

FOOD CHOICES AND MACRO- AND MICRONUTRIENT INTAKE OF SOWETANS WITH CHRONIC HEART FAILURE

by
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DECLARATION

I, the undersigned, hereby declare that the work contained in this report is my original work, that it had not been submitted in its entirety or in part to any other university for a degree, and that all the sources used or quoted had been acknowledged by references.

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ABSTRACT

In South Africa, rapid urbanisation and epidemiological transition have left the black urban population vulnerable to diseases of lifestyle such as chronic heart failure. This is in part due to the fact that changes in dietary patterns during urbanization play an important role in the increase of risk factors of these diseases. However, there is a lack of information on dietary choices of black urban populations. Therefore the current study evolved to describe the food choices and macro-and micronutrient intake of black, urban Sowetans, newly diagnosed with chronic heart failure, who attended the outpatient cardiac clinic at Chris Hani Baragwanath Hospital.

A descriptive study methodology that made use of quantitative methods of data collection was used. Study participants comprised Sowetans with chronic heart failure who attended the Chris Hani Baragwanath Hospital outpatient cardiac clinic for the first time. Consecutive sampling followed by stratified random sampling was used to identify study participants. Participants were stratified for gender. Hundred persons participated in the study. Data was collected through the Food Frequency Questionnaire, a demographic questionnaire and measuring of height and weight. Data from the FFQ's was analysed for macro- and micronutrient intake by using the MRC 'Food Finder 3' programme. Data were analysed by a statistician using StatSoft, Inc. (2009) STATISTICA, version 9.0. A p value of 0.05 was seen as statistically significant.

The most significant clinical finding is an inadequate intake of certain micro nutrients and excessive salt consumption. Study participants continued to eat the more traditional carbohydrate foods. These staples were supplemented by highly refined carbohydrate sources, such as added sugar, sweets and chocolates, cakes, biscuits and cold drinks. Women ate significantly more maltabella ($p=0.04$), sweets and chocolates ($p=0.01$) than men, while men consumed significantly more, meat ($p=0.01$), milk and milk products ($p=0.04$), additional salt ($p=0.02$) and take away foods ($p=0.05$). Both genders had inadequate intake of Vitamin D [men 4 mcg/day ($p=0.00$), and women, 4 mcg/day ($p=0.01$)], selenium, [46 mcg/day ($p=0.03$) and 32 mcg/day ($p=0.00$)], folate [215 mcg/day ($p=0.00$) and 179 mcg/day ($p=0.00$)] and Vitamin C [71 mg/day ($p=0.05$) and 66 mg/day ($p=0.07$)]. Women had an inadequate intake of iron of 9 mg/day ($P=0.00$). It is recommended that dietary health promotion packages are developed and targeted specifically at this high risk community.

Key words: Chronic heart failure, black, urban, food choices, macro-and micronutrients

OPSOMMING

Die swart stedelike bevolking in Suid Afrika gaan gebuk onder 'n al groter wordende risiko vir leefstyl siektes soos kroniese hartversaking. Dit kan gedeeltelik toegeskryf word aan veranderinge in dieet patrone as gevolg van verstedeliking en die epidemiologiese oorgang. Daar is egter nie genoeg inligting oor die voedselkeuses van swart stedelike bevolkingsgroepe nie. Die huidige studie het dus ontwikkel uit die behoefte om die voedselkeuses en mikro- en makronutrient inname van swart, stedelike Soweto inwoners wat nuut gediagnoseer is met hartversaking en die buitepatiënt kardiologie kliniek by Chris Hani Baragwanath Hospitaal bygewoon het, te bepaal.

Daar was gebruik gemaak van 'n beskrywende studie metodologie wat gebruik gemaak het van kwantitatiewe metodes van data insameling. Deelnemers aan die studie het bestaan uit swart inwoners van Soweto met kroniese hartversaking wat die buitepatiënt kardiologie kliniek by Chris Hani Baragwanath Hospitaal vir die eerste keer bygewoon het. 'n Opeenvolgende steekproef, gevolg deur gestratifiseerde steekproefneming was gebruik om die studie deelnemers te identifiseer. Deelnemers was gestratifiseer volgens geslag. Eenhonderd persone het aan die studie deelgeneem. Data is ingesamel deur gebruik te maak van die Voedsel Frekwensie Vraelys, a demografiese vraelys en die meet van lengte en gewig. Data van die Voedsel Frekwensie Vraelys was ge-analiseer vir mikro-en makronutrient inname met die MRC "Food Finder 3" program. Data is ge-analiseer deur 'n statistikus met die 'StatSoft, Inc. (2009) STATISTICA, version 9.0'. 'n P waarde van 0.05 is gesien as statisties beduidend.

