental and control group in their obesity related factor variable personal history of NCDs and sleep pattern.

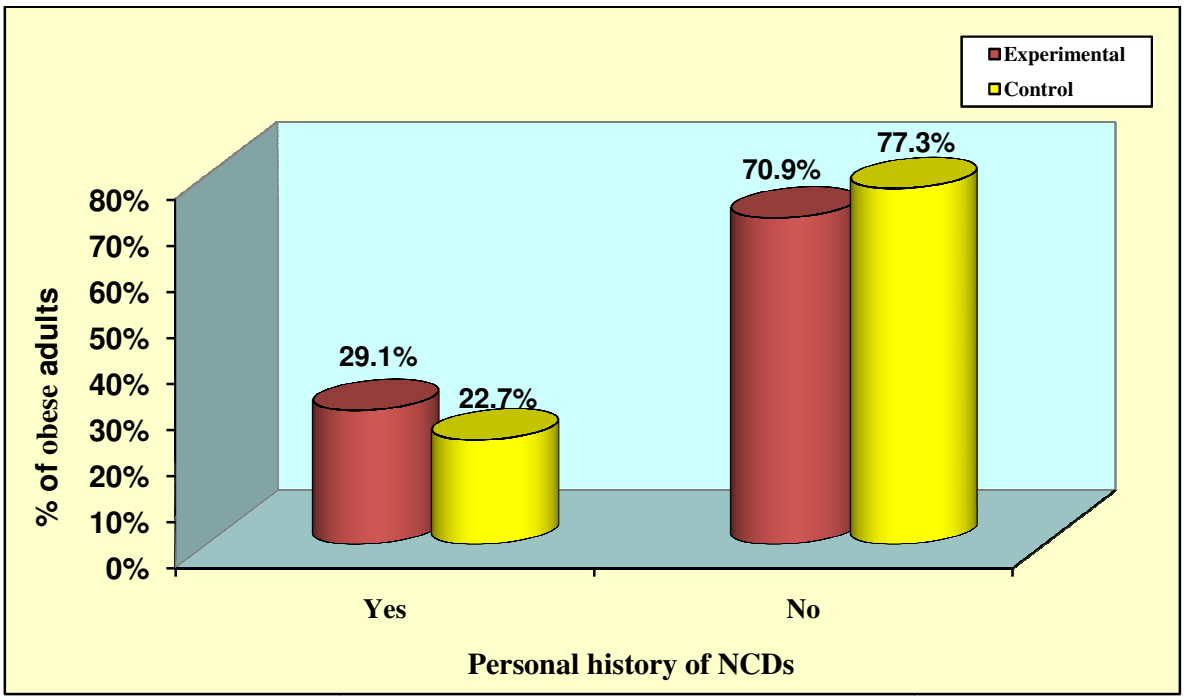


Figure 5.1.3: Percentage distribution of personal history of NCDs of obese adults in experimental and control group

Table 5.1.4: Frequency and percentage distribution of obesity related factors – smoking and use of smokeless tobacco of obese adults in experimental and control group **N = 220**

Obesity related factors		Group				Chi square test
		Experiment N=110		Control N=110		
		No.	%	N0.	%	
History of Smoking	Yes	12	10.90	15	13.60	χ^2=0.38, p=0.53
	No	98	89.10	95	86.40	
Type of smoke	Beedi	4	33.33	5	33.33	χ^2=0.40, p=0.93
	Suruttu	1	08.33	1	06.67	
	Cigarette	7	58.33	9	60.00	
Frequency	1-3 times	4	33.33	11	73.33	χ^2=7.82, p=0.06
	4-6 times	7	58.33	2	13.33	
	7-9 times	1	08.33			
	>10 yrs			2	13.33	
Chronicity of use in years	0-5	3	25.00	3	20.00	χ^2=1.74, p=0.62
	6-10	9	75.00	10	66.67	
	11-15			1	06.67	
	>15			1	06.67	
Use of smokeless tobacco	Yes	11	10.00	13	11.80	χ^2=0.18, p=0.66
	No	99	90.00	97	88.20	
Type of smokeless tobacco	Snuff	6	54.55	9	69.23	χ^2=0.54, p=0.46
	Panparag	5	45.45	4	30.77	
Frequency of use per day	1-3 times	3	27.27	5	38.46	χ^2=1.34, p=0.52
	4-6 times	3	27.27	5	38.46	
	>10 times	5	45.45	3	23.08	
Chronicity of use in years	0-5	1	09.09	5	38.46	χ^2=4.53, p=0.10
	6-10	2	18.18	4	30.77	
	>15	8	72.72	4	30.77	

The above table 5.1.4 depicts the Frequency and percentage distribution of Obesity related factors – habit of smoking and use of smokeless tobacco of obese adults in experimental and control group.

Regarding the habit of smoking, a maximum 98(89.1 of %) in experimental and 95(86.4%) in control group were not having the habit of smoking. With respect to type of smoking, majority 7(58.33%) used cigarette in experimental group and in control group

also majority 9(60%) used cigarette. When considering the frequency of smoking, majority 7(58.33%) used 4-6 times a day in experimental group and in control group majority 11(73.33%) used 1-3 times a day. With respect to chronicity of use, majority 9 (75%) were smoking for 6-10 yrs in experimental group and in control group also 10 (66.67%) were smoking for 6-10 yrs.

Regarding the use of smokeless tobacco, the maximum 99(90.0%) in experimental and 97(88.2%) in control group were not having the habit of use of smokeless tobacco. With respect to type of smokeless tobacco, 6(54.55%) used snuff in experimental group and in control group 9(69.23%) used snuff. When considering the frequency of use of smokeless tobacco, majority 5(45.45%) used more than 10 times a day in experimental group and in control group 5(38.46%) used each 1-3 times a day and 4-6 times a day. Regarding chronicity of use, maximum 8(72.72%) were using for more than 15 yrs in experimental group and in control group 5(38.46%) were using for 0-5 yrs.

The above descriptions highlighted the factors contributing to the obesity and similarity of samples in experimental and control group. The chi-square test also revealed that there was no statistically significant difference between the experimental and control group in their obesity related factor variable history of smoking and use of smokeless tobacco.

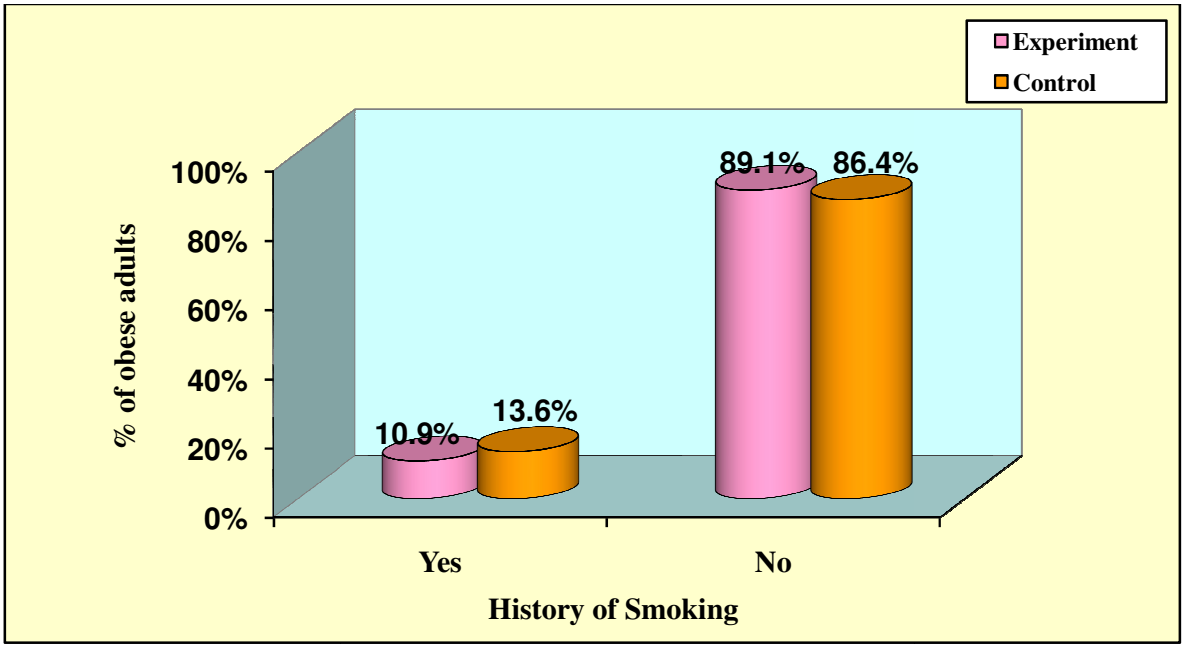


Figure 5.1.4: Percentage distribution of history of smoking of obese adults in experimental and control group.

Table 5.1.5: Frequency and percentage distribution of obesity related factors –use of alcohol and habit of exercise of obese adults in experimental and control group

N = 220

Obesity related factor		Group				Chi square test
		Experiment N=110		Control N=110		
		No.	%	No.	%	
Use of Alcohol	Yes	16	14.50	12	10.90	χ^2=0.65 p=0.41
	No	94	85.50	98	89.10	
Frequency per week	1-3 times	12	75.00	9	75.00	
	4-6 times	4	25.00	3	25.00	χ^2=0.00 p=1.00
Amount per week	< 500 ml	2	12.50	1	08.33	
	500 -1000 ml	6	37.50	4	33.33	χ^2=0.23 p=0.88
	1000 -1500 ml	8	50.00	7	58.33	
Chronicity of use in years	0-5	6	50.00	3	25.00	
	6-10	1	06.25			χ^2=1.74 p=0.62
	11-15	2	12.50	3	25.00	
	>15	7	43.75	6	50.00	
Habit of Exercise	Yes	8	07.30	7	06.40	χ^2=0.07 p=0.78
	No	102	92.70	103	93.60	
Type of exercise	Walking	4	50.00	4	57.14	
	Jogging	1	12.50	1	14.29	χ^2=0.26 p=0.96
	Bicycling	2	25.00	1	14.29	
	Playing tennis	1	12.50	1	14.29	
Intensity of exercise	Moderate	8	100.00	7	100.00	χ^2=0.00 p=1.00
Frequency of exercise	Once in a day	6	75.00	6	85.71	χ^2=0.26 p=0.60
	Twice a day	2	25.00	1	14.29	
Duration of exercise in each frequency	< 10 minutes	6	75.00	4	57.14	χ^2=0.53 p=0.46
	> 10 minutes	2	25.00	3	42.86	
Duration of exercise in years	1-3	7	87.50	6	85.71	χ^2=0.01 p=0.91
	>10	1	12.50	1	14.29	

The above table 5.1.5 describes the frequency and percentage distribution of obesity related factors- use of alcohol and habit of exercise of obese adults in experimental and control group.

With relevance to use of Alcohol, 16(14.5%) in experimental and 12(10.9%) in control group were having the history of use of alcohol. With respect to frequency of intake per week, maximum 12(75%) in experimental group and 9(75%) in control consumed 1-3times a week. Considering the amount per week, majority 8(50%) in experimental and 7(58.33%) in control consumed 1000- 1500 ml per week. Regarding the Chronicity of use, majority 7(43.75%) in experimental group and 6(50%) in control were using it for more than 15 yrs.

With regard to habit of exercise, majority 102(92.7%) in experimental and 103(93.6%) in control did not have the habit of exercise. With respect to the type of exercise among the individuals who had the habit of exercises, 4(50%) in experimental as well as 4(57.14%) in control did walking exercise. Regarding the intensity of exercise, all 8(100%) in experimental and 7(100%) in control group had moderate intensity of exercise. With relevance to the frequency of exercise, 6(75%) in experimental and 6(85.71%) in control group did the exercise once in a day. Regarding the duration of exercise in each frequency, 6(75%) in experimental group did less than 10 minutes and 4(3.6%) in control group did less than 10 minutes. Considering the duration of exercise in years, majority 7(57.14%) in experimental and 6(87.5%) in control were doing it for 1-3 yrs and only 1(12.5%) in each experimental and control group were doing for more than 10 yrs.

The above description highlighted that sedentary activity without exercise and alcohol consumption is present with the samples and those who does the exercise also are not doing it for a required duration. The same status existed for both experimental and control group showing the similarity which was also proved by chi-square that there was no statistically significant difference between the experimental and control group in their obesity related factor variable alcohol use and habit of exercise.

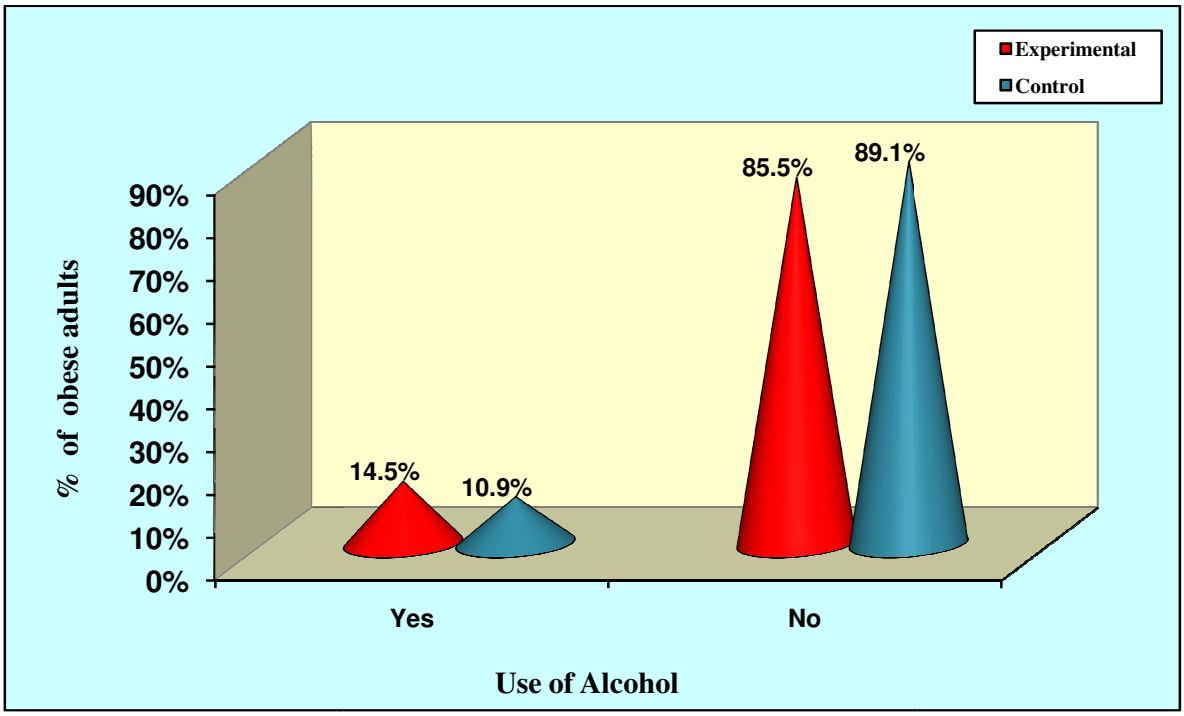


Figure 5.1.5(a): Percentage distribution of use of alcohol of obese adults in experimental and control group

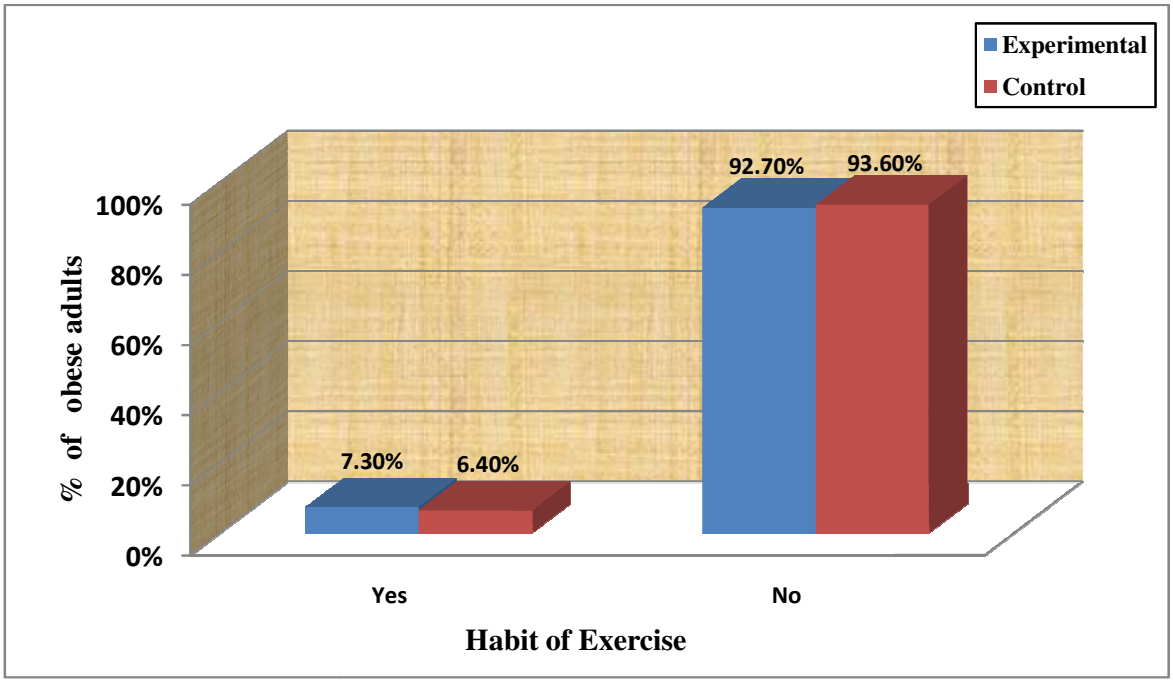


Figure 5.1.5(b): Percentage distribution of habit of exercise of obese adults in experimental and control group

Table 5.1.6: Frequency and percentage distribution of obesity related factors – women health history of obese women clients in experimental and control group

N = 160

Women health history		Group				Chi square test
		Experiment N=80		Control N=80		
		No.	%	No.	%	
Age at Puberty	<10 yrs	3	03.80	8	10.00	χ^2=4.08 p=0.13
	10 -12 yrs	29	36.30	20	25.00	
	13 -15 yrs	48	60.00	52	65.00	
Duration of menstrual cycle	< 3 days	22	27.50	30	37.50	χ^2=1.82 p=0.17
	> 3 days	58	72.50	50	62.50	
Menstrual irregularities	Present	55	68.80	57	71.30	χ^2=0.11 p=0.73
	Absent	25	31.30	23	28.80	
Dysmennorhoea	Yes	47	59.50	42	52.50	χ^2=0.78 p=0.37
	No	32	40.50	38	47.50	
Measures taken for dysmennorhoea	None	23	28.80	17	21.30	χ^2=2.54 p=0.38
	Medication	21	26.30	17	21.30	
	Others	36	45.00	46	57.50	
History of cyst in the ovary	Yes	15	18.80	14	17.50	χ^2=0.04 p=0.83
	No	65	81.30	66	82.50	
History of post menopausal	Yes	16	20.00	12	15.00	χ^2=0.69 p=0.40
	No	64	80.00	68	85.00	
History of hysterectomy	Yes	3	03.80	5	06.30	χ^2=0.52 p=0.46
	No	77	96.30	75	93.80	

The above table 5.1.6 describes the frequency and percentage distribution of obesity related factor-women health history of obese women adults in experimental and control group.

Regarding the age at puberty, 48(60.0%) women in experimental and 52(65.0%) in control attained puberty between 13-15 yrs of age. With regard to duration of menstrual cycle, 58(72.5%) in the experimental and 50(62.5%) in the control had more than 3 days of menstrual cycle.

With relevance to menstrual irregularities, majority 55(68.8%) in the experimental group and the 57(71.3%) in the control group had menstrual irregularities. Considering the presence of dysmenorrheal, 47(59.5%) in the experimental and 42(52.5%) of the control group had dysmenorrhea. Regarding the measures taken for dysmennorhoea, 36(45.0%) in the experimental and 46(57.5%) in the control group had taken other measures like drinking sugar sweetened carbonated beverages.

With respect to history of cyst in the ovary, 15(18.8%) of the experimental and 14(17.5%) of the control group had the cyst in the ovary. With relevance to history of post menopausal, 16(20.0%) of the experimental and 12(15.0%) of the control had attained the menopausal. With respect to history of hysterectomy, 3(3.8%) of the experimental and 5(6.3%) of the control had undergone hysterectomy.

The above description highlighted that the obesity risk factors like presence of cyst, consumption of carbonated beverages during dysmennorhoea, menstrual irregularities are present for both experimental and control group. The chi-square test revealed that there was no statistically significant difference between the experimental and control group in their obesity related factor variable women health history among the obese adult women.

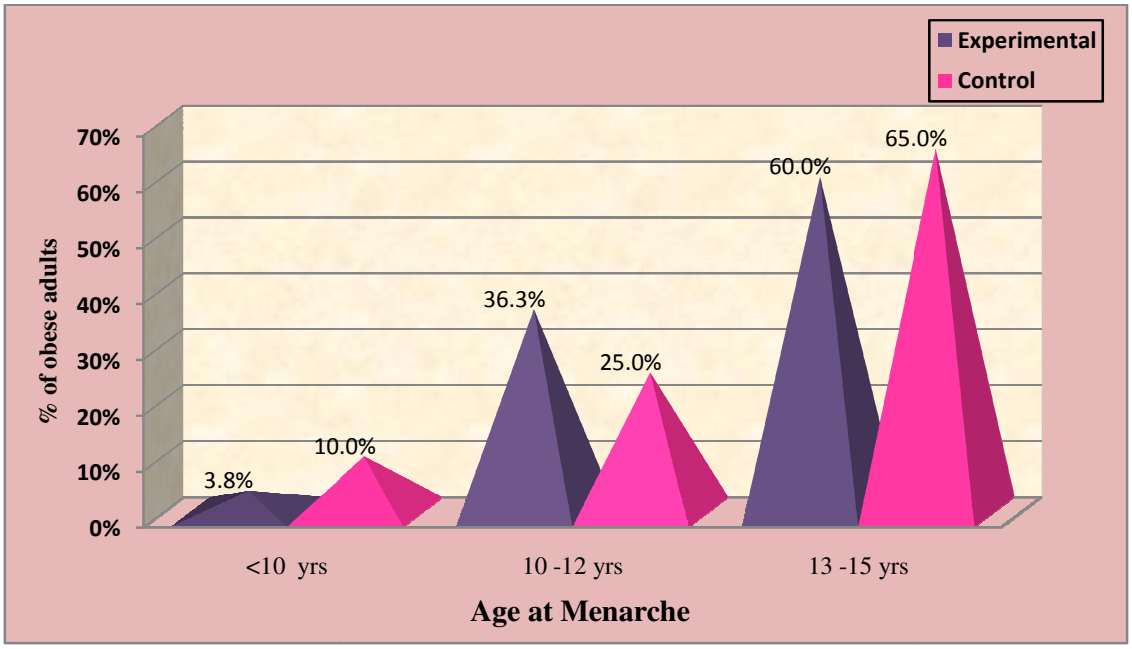


Figure 5.1.6: Percentage distribution of age at menarche of obese women adults in experimental and control group

SECTION 5.2: ASSESSMENT AND COMPARISON OF KNOWLEDGE, ATTITUDE, PRACTICES TOWARDS OBESITY AND OBESITY REDUCTION AMONG THE OBESE ADULTS IN EXPERIMENTAL AND CONTROL GROUP

Table 5.2.1: Assessment of pre test mean, SD and percentage of the knowledge components score in experimental and control group N = 220

S. No.	Aspects of knowledge	Min – Max score	Experimental N=110			Control N=110		
			Mean score	SD	%	Mean score	SD	%
1	General information	0 -3	01.37	00.57	45.67	01.45	00.58	48.33
2	Causes	0 -7	02.49	01.09	35.57	02.35	01.02	33.57
3	Diagnosis	0 -2	01.32	00.87	66.00	01.24	00.97	62.00
4	Health risk	0 -3	01.36	00.89	45.33	01.45	00.72	48.33
5	Management	0 -5	01.55	00.79	31.00	01.66	00.76	33.20
6	Prevention	0 -5	02.58	00.97	51.60	02.66	01.01	53.20
	Overall	**0 -25**	**10.67**	**02.39**	**42.68**	**10.80**	**02.18**	**43.20**

The above table 5.2.1 depicts the assessment of pre test mean, SD and percentage of knowledge components score in experimental and control group.

In the experimental group the pre test mean knowledge score of general information was 1.37 with the SD of 0.57, the mean score for causes was 2.49 with the SD of 1.09, the mean score for diagnosis was 1.32 with the SD of 0.87, the mean score for health risks was 1.36 with the SD of 0.89, the mean score for management was 1.55 with the SD of 0.79, the mean score for prevention was 2.58 with the SD of 0.97 and the overall mean score was 10.67 with the SD of 2.39.

Similarly in the control group the mean score of general information was 1.45 with the SD of 0.58, the mean score for causes was 2.35 with the SD of 1.02, the mean score for diagnosis was 1.24 with the SD of 0.97, the mean score for health risks was 1.45 with the SD of 0.72, the mean score for management was 1.66 with the SD of 0.76, the mean score for prevention was 2.66 with the SD of 1.01 and the overall mean score was 10.80 with the SD of 2.18. The above findings proved the homogeneity of the samples.

Table 5.2.2: Assessment of post test mean, SD and percentage of knowledge components score in experimental and control group N=220

S.No.	Aspects of knowledge	No. of Questions	Min – Max Score	Experimental N=110			Control N=110		
				Mean score	SD	%	Mean score	SD	%
1	General information	3	0 -3	02.61	00.56	87.00	01.55	00.71	51.67
2	Causes	7	0 -7	04.74	01.12	67.71	02.38	00.97	34.00
3	Diagnosis	2	0 -2	01.58	00.56	79.00	01.29	00.92	64.50
4	Health risk	3	0 -3	02.49	00.67	83.00	01.50	00.69	50.00
5	Management	5	0-5	04.38	00.85	87.60	01.72	00.73	34.40
6	Prevention	5	0-5	04.01	00.77	80.20	02.75	01.00	55.00
	Total	**25**	**0 -25**	**19.81**	**2.31**	**79.24**	**11.19**	**2.18**	**44.76**

The above table 5.2.3 depicts the assessment of post test mean, SD and percentage of knowledge components score in experimental and control group.

In the experimental group the post test mean knowledge components score for general information was 2.61 with the SD of 0.56, the mean score for causes was 4.74 with the SD of 1.12, the mean score for diagnosis was 1.58 with the SD of 0.56, the mean score for health risks was 2.49 with the SD of 0.67, the mean score for management was 4.38 with the SD of 0.85 and the mean score for prevention was 4.01 with the SD of 0.77.

Where as in the control group the post test mean knowledge components score for general information was 1.55 with the SD of 0.71, the mean score for causes was 2.38 with the SD of 0.97, the mean score for diagnosis was 1.29 with the SD of 0.92, the mean score for health risks was 1.50 with the SD of 0.69, the mean score for management was 1.72 with the SD of 0.73and the mean score for prevention was 2.75 with the SD of 1.00.

The overall mean knowledge score for experimental group was 19.81 with the SD of 2.31 whereas it was only 11.19 with the SD of 2.18 for the control group. Hence it is evident that the experimental group gained more knowledge than the control group which proved the effectiveness of Rural Obesity Reduction Programme.

Table 5.2.3: Frequency, percentage and Comparison of level of knowledge of the experimental and control group in pretest and post test N = 220(110+110)

Group	Level of knowledge	Group				Chi square test
		Pretest		Posttest		
		No.	%	No.	%	
Experimental	Inadequate	48	43.60	0	00.00	**χ^2=137.33, P=0.001*** DF=1**
	Moderate	62	56.40	31	28.20	
	Adequate	0	00.00	79	71.80	
Control	Inadequate	50	45.50	46	41.80	χ^2=0.29, P=0.58, DF=1
	Moderate	60	54.50	64	58.20	
	Adequate	0	00.00	0	00.00	
Chi square test		χ^2=0.07, P=0.78, DF=1		**χ^2=136.46, P=0.001*** DF=2**		

*significant at p<0.05, **significant at p<0.01, ***significant at p<0.001

The above table 5.2.3 shows the comparison of level of knowledge of experimental and control group in the pretest and post test.

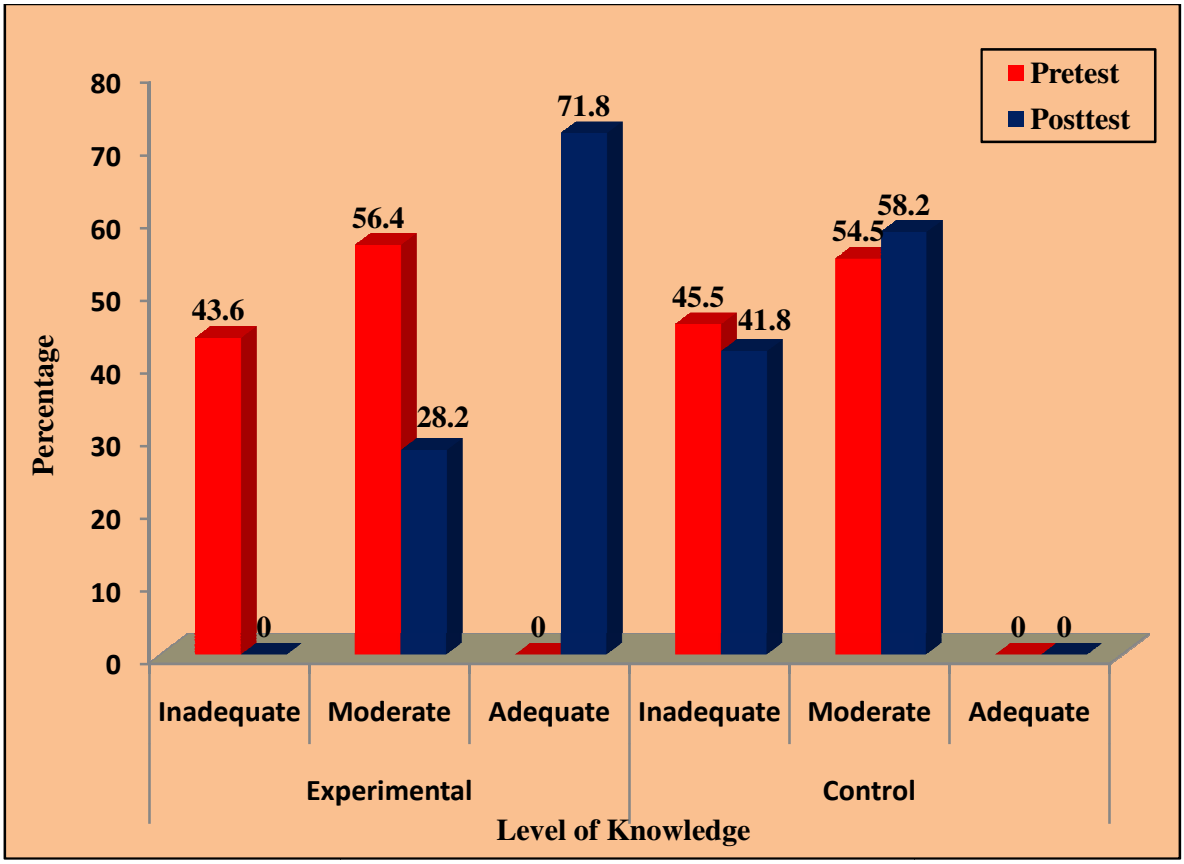
In the pretest of experimental group, none of them had adequate knowledge, 62(56.4%) had moderate knowledge and 48(43.6%) had inadequate knowledge. Similarly in control group also none of them had adequate knowledge, 60(54.5%) had moderate knowledge and 50(45.5%) had inadequate knowledge.

Regarding the post test of experimental group, 79(71.8%) had adequate knowledge, 31(28.2%) had moderate knowledge and none of them had inadequate knowledge. Whereas in the control group none of them had adequate knowledge 64(58.2%) had moderate knowledge and 46(41.8%) had inadequate and.

The chi-square test revealed that there was no statistically significant difference between the pre and post test in control group and also between the experimental and control group in pretest.

The chi-square value χ^2=137.33 at p< 0.001 level for the experimental within the group comparison revealed that there was a significant difference between the pre and post test level of knowledge of experimental group.

The chi-square value χ^2=136.46 at p< 0.001 level for between the group comparison of experimental and control group in the post test revealed that there was high level statistically significant difference between the experimental and control group in the post test which showed that the RORP had significant impact on knowledge gain among the obese adults of experimental group



5.2.3: Comparison of level of knowledge in the pre and post test for experimental and control group

Table 5.2.4: Frequency, Percentage and Comparison of level of attitude of experimental and control group in the pretest and post test N = 220(110+110)

Group	Level of attitude	Pretest		Posttest		Chi square test
		No	%	No	%	
Experimental	Unfavorable	28	25.50	0	00.00	**χ^2=153.55, P=0.001*** DF=1**
	Moderate	82	74.50	17	15.50	
	Favourable	0	00.00	93	84.50	
Control	Unfavorable	25	22.70	23	20.90	χ^2=0.10, P=0.74, DF=1
	Moderate	85	77.30	87	79.10	
	Favourable	0	00.00	0	00.00	
Chi square test		χ^2=0.22, P=0.63, DF=1		**χ^2=163.12, P=0.001***, DF=1**		

*significant at p<0.05, **significant at p<0.01, ***significant at p<0.001

The above table 5.2.4 shows the comparison of level of attitude of experimental and control group in the pretest and post test.

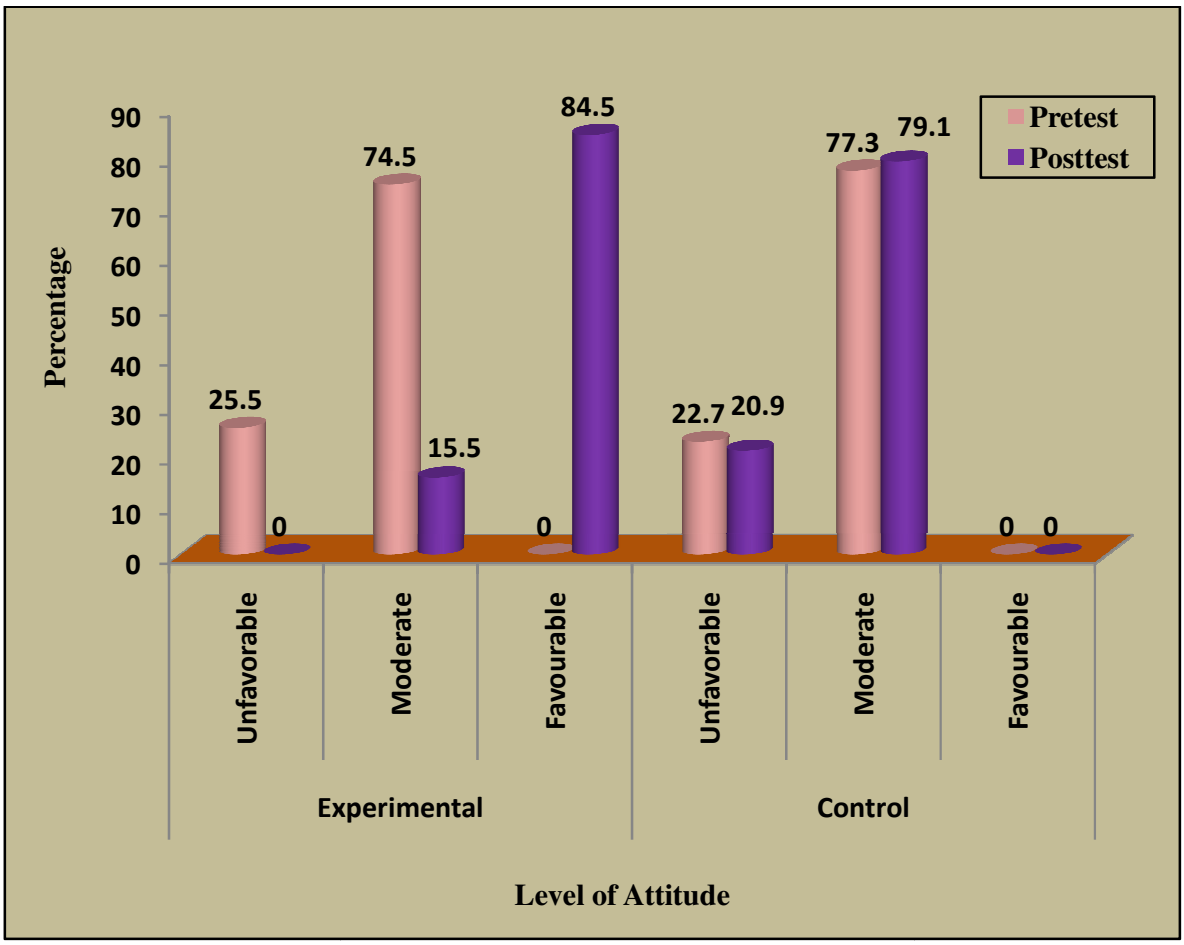
In the pretest of experimental group none of them had favorable attitude. 28(25.5%) and 82(74.5%) had unfavorable and moderate favorable attitude respectively. Similarly in control group also none of them had favorable attitude 25(22.7%) and 85(77.3%) had unfavorable and moderate favorable attitude respectively.

Where as in the post test majority of them 93(84.5%) had favorable attitude, none of them had unfavorable attitude and 17(15.5%) had moderate attitude in experimental group and in control group 23(20.9%) had unfavorable attitude, 87(79.1%) had moderate attitude and none of them had favorable attitude.

The chi-square test revealed that there was no statistically significant difference between the pre and post test in control group and also between the experimental and control group in pretest.

The chi-square value χ^2=153.55 at p< 0.001 level for the experimental within the group comparison revealed that there was a significant difference between the pre and post test level of attitude of experimental group.

The chi-square value χ^2=163.12 at p< 0.001 level for between the group comparison of experimental and control group in the post test revealed that there was high level statistically significant difference between the experimental and control group in the post test which showed that the RORP had significant impact on attitude gain among the obese adults of experimental group.



5.2.4: Comparison of level of attitude in the pre and post test for experimental and control group

5.2.5: Assessment of pre test mean, SD and percentage of practice components score in experimental and control group

N = 220

S.No	Aspects of practice	Min – Max Score	Experimental N=110			Control N=110		
			Mean score	SD	%	Mean score	SD	%
1	Dietary	15 -75	34.39	05.52	45.90	34.94	06.50	46.60
2	Physical activity	10 -50	17.80	04.08	35.60	18.51	05.14	37.00
3	Life style	10-50	28.60	05.34	57.20	29.48	05.12	59.00
	Total	**35 -175**	**80.79**	**11.99**	**46.20**	**82.93**	**12.83**	**47.40**

The above table 5.2.5 depicts the assessment of pre test mean, SD and percentage of practice components score in experimental and control group.

The analysis of the experimental group revealed that in the pretest the mean score of dietary practice was 34.39 with the SD of 5.52, mean score of physical activity practice was 17.80 with the SD of 4.08 and mean score of life style practices was 28.60 with the SD of 5.34.

Similarly in the control group the mean score of dietary practice was 34.94 with the SD of 6.50, mean score of physical activity practice was 18.51 with the SD of 5.14 and mean score of life style practices was 29.48 with the SD of 5.12.

The overall mean practice score for experimental group was 80.79 with the SD of 11.99 and for control group it was 82.93 with the SD of 12.83. The pre test findings proved the homogeneity of the samples of experimental and control group.

Table 5.2.6: Assessment of post test mean, SD and percentage of practice components score in experimental and control group

N= 220

S.No	Aspects of practice	No. of Questions	Min – Max Score	Experimental N=110			Control N=110		
				Mean score	SD	%	Mean score	SD	%
1	Dietary	15	15 -75	54.73	03.47	73.00	35.78	07.32	47.70
2	Physical activity	10	10 -50	35.37	03.30	70.70	19.27	05.57	38.50
3	Life style	10	10-50	39.07	02.87	78.10	29.89	04.86	59.80
	Total	**35**	**35 -175**	129.17	07.50	73.80	84.95	15.52	48.50

The above table 5.2.6 shows the assessment of post test mean, SD and percentage of practice components score in experimental and control group.

When observed the experimental group, the mean score of dietary practice was 54.73 with the SD of 3.47, the mean score of physical activity practice was 35.37 with the SD of 3.30 and the mean score of life style practices was 39.07 with the SD of 2.87.

Whereas in the control group the mean score of dietary practice was 35.78 with the SD of 7.32, the mean score of physical activity practice was 19.27 with the SD of 5.57and the mean score of life style practices was 29.89 with the SD of 4.86.

The overall mean practice score for experimental group was 129.17 with the SD of 07.50 and for control group it was only 84.95 with the SD of 15.52. Hence it is evident that the experimental group gained more practice than the control group.

Table 5.2.7: Frequency, Percentage and Comparison of level of practice of experimental and control group in the pretest and post test

N = 220(110+110)

Group	**Level of practice**	**Pretest**		**Posttest**		**Chi square test**
		No.	**%**	**No.**	**%**	
Experimental	Poor	15	13.60	0	00.00	**χ^2=133.50, P=0.001*** DF=1 Significant**
	Moderate	95	86.40	28	25.50	
	Good	0	00.00	82	74.50	
Control	Poor	14	12.70	13	11.80	χ^2=0.04, P=0.83, DF=1 Not significant
	Moderate	96	87.30	97	88.20	
	Good	0	00.00	0	00.00	
Chi square test		χ^2=0.04, P=0.83, DF=1		**χ^2=133.09, P=0.001*** DF=2**		

*significant at p<0.05, **significant at p<0.01, ***significant at p<0.001

The above table 5.2.7 describes the comparison of pre test and post test level of practice of both experimental and control group.

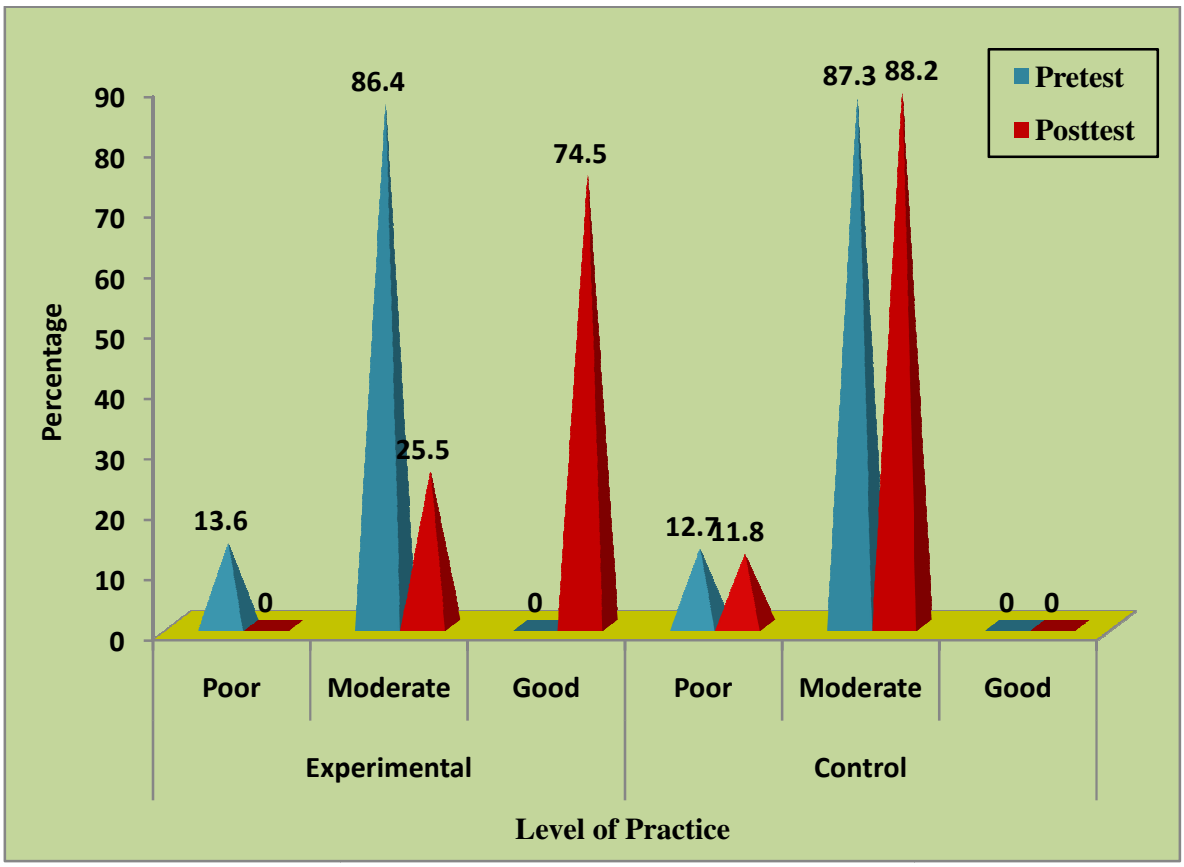
In the pretest of experimental group none of them had good practice, 15(13.6%) and 95(86.4%) of them had poor and moderate practice respectively. Similarly in control group also none of them had good practice, 14(12.7%) and 96(87.3%) of them had poor and moderate practice respectively.

Where as in the post test of experimental group majority of them 82(74.5%) of them had good practice, none of them had poor practice and in control group none of them had good practice, 13(11.8%) of them had poor practice and 97(88.2%) of them had moderate practice.

The chi-square test revealed that there was no statistically significant difference between the pre and post test in control group and also between the experimental and control group in pretest.

The chi-square value χ^2=133.50 at p< 0.001 level for the experimental within the group comparison revealed that there was a significant difference between the pre and post test level of practice of experimental group.

The chi-square value χ^2=133.09 at p< 0.001 level of between the group comparison of experimental and control group in the post test revealed that there was high level statistically significant difference between the experimental and control group in the post test which showed that the RORP had significant impact on practice gain among the obese adults of experimental group.



