

**EFFECTIVENESS OF YOGA ON OBESITY AMONG  
OBESE WOMEN IN SELECTED RURAL AREAS**



**A DISSERTATION SUBMITTED TO THE TAMILNADU DR. M.G.R  
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OF THE REQUIREMENT FOR THE DEGREE OF MASTER OF  
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## CERTIFICATE

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*“I will praise you, O Jesus, with my whole heart,*

*I will tell all your marvelous works,*

*I will be glad and rejoice in you;*

*I will sing and praise your name, oh! Most high”*

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## ABSTRACT

A study “to assess the effectiveness of Yoga on obesity among obese women residing in selected rural areas in Madurai”. **Objectives:** To identify the prevalence of obesity among women and to evaluate the effectiveness of yoga on obesity. **Study Design:** Non-equivalent pre test post test control group design. **Sampling Technique:** Convenient sampling technique was used to select Chandraleka nagar as a experimental group and Indira nagar as a control group. **Setting:** The study was conducted in two selected areas in Madurai. Chandraleka nagar and Indira nagar) **Participants:** 60 obese women in the age of 20-50 years from two rural areas of Madurai. **Tool:** Body Mass Index (BMI) was assessed by checking height and weight. **Intervention:** Yoga therapy was implemented for experimental group including Paschimotannasana, Pada hastasana, Bhujangasana, Halasanas, Dhanurasana and Anuloma Villoma. 30 minutes session a day over 4 weeks. **Statistical analysis:** Obtained data analyzed in terms of both descriptive and inferential statistics. **Results:** Findings showed that, the overall prevalence of obesity was 44.21%. In pretest, 28 women (93.33%) were in obesity class I and 2 women (6.66%) were in obesity class II. Whereas in posttest 2 women (6.66%), from obesity class I, they reached pre-obesity ie overweight and 1 women from obesity class II, they reached obesity class I. But in control group, the obesity class remaining unchanged. But all the subjects had reduction in weight in post test, for 2 subjects (6.66%) there was a reduction of weight about 400 grams and 9 subjects (30%), there was a reduction of weight up to 400-700 grams and 19 subjects (63.33%) there was a reduction of weight up

to 700-900 grams. The mean post test BMI score 32.06 of experimental group was lower than the mean post test BMI score of 33.28 of control group with a 't' value 2.38. There was no association between the BMI score and demographic variables. **Conclusions:** The increasing trend of the modern day epidemic of obesity in women calls for immediate action even in rural areas also to reduce the incidence through appropriate yoga intervention. Interventions to increase physical activity among women are needed to address the problems of physical inactivity and obesity in that population.

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## CHAPTER-I

### INTRODUCTION

#### Background of the Study

“Obesity is a condition which proves that the Lord does not help those who help themselves and help themselves and help themselves.”

*-Harkin (2007)*

The prevalence of obesity is increasing world wide at an alarming rate in both developing and developed countries. Environmental and behavioral changes brought about by economic development, modernization and urbanization have been linked to the rise in global obesity (**American Obesity Association, 2005**)

Obesity is perhaps the most prevalent form of malnutrition. As a chronic disease prevalent in both developed and developing countries and affecting children as well as adults. According to World Health Organization's report (2003), obesity is increasing globally. In 1995 there was an estimation of 200 million obese adults worldwide. As of 2000, the number of obese adults has increased to over 300 million. Contrary to the conventional wisdom, the obesity epidemic is not restricted to industrialized societies. In developing countries, it is estimated that over 115 million people suffer from obesity related problems. It is estimated that approximately 1.6 billion

adults (age 15+) were overweight and at least 400 million adults were obese. (WHO, 2005). WHO further projects that by 2015, approximately 2.3 billion adults will be overweight and more than 700 million will be obese. At least 20 million children under the age of 5 years are overweight globally in 2005.

In India, data from the **National Family Health Survey-3, (2005-06)** revealed that the prevalence of overweight and obesity was about 14.8% among women and 8.6% of the rural women had BMI of >25, out of which 4.6% had BMI of 25-30% and 1% had BMI of >30. It was also found that, the prevalence of overweight and obesity is highest in the northern states of Delhi & Punjab, where about 1 in 3 women are overweight or obese. The prevalence of overweight and obesity is much lower (4-8%). In both Delhi and Punjab, prevalence of overweight and obesity increases rapidly with age. In Delhi, for example proportion of overweight rises from less than 10% at age of 15-24 yrs to about 40% at age of 45-49 yrs. In Tamilnadu the prevalence of obesity was found to be 24.4% among urban women and 15.4% of the rural women had BMI of >25.

Obesity may be defined as an abnormal growth of the adipose tissue due to an enlargement of fat cell size (hypertrophic obesity) or an increase in fat cell number (hyperplastic obesity) or a combination of both. Obesity is often expressed in terms of body mass index (BMI). Overweight is usually due to obesity but can arise from other causes such as abnormal muscle development of fluid retention. **(Park.2009)**.

Obesity is a chronic condition that develops as a result of a complex interaction between a person's genes and the environment characterized by long-term energy

imbalance due to excessive caloric consumption, insufficient energy output [sedentary lifestyle, low resting metabolic rate (RMR), or both **(WHO, 2005)**].

Obesity, physical activity, and poor dietary behaviors have been linked to increased health risk, which may contribute to 300,000 to 400,000 additional deaths per year in the United States. This may in part be a result of the increasing prevalence of overweight (Body Mass Index [BMI]  $\geq 25.0$  kg/m<sup>2</sup>) and obesity (BMI  $\geq 30.0$  kg/m<sup>2</sup>), with these rates estimated to be approx 65% and 30% in adults, respectively. Moreover, it is estimated that 16% of children and adolescents ages 6 to 19 yr are obese. **(Davis, 2005)**

As obesity is a key factor in natural history of other chronic and non-communicable diseases, the typical time sequence of emergence of chronic diseases following the increased prevalence of obesity is important in public health planning. The first adverse effects of obesity to emerge in population in transition are hypertension, hyperlipidemia and glucose tolerance, while coronary heart disease and the long term complications of diabetes, such as renal failure begin to emerge several years later. **(Park 2009)**

Obesity is not only the problem of cities and towns. The rural people are also affected because of changes in life styles and dietary pattern. According to Rural Healthy People Initiative 2010, “there is evidence that rural life presents special challenges to maintaining a healthy weight”. Tai-Seale and Chandler (2003) stated that, a fair portion

of the disproportionate prevalence of obesity in rural areas is caused by distinctive composition of rural communities.

There are many ways of reducing obesity. Yoga is an ancient system of relaxation, exercise, and healing with origins in Indian philosophy. Early descriptions of yoga are written in Sanskrit, the classical literary language of India. The first known work is "The Yoga Sutras," written more than 2,000 years ago, although yoga may have been practiced up to 5000 years ago. **(Matacin, 2009)**

Yoga is said to be the best way of weight reduction because it has no side effects on your body. It won't make you anorexic or ultra slim. It is simply meant to proportionate your body weight in accordance to your height and lifestyle. The mechanism of Yoga in your body is simple yet extremely effective. It acts on the metabolism of your body as well as on your fat cells. The deep breathing in Yoga increases the oxygen intake to the cells of your body, including the fat cells which burn in contact of oxygen. Apart from this yoga makes one overcome from anxiety which is the major reason for overeating. Some of the Yoga asana also helps in weight control through stimulating lethargic thyroid glands for increasing their hormonal secretions, thus reducing weight. **(Rundle, 2007)**



## Significance and Need for the study

Obesity is a worldwide problem, not just an issue for industrialized nations. Therefore, we need to examine opportunities for prevention and treatment from a global perspective. **(Rebecca et al, 2009).**

Overweight and obesity lead to serious health consequences. Risk increases progressively as BMI increases. Raised body mass index is a major risk factor for chronic diseases such as:

- Cardiovascular disease (mainly heart disease and stroke) - already the world's number one cause of death, killing 17 million people each year.
- Diabetes – This has rapidly become a global epidemic. World Health Organization projects that diabetes death will increase by more than 50% worldwide in the next 10 years.
- Musculoskeletal disorders – especially osteoarthritis.
- Some cancers (endometrial, breast, and colon). **(World Health Organization, 2009)**

There is an increasing prevalence of overweight and obesity in the United States and other developed countries. This can have significant public health implications because of the association of excess body weight with increased risk of chronic diseases. It has been suggested that the increasing prevalence of excess body weight (overweight and obesity) and related diseases also has a significant impact on health care costs. Physical activity can significantly affect weight control and can also have an independent

effect on associated chronic disease risk factors. However, physical activity participation is less than optimal. Thus, it is important for health care professionals to understand the role of physical activity in weight loss, the prevention of weight gain, and to understand how to provide accurate and meaningful information to their patients. **(Davis, (2005)**

One of the causes of Diabetes and other serious medical conditions is Obesity which affects 60% of the population. Obesity and Diabetes are also termed as twin epidemics. Obesity may be defined as the excessively high amount of body fat in relation to lean body mass. This occurs when your calorie intake is greater than the amount of energy you burn. Both Obesity and Diabetes are highly preventable through proper diet, exercise and lifestyle change. Yoga will be the most suitable to facilitate treatment for this twin epidemic. The yoga principle on Healthy Diet and the practice of the asanas will to help balance the endocrine system, tone the abdominal organs, stimulate both the nervous and Circulatory System, and reduce stress. Yoga also helps one to gain a better understanding of ones' self, leading to acceptance and appreciation which will help to eliminate the psychological reasons for Obesity. The practice of Yoga deals with all the aspects of an individual: the mind, body and spirit, giving a person control over his mind and body and making the effect is more permanent than other techniques. **(Pi-Sunyer, 2009)**

**Kaaks (2010)** stated that the excess body weight is a strong determinant as well as modifiable risk factor for all-cause and cancer mortality, and as such carries the potential for primary prevention. Recently published studies greatly enhance our knowledge about the impact of body fat distribution on relative risks specific to cancer

type, and among women, there is further evidence for the role of menopausal status in modifying relative risks. Physical activity, a potential confounder, has been shown to lower the risk of many chronic diseases, independently of the degree of adiposity. A review of the literature provides much support for public health messages that advocate the benefit of change to a more active lifestyle regardless of age and level of excess body fat.

In the recent past modernization of cultures, urbanization and industrialization have greatly influenced our way of living and we have tended to drastically deviate from those well established ancient principles practiced and professed by our sages. We are trying to seek apparently comfortable living conditions where physical activities have been replaced by labour saving machines and appliances and thus have grossly confronted the nature. Food habits, on the other hand, have changed. Eating of more and more artificially preserved and processed food items lacking ingredients essential for maintaining good health is on the increase. Our exaggerated expectations remaining unfulfilled have resulted into elevated stress levels in our life. All these have given rise to so many disorders like high blood pressure, diabetes and obesity. In the promotion of physical and mental health and prevention of many of these disorders, yoga is supposed to play a vital role. Yoga - practitioner's integrated personality changes for the better as yoga has got holistic approach. **(Damodaran, 2007)**

Sedentary part time, like watching TV is increasingly popular and that too contributes to physical inactivity too. Almost all the houses have a TV. Watching TV may cause obesity in many ways; people who watch TV may eat snacks more while

watching; they may watch more commercials for high calorie &/or high fat foods and select these over more nutritious foods. They may have a lower metabolic rate because watching TV and they may substitute watching TV with more energy consuming activities. **(Sylvester, Achterberg & Williams, 1995).**

The prevalence, or epidemic of obesity is increasing in most countries throughout the world. The issues for addressing both its prevention and treatment will differ from one country to another. In some less-affluent countries the conditions that promote the positive energy balance that leads to obesity have yet to be identified. In such instances, true primordial prevention (i.e., preventing the environmental conditions for obesity from occurring) may be possible. These conditions could include promoting traditional eating patterns, preserving opportunities for active transport (walking, cycling, public transport), and protecting environments against the expansion of automobile travel. In most countries, however, those conditions are present already, and therefore the response to the epidemic will involve both primary prevention (preventing the incidence of new cases of obesity) and secondary prevention (treatment of obesity to reduce complications and prevent further weight gain) **(Rebecca et al,2008)**

Obesity itself could emerge as a single important public health problem, even in rural areas the control of body weight is therefore a priority public health objective. In rural areas women do not do heavy work as before and prolonged TV watching is also commonly prevalent. To successfully prevent and reduce the rate of obesity in societies, a multisectoral approach is needed to identify and change the main obesogenic factors in the environment. One such approach is yoga. Hence the

investigator decided to do a study to assess the effectiveness of yoga in terms of reducing obesity.

### **Statement of the Problem**

A study to assess the effectiveness of Yoga on obesity among obese women in selected rural areas of Madurai.

### **Objectives**

1. To identify the prevalence of obesity among women in selected rural areas.
2. To determine the pretest, post test level of obesity among women in experimental and control group.
3. To evaluate the effectiveness of Yoga on obesity among women in experimental group.
4. To find out the association between obesity and socio demographic variables such as age, religion, educational status, occupation, marital status, dietary pattern, physical problem related to mobility and medical illnesses.