Mees beduidendste kliniese bevinding was die ontoereikende inname van sekere mikro-nutriënte en die verhoogde inname van sout. Studie deelnemers het nog steeds die meer tradisionele koolhidraat voedsels geëet. Hierdie stapel voedsels was aangevul deur hoogs verfynde bronne van koolhidrate, soos ekstra suiker, lekkergoed en sjokolade, koek, koekies en koeldrank. Die vrouens het beduidend meer maltabella ($p=0.01$), lekkergoed en sjokolade ($p=0.01$) geëet as mans, terwyl mans beduidend meer vleis ($p=0.01$), melk en melkprodukte ($p=0.04$), bygevoegde sout ($p=0.02$) en wegneem kosse ($p=0.05$) ingeneem het. Beide geslagte het ontoereikende innames van vitamien D [mans 4 mcg/dag ($p=0.00$), en vrouens, 4 mcg/dag ($p=0.01$)], selenium [46 mcg/dag ($p=0.03$) en 32 mcg/dag ($p=0.00$)], foliensuur [215 mcg/dag ($p=0.00$) en 179 mcg/dag ($p=0.00$)] en vitamien C [71 mg/dag ($p=0.05$) en 66 mg/dag ($p=0.07$)]. Vrouens het 'n ontoereikende inname van yster van 9 mg/dag ($p=0.00$) gehad.

Daar word aanbeveel dat gesonde voedingsprogramme ontwikkel word, spesifiek gemik op hierdie bevolkingsgroep.

Sleutelwoorde: Kroniese hartversaking, swart, verstedeliking, voedselkeuses, makro- en mikronutriënte

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TABLE OF CONTENTS

DECLARATION	II
ABSTRACT	III
OPSOMMING	IV
ACKNOWLEDGEMENTS	VI
TABLE OF CONTENTS	VII
LIST OF FIGURES	XI
LIST OF TABLES	XII
LIST OF ACRONYMS	XIII
GLOSSARY OF TERMS	XV
1.1 Background to the study	1
1.2 Soweto – an overview	3
1.3 Study problem	5
1.4 Motivation for the study	5
1.5 Significance of the study	6
1.6 Study outline	7
1.7 Summary	8
2.LITERATURE REVIEW	9
2.1 Introduction	9
2.2 Epidemiological Transition Theory	9
2.3 The emergence of cardiovascular disease in developing countries	11
2.4 Incidence and prevalence of chronic heart failure	11
2.5 Aetiology of chronic heart failure	12

2.6 Pathophysiology and classification of chronic heart failure	17
2.7 Management of chronic heart failure	19
2.8 Nutritional management of chronic heart failure	21
2.8.1 Macro-nutrient intake	22
2.9 Body Mass Index (BMI) and its role in chronic heart failure	31
2.10 Self-care compliance for patients suffering from chronic heart failure	31
2.11 The importance of nutrition in chronic heart failure patients	32
2.12 Dietary patterns in black South Africans	33
2.13 Poor access to quality healthcare services in South Africa	35
2.14 Literature Summary	36
3. METHODOLOGY	38
3.1 Introduction	38
3.2 Study Aim	38
3.3 Study Objectives	38
3.4 Study Design	38
3.5 Study setting	39
3.6 Study population	39
3.7 Data collection instruments	43
3.8 Data collection	45
3.9 Data analysis	46

3.10 Ethical considerations	46
3.11 Summary	47
4.RESULTS	48
4.1 Introduction	48
4.2 Demographic details of study participants	48
4.3 Heart Failure profile of the study participants	52
4.4 Prevalence of known risk factors	52
4.5 Self-care management	54
4.6 Food choices	55
4.7 Macro-nutrient intake	58
4.8 Micro-nutrient intake	61
4.9 Summary	64
5.DISCUSSION OF FINDINGS	65
5.1 Introduction	65
5.2 Demographic details of study participants	65
5.3 Heart Failure profile of the study participants	71
5.4 Prevalence of known risk factors	71
5.5 Self-care management	74
5.6 Food choices	75
5.7 Macro-nutrient intake	78
5.8 Micro-nutrient intake	81

5.9 Summary	85
6. CONCLUSION AND RECOMMENDATIONS	86
6.1 Conclusion	86
6.2 Recommendations	87
6.3 Limitations of the study	91
7. REFERENCES	92
8. APPENDICES	98
8.1 Appendix I	98
8.2 Appendix II	103
8.3 Appendix III	125
8.4 Appendix IV	125
8.5 Appendix V	130
8.6 Appendix VI	136

LIST OF FIGURES

Figure 1.1: A map of Soweto, Gauteng	4
Figure 2.1: Causes of chronic disease (WHO/FAO, 2003)	13
Figure 2.2: The cycle of under-nutrition and poverty (Vorster & Kruger, 2007)	14
Figure 2.3: Pathophysiology algorithm of chronic heart failure (Mahan & Escott-Stump, 2004)	16
Figure 2.4: Management of CHF according to ESC Guidelines (Hunt et al, 2005)	20
Figure 5.1: Comparison of mean ages between three study populations	68
Figure 5.2: Comparison of the consuming patterns of the eight foods contributing most to mean sodium intake between the current study population and an urban African-American population	86