5.2.7: Comparison of level of practice in the pre and post test for experimental and control group

Table 5.2.8: Frequency, percentage and comparison of obesity reduction - BMI of the experimental and control group in pre test and post test N = 220(110+110)

Group	Level of BMI	Pre test Base line		Post test 1 6th week		Post test 2 12th week		Chi square test
		No.	%	No.	%	No.	%	
Experimental	**Normal**	2	01.80	4	03.60	5	04.50	**χ^2=31.58 P=0.001*** DF=4**
	Over weight	8	07.30	22	20.00	36	32.70	
	Class I	75	68.20	69	62.70	62	56.40	
	Class II	21	19.10	12	10.90	7	06.40	
	Class III	4	03.60	3	02.70	0	00.00	
Control	**Normal**	3	02.70	3	02.70	3	02.70	χ^2=0.74 P=0.99 DF=4
	Over weight	10	09.10	11	10.00	9	08.20	
	Class I	66	60.00	68	61.80	67	60.90	
	Class II	28	25.50	24	21.80	27	24.50	
	Class III	3	02.70	4	03.60	4	03.60	
Chi square test		χ^2=2.14 P=0.71 DF=4		χ^2=7.96 P=0.09 DF=4		**χ^2=32.65 P=0.001*** DF=4**		

* significant at P≤0.05 ** highly significant at P≤0.01 *** very high significant at P≤0.001

The above table 5.2.8 shows the Comparison of pretest and post test obesity reduction (BMI) within and between the experimental and control group.

In the pre test of experimental group 75(68.2%) of them were in class I obesity, 21(19.1%) of them were in class II obesity and 4(3.6%) of them were in class III obesity. Similarly 66(60.0%) of them were in class I obesity, 28(25.5%) of them were in class II obesity and 3(2.7%) of them were in class III obesity. The chi square test revealed that there is no statistically significant difference between the experimental and control group.

At the level of post test 1, 69(62.7%) of them were in class I obesity, 12(10.9%) of them were in class II obesity and 3(2.7%) of them were in class III obesity in experimental group. Considering the control group, 68(61.8%) of them were in class I obesity, 24(21.8%) of them were in class II obesity and 4(3.6%) of them were in class III obesity. Though there was mild difference for experimental group it was not statistically significant at this level.

At the level of post test 2 of experimental, the obese adults moved to the lower risk categories. In class III obesity the number reduced from 4(3.60%) in the pre test to 0(00.00%) in the post test-2, in class II obesity the number reduced from 21(19.10) in the pre test to 7(06.40%) in the post test-2, in class I obesity the number reduced from 75(68.20%) in the pre test to 62(56.40%) in the post test-2, in overweight category the number increased from 8(07.30%) in the pre test to 36(32.70%) in the post test-2 and in normal category the number increased from 2(01.80%) in the pre test to 5(04.50%) in the post test-2. In contrast the status remained the same for control group at the level of post test-2 also. The chi-square value χ^2=31.58 at p< 0.001 level for the experimental within the group comparison revealed that there was a statistically significant difference between the pre and post test level of BMI for the experimental group.

The chi-square value χ^2=32.65 at p< 0.001 level for between the group comparison of experimental and control group in the post test-2 revealed that there was high level statistically significant difference between the experimental and control group in the post test-2 which showed that the RORP had significant impact in reducing the BMI level among the obese adults of experimental group.

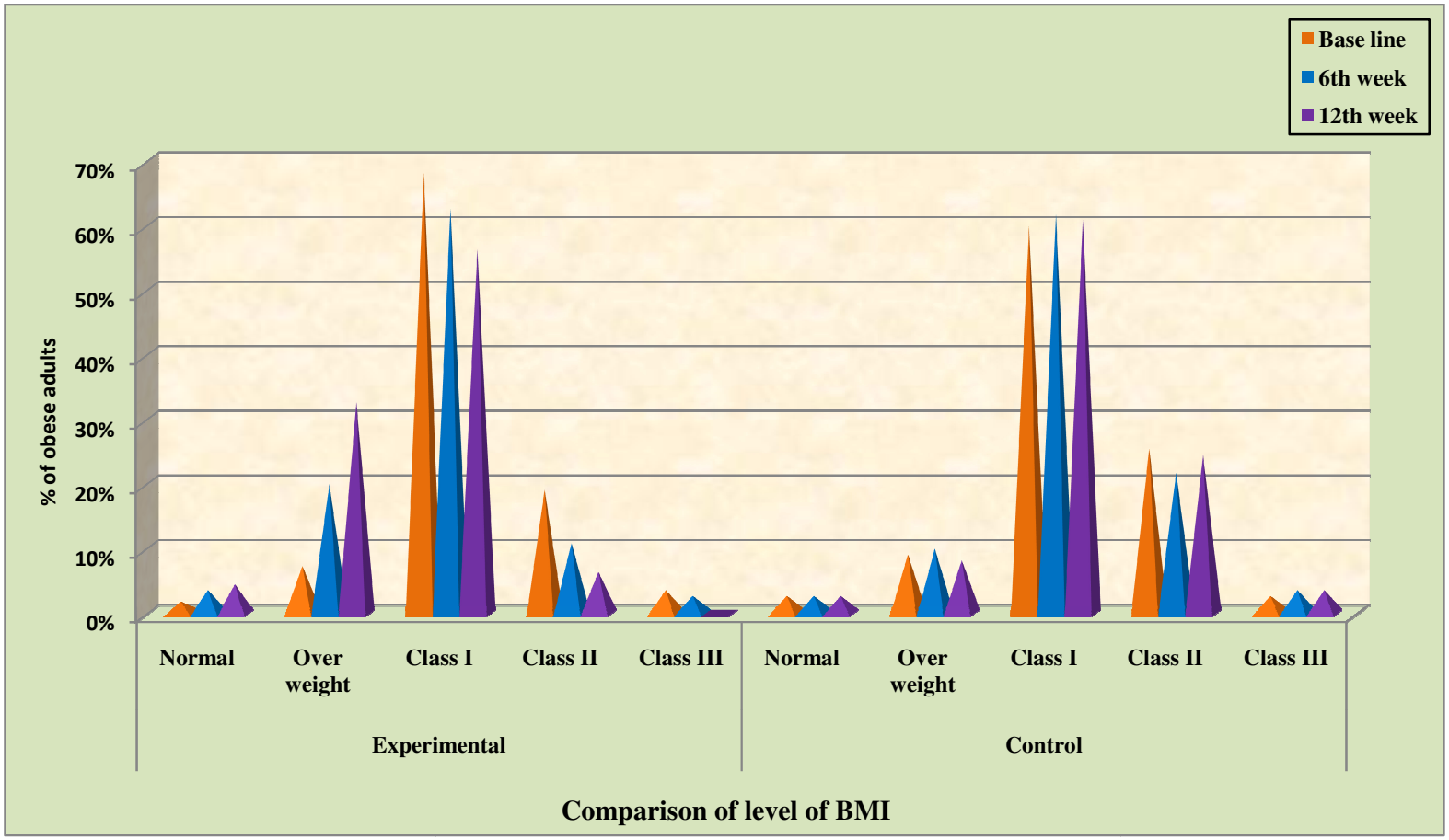


Figure 5.2.8: Comparison of level of BMI in the pre and post test for experimental and control group

Table 5.2.9: Frequency, percentage and comparison of obesity reduction - WC of the experimental and control group in pre test and post test N = 220

WC		Experiment N=110		Control N=110		Chi square test
		No.	**%**	**No.**	**%**	
Base line Pre test	Action Level I	4	03.60	2	01.80	χ^2=1.99 P=0.36, DF=4
	Action Level II	68	61.80	61	55.50	
	Obesity	38	34.50	47	42.70	
6th week Post test 1	Action Level I	7	06.40	2	01.80	χ^2=4.95, P=0.08 DF=4
	Action Level II	69	62.70	62	56.40	
	Obesity	34	30.90	46	41.80	
12th week Post test 2	Action Level I	22	20.00	3	02.70	**χ^2=20.01 P=0.001***, DF=4**
	Action Level II	62	56.40	61	55.50	
	Obesity	26	23.60	46	41.80	
Chi square test		**χ^2 =19.62, p=0.001***,DF=4**		χ^2=0.31 P=0.98, DF=4		

*significant at p<0.05, **significant at p<0.01, ***significant at p<0.001

The above table 5.2.9 describes the comparison of obesity reduction (WC) in the pre test and in the post test among the experimental and control group.

In the pretest of experimental group, 4(3.6%), 68(61.8%) and 38(34.5%) of them were under Action level-I, Action level-II and obesity category respectively. Similarly in control group 2(1.8%), 61(55.5%) and 47(42.7%) of them were under Action level-I, Action level-II and obesity category respectively. The chi square also revealed that there was no statistically significant difference found between experimental and control group.

In the post test-1 of experimental group, 7(6.4%), 69(62.7%) and 34(30.9%) of them were under Action level-I, Action level-II, and obesity category respectively. In the control group 2(1.8%), 62(56.4%) and 46(41.8%) of them were under Action level-I,

Action level-II, and obesity category respectively. Though there was mild difference for experimental group it was not statistically significant at this level.

In the post test-2 of experimental group, 22(20.0%), 62(56.4%) and 26(23.6%) of them were under Action level-I, Action level-II and obesity category respectively whereas in control group the status remained the same as 3(2.7%), 61(55.5%) and 46(41.8%) under Action level-I, Action level-II and obesity category respectively.

The chi-square value χ^2=20.01 at p< 0.001 level for between the group comparison of experimental and control group in the post test-2 revealed that there was high level statistically significant difference between the experimental and control group in the post test II which showed that the RORP had significant impact in reducing the WC level among the obese adults of experimental group.

The within the group comparison of pretest and post test-2 of experimental revealed that individuals were moving to the lower risk category. In the obesity category the number reduced from 38(34.50) in pre test to 26(23.60) in post test-2. In the action level II the number reduced from 68(61.80) in pre test to 62(56.40) in post test-2. In the action level I the number increased from 4(03.60) in pre test to 22(20.00) in post test-2 which was considered to be a low risk category. In contrast the status remained the same for the control group.

The chi-square value χ^2=19.62 at p< 0.001 level for the experimental within the group comparison revealed that there was a statistically significant difference between the pre and post test level of WC for the experimental group.

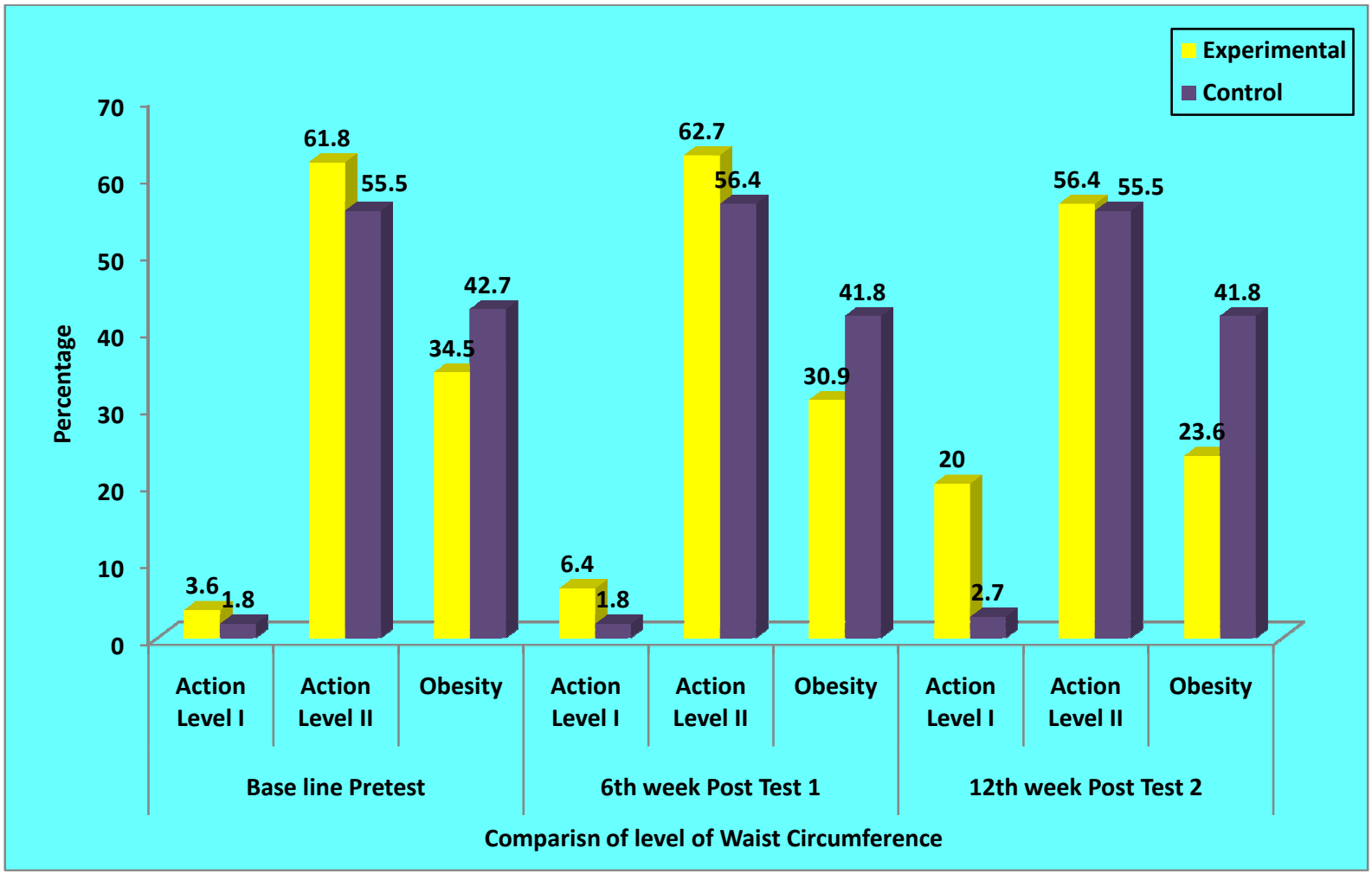


Figure 5.2.9: Comparison of level of WC in the pre and post test for experimental and control group

Table 5.2.10: Frequency, percentage and comparison of obesity reduction (PBF) of the experimental and control group in pre test and post test N = 220

Level of PBF		Experiment N=110		Control N=110		Chi square test
		No.	%	No.	%	
Base line Pre test	Average	12	10.90	10	09.10	χ^2=0.20, P=0.65, DF=1
	Obesity	98	89.10	100	90.90	
6th week Post test 1	Average	17	15.50	9	08.20	χ^2=2.79, P=0.09, DF=1
	Obesity	93	84.50	101	91.80	
12th week Post test 2	Average	26	20.00	9	08.20	**χ^2=6.34, P=0.01**, DF=1**
	Obesity	84	80.00	101	91.80	
Chi square test		**χ^2=6.59, P=0.03**, DF=4**		χ^2=0.31, P=0.98, DF=4		

*significant at p<0.05, **significant at p<0.01, ***significant at p<0.001

The above table 5.2.10 describes about the comparison, frequency and percentage distribution of level of Percent Body Fat in the pre test and in the post test among the experimental and control group.

In the pretest of experimental group, 12(10.9%) were under average category and 98(89.1%) were under obesity category. Similarly in control group 10(9.1%) were under average category and 100(90.9%) were under obesity category which proved the similarity of the groups. Chi square also revealed that there is no significant difference between experimental and control group.

In the post test-1 of experimental group, 17(15.5%) were under average category and 93(84.5%) were under obese category. In control group 9(8.2%) under average category and 101(91.8%) were under obese. Though there was mild difference in the experimental group it was statistically not significant as per the chi square test.

In the post test-2 of experimental group, 26(23.6%) were under average category and 84(76.4%) were under obesity category. But in contrast only 9(8.2%) were under average category and majority 101(91.8%) of them were under obesity category in control group. The chi-square test revealed that there is no statistically significant difference between experimental and control group in the pre test and in the post test 1.

The chi-square value χ^2=6.34 at p< 0.01 level for between the group comparison of experimental and control group in the post test-2 revealed that there was high level statistically significant difference between the experimental and control group in the post test-2 which showed that the RORP had significant impact in reducing the Percent Body Fat level among the obese adults of experimental group.

The within the group comparison of pretest and post test II of experimental revealed that individuals were moving to the lower risk category. In the obesity category, the number reduced from 98(89.10) in pre test to 84(80.00) in post test II. In the average category the number increased from 12(10.90) in pre test to 26(20.00) in post test II. In contrast the status remained the same for the control group.

The chi-square value χ^2=6.59 at p< 0.01 level for the experimental within the group comparison revealed that there was a statistically significant difference between the pre and post test level of PBF for the experimental group proving the effectiveness of RORP.

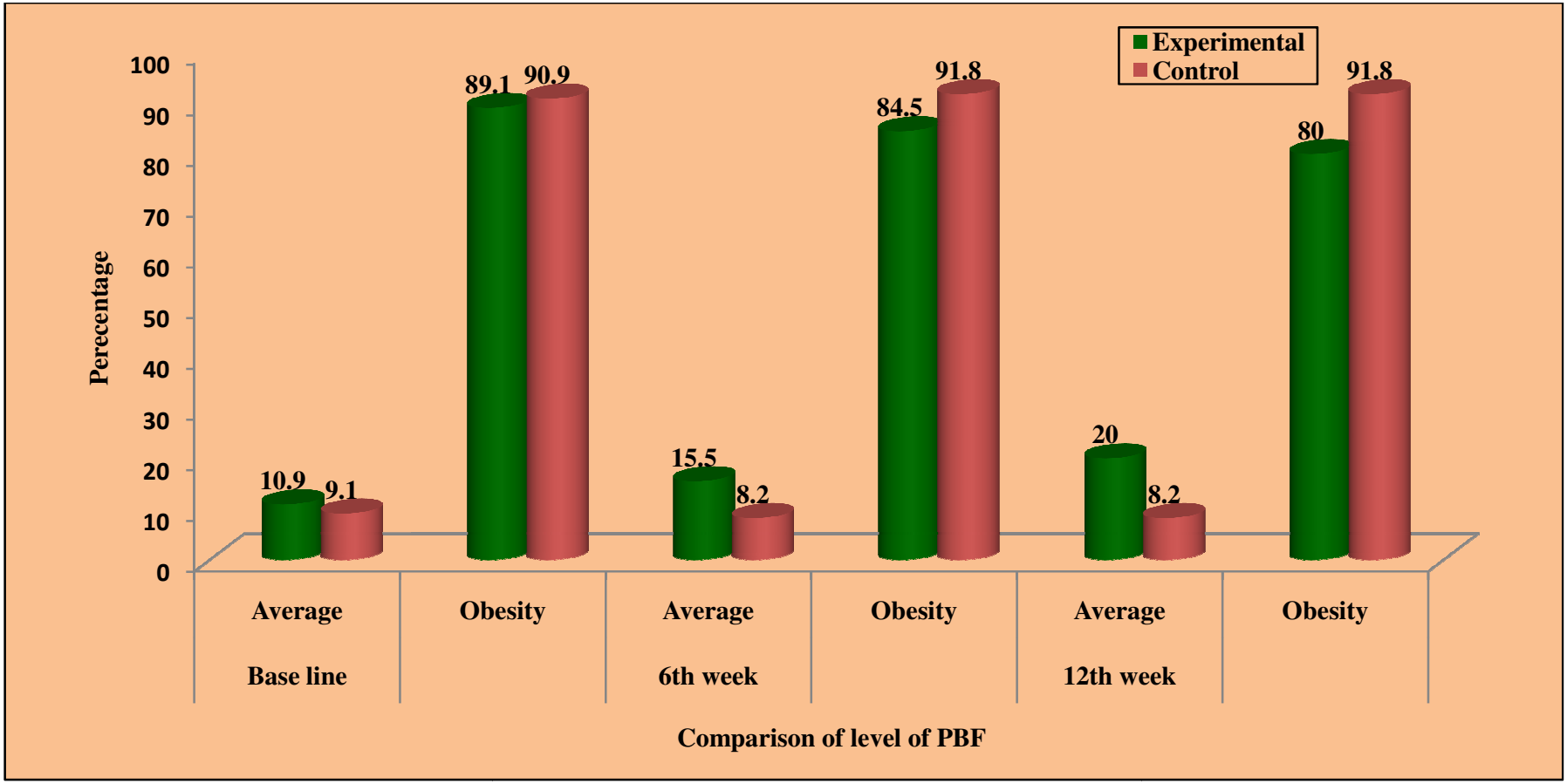


Figure 5.2.10: Comparison of level of PBF in the pre and post test for experimental and control group

SECTION 5.3: EFFECTIVENESS OF RURAL OBESITY REDUCTION PROGRAME ON KNOWLEDGE, ATTITUDE, PRACTICES TOWARDS OBESITY AND OBESITY REDUCTION AMONG OBESE ADULTS WITHIN AND BETWEEN THE EXPERIMENTAL AND CONTROL GROUP

Table 5.3.1: Comparison of pretest and post test mean knowledge components score in the experimental group N = 110

Aspects of knowledge	Pre test		Post test		Mean difference	Student's Paired t-test
	Mean	SD	Mean	SD		
General information	01.37	00.57	02.61	00.56	01.24	**t=15.15, P=0.001*** **
Causes	02.49	01.09	04.74	01.12	02.25	**t=19.53, P=0.001*** **
Diagnosis	01.32	00.87	01.58	00.56	00.26	**t=3.24, P=0.001*** **
Health risk	01.36	00.89	02.49	00.67	01.13	**t=10.90, P=0.001*** **
Management	01.55	00.79	04.38	00.85	02.83	**t=28.22, P=0.001*** **
Prevention	02.58	00.97	04.01	00.77	01.43	**t=11.68, P=0.001*** **
OVERALL	**10.67**	**02.39**	**19.81**	**02.31**	**02.25**	**t=35.61 P=0.001*** **

* significant at P≤0.05 ** highly significant at P≤0.01 *** very high significant at P≤0.001

The above table 5.3.1 describes the comparison of pretest and post test mean knowledge score in the experimental group.

Considering the **General** aspects, the mean score was 1.37 with the SD of 0.57 in the pre test and in post test it was 2.61 with the SD of 0.56. The mean difference was 1.24 which was high and the paired t test value was t=15.15, at P< 0.001 level which indicated high level statistical significance.

With regard to the causes, the mean score was 2.49 with the SD of 1.09 in the pre test and in post test it was 4.74 with the SD of 1.12. The mean difference was 2.25 which was high and the paired t test value was t=19.53 at P< 0.001 level which indicated high level statistical significance.

With respect to the diagnosis aspect, the mean score was 1.32 with the SD of 0.87 in the pre test and in post test it was 1.58 with the SD of 0.56. The mean difference was 0.26 which was high and the paired t test value was t=3.24 at P< 0.001 level which indicated high level statistical significance.

With relevance to the health risk aspect, the mean score was 1.36 with the SD of 0.89 in the pre test and in post test it was 2.49 with the SD of 0.67. The mean difference was 1.13 which was high and the paired t test value was t=10.09, at P< 0.001 level which indicated high level statistical significance.

When observing the management aspects, the mean score was 1.55 with the SD of 0.79 in the pre test and in post test it was 4.38 with the SD of 0.85. The mean difference was 2.83 which was high and the paired t test value was t=28.22, at P< 0.001 level which indicated high level statistical significance.

Considering the prevention, the mean score was 2.58 with the SD of 0.97 in the pre test and in post test it was 4.01 with the SD of 0.77. The mean difference was 1.43 which was high and the paired t test value was t=11.68, at P< 0.001 level which indicated high level statistical significance.

When analyzing the overall knowledge, the mean score was 10.67 with the SD of 2.39 in the pre test and in post test it was 19.81 with the SD of 2.31. The mean difference was 2.25 which was high and the paired t test value was t=35.61, at P< 0.001 level which indicated high level statistical significance.

The students paired t-test revealed that there is statistically significant difference in the within the group comparison of experimental group in the pre and post test at p=0.001 level proving that the Rural Obesity Reduction Program had significant impact on the knowledge gain of obese adults in the experimental group.

Table 5.3.2: Comparison of pretest and post test mean knowledge components score in the control group N = 110

Aspects of knowledge	Pretest		Posttest		Mean difference	Student's paired t-test
	Mean	SD	Mean	SD		
General information	01.45	00.58	01.55	00.71	00.10	t=1.82, P=0.07
Causes	02.35	01.02	02.38	00.97	00.03	t=1.81, P=0.07
Diagnosis	01.24	00.97	01.29	00.92	00.04	t=1.76, P=0.08
Health risk	01.45	00.72	01.50	00.69	00.05	t=1.80, P=0.07
Management	01.66	00.76	01.72	00.73	00.06	t=1.74, P=0.08
Prevention	02.66	01.01	02.75	01.00	00.09	t=1.87, P=0.06
OVERALL	**10.80**	**2.18**	**11.19**	**02.18**	**00.39**	**t=1.64, P=0.10**

* significant at P≤0.05 ** highly significant at P≤0.01 *** very high significant at P≤0.001

The above table 5.3.2 describes the comparison of pretest and post test mean knowledge score of control group.

Considering the **General** aspects, the mean score was 1.45 with the SD of 0.58 in the pre test and in post test it was 1.55 with the SD of 0.71. The mean difference was 0.10 which was less and the paired t test value was t=1.82, at P< 0.07 level which was not statistically significant.

With regard to the causes, the mean score was 2.35 with the SD of 1.02 in the pre test and in post test it was 2.38 with the SD of 0.97. The mean difference was 0.03 which was less and the paired t test value was t=1.81, at P< 0.07 level which was not statistically significant.

With respect to the diagnosis aspect, the mean score was 1.24 with the SD of 0.97 in the pre test and in post test it was 1.29 with the SD of 0.92. The mean difference was 0.04 which was less and the paired t test value was t=1.76, at P< 0.08 level which was not statistically significant.

With relevance to the health risk aspect, the mean score was 1.45 with the SD of 0.72 in the pre test and in post test it was 1.50 with the SD of 0.69. The mean difference was 0.05 which was less and the paired t test value was t=1.80, at P< 0.07 level which was not statistically significant.

When observing the management aspects, the mean score was 1.66 with the SD of 0.76 in the pre test and in post test it was 1.72 with the SD of 0.73. The mean difference was 0.06 which was less and the paired t test value was t=1.74, at P< 0.08 level which was not statistically significant.

When looking into the prevention, the mean score was 2.66 with the SD of 1.01 in the pre test and in post test it was 2.75 with the SD of 1.00. The mean difference was 0.09 which was less and the paired t test value was t=1.87, at P< 0.06 level which was not statistically significant.

When analyzing the overall knowledge, the mean score was 10.80 with the SD of 2.18 in the pre test and in post test it was 11.19 with the SD of 2.18. The mean difference was 0.39 which was less and the paired t test value was t=1.64, at P< 0.10 level which was not statistically significant.

The students paired t-test revealed that there was no statistically significant difference in within the group comparison of control group in the pre and post test and hence it is evident that the knowledge gain in the obese adults of experimental group was only due to the Rural Obesity Reduction Program.

Table 5.3.3: Comparison of pretest mean knowledge components score between the experimental and control group N = 220

Aspects of knowledge	Experimental N=110		Control N=110		Mean difference	Student's Independent t-test
	Mean	SD	Mean	SD		
General information	01.37	00.57	01.45	00.58	0.07	t=0.93, P=0.35
Causes	02.49	01.09	02.35	01.02	0.15	t=1.02, P=0.30
Diagnosis	01.32	00.87	01.24	00.97	0.08	t=0.66, P=0.50
Health risk	01.36	00.89	01.45	00.72	0.09	t=0.75, P=0.45
Management	01.55	00.79	01.66	00.76	0.11	t=1.13, P=0.25
Prevention	02.58	00.97	02.66	01.01	0.08	t=0.61, P=0.50
OVERALL	**10.67**	**02.39**	**10.80**	**02.18**	**0.13**	**t=0.41, P=0.68**

* significant at P≤0.05 ** highly significant at P≤0.01 *** very high significant at P≤0.001

The above table 5.3.3 compares pretest mean knowledge score between the experimental and control group.

Considering the **General** aspects, the mean score was 1.45 with the SD of 0.58 in the control group and in experimental it was 1.37 with the SD of 0.57, so the mean difference was 0.07. This difference between experimental and control was less and the t=0.93 at P=0.35 which was not statistically significant.

With regard to the causes, the mean score was 2.35 with the SD of 1.02 in the control group and in experimental it was 2.49 with the SD of 1.09, so the mean difference was 0.15. This difference between experimental and control was less and the t=1.02 at P=0.30 which was not statistically significant.

With respect to the diagnosis aspect, the mean score was 1.24 with the SD of 0.97 in the control group and in experimental it was 1.32 with the SD of 0.87, so the mean difference was 0.08. This difference between experimental and control was less and the t=0.66 at P=0.50 which was not statistically significant.

With relevance to the health risk aspect, the mean score was 1.45 with the SD of 0.72 in the control group and in experimental it was 1.36 with the SD of 0.89, so the mean difference was 0.09. This difference between experimental and control was less and the t=0.75 at P=0.45 which was not statistically significant.

When observing the management aspects, the mean score was 1.66 with the SD of 0.76 in the control group and in experimental it was 1.55 with the SD of 0.79, so the mean difference was 0.11. This difference between experimental and control was less and the t=1.13 at P=0.25 which was not statistically significant.

When looking into the prevention, the mean score was 2.66 with the SD of 1.01 in the control group and in experimental it was 2.58 with the SD of 0.97, so the mean difference was 0.08. This difference between experimental and control was less and the t=0.61 at P=0.50 which was not statistically significant.

When analyzing the overall knowledge, the mean score was 10.80 with the SD of 2.18 in the control group and in experimental it was 10.67 with the SD of 2.39, so the mean difference was 0.13. This difference between experimental and control was less and the t=0.41 at P=0.68 which was not statistically significant.

The students unpaired t-test revealed that there was no statistically significant difference in the between the group comparison of experimental and control group in the pre test.

Table 5.3.4: Comparison of post test mean knowledge components score between the experimental and control group N = 220

Aspects of knowledge	Experimental N=110		Control N=110		Mean difference	Student's Independent t-test
	Mean	SD	Mean	SD		
General information	02.61	00.56	01.55	00.71	01.06	**t=12.21, P=0.001*** **
Causes	04.74	01.12	02.38	00.97	02.35	**t=16.66, P=0.001*** **
Diagnosis	01.58	00.56	01.29	00.92	00.29	**t=02.82, P=0.001*** **
Health risk	02.49	00.67	01.50	00.69	00.99	**t=10.79, P=0.001*** **
Management	04.38	00.85	01.72	00.73	02.66	**t=24.98, P=0.001*** **
Prevention	04.01	00.77	02.75	01.00	01.26	**t=10.49, P=0.001*** **
OVERALL	**19.81**	**02.31**	**11.19**	**02.18**	**08.62**	**t=28.47, P=0.001*** **

* significant at P≤0.05 ** highly significant at P≤0.01 *** very high significant at P≤0.001

The above table 5.3.4 compares post test mean knowledge score between the experimental and control group.

Considering the **General** aspects, the mean score was 2.61 with the SD of 0.56 in the in the experimental and in control it was 1.55 with the SD of 0.71, so the mean difference was 1.06. This difference between experiment and control was high and t=12.21 at P<0.001 which was statistically significant.

With regard to the causes, the mean score was 4.74 with the SD of 1.12 in the experimental and in control it was 2.38 with the SD of 0.97, so mean the difference was 2.35. This difference between experiment and control was high and t=16.66 at P<0.001 which was statistically significant.

With respect to the diagnosis aspect, the mean score was 1.58 with the SD of 0.56 in the experimental and in control it was 1.29 with the SD of 0.92, so mean difference was 0.29. This difference between experiment and control was high and t=02.82 at P<0.001 which was statistically significant.

With relevance to the health risk aspect, the mean score was 2.49 with the SD of 0.67 in the experimental and in control it was 1.50 with the SD of 0.69, so the mean difference was 0.99. This difference between experiment and control was high and t=10.79 at P<0.001 which was statistically significant.

When observing the management aspects, the mean score was 4.38 with the SD of 0.85 in the experimental and in control it was 1.72 with the SD of 0.73, so the mean difference was 2.66. This difference between experiment and control was high and t=24.98 at P<0.001 which was statistically significant.

When looking into the prevention, the mean score was 4.01 with the SD of 0.77 in the experimental and in control it was 2.75 with the SD of 1.00, so the mean difference was 1.26. This difference between experiment and control was high and t=10.49 at P<0.001 which was statistically significant.

When analyzing the overall knowledge, the mean score was 19.81 with the SD of 2.31 in the experimental and in control it was 11.19 with the SD of 2.18, so the mean difference was 8.62. This difference between experiment and control was high and t=28.47 at P<0.001 which was statistically highly significant. Student's independent t-test revealed that there was very high level of statistical significance between the experimental and control group in the post test at p=0.001 level proving that the Rural Obesity Reduction Programme had significant impact on knowledge improvement of obese adults.

Table 5.3.5: Comparison of overall pre and post test mean knowledge score in the experimental and control group **N = 220(110+110)**

Group	Pretest		Posttest		Student's Dependent t-test
	Mean	SD	Mean	SD	
Experimental	10.67	02.39	19.81	02.31	**t=35.61, P=0.001*** **
Control	10.80	02.18	11.19	02.18	t=1.64, P=0.10
Unpaired t- test	t=0.41, P=0.68		**t=28.47, P=0.001*** **		

* significant at P≤0.05 ** highly significant at P≤0.01 *** very high significant at P≤0.001

The above table 5.3.5 shows the Comparison of overall pretest and posttest mean knowledge score in the experimental and control group.

For the experimental group, the mean knowledge in the pretest was 10.67 with the SD of 2.39 and in post test it was 19.83 with SD of 2.31. The student's dependent t-test revealed that t=35.61 at p=0.001 level which showed that there was high statistically significant difference between pre and post test score at p=0.001 level. In contrast the mean knowledge for control group in the pretest was 10.80 with the SD of 2.18 and in post test it was 11.19 with SD of 2.18. The t value was t=1.64 at p=0.10 level which showed that there was no statistically significant difference between pre and post test.

The comparison between the experimental and control group which was done by independent t test showed that there was no statistically significant difference found in the pre test. But very high statistically significant difference was found in the post test with t=28.47 at p=0.001 which showed the effectiveness of RORP towards the knowledge gain.

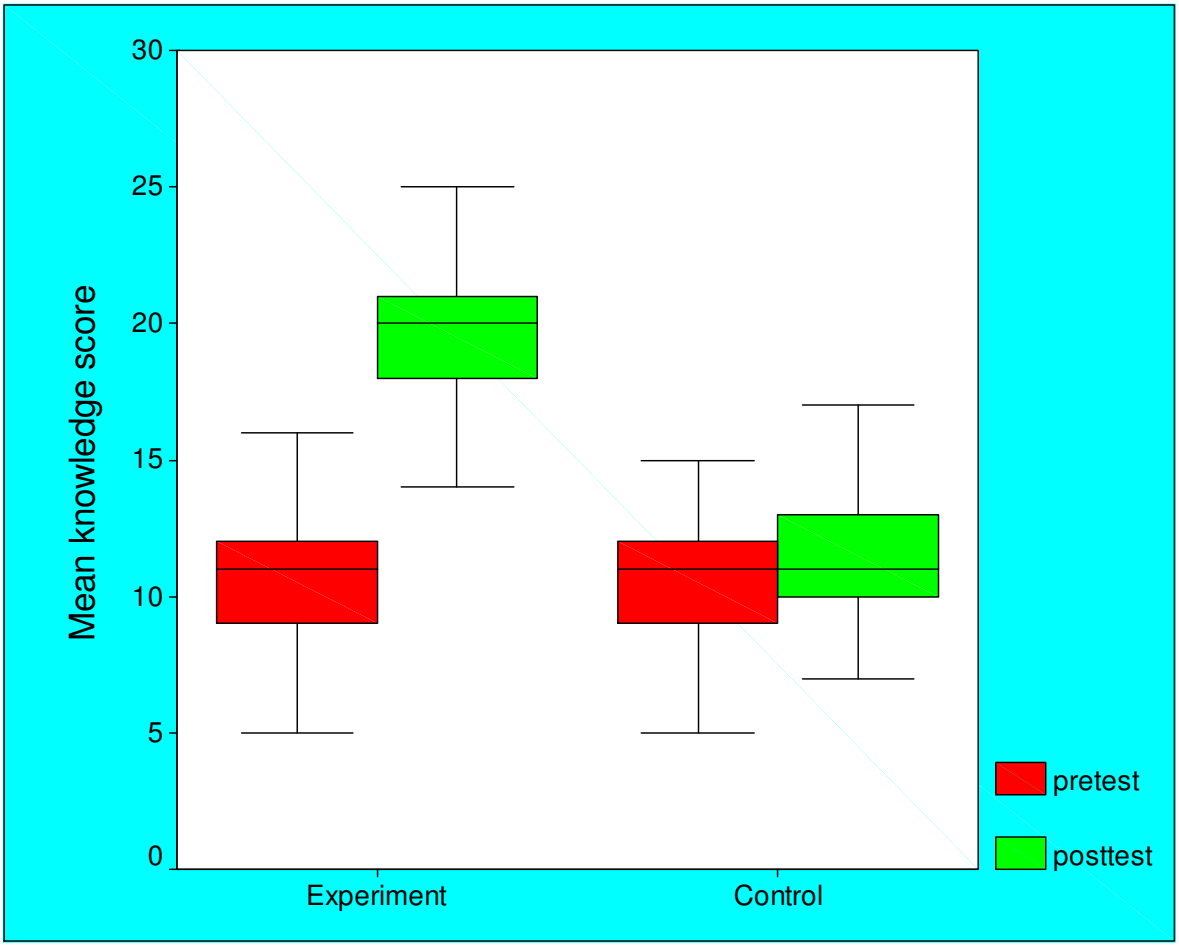


Figure 5.3.5: Box-plot compares the pretest and posttest knowledge score among the obese adults in the experimental and control group

Table 5.3.6: Comparison of overall pretest and post test mean attitude score in the experimental and control group N = 220(110+110)

Group	Pretest		Posttest		Student's Dependent t-test
	Mean	SD	Mean	SD	
Experimental	45.94	07.61	80.45	05.18	**t=36.95, P=0.001*** DF=109,**
Control	47.08	07.53	48.55	08.42	t=1.86, P=0.08, DF=109,
Student's independent t-test	t=1.12, P=0.26		**t=33.84, P=0.001***		

* significant at P≤0.05 ** highly significant at P≤0.01 *** very high significant at P≤0.001

The above table 5.3.6 shows the Comparison of overall pretest and post test mean attitude score of the experimental and control group.

The findings explain that for the experimental group the mean attitude score in the pretest was 45.94 with the SD of 7.61 and in post test it was 80.45 with SD of 5.18. The student's dependent t-test revealed that t=36.95 at p=0.001 level which showed high statistically significant difference between pre and post test score at p=0.001 level. In contrast the mean attitude score for control group in the pretest was 47.08 with the SD of 7.53 and in post test it was 48.55 with SD of 8.42. The t value was t=1.86 at p=0.08 level which showed that there was no statistically significant difference between pre and post test.

The student's independent t test which was done to do the comparison between experimental and control group showed that there was no statistically significant difference in the pre test but post test t value was t=33.84 at p=0.001 which showed high statistically significant difference in the post test proving the effectiveness of RORP towards behavior modification and attitude change.

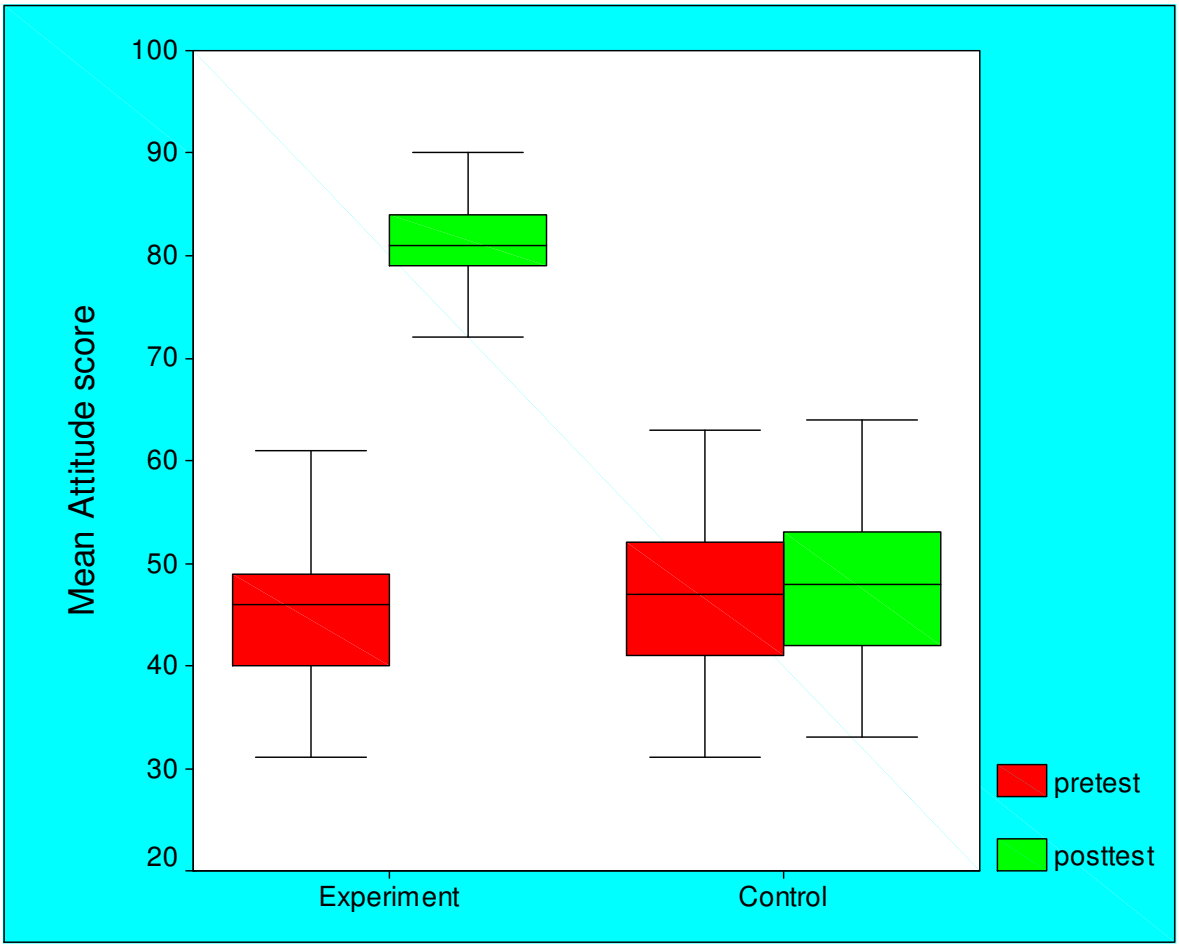


Figure 5.3.6: Box-plot compares the pretest and posttest attitude score among the obese adults in the experimental and control group

Table 5.3.7: Comparison of pretest and post test mean practice components score in experimental group **N = 110**

Practice components	Pretest		Posttest		Mean difference	Student's paired t-test
	Mean	SD	Mean	SD		
Dietary	34.39	05.52	54.73	03.47	20.34	**t=49.36, P=0.001*** **
Physical activity	17.80	04.08	35.37	03.30	17.57	**t=44.43, P=0.001*** **
Life style	28.60	05.34	39.07	02.87	10.47	**t=25.99, P=0.001*** **
OVERALL	**80.79**	**11.99**	**129.17**	**07.50**	**48.38**	**t=53.10 , P=0.001*** **

* significant at P≤0.05 ** highly significant at P≤0.01 *** very high significant at P≤0.001

The above table 5.3.7 shows the comparison of pretest and post test mean practice components score in experimental group.

Regarding the dietary practices, the mean score in the pre test was 34.39 with the SD of 5.52 and in the post test it was 54.73 with the SD of 3.47. The mean difference was 20.34 which was high and the t = 49.36 at p<0.001 level which showed very high level statistically significant difference.

With respect to physical activity practices, the mean score in the pre test was 17.8 with the SD of 4.08 and in the post test it was 35.37 with the SD of 3.30. The mean difference was 17.57 which was high and the t = 44.43 at p<0.001 level which showed very high level statistically significant difference.

With relevance to the lifestyle practices, the mean score in the pre test was 28.60 with the SD of 5.34 and in the post test it was 39.07 with the SD of 2.87. The mean difference was 10.47 which was high and the $t = 25.99$ at $p<0.001$ level which showed very high level statistically significant difference.

While analyzing the overall practices, the mean score in the pre test was 80.79 with the SD of 11.99 and in the post test it was 129.17 with the SD of 7.50. The mean difference was 48.38 which was high and the $t = 53.10$ at $p<0.001$ level which showed very high level statistically significant difference. The high mean difference between experimental and control in the post test for dietary, physical activity, life style and overall practices proved that the Rural Obesity Reduction Program had significant impact on the dietary, physical activity and lifestyle practices modification.

Table 5.3.8: Comparison of pretest and post test mean practice components score in control group **N = 110**

Practice components	Practice score				Mean difference	Student's paired t-test
	Pretest		Posttest			
	Mean	SD	Mean	SD		
Dietary	34.94	06.50	35.78	07.32	00.84	t=1.82, P=0.07
Physical activity	18.51	05.14	19.27	05.57	00.76	t=1.81, P=0.07
Life style	29.48	05.12	29.89	04.86	00.41	t=1.87, P=0.06
OVERALL	**82.93**	**12.83**	**84.95**	**15.52**	**02.02**	**t=1.64, P=0.10**

* significant at P≤0.05 ** highly significant at P≤0.01 *** very high significant at P≤0.001

The above table 5.3.8 shows the comparison of pretest and post test mean practice components score in control group. Regarding the dietary practices, the mean score in the pre test was 34.94 with the SD of 6.50 and in the post test it was 35.78 with the SD of 7.32. The mean difference was 0.84 which was very less and the t = 1.82 at p<0.001 level which showed no significant difference.

With respect to physical activity practices, the mean score in the pre test was 18.51 with the SD of 5.14 and in the post test it was 19.27 with the SD of 5.57. The mean difference was 0.76 which was less and the t = 1.81 at p<0.07 level which showed no significant difference.

With relevance to the lifestyle practices, the mean score in the pre test was 29.48 with the SD of 5.12 and in the post test it was 29.89 with the SD of 4.86. The mean difference was 0.41 which was less and the t = 1.87 at p<0.06 level which showed no significant difference.

While analyzing the overall practices, the mean score in the pre test was 82.93 with the SD of 12.83 and in the post test it was 84.95 with the SD of 15.52. The mean difference was 2.02 which was less and the t = 1.64 at p<0.10 level which showed no significant difference.