### **Hypothesis**

All hypotheses will be tested at 0.05 level of significance.

1. The mean post test Body Mass Index score of women in experimental group who had yoga therapy will be significantly lower than their pretest level.
2. The mean post test Body Mass Index score of the experimental group will be significantly lower than the mean post test score of control group.

3. There will be a significant association between obesity and their selected demographic variables such as age, religion, educational status, occupation, marital status, dietary pattern, physical problem related to mobility.

## **OPERATIONAL DEFINITIONS**

### **EFFECTIVENESS:**

In this study, it refers to the outcome of yoga therapy in reducing obesity (weight) as measured by Body Mass Index scale by WHO.

### **BODY MASS INDEX:**

It is defined as the weight in kilograms divided by the square of the height in meters ( $\text{kg}/\text{m}^2$ ).

The Body Mass Index is calculated by using the formula,

$$\text{Weight (kg)} \\ = \frac{\quad}{\text{Height}^2 \text{ (m)}}$$

Here after the Body Mass Index will be referred as BMI.

### **OBESITY:**

Obesity may be defined as an abnormal growth of the adipose tissue due to an enlargement of fat cell size (hypertrophic obesity) or an increase in fat cell number (hyperplastic obesity) or a combination of both. Obesity is often expressed in terms of body mass index (BMI).

In this study women of 20-50 years who have the Body Mass Index of more than 30 will be considered to be obese.

## **YOGA:**

Yoga has been described as ‘the union of mind, body and spirit,’ which addresses physical, mental, intellectual, emotional and spiritual dimensions towards an overall harmonious state of being.

Yoga improves fitness, promotes relaxation and reducing stress & improving physical activity and thereby reducing weight. For this study the selected yoga is,

- **Paschimootannasana:** Sit down with your legs stretched. Stretch your lower back and raise your arms. Slowly bend forward and move your hands to your lower legs, ankles or feet.
- **Pada hastasana:** Stand straight as you inhale raises your arms above your head. Slowly bend further so that your belly is touching your upper legs. Grasp your toes and breathe deeply in the pose.
- **Bhujangasana:** Lie on your belly and raise your forehead, look upwards. Put your hands and arms next to your chest on the mat without losing the bend.
- **Halasanas:** Lie flat on the floor. As you inhale, raise both legs, keeping your legs on 45degree angle.
- **Dhanurasana:** Lie on your stomach, and bend your knees. Bring your heels near your buttocks and grasp your ankles. Raise your knees further by pulling your ankles with your hands.

- **Anuloma Viloma:** Anuloma Viloma is also called the Alternate Nostril Breathing Technique. In this Breathing Technique, you inhale through one nostril, retain the breath, and exhale through the other nostril.

### **Assumptions:**

1. Yoga therapy has no adverse effects on women
2. It is assumed that the subjects would be willing to participate in study & respond honestly to the questions.
3. Obesity is commonly prevalent among rural women also
4. Obese women do not have any difficulty in practicing yoga in their residence.

### **Delimitation:**

The study is delimited to,

1. Obese women in selected area only
2. Yoga therapy is limited to selected exercise
3. The period of data collection is limited to 6 weeks

### **Projected Outcomes:**

The study is conducted to assess the effectiveness of yoga on obesity and physical activity among obese women of 20-50 yrs of age, since it has no allopathic side effects. Findings of this study would help in planning yoga therapy in the area of obesity prevalence but also implement this as a health promotion measure for at risk and risk groups, there by preventing chronic diseases.

### **Conceptual framework:**

The concept is based on J.W. Kenny's open system model. All systems are open in the fact that there is a continual exchange of matter, energy and information. Open



system is having the varying degree of interaction with environment from which the system receives varying types and amount of matter, the energy and the information are processed. After processing the input, the system returns the output (matter, energy and information) to the environment in an altered state. Feedback refers to the environmental responses to the output used by the system in adjustment, connection and accommodation to the interaction with the environment.

**Input:**

In this study, it refers to the assessment of obesity by Body Mass Index scale by WHO. There are various demographic phenomena were found to association with obesity such as age, religion, educational status, marital status, occupation, total monthly income, dietary pattern, physical problem and medical illnesses and also there are various factors contribute to cause obesity such as diet pattern and physical inactivity.

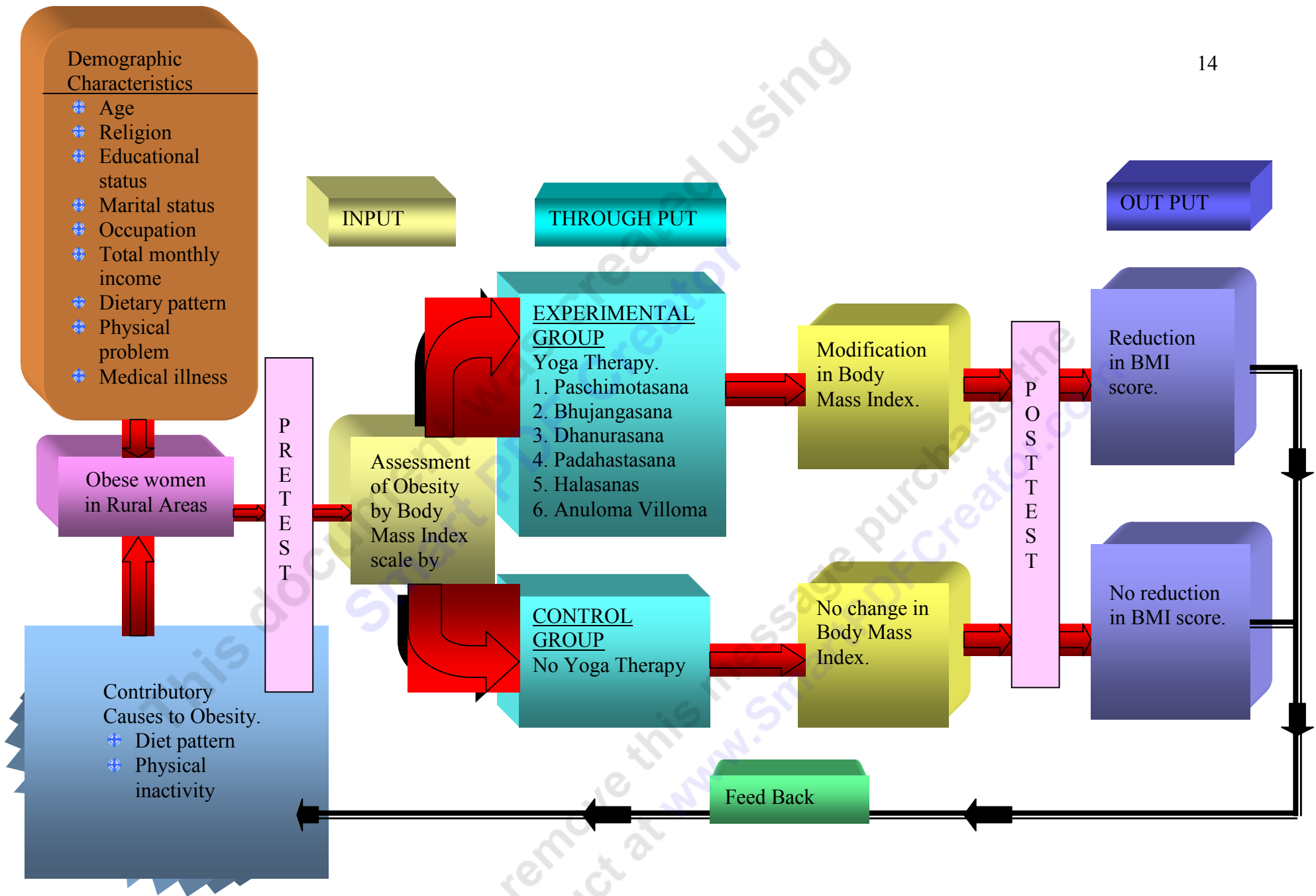
**Throughput:**

In this study, it refers to the teaching of Yoga to the experimental group. The implemented yoga therapy including Paschimotasana, bhujangasana, dhanurasana, padahasthasana, halasanas, and auloma Villoma.

After processing, the input system returns to out put. It refers to the matter, energy and information that are processed

**Output:**

In this study, it refers to the reduction in Body mass index score as measured by the post test.



**Figure 1: Conceptual Framework based on J.W. Kenny's Open System Model**

## CHAPTER-II

### Review of Literature

#### Introduction:

Literature review refers to the activities involved in identifying and searching for information on a topic and developing a comprehensive picture of the state of the knowledge that topic. (*Polit. Hungler, 1995*)

The available literature and studies are organized and presented under the following sections;

1. Related to concepts of obesity
2. Studies related to obesity
3. Studies related to effectiveness of yoga on obesity among women

#### Section I: Related to concepts of obesity

***“Obesity is a disorder; it’s as bad an addiction as smoking” (Aggarwal, 2004)***

Obesity is a state in which there is a more generalized accumulation of fat in the body leading to more than 20% desirable weight. (**Saibaba, 2001**).

#### Classification of Obesity:

According to **Park (2009)**, obesity is classified as,

❖ **Hypertrophic obesity:**

An abnormal growth of adipose tissue due to enlargement of fat cell size.

❖ **Hyperplastic obesity:**

An increase in the fat cell number.

In simple term obesity can be classified as;

1. **Android obesity:** Abdominal fat distribution
2. **Gynecoid obesity:** Even and peripheral distribution of fat around the body.

**Contributory causes of obesity:**

The risk factors and contributing causes of obesity include a range of well documented genetic and environmental factors. Obesity occurs when energy intake exceeds energy expenditure over a considerable period.

*Golan and Crow (2004)* have stated the following as the obesogenic factors of obesity;

1. Increased energy intake with high fat and refined sugary foods.
2. Reduction in physical activity and lack of habitual exercise among women.
3. Increase in sedentary behaviors among women especially the housewives a greater number of hours spent in TV viewing which may provide a context for simultaneous snack consumption and inactivity. Also introduction of modern agricultural tools and kitchen gadgets at affordable cost has modified the work for the women both in agriculture and household works and replaced the hard work of the homemakers such as hand pounding, grinding with stones etc, resulting in sedentary work in the kitchen too.

4. Family influence with regard to diet and life style are important contributory causes of modern obesity.
5. Genetic causes: Genes affect a number of weight related processes in the body, such as metabolic rate, blood glucose metabolism

### Assessment of obesity:

#### ❖ Body weight:

A simple way of calculating ideal body weight is by using any one of the following formula,

#### 1. Body mass index (Quetelet's index)

$$= \frac{\text{Weight (kg)}}{\text{Height}^2 \text{ (m)}}$$

#### 2. Ponderal index

$$= \frac{\text{Height (cm)}}{\text{Cube root of body weight (kg)}}$$

#### 3. Lorentz's formula

$$= \text{Ht (cm)} - \frac{\text{Ht (cm)} - 150}{2(\text{women}) \text{ or } 4(\text{men})}$$

#### 4. Corpulence index

$$= \frac{\text{Actual weight}}{\text{Desirable weight}}$$

This should not exceed 1.2

#### ❖ Skin fold thickness:

The measurement may be taken at all the four sites- mid-triceps, biceps, subscapular and supra-iliac regions. The sum of the measurements should be less than 40 mm in boys and 50 mm in girls.

#### ❖ Waist circumference:

Waist circumference is measured at the midpoint between the lower of the rib cage and the iliac crest. There is an increased risk of metabolic complications for women with a waist circumference  $\geq 88$  cm.

#### ❖ Waist : Hip ratio(WHR)

The WHR is calculated using the formula,

$$= \frac{\text{WC}}{\text{Hip measurement}}$$

The WHR is calculated for women should be  $<0.85$ . The WHR above 0.85 indicates truncal obesity. (Park, 2009)

## Complications of Obesity:

Obesity has become one of the major health problems worldwide. Obesity is not just a cosmetic problem, but lot of health problems & complications are associated with it.