Table 5.3.9: Comparison of pre test mean practice components score between experimental group and control group N = 220

Aspects of practice	Experimental N=110		Control N=110		Mean difference	Student's Independent t-test
	Mean	SD	Mean	SD		
Dietary	34.39	05.52	34.94	06.50	00.55	t=0.67, P=0.50
Physical activity	17.80	04.08	18.51	05.14	00.71	t=1.13, P=0.25
Life style	28.60	05.34	29.48	05.12	00.88	t=1.25, P=0.23
OVERALL	**80.79**	**11.99**	**82.93**	**12.83**	**02.14**	**t=1.27, P=0.20**

* significant at P≤0.05 ** highly significant at P≤0.01 *** very high significant at P≤0.001

The above table 5.3.9 shows the comparison of pretest mean practice components score between the experimental and control group.

Regarding the dietary practices, the mean score in the experimental group was 34.39 with the SD of 5.52 and in the control it was 34.94 with the SD of 6.50. The mean difference was 0.55 which was less and the t = 0.67 at p<0.5 level which showed no significant difference.

With respect to physical activity practices, the mean score in the experimental was 17.80 with the SD of 4.08 and in the control it was 18.51 with the SD of 5.14. The mean difference was 0.71 which was less and the t = 1.13 at p<0.25 level which showed no significant difference.

With relevance to the lifestyle practices, the mean score in the experimental was 28.60 with the SD of 5.34 and in the control it was 29.48 with the SD of 5.12. The mean difference was 0.88 which was less and the t = 1.25 at p<0.23 level which showed no significant difference.

While analyzing the overall practices, the mean score in the experimental group was 80.79 with the SD of 11.99 and in the control it was 82.93 with the SD of 12.83. The mean difference was 2.14 which was less and the t = 1.27 at p<0.20 level which showed no significant difference.

Table 5.3.10: Comparison of post test mean practice components score between experimental group and control group N = 220

Aspects of practice	Experimental N=110		Control N=110		Mean difference	Student's Independent t-test
	Mean	SD	Mean	SD		
Dietary	54.73	03.47	35.78	07.32	18.95	**t=24.53, P=0.001*** **
Physical activity	35.37	03.30	19.27	05.57	16.10	**t=26.08, P=0.001*** **
Life style	39.07	02.87	29.89	04.86	09.18	**t=17.07, P=0.001*** **
OVERALL	**129.17**	**07.50**	**84.95**	**15.52**	**44.22**	**t=26.91, P=0.001*** **

* significant at P≤0.05 ** highly significant at P≤0.01 *** very high significant at P≤0.001

The above table 5.3.10 shows the comparison of posttest mean practice components score between the experimental and control group.

Regarding the dietary practices, the mean score in the experimental group was 54.73 with the SD of 3.47 and in the control it was 35.78 with the SD of 7.32. The mean difference was 18.95 which was high and the t = 24.53 at p<0.001 level which showed very high level statistically significant difference.

With respect to physical activity practices, the mean score in the experimental was 35.37 with the SD of 3.30 and in the control it was 19.27 with the SD of 5.57. The mean difference was 16.10 which was high and the t = 26.08 at p<0.001 level which showed very high level statistically significant difference.

With relevance to the lifestyle practices, the mean score in the experimental was 39.07 with the SD of 2.87 and in the control it was 29.89 with the SD of 4.86. The mean difference was 9.18 which was high and the t = 17.07 at p<0.001 level which showed very high level statistically significant difference.

While analyzing the overall practices, the mean score in the experimental was 129.17 with the SD of 7.50 and in the control it was 84.95 with the SD of 15.52. The mean difference was 44.22 which was high and the $t = 26.91$ at $p<0.001$ level which showed very high level statistically significant difference. The high mean difference between experimental and control in the post test for dietary, physical activity, life style and overall practices proved that the Rural Obesity Reduction Program had significant impact in improving the practice level.

Table 5.3.11: Comparison of overall pretest and post test mean practice score in the experimental and control group N = 220(110+110)

Group	Pretest		Posttest		Student's Dependent t-test
	Mean	SD	Mean	SD	
Experimental	80.79	11.98	129.17	07.49	**t=53.10, P=0.001*** **
Control	82.93	12.83	84.95	15.51	t=1.58, P=0.11
Unpaired t test	t=1.27, P=0.20		**t=26.91, P=0.001*** **		

* significant at P≤0.05 ** highly significant at P≤0.01 *** very high significant at P≤0.001

The above table 5.3.11 shows the comparison of overall pretest and post test mean practice score within and between the experimental and control group.

For the experimental group, the mean practice score in the pretest was 80.79 with the SD of 11.98 and in post test it was 129.17 with SD of 7.49. The student's dependent t-test revealed that t=53.10 at p=0.001 level which was high and showed that there was high statistically significant difference between pre and post test score.

In contrast the mean practice score for control group in the pretest was 82.93 with the SD of 12.83 and in post test it was 84.95 with SD of 15.51. The t value was t=1.58 at p=0.11 level which was less and showed that there was no statistically significant difference between pre and post test.

The comparison between the experimental and control showed that there is no statistically significant difference in the pre test but post test t value was t=26.91 at p=0.001 which was high and showed that there was high statistically significant difference in the post test which proved that effectiveness of RORP towards behavior modification and change in the practice.

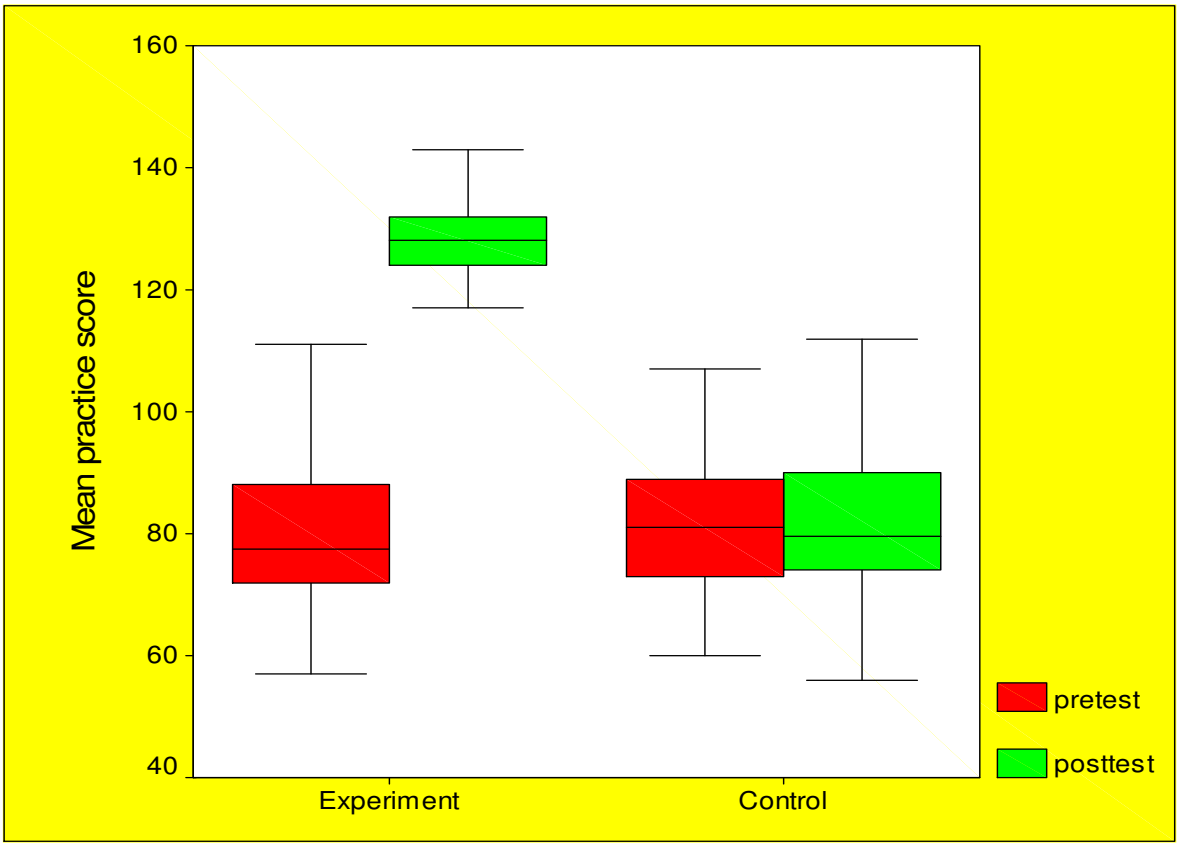


Figure 5.3.11: Box-plot compares the pretest and posttest practice score among the obese adults in the experimental and control group

Table 5.3.12 Comparison of calories and nutrients consumption within the experimental and control group in the pretest and post test N = 220(110+110)

Group	Dietary components	Pretest		Posttest		Mean difference	Student paired t-test
		Mean	SD	Mean	SD		
Experimental	Kilo calories	2713.15	338.26	1403.47	183.92	1309.68	**t=39.71, p=0.001*** **
	Carbohydrate in grams	0427.20	101.64	0248.03	039.26	179.17	**t=16.49, p=0.001*** **
	Protein in grams	0096.24	062.98	0057.55	023.72	38.69	**t=06.07, p=0.001*** **
	Fat in grams	0075.95	044.04	0028.10	013.95	48.75	**t=10.72, p=0.001*** **
Control	Kilo calories	2682.24	344.50	2663.28	330.36	18.96	t=1.71, p=0.09
	Carbohydrate in grams	0422.93	097.35	0428.53	089.44	05.60	t=1.38, p=0.16
	Protein in grams	0093.16	063.33	0092.16	063.34	01.00	t=1.75, p=0.08
	Fat in grams	0071.86	035.00	0069.15	031.77	02.71	t=1.13, p=0.26

* significant at P≤0.05 ** highly significant at P≤0.01 *** very high significant at P≤0.001

The above table 5.3.12 depicts the comparison of calories and nutrients consumption in the experimental and control group in the pretest and posttest.

With regard to control group, the mean calorie consumption in pretest was 2682.24 kilo calories with SD of 344.50 and in the post test it was 2663.28 kilo calories with SD of 330.36. The mean difference was 18.96 kilo calories which was less and the t = 1.79 at p=0.09 level which showed no significant difference. The mean carbohydrate consumption was 422.93 grams with SD of 97.35 and in post test it was 428.53 grams with SD of 89.44. The mean difference was 5.60 grams which was less and the t = 1.38 at p=0.16 level which showed no significant difference.

The mean protein consumption was 93.16 grams with SD of 63.33 and in post test it was 92.16 grams with SD of 63.34. The mean difference was 1.0 grams which was less and the t = 1.75 at p=0.08 level which showed no significant difference. The mean fat consumption was 71.86 grams with SD of 35.00 and in post test it was 69.15 grams with SD of 31.77. The mean difference was 2.71 grams which was less and the t = 1.13 at p=0.26 level which showed no significant difference.

Considering the experimental group, the mean calorie consumption in pretest was 2713.15 kilo calories with SD of 338.26 and in the post test it was 1403.47 kilo calories with SD of 183.92. The mean difference was 1309.68 kilo calories which was high and the t = 39.71 at p<0.001 level which showed very high level statistically significant difference. The mean carbohydrate consumption was 427.20 grams with SD of 101.64 and in post test it was 248.03 grams with SD of 39.26. The mean difference was 179.17 grams which was high and the t = 16.49 at p<0.001 level which showed very high level statistically significant difference.

The mean protein consumption was 96.24 grams with SD of 62.98 and in the post test it was 57.55 grams with SD of 23.72. The mean difference was 38.69 grams which was high and the t = 6.07 38.69 at p<0.001 level which showed very high level statistically significant difference. The mean fat consumption was 75.95 grams with SD of 44.04 and in post test it was 28.10 grams with SD of 13.95. The mean difference was 48.75 grams which was high and the t = 10.72 at p<0.001 level which showed very high level statistically significant difference proving the effectiveness of RORP in bringing the behavioural changes to modify the dietary habits among the experimental group.

Table 5.3.13: Comparison of calories and nutrients consumption between the experimental and control group in the pretest and post test N = 220

Dietary components		Experimental N=110		Control N=110		Mean difference	Students Independent t-test
		Mean	SD	Mean	SD		
Pretest	Kilo calories	2713.15	338.26	2682.24	344.50	30.91	t=0.67, p=0.50
	Carbohydrate	0427.20	101.64	0422.93	097.35	04.27	t=0.31, p=0.75
	Protein	0096.24	062.98	0093.16	063.33	03.08	t=0.36, p=0.72
	Fat	0075.95	044.04	0071.86	035.00	04.09	t=0.76, p=0.22
Posttest	Kilo calories	1403.47	183.92	2663.28	330.36	1259.81	**t=33.76, p=0.001*** **
	Carbohydrate	0248.03	039.26	0428.53	089.44	180.50	**t=19.38, p=0.001*** **
	Protein	0057.55	023.72	0092.16	063.34	34.61	**t=19.75, p=0.001*** **
	Fat	0028.10	013.95	0069.15	031.77	41.05	t=5.71, 30.91p=0.001 ***

* significant at P≤0.05 ** highly significant at P≤0.01 *** very high significant at P≤0.001

The above table 5.3.13 depicts the comparison of calories and nutrients consumption between the experimental and control group in the pretest and posttest.

In the pretest the mean calorie consumption in the control was 2682.24 kilo calories with SD of 344.50 and in the experimental it was 2713.15 kilo calories with SD of 338.26. The mean difference was 30.91 kilo calories which was less and the t = 0.67 at p=0.50 level which showed no significant difference. The mean carbohydrate consumption in control was 422.93 grams with SD of 97.35 and in experimental it was 427.20 grams with SD of 101.64. The mean difference was 4.27 grams which was less and the t = 1.31 at p=0.75 level which showed no significant difference.

The mean protein consumption in control was 93.16 grams with SD of 63.33 and in experimental it was 96.24 grams with SD of 62.98. The mean difference was 3.08 grams which was less and the t = 0.36 at p=0.72 level which showed no significant difference. The mean fat consumption in control was 71.86 grams with SD of 35.00 and in experimental it was 75.95 grams with SD of 44.04. The mean difference was 4.09 grams which was less and the t = 0.76 at p=0.22 level which showed no significant difference.

Considering the post test the mean calorie consumption in control group was 2663.28 kilo calories with SD of 330.36 and in the experimental it was 1403.47 kilo calories with SD of 183.92. The mean difference was 1259.81 kilo calories which was high and the t = 33.76 at p<0.001 level which showed very high level statistically significant difference. The mean carbohydrate consumption in control was 428.53 grams with SD of 89.44 and in the experimental it was 248.03 grams with SD of 39.26. The mean difference was 180.50 grams which was high and the t = 19.38 at p<0.001 level which showed very high level statistically significant difference.

The mean protein consumption in control was 92.16 with SD of 63.34 and in the experimental it was 57.55 with SD of 23.72. The mean difference was 34.61 grams which was high and the t = 19.75 at p<0.001 level which showed very high level statistically significant difference. The mean fat consumption in control was 69.15 with SD of 31.77 and in the experimental it was 28.10 with SD of 13.95. The mean difference was 41.05 grams which was high and the t = 5.71 at p<0.001 level which showed very high level statistically significant difference. Hence it was evident that RORP had significant impact in improving the dietary modifications of obese adults.

Table 5.3.14 Comparison of pre test and post test food frequency in the experimental group N = 110

Type of food	Level of consumption	Pretest		Posttest		Chi square test
		No.	%	No.	%	
Cereals	High consumption	106	96.40	110	100.00	χ^2=4.07, p=0.13
	Moderate consumption	3	02.70	0	00.00	
	Low consumption	1	00.90	0	00.00	
Refined	High consumption	23	20.90	10	09.10	**χ^2=7.07, p=0.02***
	Moderate consumption	34	30.90	49	44.50	
	Low consumption	53	48.20	51	46.40	
Pulses	High consumption	37	33.60	87	79.10	**χ^2=46.75, p=0.001*****
	Moderate consumption	70	63.60	21	19.10	
	Low consumption	3	02.70	2	01.80	
Salty foods	High consumption	2	01.80	1	00.90	**χ^2=11.25, p=0.01****
	Moderate consumption	15	13.60	2	01.80	
	Low consumption	93	84.50	107	97.30	
Yellow vegetables	High consumption	5	4.50	25	22.70	**χ^2=53.50 p=0.001*****
	Moderate consumption	25	22.70	65	59.10	
	Low consumption	80	72.70	30	27.30	
Green leafy vegetables	High consumption	15	13.60	65	59.10	**χ^2=53.94 p=0.001*****
	Moderate consumption	75	68.20	27	24.50	
	Low consumption	20	18.20	18	16.40	
Fruits	High consumption	2	01.80	13	11.80	**χ^2=50.81 p=0.001*****
	Moderate consumption	19	17.30	60	54.50	
	Low consumption	89	80.90	37	33.60	
Milk and milk products	High consumption	28	25.50	18	16.40	χ^2=3.06 p=0.21
	Moderate consumption	65	59.10	76	69.10	
	Low consumption	17	15.50	16	14.50	
Fish	High consumption	11	10.00	5	04.50	χ^2=3.59 p=0.16
	Moderate consumption	87	79.10	97	88.20	
	Low consumption	12	10.90	8	07.30	
Meat and chicken	High consumption	17	15.50	6	05.50	**χ^2=24.85 p=0.001*****
	Moderate consumption	63	57.30	96	87.30	
	Low consumption	30	27.30	8	07.30	

* significant at P≤0.05 ** highly significant at P≤0.01 *** very high significant at P≤0.001

The above table 5.3.14 shows the food frequency of experimental group in the pretest and in the post test.

Considering the cereals, the majority in the pretest and all of them in post test were high consumers and there was no statistically significant difference was found between pre and post test. Regarding the refined cereals, 34(30.9%) of them were moderate consumers in the pretest and in the post test it was 49(44.5%). The chi-square value was χ^2=7.07 at p=0.02 level which showed statistically significant difference.

With respect to the pulses, 37(33.6%) of them were high consumers in the pretest and in the post test it was increased to 87(79.1%). The chi-square value was χ^2=46.75 at p=0.001 level which showed statistically significant difference.

With regard to the salty foods, 93(84.5%) of them were low consumers in pre test and in the post test it was increased to 107(97.3%). The chi-square value was χ^2=11.25 at p=0.01 level which showed statistically significant difference.

With regard to the yellow vegetables, 80(72.7%) of them were low consumers in pre test and in the post test it was reduced to 30(27.3%). The chi-square value was χ^2=53.50 at p=0.001 level which showed statistically significant difference.

With regard to the green leafy vegetables, 15(13.6%) of them were high consumers in pre test and in the post test it was increased to 65(59.1%). The chi-square value was χ^2=53.94 at p=0.001 level which showed statistically significant difference.

With regard to the fruits, 89(80.9%) of them were low consumers in pre test and in the post test it was reduced to 37(33.6%). The chi-square value was χ^2=50.81 at p=0.001 level which showed statistically significant difference.

With regard to milk and milk products, 65(59.1%) of them in the pretest and 76(69.1%) of them in post test were moderate consumers. Hence the chi-square revealed that there was no statistically significant difference between the pre and post test of experimental group.

With regard to the fish, 87(79.1%) of them in the pretest and 97(88.2%) of them in the post test were moderate consumers. Hence the chi-square revealed that there was no statistically significant difference between the pre and post test of experimental group.

With regard to the meat and chicken, 17(15.5%) of them were high consumers in the pre test and in the post test it was decreased to 6(5.5%). The chi-square value was χ^2=24.85 at p=0.001 level which showed statistically significant difference.

It is evident from the above description that the RORP was effective in bringing the dietary modification by high consumption of cereals, pulses, yellow vegetables, green vegetables and fruits, moderate consumption of milk and milk products , fish and meat and low consumption of salty foods.

Table 5.3.15: Comparison of pre test and post test food frequency in the experimental group N = 110

Type of food	Level of consumption	Pretest		Posttest		Chi square test
		No.	%	No.	%	
Egg	High consumption	40	36.40	23	20.90	**χ^2=34.23 p=0.001*** **
	Moderate consumption	35	31.80	77	70.00	
	Low consumption	35	31.80	10	09.10	
Oily foods	High consumption	21	19.10	11	10.00	χ^2=5.31 p=0.07
	Moderate consumption	20	18.20	15	13.60	
	Low consumption	69	62.70	84	76.40	
High cholesterol foods	High consumption	9	08.20	3	02.70	χ^2=5.76 p=0.06
	Moderate consumption	12	10.90	6	05.50	
	Low consumption	89	80.90	101	91.80	
Animal fats	High consumption	1	00.90	0	00.00	χ^2=3.04 p=0.22
	Moderate consumption	2	01.80	0	00.00	
	Low consumption	107	97.30	110	100.00	
Sweets and chocolates	High consumption	10	9.10	4	03.60	**χ^2=6.47 p=0.04***
	Moderate consumption	20	18.20	11	10.00	
	Low consumption	80	72.70	95	86.40	
Instant foods	High consumption	58	52.70	18	16.40	**χ^2=37.47 p=0.001*** **
	Moderate consumption	4	03.60	12	10.90	
	Low consumption	48	43.60	90	81.80	
Coffee and tea	High consumption	80	72.70	45	40.90	**χ^2=34.43 p=0.001*** **
	Moderate consumption	3	02.70	32	29.10	
	Low consumption	27	24.50	33	30.00	
Carbonated beverages	High consumption	40	36.40	17	15.50	**χ^2=16.08 p=0.001*** **
	Moderate consumption	12	10.90	28	25.50	
	Low consumption	58	52.70	65	59.10	
Nuts	High consumption	2	01.80	0	00.00	χ^2=2.37 p=0.30
	Moderate consumption	2	01.80	1	00.90	
	Low consumption	106	96.40	109	99.10	
Use of palm oil	High consumption	108	98.20	55	50.00	**χ^2=62.15 p=0.001*** **
	Moderate consumption	2	01.80	47	42.70	
	Low consumption	2	01.80	8	07.30	

* significant at P≤0.05 ** highly significant at P≤0.01 *** very high significant at P≤0.001

The above table 5.3.15 shows the food frequency of experimental group in the pretest and in the post test.

With regard to the egg consumption, 40(36.40%) of them were high consumers in pre test and in the post test it was reduced to 23(20.90%). The chi-square value was χ^2=34.23 at p=0.001 level which showed statistically significant difference. With regard to the sweets and chocolates consumption, 80(72.70%) of them were low consumers in pre test and in the post test it was increased to 95(86.40%). The chi-square value was χ^2=6.47 at p=0.04 level which showed statistically significant difference. With regard to the instant foods consumption, 48(43.60%) of them were low consumers in pre test and in the post test it was increased to 90(81.80%). The chi-square value was χ^2=37.47 at p=0.001 level which showed statistically significant difference.

With regard to coffee and tea consumption, 80(72.70%) of them were high consumers in pre test and in the post test it was reduced to 45(40.90%). The chi-square value was χ^2=34.43 at p=0.001 level which showed statistically significant difference. With regard to the carbonated beverages consumption, 40(36.40%) of them were high consumers in pre test and in the post test it was reduced to 17(15.50%). The chi-square value was χ^2=16.08 at p=0.001 level which showed statistically significant difference. With regard to use of palm oil consumption, 108(98.20%) of them were high consumers in pre test and in the post test it was reduced to 55(50.00%). The chi-square value was χ^2=62.15 at p=0.001 level which showed statistically significant difference.

The findings revealed that there was statistically significant difference was found in the frequency of intake with the egg, sweets and chocolates, instant food, coffee and tea, carbonated beverages and palm oil. There was no statistical significance was found in the frequency of intake with oily foods, high cholesterol foods, animal fats and nuts which indicates that the RORP was effective in bringing the dietary modification by moderate consumption of egg and low consumption of oily foods, high cholesterol foods, animal fats, sweets and chocolates, instant foods carbonated beverages and nuts.

Table 5.3.16: Comparison of pre test and post test food frequency in the control group **N = 110**

Type of food	Level of consumption	Pretest		Posttest		Chi square test
		No.	%	No.	%	
Cereals	High consumption	101	91.80	104	94.50	χ^2=1.33 p=0.51
	Moderate consumption	8	07.30	6	05.50	
	Low consumption	1	00.90	0	00.00	
Refined	High consumption	17	15.50	16	14.50	χ^2=0.04 p=0.98
	Moderate consumption	24	21.80	24	21.80	
	Low consumption	69	62.70	70	63.60	
Pulses	High consumption	24	21.80	26	23.60	χ^2=0.10 p=0.94
	Moderate consumption	83	75.50	81	73.60	
	Low consumption	3	02.70	3	02.70	
Salty foods	High consumption	4	03.60	4	03.60	χ^2=0.00 p=1.00
	Moderate consumption	9	08.20	9	08.20	
	Low consumption	97	88.20	97	88.20	
Yellow vegetables	High consumption	2	01.80	7	06.40	χ^2=3.03 p=0.21
	Moderate consumption	34	30.90	30	27.30	
	Low consumption	74	67.30	73	66.40	
Green leafy vegetables	High consumption	12	10.90	11	10.00	χ^2=0.18 p=0.91
	Moderate consumption	84	76.40	83	75.50	
	Low consumption	14	12.70	16	14.50	
Fruits	High consumption	7	06.40	7	06.40	χ^2=0.00 p=1.00
	Moderate consumption	16	14.50	16	14.50	
	Low consumption	87	79.10	87	79.10	
Milk and milk products	High consumption	32	29.10	31	28.20	χ^2=0.35 p=0.84
	Moderate consumption	52	47.30	56	50.90	
	Low consumption	26	23.60	23	20.90	
Fish	High consumption	7	06.40	3	02.70	χ^2=2.02 p=0.36
	Moderate consumption	86	78.20	86	78.20	
	Low consumption	17	15.50	21	19.10	
Meat and chicken	High consumption	14	12.70	14	12.70	χ^2=0.00 p=1.00
	Moderate consumption	64	58.20	64	58.20	
	Low consumption	32	29.10	32	29.10	

* significant at P≤0.05 ** highly significant at P≤0.01 *** very high significant at P≤0.001

The above table 5.3.16 shows the food frequency of control group in the pretest and in the post test.

The findings revealed that there was no statistically significant difference found in the frequency of intake with the cereals, refined cereals, pulses, salty foods, yellow vegetables, green leafy vegetables, fruits, milk and milk products, meat, chicken and fish in the pre and post test of control group.

Hence it was evident that the Rural Obesity Reduction Programme had been effective in bringing the dietary modification by high consumption of cereals, pulses, yellow vegetables, green vegetables and fruits, moderate consumption of milk and milk products, fish and meat and low consumption of salty foods among the experimental group.

Table 5.3.17: Comparison of pre test and post test food frequency in the control group N = 110

Type of food	Level of consumption	Pretest		Posttest		Chi square test
		No.	%	No.	%	
Egg	High consumption	41	37.30	43	39.10	χ^2=0.08 p=0.96
	Moderate consumption	43	39.10	42	38.20	
	Low consumption	26	23.60	25	22.70	
Oily foods	High consumption	10	09.10	12	10.90	χ^2=0.37 p=0.83
	Moderate consumption	24	21.80	26	23.60	
	Low consumption	76	69.10	72	65.50	
High cholesterol foods	High consumption	2	01.80	2	01.80	χ^2=0.05 p=0.98
	Moderate consumption	12	10.90	11	10.00	
	Low consumption	96	87.30	97	88.20	
Animal fats	High consumption	0	00.00	0	00.00	χ^2=0.00 p=1.00
	Moderate consumption	0	00.00	0	00.00	
	Low consumption	110	100.00	110	100.00	
Sweets and chocolates	High consumption	8	07.30	10	09.10	χ^2=0.30 p=0.86
	Moderate consumption	27	24.50	25	22.70	
	Low consumption	75	68.20	75	68.20	
Instant foods	High consumption	52	47.30	52	47.30	χ^2=2.89 p=0.24
	Moderate consumption	10	09.10	9	08.20	
	Low consumption	48	43.60	49	44.50	
coffee and tea	High consumption	84	76.40	84	76.40	χ^2=0.06 p=0.96
	Moderate consumption	4	03.60	4	03.60	
	Low consumption	22	20.00	22	20.00	
Carbonated beverages	High consumption	27	24.50	29	26.40	χ^2=0.10 p=0.94
	Moderate consumption	21	19.10	21	19.10	
	Low consumption	62	56.40	60	54.50	
Nuts	High consumption	1	00.90	1	00.90	χ^2=0.00 p=1.00
	Moderate consumption	0	00.00	0	00.00	
	Low consumption	109	99.10	109	99.10	
Use of palm oil	High consumption	108	98.20	108	98.20	χ^2=0.00 p=1.00
	Moderate consumption	0	00.00	0	00.00	
	Low consumption	2	01.80	2	01.80	

* significant at P≤0.05 ** highly significant at P≤0.01 *** very high significant at P≤0.001

The above table 5.3.17 shows the food frequency of control group in the pretest and in the post test.

The findings revealed that there was no statistically significant difference found in the frequency of intake of egg, sweets and chocolates, instant food, coffee and tea, carbonated beverages, palm oil, oily foods, high cholesterol foods, animal fats and nuts.

It was also evident that only the RORP had been effective in bringing the dietary modification by moderate consumption of egg and low consumption of oily foods, high cholesterol foods, animal fats, sweets and chocolates, instant foods, carbonated beverages and nuts among the experimental group.

Table 5.3.18: Comparison of food frequency between the experimental and control group in the pre test **N= 220**

Type of food	Level of consumption	Experimental N=110		Control N=110		Chi square test
		No.	%	No.	%	
Cereals	High consumption	106	96.40	101	91.80	χ^2=2.39 p=0.30
	Moderate consumption	3	02.70	8	07.30	
	Low consumption	1	00.90	1	00.90	
Refined	High consumption	23	20.90	17	15.50	χ^2=4.72 p=0.09
	Moderate consumption	34	30.90	24	21.80	
	Low consumption	53	48.20	69	62.70	
Pulses	High consumption	37	33.60	24	21.80	χ^2=3.87 p=0.14
	Moderate consumption	70	63.60	83	75.50	
	Low consumption	3	02.70	3	02.70	
Salty foods	High consumption	2	01.80	4	03.60	χ^2=2.25 p=0.32
	Moderate consumption	15	13.60	9	08.20	
	Low consumption	93	84.50	97	88.20	
Yellow vegetables	High consumption	5	04.50	2	01.80	χ^2=2.89 p=0.23
	Moderate consumption	25	22.70	34	30.90	
	Low consumption	80	72.70	74	67.30	
Green leafy vegetables	High consumption	15	13.60	12	10.90	χ^2=1.90 p=0.33
	Moderate consumption	75	68.20	84	76.40	
	Low consumption	20	18.20	14	12.70	
Fruits	High consumption	2	01.80	7	06.40	χ^2=3.05 p=0.21
	Moderate consumption	19	17.30	16	14.50	
	Low consumption	89	80.90	87	79.10	
Milk and milk products	High consumption	28	25.50	32	29.10	χ^2=3.59 p=0.17
	Moderate consumption	65	59.10	52	47.30	
	Low consumption	17	15.50	26	23.60	
Fish	High consumption	11	10.00	7	06.40	χ^2=1.75 p=0.42
	Moderate consumption	87	79.10	86	78.20	
	Low consumption	12	10.90	17	15.50	
Meat and chicken	High consumption	17	15.50	14	12.70	χ^2=0.36 p=0.83
	Moderate consumption	63	57.30	64	58.20	
	Low consumption	30	27.30	32	29.10	

* significant at P≤0.05 ** highly significant at P≤0.01 *** very high significant at P≤0.001

The above table 5.3.18 shows the comparison of food frequency between the experimental and control group in the pretest.

The findings revealed that there was no statistically significant difference found in the frequency of intake with the refined cereals, pulses, salty foods, yellow vegetables, green leafy vegetables, fruits, meat & chicken, cereals, milk and milk products and fish between the experimental and control group in the pretest.

Table 5.3.19: Comparison of food frequency between the experimental and control group in the pre test **N = 220**

Type of food	Level of consumption	Experimental N=110		Control N=110		Chi square test
		No.	%	No.	%	
Egg	High consumption	40	36.40	41	37.30	χ^2=2.16 p=0.33
	Moderate consumption	35	31.80	43	39.10	
	Low consumption	35	31.80	26	23.60	
Oily foods	High consumption	21	19.10	10	09.10	χ^2=4.60 p=0.10
	Moderate consumption	20	18.20	24	21.80	
	Low consumption	69	62.70	76	69.10	
High cholesterol foods	High consumption	9	08.20	2	01.80	χ^2=4.72 p=0.10
	Moderate consumption	12	10.90	12	10.90	
	Low consumption	89	80.90	96	87.30	
Animal fats	High consumption	1	00.90			χ^2=3.04 p=0.22
	Moderate consumption	2	01.80			
	Low consumption	107	97.30	110	100.00	
Sweets and chocolates	High consumption	10	09.10	8	07.30	χ^2=1.42 p=0.49
	Moderate consumption	20	18.20	27	24.50	
	Low consumption	80	72.70	75	68.20	
Instant foods	High consumption	58	52.70	52	47.30	χ^2=2.89 p=0.24
	Moderate consumption	4	03.60	10	09.10	
	Low consumption	48	43.60	48	43.60	
Coffee and tea	High consumption	80	72.70	84	76.40	χ^2=0.75 p=0.68
	Moderate consumption	3	02.70	4	03.60	
	Low consumption	27	24.50	22	20.00	
Carbonated beverages	High consumption	40	36.40	27	24.50	χ^2=5.11 p=0.08
	Moderate consumption	12	10.90	21	19.10	
	Low consumption	58	52.70	62	56.40	
Nuts	High consumption	2	01.80	1	00.90	χ^2=2.37 p=0.30
	Moderate consumption	2	01.80			
	Low consumption	106	96.40	109	99.10	
Use of palm oil	High consumption	108	98.20	108	98.20	χ^2=0.00 p=1.00
	Moderate consumption	2	01.80	2	01.80	

* significant at P≤0.05 ** highly significant at P≤0.01 *** very high significant at P≤0.001

The above table 5.3.19 shows the comparison of food frequency between the experimental and control group in the pretest.

The findings revealed that there was no statistically significant difference found in the frequency of intake of egg, sweets and chocolates, instant food, coffee and tea, carbonated beverages, palm oil, oily foods, high cholesterol foods, animal fats and nuts between the experimental and control group in the pretest.

Table 5.3.20: Comparison of food frequency between the experimental and control group in the post test **N = 220**

Type of food	Level of consumption	Experimental N=110		Control N=110		Chi square test
		No.	%	No.	%	
Cereals	High consumption	110	100.00	104	94.50	**χ^2=6.17 p=0.01****
	Moderate consumption	0	00.00	6	05.50	
	Low consumption	0	00.00	0	00.00	
Refined	High consumption	10	09.10	16	14.50	**χ^2=12.93 p=0.01****
	Moderate consumption	49	44.50	24	21.80	
	Low consumption	51	46.40	70	63.60	
Pulses	High consumption	87	79.10	26	23.60	**χ^2=68.42 p=0.001*****
	Moderate consumption	21	19.10	81	73.60	
	Low consumption	2	01.80	3	02.70	
Salty foods	High consumption	1	00.90	4	03.60	**χ^2=6.74 p=0.03***
	Moderate consumption	2	01.80	9	08.20	
	Low consumption	107	97.30	97	88.20	
Yellow vegetables	High consumption	25	22.70	7	06.40	**χ^2=40.61 p=0.001*****
	Moderate consumption	65	59.10	30	27.30	
	Low consumption	30	27.30	73	66.40	
Green leafy vegetables	High consumption	65	59.10	11	10.00	**χ^2=67.00 p=0.001*****
	Moderate consumption	27	24.50	83	75.50	
	Low consumption	18	16.40	16	14.50	
Fruits	High consumption	13	11.80	7	06.40	**χ^2=47.43 p=0.001*****
	Moderate consumption	60	54.50	16	14.50	
	Low consumption	37	33.60	87	79.10	
Milk and milk products	High consumption	18	16.40	31	28.20	**χ^2=7.74 p=0.02***
	Moderate consumption	76	69.10	56	50.90	
	Low consumption	16	14.50	23	20.90	
Fish	High consumption	5	04.50	3	02.70	**χ^2=6.99 p=0.03***
	Moderate consumption	97	88.20	86	78.20	
	Low consumption	8	07.30	21	19.10	
Meat and chicken	High consumption	6	05.50	14	12.70	**χ^2=24.00 p=0.001*****
	Moderate consumption	96	87.30	64	58.20	
	Low consumption	8	07.30	32	29.10	

* significant at P≤0.05 ** highly significant at P≤0.01 *** very high significant at P≤0.001

The above table 5.3.20 shows the comparison of food frequency between the experimental and control group in the posttest.

Considering the cereals, 110(100%) in the experimental 104(94.50%) in the control were high consumers. The chi square value χ^2=6.17 at p=0.01 level showed statistically significant difference. Regarding the refined cereals, 49(44.50%) in the experimental and only 24(21.80%) in the control were moderate consumers. The chi square value χ^2=12.93 at p=0.01 level showed statistically significant difference. Regarding the pulses, 87(79.10%) in the experimental and only 26(23.60%) in the control were high consumers. The chi square value χ^2=68.42 at p=0.001 level showed statistically significant difference.

With respect to salty foods, 107(97.30%) in the experimental and 97(88.20%) in the control were low consumers. The chi square value χ^2=6.74at p=0.03 level showed statistically significant difference. In relevance to yellow vegetables, 25(22.70%) in the experimental and only 7(6.40%) in the control were high consumers. The chi square value χ^2=40.61 at p=0.001 level showed statistically significant difference. Regarding the green leafy vegetables, 65(59.10%) in the experimental and only 11(10.00%) in the control were high consumers. The chi square value χ^2=67.00 at p=0.001 level showed statistically significant difference.

With respect to fruits, 60(54.50%) in the experimental and only 16(14.50%) in the control were moderate consumers. The chi square value χ^2=47.43 at p=0.001 level showed statistically significant difference. Considering milk and milk products, 76(69.10%) in the experimental and only 56(50.90%) in the control were moderate

consumers. The chi square value χ^2=7.74 at p=0.02 level showed statistically significant difference. With respect to fish consumption, 97(88.20%) in the experimental and only 86(78.20%) in the control were moderate consumers. The chi square value χ^2=6.99 at p=0.03 level showed statistically significant difference. In relation to meat and chicken consumption, 6(5.5%) in the experimental and 14(12.70%) in the control were high consumers. The chi square value χ^2=24.00 at p=0.01 level showed statistically significant difference.

The findings revealed that there was statistically significant difference found in the frequency of intake of cereals, refined cereals, pulses, salty foods, yellow vegetables, green leafy vegetables, fruits, meat & chicken, milk and milk products and fish between the experimental and control group in the post test.

Hence it was evident that the RORP was effective in bringing the behavioral changes of dietary modifications by high consumption of cereals, pulses, green vegetables and fruits, moderate consumption of milk and milk products, fish and meat and low consumption of salty foods.

Table 5.3.21: Comparison of food frequency between the experimental and control group in the post test **N = 220**

Type of food	Level of consumption	Experimental N=110		Control N=110		Chi square test
		No.	%	No.	%	
Egg	High consumption	23	20.90	43	39.10	**χ^2=22.78 p=0.001*** **
	Moderate consumption	77	70.00	42	38.20	
	Low consumption	10	09.10	25	22.70	
Oily foods	High consumption	11	10.00	12	10.90	χ^2=3.92 p=0.14
	Moderate consumption	15	13.60	26	23.60	
	Low consumption	84	76.40	72	65.50	
High cholesterol foods	High consumption	3	02.70	2	01.80	χ^2=1.75 p=0.14
	Moderate consumption	6	05.50	11	10.00	
	Low consumption	101	91.80	97	88.20	
Animal fats	High consumption	0	00.00	0	00.00	χ^2=0.00 p=1.00
	Moderate consumption	0	00.00	0	00.00	
	Low consumption	110	100.00	110	100.00	
Sweets and chocolates	High consumption	4	03.60	10	09.10	**χ^2=10.37 p=0.01****
	Moderate consumption	11	10.00	25	22.70	
	Low consumption	95	86.40	75	68.20	
Instant foods	High consumption	18	16.40	52	47.30	**χ^2=20.66 p=0.001*** **
	Moderate consumption	12	10.90	9	08.20	
	Low consumption	90	81.80	49	44.50	
Coffee and tea	High consumption	45	40.90	84	76.40	**χ^2=35.77 p=0.001*** **
	Moderate consumption	32	29.10	4	03.60	
	Low consumption	33	30.00	22	20.00	
Carbonated beverages	High consumption	17	15.50	29	26.40	χ^2=4.33 p=0.11
	Moderate consumption	28	25.50	21	19.10	
	Low consumption	65	59.10	60	54.50	
Nuts	High consumption	0	00.00	1	00.90	χ^2=2.00 p=0.36
	Moderate consumption	1	00.90	0	00.00	
	Low consumption	109	99.10	109	99.10	
Use of palm oil	High consumption	55	50.00	108	98.20	**χ^2=67.83 p=0.001*** **
	Moderate consumption	47	42.70	0	00.00	
	Low consumption	8	07.30	2	01.80	

* significant at P≤0.05 ** highly significant at P≤0.01 *** very high significant at P≤0.001

The above table 5.3.21 shows the comparison of food frequency between the experimental and control group in the post test.

With respect to egg consumption, 77(70.00%) in the experimental and only 42(38.20%) in the control were moderate consumers. The chi square value χ^2=22.78 at p=0.001 level showed statistically significant difference. With regard to sweets, and chocolates consumption 95(86.40%) in the experimental and only 75(68.20%) in the control were low consumers. The chi square value χ^2=10.37 at p=0.01 level showed statistically significant difference. With respect to instant food consumption, 90(81.80%) in the experimental and only 49(44.50%) in the control were low consumers. The chi square value χ^2=20.66 at p=0.001 level showed statistically significant difference.

With respect to coffee and tea consumption, 45(40.90%) in the experimental and 84(76.40%) in the control were moderate consumers. The chi square value χ^2=35.77 at p=0.001 level showed statistically significant difference. Regarding the palm oil use, 55(50.00%) in the experimental and 108(98.20%) in the control were moderate consumers. The chi square value χ^2=67.83 at p=0.001 level showed statistically significant difference.

The findings revealed that there was statistically significant difference was found in the frequency of intake of egg, sweets and chocolates, instant food, coffee and tea, palm oil, between the experimental and control group in the post test. There was no statistically significant difference was found in the frequency of intake of oily foods, high cholesterol foods, animal fats carbonated beverages and nuts between the experimental and control group. Hence it is evidently proved that the RORP was effective in bringing the behavior change towards dietary modification among the experimental group by moderate consumption of egg and low consumption of oily foods, high cholesterol foods, animal fats, sweets and chocolates, instant foods, carbonated beverages and nuts among the experimental group.

Table 5.3.22: Comparison of overall pre and post test mean obesity reduction (BMI) in the experimental and control group N = 220(110+110)

Group	Pre test Baseline		Post test 1 6th week		Post test 2 12th week		Repeated measures ANOVA
	Mean	SD	Mean	SD	Mean	SD	
Experimental	28.17	3.02	27.49	2.96	25.52	2.89	**F=25.90, P=0.001*** **
Control	28.12	3.00	28.07	3.16	28.00	3.11	F=0.11, P=0.90
Student independent t test	t=0.10, p =0.92		t=1.39, p=0.16		**t=6.12, p=0.001*** **		

* significant at P≤0.05 ** highly significant at P≤0.01 *** very high significant at P≤0.001

The above table 5.3.22 shows the comparison of pretest and post test mean obesity reduction (BMI) score in the experimental and control group.

With regard to the experimental group in the pre test, the mean BMI was 28.17 with the SD of 3.02, at post test 1 the mean BMI was 27.49 with the SD of 2.96 and it was further reduced to 25.52 with the SD of 2.89 in the post test 2. In contrast the mean BMI in the control group remained the same as 28.12 with the SD of 3.0, 28.O7 with the SD of 3.16 and 28.0 with the SD of 3.11 in pretest, post test 1 and post test 2 respectively. The F test revealed that there is high statistically significance difference in the pre and post test of experimental group (F=25.90, p=0.001) proving the effectiveness of RORP and there was no significant difference was found in the level of BMI for the control group.

With respect to the comparison between the experimental and control group, the independent student t test revealed that there was no statistically significant difference in the mean BMI between experimental and control group in the pre test and also in post test 1 but very high level statistical significance was found at the post test 2 (t=6.12 at p=0.001) level proving the effectiveness of RORP.

Table 5.3.23: Comparison of overall pre and post test mean obesity reduction (WC) in the experimental and control group N = 220(110+110)

Group	Pre test Baseline		Post test1 6th week		Post test 2 12th week		Repeated measures ANOVA
	Mean	SD	Mean	SD	Mean	SD	
Experimental	91.38	06.88	90.00	07.01	88.46	07.20	**F=4.70 P=0.001*** **
Control	91.45	06.78	91.13	06.78	90.85	06.84	F=0.19 P=0.82
Student independent t test	t=0.08, p=0.93		t=1.21, p=0.22		**t=2.52, p=0.01****		

* significant at P≤0.05 ** highly significant at P≤0.01 *** very high significant at P≤0.001

The above table 5.3.23 shows the Comparison of pretest and post test mean obesity reduction (WC) in the experimental and control group.

With regard to the experimental group in the pre test, the mean WC was 91.38 with the SD of 6.88, in post test 1 the mean WC was 90.00 with the SD of 7.0 and it was further reduced to 88.46 with the SD of 7.20 in the post test 2. The F test (F=4.7 at p=0.001 level) revealed high statistical significance difference in the experimental group proving the effectiveness of RORP and in contrast the control group mean WC remained the same as in pre test the mean WC was 91.45 with the SD of 6.78, at post test 1 the mean WC was 91.13 with the SD of 6.78 and at post test 2 it was 90.85 with the SD of 6.84. There was no significant difference was found in the level of WC for the control group in the pre and post test.

When comparison was made between the experimental and control group the independent student t test revealed that there was no statistically significant difference in the mean WC between experimental and control group in the pre test and also in post test 1 but high level statistical significance was found at the post test 2 (t=2.52 at p=0.01) level proving the effectiveness of RORP.

Table 5.3.24: Comparison of overall pre and post test mean obesity reduction (PBF) in the experimental and control group N = 220(110+110)

Group	Pre test Baseline		Post test1 6th week		Post test 2 12th week		Repeated measures ANOVA
	Mean	SD	Mean	SD	Mean	SD	
Experimental	34.77	05.21	33.60	05.23	32.49	05.35	**F=5.16 P=0.001*** **
Control	34.85	05.57	34.81	05.48	34.69	05.56	F=0.07 P=0.92
Student independent t test	t=0.12, p=0.91		t=1.66, p=0.10		**t=2.14, p=0.03***		

* significant at P≤0.05 ** highly significant at P≤0.01 *** very high significant at P≤0.001

The above table 5.3.24 shows the Comparison of pretest and post test mean obesity reduction (PBF) in the experimental and control group.

With regard to the experimental group in the pre test, the mean PBF was 34.77 with the SD of 5.21, at post test 1 the mean PBF was 33.60 with the SD of 5.23 and it was further reduced to 32.49 with the SD of 5.35 in the post test 2. The F test revealed (F=5.16 at p=0.001 level) high statistically significant difference in the experimental group proving the effectiveness of RORP whereas in control group the pre test the mean PBF was 34.85 with the SD of 5.57, at post test 1 the mean PBF was 34.81 with the SD of 5.48 and at post test 2 also it was 34.69 with the SD of 5.44. The F test revealed that there was no significant difference was found in the level of PBF for the control group.

When comparison was made between the experimental and control group the independent student t test revealed that there was no statistically significant difference in the mean WC between experimental and control group in the pre test and also in post test 1 but high statistically significant difference was found at the post test 2 level (t=2.14 at p=0.03 level) proving the effectiveness of RORP in reducing the Percent Body Fat.

Table 5.3.25: Overall effectiveness of Rural Obesity Reduction Program on knowledge, attitude, practices towards obesity and Obesity reduction among the Obese adults within experimental and control group in the pre and post test

N = 220(110+110)

Variables	Group	Measurement point	Max score	Mean score	Mean Difference	Percentage Difference
Knowledge	Experimental	Pretest	25	10.67	09.14	36.60
		Posttest	25	19.81		
	Control	Pretest	25	10.80	00.39	01.60
		Posttest	25	11.19		
Attitude	Experimental	Pretest	100	45.94	34.51	34. 50
		Posttest	100	80.45		
	Control	Pretest	100	47.08	01.47	01.50
		Posttest	100	48.55		
Practice	Experimental	Pretest	175	80.79	48.38	27.60
		Posttest	175	129.17		
	Control	Pretest	175	82.93	02.02	01.20
		Posttest	175	84.95		
Obesity reduction - BMI	Experimental	Pretest		28.16	02.64	09.40
		Posttest		25.51		
	Control	Pretest		28.12	00.12	00.40
		Posttest		27.99		
Obesity reduction- WC	Experimental	Pretest		91.38	02.92	03.20
		Posttest		88.46		
	Control	Pretest		91.45	00.60	00.70
		Posttest		90.85		
Obesity reduction – PBF	Experimental	Pretest		34.77	02.27	06.50
		Posttest		32.49		
	Control	Pretest		34.85	00.16	00.50
		Posttest		34.69		

The above table 5.3.35 shows the overall effectiveness of Rural Obesity education Program on knowledge, attitude, practices towards obesity and Obesity reduction among the obese adults within the experimental and control group in the pre and post test.

Considering the knowledge, the mean differed knowledge score for the experimental group was 9.14(36.6%) where as for control group it was only 0.39(1.6%).

With regard to attitude, the mean differed attitude score for the experimental group was 34.51(34.5%) where as for control group it was only 1.47(1.5%).

With respect to practice, the mean differed practice score for the experimental group was 48.38(27.6%) where as for control group it was only 2.02(1.2%).

With relevance to obesity reduction, the mean differed BMI score for the experimental group was 2.64(9.4%) where as for control group it was only 0.12(0. 4%).

With relevance to obesity reduction, the mean differed WC score for the experimental group was 2.92(3.2 %) where as for control group it was only 0.60(0. 7%).

With relevance to obesity reduction, the mean differed PBF score for the experimental group was 2.27(6.5 %) where as for control group it was only 0.16(0.5%).

The above findings revealed that the mean difference of the variables were high for the experimental group comparing to the control group which proved that the RORP was highly effective in bringing the behavioral modification among the obese adults with respect to knowledge, attitude, practice and obesity reduction.

SECTION 5.4: ASSESSMENT OF RELATIONSHIP AMONG KNOWLEDGE, ATTITUDE, PRACTICE AND OBESITY REDUCTION IN THE PRETEST AND POSTTEST OF THE EXPERIMENTAL AND CONTROL GROUP

Table 5.4.1: Assessment of relationship among the knowledge, attitude, practice and obesity reduction in the pre and post test of the experimental group N = 110

	Correlation between	Karl pearson Correlation coefficient	Interpretation
Pretest	Knowledge Vs Attitude	r=0.10, p=0.28	Poor, positive correlation
	Knowledge Vs Practice	r=0.09, p=0.25	Poor, positive correlation
	Knowledge Vs Obesity	r=-0.03, p= 0.73	Poor, negative correlation
	Attitude Vs Practice	r=0.02, p=0.83	Poor, positive correlation
	Attitude Vs Obesity	r=-0.07, p=0.85	Poor, negative correlation
	Practice Vs Obesity	r=-0.04, p=0.09	Poor, negative correlation
Posttest	Knowledge Vs Attitude	**r=0.42, p=0.001*** **	Moderate , positive correlation
	Knowledge Vs Practice	**r=0.50, p=0.001*** **	Moderate, positive correlation
	Knowledge Vs Obesity	**r=-0.38, p=0.001*** **	Fair, negative correlation
	Attitude Vs Practice	**r=0.39, p=0.01** **	Fair, positive correlation
	Attitude Vs Obesity	**r=-0.30, p=0.01*** **	Fair, negative correlation
	Practice Vs Obesity	r=-0.35, p=0.01	Fair, negative correlation

* significant at P≤0.05 ** highly significant at P≤0.01 *** very high significant at P≤0.001

The above table 5.4.1 describes the relationship among the post test knowledge, attitude, practice and obesity reduction of the experimental group.

For experimental group in the pretest there was no significant correlation between the variables. In contrast statistically significant relationship was found at the post test. Moderate and fair positive correlation was found between knowledge Vs attitude (r=0.42, p=0.001) and knowledge Vs practice (r=0.5, p=0.001) which indicates that when knowledge increases the attitude and practice increases. Fair positive correlation was found with attitude Vs practice (r=0.39, p=0.01) which means that when attitude increases practice also increases. Fair negative correlation was found between knowledge Vs obesity (r=-0.38, p=0.001), attitude Vs obesity (r=-0.30, p=0.01) and practice Vs obesity (r=-0.35, p=0.01) which showed that when knowledge, attitude and practice increases the level of obesity was reduced.

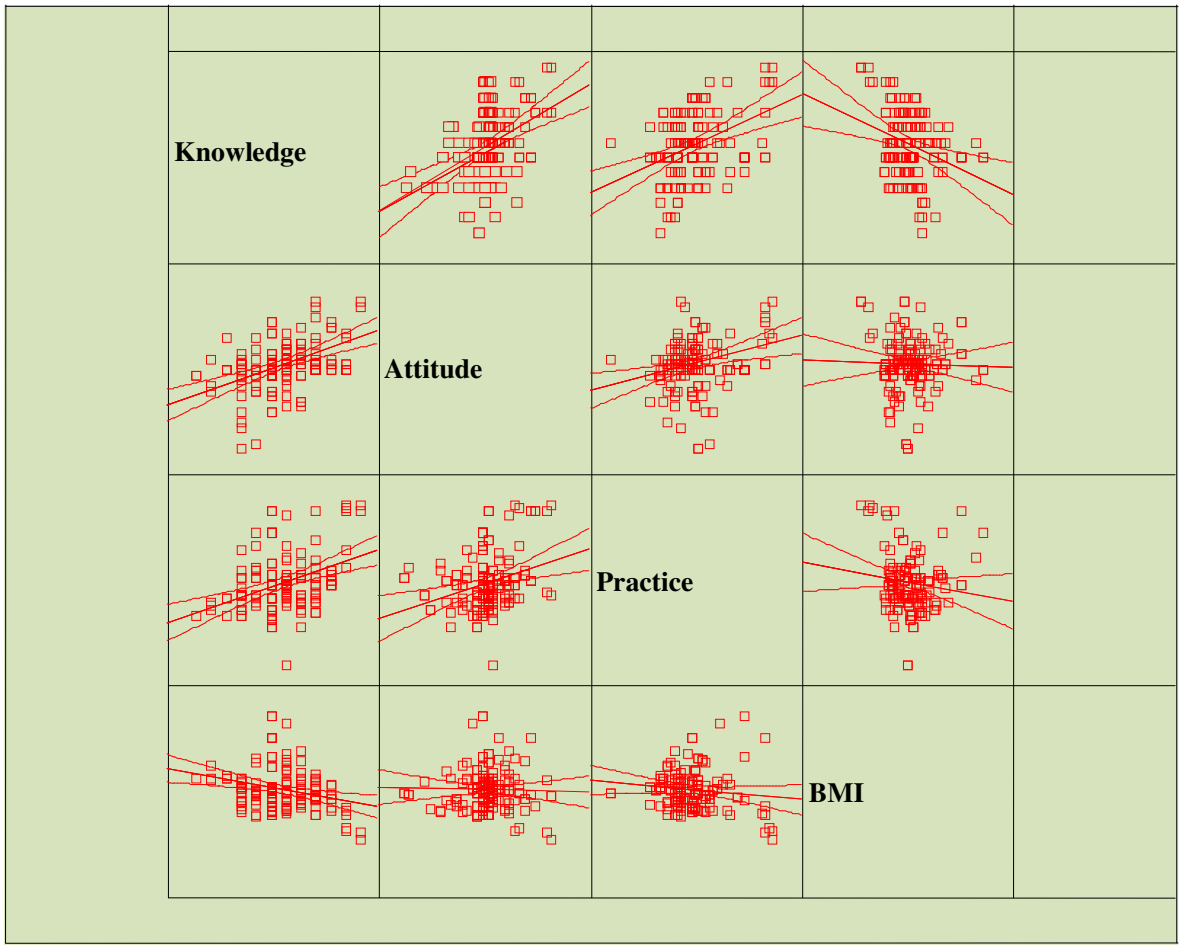


Figure 5.4.1: Correlation matrix shows the correlation between knowledge, attitude, practice and obesity among the obese adults of experiment group

Table 5.4.2: Assessment of relationship among the pre and post test knowledge, attitude, practice and obesity reduction of the control group N = 110

	Correlation between	Karl Pearson Correlation coefficient	Interpretation
Pretest	Knowledge Vs Attitude	r=0.14, p=0.13	Poor, positive correlation
	Knowledge Vs Practice	r=-0.08, p=0.36	Poor, positive correlation
	Knowledge Vs Obesity	r=-0.10, p= 0.30	Poor, negative correlation
	Attitude Vs Practice	r=0.11, p=0.41	Poor, negative correlation
	Attitude Vs Obesity	r=-0.04, p=0.66	Poor, negative correlation
	Practice Vs Obesity	r=-0.11, p=0.53	Poor, positive correlation
Posttest	Knowledge Vs Attitude	r=0.14, p=0.13	Poor, positive correlation
	Knowledge Vs Practice	r=-0.08, p=0.36	Poor, negative correlation
	Knowledge Vs Obesity	r=-0.10, p= 0.30	Poor, negative correlation
	Attitude Vs Practice	r=0.11, p=0.41	Poor, negative correlation
	Attitude Vs Obesity	r=-0.04, p=0.66	Poor, positive correlation
	Practice Vs Obesity	r=-0.11, p=0.53	Poor, positive correlation

* significant at P≤0.05 ** highly significant at P≤0.01 *** very high significant at P≤0.001

The above table 5.4.2 describes the relationship among the pre test and post test knowledge, attitude, practice and obesity reduction of the control group.

In both pretest and post test there was poor positive correlation was found between the knowledge and attitude, knowledge and practice and attitude and practice. Poor negative correlation was found between knowledge and obesity, attitude and obesity and practice and obesity. But there was no statistically significant relationship was found.

SECTION 5.5: ASSOCIATION OF MEAN DIFFERED KNOWLEDGE, ATTITUDE, PRACTICE AND OBESITY REDUCTION WITH SELECTED DEMOGRAPHIC VARIABLES OF OBESE ADULTS IN THE EXPERIMENTAL GROUP

Table 5.5.1: Association of mean differed knowledge with selected demographic variables of obese adults in the experimental group N = 110

Demographic Variables		Level of knowledge gain				Total	Chi-square Test
		Below average (<36%)		Above average (>36%)			
		N	0	N	0		
Age	20-30 yrs	20	66.70	10	33.30	30	**χ^2=7.03 p=0.03***
	31 -40 yrs	21	52.50	19	47.50	40	
	41 -50 yrs	14	35.00	26	65.00	40	
Gender	Male	11	36.70	19	63.30	30	**χ^2=4.58 p=0.03***
	Female	44	55.00	36	45.00	80	
Family history of NCD	Yes	18	36.00	32	64.00	50	**χ^2=7.18 p=0.01****
	No	37	61.70	23	38.30	60	

* significant at P≤0.05 ** highly significant at P≤0.01 *** very high significant at P≤0.001

The above table 5.5.1 reveals the association of mean differed knowledge with selected demographic variables of obese adults in the experimental group.

Chi-square test findings revealed that there was statistically significant association was found for the demographic variable Age (x^2=7.03, p=0.03), Gender (x^2=4.58, p=0.03) and family history of NCD (x^2=7.18, p=0.01) with the mean differed knowledge of obese adults. There was no statistically significant association was established for other demographic variables like education, occupation, income, marital status, type of family, family size, family history of NCD, history of NCD, history of smoking, use of alcohol and habit of exercise.

Elderly, male obese adults with family history of NCDs gained more knowledge.

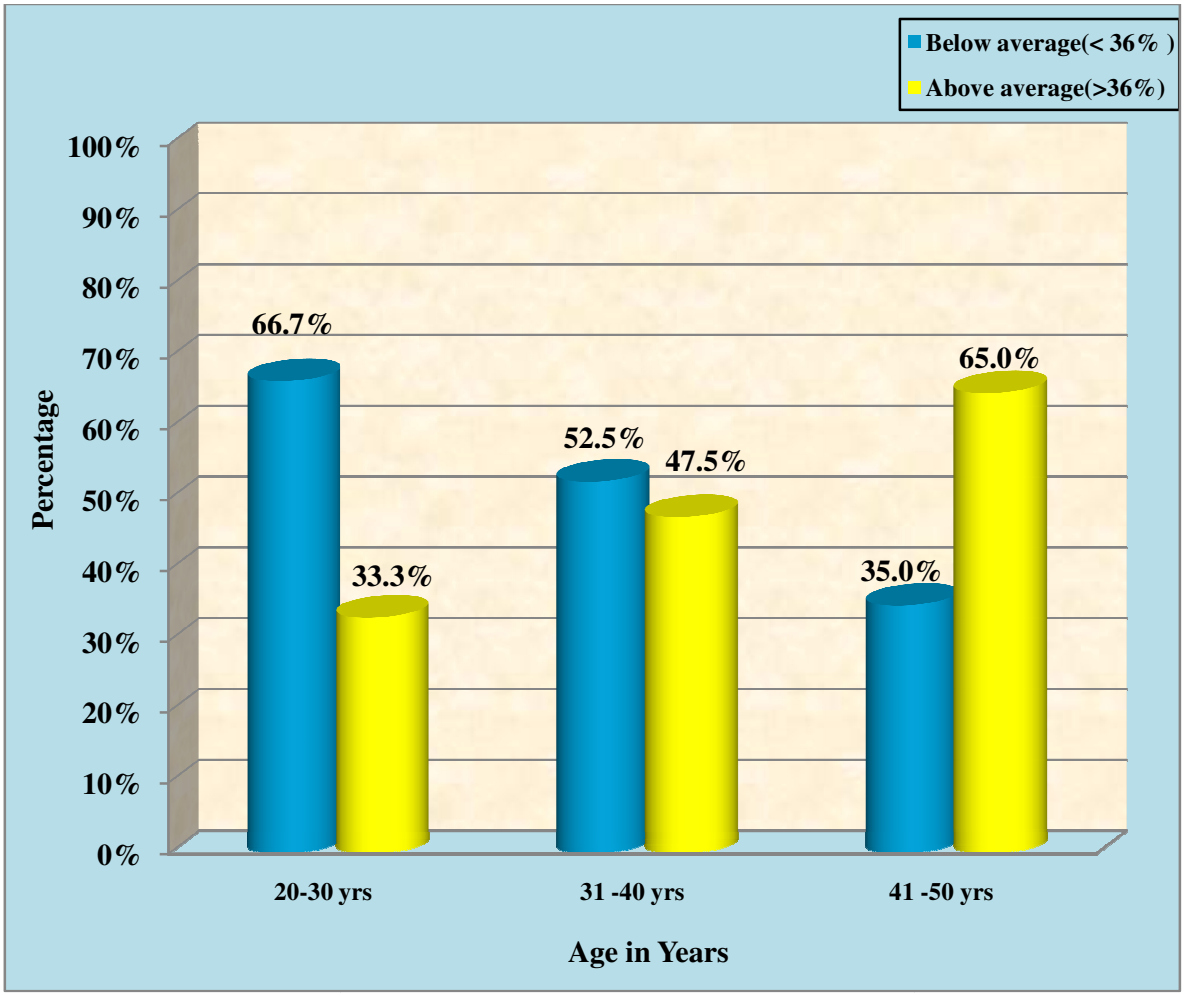


Figure 5.5.1(a): Association of demographic variable age with the mean differed knowledge of obese adults in the experimental group

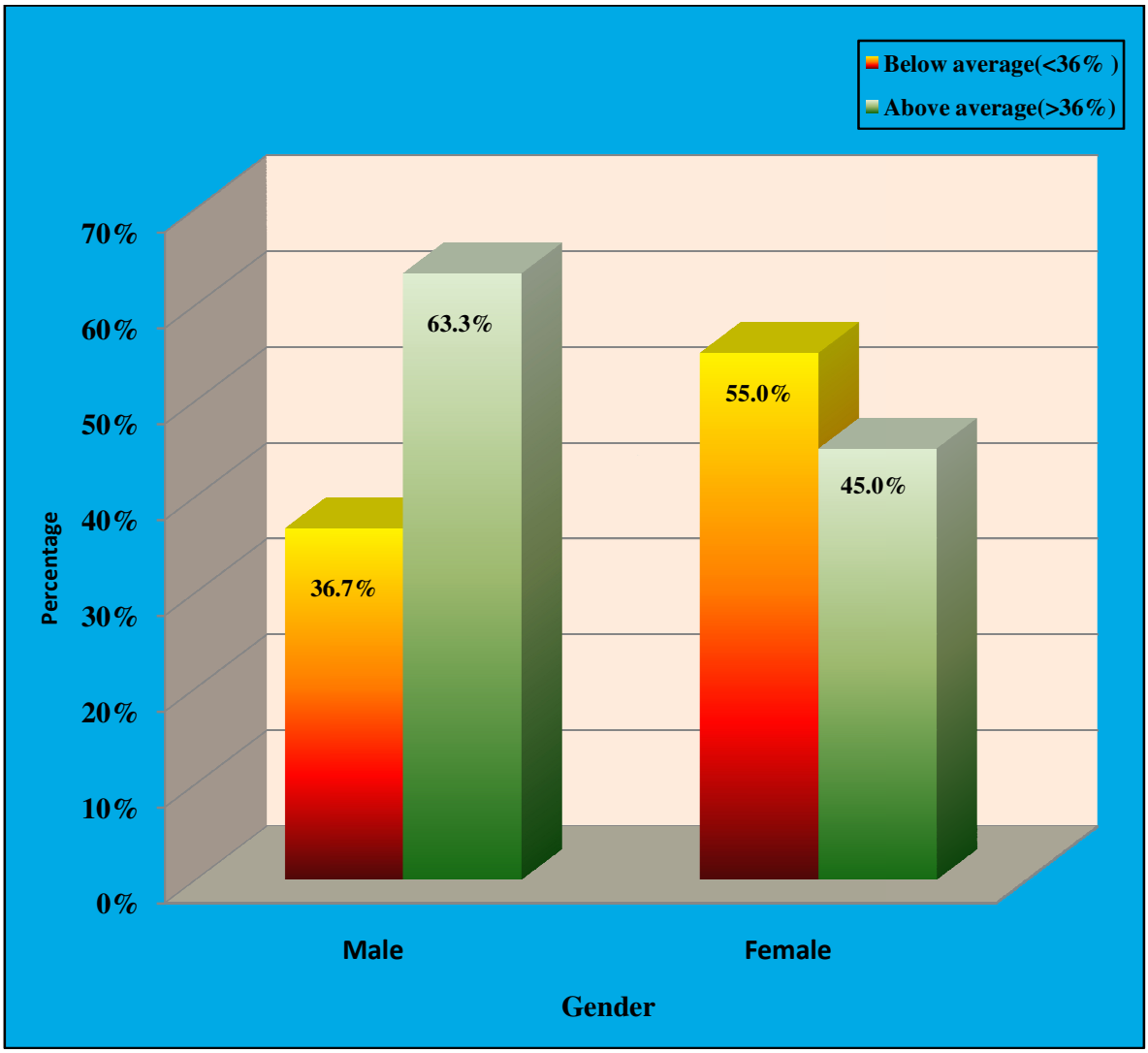


Figure 5.5.1(b): Association of demographic variable gender with the mean differed knowledge of obese adults in the experimental group

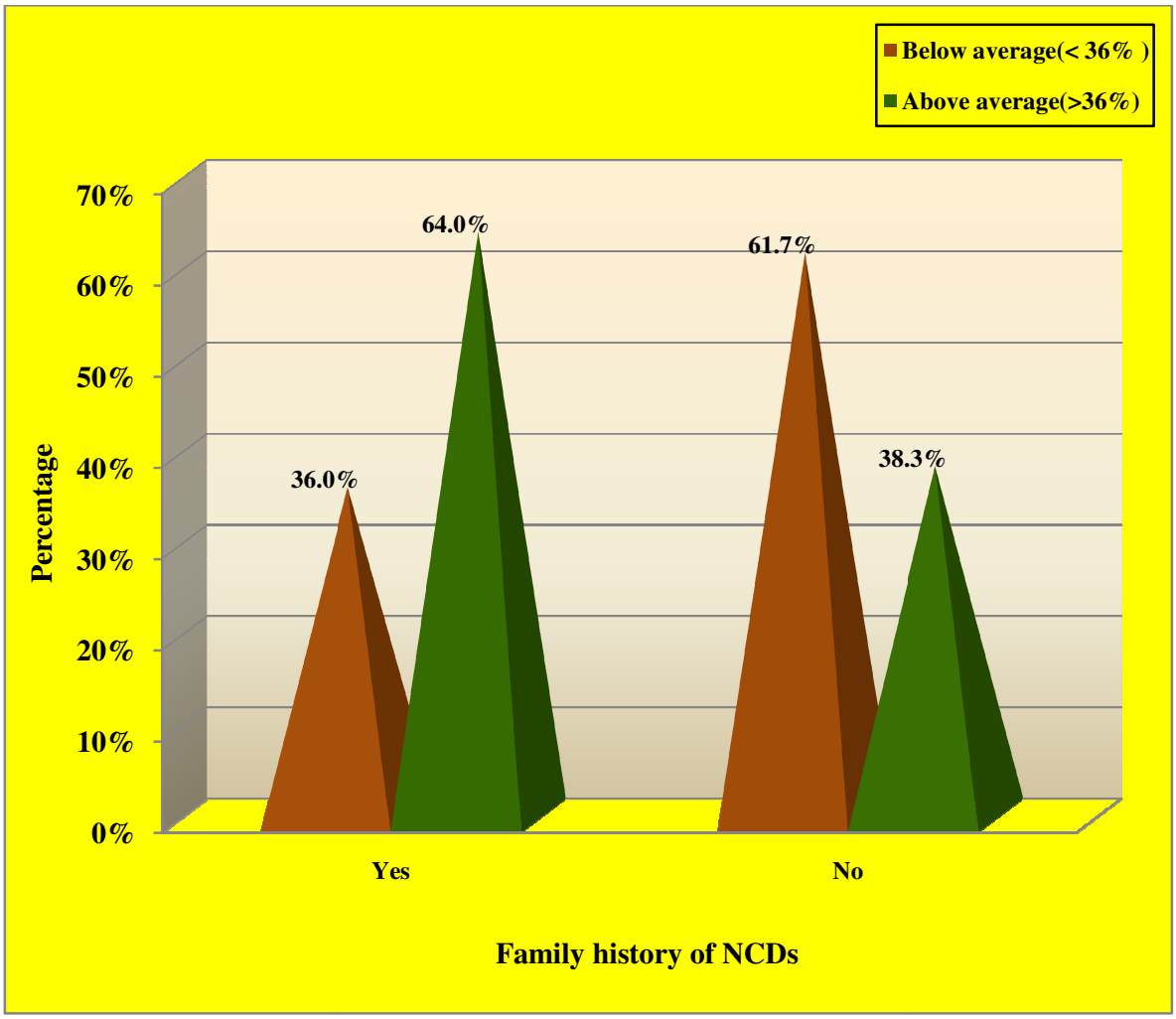


Figure 5.5.1(c): Association of demographic variable family history of NCDs with the mean differed knowledge of obese adults in the experimental group

Table 5.5.2: Association of mean differed attitude with selected demographic variables of obese adults in the experimental group N = 110

Demographic Variables		Level of Attitude gain				Total	Chi-square test
		Below average (<34%)		Above average (>34%)			
		N	0	N	0		
Age	20-30 yrs	21	70.00	9	30.00	30	**χ^2=9.80 p=0.01****
	31 -40 yrs	21	52.50	19	47.50	40	
	41 -50 yrs	13	32.50	27	67.50	40	
Education	Non literate	13	76.40	4	24.60	17	**χ^2=10.61 p=0.05***
	Primary school	10	55.50	8	44.50	18	
	Middle school	12	52.20	11	47.80	23	
	High school	16	45.70	19	54.30	35	
	Higher secondary	3	25.00	9	75.00	12	
	UG or PG	1	20.00	4	80.00	5	
History of NCD	Yes	10	31.20	22	68.80	32	**χ^2=6.34 p=0.01***
	No	45	57.60	33	42.40	78	

* significant at P≤0.05 ** highly significant at P≤0.01 *** very high significant at P≤0.001

The above table 5.5.2 reveals the association of mean differed attitude with selected demographic variables of obese adults in the experimental group

Chi-square test findings revealed that there was statistically significant association was found for the demographic variable Age (χ^2=9.80 at p=0.01), Education (χ^2=10.61 at p=0.05) and history of NCD (χ^2=6.34 at p=0.01) with the mean differed attitude of obese adults.

Elderly, educated obese adults with history of NCDs gained more attitudes.

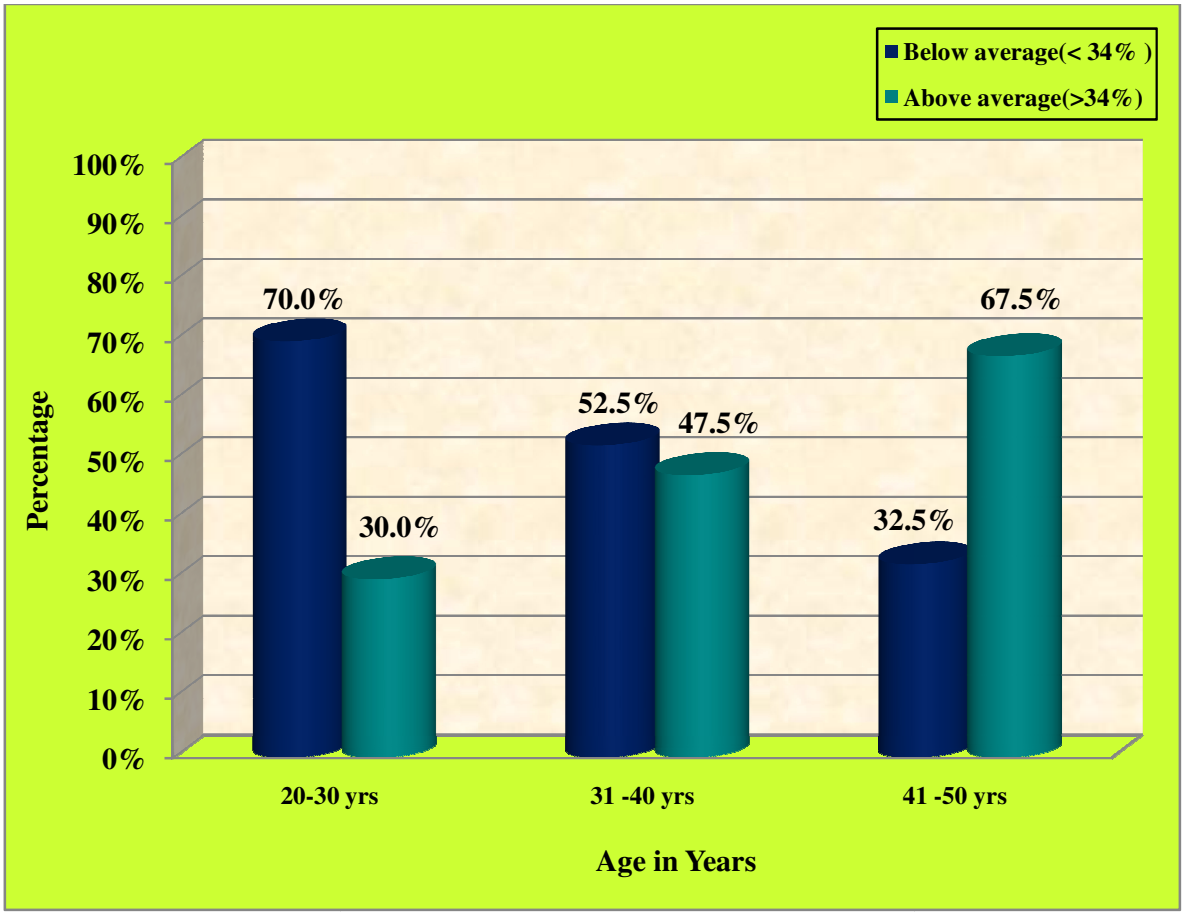


Figure 5.5.2(a) : Association of demographic variable age with the mean differed attitude of obese adults in the experimental group

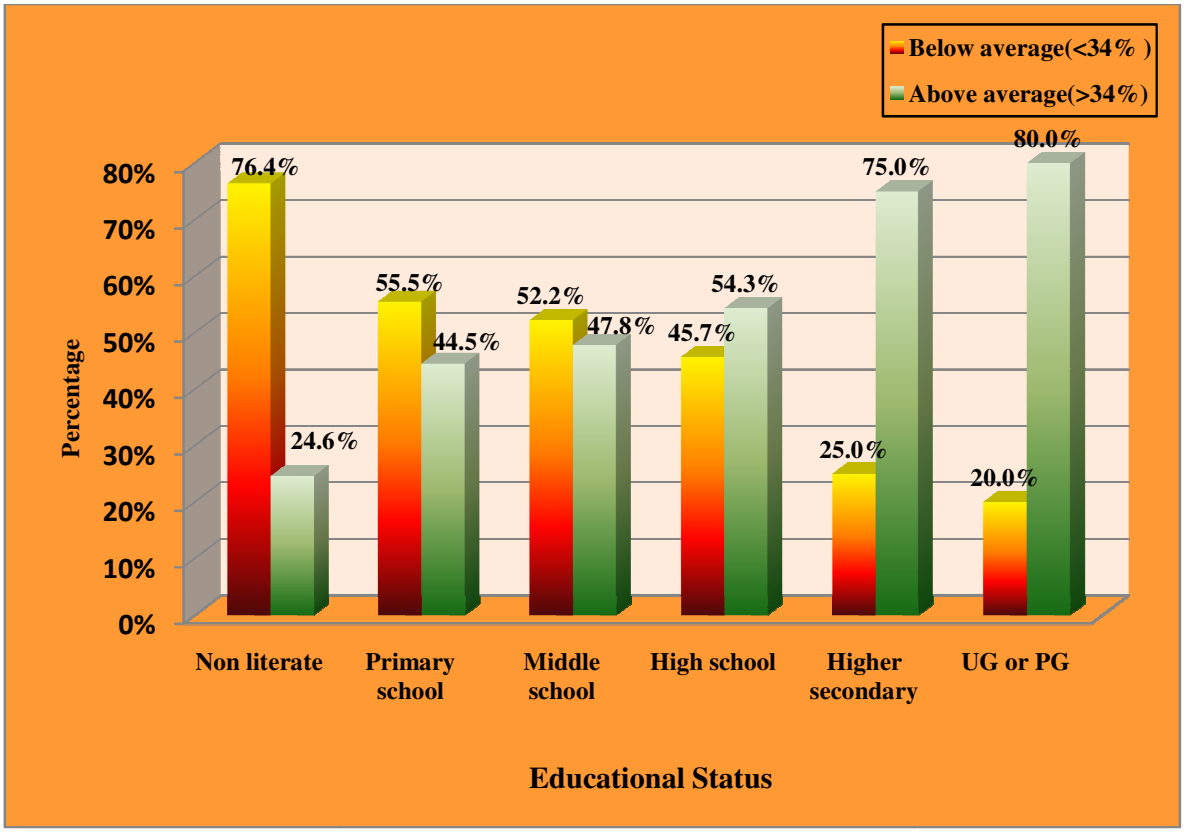


Figure 5.5.2(b): Association of demographic variable educational status with the mean differed attitude of obese adults in the experimental group

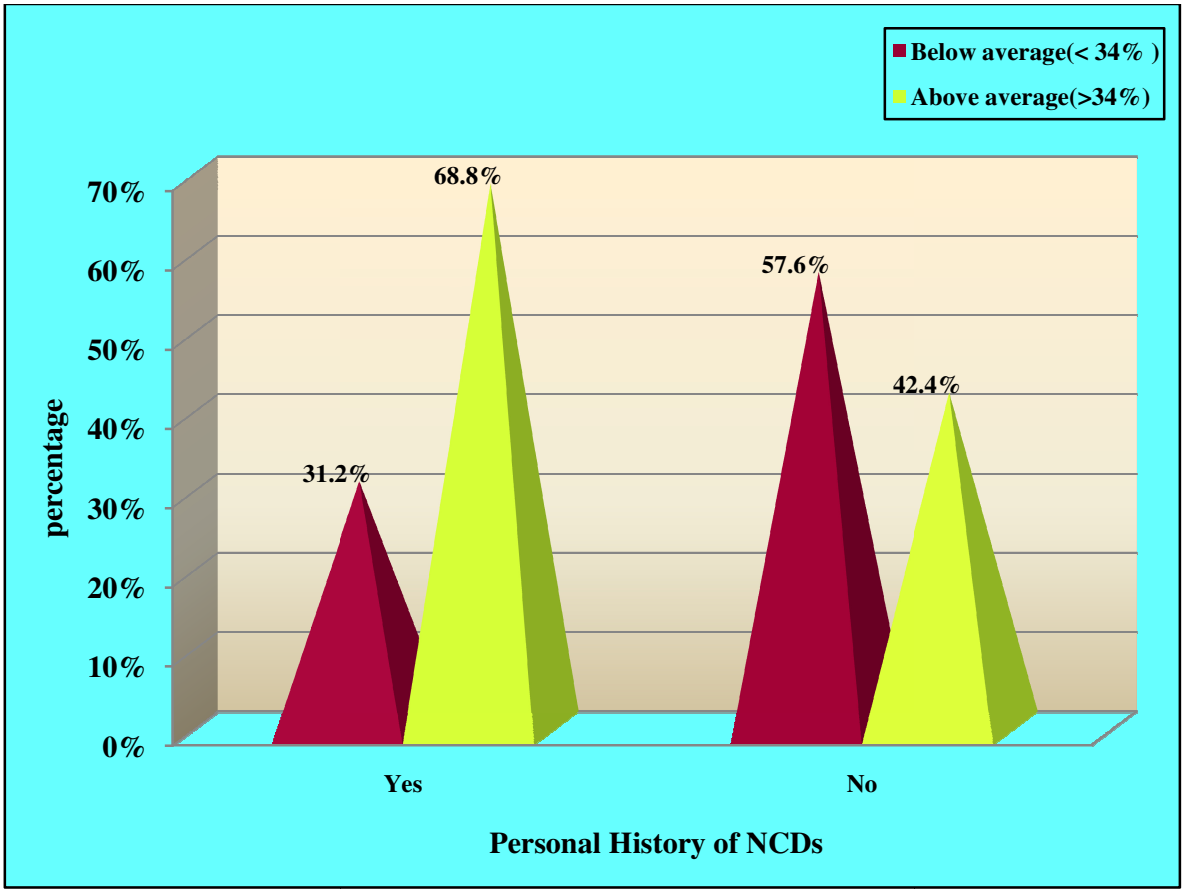


Figure 5.5.2(c): Association of demographic variable personal history of NCDs with the mean differed attitude of obese adults in the experimental group

Table 5.5.3: Association of mean differed practice with selected demographic variables of obese adults in the experimental group N=110

Demographic Variables		Level of Practice gain				Total	Chi-square test
		Below average (<27%)		Above average (>27%)			
		N	0	N	0		
Age in years	20-30	20	66.70	10	33.30	30	**χ^2=7.03 p=0.02***
	31 -40	21	52.50	19	47.50	40	
	41 -50	14	35.00	26	65.00	40	
Family history of NCD	Yes	15	30.00	35	70.00	50	**χ^2=14.66 p=0.01****
	No	40	66.70	20	33.30	60	
History of NCD	Yes	11	34.30	21	65.70	32	**χ^2=4.40 p=0.03***
	No	44	56.40	34	43.60	78	

* significant at P≤0.05 ** highly significant at P≤0.01 *** very high significant at P≤0.001

The above table 5.5.3 reveals the association of mean differed practice with selected demographic variables of obese adults in the experimental group.

Chi-square test findings revealed that there was statistically significant association was found for the demographic variable Age (χ^2 = 7.03 at p=0.02 level), history of NCD (χ^2 =4.40 at p=0.03 level) and family history of NCD (χ^2 =14.66 at p=0.01) with the mean differed practice of obese.

Elderly obese adults with family history of NCDs and personal history of NCDs gained more practice.

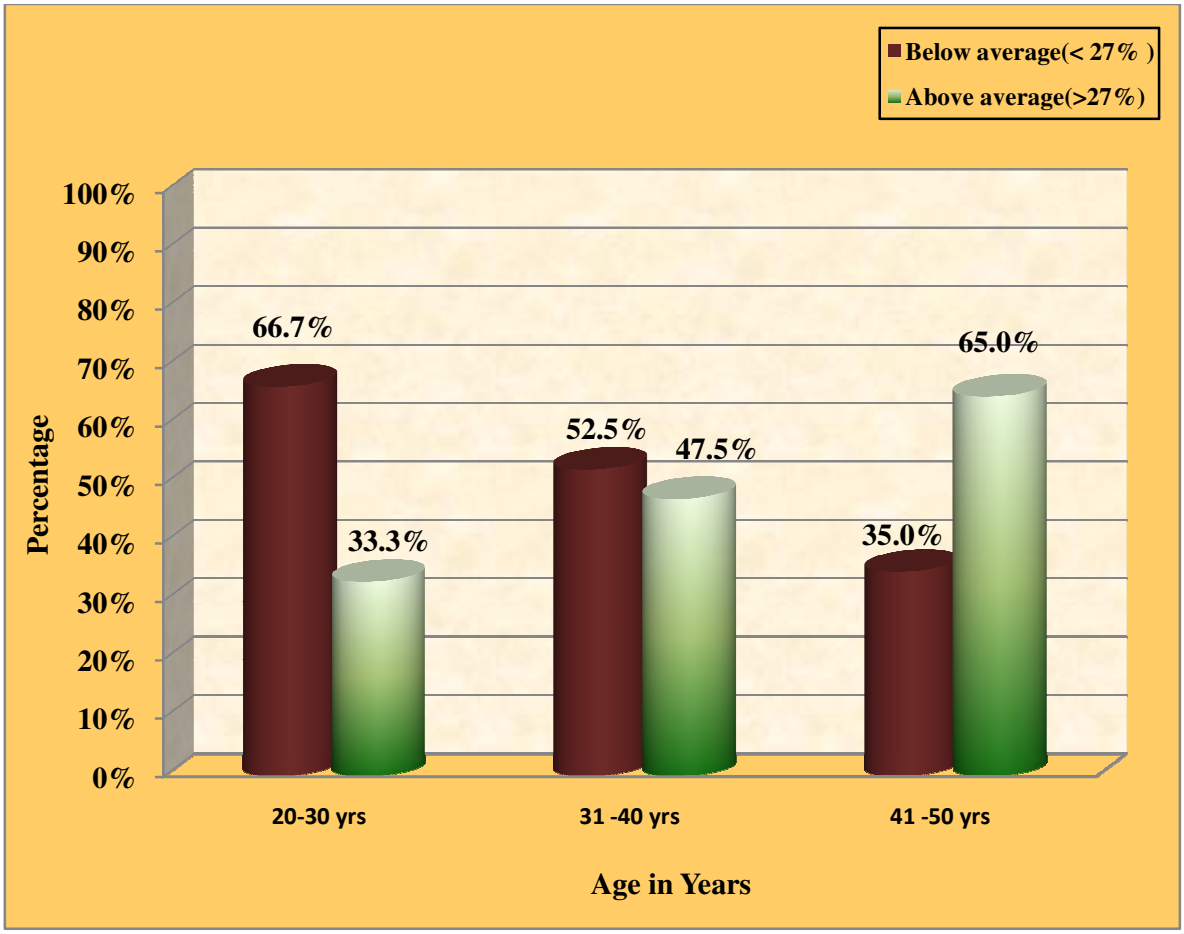


Figure 5.5.3(a): Association of demographic variable age with the mean differed practice of obese adults in the experimental group

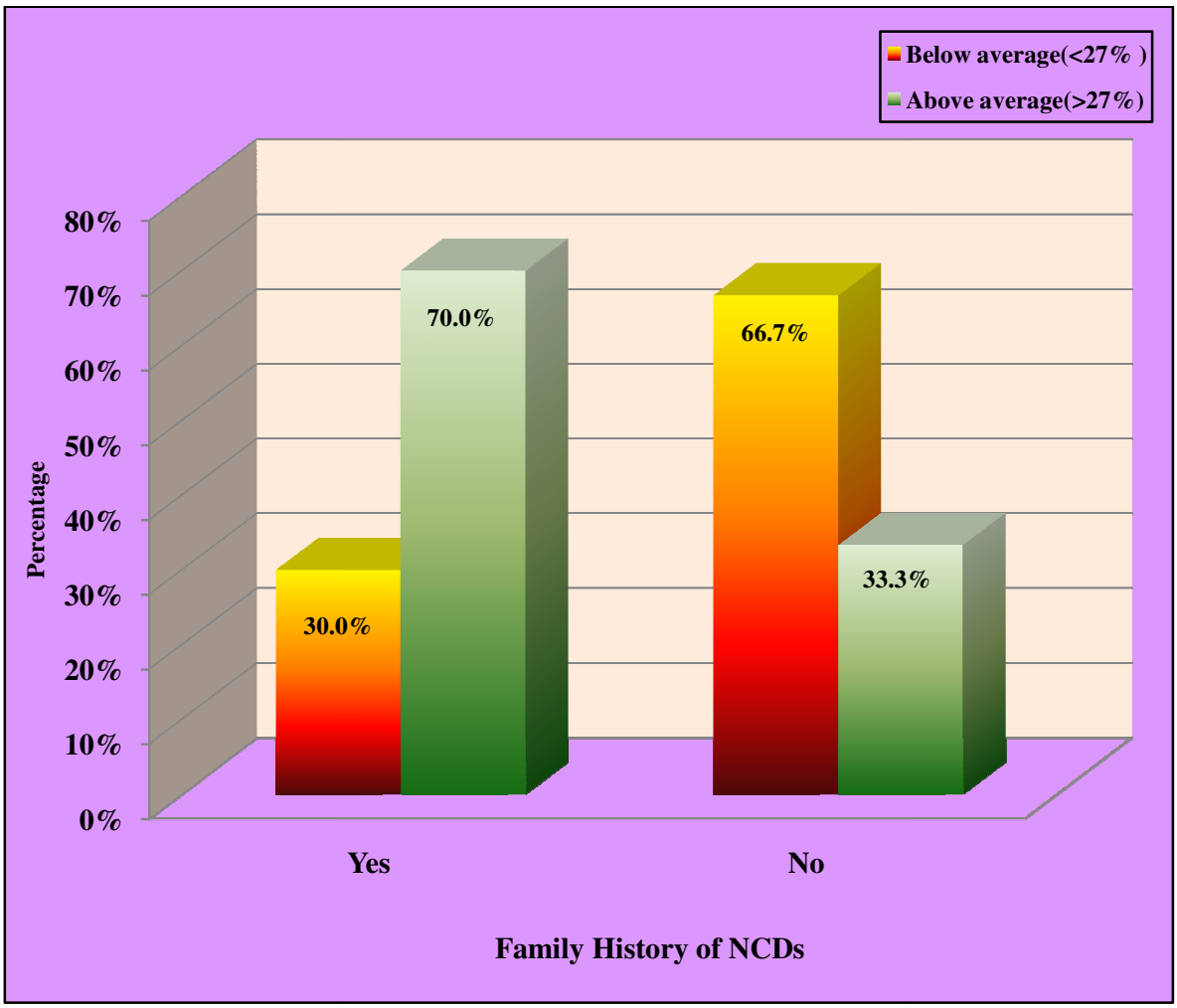


Figure 5.5.3(b): Association of demographic variable family history of NCDs with the mean differed practice of obese adults in the experimental group

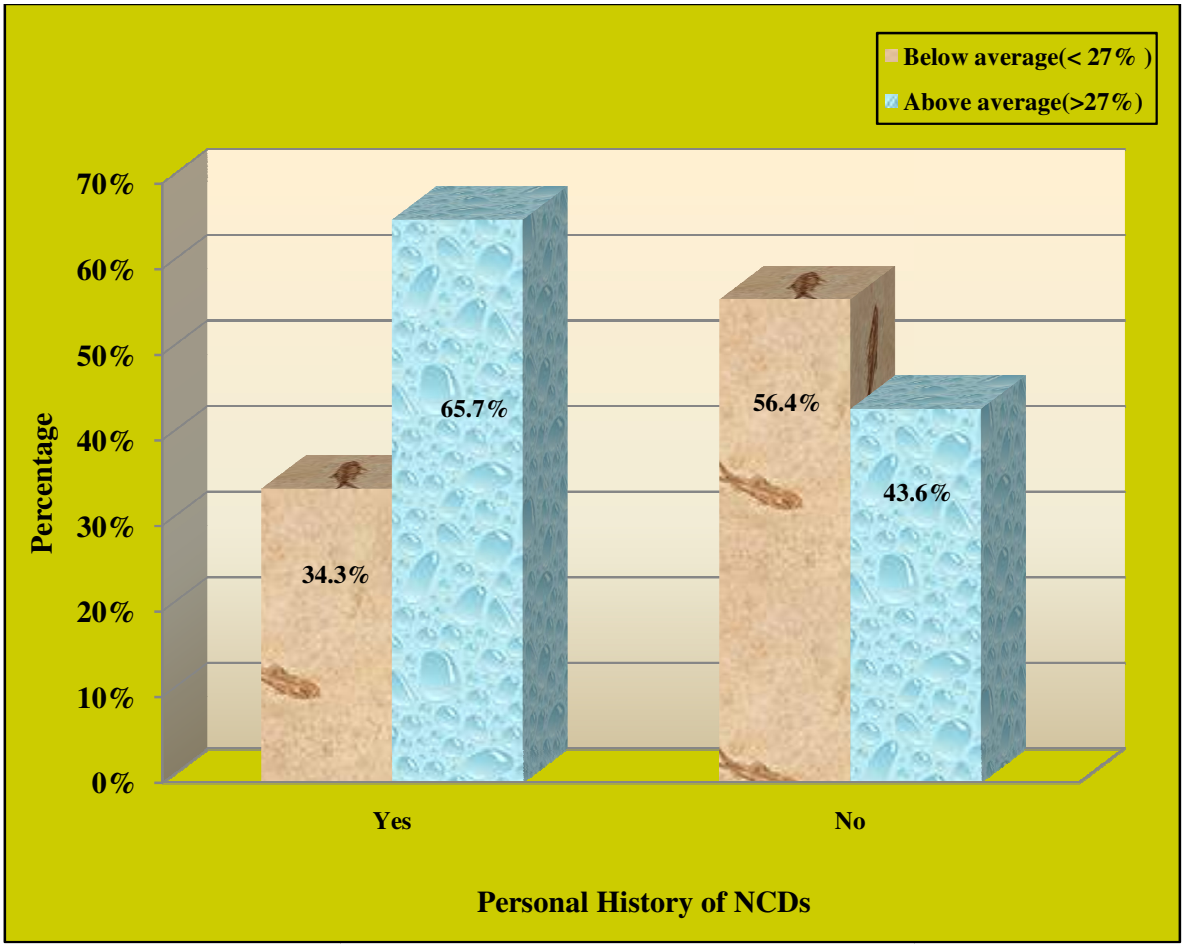


Figure 5.5.3(c): Association of demographic variable personal history of NCDs with the mean differed practice of obese adults in the experimental group

Table 5.5.4: Association of mean differed obesity reduction with selected demographic variables of obese adults in the experimental group N = 110

Demographic Variables		Level of Obesity reduction				Total	Chi-square test
		Below average(<9%)		Above average(>9%)			
		N	0	N	0		
Gender	Male	9	30.00	21	70.00	30	**χ^2=6.60 p=0.01****
	Female	46	57.50	34	42.50	80	
Family history of NCD	Yes	15	30.00	35	70.00	50	**χ^2=14.66 p=0.01****
	No	40	66.70	20	33.30	60	
Habit of Exercise	Yes	1	12.50	7	87.50	8	**χ^2=4.45 p=0.03***
	No	54	52.90	48	47.10	102	

* significant at P≤0.05 ** highly significant at P≤0.01 *** very high significant at P≤0.001

The above table 5.5.4 reveals the association of mean differed obesity reduction with selected demographic variables of obese adults in the experimental group.