**Figure 2:** Complications of obesity

So, obesity is not just a cosmetic problem, but lot of health problems & complications are associated with it. (Thomson, 2007)

**Control and Prevention:**

The control of obesity centers on weight reduction. This can be achieved by dietary changes, increased physical activity and a combination of both. **(Park, 2009)**

**1. Dietary Changes:**

Following dietary principles apply to both prevention and treatment

- A. The most basic consideration is that the food energy intake should not be greater than energy expenditure.
- B. The proportion of energy dense foods such as simple carbohydrates and fats should be reduced. Adequate levels of essential nutrients with low energy diets as close as possible to existing nutritional patterns should be ensured. Most conventional diets for weight reduction are based on 1000 kcal daily diet for an adult.
- C. The fiber diet in the diet should be increased **(Park,2009)**

**2. Increased Physical Activity:**

This is an important part of weight reducing program. Regular physical exercise is the key to increased energy expenditure. Aerobic exercise burns fat and calories and helps to lose weight. It is important for everyone to get aerobic exercise at least 3 to 5 times/week for 20 to 60 minutes. Common aerobic exercises include knee lifts, light jogging, walking, cycling, running, climbing stairs and various dance movements. **(Aerobics, 2005)**



## Section II. Studies related to Obesity

It is estimated that in excess of 65% of adults are classified as overweight (body mass index 25.0 kg/m<sup>2</sup>), with 30% of adults classified as obese (body mass index 30 kg/m<sup>2</sup>) these prevalence rates of overweight and obesity reflect a significant increase in these prevalence rates over the past few decades. **(Jakicic and Otto, 2005.)**

Many Asian countries are beginning to recognize the epidemic of obesity as a health and social burden. In China about 15% of the population has BMI of >25. In Japan nearly 30% of the population have BMI of >25 and in Singapore 30% of the population has BMI of >25. Most explanation for Asia's obesity revolves around their genetic predisposition to store fat particularly around the abdomen and there are compounding cultural factors. Asian culture tends to use food as a reward and in many Asian countries a large body weight is seen as a welcome sign of prosperity. **(Mandavilli & Cyranski, 2004).**

A study was conducted by **Jamwal and Raina (2009)** to find out the magnitude of overweight and obesity among rural adults of Jammu and whether there exists an association of overweight/obesity with age, sex, physical activity & hypertension. Adults > 30 years with sample size 2216 were studied. Prevalence of obesity was 2.21% with females 3.35%: males 1.02%. Prevalence of overweight was 9.70% with females 11.63%: males 7.68%. A strong association between obesity/overweight and gender was found (p value <.000004). An increase in prevalence of obese & overweight persons with age up

to 59yrs. & 49yrs. respectively in both the sexes, declining thereafter; but this association with age was not statistically significant. Proportion of obese & overweight persons was higher in sedentary workers when compared with that in moderate and heavy workers, results being statistically significant (p value <.01).

**Varghese et al (2008)** conducted a study in Calicut, in which they found overall prevalence of obese and overweight as 5.5% & 24.8% respectively. They also found an increase in prevalence of obese or overweight with age from “20-29yrs” to “50 -59yrs”; showing a decline thereafter.

In a study conducted by **Venkatramana, Chandrasekhar Rao, Annaiah, Madhavi, and Chengal Reddy (2005)** in Andhra Pradesh, the overall prevalence of obesity found was 1.91 %; (1.03% in males & 2.79% in females) & prevalence of overweight persons 11.48% (13.33% in males & 9.74% in females). In a study conducted in a Chinese rural population by **Zhang, Zhaoqing, and Xinzhong (2008)**, the prevalence of overweight persons were 18.6%; significantly higher among women than men. The prevalence of obesity was 1.7%, also higher among women than men.

The study conducted by **Chacko, Mathew, and Sekar (2004)** in Coimbatore to find out the extent of the problem of obesity and people's awareness about risk factors and complications of obesity revealed the following findings. A cross sectional survey was conducted in Coimbatore district between March and September 2003 in which 537 urban women and 661 rural women aged 20 years and older in Coimbatore were

randomly selected, interviewed and the BMI was assessed. The prevalence of overweight in urban area was 43.9% and in rural area was 32.6%. 43% of women failed to recognize that obesity can lead to Diabetes and 37% failed to do so regarding its contribution to Heart attack. In general, awareness was found to be higher in the overweight group compared to normal weight. Age, Education, Occupation, Standard of living, and Place of residence were found to be associated with the knowledge about obesity as a risk factor for Diabetes and Heart attack. When asked about the causes, being happy was suggested as a cause by 60%, whereas 30% failed to mention excess eating and 26% failed to mention lack of exercise. Among the overweight women a large proportion of them (36%) did not consider themselves to be overweight.

Once thought as the problems of the affluent, especially of the cities and towns, the over weight and obesity is now penetrating even among the poorest of the rural areas and the urban rural differences diminished. A study conducted at the United States among 4391 women aged 40-64 yrs(24% of them lived in urban areas, 31.27% in rural areas and 45% in suburban areas) revealed that 29% of rural women were obese, compared with 28% of urban women and 22% of suburban women (**Ramsey & Glenn, 2002**).

Overweight and obesity are on the rise all over the world and are highly prevalent in rural areas that pose significant risks to the health. In a study conducted among 450 adult women who received health care in rural upstate New York, approximately 30% of the sample had a BMI of >29 and were defined as obese (**Olson & Bove, 2002**).

A study conducted at Australia by **Coulson, Pinazar, & Margolis (2005)**, revealed that the prevalence of obesity was more among the middle aged population (31-40 yrs, 26%, 41-50 yrs, 19% and 51-65 yrs, 29%), most of the subjects were married (69%) and majority of them had high school education (43%).

In India a significant percentage of the population are now overweight and obesity that consist of a considerable proportions of women. A study conducted to determine the prevalence of overweight and obesity among Punjabi females, found that among 1700(900 urban and 800 rural) adult women from 20-45 yrs the combined prevalence of overweight and obesity was 43.88% for urban and 22.26% for rural population.**(Sindhu 2005)**

### **3. Studies related to effectiveness of yoga on obesity among women**

**Hagins, Moore and Rundle (2007)** conducted an observational study to evaluate effectiveness of hatha yoga on obesity and physical activity, which improves and maintains health. The result showed that yoga had effectiveness on energy expenditure, there by controlling obesity and improving levels of physical activity to maintain health.

**Guarracino et al. (2004)** conducted a study on yoga participation is beneficial to obesity. The objective of this study was to evaluate the effects of hatha and relaxation yoga on obesity and quality of life. Seventy healthy women aged 30 years or older completed a survey. A statistically significant body mass index for obesity (30.0) was

observed ( $P < .001$ ). The study concluded that hatha and relaxation yoga had a statistically significant role in controlling weight.

A new study led by **Kristal (2007)** and group at Fred Hutchinson Cancer Research Center has found that regular yoga practice may help prevent middle-age obesity in normal-weight people and may promote weight loss in those who are overweight. The study measured the impact of yoga with weight change, independent of other factors such as diet or other types of physical activity. The researchers found that between the ages of 45 and 55, most people gained about a pound a year, however, men and women who were of normal weight at age 45 and regularly practiced yoga gained about 3 fewer pounds during that 10-year period than those who didn't practice yoga. The researchers noted the greatest effect of regular yoga practice was among people who were overweight. "Men and women who were overweight and practiced yoga lost about 5 pounds, while those who do not practice yoga gained about 14 pounds in that 10-year period.

**Gharote (2004)** quotes that yoga is relatively more effective than more popular methods like aerobics in treating obesity at Lonavala in Mumbai. Although both aerobics and yoga were found to be effective in controlling overweight and excessive body fat, Yoga was found to be more effective and appropriate than aerobics. A set of around 204 male and female obese people aged between 15-60 years for a period of one month. While patients, who followed Yoga and a strict diet, lost up to 15 kg body fat and 95 per cent of them reported their blood pressure (BP) levels reaching normal levels, those who

followed aerobics lost only up to eight kg and only 25 per cent of the latter group experienced normalcy in BP.

**Tim et al (2009)** conducted a study in terms of Physical Activity Patterns and Obesity in Hispanic and Non-Hispanic White Women. 2039 participated in the 4-Corner's Breast Cancer Study to evaluate associations between physical activity and language acculturation and the associated effects on obesity. Results revealed that the majority of both Hispanic and non-Hispanic white women did not perform 30 min of activity  $\geq 5$  days in week, although a greater percentage of Hispanic women meet the goal if they reported higher levels of language acculturation. However, the type and intensity of activities performed by Hispanic and non-Hispanic women differed; Hispanic women reported more housework, dependent care giving, dancing, and work activity. Differences in activity patterns existed by level of language acculturation among Hispanic women. Hispanic women who had higher levels of language acculturation reported continued activity throughout their lives. Prevalence of obesity was greater among Hispanic than non-Hispanic white women for all levels of language acculturation. Women with intermediate levels of language acculturation had the greatest relative risk of obesity compared with non-Hispanic white women (odds ratio (OR) = 2.79, 95% confidence interval (CI) = 1.85-4.02); Hispanic women with higher levels of language acculturation also were at increased relative risk of obesity (OR = 1.78, 95% CI = 1.28-2.47). The study concluded that the interventions to increase physical activity among Hispanic women are needed to address the problems of physical inactivity and obesity in that

population. Facilitating culturally relevant activities might be reasonable approaches to increasing physical activity.

Physical activity is an important component on long-term weight control, and therefore adequate levels of activity should be prescribed to combat the obesity epidemic. Although there is evidence that 30 min of moderate-intensity physical activity may improve health outcomes, the amount of physical activity that may be necessary to control body weight may be 30 min/d. There is a growing body of scientific literature suggesting that at least 60 min of moderate-intensity physical activity may be necessary to maximize weight loss and prevent significant weight regain. Moreover, adequate levels of physical activity appear to be important for the prevention of weight gain and the development of obesity. **(Otto and Jakicic, 2005)**

**Hagan, Upton, Wong, and Whittam, (2006)** conducted a study among men and women of 30-50 yrs at Health Services Research Center, Florida and reported reductions in body weight of 11.4, 8.4, and 0.3% in males participating in 12 wk of yoga exercise, respectively. A similar pattern of weight losses of 7.5, 5.5, and 0.6% was observed in women engaging in the same interventions.

A study conducted by **McGuire et al (2004)** was that individuals in the National Weight Control Registry who reduced their level of leisure-time physical activity also reported weight regain across a 1-yr period. Thus, for exercise to be effective long term, it will be important to implement strategies that will facilitate the maintenance of the exercise behavior long term in overweight and previously overweight individuals.

**Pendse et al (2009)** conducted a study on the effect of specific yoga practices on obesity at Thane, Maharashtra. A camp was conducted for obese persons. The duration was six weeks. Specific dynamic yoga practice along with routine yoga practices were taught to the participants and practiced by the participants for one and half hour every day. The medical parameters considered for the study were- Body Mass Index, Waist-Hip Ratio. Pre and post camp measurement of these parameters was done for each participant. No individual diet plan was recommended. Results revealed that weight recorded before and after the camp showed significant reduction. Abdominal Obesity shows significant reduction. Reduction in waist and hip measurement to certain percentage in each and every participant. Researchers concluded that yogic way can be effective way of dealing with obesity.

**Innes, Bourguignon and Taylor (2006)** at university of Virginia proved the years of yoga help reduce obesity and related risks. They conducted a yoga classes for duration of 3 years except on Saturdays and Sundays. The evidence shows that it may also be good for weight and heart health. They found that, in addition to reducing obesity, yoga helped with reducing obesity related risks. Research participants who performed active yoga asanas experienced weight loss ranging from 1.5 to 13.6 percent. Total cholesterol was 5.8 to 25.2 percent lower in yoga practitioners.



## **CHAPTER-III**

### **Research Methodology**

The methodology of study includes research approach, research design, variables, setting of the study, population, sample and sampling technique, sampling criteria, development and description of the tool, pilot study, the procedure for data collection and plan for data analysis also part of the study.

This chapter deals with the methodology that was selected by the investigator in order to assess the effectiveness of yoga on obesity among obese women in selected rural areas of Madurai.

#### **Research Approach**

Experimental approach was used for this study. Considering the purpose of the study i.e. to assess the effectiveness of yoga on obesity an experimental approach was found to be appropriate method for this study.

#### **Research design**

Non equivalent pretest, post test control group design was adopted for this study.

This can be represented by,

<b>GROUP</b>	<b>PRETEST</b>	<b>INTERVENTION</b>	<b>POSTTEST</b>
Experimental group	O1	X	O2
Control group	O1	-	O2

O1 – Measurement of BMI level before manipulation

O2 – Measurement of BMI level after manipulation

X – Intervention (Yoga therapy)

### **Variables**

Dependent variable: Obesity

Independent variable: Yoga therapy

### **Setting of the study**

This study was conducted in two selected rural areas of Madurai, Indira Nagar and Chandraleka Nagar.

The study subjects for the experimental group belonged to Indira nagar and subjects for the control group belonged to Chandraleka nagar. They are away from each other. Indira nagar is a village which is nine kilometers away from the Sacred Heart Nursing College, Madurai. Total population of Indira nagar was 1927, among this 358 women were in the age of 20-50 years. Chandrleka Nagar is a village which is nine kilometers away from the Sacred Heart Nursing College, Madurai. Total population of Chandraleka nagar was 1896 among this 326 women were in the age of 20-50 years. Both are remote areas, located away from Madurai town. Most of the people are going for

daily wages. In both areas, women are having low standard of living. Most of the women are not employed, but take care of household chores. Most of the people are having sedentary lifestyle with all facilities such as gas, cooker and washing machine for an apparently comfortable living with less physical activities.