Chi-square test findings revealed that there was statistically significant association was found for the demographic variable gender (χ^2 = 6.60 p=0.01), habit of exercise (χ^2 = 4.45 at p=0.03 level) and family history of NCDs (χ^2 = 14.66 at p=0.01 level) with the mean differed obesity reduction of obese adults which indicated that Obesity reduction was found with male obese adults with family history of NCDs and habit of exercise.

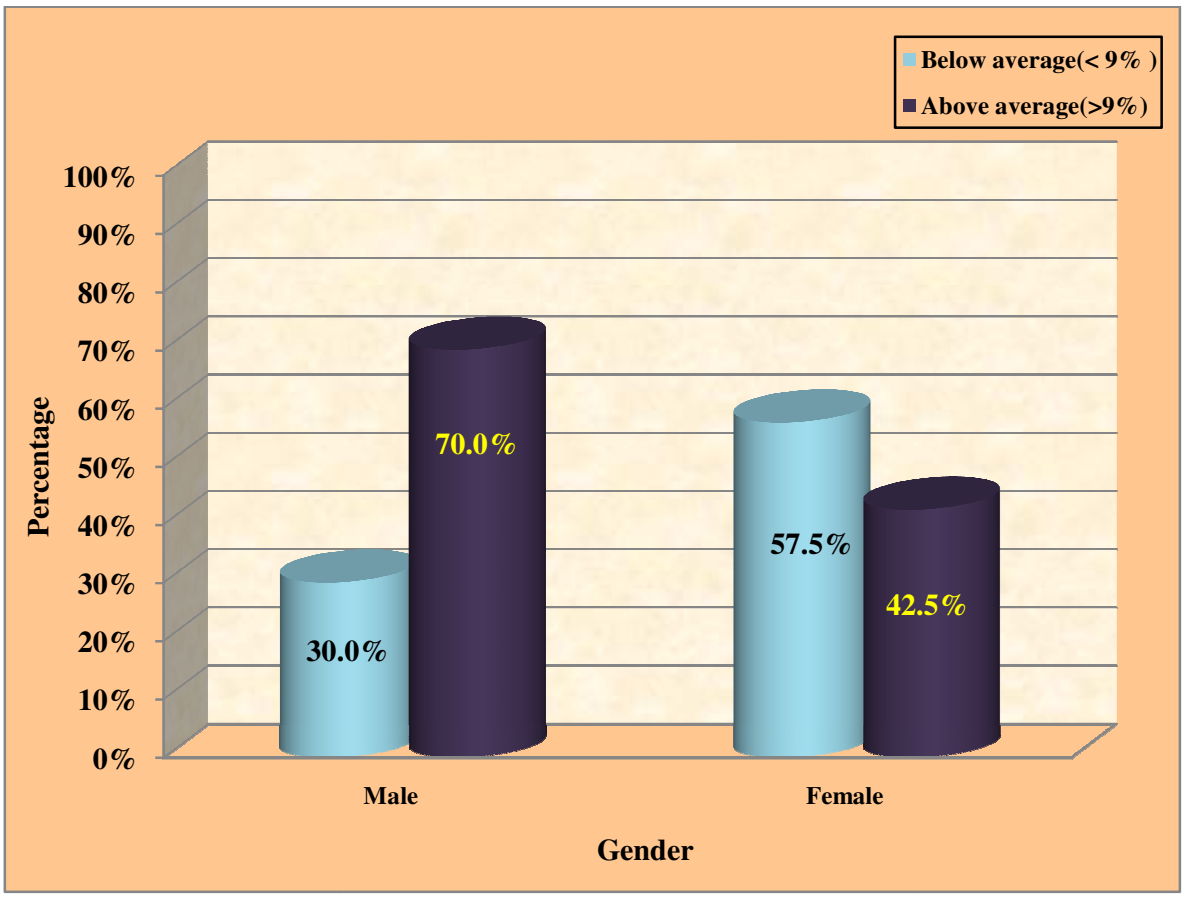


Figure 5.5.4(a): Association of demographic variable gender with the mean differed obesity reduction of obese adults in the experimental group

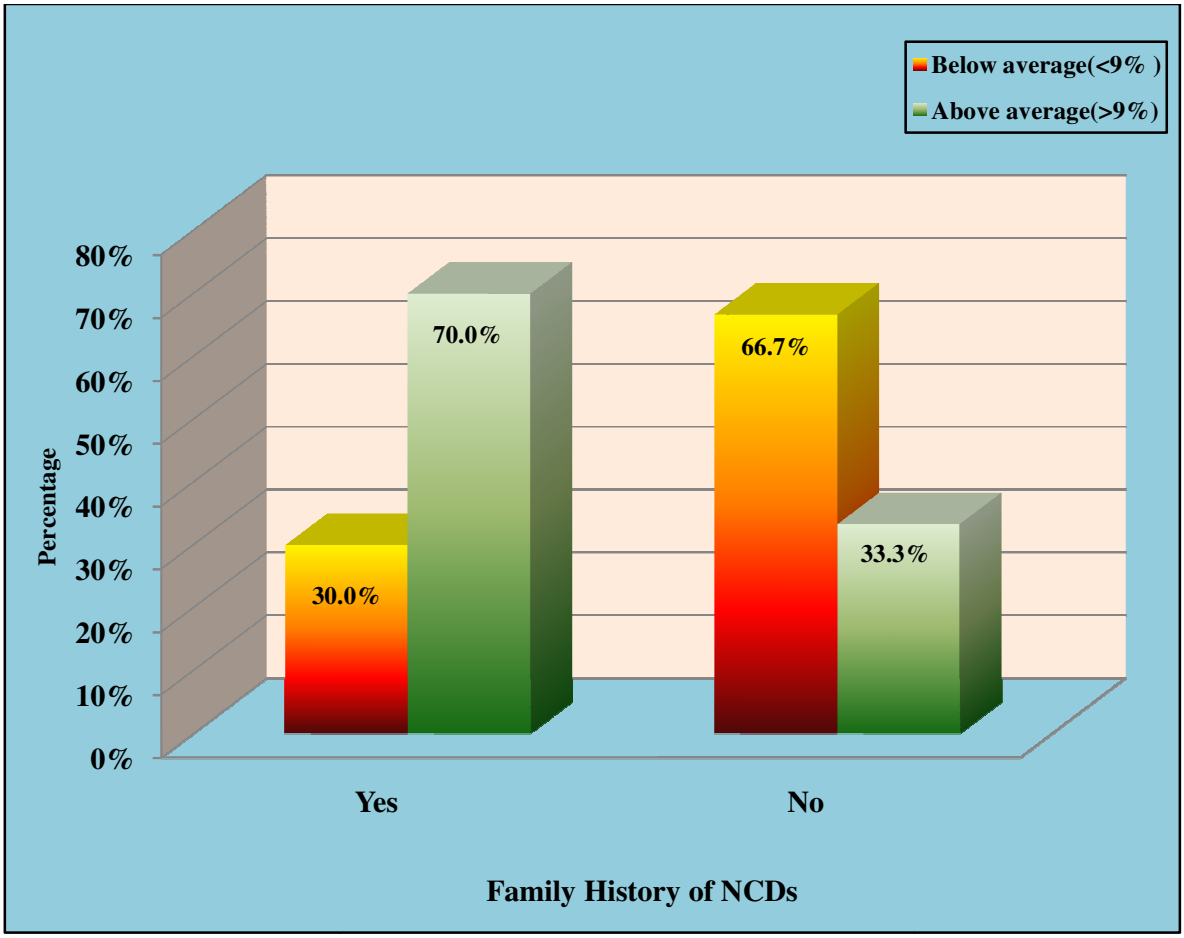


Figure 5.5.4(b): Association of demographic variable family history of NCDs with the mean differed obesity reduction of obese adults in the experimental group

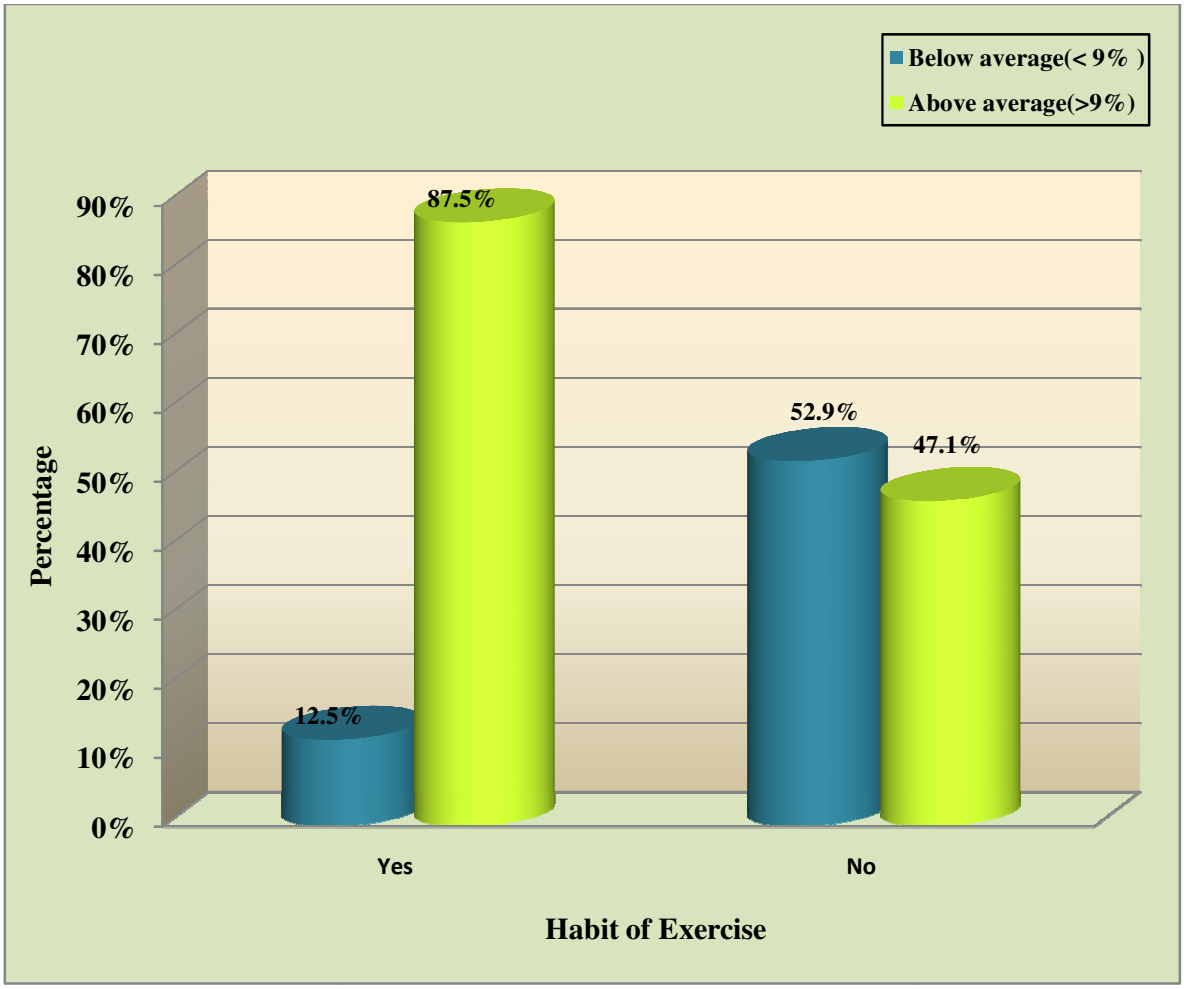


Figure 5.5.4(c): Association of demographic variable habit of exercise with the mean differed obesity reduction of obese adults in the experimental group

CHAPTER – 6

DISCUSSION

The present study was executed to assess the effectiveness of Rural Obesity Reduction Program on knowledge, attitude, practice towards obesity and obesity reduction among the obese adults. The findings of the study proved that there was a significant improvement in the level of knowledge, attitude, practice towards obesity and obesity reduction among the obese adults in the experimental group after the administration of behavioral interventions. The findings are discussed and presented objective wise below:

Description of obese adults based on their back ground variable

Totally 220 samples participated in the study each 110 to experimental and control group. With respect to age, 40(36.4%) of them were in both 31-40 yrs and 41-50 yrs age group for both experimental and control group. Considering the gender, maximum of the samples 80(72.70%) were female in both experimental and control group. With regard to education, 35(31.8%) had high school education in the experimental group and 27(24.5%) had middle school education in control group.

When looking into the occupation, 41(37.3%) of the experimental group and 46(41.8%) of the control group were unskilled worker. When analyzing the monthly family income, majority 66(60%) of the experimental and 55(50%) of control group were in Rs 3301-7300 category. When observing the marital status, maximum 95(86.4%) of the experimental and 92(83.6%) of the control group were married. Regarding the type of family, 70(63.6%) of the experimental group and 73(66.4%) of control group

were in nuclear family. With respect to family size, 55(50%) of the experimental group and 66(60%) of the control group had small family size.

With respect to family history of NCDs, 50(45.5%) of the experimental and 47(42.7%) of the control group had the family history of NCDs. With respect to the personal history of NCDs, 32(29.1%) of the experimental and 25(22.7%) of the control group had the NCDs. When observing the history of sleep, 62(56.4%) of the experimental and 57(51.8%) of the control group had regular sleep pattern.

With regard to history of smoking 12(10.9%) in experimental and 15(13.6%) in control group were having the habit of smoking. Regarding the use of smokeless tobacco, 11(10.0%) in experimental and 13(11.8%) in control group were having the history of use of smokeless tobacco. With relevance to use of Alcohol, 16(14.5%) in experimental and 12(10.9%) in control group were having the history of use of alcohol. With regard to habit of exercise, 8(7.3%) of the experimental and 7(6.4%) of the control group had the habit of exercise.

With respect to history of cyst in the ovary, 15(18.8%) of the experimental and 14(17.5%) of the control had the cyst in the ovary. With relevance to attainment of menopause, 16(20.0%) of the experimental and 12(15.0%) of the control had attained the menopause. With respect to history of hysterectomy, 3(3.8%) of the experimental and 5(6.3%) of the control had undergone hysterectomy.

The chi square test revealed that there was no statistically significant difference between the experimental and control group in their general demographic variables which proved the homogeneity of the population.

The first objective was to assess and compare the pretest and post test knowledge, attitude, practice and obesity among the obese adults in experimental and control groups.

Study findings presented in table 5.2.3 showed the comparison of overall pre and post test level of knowledge among the obese adults in experimental and control group. The analysis revealed that in the pretest none of the samples had adequate knowledge; 62(56.4%), 48(43.6%) of experimental and 60(54.5%), 50(45.5%) of control had moderate and inadequate knowledge respectively which revealed the homogeneity of samples in the pretest. After implementation of RORP the post test result revealed that majority 79(71.8%) of obese adults in the experimental group had adequate knowledge but the same status continued in the control group.

Study findings presented in table 5.2.4 showed the overall pre and post test level of attitude among the obese adults in experimental and control group. The analysis revealed that in the pretest none of the samples had favorable attitude; 82(74.5%), 28(25.5%) of experimental and 85(77.3%), 25(22.7%) of control had moderate and unfavorable attitude respectively which revealed the similarity of samples in the pretest. After implementation of RORP the post test result revealed that majority 93(84.5%) of obese adults in the experimental group had favorable attitude but none of them had favorable attitude in the control group.

Study findings presented in table 5.2.7 showed the overall pre and post test level of practice among the obese adults in experimental and control group. The analysis revealed that in the pretest none of the samples had good practice, 95(86.4%), 15(13.6%) of the experimental and 96(87.3%), 14(12.7%) of control had moderate and poor practice respectively which revealed the similarity of samples in the pretest. After implementation of RORP the post test result revealed that majority 82(74.5%) of obese adults in the experimental group had good practice but none of them had good practice in the control group.

Study findings presented in table 5.2.8 showed the overall pre and post test level of obesity (BMI) among the obese adults in experimental and control group. The analysis revealed that in the pretest the majority 75(68.2%), 21(19.1%), 4(3.6%), 8(7.3%), 2(1.8%) of the obese adults in experimental and 66(60.0%), 28(25.5%), 3(2.7%), 10(9.1%), 3(2.7%) in control had class I, class II, class III obesity, over weight and normal BMI respectively, revealing the homogeneity of samples in the pretest. After implementation of RORP the post test 1 result revealed that in class I obesity the number reduced to 69(62.7%) from75(68.2%), the overweight category increased from 8(7.3%) to 22(20.0%) which indicates that the BMI is gradually reducing and samples were moving towards the low risk category in experimental group. In post test 2 of obese adults in the experimental group none of them had class III obesity and number in class I and class II reduced to 62(56.4%) and7(6.4%) respectively. In contrast status of the control group remained the same and for class III obesity the number of obese adults increased from 3(2.7%) to 4(3.6%) which indicated the movement towards high risk.

Study findings presented in table 5.2.9 showed the overall pre and post test level of obesity (WC) among the obese adults in experimental and control group. The analysis revealed that in the pretest 68(61.8%), 38(34.5%) of the samples in experimental and 61(55.5%), 47(42.7%) in control were in action level II and obese category respectively, revealing the similarity of samples in the pretest. After implementation of RORP the post test 1 result revealed that number in obesity category reduced to 34(30.9%) from38(34.5%), the action level I increased from 4(3.6%) to 7(6.4%) which indicated that the WC is gradually reducing and samples were moving towards the low risk category in experimental group. In post test 2 of obese adults in the experimental group the number in obesity category further reduced to 26(23.6%) and action level I increased to 22(20.0%) which showed the movement towards the low risk. In contrast the control group status remained the same.

Study findings presented in table 5.2.10 showed the overall pre and post test level of PBF among the obese adults in experimental and control group. The analysis revealed that in the pretest none of them had ideal value and the majority 98(89.1%) of the samples in experimental, 100(90.90%) in control were under obesity level which revealed the similarity of samples in the pretest. After implementation of RORP the post test 1 result revealed that the number in obesity slightly reduced to 93(84.5%) from 98(89.1%), the number in average category increased from 12(10.9%) to 17(15.5%) which indicated that the PBF is gradually reducing and samples were moving towards the low risk category in experimental group. In post test 2 of obese adults in the experimental group the number in obese category further reduced to 84(76.4%) and the number in average category further increased to 26(20.00%) from 17(15.5%). In

contrast the control group status remained the same and for obesity category the number of samples increased to 101(91.8%) which indicated movement towards high risk.

The statistical analysis above proved that the RORP had significant impact in improving the knowledge, attitude, practice towards obesity and obesity reduction of obese adults of the within and between the experimental group and control group at $p<0.001$ level. Thus the null hypothesis **NH_1** stated that **"There is no significant difference in the pre and post test level of knowledge, attitude, practice and obesity reduction among the obese adults within and between the experimental and control group at $p<0.05$"** was not accepted for the experimental group and accepted for the control group.

The present study findings were consistent with findings of the following study

Ranjana Tiwari, Dhiraj Srivastava, and Neeraj Gour(2009)[23] conducted a cross sectional study to determine the prevalence of obesity in both sexes in persons aged 30 years and above to determine the relationship of epidemiological determinants on the obesity status in the study subjects. A house-to-house survey method was used and findings showed that 34.4% of males and 31.3 % of females were either obese or over weight. There was a statistically significant difference noted in the preference towards fried food and fast food between obese/overweight and persons with normal BMI. The study recommended that BMI plays a crucial role in its early detection as it is simple to calculate and can even detect the pre-obesity stage in time

The second objective was to determine the effectiveness of Rural Obesity Reduction Program on knowledge, attitude, practice and obesity reduction of obese adults.

Findings presented in table 5.3.5 explained that for the experimental group the mean knowledge in the pretest was 10.67 with the SD of 2.39 and in post test it was

19.81 with SD of 2.31. The student's dependent t-test revealed that t=35.61 at p=0.001 level which indicated that there was very high statistically significant difference between pre and post test. In contrast the mean knowledge for control group in the pretest was 10.80 with the SD of 2.18 and in post test it was 11.19 with SD of 2.18. The t value was t=1.64 at p=0.10 level which showed that there was no statistically significant difference between pre and post test.

Study findings in table 5.3.5 also revealed that the overall pretest mean knowledge score for the experimental group was 10.67 with the SD of 2.39 and for control group it was 10.80 with the SD of 2.18 which was almost equal for both the group. The t value was t=0.41, p=0.68 which showed no significance. In contrast the overall posttest mean knowledge score for the experimental group was 19.81 with the SD of 2.31 and for control group it was 11.19 with the SD of 2.18. The t value was t=28.47 p=0.68 which showed very high statistical significance. The mean gained knowledge score for the experimental group was 9.14(36.6%) and for control group it was only 0.39(1.5%) which showed that the experimental group had improved to a great extent.

Findings presented in table 5.3.6 explained that for the experimental group the mean attitude score in the pretest was 45.94 with the SD of 7.61 and in post test it was 80.45 with SD of 5.18. The student's dependent t-test revealed that t=36.95 at p=0.001 level which indicated that there was very high statistically significant difference between pre and post test. In contrast the mean attitude score for control group in the pretest was 47.08 with the SD of 7.53 and in post test it was 48.55 with SD of 8.42. The t value was t=1.86 at p=0.08 level which showed that there was no statistically significant difference between pre and post test.

Study findings in table 5.3.6 also revealed that the overall pretest mean attitude score for the experimental group was 45.94 with the SD of 7.64 and for control group it was 47.08 with the SD of 7.53 which proved the homogeneity of the group. The t value was t=1.12 p=0.26 which showed no significance. In contrast the overall posttest mean attitude score for the experimental group was 80.45 with the SD of 5.18 and for control group it was 48.55 with the SD of 8.42. The t value was t=33.84 p=0.001 which showed very high statistical significance. The mean gained attitude score for the experimental group was 34.51(34.5%) and for control group it was only 1.47(1.5%) which showed that the experimental group had improved to a great extent.

Findings presented in table 5.3.11 explained that for the experimental group the mean practice score in the pretest was 80.79 with the SD of 11.98 and in post test it was 129.17 with SD of 7.49. The student's dependent t-test revealed that t=53.10 at p=0.001 level which indicates that there was very high statistically significant difference between pre and post test. In contrast the mean practice score for control group in the pretest was 82.93 with the SD of 12.83 and in post test it was 84.95 with SD of 15.51. The t value was t=1.58 at p=0.11 level which showed that there was no statistically significant difference between pre and post test.

Study findings in table 5.3.11 also revealed that the overall pretest mean practice score for the experimental group was 80.79 with the SD of 11.99 and for control group it was 82.93 with the SD of 12.83 which proved the similarity of the group. The t value was t=1.27, p=0.20 which showed no significance. In contrast the overall posttest mean practice score for the experimental group was 129.17 with the SD of 7.50 and for control group it was 84.95 with the SD of 15.51. The t value was t=26.91, p=0.001 which

showed very high statistical significance. The mean gained practice score for the experimental group was 48.38(27.6%) and for control group it was only 2.02(1.2%) which showed that the experimental group had improved to a great extent.

Findings presented in table 5.3.22 explained that for the experimental group the mean BMI score in the pretest was 28.17 with the SD of 3.02 and in post test it was 25.52 with SD of 2.89. The Repeated measures ANOVA F-test revealed that F=25.90 at p=0.001 level which indicates that there was very high statistically significant difference between pre and post test. In contrast the mean BMI score for control group in the pretest was 28.12 with the SD of 3.00 and in post test it was 28.00 with SD of 3.11. The F value was F=0.11 at p=0.90 level which showed that there was no statistically significant difference between pre and post test.

Study findings in table 5.3.22 also revealed that the overall pretest mean BMI score for the experimental group was 28.17 with the SD of 3.02 and for control group it was 28.12 with the SD of 3.00 which was almost equal for both the group. The t value was t=0.10, p=0.92 which showed no significance. In contrast the overall posttest mean BMI score for the experimental group was 25.52 with the SD of 2.89 and for control group it was 28.00 with the SD of 3.11. The t value was t=6.12, p=0.001 which showed very high statistical significance. The mean reduction in the BMI score for the experimental group was 2.64(9.4%) and for control group it was only 0.12(0.4%) which showed that the experimental group had improved.

Findings presented in table 5.3.23 explained that for the experimental group the mean WC score in the pretest was 91.38 with the SD of 6.88 and in post test it was 88.46

with SD of 7.20. The Repeated measures ANOVA F-test revealed that F=4.70 at p=0.001 level which indicates that there was very high statistically significant difference between pre and post test. In contrast the mean WC score for control group in the pretest was 91.45 with the SD of 6.78 and in post test it was 90.85 with SD of 6.84. The F value was F=0.19 at p=0.82 level which showed that there was no statistically significant difference between pre and post test.

The study findings in table 5.3.23 also revealed that the overall pretest mean WC score for the experimental group was 91.38 with the SD of 6.88 and for control group it was 91.45 with the SD of 6.78 which was almost equal for both the group The t value was t= 0.08, p=0.93 which showed no significance. In contrast the overall posttest mean WC score for the experimental group was 88.46 with the SD of 7.20 and for control group it was 90.85 with the SD of 6.84. The t value was t=2.52, p=0.01 which showed very high statistical significance The mean reduction in the WC score for the experimental group was 2.92(3.2%) and for control group it was only 0.60(0.7%) which showed that the experimental group had improved.

Findings presented in table 5.3.24 explained that for the experimental group the mean PBF score in the pretest was 34.77 with the SD of 5.21 and in post test it was 32.49 with SD of 5.35. The Repeated measures ANOVA F-test revealed that F=5.16 at p=0.001 level which indicates that there was very high statistically significant difference between pre and post test. In contrast the mean PBF score for control group in the pretest was 34.85 with the SD of 5.57 and in post test it was 34.69 with SD of 5.56. The F value was F=0.07 at p=0.92 level which showed that there was no statistically significant difference between pre and post test.

Study findings in table 5.3.24 also revealed that the overall pretest mean PBF score for the experimental group was 34.77 with the SD of 5.21 and for control group it was 34.85 with the SD of 5.57 which was almost equal for both the group. The t value was t= 0.12 p=0.91. In contrast the overall posttest mean PBF score for the experimental group was 32.49 with the SD of 5.35 and for control group it was 34.69 with the SD of 5.44. The t value was t=2.14, p=0.03 which showed statistical significant difference. The mean reduction in the PBF score for the experimental group was 2.27(6.5%) and for control it was only 0.16(0.5%) which showed that the experimental group had improved.

The statistical analysis above proved that the Rural Obesity Reduction Programme had significant impact on improving the knowledge, attitude, practice towards obesity and obesity reduction of obese adults between the experimental and control group and also between the pretest and post test of experimental group at $p<0.001$ level. Thus the null hypothesis $\mathbf{NH_1}$ stated that **"There is no significant difference in the pre and post test level of knowledge, attitude, practice and obesity reduction among the obese adults within and between the experimental and control group at $p<0.05$"** was not accepted for the experimental group and accepted for the control group.

The present study results are consistent with the findings of the following studies

Praween Agrawal, Kamla Gupta, Vinod Mishra & Sutapa Agrawal (2013)[34] examined the effects of sedentary lifestyle and dietary habits on BMI change in a follow-up study of 325 women (aged 15–49 years) in Delhi, systematically selected from the 1998–1999 NFHS samples who were re-interviewed after 4 years in 2003. Information was collected on height, weight, dietary habits, and sedentary lifestyle through face-to-face interviews. Overall, a 2.0-point increase in mean BMI was found among women in

just 4 years. Every second normal-BMI woman, two in five overweight women and every fourth obese woman experienced a > 2.0-point increase in her mean BMI. High sedentary lifestyle (OR: 2.63; 95% CI: 1.29–5.35) emerged as the main predictor of a > 2.0-point increase in mean BMI in adjusted analysis, but there was weak evidence of association with the dietary covariates. Findings suggested that a high sedentary lifestyle is a determinant of weight gain among adult women in urban India.

Astrup A (2009)[123] conducted a review to assess the dietary management of obesity and reported that the reduction of the total fat content of diets produced weight loss in both the short term and over periods as long as 7 years. A fat-reduced diet, combined with physical activity reduced almost all risk factors for cardiovascular disease and also reduced the incidence of type 2 diabetes. The combination of reduction of dietary fat and energy and increased physical activity had been shown to reduce the incidence of diabetes by 58% in 2 major trials. In post hoc analyses, the reduction in dietary fat (energy density) and increase in fiber were the strongest predictors of weight loss and diabetes-protective effects. Low-carbohydrate diets may be an option for inducing weight loss in obese patients, but a very low intake of carbohydrate-rich foods is not commensurate with a healthy and palatable diet in the long term. However, there is evidence that increasing the protein content of the diet from 15% up to 20%-30%, at the expense of carbohydrates, increases the satiating effect of the diet and induces a spontaneous weight loss and this could turn out to be a preferred option for patients with metabolic syndrome and type 2 diabetes.

PK Newby, Denis Muller (2003)[35] conducted a longitudinal study to elucidate the nutritional etiology of changes in BMI and WC by dietary intake pattern. 459 healthy

men and women participated in the study. Five dietary patterns were derived (healthy, white bread, alcohol, sweets and meat and potatoes). The mean annual change in BMI was 0.30 ± 0.06 for subjects in the meat-and-potatoes cluster and 0.05 ± 0.06 for those in the healthy cluster ($P < 0.01$). The mean annual change in waist circumference was more than 3 times as great for subjects in the white-bread cluster (1.32 ± 0.29 cm) as for those in the healthy cluster (0.43 ± 0.27 cm) ($P < 0.05$). The study concluded that consuming a diet high in fruit, vegetables, reduced-fat dairy, whole grains, low red and processed meat, fast food and soda was associated with smaller gains in BMI and waist circumference.

Penny Gordon-Larsen, Ningqi Hou et al., (2008)[38] conducted a prospective study to evaluate the association between changes in leisure-time walking and weight gain over a 15-y period. Prospective data from the Coronary Artery Risk Development in Young Adults (CARDIA) Study of 4995 men and women aged 18–30 y at baseline (1985–1986) from 4 US cities were collected and re examined at 2, 5, 7, 10, and 15 y later and found that Mean (±SE) baseline weights were 77.0 ± 0.3 kg (men) and 66.2 ± 0.3 kg (women), weight gain was ≈1 kg/y, and the mean duration of walking at baseline was <15 min/d. After accounting for non walking physical activity, calorie intake, and other covariates, found a substantial association between walking and annualized weight change; the greatest association was for those with a larger baseline weight. The study concluded that walking throughout adulthood may attenuate the long-term weight gain that occurs in most adults.

Cris A. Slentz, Joseph A. Houmard and William E. Kraus (2009)[36] conducted a review with a aim to highlight some of the efficacy-based data on the effects of exercise

(and also a sedentary lifestyle) on abdominal obesity, visceral fat, and metabolic risk and how impaired fatty acid oxidation (FAO) in skeletal muscle may be related to both insulin resistance and a contributor to weight gain. In was evident that exercise in sufficient amounts can lead to substantial decreases in body weight, total body fat, and visceral fat. Additionally, evidence now supports the conclusion that there is a dose–response relationship between exercise amount and these changes, i.e., more exercise leads to additional benefits. Unfortunately, it is also apparent that in sedentary middle-aged men and women, short periods of physical inactivity lead to significant weight gain, substantial increases in visceral fat, and further metabolic deterioration. Finally, favorable modulation of mitochondrial oxidative capacity in skeletal muscle by exercise training may reduce a block for complete oxidation of fatty acids in muscle and thereby relieve a block to effective insulin signaling.

The third objective was to to identify the relationship among the knowledge, attitude, practice and obesity reduction in the pre and post test of experimental and control group.

The findings presented in table 5.4.1 showed that for experimental group in the pretest there was no significant relationship among the variables. In contrast statistically significant relationship was found at the post test. Moderate and fair positive correlation was found between knowledge Vs attitude (r=0.42, p=0.001), knowledge Vs practice (r=0.5, p=0.001) and attitude Vs practice (r=0.39, p=0.01) which indicated that when the knowledge increased the attitude and practice also increased. Fair negative correlation was found between knowledge Vs obesity (r=-0.38, p=0.001), attitude Vs obesity (r=-0.30, p=0.01) and practice Vs obesity (r=-0.35, p=0.01) which showed that when knowledge, attitude and practice increased the level of obesity was reduced.

The findings presented in table 5.4.1 also showed that there was no statistically significant relationship was found among the variables in the pre and post test of the control group.

The statistical analysis proved that the Rural Obesity Reduction Programme had significant impact in improving the relationship among the knowledge, attitude, practice towards obesity and obesity reduction of obese adults of the experimental group at $p<0.001$ level. Thus the null hypothesis **NH_2** stated that **"There is no significant relationship among the knowledge, attitude, practice and obesity reduction in the pre and post test of the experimental and control group at $p<0.05$.**" was not accepted for the experimental group and accepted for the control group.

The fourth objective was to associate the mean differed knowledge, attitude, practice and obesity reduction of obese adults in the experimental group with their selected demographic variables.

Regarding the knowledge and demographic variable, the Chi-square test findings in table 5.5.1 revealed that there was statistically significant association was found for the demographic variable age ($x^2=7.03$, $p=0.03$), gender ($x^2=4.58$, $p=0.03$) and family history of NCD ($x^2=7.18$, $p=0.01$) with the mean differed knowledge of obese adults. There was no statistically significant association was established for other demographic variables like education, occupation, income, marital status, type of family, family size, history of NCD, history of smoking, use of alcohol and habit of exercise.

With respect to the attitude and demographic variable, the Chi-square test findings in table 5.5.2 revealed that there was statistically significant association was

found for the demographic variable age (x^2=9.80, p=0.01), education (x^2=10.61, p=0.05) and personal history of NCD (x^2=6.34, p=0.05) with the mean differed attitude of obese adults. There was no statistically significant association was established for other demographic variables like gender, occupation, income, marital status, type of family, family size, family history of NCD, , history of smoking, use of alcohol and habit of exercise.

Considering the practice and demographic variable, the Chi-square test findings in table 5.5.3 revealed that there was statistically significant association was found for the demographic variable age (x^2=7.03, p=0.02), family history of NCD (x^2=14.66, p=0.01) and personal history of NCD (x^2=4.40, p=0.03) level with the mean differed practice of obese adults. There was no statistically significant association was established for other demographic variables like gender, education, occupation, income, marital status, type of family, family size, history of smoking, use of alcohol and habit of exercise.

With relevance to the obesity reduction and demographic variable, the Chi-square test findings in table 5.5.4 revealed that there was statistically significant association was found for the demographic variable gender (x^2=6.60, p=0.01), family history of NCD (x^2=14.66, p=0.01) and habit of exercise (x^2=4.45, p=0.03) level with the mean differed obesity reduction of obese adults. There was no statistically significant association was established for other demographic variables like age, education, occupation, income, marital status, type of family, family size, history of NCDs, history of smoking, use of alcohol and habit of exercise.

Hence, the NH_3 stated earlier that **"There is no significant association of mean differed knowledge, attitude, practice and obesity reduction of obese adults of the experimental group with their selected demographic variables at p<0.05**" was not accepted for the demographic variable age, gender, education, family history of NCDs, personal history of NCDs and habit of exercise and accepted for the other demographic variables.

The present study findings are consistent with the following studies

Sherina Mohd Sidik, Lekhraj Rampal (2009)[37] conducted a community based cross sectional study with the aim to determine the prevalence and factors associated with obesity among adult women in Selangor. 972 women participated in the study. The mean age was 37.91 ± 10.91. The prevalence of obesity among the respondents was 16.7% (mean = 1.83 ± 0.373). Obesity was found to be significantly associated with age (p = 0.013), ethnicity (p = 0.001), religion (p = 0.002), schooling (p = 0.020), educational level (p = 0.016), marital status (p = 0.001) and the history of suffering a miscarriage within the past 6 months (p = 0.023).

Jain A, Paranjape S (2013)[83] did retrospective analysis of all elderly patients following up in primary care hospital to find the exact prevalence of T2DM in elderly. It was observed that from total 585 elderly people of which 178 had T2DM (30.42%-Prevalence). The sex ratio of Diabetic males to females was almost equal (1:0.97). Obesity was present in 114 people (64%). High prevalence of hypertension was found in Diabetic elderly population (80%). The contributing factors were urban living with high prevalence of central obesity and Asian ethnicity. The study concluded that occurrence of NCDs was directly associated with obesity.

The present was guided by the conceptual framework based on integrated omaha system model of problem solving and integrated theory of health behaviour change (ITHBC). Omaha system included the following components: Problem Classification Scheme, Intervention scheme and Problem rating scale for outcomes. Based on the components the investigator identified the knowledge, attitude, practice and level of obesity problems which was used to plan the individualized interventions. The interventions were implemented and evaluated the outcome at two stages of proximal and distal outcomes. Thus the conceptual framework aided the investigator to identify problem, to plan and implement the intervention and to evaluate the outcome.

According to ITHBC the health behavior change can be enhanced by fostering knowledge and beliefs, increasing self-regulation skills and abilities and enhancing social facilitation. Engagement in self-management behaviors is seen as the proximal outcome, and this, in turn, influences the long term outcome of improved health status. Person-centered interventions are directed to increase knowledge and beliefs, self-regulation skills and abilities, and social facilitation. Accordingly the investigator planned the personalized behavioural interventions (IEC, dietary and physical activity modification and individual counseling) which helped the obese adults to gain knowledge, attitude and practice. The obese adults modified their dietary, physical activity and lifestyle practices and engaged in self management behavior. Reduction in the level of obesity was seen as improved health status. Thus the conceptual framework aided the investigator to implement the RORP effectively.

Thus the major concepts of both the theories guided the evidence generation and helped the investigator to achieve the objectives of this study.

The above discussions clearly showed that there has been a statistically significant impact of the Rural Obesity Reduction Programme on knowledge, attitude, practice towards obesity and obesity reduction of obese adults. This draws the conclusion for the study that Rural Obesity Reduction Programme can be used as an effective tool by community health nurses, nurse educators, nurse administrators, nurse researchers and other health care professionals for the obesity prevention and management.

CHAPTER – 7

SUMMARY, CONCLUSION, IMPLICATIONS, RECOMMENDATIONS AND LIMITATIONS

The present study was aimed to assess the effectiveness of Rural Obesity Reduction programme on knowledge, attitude, practice towards obesity and obesity reduction among the obese adults.

7.1 SUMMARY

Overweight and obesity are the fifth leading risk for global deaths. At least 2.8 million adults die each year as a result of being overweight or obese. In addition, 44% of the diabetes burden, 23% of the ischemic heart disease burden and between 7% to 41% of certain cancer burdens are attributable to overweight and obesity. WHO global estimates of 2008 reported that more than 1.4 billion adults, 20 and above, were overweight and of these overweight adults, over 200 million men and nearly 300 million women were obese. Overall, more than 10% of the world's adult population was obese. 35% of adults aged 20 and over were overweight in 2008, and 11% were obese[3].

The statement of the problem was

A true experimental study to assess the effectiveness of Rural Obesity Reduction Program (Behavioural intervention) on Knowledge, Attitude, Practice towards Obesity and Obesity reduction among the obese adult population at selected rural communities of Omayal Achi Community Health Centre.

The objectives of the study were

1. To assess and compare the pretest and post test level of knowledge, attitude, practice and obesity among the obese adults in experimental and control groups.
2. To determine the effectiveness of Rural Obesity Reduction Program on knowledge, attitude, practice and obesity reduction of obese adults.
3. To identify the relationship among the knowledge, attitude, practice and obesity reduction in the pre and post test of experimental and control group.
4. To associate the mean differed knowledge, attitude, practice and obesity reduction of obese adults in the experimental group with their selected demographic variables.

The Null Hypotheses formulated were

NH_1: There is no significant difference in the pre and post test level of knowledge, attitude, practice and obesity reduction among the obese adults within and between the experimental and control group at $p<0.05$.

NH_2: There is no significant relationship among the knowledge, attitude, practice and obesity reduction in the pre and post test of the experimental and control group at $p<0.05$.

NH_3: There is no significant association of mean differed knowledge, attitude, practice and obesity reduction of obese adults of the experimental group with their selected demographic variables at $p<0.05$.

The major assumptions were

- Obesity may be more prevalent among the rural adults.

- The level of Obesity may be contributed by non – modifiable factors (Age, Gender, and genetic impact) and modifiable factors (dietary, physical activity and lifestyle practices- sleep, smoking, exercise and alcohol consumption).
- Rural obese adults may need assistance to cope with the problem and its management to lead a healthy life.
- The behavioural interventions may enhance the obese adults' knowledge, attitude, practice and may reduce the level of obesity, which will prevent the development of co-morbidities and its complications.

The conceptual framework for the present study was based on the integrated Omaha System Model of the problem solving process and Integrated Theory of Health Behaviour Change which guided the investigator to bring out behaviour modification in dietary, physical activity and lifestyle modification among the obese adults.

A true experimental design was used for the study. The dependent variables were knowledge, attitude, practice towards obesity and obesity reduction of the obese adults and the independent variable was Rural Obesity Reduction Programme. The study was conducted at adopted villages of Omayal Achi Community Health Centre (OACHC), Arakambakkam.

Multi stage sampling technique (Probability Sampling technique) was used to select the samples. At first stage six villages were selected from 18 villages by Simple Random Sampling technique. Then the selected six villages were screened for obese adults. Totally 881 available adults were screened of which 504 adults were identified as obese from six villages.

At the second stage three villages were allocated to each experimental and control group by using Simple Random Sampling technique. At the third stage Computerized Random Generation method was used to select 113 samples for each experimental and control group. The final sample size after the attrition was 110 for each group.

The data was collected by using Structured interview schedule for knowledge, Rating scale to assess the attitude, FFQ, 3 day dietary recall, dietary, physical activity and life style practices checklist to assess the practice and bio physiological measurements, BMI, WC and PBF to assess the obesity. Various experts in the field of Nutrition, Community Health Nursing, Community Medicine, Nursing research and psychology validated the tool.

The reliability of the tool was established by test retest method for knowledge(r=0.85), split half for attitude(r=0.87) and inter rater for practice(r=0.86) and obesity(r=0.94) (Height, Weight, Waist Circumference, BMI and PBF)

The obese adults were administered Rural Obesity Reduction Programme which consisted of group of behavioural intervention of Information, Education, Communication [IEC] package for knowledge on general aspects, prevention and management of obesity, dietary and Physical activity modification for practice and individual counselling for attitude towards obesity.

The investigator took measures to follow the ethical principles preceding the investigation. The investigator followed the principles of human rights, beneficence and Non-maleficence, dignity, confidentiality and justice.

Frequency and percentage was used to describe the background variable. Mean and standard deviation was used to assess the level of knowledge, attitude, practice and obesity reduction. 'F' test, Paired and unpaired 't' test was used to assess the effectiveness of Rural Obesity Reduction Program. Co- relation coefficient was used to assess the relationship of the variables. Chi-square test was used to associate the knowledge, attitude, practice and obesity reduction with selected background variables of the experimental group.

The major findings of the study were

- The analysis revealed that in the experimental group, the overall mean knowledge score in the post test was 19.81 with S.D 2.31 whereas in control group, it was 11.19 with S.D of 2.18. The unpaired 't' test value was t = 28.47 which was greater than the table value at p=0.001 and revealed that there was a high significant difference between the experimental and control group at $p<0.001$ level.
- The analysis showed that in the experimental group, the overall mean attitude score in the post test was 80.45 with S.D 5.18 whereas in control group, it was 48.55 with S.D of 8.42. The unpaired 't' test value was t = 33.84 which was greater than the table value at p=0.001 and revealed that there was a high significant difference between the experimental and control group at $p<0.001$ level.
- The analysis also revealed that in the experimental group, the overall mean practice score in the post test was 129.17 with S.D 7.49 whereas in control group, it was 84.95 with S.D of 15.51. The unpaired 't' test value was t = 26.91 which was greater than the table value at p=0.001 and revealed that there was a high significant difference between the experimental and control group at $p<0.001$ level.

- The analysis found that in the experimental group, the overall mean kilo calories, carbohydrates and fat consumption in the post test was 1403.47 with S.D of 183.92, 248.03 with SD of 39.26 and 28.10 with the SD of 13.95 respectively whereas in control group, it remained the same with mild increase and decrease as 2663.28 with S.D of 330.36, 428.53 with S.D of 89.44, 69.15 with S.D of 31.77. The unpaired 't' test value was t = 33.76, t=19.38 and t=5.71 which was greater than the table value at p=0.001 for all three components and revealed that there was a high significant difference between the experimental and control group at $p<0.001$ level.

- Analysis of food frequency revealed that there was statistically significant difference was found in the pre and post test of experimental and also between the experimental and control group in the consumption of cereals, refined cereals, pulses, salty foods, yellow vegetables, green leafy vegetables, fruits milk and milk products, fish, meat and chicken, egg, sweets and chocolates, instant foods, coffee and tea and use of palm oil.
- Regarding the Obesity reduction the analysis revealed that in the post test of experimental group, the overall mean BMI, WC and PBF was 25.52 with S.D of 2.89, 88.46 with SD of 7.20 and 32.49 with the SD of 5.35 respectively whereas in control group, it remained the same with mild increase and decrease as 28.00 with S.D of 3.11, 90.85 with S.D of 6.84 and 34.69 with S.D of 5.44. The unpaired 't' test value was t = 6.12, t=2.52 and t=2.14 which was greater than the table value at p=0.001, p=0.01 and p=0.03 for all three components and revealed that there was a high significant difference between the experimental and control group at $p<0.001$ level.
- Chi-square test revealed that there was statistically significant association was found between the study variables knowledge, attitude, practice and obesity reduction and the

selected demographic variables of age, gender, education, family history of NCDs, personal history of NCDs and habit of exercise.

- The evidence generated from the study revealed that for the experimental group the Rural Obesity Reduction Programme had significant impact in improving the knowledge, attitude, practice and level of obesity reduction at p=0.001 level. The calorie, carbohydrate and fat consumption also was reduced and there was statistically significant difference at p=0.001 level. There was also fair correlation among the knowledge, attitude, practice and level of obesity reduction. It was also found to have statistically significant association of knowledge, attitude, practice and obesity reduction with selected demographic variables. Hence there was statistically significant difference between the experimental and control group. So the Null hypothesis framed was not accepted by the investigator thereby concluding that the RORP was effective in improving the knowledge, attitude, practice and level of obesity reduction.

7.2 CONCLUSION

It has become the need of the hour that we seriously have to think out how many of the life threatening and devastating diseases and its burden can be prevented by simple modification in our lifestyle practices. One side extensive researches and clinical trials are being carried out for inventing modernised high tech equipments, high potent drugs and advanced technology for the diagnostic and therapeutic field in order to reduce the burden caused by NCDs. On the other side we fail to prevent these by simple modifications of dietary, physical activity and life style habits which would make a great difference in our life. We fail to observe our own behaviour and activities which results in serious health problems. It has become essential for everybody to know about the health behaviour to

lead a healthy life. The RORP which has a group of behavioural interventions helps the individual to know about the various aspects of obesity and develop healthy practices to prevent and manage the obesity by behavioural modification. The study concludes that RORP is an effective intervention strategy to reduce obesity and bring out healthier lifestyle habits among the adults. The study recommends the utilization of RORP by the Community Health Nurses, Nurse Researchers, Nurse Administrators, Nurse Educators and Primary and Secondary health care professionals to prevent and manage obesity, to increase awareness towards obesity and to change the behaviour towards the lifestyle modifications from grass root level.

7.3 NURSING IMPLICATIONS

The investigator has devised the following implications that may be vital for the Community Health Nurses, Community Health Administrators, Nurse Educators and Researchers.

7.3.1 COMMUNITY HEALTH NURSES (CHN)

- The RORP intervention package needs to be focused as a vital component while providing the health care services at all levels of care.
- Community Health Nurses need to explore about the readiness for change among the community members
- CHN need to assess the risk factors and root causes of obesity among the people.
- CHN need to advice on impacts of health risks of obesity and benefits of weight reducing strategies.
- CHN can assist the individuals to address the barriers and driving forces of weight reduction strategies.

- CHN need to promote and support exclusive breastfeeding for the first six months of life and programmes to ensure optimal feeding for all infants and young children;
- The Community Health Nurses can provide RORP to prevent and manage overweight and obesity.
- The Community Health Nurses can incorporate various behavioural intervention to prevent and manage the overweight and obesity.
- Community Health Nurses can develop the best practice model for bringing the awareness and behaviour changes in the lifestyle modification.
- Community Health Nurses needs to educate and counsel the obese adults and general population about the importance of RORP to lead a healthy life.
- During home visit the Community Health Nurse can organise focus group discussion and guide family members on weight reducing strategies.
- Community Health Nurses can involve the NGO's and locally influential community leaders in promotion of healthful living among the community members.
- The information about the components of RORP need to be disseminated to all the other service settings of community health like occupational area, schools, old age homes and in rehabilitation centres.
- Community Health Nurses can organize a multi disciplinary practice committee to appraise the current weight reducing strategies and make necessary changes in nursing care interventions.

7.3.2 COMMUNITY HEALTH NURSE ADMINISTRATOR

- Community Health Nurse Administrators can adopt the Rural Obesity Reduction Programme as a strategy to solve the problems of overweight and obesity.
- Community Health Nurse Administrators can take measures to enhance the community participation for managing the overweight and obesity.
- Need to take vital role in identifying, forming and coordinating team of volunteers in the community to implement RORP.
- Community Health Nurse Administrators can utilize the RORP strategies to create awareness among the public on obesity prevention and management.
- Community Health Nurse Administrators can organise community programms for obese people to encourage lifestyle, dietary and physical activity modification.
- Community Health Nurse Administrators can organise in-service education programmes for the health personnel on managing and preventing the complications of obesity.
- Community health nurse administrator can promote the inter-sectoral co-ordination between the health care personnel, dieticians and psychologist for bringing the behavioural changes among the obese adults
- Other nursing care interventions like yoga, breathing exercises and hydration therapy may be rendered for managing this obesity problem.
- Community Health Nurse Administrators can organise community propagation activities.
- CHN Administrators need to influence the Panchayath Raj Institution to promote active and safe methods of travelling to and from schools and work places, to improve sports, recreation and leisure facilities and to increase the number of safe spaces available for active play.

7.3.3 NURSING EDUCATOR

- Nurse educators can organize seminars, workshops, continuing nursing education and training programs on obesity reduction.
- Nurse educators need to devise a nursing curriculum in which the importance of knowledge, attitude, practice and behavioural intervention in the management and prevention of metabolic disorders are emphasised.
- Nurse educators need to select and organize the learning experience for students where the knowledge on role of dietary, physical activity and life style modification in the prevention and management of metabolic disorders will be enhanced.
- Nurse educator should strengthen the concept of community based nursing research in preventing and managing the metabolic disorders.
- Students need to be given training on enhancing counselling skills of individuals with the metabolic disorders.
- Nurse educator can device a curriculum for training the community volunteers and Self Help Group women on prevention and management of metabolic disorders

7.3.4 NURSING RESEARCH

- The findings of the study need to be communicated in the indexed journal and the importance of or effectiveness of RORP is disseminated.
- The present study findings can be utilized for other researches like Meta analysis and Secondary analysis to study about the effectiveness of behavioural intervention in the obesity reduction
- The present study lays the base for assessing the effectiveness of behavioural change intervention for the other metabolic disorders like Diabetes Mellitus

- Health care providers at various health care setting can utilize the findings for validating the need for behavioural intervention in the obesity reduction.
- New theories need to be constructed to understand the behavioural change and its effectiveness in bringing the healthy life style modification.

7.4 RECOMENDATIONS

The study finding shows that the RORP is an effective strategy to prevent and manage the obesity among the adults and therefore recommends the following:

1. The intervention package RORP can be utilised in the primary and secondary health care services settings of government as well as private.
2. OACHC which serve the population of study setting need to carry out the RORP strategies in prevention and management of lifestyle and metabolic disorders.
3. The Village Health Nurses, Sector Health Nurses, Community Health Nurses and other health care professionals need to be trained on the components of RORP and training module can be devised by the NRHM for various categories of health care personnel.
4. A refresher course can be organised for all health care workers on recent trends of nutritional aspects and food exchange for obesity reduction and prevention by the clinical nutritionist.
5. The components of obesity screening like BMI, WC and PBF need to be an integral part of health assessment in all the primary, secondary and tertiary level of health care settings like the vital signs.
6. All the health care professionals especially tertiary care practitioners need to be oriented about the Indian cut off ranges of BMI and WC based on Dr. Misra et al., study.

7. BMI, WC and PBF cut off ranges need to be considered as eligibility criteria for selection in government, private and corporate employment services.
8. The primary health care practitioners and the independent community health nurse practitioners need to be trained on the medical management of obesity and its criteria.
9. A separate National Health Programe on prevention and control of obesity can be launched by the central and state governments.
10. Government should increase excise tax on chocolates, ice creams, confectionaries, and carbonated sugary drinks.
11. Government should provide subsidies on healthy foods or with targeted health education campaigns.
12. Government should develop a national policy and action plan on food and nutrition, with an emphasis on national nutrition priorities including the control of Diet-Related Non Communicable Diseases.
13. Government should establish and implement food-based dietary guidelines and support the healthier composition of food by reducing salt levels, eliminating industrially produced trans-fatty acids and decreasing saturated fats.
14. Government should establish partnership with the food and beverage industry in the design and implementation of actions to fight obesity, particularly in product reformulation to avoid particularly unhealthy ingredients (e.g. saturated fats and too much salt), in reducing excessive portion sizes and providing healthy menu alternatives, in limiting advertising particularly to vulnerable groups like children and informing consumers about food contents.
15. The members of the family and teachers in the school should ensure that healthy eating is practiced by children in the home and at school.

16. Accurate and balanced health promotion messages such as encouraging “active transport” – cycling and walking and active leisure need to be disseminated in order to enable them to make well-informed, healthy choice
17. Health promotion efforts should be intensified, particularly through local initiatives by better facilities for physical activity, health education and further measures at the school level
18. Government should implement school-based programmes in line with WHO’s health-promoting schools initiative.
19. Village Panchayath should ensure that physical environments support safe active commuting and create space for recreational activity, by ensuring that walking, cycling and other forms of physical activity are accessible to and safe for all.
20. Government should introduce transport policies that promote active and safe methods of travelling to and from schools and workplaces, such as walking or cycling and improve sports, recreation and leisure facilities.
21. Government policies should promote physical activity by enhanced school based physical education, social support interventions in community settings and encouraging parenting involvement.
22. The effectiveness of RORP can be assessed among the adolescents in the community area
23. The effectiveness of RORP can be assessed among the urban obese adult populations Urban Obesity Reduction Programme (UORP).
24. The effectiveness of RORP can be compared between the urban and rural obese populations of community.
25. The effectiveness of RORP/UORP can be conducted as a prospective study to assess the development of co morbidities.

26. A qualitative study can be conducted to assess the lived in experiences of obese adults.
27. A qualitative study can be conducted to assess the factors contributing to the failure of weight maintenance.
28. A study can be conducted to assess the psychological factors contributing to the development of obesity.
29. A study can be conducted to assess the quality of life (QOL) and level of obesity among the obese population.
30. Screening for obesity among the school going children and the effectiveness of school based intervention programme can be assessed.
31. Effectiveness of family based intervention programme can be assessed.
32. Establishment and execution of 'KIOSK' centres for assessment of obesity at schools and colleges, industries and office settings, temples and churches, malls and theatres and in the urban and rural community.
33. A grand theory can be constructed to devise the behavioural change interventions in prevention and control of obesity.
34. The investigator identified the rapidly growing problems of use of smokeless tobacco (panparag, gutkha etc..) product and Alcoholism among the adolescent boys which need to be addressed immediately and action can be taken by the OAHC to control the status.

7.5 LIMITATION

1. There was an attrition rate of 2.65% for the experimental and control group due to change of residents' inability to adhere to the intervention package and unavailability of the samples.

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DATA COLLECTION INSTRUMENT

Dear Participant,

This study is to assess the effectiveness of comprehensive nursing care package on HRQOL among hypertensive clients.

It is very important to self manage the disease condition to lead the life, for which the clients should have high level HRQOL. So to improve the HRQOL comprehensive nursing care package will be administered. The treatment of the hypertensive clients will be done as per the routine of this health centre, details about the clients documented will be kept confidentially and anonymity will be maintained throughout the study. The details will be used only for this study purpose.

The intervention to these hypertensive clients will be based on the health centre treatment guidelines.

The study will involve the questions related to HRQOL. The consent of your participation is purely voluntary and you are given the freedom to withdraw from our study any time. There is no difference in medical treatment based on your inclusion into the study.

Any queries with regard to the participation will be clarified by the investigator at any time.

My sincere thanks for having consented for the participation in this study.

SECTION A: SCREENING TOOL TO ASSESS THE OBESITY AMONG THE ADULTS

1. **Age:**
    a. 20-30 years
    b. 31-40 years
    c. 41-50 years

2. **Gender :**
    a. Male
    b. Female

3. **Weight in kg:**

4. **Height in cm:**

5. **Body Mass Index (Asia Indian specific cut-offs)**
    a. Less than 18
    b. 18.0-22.9
    c. 23.0-24.9
    d. More than 25

6. **Waist circumference: (Asia Indian specific cut-offs)**
    a. Male i. less than 90 cm ii. 90 cm and above
    b. Female i. less than 80 cm ii. 80 cm and above

7. **History of hormonal therapy/steroid therapy** **:** Yes/No

8. **Use of Oral contraceptives** **:** Yes/No

9. **Undergoing any obesity reduction program?** **:**Yes/No

10. **Any contra indication to present intervention package** **:** Yes/No

11. **Contact details if Obese:**

SECTION: B ASSESSMENT TOOL FOR DATA COLLECTION

Part – 1: Background variables **S. No. :**

Part – 1a: Demographic Variables

1. **Age**
    a. 20-30 yrs
    b. 31-40 yrs
    c. 41-50 yrs

2. **Gender**
    a. Male
    b. Female

3. **Educational qualification**
    a. Non literate
    b. Primary school
    c. Middle school
    d. High school
    e. Higher secondary or post high school diploma
    f. Graduate or post graduate
    g. Professional and others

4. **Occupation**
    a. Profession
    b. Semi profession
    c. Clerical, shop owner, farmer
    d. Skilled worker
    e. Semi skilled worker
    f. Unskilled worker
    g. Unemployed

5. **Total household income per month**
    a. Less than Rs.3,300
    b. Rs.3,301-7,300

c. Rs.7,301-14,500

d. More than Rs.14,500

6. Marital status

a. Married

b. Single

c. Divorced

d. Widow /widower

e. Separated

f. Others

7. Type of family

a. Nuclear

b. Extended

c. Joint

d. Others

8. Family size

a. Small (2-4)

b. Medium (5-7)

c. Large (> 7)

9. **Family History of Non-Communicable Disease a) Yes b) No**

	Obesity/ Overweight (a)	**Diabetes Mellitus (b)**	**Cardiovascular Diseases (c)**	**Cancer (d)**	**Hypertension (e)**	**Osteoporosis (f)**	**Thyroid disorder (g)**	**Kidney disease (h)**
9.1Father								
9.2Mother								
9.3Sibling								
9.4 Grand parents								

Part 1b: Personal History of Obesity Related Factors:

1	**Personal history of Non Communicable Disease** a. Yes b. No	**If yes** **1.1 Type of disease** **a.**Diabetes Mellitus b.HyperTension c.CardioVascular Disease d.Cancer e.Thyroid disorder f.Hepatic disease g.Renal disease h.Mental illness	**1.2 Chronicity of illness** a. 0-3years b. 4-6years c. 7-9years d. 10years and above	**1.3 Treatment** a. Regular **b.** Irregular
2.	**Sleep pattern** a. Regular sleep pattern (8 hrs of sleep in the night) b. Irregular sleep pattern (less than 8 hrs of sleep in the night, shift duty etc…			
3.	**History of Smoking** a. Yes b. No	**If Yes** **3.1Type of smoke tobacco** a. Beedi b. Suruttu c. Cigarette d. Others	**3.2 Frequency of use per day** a.1-3 times b.4-6 times c.7-9 times d. above 10 times	**3.3 Chronicity of use** a. 0-5 years b. 6-10 years c.11-15 years d. Above 15 years
4.	**Use of smokeless tobacco** a. Yes b. No	**If Yes** **4.1 Type of smokeless tobacco products used** **a**. Snuff b.Tobbaco c.PanParag d.Others	**4.2 Frequency of use per day** a.1-3 times b.4-6 times c.7-9 times d. above 10 times	**4.3 Chronicity of use** a. 0-5 years b. 6-10 years c.11-15 years d. Above 15 years
5.	**Use of Alcohol** a. Yes b. No	**If Yes** **5.1 Frequency per week** a.1-3 times b.4-6 times c.7-9 times d.above 10 times	**5.2 Amount per week** a. Less than 500 ml b. 500ml-1000ml c. 1000ml-1500ml d. 1500ml-2000ml	**5.3 Chronicity of use** a. 0-5 years b. 6-10 years c.11-15 years d. Above 15 years

6.	**Habit of exercise** a. Yes b. No	**If Yes** **6.1 Type of exercise** a.Walking b.Jogging c.Bicycling d.Swimming e.Weight lifting f.Playing shuttle g.Playing tennis h.Others	**6.2 Intensity of exercise** a.Moderate intensity b.Vigorous intensity	**6.3 Frequency of exercise** a. Once in a day b. Twice in a day c.2-3 times in a weak d. Rarely	**6.4 Duration of exercise in each frequency** a.< 10 minutes b. 10-20 minutes c.21-30 minutes d.31-40 minutes e.41-50 minutes d.51-60 minutes e. others	**6.5 Duration of exercise in years** a. 1-3 years b.4-6 years c.7-9 years d. > 10 years

7. Women Health History

7	7.1 **Age of Puberty** a. <10 yrs b. 10-12 yrs c. 13-15 yrs	**7.2 Duration of menstrual cycle** a. <3days b. 3-5 days	**7.3 Frequency of Menstruation** a.Regular b.Irregular	**7.4 Dysmennorhoea** a. Yes b. No	**7.5 Measures taken for dysmennorhoea** a.None b.Medication c.Naturaltherapy d.Others (cola)	**7.6 History of cyst in the ovary** a. Yes b. No	**7.7 Attained Menopause** a. Yes b. No	**7.8 History of Hysterectomy** a. Yes b. No

Part – 2: Assessment of Level of Obesity:

Snow	Bio-physiological Measurements	Range of values		Inference	Pretest	Post test1	Post test2
1	**BMI**	a. 18.0 – 22.9 b. 23.0 – 24.9 c. 25.0 - 29.9 d. 30.0 - 34.9 e. More than 35		a. Normal b. Overweight c. Class I obesity d. Class II obesity e. Class III obesity			
2	**Waist Circumference**	**Male**	**Female**	a. Normal b. Action Level I c. Action Level II d. Obesity			
		< 78 cm	< 72cm				
		78-90 cm	72-80 cm				
		90-102 cm	80 -88 cm				
		>102 cm	>88 cm				
3	**Percent Body Fat(American Council on Exercise)**	**Male**	**Female**	a. Ideal b. Average c. Obese			
		14-17%	21-24 %				
		18-24%	25-31 %				
		>25%	> 32%				

Part 3: Structured Questionnaire to assess the knowledge on obesity and its reduction

S.No	Questions	I	II
	General information about obesity		
1	**Obesity means** a. Body weight 10% higher than the ideal weight b. Body weight 15% higher than the ideal weight c. Body weight 20% higher than the ideal weight d. Body weight 25% higher than the ideal weight		
2	**An obese person has abnormal or excessive accumulation of** a. Carbohydrates b. Proteins c. Fats d. Vitamins and minerals		
3	**Obesity is more common among** a. Male b. Female c. Both **d.** Transgender		
	Causes of obesity		
4	**Obesity can be caused by** a. Eating more food than your body can use b. Eating fruits c. Eating green leafy vegetables d. Tight writing work in the office		
5	**Which of the following is not the cause of obesity** a. Age b. Genetics c. Medicine d. Sleeping adequately		
6	**The other factor which causes obesity is** a. Stress b. Relaxed c. Sleeping d. Playing		
7	**Which of the following contributes to weight gain** a. Brown rice b. Fruits c. Wheat d. Sweetened soft drink		
8	**Rice contributes to weight gain because it is** a. Digested easily b. Absorbed rapidly into the blood stream c. Eliminated easily from blood **d.** Absorbed rapidly into the urine		

S.No	Questions	I	II
9	**People with the following activity are under risk to become obese** a. Sedentary activity b. Moderate activity c. Heavy activity d. Regular exercise activity		
10	**Which of the following factor is strongly associated with weight gain** a. Hours spent on watching TV b. Hours spent on playing c. Hours spent on house hold activities d. Hours spent on deep breathing		
	Diagnosis of obesity		
11	**Body Mass Index is calculated from** a. Height and weight b. Skin fold thickness and weight c. Height and skin fold thickness **d.** Weight and body fat		
12	**Waist Circumference indicates** a. Risk of chronic disease b. Inability to work c. Inability to walk **d.** Healthy body		
	Health risks of obesity		
13	**The risk for Diabetes and hypertension disease is more among the people with** a. Osteoarthritis b. Bronchial asthma c. Obesity d. Skin diseases		
14	**Obesity can cause the following health problems** a. Heart disease b. Pneumonia c. Eating disorder d. Bronchial asthma		
15	**The ultimate impact of obesity is** a. Decreased relaxation b. Decreased life expectancy c. Decreased activity d. Decreased food intake		
	Management of Obesity		
16	**We can reduce the excess body weight by** a. Balancing food intake and energy expenditure b. Consumption of energy in less than energy expenditure c. Consumption of energy in excess than energy expenditure **d.** Balancing work and relaxation		
17	**Which of the following is not the management of obesity** a. Medications b. Surgery		

S.No	Questions	I	II
	c. Aerobic exercise d. Non specific diet control		
18	**Healthy weight loss is** a. Half kg per week b. One kg per week c. One & half kg per week d. Two kg per week		
19	**Ideal way of managing mild and moderate obesity is** a. Drugs b. Vigorous intensity physical activity c. Modification in dietary habits d. Modification in dietary habits and moderately intense physical activity		
20	**Physical activity recommended for weight loss is** a. 60 minutes/day of moderate intensity physical activity b. 60 minutes/day of vigorous intensity physical activity c. 30 minutes/day of moderate intensity physical activity d. 15 minutes/day of vigorous intensity physical activity		
	Prevention		
21	**Physical activity expected for healthful life is** a. 60 minutes/day of moderate intensity physical activity b. 60 minutes/day of vigorous intensity physical activity c. 30 minutes/day of moderate intensity physical activity d. 30 minutes/day of vigorous intensity physical activity		
22	**Which of the following is Junk food** a. Vegetable sandwich b. Cakes and deep fried food c. Onion raitha d. Fruit salad		
23	**The following food can be restricted to maintain the ideal body weight** a. Sugar sweetened beverages b. Brown rice c. Wheat d. Oats		
24	**The important measure for prevention of obesity is** a. High calorie intake and less exercises b. Normal calorie intake and regular exercise c. Low calorie intake and heavy exercise d. High calorie and heavy exercise		
25	**Ideal measure to keep the obesity off is** a. Moderate intensity exercise b. Avoiding fat c. Healthy life style practices d. Avoiding drugs		

Part 4: Scale to assess the Attitude towards obesity:

S.No	Items	Strongly Agree (a)	Agree (b)	Un Certain (c)	Disagree (d)	Strongly Disagree (e)	I	II
1	My weight is more than normal							
2	Balancing food intake and energy expenditure is impossible.							
3	Avoiding fast foods/fried item is good for health							
4	Snacking is healthy							
5	Eating meals and snacks while watching TV is healthy							
6	Preferred food should be consumed more							
7	Occupation may cause stress							
8	I feel that sleeping more hours induces obesity							
9	Drugs and Hormone intake may increase the weight							
10	Consuming alcohol is nothing to do with weight gain							
11	Hereditary factors influence obesity.							
12	5 mini meal is better than 3 full meal per day.							
13	Eating the food fast can reduce weight gain							
14	Obesity may cause other health hazards							
15	Obese people may have decreased life expectancy							
16	Regular exercise and dietary modification can only bring healthy weight loss							
17	If we reduce the weight also weight maintenance is not possible for the long term.							
18	We can seek advice of experts to reduce weight							
19	Work load may not allow to plan healthy diet and go for regular exercise for anyone							
20	It is difficult to manage the stress.							

Part 5: Assessment of Dietary, Physical Activity and lifestyle practices.

Part 5a: Assessment of Dietary Practices

1. **3 Day dietary recall with quantity**

Meal/ Snacks	Sunday		Week day 1		Week day 2	
	Pretest	Post test	Pretest	Post test	Pretest	Post test
Early morning						
Break fast						
Mid morning						
Lunch						
Evening						
Dinner						
Bed time						
Any other						

2. Food Frequency Questionnaire:

Foods	More than 2 times a day (a)	Once a day (b)	4-6 times a week (c)	2-3 times a week (d)	Once a week (e)	2-3 times a month (f)	Once a month (g)	Consumed rarely (h)	Pretest	Post test
2.1 Cereals (rice, wheat, ragi etc..)										
2.2 Refined cereals (maida,ravai etc..)										
2.3 Pulses and legumes										
2.4 Salty foods (pickles, chips, dry fish etc….)										
2.5 Yellow vegetables										
2.6 Green leafy vegetables										
2.7 Fruits										
2.8 Milk and milk products										
2.9 Fish										
2.10 Meat and chicken										
2.11 Egg										
2.12 Oily foods (pakoda, samosa, puffs, vadai, bajji etc)										
2.13 High cholesterol foods(cream based foods)										
2.14 Animal fats (butter and ghee)										
2.15 Sweets and chocolates										
2.16 Instant foods (noodles, biscuits, lays and kurkure)										
2.17 Coffee and tea										
2.18 Carbonated beverages										
2.19 Nuts										
2.20 Use of palm oil										

3. Dietary practice checklist

S.No	Criteria	Always (a)	Most of the time (b)	Some time (c)	Rarely (d)	Never (e)	Pre test	Post test
3.1	**Dietary Practices** I consume Vegetarian Diet							
3.2	I consume Non-Vegetarian Diet							
3.3	I eat food at regular time each day							
3.4	I eat food prepared at home							
3.5	I eat food prepared at hotel							
3.6	My work load makes me to skip the meal break fast							
3.7	I compensate skipped meals with the sweetened/carbonated soft drinks							
3.8	I snack between meals							
3.9	I have a Habit of snacking while watching television							
3.10	I am having the habit of eating slowly							
3.11	My water Consumption is more than 8-10 cups per day							
3.12	I Consume rice based food several times a day daily.							
3.13	I eat fruits 2 servings/day							
3.14	I eat vegetables 2 servings per day.							
3.15	I eat small frequent feeds							

Part 5b: Check list for assessment of physical activity practice

S.No	Criteria	Always (a)	Most of the time (b)	Some time (c)	Rarely (d)	Never (e)	Pre test	Post test
1	I do exercise							
2	I sweat after exercise							
3	I perform household activities like washing clothes & dish, mob, sweep etc.,							
4	I watch Television more than 2 hrs/day.							
5	My leisure time activities are reading books and watching tv							
6	I use vehicle for short distance travel also							
7	I play with my kids actively							
8	I involve myself in social service activities							
9.	I avoid climbing steps							
10.	I don't involve myself in gardening							

Part 5c: Check list for assessment of life style practices

S.No	Criteria	Always (a)	Most of the time (b)	Some time (c)	Rarely (d)	Never (e)	Pre test	Post test
1	I do smoke regularly (beedi, Cigarette, Suruttu, etc							
2	I use other Smokeless tobacco products							
3	I drink alcohol regularly							
4	I have a regular sleeping habit							
5	I go for a regular health check up and screening							
6	I use self medication for minor ailments							
7	I am a heavy worker							
8	My family life is stressful							
9.	My working environment is relaxed							
10.	I can get along with people easily							

தகவலறிந்த ஒப்புதல் படிவம்

மதிப்பிற்குரியவரே வணக்கம்,

நான் சென்னை புழலில் உள்ள உமையாள் ஆச்சி செவிலியர் கல்லூரியில் முனைவர் பட்டத்திற்காக பயிற்சி பயிலும் மாணவி. என் படிப்பின் ஒரு பகுதியாக உடல் பருமன் பற்றிய ஆராய்ச்சி மேற்கொண்டுள்ளேன். ஆகவே நீங்கள் தயவுடன் இந்த ஆய்வில் உங்களை பற்றிய அடிப்படை விவரங்களையும், உடல் பருமன் பற்றிய உங்கள் அறிவு, மனப்பாங்கு, உணவு, உடற்பயிற்சி, வாழ்க்கை முறை பழக்க வழக்கங்கள் ஆகியவற்றை பற்றிய வினாக்களுக்கு உங்கள் விடையையும், ஒத்துழைப்பையும் அளிக்குமாறு கேட்டுக் கொள்கிறேன் மேலும் உங்கள் ஒத்துழைப்பை உடல் பருமனை அறியும் சோதனையிலும் தர விழைகிறேன்.

உங்களின் மேலான ஒத்துழைப்பை உடல் பருமனை குறைப்பதற்காக மேற்கொள்ளும் செயல்பாடுகளிலும் தருமாறு வேண்டுகிறேன்.

உங்கள் பதில்கள் மிகவும் இரகசியமாக பாதுகாக்கப்படும், மற்றும் என்னுடைய இந்த ஆய்வுக்காக மாத்திரமே பயன்படுத்தப்படும் எனவும் உறுதியளிக்கிறேன்.

உங்களுக்கு ஏதாவது சந்தேகம் தோன்றினால் தயக்கமின்றி வெளிப்படுத்தவும். அதற்குரிய விளக்கமளிக்கப்படும். இதில் பங்கேற்பது முற்றிலும் உங்களுடைய விருப்பமே. ஆய்வின் இடையில் கூட நீங்கள் விலக விரும்பினால் விலகிக்கொள்ளலாம்.

இந்த ஆய்வு எந்த வித தீங்கும் உங்களுக்கு ஏற்படுத்தாது என உறுதியளிக்கிறேன்.

இர.பத்மாவதி
உமையாள் ஆச்சி செவிலியர் கல்லூரி

நான் இந்த ஆய்வில் பங்கேற்க மனப்பூர்வமாக சம்மதிக்கிறேன்.

பங்கேற்பாளர் கையொப்பம்

பிரிவு - அ: பெரியவர்களிடத்தில் உடல் பருமனை கண்டறியும் கருவி

1. **வயது வருடங்களில்:**
   - அ. 20-30
   - ஆ. 31-40
   - இ. 41-50
2. **பாலினம்:**
   - அ. ஆண்
   - ஆ. பெண்
3. **எடை கிலோ கிராமில்:**
4. **உயரம் சென்டிமீட்டரில்:**
5. **உடல் பருமன் அலகு: (ஆசிய இந்தியர்களுக்கான கட் ஆஃப்)**
   - அ. 18க்கு குறைவாக
   - ஆ. 18.0-22.9
   - இ. 23.0-24.9
   - ஈ. 25க்கு மேலாக
6. **இடைப்பகுதி சுற்றளவு: (ஆசிய இந்தியர்களுக்கான கட் ஆஃப்)**
   - அ. ஆண் i. 90 செ.மீக்கு குறைவாக
     ii. 90 செ.மீக்கு மேலாக
   - ஆ. பெண் i. 80 செ.மீக்கு குறைவாக
     ii. 80 செ.மீக்கு மேலாக
7. **ஹார்மோன் மற்றும் ஸ்டிராய்டு சிகிச்சைக்கான வரலாறு:** அ) ஆம் ஆ) இல்லை
8. **கருத்தடை மாத்திரை உபயோகிப்பு:** அ) ஆம் ஆ) இல்லை
9. **உடல் பருமன் குறைப்பு நிகழ்வுகளில் ஈடுபட்டு உள்ளீரா? அ) ஆம் ஆ) இல்லை**
10. **தற்போதைய சிகிச்சைக்கு எதிர்குறிப்பு** அ) ஆம் ஆ) இல்லை
11. **உடல் பருமன் உள்ளவரெனில் தொடர்புவிவரங்கள்:**

பிரிவு ஆ: தகவல் சேகரிப்புக்கான மதிப்பீட்டுக்கருவி

பகுதி 1: அடிப்படை விவரங்கள்

பகுதி 1அ: தனி நபர் விவரங்கள்

1. **வயது வருடங்களில்**
   - அ. 20-30 ஆண்டுகள்
   - ஆ. 31-40 ஆண்டுகள்
   - இ. 41-50 ஆண்டுகள்

2. **பாலினம்**
   - அ. ஆண்
   - ஆ. பெண்

3. **கல்வித்தகுதி**
   - அ. படிக்காதவர்
   - ஆ. ஆரம்பக்கல்வி
   - இ. நடுநிலைக்கல்வி
   - ஈ. மேல்நிலைக்கல்வி
   - உ. உயர்நிலைக்கல்வி / தொழில்நுணுக்கக்கல்வி
   - ஊ. இளநிலை மற்றும் முதுநிலைப்பட்டப்படிப்பு
   - எ. தொழிற்சார்ந்த கல்வி மற்றும் பிற

4. **தொழில்**
   - அ. உயர்தொழில்
   - ஆ. பகுதி உயர்தொழில்
   - இ. எழுத்தர், கடைமுதலாளி மற்றும் விவசாயம்
   - ஈ. நுட்பமான வேலை
   - உ. அரை நுட்பமான வேலை
   - ஊ. நுட்பமில்லா வேலை
   - எ. வேலையில்லாதவர்

5. **குடும்பமாத வருமானம்**
   - அ. 3,300க்கு குறைவாக
   - ஆ. 3,301 – 7,300

இ. 7,301 – 14,500

ஈ. 14,500க்கு மேலாக

6. திருமண நிலை

அ. திருமணமானவர்

ஆ. திருமணமாகாதவர்

இ. விவாகரத்து ஆனவர்

ஈ. கணவன்/மனைவியை இழந்தவர்

உ. பிரிந்து வாழ்பவர்

ஊ. மற்றவை

7. குடும்ப வகை

அ. தனிக்குடும்பம்

ஆ. விரிவுப்பட்ட குடும்பம்

இ. கூட்டுக்குடும்பம்

ஈ. மற்றவை

8. குடும்ப அளவு (உறுப்பினர் எண்ணிக்கை)

அ. சிறியது (2-4)

ஆ. நடுத்தமானது (5-7)

இ. பெரியது >7

9. குடும்ப உறுப்பினர்களுக்கு தொற்று மூலம் பரவா நோய்கள்/ நாட்பட்ட நோய்கள் இருப்பதற்கான வரலாறு அ. ஆம் ஆ. இல்லை

	உடல் பருமன் / அதிக எடை (அ)	நீரிழிவு நோய் (ஆ)	இருதய நோய் (இ)	புற்று நோய் (ஈ)	இரத்த அழுத்தம் (உ)	எலும்பு தேய்மானம் (ஊ)	தைராய்டு பிரச்சனை (எ)	சிறுநீரக பிரச்சனை (ஏ)
9.1தந்தை								
9.2 தாய்								
9.3 உடன் பிறந்தவர்கள்								
9.4 தாத்தா மற்றும் பாட்டிக்கு								

பகுதி 1ஆ: உடல் பருமன் சம்பந்தமான காரணிகள் இருப்பதற்கான சுயவரலாறு

1	**தொற்று மூலம் பரவா/ நாட்பட்ட நோய்கள் இருப்பதற்கான சுயவரலாறு** அ. ஆம் ஆ. இல்லை	**ஆம் எனில்** **1.1 நோய்கள் வகை** அ. சர்க்கரை நோய்/ நீரிழிவு நோய் ஆ. இரத்த அழுத்தம் இ. இருதய நோய்கள் ஈ. புற்று நோய் உ. தைராய்டு பிரச்சனை ஊ. கல்லீரல் நோய் எ. சிறுநீரக நோய் ஏ. மனநிலை பாதிப்பு	**1.2 எத்தனை ஆண்டுகளாக** அ. 0-3 ஆண்டுகள் ஆ.4-6 ஆண்டுகள் இ. 7-9 ஆண்டுகள் ஈ. 10 ஆண்டுகளுக்கு மேலாக	**1.3 சிகிச்சை** அ. தொடர் சிகிச்சை ஆ. ஒழுங்கற்ற சிகிச்சை
2.	**தூக்கமுறை** அ. இரவில் தொடர்ந்து உறங்குதல் ஆ. இரவில் விட்டுவிட்டு உறங்குதல்/ஒழுங்கற்ற உறக்கம்			
3.	**புகை பிடிக்கும் பழக்கம்** அ. ஆம் இ. இல்லை	**ஆம் எனில்** **3.1 புகையிலை வகை** அ. பீடி ஆ. சுருட்டு இ. சிகரெட் ஈ. மற்றவை	**3.2 ஒரு நாளைக்கு எத்தனை முறை உபயோகிப்பு** அ.1-3 முறை ஆ.4-6 முறை இ.7-9 முறை ஈ.10 முறைக்கு மேலாக	**3.3 எத்தனை வருடங்கள் உபயோகிப்பு** அ. 0-5 ஆண்டுகள் ஆ. 6-10 ஆண்டுகள் இ. 11-15 ஆண்டுகள் ஈ. 15 ஆண்டுகளுக்கு மேல்
4.	**புகையில்லா புகையிலை உபயோகிப்பு** அ. ஆம் ஆ. இல்லை	**ஆம் எனில்** **4.1 புகையிலை வகை** அ. மூக்குப்பொடி ஆ. புகையிலை மெல்லுதல் இ. பான்பராக் ஈ. மற்றவை	**4.2 ஒரு நாளைக்கு எத்தனை முறை உபயோகிப்பு** அ.1-3 முறை ஆ.4-6 முறை இ.7-9 முறை ஈ. 10 முறைக்கு மேல்	**4.3 எத்தனை வருடங்கள் உபயோகிப்பு** அ. 0-5 ஆண்டுகள் ஆ. 6-10 ஆண்டுகள் இ.11-15 ஆண்டுகள் ஈ. 15 ஆண்டுகளுக்கு மேல்
5.	**மதுபானம் அருந்தும் பழக்கம்** அ. ஆம் ஆ. இல்லை	**ஆம் எனில்** **5.1 ஒரு வாரத்திற்கு எத்தனை முறை** அ.1-3 முறை ஆ.4-6 முறை இ.7-9 முறை ஈ. 10 முறைக்கு மேல்	**5.2 ஒரு வாரத்திற்கு அருந்தும் அளவு** அ. 500 மில்லி லிட்டருக்கு குறைவாக ஆ. 500-1000 மி.லி இ. 1000-1500 மி.லி ஈ. 1500-2000 மி.லி	**5.3 எத்தனை ஆண்டுகளாக பழக்கம்** அ. 0-5 ஆண்டுகள் ஆ. 6-10 ஆண்டுகள் இ. 11-15 ஆண்டுகள் ஈ. 15 ஆண்டுகளுக்கு மேல்

6	**உடற்பயிற்சி பழக்கம்** அ. ஆம் ஆ. இல்லை	**6.1 உடற்பயிற்சி வகை** அ. நடத்தல் ஆ. ஓடுதல் இ. மிதிவண்டி ஓட்டுதல் ஈ. நீச்சல் உ எடை தூக்குதல் ஊ. ஷெட்டில் விளையாடுதல் எ. டென்னிஸ் விளையாடுதல் ஏ. மற்றவை	**6.2 உடற் பயிற்சி தீவிரம்** அ. மிதமான தீவிரம் ஆ.கடினமான தீவிரம்	**6.3 எத்தனை முறை உடற்பயிற்சி செய்வீர்** அ. ஒரு நாளைக்கு ஒரு முறை ஆ. ஒரு நாளைக்கு இரண்டு முறை இ. வாரத்திற்கு 2-3 முறை ஈ. எப்போழுதாவது	**6.4 ஒவ்வொரு முறையும் எவ்வளவு நேரம் உடற்பயிற்சி செய்வீர்** அ. <10 நிமிடம் ஆ. 10-20 நிமிடங்கள் இ.21-30 நிமிடங்கள் ஈ.31-40 நிமிடங்கள் உ.41-50 நிமிடங்கள் ஊ.51-60 நிமிடங்கள் எ. மற்றவை	**6.5 எத்தனை ஆண்டுகளாக உடற்பயிற்சி செய்வீர்கள்** அ.1-3 ஆண்டுகள் ஆ.4-6 ஆண்டுகள் இ.7-9 ஆண்டுகள் ஈ.>10 ஆண்டுகள்
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7. பெண்கள் நல வரலாறு:

	7.1 **வயதுக்கு வந்த வயது** அ.<10 ஆ.10-12 வயது இ.13-15 வயது	**7.2 மாதவிடாய் காலத்தின் அளவு** அ. <3 நாட்கள் ஆ. 3-5 நாட்கள்	**7.3 மாதவிடாய் சுழற்சி** அ. தொடர் சுழற்சி ஆ. ஒழுங்கற்ற சுழற்சி	**7.4 மாத விடாய் காலத்தின் போது வலி** அ. ஆம் ஆ. இல்லை	**7.5 மாதவிடாய் வலியின் போது சிகிச்சை** அ.எதுவுமில்லை ஆ.மாத்திரைகள் இ.இயற்கை வைத்தியம் ஈ.மற்றவை (சோடா மற்றும் கோலா குடித்தல்)	**7.6 அண்டகத்தின் கட்டி** அ.ஆம் ஆ.இல்லை	**7.7 மாத விலக்கு அடைந்த நிலை** அ. ஆம் இ.இல்லை	**7.8 கருப்பை நீக்கப் பட்ட வரலாறு** அ. ஆம் ஆ. இல்லை
I								

பகுதி – III: உடல்பருமன் நிலை பற்றி அறிதல்

வ.எண்.	**அளவீடுகள்**	**மதிப்புகளின் வரம்பு**		**அனுமானம்**	**I**	**II**	**III**	**IV**
1.	உடல் நிறை குறியீட்டெண்	அ) 18.0 – 22.9 ஆ) 23.0 – 24.9 இ) 25.0 – 29.9 ஈ) 30.0 – 34.9 உ) >35		அ. இயல்பு ஆ. எடை கூடுதல் இ. வகுப்பு I ஈ. வகுப்பு II ப. வகுப்பு III				
2.	இடை சுற்றளவு	**ஆண்**	**பெண்**	அ. இயல்பு ஆ. நடவடிக்கை நிலை I இ. நடவடிக்கை நிலை II ஈ. உடல் பருமன்				
		<78 செ.மீ	<72 செ.மீ					
		78-90 செ.மீ	72-80 செ.மீ					
		90-102 செ.மீ	80-88 செ.மீ					
		>102 செ.மீ	>88 செ.மீ					
3.	உடல் கொழுப்பு சதவீதம்	**ஆண்**	**பெண்**					
		14-17%	21-24%	சரியானது				
		18-24%	25-31%	சராசரி				
		>25%	> 32%	உடல் பருமன்				

பகுதி 3: உடல்பருமன் மற்றும் அதன் குறைப்பு பற்றிய அறிவை மதிப்பிடும் கட்டமைக்கப்பட்ட வினாத்தாள்