### **Population**

The target population of the study was women in the age of 20-50 years who were residing in Indira Nagar and Chandraleka Nagar.

### **Sample**

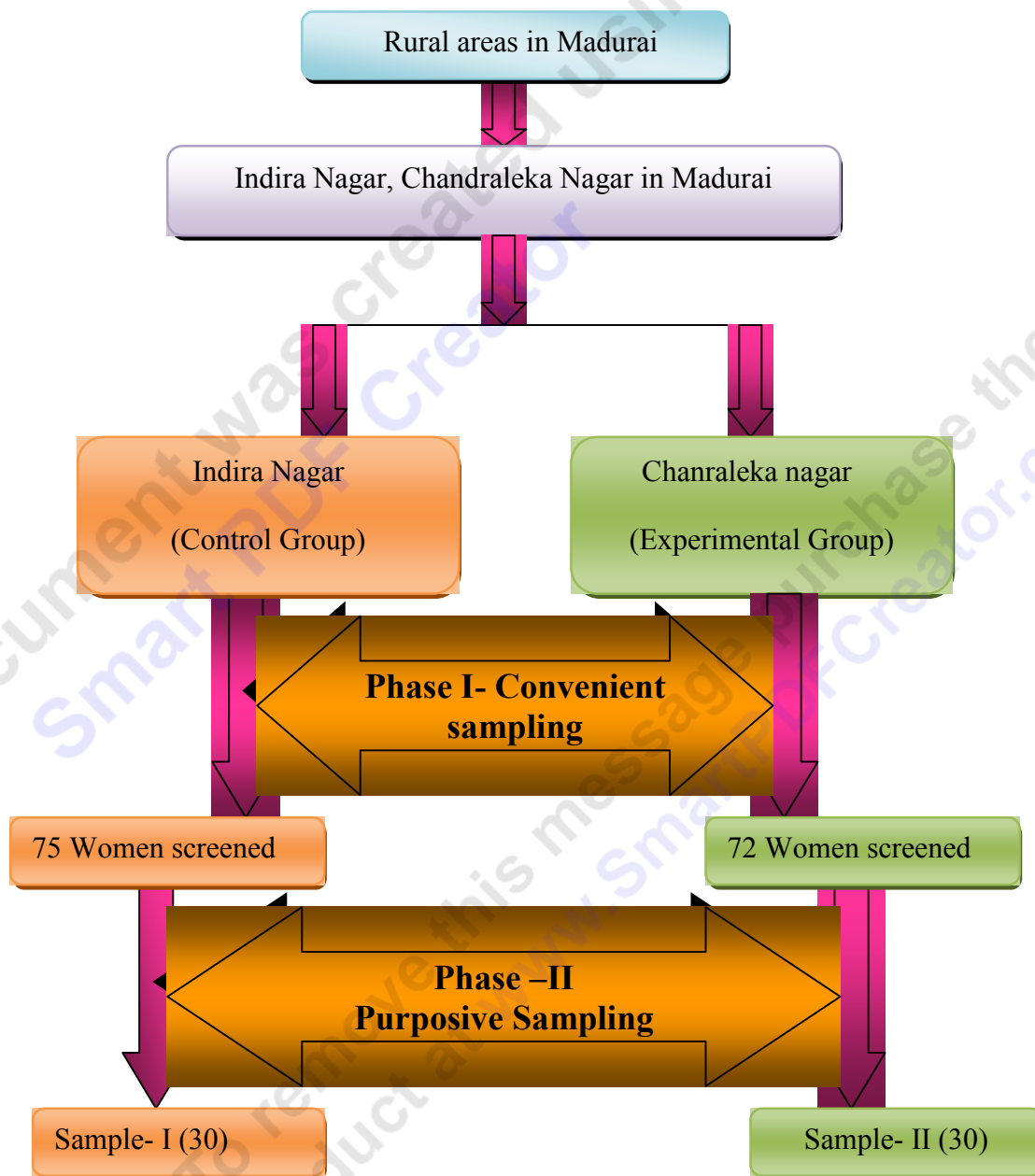
The obese women, who belonged to Indira nagar and Chandraleka nagar, who fulfilled the inclusion and exclusion criteria.

### **Sample Size**

The Sample consisted of 60 obese women. Among them 30 obese women were in the experimental group and 30 obese women were in the control group.

**Sampling Technique:**

Convenient and Purposive sampling method

**Figure 3:** Sampling technique

## **Criteria for sample selection**

### **Inclusion Criteria:**

- Obese women in age of 20-50 yrs with BMI of 30 and above
- Who were willing to participate in yoga

### **Exclusion criteria:**

- Obese women who are already taking weight reduction treatment
- Obese women with arthritis, hip joint pain
- Women on treatment on infertility

## **Research Tool and Technique**

The data collection tool consist of

**Part I** – Socio demographic profile (age, religion, education, occupation, dietary Pattern, income, and physical problem)

**Part II** – Calculation of Body Mass Index as per WHO classification, by checking the height using measuring tape and weight using weighing machine.

### **Description of Tool**

#### **Part-I Socio demographic profile**

It comprised of demographic data of the obese women such as age, religion, education, occupation, dietary pattern, family income, physical problem related to mobility and medical illnesses.

**Part II (Obesity level) - Body Mass Index Classification By World Health Organization(WHO)**

The Body Mass Index is calculated by using the formula,

$$\text{Weight (kg)} \\ = \frac{\text{Weight (kg)}}{\text{Height}^2 \text{ (m)}}$$

CASSIFICATION	BODY MASS IINDEX
Under weight	<18.5
Normal weight	18.5-24.9
Over weight	25-29.9
Obesity class I (Moderate)	30-34.9
Obesity class II(Severe)	35-39.9
Obesity class III (Extreme obesity)	>40

**Testing the Tool**

**Validity:**

The Validity of the procedure was sent to by five experts. The experts were one general physician, one doctoral person specialized in yoga therapy and three nursing experts

### **Reliability:**

The reliability of the Body Mass Index (BMI) was determined by test re-test method and obtained value was,  $r=0.88$  which showed highly reliability.

### **Intervention:**

The intervention package was developed by the investigator after reviewing the literature and by obtaining the experts opinion. Before implementing the intervention researcher underwent a certificate course on Yoga. The yoga intervention package includes, general instructions, different types of yoga for reduction of weight. The asanas are,

- **Paschimotannasana:** Sit down with your legs stretched. Stretch your lower back and raise your arms. Slowly bend forward and move your hands to your lower legs, ankles or feet.
- **Pada hastasana:** Stand straight as you inhale raises your arms above your head. Slowly bend further so that your belly is touching your upper legs. Grasp your toes and breathe deeply in the pose.
- **Bhujangasana:** Lie on your belly and raise your forehead, look upwards. Put your hands and arms next to your chest on the mat without losing the bend.
- **Halasanas:** Lie flat on the floor. As you inhale, raise both legs, keeping your legs on 45degree angle.
- **Dhanurasana:** Lie on your stomach, and bend your knees. Bring your heels near your buttocks and grasp your ankles. Raise your knees further by pulling your ankles with your hands.

- **Anuloma Viloma:** Anuloma Viloma is also called the Alternate Nostril Breathing Technique. In this Breathing Technique, you inhale through one nostril, retain the breath, and exhale through the other nostril.

The method used for teaching asanas was demonstration, by researcher and discussion, using flash cards. The total time duration for teaching yoga asanas was 30minutes.

### **Pilot Study**

The pilot study was conducted in Karuppayurani on twelve subjects (six experimental and Six for control group). The purpose was to find out the feasibility of the study. Measuring obesity and yoga therapy were found to be feasible.

### **Data Collection Procedure**

Data collection was done in II phases.

#### **Phase I:-**

In phase I, the survey was carried out in Chandralekha Nagar(Experimental Group) and Indira Nagar (Control Group). In Chandralekha Nagar, 72 women in the age of 20-50 years were screened for obesity. In Indira Nagar , 75 women in the age of 20-50 years were screened for obesity. For screening obesity, weight, height was checked and then BMI was calculated. Body weight was measured with a weighing machine with the participants removing shoes and heavy garment. The weight was recorded to the nearest 0.25 kg. Each reading was taken thrice and the average was taken as the final measurement. The height was measured with a measuring tape. The subjects were asked to stand in barefoot and the highest point on the head was marked off on the wall. Height



was read to the nearest 0.5cm. Each reading was taken thrice and the average was taken as the final measurement. BMI of the respondents was computed using the formula, weight (kg)/height (m<sup>2</sup>).

### **Phase II:-**

From the over all screened sample of 72 Chandralekha Nagar (Experimental group) 33 women were selected based on BMI i.e. BMI >29.9, and selected set criteria, and 3 women did not accept to attend yoga so, they have been excluded from study and from Indira Nagar out of 75 women, 32 women were selected based on BMI and selected set criteria and 2 women excluded, as they had arthritis. Thus a total of 60 women were selected for a study.

### **Experimental Group:**

The aim of the proposed study was explained to Anganwadi Worker of Chndraleka nagar, with her cooperation the researcher went door by door of study subjects and they were asked to gather in Anganwadi. On 1<sup>st</sup> day morning the asanas were demonstrated to 15 women by the researcher and also by using flash cards. On the same day, the same asanas were demonstrated to the remaining 15. Thirty minutes had been taken for demonstrating the exercises. Then Re-demonstration was done by the subjects. This was continued for the rest of 11 days in the Anganwadi. As per convenience of the samples, from 12<sup>th</sup> day onwards the researcher used to go to their respective house to supervise and encouraged them to do exercises. The subjects were given with the daily dairy and they marked in the dairy and this was rechecked or verified by researcher.

**Control group:**

Indira Nagar was selected for control. On the first day height and weight of the women was checked and BMI was calculated. No interventions were done for this group.

**Plan for data Analysis**

Data analysis was done in accordance with the objective of the study. The data was organized and tabulated, summarized as follows:-

1. Descriptive statistics was used for interpreting the data such as frequency and percentage.
2. Chi-square was used to determine the association between the variables.
3. To find out the level of significance 't' test was used.

**Protection of Human rights**

The proposed study was conducted after the approval of Research Committee of the college. Permission was obtained from the DDHS. Oral consent was obtained from each study subjects before starting the data collection.

**Summary**

This chapter dealt with the research approach, design, setting, population, sample and sampling technique, development of data collection tools and testing the tool, yoga therapy, pilot study, data collection procedure, plan for data analysis and protection of human rights.

## **CHAPTER –IV**

### **ANALYSIS AND INTERPRETATION OF DATA**

Analysis is the process of organizing and synthesizing data in such a way that research questions can be answered and hypothesis tested (Polit & Hungler, 1999).

This chapter deals with the description of the sample, analysis and interpretation of the data collected and achievements of the objectives of the study. The data collected is tabulated and presented below.

**The data collected were organized under the following sections:**

**Section I:**

- A. Frequency distribution of the subjects in the experimental and control group based on their demographic data.
- B. Prevalence of obesity among screened women in experimental group and control group

**Section II:**

- A. Level of obesity in pretest and posttest of experimental group
- B. Level of obesity in pretest and posttest of control group.

**Section III: Effectiveness of Yoga on obesity**

- A. Comparison of mean pretest BMI score and post test BMI score of experimental group.

- B. Comparison of weight reduction in posttest among subjects of experimental group and control group.
- C. Comparison of mean post test BMI score of experimental group with control group.

**Section IV: Association with selected demographic variables.**

- A. Association between obesity and selected demographic variables with post test score of experimental group.

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## Section – I

Deals with the distribution of subjects of experimental group and control group according to demographic variables.

**Table 1:**

Frequency distribution of the subjects in the experimental and control group based on their demographic data.

Demographic Variables	Experimental Group		Control Group		Total (n=60)	
	F	%(n=30)	F	%(n=30)	F	%
<b>Age</b>						
20-30 years	15	50%	17	56.66%	32	53.33%
30-40 years	10	33%	8	26.66%	18	30%
40-50 years	5	16.66%	5	16.66%	10	16.66%
<b>Religion</b>						
Hindu	16	53.33%	19	63.33%	35	58.33%
Muslim	14	46.66%	11	36.66%	25	41.66%
<b>Educational Status</b>						
Illiterate	10	33.33%	8	26.66%	18	30%
Educated	20	66.66%	22	73.33%	42	70%

Demographic Variables	Experimental Group (n=30)		Control Group(n=30)		Total (n=60)	
	F	%	F	%	F	%
<b>Marital Status:</b>						
Married	27	90%	26	86.66%	53	88.33%
Single	3	10%	4	13.33%	7	11.66%
<b>Occupation</b>						
House wife	30	100%	30	100%	60	100%
<b>Total monthly Income in Family</b>						
2000-3000	13	43.33%	12	40%	25	41.66%
3000-4000	17	56.66%	18	60%	35	58.33%
<b>Physical problem related to mobility</b>						
a. Yes	5	16.66%	5	16.66%	10	16.66%
b. No	25	83.33%	25	83.33%	50	83.33%
<b>Medical illness</b>						
a. Yes	2	6.66%	2	6.66%	4	6.66%
b. No	28	93.33%	28	93.33%	56	93.33%

The data presented in table 1 describes the following.

Regarding age of subjects, 17(56.66%) in control group were from 20-30 years of age whereas in experimental group 15(50%) were from 20-30 years of age.

With regard to religion of subjects, 19(63.33%) in control group were Hindus, whereas in experimental group 16(53.33%) were Hindus in experimental group.

Regarding educational status of the subjects, 22(73.33%) in control group, 20(66.66%) in experimental group were educated up to secondary school.

Regarding marital status of the subjects 27(90%) in experimental group and 26(86.66%) in control group were married.

Regarding occupation, 30(100%) in both groups are home makers.

Regarding total monthly income, 18(60%) in control group and 17(56.66%) in experimental group were getting Rs. 3000-4000.

With regard to the physical problem related to mobility, 25(83.33%) in both the groups do not have problem and only 5(16.66%) in both the groups were having the physical problem.

Regarding medical illnesses 28(93.33%) in both the groups does not have any medical problem.

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## Section-II

**Table 2:**

Prevalence of obesity among screened women in experimental and control group.

Factor	Area I (Experimental Group (n=72))		Area I (Control Group(n=75))	
	F	%	F	%
	Obesity Present	33	45.83%	32
Obesity Absent	39	54.16%	43	57.33%

Table 2 depicts that, In area I, from the overall screened sample of 72, 33 women (45.83%) were obese, and 39 women (54.16%) were found absent of obesity. In area II, from the overall screened sample of 75, 32 women (42.66%) were found to be obese and 43 women (57.33%) were found to be absent of obesity.



**Table 3:**

Level of obesity in pretest and posttest among subjects of experimental group

(n=30)

	Over weight		Obesity class I		Obesity class II	
	F	%	F	%	F	%
Pre test	0	0	28	93.33%	2	6.66%
Post test	2	6.66%	27	90%	1	3.33%

Table 3 depicts the change in the level of obesity. In pretest 28 women (93.33%) were in obesity class I and 2 women (6.66%) were in obesity class II. Whereas in posttest 2 women (6.66%), from obesity class I, they reached pre-obesity ie overweight and 1 woman from obesity class II, has reached obesity class I.

**Table 4**

Level of obesity in pretest and posttest among subjects of control group  
(n=30)

	Over weight		Obesity class I		Obesity class II	
	F	%	F	%	F	%
Pre test	0	0	26	86.66%	4	13.33%
Post test	0	0	26	86.66%	4	13.33%

Table 4 depicts that, in pretest 26 women (86.66%) were in obesity class I and 4 women (13.33%) were in obesity class II. In post test, obesity class remaining unchanged for control group.

### Section III

#### Effectiveness of Yoga on obesity

##### Objective:

Assessment of effectiveness of yoga on obesity among women in experimental group.

##### Table 5:

Comparison of mean pretest BMI score and post test BMI score of experimental group.

BMI score	N	Mean	Mean Difference	SD	't'value	DF
Pre test	30	32.42		2.51		
			0.36		17.5*	29
Post test	30	32.06		1.67		

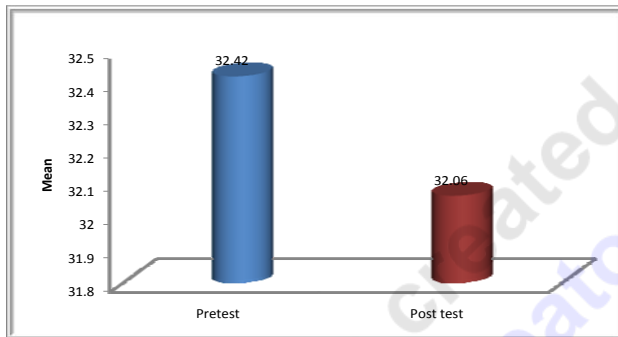
\* significance at ( $p < 0.05$ ) level

To compare the mean pre test and post test BMI score of women the null hypothesis stated was as follows:  $H_0$  - The mean post test BMI score of women in experimental group who had yoga therapy will not be significantly lower than their pretest level.

The hypothesis was tested using paired t-test.

Table-5 portrays that the mean post test BMI score of 32.06 was higher than the mean pretest BMI score 32.42. The obtained 't' value 17.5 was statistically highly significant at 0.05 levels. This illustrates the mean difference of 0.36 was a true difference and has not occurred by chance. So the researcher rejects the null hypothesis and accepts the research hypothesis. Fig-1

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**Figure-4:** Comparison of mean pretest BMI score and post test BMI score of experimental group.

**Table 6:**

Comparison of weight reduction in posttest among subjects of experimental group and control group.

Group	Level of Weight reduction					
	<400 gms		400-700gms		700-900gms	
	F	%	F	%	F	%
Experimental group	2	6.66%	9	30%	19	63.33%
Control Group	0	0	0	0	0	0

Table 6 depicts that, in post test 2 subjects (6.66%) there was a reduction of weight about 400 grams and 9 subjects (30%), there was a reduction of weight up to 400-700 grams and 19 subjects (63.33%) there was a reduction of weight up to 700-900 grams. Whereas in control group none of them had reduce the weight.

**Table 7:**

Comparison of mean post test BMI score of experimental group with control group

(n=30)

BMI Score	N	Mean	MD	SD	't' value	Df
Experimental Group	30	32.06	1.22	1.67	2.38 *	29
Control Group	30	33.28		2.52		

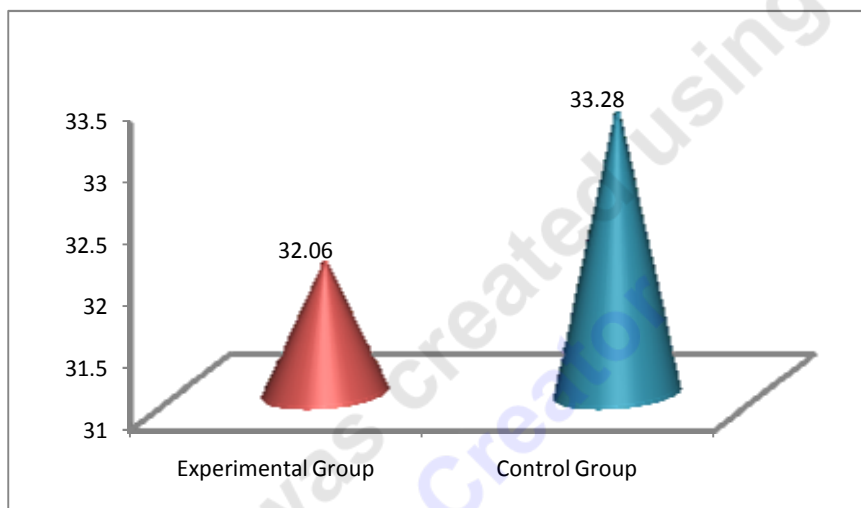
\* Significance at the (P<0.05) level

The null hypothesis stated was as follows:

H<sub>0</sub> - The mean post test BMI score of the experimental group will not be significantly lower than the mean post test score of control group.

The hypothesis was tested using Independent 't' test.

Table- 7 portrays that the mean post test BMI score 32.06 of experimental group was lower than the mean post test BMI score of 33.28 of control group. The obtained 't' value 2.38 at df 29 was statistically highly significant at 0.05 level. This illustrates that the mean difference of 1.22 was a true difference. So the researcher rejects the null hypothesis and accepts the research hypothesis. Fig-2



**Figure 5:** Comparison of mean post test BMI score of experimental group with mean post test BMI score of control group.



## SECTION –IV

**Objective:**

To find out the association between obesity and socio demographic variables.

**Table-8**

Association between BMI and demographic variables.

Demographic variables			Total	(N=30)	
	Below Mean	Above Mean		X <sup>2</sup>	Df
<b>Age</b>					
a. 20-30 years	6	8	14		
b. 30-40 years	3	7	10	0.405#	2
c. 40-50 years	2	4	6		
<b>Religion</b>					
a. Hindu	7	9	16	0.726#	1
b. Muslim	4	10	14		
<b>Educational Status</b>					
a. Illiterate	5	5	10		
b. Primary	4	9	13	1.157#	2
c. Secondary	2	5	7		
<b>Marital status</b>					
a. Married	9	18	27		
b. Single	2	1	3	0.650#	1

<b>Demographic variables</b>	<b>Below Mean</b>	<b>Above Mean</b>	<b>Total</b>	<b>X<sup>2</sup></b>	<b>Df</b>
<b>Total monthly Income</b>					
a. 2000-3000	6	7	13	0.723#	1
b. 3000-4000	5	12	17		
<b>Physical problem</b>					
a. Yes	1	4	5	0.725#	1
b. No	10	15	25		
<b>Medical problem</b>					
a. Yes	1	1	2	1.696#	1
b. No	10	18	28		

# Insignificant at 0.05 level of significance

To find out the association between the mean reduction of body weight and selected demographic variables such as age, religion, educational status, marital status, total monthly income, physical problem and medical problem, the null hypothesis was stated as follows.

H<sub>03</sub>- There will not be any significant association between the BMI score and demographic variables.

From the above table 8 it is inferred that there was no significant association between BMI score and demographic variables. So the researcher accepts the null hypothesis and reject research hypothesis.

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## CHAPTER –V

### DISCUSSION

The aim of the study was to identify the prevalence of obesity among women and to assess the effectiveness of Yoga on obesity and physical activity among women residing in selected rural areas of Madurai. The study findings are discussed in this chapter with reference to the objectives stated in Chapter-1

#### **Distribution of demographic characteristics of the subjects:**

Regarding the age of subjects, 17 (56.66%) in control group were from 20-30 years of age whereas in experimental group 15 (50%) were from 20-30 years. With respect to educational level, majority of the subjects had education up to high school and majority of the subjects 90% in experimental group and 86.66% in control group were married. Similarly a study conducted at Australia by Coulson, et al (2005) revealed that the prevalence of overweight and obesity was more among the middle aged population (31-40 years= 26%, 41-50 years=19%, 51-65%=29% and they stated that majority of the subjects (49.99%) had high school education and most of the subjects (69%) were married

With regard to religion, highest proportions, i.e. 63.33% in control group and 53.33 % in experimental group were Hindus. All the participants (100%) were not employed in both groups. Carrol et al, (2001) conducted a study that, prevalence and trends of overweight and obesity in the United States, examined the body fat and fat mass were lower in the active women when compared with their sedentary controls, even

the cells of the women who were active appeared the same as sedentary people who were 10 years younger.

All the participants were (100%) were non-vegetarian. In general a diet containing more energy than needed may lead to deposition of adipose tissue resulting in obesity. So this group requires intervention such as yoga therapy. With regard to monthly income, 18 (60%) in control group and 17 (56.66%) in experimental group were getting Rs. 3000-4000. There is no congruent literature found with relation this study finding.

With regard to the physical problem related to mobility, 25 (83.33%) do not have problem and only 5 (16.66%) had physical problem in both groups. There is no congruent literature found with relation this study finding. Regarding medical illnesses 28(93.33%) in both the groups does not have any medical problem. Literature search could not elicit any study which is consistent with this study finding.(Table 1)

**The first objective of the study was to identify the prevalence of obesity among women in selected rural areas:**

To identify the prevalence of obesity among women in rural areas, the survey was carried out at Indira nagar and Chandraleka nagar. Table 2 depicts that, In area I, from the overall screened sample of 72, 33 women (45.83%) were obese, and 39 women (54.16%) were found absent of obesity. In area II, from the overall screened sample of 75, 32 women (42.66%) were found to be obese and 43 women (57.33%) were found to be absent of obesity. (Table. 2)

**The second objective of the study was to assess the pretest, post test level of obesity among women in experimental and control group.**

Table 3 depicts that, in pretest 28 women (93.33%) were in obesity class I and 2 women (6.66%) were in obesity class II. Whereas in posttest 2 women (6.66%), from obesity class I, they reached pre-obesity ie overweight and 1 women from obesity class II, they reached obesity class I. This illustrates that the change of obesity class was true and has not occurred by chance. Table 4 depicts that, in pretest 26 women (86.66%) were in obesity class I and 4 women (13.33%) were in obesity class II. In post test, obesity class remaining unchanged for control group.

**To assess the effectiveness of Yoga on obesity among women in experimental group.**

In order to assess the effectiveness of yoga on obesity among women, the investigator used BMI scale. There was a significant difference in BMI score between the experimental and control groups. As per table 7 the mean post test BMI score (32.28) of control group was higher than the mean post test BMI score (32.06) of experimental groups. From the mean difference of (1.22) it is evident that the Yoga therapy was found to be effective in the experimental group only. Table 6 depicts that, in post test 2 subjects (6.66%) there was a reduction of weight about 400 grams and 9 subjects (30%), there was a reduction of weight up to 400-700 grams and 19 subjects (63.33%) there was a reduction of weight up to 700-900 grams. Whereas in control group none of them had reduce the weight. Jakicic et al (2006) conducted a study in United States and have reported that long-term weight loss was improved in overweight and obese women with the addition of 200–300 min/wk of physical activity. These findings are similar to the

results reported by Schoeller et al (2006) who demonstrated that weight loss maintenance was improved when individuals engaged in the equivalent of 65 min/d of moderate intensity physical activity for a period of 12 weeks.