வ. எண்.	வினாக்கள்	I	II
	உடல்பருமன் பற்றிய பொது விவரங்கள்		
1	**உடல் பருமன் என்பதன் பொருள்** அ. சரியான எடையை விட 10 சதவீதம் அதிகமான உடல் எடை ஆ. சரியான எடையை விட 15 சதவீதம் அதிகமான உடல் எடை இ. சரியான எடையை விட 20 சதவீதம் அதிகமான உடல் எடை ஈ. சரியான எடையை விட 25 சதவீதம் அதிகமான உடல் எடை		
2	**உடல் பருமன் உள்ள நபர் கீழ்கண்ட எவற்றை அதிகமாக அல்லது அசாதாரணமாக உடலில் சேர்த்து வைத்திருப்பார்** அ. மாவுச்சத்து ஆ. புரதச்சத்து இ. கொழுப்புச்சத்து ஈ. வைட்டமின் மற்றும் தாது சத்துக்கள்		
3	**பொதுவாக உடல்பருமன் கீழ்கண்ட யாருக்கு அதிகமாக உள்ளது?** அ. ஆண்கள் ஆ. பெண்கள் இ. இருவருக்கும் ஈ. திருநங்கை		
	உடல் பருமனுக்கான காரணங்கள்		
4	**உடல்பருமன் கீழ்க்கண்ட எவற்றால் வரலாம்** அ. உடல் தேவைக்கு அதிகமாக உணவு உண்ணுதல் ஆ. பழங்களை உண்ணுதல் இ. பச்சை காய்கறிகளை உண்ணுதல் ஈ. இடைவெளியில்லா எழுத்துப்பணி		
5	**கீழ்கண்ட எவற்றால் உடல்பருமன் வராது** அ. வயது ஆ. மரபு வழி இ. மருந்துகள் ஈ. போதுமான தூக்கம்		
6	**உடல் பருமனை உண்டாக்கும் மற்ற காரணிகள்** அ. மன அழுத்தம் ஆ. ஒய்வு எடுத்தல் இ. உறங்குதல் ஈ. விளையாடுதல்		
7	**கீழ்க்கண்ட எவை எடை கூடுதலுக்கு பங்களிக்கின்றது** a. பழுப்பு அரிசி b. பழங்கள் c. கோதுமை d. இனிப்பூட்டிய குளிர்பானங்கள்		
8	**அரிசி எடை கூடுதலுக்கு பங்களிக்கின்றது ஏனெனில்** அ. சுலபமாக ஜீரணமாகின்றது ஆ. வேகமாக இரத்த ஓட்டத்தில் உறிஞ்சப்படுகிறது இ. இரத்தத்திலிருந்து சுலபமாக நீக்கப்படுகிறது ஈ. வேகமாக சிறுநீரகத்தில் உறிஞ்சப்பட்கிறது		
9	**கீழ்கண்ட உடல்செயல்பாடு உள்ளவர்கள் உடல்பருமனாகும் அபாயத்தில் உள்ளனர்** a. உடல் உழைப்பு தேவைப்படாத செயல்பாடு b. மிதமான செயல்பாடு c. கடுமையான செயல்பாடு d. வழக்கமான உடற்பயிற்சி செயல்பாடு		

வ. எண்.	வினாக்கள்	I	II
10	**கீழ்கண்டவற்றுள் எந்த காரணி எடை கூடுதலுடன் சம்பந்தப்பட்டது?** அ. தொலைக்காட்சி பார்ப்பதில் நேரம் செலவிடுதல் ஆ. விளையாடுவதில் நேரம் செலவிடுதல் இ. வீட்டு வேலை செய்வதில் நேரம் செலவிடுதல் ஈ. மூச்சுப்பயிற்சியில் நேரம் செலவிடுதல்		
	உடல் பருமனை கண்டறிதல்		
11	**கீழ்கண்ட எவற்றிலிருந்து உடல் நிறைகுறியீட்டெண் கணக்கிடப்படுகிறது** அ. உயரம் மற்றும் எடை ஆ. எடை மற்றும் தோல்மடிப்பு தடிமன் இ. உயரம் மற்றும் தோல் மடிப்பு தடிமன் ஈ. எடை மற்றும் உடல் கொழுப்பு		
12	**அதிகமான இடை சுற்றளவு கீழ்க்கண்ட எவற்றை குறிக்கும்** அ. நாட்பட்ட நோய்க்களுக்கான அபாயம் ஆ. வேலை செய்ய இயலாமை இ. நடக்க இயலாமை ஈ. ஆரோக்கியமான உடல்		
	உடல் பருமனால் விளையும் உடல் நல அபாயங்கள்		
13	**கீழ்கண்ட எந்த நோயுள்ள நபருக்கு நீரிழிவு மற்றும் இரத்தம் அழுத்தம் நோய் வரும் அபாயம் அதிகம்** அ. கீல் வாதம் ஆ. மூச்சுக்குழாய் ஆஸ்த்துமா இ. உடல் பருமன் ஈ. தோல் வியாதிகள்		
14	**உடல் பருமன் கீழ்க்கண்ட சுகாதார பிரச்சனையை ஏற்படுத்தலாம்** அ. இதய பிரச்சனை ஆ. கபவாதம் இ. உண்ணும் ஒழுங்கீணம் ஈ. மூச்சுக்குழாய் ஆஸ்த்துமா		
15	**உடல் பருமனால் விளையும் முடிவான பாதிப்பு** அ. குறைவான ஓய்வு ஆ. குறைவான ஆயுள் இ. குறைவான செயல்பாடு ஈ. குறைவான உணவு உண்ணுதல்		
	உடல் பருமன் சிகிச்சை		
16	**அதிகமான உடல் எடையை கீழ்கண்டவற்றின் மூலமாக குறைக்கலாம்** அ. உணவு உண்ணுதல் மற்றும் ஆற்றல் செலவினை சமநிலை படுத்துதல் ஆ. ஆற்றல் செலவினை விட குறைவாக உண்ணுதல் இ. ஆற்றல் செலவினை விட அதிகமாக உண்ணுதல் ஈ. வேலை மற்றும் ஓய்வினை சமநிலைபடுத்துதல்		
17	**கீழ்கண்ட எவை உடல் பருமன் சிகிச்சை ஆகாது** அ. மருந்துகள் ஆ. அறுவை சிகிச்சை இ. காற்றியல் உடற்பயிற்சி ஈ. குறிப்பிடத்தக்கதல்லாத உணவு கட்டுப்பாடு		
18	**ஆரோக்கியமான எடை இழப்பு என்பது** அ. வாரத்திற்கு ½ கிலோ குறைத்தல் ஆ. வாரத்திற்கு 1 கிலோ குறைத்தல் இ. வாரத்திற்கு 1½ கிலோ குறைத்தல் ஈ. வாரத்திற்கு 2½ கிலோ குறைத்தல்		

வ. எண்.	வினாக்கள்	I	II
19	**லேசான மற்றும் மிதமான உடல்பருமன் நிர்வகிக்கும் சிறந்த வழி** அ. மருந்துகள் ஆ. தீவிர தீவிரம் உடல் செயல்பாடு இ. உணவு பழக்கம் மாற்றம் ஈ. உணவு பழக்கம் மாற்றம் மற்றும் மிதமான தீவிரம் உடல் செயல்பாடு		
20	**எடை குறைப்பிற்கு பரிந்துரைக்கப்படும் உடல் செயல்பாடு** அ. ஒரு நாளைக்கு 60 நிமிட மிதமான தீவிரம் உடல் செயல்பாடு ஆ. ஒரு நாளைக்கு 60 நிமிட தீவிர தீவிரம் உடல் செயல்பாடு இ. ஒரு நாளைக்கு 30 நிமிட மிதமான தீவிரம் உடல் செயல்பாடு ஈ. ஒரு நாளைக்கு 15 நிமிட தீவிர தீவிரம் உடல் செயல்பாடு		
	தடுப்பு முறைகள்		
21	**ஆரோக்கியமான வாழ்விற்கு எதிர்ப்பார்க்கப்படும் உடல் செயல்பாடு** அ. ஒரு நாளைக்கு 60 நிமிட மிதமான தீவிரம் உடல் செயல்பாடு ஆ. ஒரு நாளைக்கு 60 நிமிட தீவிர தீவிரம் உடல் செயல்பாடு இ. ஒரு நாளைக்கு 30 நிமிட மிதமான தீவிரம் உடல் செயல்பாடு ஈ. ஒரு நாளைக்கு 30 நிமிட தீவிர தீவிரம் உடல் செயல்பாடு		
22	**கீழ்க்கண்டவற்றுள் எவை ஓங்க் உணவுகள்** அ. காய்கறி ரொட்டி ஆ. கேக்குகள் மற்றும் எண்ணெயில் பொறிந்த உணவுகள் இ. நறுக்கப்பட்ட பழங்கள் கலவை ஈ. நறுக்கப்பட்ட காய்கறிகள் கலவை		
23	**சிறந்த உடல் எடையை பராமரிக்க கீழ்கண்ட உணவினை தவிர்க்கலாம்** அ. சர்க்கரை இனிப்பூட்டிய பானங்கள் ஆ. பழுப்பு அரிசி இ. கோதுமை ஈ. ஓட்ஸ்		
24	**உடல் பருமனை தடுக்கும் முக்கியமான நடவடிக்கை** அ. அதிக கலோரி உட்கொள்ளல் மற்றும் குறைவான உடற்பயிற்சிகள் ஆ. சாதாரணகலோரி உட்கொள்ளல் மற்றும் வழக்கமான உடற்பயிற்சி இ. குறைந்த கலோரி உட்கொள்ளல் மற்றும் கடுமையான உடற்பயிற்சி ஈ. அதிக கலோரி உட்கொள்ளல் மற்றும் கடுமையான உடற்பயிற்சி		
25	**உடல் பருமனை தடுக்க சிறந்த வழி** அ. மிதமான தீவிர பயிற்சி ஆ. கொழுப்பு தவிர்த்தல் இ. ஆரோக்கியமான வாழ்க்கைப் பாணி நடைமுறைகள் ஈ. மருந்துகள் தவிர்ப்பது		

பகுதி 4: உடல்பருமனை பற்றிய மனப்பாங்கை மதிப்பிடும் அளவுகோல்

S.No.	கூற்று	உ.ஏ (அ)	ஏ (ஆ)	ஐ (இ)	ம (ஈ)	உ.ம (உ)	I	II
1	எனது எடை இயல்பு எடையை விட கூடுதல்							
2	உணவு உட்கொள்ளுதல் மற்றும் ஆற்றல் செலவிடுதலை சமநிலை படுத்துவது முடியாது							
3	துரித உணவு மற்றும் எண்ணெயில் பொறித்த உனவு ஆகியவற்றை தவிர்ப்பது உடல் நலத்திற்கு நல்லது.							
4	திண்பண்டங்கள் உண்பது ஆரோக்கியமானது.							
5	உணவு மற்றும் திண்பண்டங்களை தொலைக்காட்சி பார்த்துக்கொண்டே உண்பது ஆரோக்கியமானது.							
6	விருப்பமான உணவுகளை அதிகமாக உட்கொள்ளலாம்.							
7	வேலை மன அழுத்தத்தை விளைவிக்கலாம்.							
8	அதிகமான நேரம் உறங்குதல் உடல்பருமனை ஏற்படுத்தும்.							
9	மருந்துகள் மற்றும் ஹார்மோன் உட்கொள்ளுதல் எடையை அதிகரிக்கும்.							
10	மது அருந்துதல் எடை கூடுதலுக்கு எதையும் செய்வதில்லை.							
11	பரம்பரை காரணிகள் எடை கூடுதலில் தாக்கம் ஏற்படுத்தும்.							
12	ஒரு நாளைக்கு 5 சிறிய உணவுகள் 3 முழு உணவுகளை விட சிறந்தது.							
13	வேகமாக உணவு உண்ணுதல் எடை கூடுதலை குறைக்கும்.							
14	உடல் பருமன் மற்ற உடல்நல கேடுகளை ஏற்படுத்தும்.							
15	உடல் பருமனுள்ள மனிதர்களுக்கு வாழ்நாள் குறைவாக இருக்கும்.							
16	தொடர்ந்த உடற்பயிற்சி மற்றும் உணவுப்பழக்க வழக்கங்களை மாற்றுதலே ஆரோக்கியமான எடை குறையை ஏற்படுத்தும்.							
17	எடையை குறைத்தாலும் நீண்ட நாட்களுக்கு எடையை பராமரிப்பது இயலாதது / முடியாதது.							
18	நாம் எடையை குறைக்க வல்லுனர்களிடம் ஆலோசனை கேட்கலாம்.							
19	வேலைப் பளு ஆரோக்கிய உணவு மற்றும் தொடர் உடற்பயிற்சியை அனுமதிகாது.							
20	மன அழுத்தத்தை சமாளிப்பது கடினம்.							

குறிப்பு:

உ.ஏ - உறுதியாக ஏற்கிறேன்

ஏ - ஏற்கிறேன்

ஐ - ஐயத்திற்கு இடமாக

ம - மறுக்கிறேன்

உ.ம - உறுதியாக மறுக்கிறேன்

பகுதி 5: உணவு, உடல்செயல்பாடு மற்றும் வாழ்க்கை முறை பழக்கங்களை மதிப்பிடுதல்

பகுதி 5அ: உணவு பழக்கங்களை மதிப்பிடுதல்

1. மூன்று நாள் உணவு உண்டதை நினைவு கூறுதல்.

உணவு/ திண்பண்டங்கள்	ஞாயிறு		வார நாள் I		வார நாள் 2	
	I	II	I	II	I	II
அதிகாலை						
காலை உணவு						
காலை மத்தியில்						
நண்பகல்						
மாலை						
இரவு உணவு						
படுக்கும் நேரம்						
மற்றவை						

2. உணவு நிகழ்வு கேள்விப்பட்டியல்

உணவு குழுக்கள்	ஒரு நாளில் இரண்டு முறை (அ)	ஒரு நாளில் ஒரு முறை (ஆ)	ஒரு வாரத்தில் 4-6 முறை (இ)	ஒரு வாரத்தில் 2-3 முறை (ஈ)	வாரத்தில் ஒரு முறை (உ)	ஒரு மாதத்திற்கு 2-3 முறை (ஊ)	மாதத்தில் ஒரு முறை (எ)	எப்பொழுதாவது (ஏ)	I	II
2.1 தானியங்கள் (அரிசி, கோதுமை, கேழ்வரகு, மற்றும் பல ...)										
2.2 செம்மைப் படுத்தப்பட்ட தானியங்கள் (மைதா, ரவை, மற்றும் பல ...)										
2.3 பருப்பு மற்றும் முழு பருப்பு வகைகள்										
2.4 உப்புவகை உணவுகள் (ஊறுகாய், சிப்ஸ், கருவாடு, மற்றும் பல ...)										
2.5 மஞ்சள் காய்கறிகள்										
2.6 பச்சை காய்கறிகள்										
2.7 பழங்கள்										
2.8 பால் மற்றும் பால் பொருட்கள்										
2.9 மீன்										
2.10 ஆட்டிறைச்சி மற்றும் கோழியிறைச்சி										
2.11 முட்டை										
2.12 எண்ணெய் உணவுகள் (பக்கோடா, சமோசா, பப்ஸ், வடை, பஜ்ஜி, மற்றும் பல)										
2.13 அதிக கொழுப்பு சத்து உணவு (கிரீம் சார்ந்த உணவு)										
2.14 விலங்கு கொழுப்புகள் (வெண்ணெய் மற்றும் நெய்)										
2.15 இனிப்பு மற்றும் சாக்லேட்ஸ்										
2.16 உடனடி உணவு (நூடுல்ஸ், பிஸ்கட்ஸ், லேஸ், குர்குரே மற்றும் பல...)										
2.17 காபி மற்றும் டீ										
2.18 கார்பனேற்றப் பட்ட பானங்கள்										
2.19 நட்ஸ்/ சொட்டைகள்										
2.20 பாம் ஆயில் பயன்பாடு										

3. உணவுப் பழக்க பட்டியல்

வ. எண்.		எ. நே (அ)	பெ. நே (ஆ)	சி. நே (இ)	எ (ஈ)	எ.இ (உ)	I	II
3.1	நான் சைவ உணவை உண்கிறேன்.							
3.2	நான் அசைவ உணவை உண்கிறேன்.							
3.3	தினமும் சரியான நேரத்தில் நான் உணவை உண்கிறேன்.							
3.4	நான் வீட்டில் சமைத்த உணவை உண்கிறேன்.							
3.5	நான் ஹோட்டலில் சமைத்த உணவை உண்கிறேன்.							
3.6	என்னுடைய வேலைப்பளு என்னுடைய காலை உணவை தவிர்க்க செய்யும்.							
3.7	தவிர்த்த உணவை நான் இனிப்பு பானங்கள் அருந்தி சரிசெய்வேன்.							
3.8	உணவு வேலைகளுக்கு இடையில் திண்பண்டங்கள் எடுப்பேன்.							
3.9	எனக்கு தொலைக்காட்சி பார்க்கும்போது திண் பண்டங்கள் சாப்பிடும் பழக்கம் உள்ளது.							
3.10	எனக்கு மெதுவாக சாப்பிடும் பழக்கம் உள்ளது.							
3.11	நான் தினமும் 8-10 டம்பளர் தண்ணீர் குடிப்பேன்.							
3.12	தினமும் அரிசி சார்ந்த உணவை ஒரு நாளுக்கு பல தடவை உண்பேன்.							
3.13	நான் பழங்களை ஒரு நாளுக்கு இருமுறை உண்பேன்.							
3.14	நான் காய்கறிகளை ஒரு நாளுக்கு இருமுறை உண்பேன்.							
3.15	நான் சிறிய அளவு உணவை அடிக்கடி உண்பேன்.							

குறிப்பு: எ.நே - எல்லா நேரங்களிலும், பெ.நே - பெரும்பாலான நேரங்களில்

சி.நே - சில நேரங்களில், எ - எப்பொழுதாவது,

எ.இ - எப்பொழுதும் இல்லை

பிரிவு 5ஆ: உடலுழைப்பு பழக்கப் பட்டியல்

வ. எண்.		எ. நே (அ)	பெ. நே (ஆ)	சி. நே (இ)	எ (ஈ)	எ.இ (உ)	I	II
1.	நான் உடற்பயிற்சி செய்கிறேன்.							
2.	உடற்பயிற்சிக்கு பிறகு நான் வியர்ப்பேன்							
3.	துணிதுவைத்தல், பெருக்குதல், பாத்திரம் கழுவுதல், வீடு துடைத்தல் போன்ற வீட்டு வேலைகளை செய்கிறேன்.							
4.	ஒரு நாளுக்கு இரண்டு மணி நேரத்திற்கு மேலாக நான் தொலைக்காட்சி பார்ப்பேன்.							
5.	புத்தகங்களை படிப்பதும், தொலைக்காட்சி பார்ப்பதுமே என் ஓய்வு வேலையாகும்.							
6.	நான் சிறிய தூர பயணத்திற்கு கூட வாகனம் பயன்படுத்துவேன்.							
7.	நான் குழந்தைகளுடன் சுறு சுறுப்பாக விளையாடுவேன்.							
8.	நான் என்னை சமூக சேவை செயல்பாடுகளில் ஈடுபடுத்திக் கொள்வேன்.							
9.	நான் மாடிப்படி ஏறுதலை தவிர்ப்பேன்.							
10.	தோட்ட வேலைகளில் நான் என்னை ஈடுபடுத்துவது இல்லை.							

பிரிவு 5இ: வாழ்க்கை முறை பழக்க பட்டியல்:

வ. எண்.		எ. நே (அ)	பெ. நே (ஆ)	சி. நே (இ)	எ (ஈ)	எ.இ (உ)	I	II
1.	நான் வழக்கமாக புகை பிடிக்கிறேன்.							
2.	நான் மற்ற புகையில்லா புகைப்பொருட்களை பயன் படுத்துகிறேன்.							
3.	நான் மதுபானத்தை வழக்கமாக குடிக்கிறேன்.							
4.	எனக்கு முறையான/ தொடர்ந்த தூக்கப்பழக்கம் உள்ளது.							
5.	நான் வழக்கமாக உடல் நல பரிசோதனை செய்கிறேன்.							
6.	நான் சிறிய வியாதிகளுக்கு சுய மருந்துகளை எடுத்துக் கொள்வேன்.							
7.	நான் ஒரு கடின உழைப்பாளி							
8.	என் குடும்ப வாழ்க்கை மண அழுத்தம் உடையது.							
9.	நான் வேலை பார்க்கும் சூழல் அமைதியாக இருக்கும்.							
10.	நான் மக்களுடன் சுலபமாக கலந்து கொள்வேன்.							

BIO PHYSIOLOGICAL MEASUREMENTS

Bio-Physiological Variables included in this study was weight and height to calculate BMI, waist Circumference and Percent Body Fat.

Weight: Body weight was measured (to the nearest 0.5kg) with the subject standing motionless on the weighing scale, feet about 15cm apart and weight equally distributed on each leg. Subjects were instructed to wear minimum outwear (as culturally appropriate) and no footwear while their weight was being measured. The weighing machine was calibrated by the bio-medical department experts. Standardization was done for every tenth sample.

Height: Height was measured to the nearest 0.5cm with the subject standing in an erect position against a vertical surface, and the head positioned so that the top of the external auditory meatus was level with the inferior margin of the body orbit (Frankfurt's plain).

BMI: Body Mass Index was calculated as weight in kilograms divided by height in meters squared. Based on their BMI, individuals were classified into four groups: Underweight (BMI <18), normal (BMI -18 – 22.9), Over Weight (BMI - 23 – 24.9), class I Obesity (BMI - 25 – 29.9), class II Obesity (BMI – 30 –34.9) and class III Obesity (BMI – 35 –35.9) as per Indian Dietetic Association and ICMR recommendation based on Dr. Mishra study's consensus agreement.

Waist Circumference: waist circumference was measured with a standard measuring tape, while subjects were lightly clothed, at a level midway between the lower margin of the last rib and iliac crest in centimeters (to the nearest 0.1cm).
According to Misra et al., 2008 Indian studies WC cut-off for Asian Indians are
Action Level 1: Men 78cm Women: 72cm
Action Level 2: Men 90cm Women: 80cm

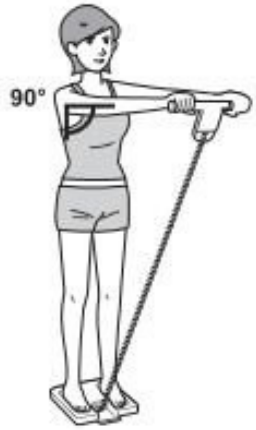
According to WHO

Waist circumference (WC) cut off for: Men = 102cm and for Women = 88cm

Percent Body Fat: Body fat percentage refers to the amount of body fat mass in regards to the total body weight expressed as a percentage.

Body fat percentage = body fat mass (kg)/ body weight (kg) *100

It is the amount of fat in the body, compared to everything else. Everything else includes organs, muscles, bones, tendons, water, and so on which will be measured by Bio electrical Impedance Analysis (BIA). Body Fat analyser was used to measure the Percent Body Fat and it was calibrated by bio medical engineering department. Standardization was done for every tenth sample.



Correct Posture for Measurement

The general principle behind BIA:

1. Four conductors are attached to a person's body and a small electric current is sent through the body.
2. The resistance between the conductors provides a measure of body fat between a pair of electrodes, since the resistance to electricity varies between adipose, muscular and skeletal tissue.
3. Fat-free mass (muscle) is a good conductor as it contains a large amount of water (approximately 73%) and electrolytes, while fat is anhydrous and a poor conductor of electric current.
4. Factors that affect the accuracy and precision of this method include instrumentation, subject factors and technician skill.

The following steps were followed to measure the percent body fat.

1. Height and Weight was measured using the standardized procedure.
2. Level and hard surface was selected.
3. Power was turned on. Display blinked and changed to "0.0kg"
4. Guest mode was selected in the display unit.
5. Personal data like age, gender and height was set in the unit.
6. The individual was asked to step on the main unit and place both the feet on the foot electrode with weight evenly distributed on the measurement platform. Instruction was given to stand with knees and back straight. (the display will show the weight and the weight result will blink twice. The unit will then start to measure the body fat percentage…)
7. When start appears on the display, the individuals were asked to extend the arms at a 90 degree angle to their body. (the indicators in the measurement progress bar at the bottom of the display will gradually appear from left to right).
8. After the measurement is complete, the weight is displayed again. At this point the individuals were asked to step off the unit.
9. The measurement results were viewed by pressing the SET/MODE button. The display changes with each press of the SET/MODE button as follows: FAT-VISCERAL FAT-BMI-RESTING METABOLISM-BODY AGE-WEIGHT (again)

Specific instructions for measuring percent body fat

Measurements should not be taken

1. Immediately after exercise
2. Soon after drinking lots of water or eating a meal
3. When dehydrated
4. After drinking alcohol
5. After a bath
6. When the feet or arms are wet

Recommended time for measurements

1. After waking up
2. Before lunch and about 2 hours or more after breakfast
3. In the afternoon about 2 hours or more after lunch and before taking a bath or eating dinner.
4. Before going to bed and about 2 hours or more after dinner or bath

Possible errors of measurements:

1. When palms or soles are not in firm contact with electrodes
2. When posture is wrong
3. When values of body composition are out of measurable range (weight is 150 kg or over.
4. During abnormal operation
5. When moved the body while measuring
6. Stepped on the unit before the display indicated “0.0kg”

LESSON PLAN

ON

OBESITY

HEALTH EDUCATION PLAN ON OBESITY

AIM	:	Teach the obese adults regarding the management and prevention of obesity and body weight maintenance.
GENERAL OBJECTIVES	:	At the end of the teaching, the obese adults will be able to gain in depth understanding about the prevention and management of obesity. And also will be able to adhere to the weight reducing strategies.
SPECIFIC OBJECTIVES	:	At the end of the teaching the obese adults will be able to ➢ explain the meaning of obesity ➢ enlist and brief the causes of obesity ➢ describe in detail about the health impacts of obesity ➢ list the methods of diagnosis of obesity ➢ explain about the dietary, physical activity, medical and surgical management and prevention of obesity ➢ explain the management of obesity by family involvement and social support ➢ explain the importance of monitoring and use of results for management of obesity. ➢ mention the role of behavioral change strategies, goal setting, risk factor reduction and problem solving in the management of obesity. ➢ state the benefits of obesity reduction

NAME OF THE TEACHER	**:**	**Ms.R.PADMAVATHI, PhD SCHOLAR**
TOPIC	**:**	Obesity
METHOD OF TEACHING	**:**	Lecture cum Discussion
AV AIDS	**:**	Flash Cards
DATE	**:**	All days from Jan 2012 onwards
TIME	**:**	20 Minutes
VENUE	**:**	Houses of obese adults
GROUP	**:**	Obese adults and their family
SEATING ARRANGEMENT	**:**	1:2-3

:

OBJECTIVES	CONTENT	EVALUATION
To introduce the topic	Obesity can be seen as the first wave of a defined cluster of Non Communicable Diseases. It is also called "New World Syndrome," creating an enormous socioeconomic and public health burden in developed and developing countries.	
To explain the meaning of obesity	If a person's body weight is at least 20% higher than it should be he or she is considered obese. Obesity means having too much body fat. It is not the same as being overweight, which means weighing too much. A person may be overweight from extra muscle, bone, or water, as well as from having too much fat.	What is obesity?
To enlist and brief the causes of obesity	**Consuming too many calories:** People are eating much more than they need. Consumption of increased calories is seen worldwide. Most of the increased food consumption has consisted of carbohydrates (sugars). Increased consumption of sweetened drinks has contributed significantly to the raised CHOs intake over the last 3 decades. The consumption of fast foods has tripled over the same period. Consumption of too much Alcohol also tends to put on weight. Many people do not have time to plan and make healthy meals. **Leading a sedentary lifestyle:** With the arrival of televisions, computers, videogames, remote controls, washing machines & other modern convenience devices, the majority of people are leading a much more sedentary life style compared to their parents & grandparents. More people today work desk jobs compared to more active jobs in the past. People with less free time have less time to exercise. As large supermarkets & shopping malls started to appear, people move	List few causes of obesity and explain how sedentary lifestyle leads to obesity.

OBJECTIVES	CONTENT	EVALUATION
	from using their feet to driving their cars & vehicles to get their provisions. The less we move around the fewer calories are burned. Physical activity has a beneficial effect on our insulin level by keeping them stable. Unstable insulin levels are closely associated with weight gain. **Not sleeping enough:** Sleep deprivation significantly increases obesity risk because of the increased appetite as a result of hormonal changes. Sleep deprivation causes increased production of appetite stimulating hormone Ghrelin & decreased production of appetite suppressing hormone leptin. **Endocrine disruptors (Foods that interface with lipid metabolism**): Fructose (a type of sugar) in beverages may alter lipid energy metabolism & cause obesity ,DM ,HTN and fatty liver. **Medications** Medications used in treating depression (Anti depressants) Medications used in controlling seizures (Anticonvulsants) Medications used in lowering blood sugar Oral contraceptives Corticosteroids (Prednisolone) Blood pressure medications (Anti Hypertensives) **Genetics:** A Person is more likely to develop obesity if one or both parents are obese. (One Genetic cause of obesity is leptin deficiency) The role of leptin replacement as a treatment for	

OBJECTIVES	CONTENT	EVALUATION
	obesity is currently being explored. Leptin is a hormone produced in fat cells, and also in the placenta. Leptin controls weight by signaling the brain to eat less when body fat stores are too high. **Over eating:** Over eating leads to weight gain, especially if the diet is high in fat. Foods high in fat or sugar have high energy density (foods that have a lot of calories in a small amount of food) **A diet high in simple carbohydrate:** Carbohydrates increase blood glucose levels, which in turn stimulate insulin release by the pancreas, and insulin promotes the growth of fat tissue and can cause weight gain. Simple Carbohydrates (Sugar, fructose, desserts, soft drinks, beer and wine etc) absorbed in to the blood stream easily than complex carbohydrates (brown rice ,wheat, vegetables and raw fruits…etc) & thus cause a pronounced insulin release after meals than complex CHOs. **Frequency of eating:** People who eat small meals 4 or 5 times daily have lower cholesterol levels & more stable blood sugar levels than people who eat less frequently 2 or 3 large meals daily, because small frequent meals produce stable insulin levels whereas large meals cause large spikes of insulin after meals.	

OBJECTIVES	CONTENT	EVALUATION
	Slow metabolism: Muscle burns more calories than other tissue. Women have less muscle than men. Women have a slower metabolism than men & hence have a tendency to put on weight than men & weight loss is more difficult for women. As we age, we tend to lose muscle & our metabolism slows: we tend to gain weight as we get older particularly if we do not reduce our daily caloric intake. **Psychological factors:** Many people eat excessively in response to emotions such as boredom, sadness, stress or anger. **Diseases:** Hypothyroidism, Insulin resistance, Poly cystic ovary syndrome, Cushings syndrome all contributes to obesity. **Other causes:** Menopause women may gain 12-15 pounds during menopause. Pregnant women are unable to lose the weight they gained during pregnancy	
To describe about the health impacts of obesity	1. **Bone & cartilage degeneration (osteoarthritis):** Obesity is an important risk factor for osteoarthritis in most joints especially at the knee joint. 2. **Coronary Heart disease** 3. **Gall bladder disease:** Being overweight is a significant risk factor for gall stones. 4. **Hypertension**	12. What are the health effects of obesity?

OBJECTIVES	CONTENT	EVALUATION
	5. **High cholesterol** **6. Respiratory problems** 7. **Several cancers:** Women- Cancer Breast, Uterus and Bladder. Men - Cancer Colon, Rectum and Prostate. 8. **Stroke:** Obesity has linked to more strokes among women aged 35 to 54. 9. **Type 2 diabetes:** Obesity is the strongest risk factors for type 2 DM and it is associated with central obesity. 10. **Insulin Resistance:** Effectiveness of insulin in transporting Glucose in to cells is diminished. **11. Reduce life expectancy**	
To list the methods of diagnosis of obesity	**Obesity is diagnosed by the following methods** **BMI** Measured by persons Height& weight (Equals the persons weight in Kg divided by Height in meters square). Based on their BMI, individuals are classified into four groups: Underweight (BMI <18), normal (BMI -18 – 22.9), Over Weight (BMI - 23 – 24.9), class I Obesity (BMI - 25 – 29.9), class II Obesity (BMI – 30 –34.9) and class III Obesity (BMI – 35 –35.9) as per ICMR and Indian Dietetic Association recommendation. **Waist Circumference** WC cut-off for Asian Indians are given below	How to identify the obesity?

<table>
<tr><th>OBJECTIVES</th><th>CONTENT</th><th>EVALUATION</th></tr>
<tr><td></td><td>Action Level 1: Men 78cm Women: 72cm Any person with WC above these levels should avoid gaining weight and maintain physical activity to avoid acquiring any of the cardiovascular risk factor. These action level 1 cut-offs need to be researched further.

Action Level 2: Men 90cm Women: 80cm Subject with WC above this should seek medical help so that obesity-related risk factors could be investigated and managed.
According to WHO WC cut off for: Men = 102cm and for Women = 88cm
Percent body fat: The range for percent body fat is given by American Council on Exercise.
<table>
<tr><th rowspan="4">Percent Body Fat (American Council on Exercise)</th><th>Male</th><th>Female</th><th></th></tr>
<tr><td>14-17%</td><td>21-24 %</td><td>Ideal</td></tr>
<tr><td>18-24%</td><td>25-31 %</td><td>Average</td></tr>
<tr><td>>25%</td><td>> 32%</td><td>Obese</td></tr>
</table>
</td><td></td></tr>
<tr><td>To explain about the dietary, physical activity, medical, surgical management and prevention of obesity</td><td>Obesity can be managed by the following methods :
Dietary modifications: The first step in dietary management of obesity is to lose weight by decreasing energy intake to achieve an energy deficit that can be sustained for a sufficient period. A 5-10% weight loss over a 3-6 month period has massive health benefits. A weight loss of 0.5 kg/week is a safe and achievable target and can be achieved by a 500 to 1000kcal daily deficit. The second step, following weight loss, is to maintain weight loss by ensuring that energy intake matches energy needs.</td><td>Explain the dietary management of obesity.</td></tr>
</table>

OBJECTIVES	CONTENT	EVALUATION
	Strategies to reduce Saturated Fatty Acids and Trans fatty acids : **1.** Avoiding hydrogenated fats as spreads or for flavoring **2.** Avoiding or reducing the consumption of meat **3.** Using specially manufactured low fat foods. **4.** Modifying common foods to be lower in fat (Ex: Removing skin from chicken) **5.** Replacing high fat foods with low fat foods.(Substituting skim milk for whole milk) **6.** Consumption of low calories diet. **7.** High consumption of whole grains, pulses, yellow/orange/green leafy vegetables, fruits and milk **8.** Moderate consumption of refined cereals, fish, chicken and egg(without yellow) **9.** Low consumption of salts, oily foods, High cholesterol food, animal fats, sweets and chocolates, instant foods and carbonated beverages. **10.** Consume high fibre diet like fruits and vegetables. **11.** Consume adequate diet rich in vitamins and minerals like fruits and vegetables. **12.** Consume fresh juices without sugar. **13.** Reduce the use of refined cereals as they do not have fibre content. **14.** Reduce the direct sugar intake. **15.** Avoid deep fried items. **16.** Avoid pickles, dried fish and pappads. **17.** Restrict the non-vegetarian items like mutton and chicken as they have transfat.	

OBJECTIVES	CONTENT	EVALUATION
	18. Avoid eggs yellow part as it has high fat content. **19.** Consume 8 – 10 tumblers of water every day. **20.** Consume ginger, garlic, tulsi, cloves, fennel, fenugreek as its medicinal properties reduces the fat. **21.** The food items which are rich in calcium, potassium and magnesium and fibre materials like sea foods, fruits and vegetables should be consumed as it prevents the fat deposition in the blood vessels. **22.** Avoid or restrict the alcohol intake. **Foods to be included while on low calorie diet** **Group A vegetable: 100 grams or ½ cup cooked (30 k.cal, CHO 6 grams)** Cabbage, lettuce, chow chow, brinjal, cauliflower, mint, white radish, plantain stem, cucumber, capsicum, drumstick, French beans, green papaya, knol khol, ladies finger, mushroom, tomato, pumpkin, snake gourd, bitter gourd, plantain flower and leafy greans-fenu greek, Amaranth, etc **Group B vegetable: 100 grams or ½ cup cooked (50-60 k.cal, CHO 6-12 grams and 2-3 grams protein)** Beet root, carrot, drumstick leaves, turnip, coriander leaves, agathi, onion big, mango ginger, field beans, double beans, pink radish and jack fruit tender. **Fruits: (40 k.cal, 10 grams of CHO)**	

OBJECTIVES	CONTENT	EVALUATION
	Amla(4-5), apple(1small), banana(1/2 small), custard apple(1small), dates(2), grapes(20), guava(1 medium size), jack fruit(3 pieces), mango(1small), orange(1 average), papaya ripe(2''*3'')slice, pear(1 small), plum(2), pine apple(1slice) and sapota(1small) **Physical activity modification:** For reducing the weight the obese adults(18-64 years) should perform moderate intensity aerobic physical activity to 300 mts per week or engage in 150 mts of vigorous intensity aerobic physical activity per week. Activity that is performed at 3-5.9 times the intensity of the rest is the moderate intensity physical activity Ex: Walking briskly (4 miles per hour), Climbing, Gardening, Dancing, Bicyclying, Yogasanas & pranayama and Playing with children. **Tips to reduce weight** - Reduce fat foods - Eat chappathi or non at the beginning of meal to avoid heavy eating - Drink water before and inbetween food to feel fullness of stomach - When feeling hungry avoid eating instant and fast food items. Instead eat vegetable salad and soups. - Eating full fruit is better than fruit juice - Check your weight weekly - Choose exercise according to the health condition	

OBJECTIVES	CONTENT	EVALUATION
	✚ Incorporate exercise and dietary modification into your daily routines. **Medications:** Weight reducing medicines can be useful if not successful at losing 1 pound a week after 6 months of using lifestyle changes. Individual should only use medicines as part of a program that includes diet, physical activity, and behavioral changes. Weight-loss medicines might be suitable for adults who are obese (a BMI of 30 or greater). People who have BMIs of 27 or greater with heart disease and other health conditions. **Surgical management:** Two common weight-loss surgeries include banded gastroplasty and Roux-en-Y gastric bypass. For gastroplasty, a band or staples are used to create a small pouch at the top of your stomach. This surgery limits the amount of food and liquids the stomach can hold. For gastric bypass, a small stomach pouch is created with a bypass around part of the small intestine where most of the calories you eat are absorbed. This surgery limits food intake and reduces the calories your body absorbs. **Prevention of obesity:** ✚ Healthy eating plan (food choices and focus on the balance of energy IN and OUT) ✚ Focus on portion size ✚ Being active (Making personal and family time active) ✚ Reducing screen time (Limiting the use of TVs, computers and videogames) since they	

OBJECTIVES	CONTENT	EVALUATION
	limit time for physical activities - Keeping track of weight, body mass index and waist circumference.	
To explain family involvement & social support for behavioural modification towards weight reducing strategies.	- Management of obesity is a family challenge. - Weight reduction and maintenance has become the major responsibility of the individual as well as the family. - Family members should have a check over the dietary, physical activity and life style practices of the individuals. - Obese adults should learn about the weight reducing strategies and its maintenance. - Stress free family environment acts as a support to individuals	How family members can be involved?
To explain the importance of monitoring and use of results for management of obesity	- Monitor the BMI, WC and PBF regularly monthly twice. - Monitor blood sugar, blood pressure and lipid profile at least to screen for the development of co morbidities - Count the calories intake - Monitor for balancing the energy in and out	How monitoring is helpful in managing and preventing complications of obesity?
To mention behavioural change strategies, goal setting, risk factor reduction &	**Behavioural change strategies, goal setting, risk reduction & problem solving in obesity management** **Changing behaviours through goal setting :** Obese adults should be encouraged to :	How to solve this problem?

OBJECTIVES	CONTENT	EVALUATION
problem solving.	➢ Reduce the calorie intake ➢ Balance the calorie intake and expenditure ➢ Reduction of high energy dense foods ➢ Avoidance of oily and high cholesterol foods ➢ Avoid or minimize the alcohol intake ➢ Healthy dietary practices ➢ Active leisure time ➢ Moderate intensity exercises for at least 30 minutes daily in the morning and evening ➢ Use of stress management techniques ➢ Maintenance of healthy social relationship **Patient, family and Health Care worker partnership in planning care:** ➢ Involve the individual and family in plan of care. ➢ Provide many options and suggestions for the individuals to decide ➢ Personalized strategies. ➢ Encourage and provide positive reinforcement.	
To state the benefits of obesity reduction	Various study results have revealed that there is proportional decrease in the incidence of cardio vascular diseases, diabetes mellitus, hypertension, respiratory problems and ortho problems with the 5-10% of weight loss also.	What are all the benefits of weight reduction?

OBJECTIVES	CONTENT	EVALUATION
Recapitulation:	As the obesity is the risk factor for many chronic diseases even among the young adults it has to be managed properly for preventing the developments of co morbidities. The individuals should know how to manage the obesity and also how to maintain the weight reduction. Behavioral change which aids in dietary, physical activity and lifestyle modification helps to adhere to the weight reduction strategies. Thus it is essential to know the self management of obesity to lead a healthy life.	

உடல் பருமன்

பற்றிய பாடத்திட்டம்

உடல் பருமன் பற்றிய நல கல்வி திட்ட வரைவு:

குறிக்கோள்	:	உடல் பருமன் உள்ள பெரியவர்களுக்கு, உடல் பருமனை நிர்வகித்தல் மற்றும் தடுத்தல் மேலும் உடல் எடையினை பராமரித்தல் பற்றி கற்பித்தல்.
பொதுவான இலக்குகள்	:	இந்த கற்பித்தலின் இறுதியில் உடல் பருமன் உள்ள பெரியவர்கள் உடல் பருமனை நிர்வகித்தல் மற்றும் தடுத்தல் பற்றிய ஆழ்ந்த புரிதல் பெற இயலும். மேலும் எடையை குறைக்கும் உத்திகளை கடைபிடிக்க இயலும்.
குறிப்பிட்ட இலக்குகள்	:	இந்த கற்பித்தலின் இறுதியில், உடல் பருமன் உள்ளவர்கள் அறிவதாவது ➢ உடல் பருமனின் பொருளை விளக்குதல் ➢ உடல் பருமனின் காரணங்களை பட்டியலிட்டு விளக்குதல் ➢ உடல் பருமனின் உடல் நல பாதிப்புகளை விரிவாக விவரித்தல் ➢ உடல் பருமனை கண்டறியும் முறைகளை பட்டியலிடுதல் ➢ உடல் பருமனை, உணவு, உடலுழைப்பு, மருந்துகள் மற்றும் அறுவை சிகிச்சை மூலம் நிர்வகித்தல் மற்றும் உடல் பருமனை தடுத்தல் பற்றி விளக்குதல். ➢ உடல் பருமனை நிர்வகிப்பதில் குடும்பத்தினரின் பங்கையும் சமூக ஆதரவையும் குறித்து விளக்குதல். ➢ உடல் பருமனை தொடர்ந்து கண்காணித்தல் மற்றும் அதன் முடிவினை உடல்பருமனை நிர்வகித்தலில் பயன்படுத்துவதின் முக்கியத்துவத்தை விளக்குதல். ➢ உடல் பருமனை நிர்வகித்தலில் நடத்தையை மாற்றும் உத்திகள், இலக்குகள் அமைத்தல், அபாய காரணிகளை குறைத்தல் மற்றும் பிரச்சனைகளை கையாளுதல் ஆகியவற்றின் பங்கினை குறிப்பிடுதல் ➢ உடல் பருமனை குறைத்தலின் நன்மைகளை குறிப்பிடுதல்.

கற்பிக்கும் மாணவியின் பெயர்	:	**திருமதி.இரா.பத்மாவதி, முனைவர் படிப்பு மாணவி**
தலைப்பு	:	**உடல் பருமனை நிர்வகித்தல் மற்றும் தடுத்தல்**
கற்புக்கும் முறை	:	**விரிவுரை உடனாக கலந்துரையாடல்**
கேட்பொலி காட்சி உதவி	:	**மின்வெட்டொளி அட்டை**
தேதி	:	**ஜனவரி 2012 முதல் - எல்லா நாட்களும்**
நேரம்	:	**20 நிமிடங்கள்**
இடம்	:	**உடல் பருமன் உள்ள பெரியவர்களின் வீடுகள்**
குழு	:	**உடல் பருமன் உள்ள பெரியவர்கள் மற்றும் அவர்களுடைய குடும்பத்தினர்கள்**
அமர்விக்கும் முறை	:	**1:2-3**

OBJECTIVES	CONTENT	EVALUATION
பாடத்தலைப்பினை அறிவித்தல்	நாட்பட்ட நோய்களின் தொகுப்பில் முதல் அலையாக உடல்பருமன் காணப்படுகின்றது. வளரும் மற்றும் மேலை நடுகளில் பொது சுகாதாரம் மற்றும் சமூக பொருளாதாரத்தில் மிகப்பெரிய பாரத்தை உருவாக்கி "உலகின் புதிய நோய்க்குறியீடு" என அழைக்கப்படுகின்றது.	
உடல் பருமனின் அர்த்தத்தை விளக்குதல்	ஒரு நபரின் உடல் எடை இருக்க வேண்டிய எடையை விட 20 விழுக்காடு அதிகமாக இருந்தால் அந்த நபர் உடல் பருமன் உடையவராக கருதப்படுகிறார். உடல் பருமன் என்பது அதிகமான உடல் கொழுப்பு உடையதாகும். எடை கூடுதலாக இருத்தல் போல உடல் பருமன் இல்லை. ஏனெனில் எடை கூடுதல் என்பது அதிக தசையாலோ, எலும்புகளாலோ அல்லது நீர் மற்றும் கூடுதலான கொழுப்பு மூலம் இருக்கலாம்.	உடல் பருமன் என்றான் என்ன?
உடல் பருமனின் காரணங்களை பட்டியலிட்டு சுருக்கமாக விளக்குதல்	**அதிக கலோரிகளை உட்கொள்ளுதல்:** மக்கள் உடல் தேவைக்கு அதிகமாக உணவு உட்கொள்கிறார்கள். அதிக கலோரிகளை உட்கொள்ளுதல் உலகம் முழுவதும் காணப்படுகின்றது. பெரும்பாலான அதிக உணவு உட்கொள்ளுதலில் மாவுச்சத்து/சர்க்கரை உள்ளது. கடந்த 30 ஆண்டுகளாக அதிக அளவு இனிப்பூட்டப்பட்ட குளிர்பானங்களை உட்கொள்ளுதலே, அதிக மாவுச்சத்து/சர்க்கரை உட்கொள்ள காரணமாகியுள்ளது. துரித உணவுகளை உட்கொள்ளுதலும் மும்மடங்காகியுள்ளது. இக்கால கட்டத்தில் மதுபாணங்களை உட்கொள்ளுதலும் எடையை அதிகரிக்கும். ஆரோக்கியமான உணவினை திட்டமிட்டு செய்ய பல நபர்களுக்கு நேரமே இல்லை. **உடலுழைப்பு இல்லாத வாழ்க்கைமுறையை நடத்துதல்:** தொலைக்காட்சி, கணினிகள், நிகழ்பட விளையாட்டுகள், தொலைகட்டுபாடுகள், சலவை	உடல் பருமனை விளைவிக்கும் சில காரணங்களை பட்டியிடுக. மேலும் எவ்வாறு உடலுழைப்பு இல்லாத வாழ்க்கை முறையால் உடல் பருமன் வரும் என்பதை விளக்குக.