After the intervention, comments received from the participants regarding yoga class and physical activity revealed the following verbatim;

**With regard to Yoga class:**

*“We participated in your study because you conducted yoga classes for us.*

*Otherwise we could not have afforded yoga classes individually.*

*Few subjects expressed that “we are in need of some treatment modalities for weight reduction, but timely you came and helped us through your study”*

**Physical activity:**

*“Before doing yoga it was difficult for us to do the daily activities especially to fetch water from public tap even from a small distance. Indeed, yoga classes helped us to improve the activities of daily living and we are grateful to you. So though the obesity level was not shifted to all subjects, there was a significant reduction, in spite of one month yoga therapy.*

**The fourth objective was to find out the association between obesity and socio demographic variables such as age, religion, educational status, marital status, occupation, total monthly income, dietary pattern, physical problem and medical problem.**

An analysis on whether the variable in the study exerts any influence in the BMI score is stated here. In this the researcher found that, there was no association between

the post test BMI score and selected demographic variables such as age, religion, educational status, occupation, total monthly income, marital status, dietary pattern, physical problem related to mobility and medical illnesses.

The null hypothesis was, there will not be any significant association between the BMI score and demographic variables.

From the table 8 it is inferred that there was no significant association between BMI score and demographic variables. So the researcher accepts the null hypothesis and reject research hypothesis.

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## **CHAPTER-VI**

### **SUMMARY, CONCLUSION, IMPLICATIONS AND RECOMMENDATIONS**

This chapter deals with the summary of the study, the implications for nursing practice, nursing education, nursing research, nursing administration and recommendations for future research.

#### **Summary of the Study**

The study was undertaken to assess the effectiveness of yoga on obesity among women in selected rural areas adopted by Sacred Heart Nursing College, Madurai. The following objectives were set for the study.

1. To identify the prevalence of obesity among women in selected rural areas.
2. To determine the pretest, post test level of obesity among women in experimental and control group.
3. To evaluate the effectiveness of Yoga on obesity among women in experimental group.
4. To find out the association between obesity and socio demographic variables such as age, religion, educational status, occupation, marital status, dietary pattern, physical problem related to mobility and medical illnesses.

The following hypotheses were set for the study. All hypotheses were tested as 0.05 level of significance.

1. The mean post test Body Mass Index score of women in experimental group who had yoga therapy will be significantly lower than their pretest level.
2. The mean post test BMI score of the experimental group will be significantly lower than the mean post test score of control group.
3. There will be a significant association between obesity and their selected demographic variable such as age, religion, educational status, occupation, total monthly income, marital status, dietary pattern, physical problem related to mobility and medical illnesses.

The conceptual framework of this study was based upon on J.W Kenny's open system theory.

Non-equivalent pretest, posttest control group design was used for the study.

Independent Variable was Body Mass Index and Dependent variable was Yoga therapy

The tool used for data collection was BMI scale by WHO. The reliability of BMI was tested by test-retest method and found to be  $r=0.88$ . The content validity of procedure was obtained from five experts.

Indira Nagar and Chandraleka Nagar, which were rural areas belonging to Madurai, were selected. The convenient sampling technique was used for experimental and control group respectively. From these villages, the women who fulfilled inclusion criteria were selected.

Descriptive statistics (percentage, mean and standard deviation) and inferential statistics (chi-square, paired 't' test and independent 't' test) were used to analyze the data and to test the hypotheses.

### Major findings of the Study

#### a. Demographic characteristics of the sample.

- ✦ With regard to age, majority of the participants 17 (56.66%) were 20-30 years of age.
- ✦ With regard to religion, majority (63.33%) were Hindu from experimental group and 53.33% from control group.
- ✦ Most of the participants 22 (73.33%) had up to secondary school education
- ✦ Majority of the subjects (90%) were married in both groups
- ✦ All the participants 30 (100%) were Home makers in both groups.
- ✦ With regard to total monthly income, majority 18 (60%) in control group and 17 (56.66%) in experimental group were getting Rs. 3000-4000/month.
- ✦ It was found that, majority 25 (83.33%) had no any physical problems related to mobility in both groups.

- ✦ Majority of the subjects 28 (93.33%) had no any medical illnesses in both groups.

### **Prevalence of obesity:**

A total of 147 women from 20-50 years of age were screened from Chandraleka and Indira nagar. The overall prevalence of obesity is 44.21%.

Which suggest that even, in rural population half of the women in this age group are found to be obese.

### **Among the Women in Experimental group:**

- ✦ In pretest, 28 women (93.33%) were in obesity class I and 2 women (6.66%) were in obesity class II. Whereas in posttest 2 women (6.66%), from obesity class I, they reached pre-obesity ie overweight and 1 women from obesity class II, they reached obesity class I.
- ✦ In post test 2 subjects (6.66%) had reduction of weight about 400 grams, and 9 subjects (30%) had reduction of weight up to 400-700 grams and 19 subjects (63.33%) had reduction of weight up to 700-900 grams.
- ✦ The mean post test BMI score of 32.06 was higher than the mean pretest BMI score 32.42.
- ✦ The mean post test BMI score 32.06 of experimental group was lower than the mean post test BMI score of 33.28 of control group. So the yoga intervention was effective.
- ✦ There is no significant association between BMI and selected demographic variables.

## Conclusions

The following conclusions were drawn from this study.

1. The women who participated in the study have no previous exposure to Obesity treatment modalities.
2. The mean post test BMI score of 32.06 was higher than the mean pretest BMI score 32.42.
3. The mean post test BMI score 32.06 of experimental group was lower than the mean post test BMI score of 33.28 of control group
4. There is no significant association between BMI and selected demographic variables such as age, religion, educational status, occupation, total monthly income, marital status, dietary pattern, physical problem related to mobility and medical illnesses.

## Limitations

1. In this study only BMI was measured and not other measures of obesity.
2. Post test was conducted within six weeks.
3. Because of small sample size findings must be interpreted with caution
4. The samples were selected by purposive sampling technique and not by random sampling.
5. Intervention was done for only ½ hour/day
6. No other counseling with regard to other contributory factors of obesity, so the level was reduced to only some extends.
7. The setting was a rural area hence obesity class III were not commonly found.

## **Implications for Nursing**

The findings of the present study support that Yoga therapy is very effective in terms of reducing weight. The findings of the study have several implications in the following fields.

### **Nursing Practice:**

- Since women health is given importance in today's health scenario, community health nurses can bring innovations in nursing care because every woman is a unique individual.
- Community health nurses can help women to formulate self help association or group to promote health and implement lifestyle modification strategies like Yoga to sustainable prevention and management of obesity.

### **Nursing Education:**

- Nurse educator can also empower nursing students with adequate skills and knowledge in Yoga therapy to promote health of women.
- Yoga can be integrated in the curriculum of nursing, so all the nursing students will be prepared to help the women and also general population.

### **Nursing Research:**

- This study also brings about the fact that more studies are needed to be done in different settings using Yoga strategies to different groups.

**Nursing administration:**

- Nurse administrators shall organize Yoga classes in community area for rendering services.
- Nurse administrators can provide resources for rendering services.
- Nurse administrator can promote evidence based practice.
- Nurse administrators shall organize Yoga training for nurses

**Recommendations**

On the basis of the present study the following recommendations have been made for further studies.

- Similar study can be conducted for a larger group for a longer period.
- Similar study can be conducted to adolescent group
- This study can be done as a comparative study between rural and urban women.
- The effectiveness of yoga on physical activity can be tested among obese women.
- A follow up study can be done to find out whether the women are doing yoga regularly and its effect on obesity and importance of quality of life.

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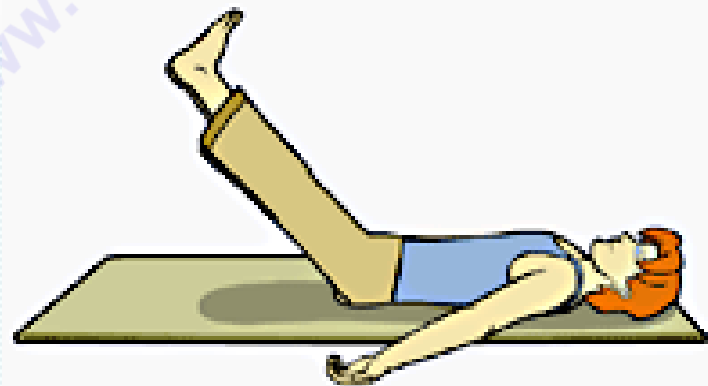
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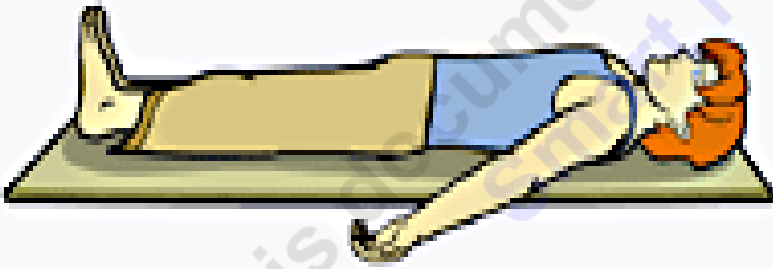
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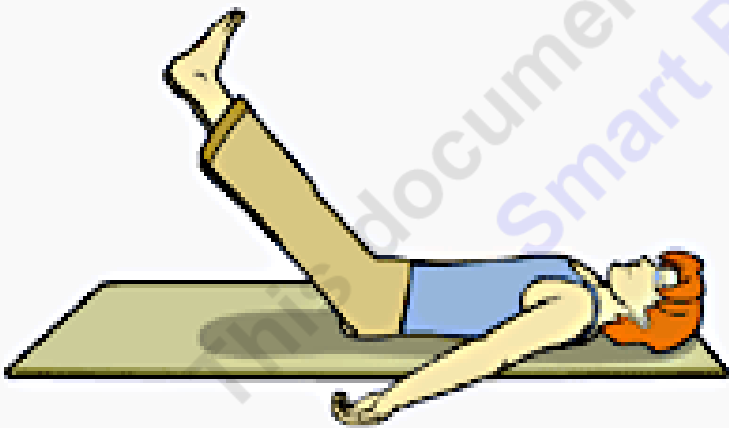


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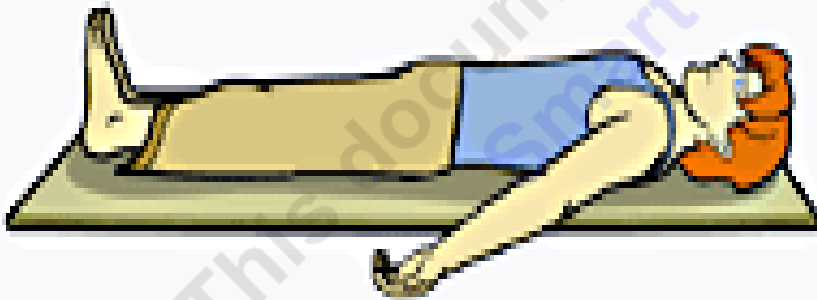
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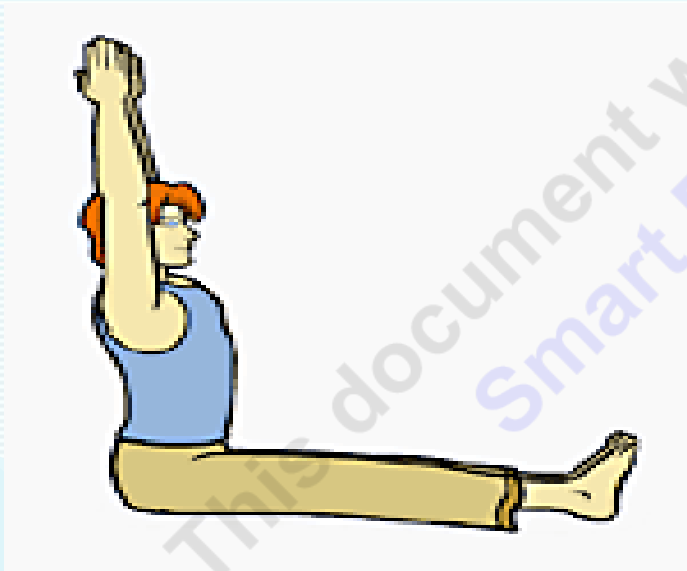


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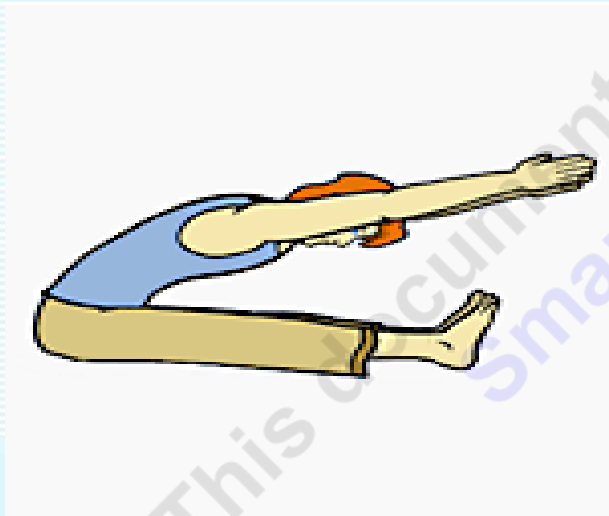
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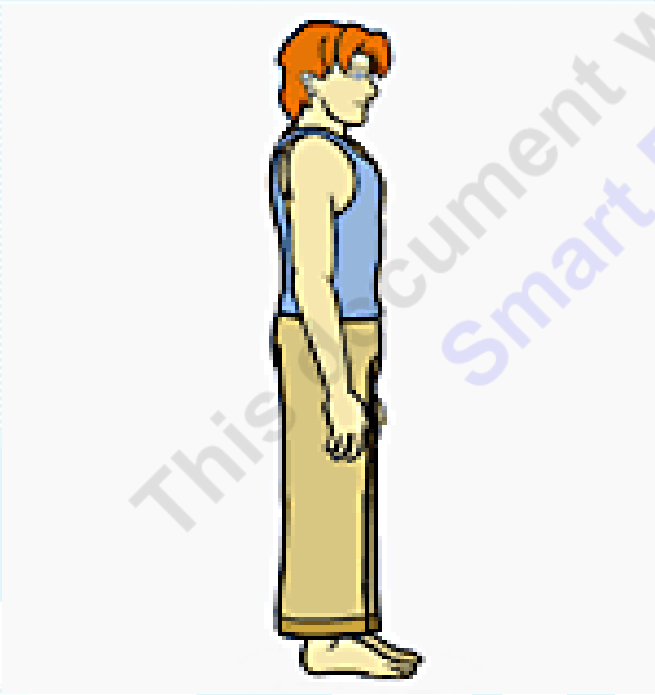


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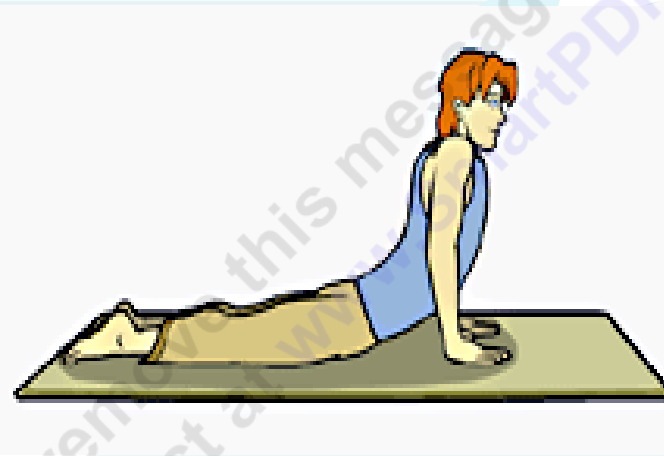
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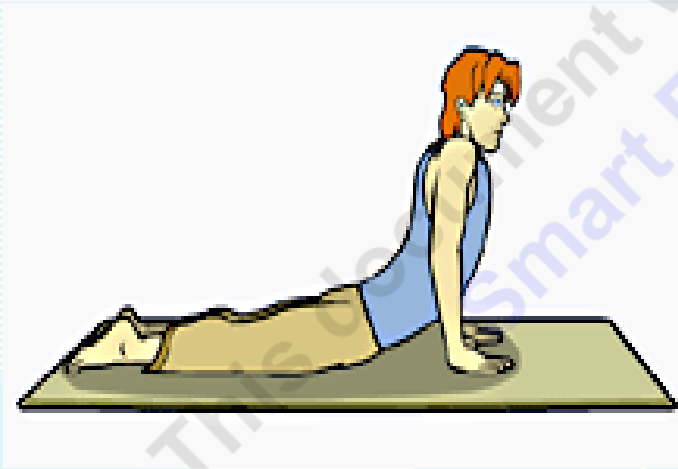
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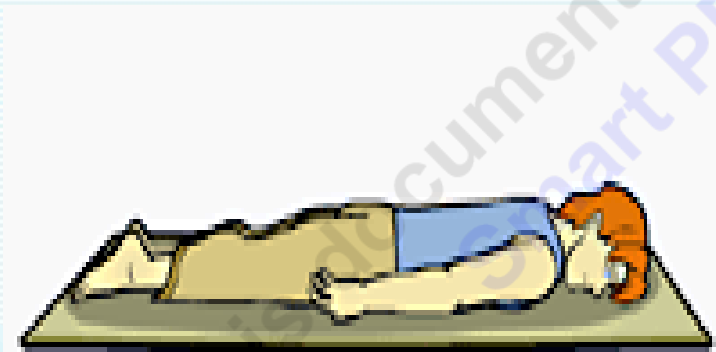
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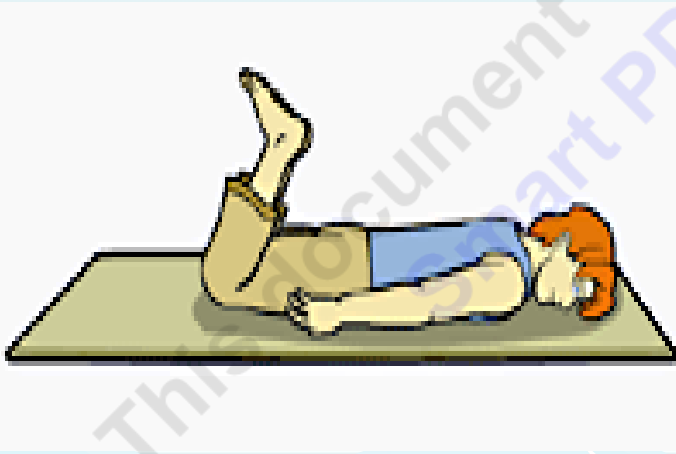


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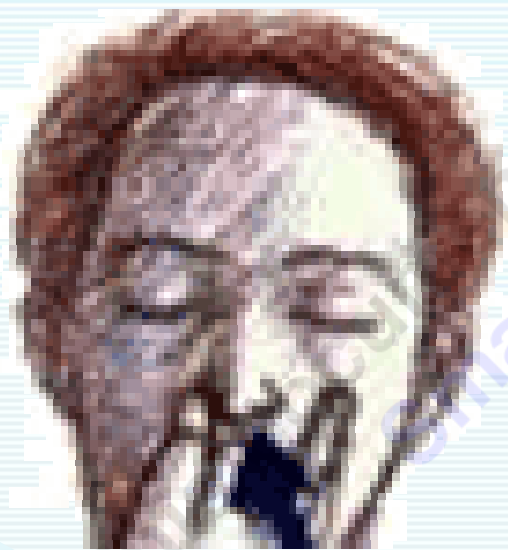


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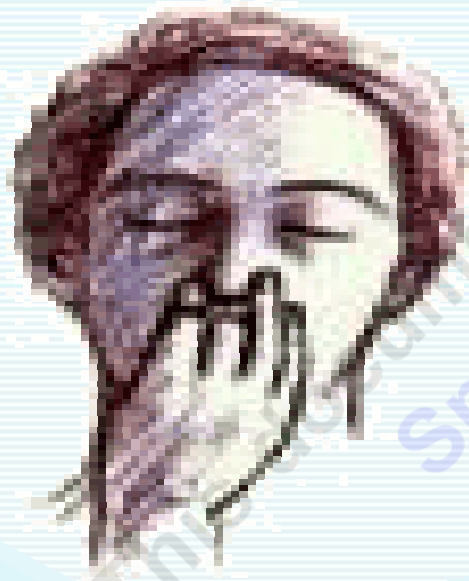
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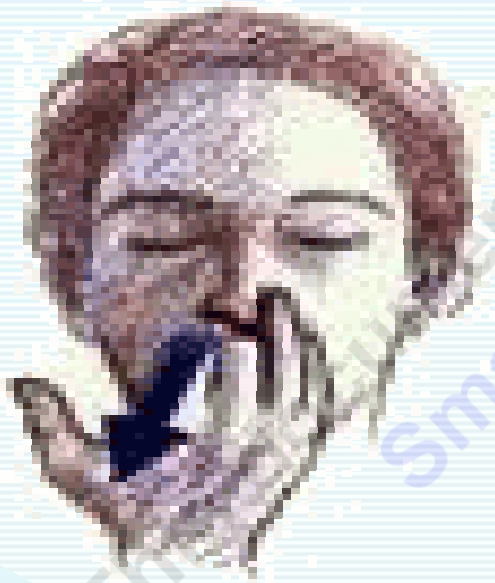


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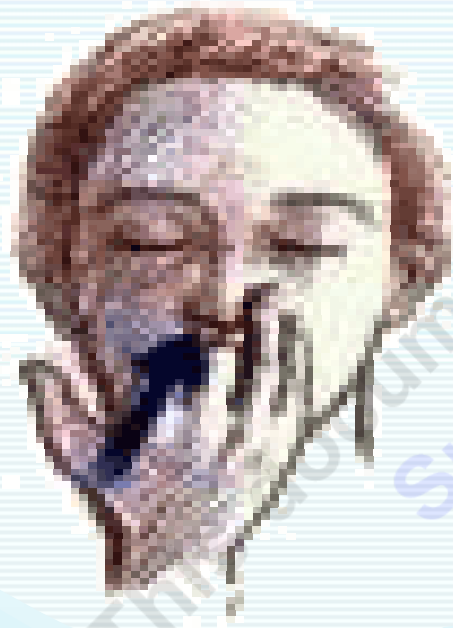
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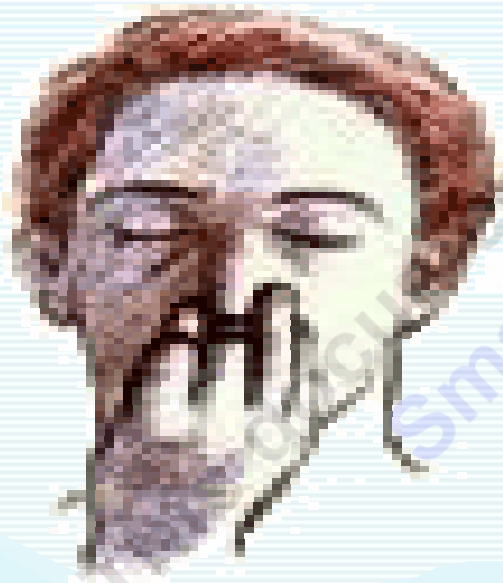


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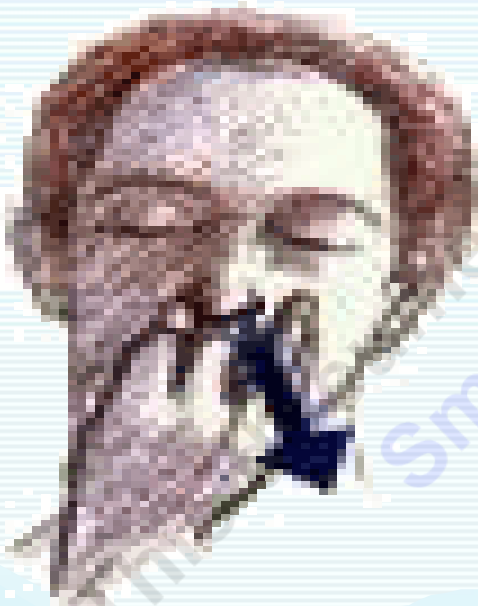


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## MASTER SCORE SHEET

Sample No	Experimental Group		Control Group	
	Pre test	Post test	Pre test	Post test
1.	31.7	31.3	32.8	32.8
2.	31.1	30.4	32.3	32.3
3.	30.6	30.3	32	32
4.	35.1	34.7	35.9	35.9
5.	30.4	30	34.9	34.9
6.	31.8	31.4	32.2	32.2
7.	32	31.7	32.8	32.8
8.	32.3	31.9	31	31
9.	31.5	31.1	30.4	30.6
10.	35.5	35.1	34.8	34.8
11.	34.5	34.2	33.3	33.3
12.	30	29.7	30	30
13.	33.2	32.9	37.9	37.9
14.	33.3	33	33.2	33.2
15.	32.2	31.8	30.6	30.6
16.	34.6	34.2	34.8	34.6
17.	33.7	33.3	38.7	38.7
18.	31.6	31.3	34.2	34.2
19.	32	31.6	31	31
20.	34.4	34.1	34.6	34.6
21.	31	30.9	35.8	35.8
22.	32.8	32.5	38.6	38.4
23.	32.2	31.8	31.6	31.6
24.	30	29.7	34.2	34.2
25.	34.2	33.8	31.9	31.8
26.	31.8	31.4	30.4	30.4
27.	30.4	30.1	34	34
28.	33.7	33.4	30.2	30.2
29.	34.6	34.3	30.1	30.1
30.	30.8	30.4	32.2	32.2

## APPENDIX-I

### COPY OF LETTER SEEKING EXPERTS OPINION FOR TOOL AND CONTENT VALIDITY

From,

\_\_\_\_\_  
II Year M.Sc., Nursing,  
Sacred Heart Nursing College  
Ultra Trust, Madurai-20.