OBJECTIVES	CONTENT	EVALUATION
	இயந்திரங்கள், மற்றும் நவீன சௌகரியமான கருவிகள் ஆகியவற்றின் வருகையினால் பெரும்பாலான மனிதர்கள் அவர்களுடைய பெற்றோர்கள் மற்றும் தாத்தா பாட்டியினை ஒப்பிடும் போது மிக அதிகமாக உடலுழைப்பு இல்லாத வாழ்க்கை முறையை நடத்துகின்றார்கள். முந்தைய காலத்தைவிட தற்போது நிறைய மக்கள் சுறுசுறுப்பான வேலையை விட அலுவலில் உட்கார்ந்து செய்யும் வேலையை அதிகமாக செய்கிறார்கள். குறைவான ஓய்வு நேரம் உள்ளவர்களுக்கு உடற்பயிற்சிக்கு குறைவான நேரமே உள்ளது. பல்பொருள் சந்தை மற்றும் பல்கடை அங்காடிகளின் வருகையினால் மக்கள் மளிகை வாங்கக்கூட நடப்பதை விட்டு வாகனங்களை பயன்படுத்த ஆரம்பித்துவிட்டார்கள். நம் உடலின் இன்சுலின் அளவை நிலையாக வைக்க உடலுழைப்பு மிகவும் உதவியாக இருக்கும். நிலையில்லா இன்சுலின் அளவு எடை அதிகரிப்புடன் சம்பந்தப்பட்டது. **போதுமான தூக்கமின்மை:** தூக்கமின்மை ஹார்மோன்களின் மாற்றத்தை ஏற்படுத்தி பசியை அதிகரிப்பதால் உடல் பருமன் அபாயத்தை கணிசமாக அதிகரிக்கின்றது. தூக்கமின்மை பசியை அதிகரிக்கும் ஹார்மோனை அதிகமாக உற்பத்தி செய்து, பசியை குறைக்கும் ஹார்மோனை குறைவாக உற்பத்தி செய்கின்றது. **நாளமில்லா சுரப்பிகளை பாதிப்பது:** (கொழுப்பு வளர்சிதை மாற்றத்தை பாதிக்கும் உணவுகள்) குளிர்பானங்களில் உள்ள "பிரக்டோஸ்" என்ற ஒரு வகையான சர்க்கரை கொழுப்பு வளர்சிதை மாற்றத்தை பாதித்து உடல்பருமன், நீரிழிவு நோய், இரத்தக்கொதிப்பு மற்றும் கொழுப்பு கல்லீரலை விளைவிக்கின்றன. **மருந்துகள்:** மன அழுத்தம், வலிப்பு நோய், நீரிழிவு நோய், இரத்தக்கொதிப்பு	

OBJECTIVES	CONTENT	EVALUATION
	ஆகியவற்றை நிர்வகிக்க பயன்படுத்தும் மருந்துகள் மற்றும் கருத்தடை மாத்திரைகள், ஊக்க மருந்துகள் (ஸ்டிராய்டு) ஆகியவை உடல் பருமனை அதிகரிக்கின்றது. **மரபணுவியல்:** ஒன்று (அ) இரண்டு பெற்றோருமே உடல் பருமனாக இருந்தால் அவருடைய வாரிசுகளுக்கு உடல் பருமன் வர அதிக வாய்ப்புகள் உள்ளது. **அதிகமாக கொழுப்பு உண்ணுதல்:** கொழுப்பு மற்றும் சர்க்கரை அதிகமாக உள்ள உணவுகள் சிறிதளவே இருந்தாலும் உயர் ஆற்றல் அடர்த்தி உள்ளவை. அத்தகைய உணவினை உண்ணும்போது உடல் எடையை அதிகரிக்கும். **எளிமையான மாவுச்சத்து அதிகமாக உள்ள உணவுப்பொருள்கள்:** எளிதில் ஜீரணமாகக்கூடிய (அரிசி, சர்க்கரை, குளிர்பானங்கள், மதுபானங்கள் மாவுச்சத்து சிக்கலான மாவுச்சத்தை (கட்டரிசி, கோதுமை, காய்கறிகள், பச்சைபழங்கள்) விட வேகமாக ரத்தத்தில் உறிஞ்சப்படுவதால் அதிக அளவு இன்சுலின் வெளிவிடப்பட்டு, சர்க்கரை கொழுப்பாக மாற்றப்பட்டு சேமிக்கப்படுகிறது. இதனால் கொழுப்பு திசு அதிகரித்து உடல் எடை கூடுகின்றது. **அடிக்கடி உண்ணுதல்:** ஒரு நாளில் 2(அ) 3 முறை மிகப்பெரிய அளவு உணவு உண்பதை விட சிறிது சிறிதாக 4(அ) 5 முறை உணவு உட்கொள்ளுதல் உடலின் கொழுப்பின் அளவை குறைக்கும். இரத்தத்தில் உள்ள சர்க்கரையின் அளவும் நிலையாக இருக்கும். ஏனெனில் சிறிய உணவு நிலையான அளவு இன்சுலினை வெளியிடும் மிகப்பெரிய உனவு அதிகமான அளவு இன்சுலினை வெளியிடும்.	

OBJECTIVES	CONTENT	EVALUATION
	இதனால் உடல் எடையும் கூடும். **மெதுவான வளர்சிதை மாற்றம்:** உடலின் மற்ற திசுக்களை விட தசைகளே அதிக கலோரிகளை எரிக்கும். பெண்களுக்கு ஆண்களை விட குறைவான தசை உள்ளதால் அவர்களுக்கு மெதுவான வளர்சிதை மாற்றம் இருக்கும். எனவே பெண்களுக்கு எடை அதிகரிக்கும் நிலை உள்ளது. எடை குறைத்தலும் பெண்களுக்கு கடினம். அதே போல், வயதானவர்களுக்கும் தசை குறைவதால் வளர்சிதை மாற்றமும் குறையும். எனவே, வயது அதிகரிக்கும் போது நாமும் நம் கலோரிகளை குறைக்க வேண்டும். இல்லை என்றால் அதுவே எடை கூடுதலுக்கு வழிவகுக்கும். **உளவியல் காரணங்கள்:** பெரும்பாலான மனிதர்கள், சோகமாக இருக்கும் போதும், மன அழுத்தத்துடன் இருக்கும் போதும், கோபமாக இருக்கும்போதும் மற்றும் அலுப்பு/சலிப்புடன் இருக்கும்போதும் மிக அதிக அளவு உணவை உட்கொள்கிறார்கள். **நோய்கள்:** குறைவான தைராய்டு சுரப்பு, இன்சுலின் எதிர்ப்பு, கருப்பையில் நீர்க்கட்டி மற்றும் குஷ்சிங் நோய்க்குறி ஆகிய நோய்களே உடல் பருமனை அதிகரிக்கும். **மற்றவை:** • மாதவிளக்கு அடைந்த பெண்களுக்கு எடை அதிகரிக்கின்றது. • கர்ப்பத்தின் போது அதிகரித்த எடையை சில பெண்களால் குறைக்க இயலுவதில்லை.	
உடல் பருமனின் பாதிப்புகளை விளக்குதல்	**எலும்பு மற்றும் குருத்தெலும்பு சீரழிவு (எலும்புகளின் கீல்வாதம்):** மூட்டுகளில் எலும்புகலின் கீழ்வாதத்திற்கு உடல்பருமன் மிக முக்கிய அபாய காரணியாகும்,	உடல் பருமனின் பாதிப்புகள்

OBJECTIVES	CONTENT	EVALUATION
	குறிப்பாக முழங்கால் மூட்டுக்களை அதிகமாக பாதிக்கும். 2. **இதய இரத்தக்குழாய் பாதிப்பு** 3. **பித்தப்பை நோய்:** பித்தப்பை கற்கள் வர உடல் பருமன் குறிப்பிட்ட அபாய காரணியாகும். 4. **இரத்தக் கொதிப்பு** 5. **அதிக கொழுப்புச்சத்து** 6. **சுவாச பிரச்சினை** 7. **பல புற்று நோய்கள்:** பெண்கள் – மார்பகம், கருப்பை மற்றும் சீருநீரகபை புற்றுநோய். ஆண்கள் – பெருங்குடல், மலக்குடல் மற்றும் புராஸ்டேட் சுரப்பி புற்றுநோய். 8. **பக்கவாதம்:** 35 – 54 வயது வரையான பெண்கள் அதிகமாக பாதிக்கப்படுகின்றார்கள். 9. **வகை 2 நீரிழிவு:** வகை-2 நீரிழிவு நோயின் மிக உறுதியான அபாய காரணி உடல் பருமன் ஆகும். மேலும் இது மைய உடல் பருமன்/வயிற்று உடல் பருமனுடன் சம்மந்தப்பட்டது. 10. **இன்சுலின் எதிர்ப்பு:** குளுக்கோஸை செல்லினுள் அனுப்புதல் குறைகிறது. 11. **குறைவான வாழ்க்கை எதிர்பார்ப்பு**	என்னென்ன?
உடல் பருமனை கண்டறியும் முறைகளை பட்டியலிடுதல்	**கீழ்கண்ட முறைகள் மூலமாக உடல்பருமன் கண்டறியப்படுகிறது:** **உடல் நிறை குறியீட்டெண்:** ஒரு மனிதனின் எடை மற்றும் உயரத்தை கொண்டு உடல் நிறை குறியீட்டெண் கணக்கிடப்படுகிறது. இது ஒரு மனிதனின் எடையை அவனுடைய உயரத்தின் மீட்டர் அளவின் இருமடங்கால் வகுக்கும்போது	உடல் பருமனை எவ்வாறு கண்டறிவது

OBJECTIVES	CONTENT	EVALUATION
	பெறப்படுகிறது. இந்திய மருத்துவ ஆராய்ச்சி குழுமம் மற்றும் இந்திய உணவு கழகத்தின் படி ஒரு நபரை உடல் நிறைகுறியீட்டெண் அடிப்படையில் கீழ்க்கண்ட வகைகளாக பிரிக்கலாம். உடல் நிறை குறியீட்டெண் <18 - எடை குறைவு உடல் நிறை குறியீட்டெண் 18 – 22.9 - சரியான எடை உடல் நிறை குறியீட்டெண் 23 – 24.9 - அதிக எடை உடல் நிறை குறியீட்டெண் 25 – 29.9 – வகை I உடல் பருமன் உடல் நிறை குறியீட்டெண் 30 – 34.9 – வகை II உடல் பருமன் உடல் நிறை குறியீட்டெண் 35 – 39.9 – வகை III உடல் பருமன் **இடை சுற்றளவு:** ஆசிய இந்தியர்களுக்கான இடை சுற்றளவு வரம்பு. **நடவடிக்கை நிலை I:** ஆண்கள்: 78 செ.மீ, பெண்கள்: 72 செ.மீ. இடை சுற்றளவு இந்த வரம்பிற்கு அதிகமாக உள்ளவர்கள் எடை கூடுதலை குறைத்து உடலுழைப்பை பராமரித்து, இருதய நோய்க்கான அபாய காரணங்களை தவிர்க்க வேண்டும். **நடவடிக்கை நிலை 2:** ஆண்கள்: 90 செ.மீ, பெண்கள்: 80 செ.மீ. இடை சுற்றளவு இந்த வரம்பிற்கு அதிகமாக உள்ளவர்கள் மருத்துவ உதவியை நாடி உடல்பருமண் சம்மந்தமான அபாய காரணங்களை கண்டறிந்து குணப்படுத்த வேண்டும்.	

<table>
<tr><th>OBJECTIVES</th><th>CONTENT</th><th>EVALUATION</th></tr>
<tr><td></td><td>உடல் கொழுப்பு சதவீதம்: அமெரிக்க உடற்பயிற்சி குழுமத்தின் வரம்பு கீழே கொடுக்கப்பட்டுள்ளது.

<table>
<tr><td rowspan="4">உடல் பருமன் சதவீதம் (அமெரிக்க உடல்பயிற்சி குழுமம்)</td><td>ஆண்கள்</td><td>பெண்கள்</td><td></td></tr>
<tr><td>14-17%</td><td>21-24 %</td><td>சிறந்த்து</td></tr>
<tr><td>18-24%</td><td>25-31 %</td><td>சராசரி</td></tr>
<tr><td>>25%</td><td>> 32%</td><td>உடல் பருமன்</td></tr>
</table></td><td></td></tr>
<tr><td>உடல் பருமனை உணவு, உடலுழைப்பு, மருந்துகள், அறுவை சிகிச்சை மூலம் நிர்வகித்தில் மற்றும் தடுத்தல் பற்றி விளக்குதல்</td><td>உடல் பருமனை கீழ்கண்ட முறைகளில் நிர்வகிக்கலாம்:
உணவு முறை மாற்றங்கள்: எடையை குறைப்பதில் முதல்படி என்னவெனில் உணவு மூலம் எடுக்கும் கலோரி / ஆற்றலை குறைத்து ஆற்றல் இழப்பை போதுமான காலத்திற்கு நீடித்து இருக்க வேண்டும். 3லிருந்து 6 மாதத்திற்குள் சராசரியாக 5-10% எடை குறைவு கூட மிகப்பெரிய உடல் நல நன்மையை ஏற்படுத்த முடியும். ஒரு வாரத்திற்கு 1/2 கிலோ எடை குறைப்பு என்பது பாதுகாப்பான இலக்காகும். இதனை தினமும் 500லிருந்து 1000 கிலோ கலோரி இழப்பின் மூலம் அடைய முடியும்.

எடை குறைக்கும் இரண்டாம்படி உடலுக்கு தேவையான கலோரியையும், உணவு மூலம் எடுக்கும் கலோரியையும் சமநிலைபடுத்துவதாகும்.</td><td>உணவு முறை மூலம் உடல்பருமனை குறைக்கும் முறையை விளக்குக</td></tr>
</table>

OBJECTIVES	CONTENT	EVALUATION
	கொழுப்பு தவிர்க்கும் உத்திகள்: **1.** சுவைக்காக ஹைட்ரஜனேற்றப்பட்ட கொழுப்புகளை உணவின் மேல் பரப்புவதை தவிர்க்க வேண்டும் (உ.ம்: கேக் மீதுள்ள க்ரீம்கள்). **2.** இறைச்சி உண்ணுதலை தவிர்த்தல் (அ) குறைத்தல். **3.** சிறப்பாக தயாரிக்கப்பட்ட கொழுப்பு குறைந்த உணவுகளை பயன்படுத்துதல். **4.** பொதுவான உணவுப்பொருள்களை குறைவான கொழுப்பு உள்ளவையாக மாற்றுதல் (உ.ம்: கோழிக்கறியிலிருந்து தோலை நீக்குதல்). **5.** அதிகமான கொழுப்பு உணவுகளுக்கு பதிலாக குறைவான கொழுப்பு உணவுகளை பயன்படுத்துதல் (உ.ம்: கொழுப்பு நீக்கப்பட்ட பாலை பயன்படுத்துதல்). **6.** குறைவான கலோரிகள் உள்ள உணவை உண்ணுதல் **7.** முழுதானியங்கள், பருப்புகள், பச்சை/ஆரஞ்சு/மஞ்சள் காய்கறிகள் மற்றும் பழங்களை அதிக அளவு உண்ணுதல். **8.** செம்மை படுத்தப்பட்ட தானியங்கள், கோழிக்கறி, முட்டை மற்றும் மீன் போன்றவற்றை மிதமான அளவு உண்ணுதல். **9.** எண்ணெய் பொருட்கள், கொழுப்பு அதிகமுள்ள உணவுகள், விலங்கு கொழுப்புகள், இனிப்பு மற்றும் சாக்லேட்டுகள், துரித உணவுகள், கார்பனேற்றப்பட்ட பானங்கள் மற்றும் உப்பு பொருட்களை குறைவாக உண்ணுதல். **10.** நார்சத்து அதிகமுள்ள பழம் மற்றும் காய்கறிகளை உண்ணுதல். **11.** பழச்சாறுகளை சர்க்கரை இல்லாமல் குடித்தல்.	

OBJECTIVES	CONTENT	EVALUATION
	12. நேரடி சர்க்கரை சேர்ப்பதை / உண்பதை தவிர்த்தல். 13. எண்ணெயில் பொறித்த பொருட்களை தவிர்த்தல். 14. ஊறுகாய், அப்பளம், கருவாடு போன்றவற்றை தவிர்த்தல். 15. கொழுப்பு அமிலங்கள் உள்ளதால் அசைவ உணவுகளை தவிர்த்தல். 16. முட்டையின் மஞ்சள் கருவில் கொழுப்பு அமிலங்கள் அதிகம் உள்ளதால் அதனை தவிர்த்தல். 17. ஒரு நாளைக்கு 8-10 டம்ளர் தண்ணீர் குடித்தல். 18. இஞ்சி, பூண்டு, துளசி, கிராம்பு, பெருஞ்சீரகம் மற்றும் வெந்தயம் ஆகியவற்றின் மருத்துவ குணங்கள் கொழுப்பை குறைப்பதால், அவற்றை உணவில் சேர்க்க வேண்டும். 19. கால்சியம், பொட்டாசியம், மக்னீசியம் மற்றும் நார்சத்து நிறைந்த உணவுகளான கடல் உணவுகள், பழங்கள் மற்றும் காய்கறிகள், இரத்தக்குழாய்களில் கொழுப்பு சேர்வதை தவிர்ப்பதால் அதனை உணவில் சேர்க்க வேண்டும். 20. மதுபானம் அருந்துவதை குறைத்தல் (அ) தவிர்த்தல். **எடையை குறைக்கும் குறைவான கலோரி உணவில் சேர்க்க வேண்டிய உணவுகள்:** **பிரிவு அ காய்கறிகள் (100 கிராம் 30 கிலோ களோரிகள்)** முட்டை கோஸ், கீரைவகை, சௌ-சௌ கத்திரிக்காய், காலிபிளவர், புதினா, வெள்ளை முள்ளங்கி, வாழைத்தண்டு, வெள்ளரிக்காய், குடை மிளகாய், முருங்கைக்காய், பிரெஞ்சு பீன்ஸ், பப்பாளிகாய், நூக்கல், வெண்டக்காய், காளான்,	

OBJECTIVES	CONTENT	EVALUATION
	தக்காளி, பூசனிக்காய், புடலங்காய், பாகற்காய், வாழைப்பழம் மற்றும் பலர். **பிரிவு ஆ காய்கறிகள்: (100 கிராம் 60 கி.களோரிகள்)** பீட்ரூட், கேரட், முருங்கைக்கீரை, சிவப்பு முள்ளங்கி, கொத்தமல்லி, அகத்தி, வெங்காயம் (பெரிது), இஞ்சி, பீன்ஸ், டபுள்பீன்ஸ், இளஞ்சிவப்பு முள்ளங்கி, பலாக்காய். **பழங்கள் (100 கிராம் – 40 கி. களோரிகள்)** நெல்லி(4-5), ஆப்பிள்(1 சிறியது), வாழைப்பழம் (1/2 சிறியது), சீத்தாப்பழம்(1 சிறியது), பேரிச்சை(2), திராட்சை(20), கொய்யா(1 நடுத்தர அளவு), பலாப்பழம்(3 சுலைகள்), மாம்பழம்(1 சிறியது), ஆரஞ்சு (1 சராசரியான), பழுத்த பப்பாளி (2"*3" அளவு துண்டுகள்), பேரி(1 சிறியது), பிளம்(2), அண்ணாசிப்பழம்(1துண்டுகள்) மற்றும் சப்போட்டா(1 சிறியது), **உடல் உழைப்பு மாற்றம்:** உலக சுகாதார நிலையத்தின் பரிந்துரைகள் படி, எடையை குறைக்க உடல் பருமனுள்ள பெரியவர்கள் (18 – 64 வருடங்கள்) கடைபிடிக்க வேண்டிய உத்திகள் கீழ்க்கண்டவாறு • வாரத்திற்கு 300 நிமிடங்கள் மிதமான தீவிரம் உடற்பயிற்சி ((உ.ம்) ஒரு மணி நேரத்தில் நான்கு மைல்கள் நடத்தல், படியேறுதல், தோட்டவேலை செய்தல், நடனமாடுதல், சைக்கிள் ஓட்டுதல், மூச்சு பயிற்சி மற்றும் குழந்தையுடன் விளையாடுதல்) அல்லது வாரத்திற்கு 150 நிமிடங்கள் தீவிர தீவிரம் உடற்பயிற்சி ((உ.ம்) வேகமாக ஆடுதல், குதித்தல்,...) செய்தல்.	

OBJECTIVES	CONTENT	EVALUATION
	எடை குறைக்கும் குறிப்புகள் • கொழுப்புச் சத்துள்ள உணவு வகைகளைக் குறைத்துக் கொள்ளுங்கள். • சாப்பாட்டின் தொடக்கத்திலேயே சுக்கா சப்பாத்தி அல்லது தந்தூரி ரொட்டிகளைச் (முழுக்கோதுமையில் செய்யப்பட்டிருக்க வேண்டும்) சாப்பிட்டால் நிறைய சாப்பிட வேண்டும் என்ற எண்ணம் குறையும். • சிறிது சிறிதாக எடுத்து பொறுமையாக மென்று சாப்பிடுங்கள். • சாப்பிடுவதற்கு முன்பும், இடை இடையேயும் அரை டம்ளர் தண்ணீராவது அருந்துங்கள். இதனால் வயிறு சீக்கிரமே நிரம்பி சாப்பிடும் அளவு குறையும். • பசிக்கும் போது கண்டதை வாங்கிச் சாப்பிடாதீர்கள். பேல்பூரி, பானிபூரி போன்ற துரித உணவு வகைகளை தவிர்த்துவிடுங்கள். அதற்கு பதிலாக, வெஜிட்டபிள் சூப் சாப்பிடலாம். சிறிதளவு எலுமிச்சை பிழிந்து வெள்ளரிப் பிஞ்சு வெங்காயம் கொண்ட சாலட் சாப்பிடலாம். • ஜூஸ் குடிப்பதைக் காட்டிலும் முழுப்பழங்களாகச் சாப்பிடுவது நல்லது. • வாரந்தோறும் எடையை சரி பாருங்கள். • உடல் பருமனைக் குறைப்பதற்கு அவரவர் உடல் நிலைக்கேற்ற பயிற்சிகள், யோகாசனங்கள், நடைப் பயிற்சிகளைத் தேர்ந்தெடுத்து பின்பற்றலாம். அப்போதுதான் பயிற்சிகள் உங்களுக்கு அலுப்பு தராது. • வாழ்க்கை முழுவதும் உடற்பயிற்சியா, உனவுக்கட்டுப்பாடா என்று திகைத்து விடாதீர்கள். இதுவே அன்றாட வாழ்க்கையாக மாற்றிக் கொள்ளுங்கள். போகப் போகப் பழகிவிடும்.	

OBJECTIVES	CONTENT	EVALUATION
	மருந்துகள்: வாழ்க்கை முறை மாற்றங்கள் செய்து 6 மாதம் ஆகியும் எடை குறையவில்லையெனில், மருந்துகள் உதவும். மருந்துகளை உணவு மாற்றம், உடலுழைப்பு மாற்றம் மற்றும் நடத்தை மாற்றத்துடன் சேர்ந்தே பயன்படுத்த வேண்டும். உடல் நிறை குறியீட்டெண் 30க்கு மேலாக உள்ள உடல்பருமன் உள்ளவர்கள் மற்றும் உடல் நிறை குறியீட்டெண் 27க்கு மேலாக மற்றும் பிற உடல் நலகேடு உள்ள உடல் பருமன் உள்ளவர்கள் மருத்துவமனையை நாடலாம். **அறுவை சிகிச்சை:** உணவுப்பையின் அளவை குறைத்தல் மற்றும் உணவு சத்து உறிஞ்சுவதை தவிர்த்தல் என்ற இரண்டு முறைகளின் மூலமாக அறுவை சிகிச்சை எடை குறைப்பதற்கு உதவியாக இருக்கிறது. **உடல் பருமனை தவிர்த்தல்:** ஆரோக்கியமான உணவுத்திட்டம் (உடல் கலோரி உட்கொள்ளுதல் மற்றும் செலவினை சம நிலைப்படுத்துதல்). உணவு அளவினில் கவனம் செலுத்துதல். சுறுசுறுப்பாக இருத்தல் (சுய மற்றம் குடும்ப நேரத்தை சுறுசுறுப்பாக வைத்தல்). திரையில் நேரம் (தொலைக்காட்சி, கணினி மற்றும் வீடியோ விளையாட்டுகளை) குறைத்தல். எடை, உடல் நிறை நிறையீட்டெண், இடை சுற்றளவு ஆகியவற்றை தொடர்ந்து கண்காணித்தல்.	

OBJECTIVES	CONTENT	EVALUATION
எடை குறைக்கும் உத்தியில் நடத்தையை மாற்றுவதில் குடும்பத்தினர் பங்கையும் சமூக ஆதரவையும் விளக்குதல்	➢ உடல் பருமனை நிர்வகித்தல் குடும்பத்தின் சவாலாகும். ➢ எடையை குறைத்தல் மற்றும் பராமரித்தல் தனி நபர் மற்றும் குடும்பத்தின் பொறுப்பாகும். ➢ ஒருவரின் உணவு, உடலுழைப்பு மற்றும் வாழ்க்கைமுறை பழக்கங்களை குடும்ப உறுப்பினர்கள் கவனிக்க வேண்டும். ➢ உடல் பருமன் உள்ளவர்கள் எடையை குறைக்கும் மற்றும் பராமரிக்கும் உத்திகளை கற்க வேண்டும். ➢ மன அழுத்தம் இல்லாத குடும்ப சூழ்நிலை தனி நபருக்கு ஆதரவாக இருக்கும்.	எவ்வாறு குடும்பத்தினர் இதில் ஈடுபட முடியும்?
உடல்பருமனை நிர்வகிப்பதில் தொடர்கணிகானித்தல் மற்றும் அதன் முடிவினை பயன்படுத்தலின் முக்கியத்துவம் பற்றி விளக்குதல்	➢ உடல் நிறை குறியீட்டெண், இடைச்சுற்றளவு, உடல் கொழுப்பு சதவீதம் ஆகியவற்றை மாத்ம் இரு முறை கண்காணித்தல். ➢ இணை ஆரோக்கியமின்மைகள் வருவதை சோதிக்க இரத்த சர்க்கரை, இரத்த அழுத்தம் மற்றும் கொழுப்புகளின் அளவை கண்காணிக்க வேண்டும். ➢ கலோரிகள் உண்பதை கணக்கிடவும். ➢ ஆற்றல் உள்ளெடுத்தல் மற்றும் செலவிடுதல் சமநிலையை கண்காணித்தல்.	உடல் பருமனை நிர்வகித்தல் மற்றும் தடுத்தலில் தொடர்கண்காணிப்பு எவ்வாறு உதவும்?
உடல் பருமனை நிர்வகித்தலில், நடத்தையை மாற்றும் உத்திகள் இலக்குகள் அமைத்தல், அபாய காரணங்களை குறைத்தல், மற்றும்	**நடத்தையை மாற்றும் உத்திகள் இலக்குகள் அமைத்தல், அபாய காரணங்களை குறைத்தல், மற்றும் பிரச்சனையை கையாளுதல்:** **இலக்குகள் அமைத்தல் மூலமாக நடத்தைகளை மாற்றுதல்:** உடல்பருமனுள்ள நபர்கள் கீழ்கண்டவற்றிற்கு ஊக்குவிக்கப்பட வேண்டும்: ➢ குறைவான கலோரியை எடுத்தல்.	இந்த பிரச்சனையை எவ்வாறு தீர்க்க வேண்டும்?

OBJECTIVES	CONTENT	EVALUATION
பிரச்சனையை கையாளுதல் ஆகியவற்றின் பங்கினை குறிப்பிடுதல்	➢ கலோரி எடுத்தல் மற்றும் செலவிடுதலை சமநிலைப்படுத்துதல். ➢ அதிக ஆற்றல் அடர்ந்த உணவுகளை குறைத்தல் (சிறிய அளவில் அதிக கலோரிகளை கொடுக்கும் உணவுகள்). ➢ எண்ணெய் மற்றும் கொழுப்பு உணவுகளை தவிர்த்தல். ➢ மதுபானம் அருந்துதலை குறைத்தல் (அ) தவிர்த்தல். ➢ ஆரோக்கிய உணவு பழக்கவழக்கங்கள். ➢ சுறுசுறுப்பான ஓய்வு நேரம். ➢ தினமும் காலை மற்றும் மாலையில் 30 நிமிடம் மிதமான தீவிர உடற்பயிற்சிகள் செய்தல். ➢ மன அழுத்தத்தை நிர்வகிக்கும் உத்திகளை கையாளுதல். ➢ ஆரோக்கியமான சமூக உறவுகளை பராமரித்தல். **பராமரிப்பை திட்டமிடுதலில் நோயாளி குடும்பம் மற்றும் சுகாதார பணியாளர்களின் பங்கீடு:** ➢ நோயாளி மற்றும் குடும்ப உறுப்பினர்களை பராமரிப்பை திட்டமிடுதலில் சேர்த்தல் வேண்டும். ➢ நோயாளி முடிவு செய்ய பலவேறு வழி வகைகள் தர வேண்டும். ➢ தனிப்பயனாக்கிய/தனிப்பட்ட உத்திகள், கையாள வேண்டும். ➢ ஊக்குவித்தல் மற்றும் சாதகமான வலுவூட்டல் தர வேண்டும்.	

OBJECTIVES	CONTENT	EVALUATION
உடல் பருமனை குறைத்தலின் நன்மைகளை குறிப்பிடுதல்	5-10 சதவீதம் எடை குறைப்பு கூட, இதய நோய், நீரிழிவு நோய், இரத்த அழுத்தம், சுவாச பிரச்சனை மற்றும் மூட்டு பிரச்சனைகள் வருவதை நேர்விகிதத்தில் தவிர்க்கின்றன என பல ஆய்வு முடிவுகள் தெரிவிக்கின்றன.	எடை குறைப்பதால் கிடைக்கும் நன்மைகள் யாவை?
சுருக்கக்குறிப்பு (அ) தொகுத்து கூறுதல்	உடல் பருமனானது இளம் பெரியவர்களினுடைய பெரும்பாலான நாட்பட்ட நோய்களுக்கான அபாய காரணியாக இருப்பதனால், இணை நோய்கள் வராமல் தடுக்க உடல் பருமனை சரியாக நிர்வகித்தல் வேண்டும். ஒரு தனி நபர் உடல்பருமனை குறைத்தல் மற்றும் எடை குறைத்தலை பராமரித்தல் ஆகியவற்றை அறிந்திருக்க வேண்டும். நடத்தை மாற்றமே, உனவு, உடலுழைப்பு மாற்றம், வாழ்க்கை முறை மாற்றத்திற்கும், எடை குறைப்பு உத்திகளை பின் பற்றுவதற்கும் உதவி புரிகின்றது. எனவே, ஆரோக்கியமான வாழ்க்கையை வாழ சுயமாக உடல் பருமனை நிர்வகிப்பதை ஒருவர் அறிந்து கொள்வது அவசியமாகும்.	

DIETARY MODIFICATIONS

The investigator prescribed the obese adults low calorie diet which was recommended by the Indian Dietetic Association. The calculation was based on the formula 20 k.cal per kg expected body weight and the calorie reduced was not less than 1200 k.cal for women &1400 k.cal for men. No harm certificate for the intervention was obtained from the family medicine physician and the clinical nutritionist.

The first step in dietary management of obesity is to lose weight by decreasing energy intake to achieve an energy deficit that can be sustained for a sufficient period. A 5-10% weight loss over a 3-6 month period has massive health benefits. A weight loss of 0.5 kg/week is a safe and achievable target and can be achieved by a 500 to 1000kcal daily deficit. The second step, following weight loss, is to maintain weight loss by ensuring that energy intake matches energy needs.

Strategies to reduce Saturated Fatty Acids and Trans fatty acids:

1. Avoiding hydrogenated fats as spreads or for flavoring
2. Avoiding or reducing the consumption of meat
3. Using specially manufactured low fat foods.
4. Modifying common foods to be lower in fat (Ex: Removing skin from chicken)
5. Replacing high fat foods with low fat foods.(Substituting skim milk for whole milk)
6. Consumption of low calories diet.
7. High consumption of whole grains, pulses, yellow/orange/green leafy vegetables, fruit and milk
8. Moderate consumption of refined cereals, fish, chicken and egg(without yellow)
9. Low consumption of salts, oily foods, High cholesterol food, animal fats, sweets and chocolates, instant foods, carbonated beverages.
10. Consume high fibre diet like fruits and vegetables.
11. Consume adequate diet rich in vitamins and minerals like fruits and vegetables.
12. Consume fresh juices without sugar.
13. Reduce the use of refined cereals as they do not have fibre content.

14. Reduce the direct sugar intake.
15. Avoid deep fried items.
16. Avoid pickles, dried fish and pappads.
17. Restrict the non-vegetarian items like mutton and chicken as they have transfat.
18. Avoid eggs yellow part as it has high fat content.
19. Consume 8 – 10 tumblers of water every day.
20. Consume ginger, garlic, tulsi, cloves, fennel, fenugreek as its medicinal properties reduces the fat.
21. The food items which are rich in calcium, potassium and magnesium and fibre materials like sea foods, fruits and vegetables should be consumed as it prevents the fat deposition in the blood vessels.
22. Avoid or restrict the alcohol intake to 1 ounce/day.

Foods to be included while on low calorie diet are

Group A vegetable: 100 grams or ½ cup cooked (30 k.cal, CHO 6 grams)

Cabbage, lettuce, chow chow, brinjal, cauliflower, mint, white radish, plantain stem, cucumber, capsicum, drumstick, French beans, green papaya, knol khol, ladies finger, mushroom, tomato, pumpkin, snake gourd, bitter gourd, plantain flower and leafy greans-fenu greek, Amaranth, etc

Group B vegetable: 100 grams or ½ cup cooked (50-60 k.cal, CHO 6-12 grams and 2-3 grams protein)

Beet root, carrot, drumstick leaves, turnip, coriander leaves, agathi, onion big, mango ginger, field beans, double beans, pink radish and jack fruit tender.

Fruits: (40 k.cal, 10 grams of CHO)

Amla(4-5), apple(1small), banana(1/2 small), custard apple(1small), dates(2), grapes(20), guava(1 medium size), jack fruit(3 pieces), mango(1small), orange(1 average), papaya ripe(2''*3'')slice, pear(1 small), plum(2), pine apple(1slice) and sapota(1small)

Model menu plans are given below:

1200 Kcal Diet (1 cup- 200 ml)

Time	Item with Quantity	Energy (kilo calories)	Protein (gram)	Carbohydrate(g)	Fat (g)
6.00 am	Tea/ Coffee -120 ml	39	1.92	2.4	2.4
8.00 am	Idli-2 / Dosai-1 / Bread- 2 slice/ Chapathi- 1	170	3.2	40	0
	Sambar ½ cup /Dhal ¼ cup	42.5	2.8	7.5	1.0
10.00 am	Vegetable soup/Butter Milk- 200 ml	30	0.5	0	7
1.00 pm	Rice 1 cup/ Pulka-2	170	3.2	40	0
	Dhal ½ cup/Sambar 1 cup	85	5.6	15	0
	Vegetables ½ cup A	30	1.0	6	0.2
	Vegetables ½ cup B	50	1.0	6	0.2
	Curd 100 ml	85	3.2	4	4
4.00 pm	Tea/ Coffee - 120 ml	39	1.92	2.4	2.4
8.00 pm	Same as lunch	400	14	71	4.4
	Allowance per day				
	Oil- 1 tsp	45	0	0	5
	Sugar-2 tsp	40	0	10	0
	Total	**1226**	**38.3**	**204.3**	**26.6**

Note: Non-vegetarians can replace one pulse portions with chicken (75 grams) or fish (75-100 grams) or egg (1 medium) or meat (50 grams) for two times in a week.

1 vegetable portion can be replaced with ½ cup of fruits during the dinner.

1400 Kcal Diet (1 cup- 200 ml)

Time	Item with Quantity	Energy (kilo calories)	Protein (gram)	Carbohydrate (g)	Fat (g)
6.00 am	Tea/ Coffee -120 ml	39	1.92	2.4	2.4
8.00 am	Idli-2 / Dosai-1 / Bread- 2 slice/ Chapathi- 1	170	3.2	40	0
	Sambar ¾ cup /Dhal ½ cup	85	5.6	15	0
10.00 am	Vegetable soup/Butter Milk-200 ml	30	0.5	0	7
1.00 pm	Rice 1 cup/ Pulka-2	170	3.2	40	0
	Dhal ½ cup/Sambar ¾ cup	85	5.6	15	0
	Vegetables ½ cup A	30	1.0	6	0.2
	Vegetables ½ cup B	50	1.0	6	0.2
	Curd 100 ml	85	3.2	4	4
4.00 pm	Tea/ Coffee - 120 ml	39	1.92	2.4	2.4
	Sundal ½ cup	85	5.6	15	0
8.00 pm	Same as lunch	400	14	71	4.4
	Allowance per day				
	Oil- 2 tsp	90	0	0	10
	Sugar-4 tsp	80	0	20	0
	Total	**1438**	**46.74**	**236.8**	**30.6**

Note: Non-vegetarians can replace one pulse portions with chicken (75 grams) or fish (75-100 grams) or egg (1 medium) or meat (50 grams) for two times in a week.

1 vegetable portion can be replaced with ½ cup of fruits during the dinner.

1600 Kcal Diet (1 cup- 200 ml)

Time	Item with Quantity	Energy (kilo calories)	Protein (gram)	Carbohydrate(g)	Fat (g)
6.00 am	Tea/ Coffee -120 ml	39	1.92	2.4	2.4
8.00 am	Idli-3 / Dosai-1 ½ / Bread- 3 slice/ Chapathi- 2	255	4.8	60	0
	Sambar ¾ cup /Dhal ½ cup	85	5.6	15	0
10.00 am	Fruit ½ cup	40	0.1	10.0	0
1.00 pm	Vegetable soup/Butter Milk- 200 ml	30	0.5	0	7
	Rice 1 cup/ Pulka-2	170	3.2	40	0
	Dhal ½ cup/Sambar ¾ cup	85	5.6	15	0
	Vegetables ½ cup A	30	1.0	6	0.2
	Vegetables ½ cup B	50	1.0	6	0.2
	Curd 100 ml	85	3.2	4	4
4.00 pm	Tea/ Coffee - 120 ml	39	1.92	2.4	2.4
	Sundal ½ cup	85	5.6	15	0
8.00 pm	Same as lunch	400	14	71	4.4
	Allowance per day				
	Oil- 4 tsp	180	0	0	20
	Sugar-4 tsp	80	0	20	0
	Total	**1653**	**48.44**	**266.8**	**40.6**

Note: Non-vegetarians can replace one pulse portions with chicken (75 grams) or fish (75-100 grams) or egg (1 medium) or meat (50 grams) for two times in a week.

1800 Kcal Diet (1 cup- 200 ml)

Time	Item with Quantity	Energy (kilo calories)	Protein (gram)	Carbohydrate(g)	Fat (g)
6.00 am	Tea/ Coffee -120 ml	39	1.92	2.4	2.4
8.00 am	Idli-3 / Dosai-1 ½ / Bread- 3 slice/ Chapathi- 2	255	4.8	60	0
	Sambar ¾ cup /Dhal ½ cup	85	5.6	15	0
	Fruit ½ cup	40	0.1	10.0	0
10.00 am	Vegetable soup/Butter Milk- 200 ml	30	0.5	0	7
1.00 pm	Rice 1 ½ cup/ Pulka-3	255	4.8	60	0
	Dhal ½ cup/Sambar ¾ cup	85	5.6	15	0
	Vegetables ½ cup A	30	1.0	6	0.2
	Vegetables ½ cup B	50	1.0	6	0.2
	Curd 100 ml	85	3.2	4	4
4.00 pm	Tea/ Coffee - 120 ml	39	1.92	2.4	2.4
	Sundal ½ cup	85	5.6	15	0
8.00 pm	Same as lunch	485	15.6	91	4.4
	Allowance per day				
	Oil- 4 tsp	180	0	0	20
	Sugar-4 tsp	80	0	20	0
	Total	**1823**	**51.64**	**306.8**	**40.6**

Note: Non-vegetarians can replace one pulse portions with chicken (75 grams) or fish (75-100 grams) or egg (1 medium) or meat (50 grams) for two times in a week.

2000 Kcal Diet (1 cup- 200 ml)

Time	Item with Quantity	Energy (kilo calories)	Protein (gram)	Carbohydrate(g)	Fat (g)
6.00 am	Tea/ Coffee -120 ml	39	1.92	2.4	2.4
8.00 am	Idli-4 / Dosai-2 / Bread- 4 slice/ Chapathi- 3	340	6.4	80	0
	Sambar ¾ cup /Dhal ½ cup	85	5.6	15	0
	Fruit ½ cup	40	0.1	10.0	0
10.00 am	Vegetable soup/Butter Milk- 200 ml	30	0.5	0	7
1.00 pm	Rice 1 ½ cup/ Pulka-3	255	4.8	60	0
	Dhal ½ cup/Sambar ¾ cup	85	5.6	15	0
	Vegetables ½ cup A	30	1.0	6	0.2
	Vegetables ½ cup B	50	1.0	6	0.2
	Curd 100 ml	85	3.2	4	4
	Fruit ½ cup	40	0.1	10.0	0
4.00 pm	Tea/ Coffee - 120 ml	39	1.92	2.4	2.4
	Sundal ½ cup	85	5.6	15	0
8.00 pm	Same as lunch	525	15.7	101	4.4
	Allowance per day				
	Oil- 5 tsp	225	0	0	25
	Sugar-4 tsp	80	0	20	0
	Total	**2033**	**53.44**	**346.8**	**45.6**

Note: Non-vegetarians can replace one pulse portions with chicken (75 grams) or fish (75-100 grams) or egg (1 medium) or meat (50 grams) for two times in a week.

PHYSICAL ACTIVITY MODIFICATION

WHO has given Global strategy on physical activity. In adults aged 18–64, physical activity includes leisure time physical activity (for example: walking, dancing, gardening, hiking, swimming), transportation (e.g. walking or cycling), occupational (i.e. work), household chores, play, games, sports or planned exercise, in the context of daily, family, and community activities in order to improve cardio respiratory and muscular fitness, bone health, reduce the risk of NCDs and depression.

Global recommendations

1. Adults aged 18-64 years should do at least 150 minutes of moderate-intensity aerobic physical Activity throughout the week, or do at least 75 minutes of vigorous – intensity aerobic physical activity. Throughout the week, or an equivalent combination of moderate-and vigorous-intensity activity.
2. Aerobic activity should be performed in bouts of at least 10 minutes duration.
3. For additional health benefits, adults should increase their moderate – intensity aerobic physical activity to 300 minutes per week, or engage in 150 minutes of vigorous-intensity aerobic physical activity per week, or an equivalent combination of moderate-and vigorous-intensity activity.
4. Muscle – strengthening activities should be done involving major muscle groups on 2 or more days a week.

These guidelines are relevant to all healthy adults aged 18–64 years, unless specific medical conditions indicate to the contrary, irrespective of gender, race, ethnicity or income level. They also apply to individuals in this age range with chronic non communicable conditions not related to mobility such as hypertension or diabetes. These recommendations can be applied to adults with disabilities. However they may need to be adjusted for each individual based on their exercise capacity and specific health needs. Pregnant, postpartum women and persons with cardiac events may need to take extra precautions and seek medical advice before striving to achieve the recommended levels of physical activity for this age group.

Intensity of physical activity

Intensity refers to the rate at which the activity is being performed or the magnitude of the effort required to perform an activity or exercise. It can be thought of how hard a person works to do the activity. Metabolic Equivalents (METs) are commonly used to express the intensity of physical activities. MET is the ratio of a person's working metabolic rate relative to their resting metabolic rate. One MET is defined as the energy cost of sitting quietly and is equivalent to a caloric consumption of 1kcal/kg/hour. It is estimated that compared with sitting quietly, a person's caloric consumption is three to six times higher when being moderately active (3-6 METs- examples brisk walking, dancing, gardening, house work and domestic chores and moving moderate loads) and more than six times higher when being vigorously active (>6 METs- for example running, walking/ climbing briskly up a hill, fast cycling, fast swimming, competitive sports digging ditch and moving heavy loads).

In this study the investigator recommended sixty minutes of brisk walking in a day for 5 days in a week. The obese adults were instructed to walk 2 miles in 30 minutes as suggested by National Institute of Health.

STRUCTURED COUNSELLING PROGRAMME

PLAN FOR COUNSELLING PROGRAMME

Subject	**:**	Obesity management and weight maintenance
Topic	**:**	How to bring behavioral modification
Group	**:**	Obese adults
Place	**:**	houses of obese adults
Time	**:**	30 minutes for each session for each obese adult

Seating Arrangement:

Calm, quiet and separate area which is well ventilated with 2 chairs/mats facing each other. No audio and video recording done.

General Objective:

At the end of the programme the obese adults will demonstrate positive improvement in their behavior.

STEPS:

1. Established a safe, trusting environment.
2. Brief self introduction was given.
3. Encouraged and helped the individual to identify the constraints of primary focus. The counselor actively listened to obese adult's expression of feelings and focused their constraints to lead the life of obese adults.
4. Once the individual had completed the counselor recapitulated on what they narrated. Then reflected on their concern and interpreted it to the individual to confirm their expression.
5. Within 2 – 3 sessions the problem was finally described as a statement then the counselor tried to transform the problem statements into goal setting.
6. Once the goal was set the counselor along with the obese adults explored the possible approaches which were devised to achieve the goal. The counselor motivated the clients to select the modalities to achieve the goal and assisted to devise the plan.

7. After devising the plan, the client was motivated to make a contract to fulfill the plan with various modalities.
8. The counselor assured for availability and encouraged the clients to try with various modalities to achieve the goal.
9. Counselor made the obese adults to reflect their feeling and clarified their doubts. Counselor made a contract with clients to fulfill their goal. Gave encouragement and assurance to develop their confidence in achieving the set goal.
10. Each session was initiated with confirming the previous goal achievements.