To,

Respected Madam/Sir,

Sub: Requesting opinion and suggestion of experts for the tool for its  
validity

I am \_\_\_\_\_ II year Master Degree Nursing student in Sacred  
Heart nursing College. In partial fulfillment of Master Degree in Nursing, I have selected  
the topic mentioned below for the research project to be submitted to the Dr. M.G.R  
University, Chennai.

**Problem Statement:**

**A study to assess the effectiveness of yoga therapy on obesity among  
obese women in selected rural areas in Madurai.**

Hence I request you to kindly examine the tool, content and give your  
valuable opinion and suggestion for improvement of tool and content.

**Enclosure:**

- Problem statement
- Demographic profile
- Tool
- Intervention package

Thanking you,

Place:

Date:

Yours sincerely,

\_\_\_\_\_

**APPENDIX-II****COPY OF LETTER SEEKING PERMISSION FROM THE DDHS TO CONDUCT  
THE STUDY**

To

The Deputy Director of Health Services,  
Viswanathapuram,  
Madurai.

**Respected Sir/ Madam,**

Sub: Sacred Heart Nursing College, Madurai-Project work of M.Sc., (N) student –  
permission requested –reg

We wish to state that \_\_\_\_\_ final year M.Sc., (N) student of our  
college has to conduct a Research project, which is to be submitted to the Tamilnadu Dr.  
M.G.R Medical University, Chennai in partial fulfillment of University requirements.

The topic of research project is **‘A study to assess the effectiveness of yoga on  
obesity among obese women in selected rural areas of Madurai’**.

We therefore request you to kindly permit her to do the research work under your  
valuable guidance and suggestions.

Thanking You,

Yours faithfully,

Principal,

SACRED HEART NURSING COLLEGE

ULTRA TRUST, MADURAI-20.

**APPENDIX-III****List of Experts Consulted for the Content Validity of Research****Tool****Dr. Joy Patricia Pushparani, M.D (Community Medicine)**

Associate Professor,  
Institute of Community Medicine,  
Madurai Medical College,  
Madurai-20

**Dr. Kurinji Priya, M.D**

Karthik Nursing Home,  
Madurai.

**Dr. S. Jeyaprakasam, M.Sc, MA., MA., Ph.D,**

Independent Scholar and Counseling,  
Peace and Non-Violence Consultant,  
The Valliammal Institution,  
Madurai.

**Prof. Bernice Margrett, M.Sc(N)**

Principal,  
N.D.R.K Institute of Nursing,  
Hassan, Karnataka State.

**Prof. Chandrakala, M.Sc (N), Ph. D.,**

Vice –Principal,  
Sacred Heart Nursing College,  
Ultra Trust, Madurai.

**APPENDIX-IV****Part-I****Socio – Demographic Data**

1. Name: \_\_\_\_\_ Study No: \_\_\_\_\_
2. Age in years:
- a. 20-25 years
  - b. 26-30 years
  - c. 31-35 years
  - d. 36-40 years
  - e. 41-45 years
  - f. 46-50 years
3. Religion
- a. Hindu
  - b. Muslim
  - c. Christian
4. Educational Status
- a. Illiterate
  - b. Primary School
  - c. Secondary school
  - d. Higher Secondary
  - e. College
5. Marital Status
- a. Single
  - b. Married
  - c. Widow
  - d. Divorce
6. Occupation

- a. House wife
- b. Cooli
- c. Others
7. Total family income per month from all sources
- a. < Rs 2000
- b. Rs 2000-3000
- c. Rs3000-4000
- d. > Rs 4000
8. Dietary pattern
- a. Vegetarian
- b. Non-Vegetarian
9. Do you have any physical problem?
- a. Yes
- b. No
- If yes what type of problem do you have?
1. Difficulty in walking
2. Difficulty in doing household works
3. Difficulty in climbing stairs
4. Breathlessness
5. Others
10. Do you have any medical illnesses?
- a. Yes
- b. No
- If yes what type of illnesses do you have?
1. Hypertension
2. Diabetes
3. Heart Diseases
4. Others



**APPENDIX-IV. a****Part –II****CLINICAL PARAMETERS:**

1. Height
2. Weight
3. Body Mass Index

**The Body Mass Index is calculated by using the formula,**

$$= \frac{\text{Weight (kg)}}{\text{Height}^2 \text{ (m)}}$$

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**APPENDIX-V**  
**INTERVENTION- ENGLISH**  
**Yoga Treatment for Obesity**

<b>ASANAS</b>	<b>DIRECTIONS</b>
1.Paschima-uttana-asana	<ol style="list-style-type: none"> <li>1. Sit down with your legs stretched. Stretch your lower back and raise your arms. Look forward, lengthen your back, and keep the chest and your breathing free.</li> <li>2. Slowly bend forward, stretch your crown upward and try not to lose the supporting dynamism of the lower back. See to it that your legs do not move or tilt.</li> <li>3. As you exhale move your hands to your lower legs, ankles or feet. Lightly pull your legs, ankles or feet and continue stretching.</li> </ol> <p style="text-align: right;"><b><u>20-30 counts</u></b></p>
2. Double Leg Raise	<ol style="list-style-type: none"> <li>1. Lie flat on the floor.</li> <li>2. As you inhale, raise both legs, keeping your knees straight and your buttocks on the floor</li> <li>3. Exhale and lower your legs. Repeat ten times.</li> </ol>

	<b><u>20-25Seconds</u></b>
3. Bhujanga-asana	<ol style="list-style-type: none"> <li>1. Lie on your belly, while your head rests on your lower arms.</li> <li>2. Raise your forehead, look upwards and stretch your hands backwards. Let your weight rest on your chest.</li> </ol> <p style="text-align: center;"><b><u>10-15 Seconds</u></b></p>
4. Bow Yoga Pose (Dhanur-asana)	<ol style="list-style-type: none"> <li>1. Lie on your stomach, arms on your sides, and palms facing upward.</li> <li>2. Bend your knees. Bring your heels near your buttocks.</li> <li>3. Reach back with your arms and grasp your ankles.</li> <li>4. Raise your knees further by pulling your ankles with your hands.</li> </ol> <p>Continue breathing regularly and try to increase the stretching in the chest and the backward bend for a relaxed body and mind.</p> <p style="text-align: center;"><b><u>10-15 seconds</u></b></p>
5. (Hands to feet) Pada Hastasana	<ol style="list-style-type: none"> <li>1. Stand in tada-asana Start with the Mountain Pose.</li> <li>2. Bend forward. Touch your toes. Pull up your knee-caps. Tighten your thighs.</li> <li>3. Bend further. Hold your ankles or place your hands by the sides of your feet. Touch your head to your knee.</li> </ol> <p style="text-align: center;"><b><u>20-100 counts</u></b></p>

6. Anuloma Viloma	<ol style="list-style-type: none"><li>1. Inhale through the left nostril, closing the right with the thumb, to the count of four.</li><li>2. Hold the breath, closing both nostrils, to the count of sixteen.</li><li>3. Exhale through the right nostril, closing the left with the ring and little fingers, to the count of eight.</li><li>4. Inhale through the right nostril, keeping the left nostril closed with the ring and little fingers, to the count of four.</li><li>5. Hold the breath, closing both nostrils, to the count of sixteen</li><li>6. Exhale through the left nostril, keeping the right closed with the thumb, to the count of eight.</li></ol> <p style="text-align: right;"><b><u>5 minutes</u></b></p>
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APPENDIX- V. a

INTERVENTION- ENGLISH

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- ê£ŠH†ì Hì, 3 ñE «íó¬ èN^¶Š ðJŸC æêœè «õ±´.
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<p>ðÉîývî Ýêù&lt;</p>	<ol style="list-style-type: none"> <li>1. èÉ™è-÷ «ê™® -ð® «ïóÉè GI™%®î G-òJ™ GÝè¼&lt;.</li> <li>2. Í,,-è àœðÉfA, °èÉ†' -èè-÷^ î-ò,° «ñðÉè àð™î¼&lt;.</li> <li>3. Í,,-è °ðOM†', °èÉ†' àð™Fð -èè-÷ ßø,AððÉÁ °Q%® èÉ™Mó™è-÷^ °iÉî¼&lt;.</li> <li>4. «ñ¼&lt; °Q%® î-òðÉ™ èÉ™ °†®èè-÷^ °iÉî¼&lt;.</li> </ol> <p style="text-align: center;">20-25 °iÉ®èœ</p>
<p>¹üfèÉêù&lt;</p>	<ol style="list-style-type: none"> <li>1. ðJÁ î-òJ™ ðF»&lt;ð® î-óMKŠHj e® °Š¹øŠð',è¼&lt;.</li> <li>2. Í,,-è àœðÉfA, °èÉ†', «îÉœŠð†-î-ò àð™î¼&lt;.</li> <li>3. Í,,-è àœðÉfAð, àî-ò ð-÷^® î-ò-ò, 4 Üf°ð^FÝ° àð™î¼&lt;.</li> <li>4. -è°†®-ò «ïóÉè -ð® ,àî-ò «ïóÉè -ð,è¼&lt;.</li> </ol> <p style="text-align: center;">10-15 °iÉ®èœ</p>
<p>îÁóÉêù&lt;</p>	<ol style="list-style-type: none"> <li>1. î-òMKŠHj e® °Š¹øŠð',è¼&lt;.</li> <li>2. ßó†' èÉ™è-÷»&lt; ñ®,è¼&lt;.</li> <li>3. -è°†®è-÷ ñi,èÉñ™, àœ÷f-èè-÷, °èÉ†' èµ,èÉ™è-÷Š H®,è¼&lt;.</li> </ol>

	<p>4. Í,,-ê àœð£fA,ªè£†´, î-ô, ñ£~¹ ñŸÁ&lt;ª£-ìŠ ð°F-ò M™ ð®ð^F™ ð-÷,è³/₄&lt;.</p> <p>10-15ª£®èœ</p>
<p>àî£ù ð£î Ýêù&lt;</p>	<p>1. î-óMKŠH; e¶ ñ™ô£%¶ ð´,è³/₄&lt;.</p> <p>2. Í,,-ê àœð£fA,ªè£†´, Þó†´ è£™è-÷»&lt; î-óJL¼%¶ æ~ Ü® àð~F H®,è³/₄&lt;.</p> <p>3. Í,,-êªðOM†´,ªè£†´ Þó†´ è£™è-÷»&lt;ªñ¶ð£è^ î-óJ™ Þø,è³/₄&lt;.</p> <p>20-100ª£®èœ</p>
<p>ÛÂ«ô£ñ£, M«ô£ñ£ (Hó£íò£ñ&lt;)</p>	<p>1.ªð¼Mó-ò,ªè£†´ ðð¶ í£C-ò Í®M†´ Þ¶¶ í£C ðNò£è Í,,-ê àœO¿¶, â† 4 ð-ó â†í³/₄&lt;.</p> <p>2. Þó†´ í£Cè-÷»&lt; Í®,ªè£†´, Í,,-êŠ H®¶ â† 16 ð-ó â†í³/₄&lt;.</p> <p>3. Þ¶¶ í£C-ò «ñ£Fó&lt; ñŸÁ&lt; CÁ Mó™èœªè£†´ Í®,ªè£†´, ðð¶ í£C ðNò£è Í,,-ê M†´, â† 8 ð-ó â†í³/₄&lt;.</p> <p>4. «ñ£Fó&lt; ñŸÁ&lt; CÁ Mó™èœªè£†´ Þ¶¶ í£C-ò Í®ðð£Á, ðð¶ í£C ðNò£è Í,,-ê àœO¿¶, â† 4 ð-ó â†í³/₄&lt;.</p> <p>5. Þó†´ í£Cè-÷»&lt; Í®,ªè£†´, Í,,-êŠ H®¶ â† 16 ð-ó â†í³/₄&lt;.</p> <p>6. ðð¶ í£C-òªð¼Mó-ò,ªè£†´ Í®, Þ¶¶ í£C ðNò£è Í,,-ê M†´, â† 8 ð-ó â†í³/₄&lt;.</p>

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