LIST OF TABLES

Table 2.1: Chronic Heart Failure classification system (ESC Guidelines, 2008)	18
Table 2.2: A comparison of methodologies of four studies on food choices and dietary patterns in black South Africans	33
Table 3.3: Sampling of study participants	41
Table 4.4: Socio-demographic profile of the study cohort	50
Table 4.2: Impact of educational level on macro-and micronutrient intake	51
Table 4.3: Heart failure profile of the study cohort	54
Table 4.4: Prevalence of risk factors for CHF of the study population	55
Table 4.5: Weight classification in adults according to BMI (Mahan & Escott-Stump, 2004)	56
Table 4.6: Compliance to treatment	57
Table 4.7: Mean daily food consumption of study participants according to the quantitative food frequency questionnaire	58
Table 4.8: Most popular foods consumed daily by men and women	60
Table 4.9: Macro-nutrient intake of study participants in comparison to WHO/FAO recommended intakes (WHO/FAO, 2003)	62
Table 4.10: Micro-nutrient intake of study participants in relation to WHO/FAO recommended intakes (WHO/FAO, 2003)	64
Table 5.1: Comparison of unemployment rates (Statistics SA, 2004)	72
Table 5.2: Monthly income for the population of Johannesburg 2009-2011 (Gaffney, 2009)	73
Table 5.3: A comparative table of food choices of black South Africans according to four studies	79
Table 5.4: Comparison of macro-nutrient intake in current study and three other dietary studies done in South Africa	83
Table 6.1: An example of what a community-based dietary intervention programme for chronic non-communicable diseases prevention in Soweto might look like	92

LIST OF ACRONYMS

ACC	American College of Cardiology
ACE-I	ACE inhibitors or angiotensin-converting enzyme inhibitors
AHA	American Heart Association
AF	Atrial Fibrillation
ARB	Angiotensin receptor blocker
AIDS	Acquired immune deficiency syndrome
BMI	Body Mass Index
BRISK	Black Risk Factor Study
CAD	Coronary Artery Disease
CDL	Chronic diseases of lifestyle
CHBH	Chris Hani Baragwanath Hospital
CHF	Chronic heart failure
CORIS	Coronary Risk Factor Intervention Study
CVD	Cardiovascular disease
DALY's	Disability-adjusted life years
DHA	Docosaheptaenoic acid
DM	Diabetes Mellitus
DRI	Daily Recommended Intake
EPA	Eicosapentaenoic acid
ESC	European Society of Cardiology
FAO	Food and Agriculture Organization of the United Nations
QFFQ	Quantitative Food Frequency Questionnaire
HDL	High-density lipoprotein
HFSA	Heart Failure Society of America
HIV	Human Immunodeficiency virus
HOS	Heart of Soweto study
ICD	Implantable cardioverter-defibrillator
IHD	Ischemic heart disease
LDL	Low-density lipoprotein
LDL-C	Low-density lipoprotein cholesterol

LMIC	Low- and middle income countries
LV	Left ventricular
LVEF	Left-ventricular ejection fraction
MI	Myocardial infarction
MRC	Medical Research Council of South Africa
MUFA	Mono-unsaturated fatty acids
NCD	Non-communicable disease
NYHA	New York Heart Association
PUFA	Poly-unsaturated fatty acids
REE	Resting Energy Expenditure
SAFBDG	South African Food Based Dietary Guidelines
SADHS	South African Demographic and Health Survey
SFA	Saturated fatty acids
SOWETO	South Western Township
TG	Triglycerides
THUSA	Transition, Health and Urbanisation Study
WHO	World Health Organisation

GLOSSARY OF TERMS

Body mass index (BMI)

The ‘body mass index’ (BMI), or ‘Quetelet index’, is used to determine a person’s healthy body weight based on height and described in statistical terms (Mahan & Escott-Stump, 2004).

Cardiovascular disease (CVD)

Cardiovascular disease (CVD) refers to diseases of the heart and blood vessels, such as hypertension, diseases of the heart muscle, stroke and a common end result of CVD, is chronic heart failure (Mahan & Escott-Stump, 2004).

Chronic heart failure (CHF)

Chronic heart failure (CHF) is caused by the inability of the heart to pump blood efficiently around the body. It is initiated by damage to the heart muscle either of acute (myocardial infarction) or insidious (hemodynamic pressure or volume overloading) onset. The circulation becomes slow causing excess fluid to be retained in the body (Mahan & Escott-Stump, 2004).

Diabetes Mellitis (DM)

Diabetes Mellitis (DM) results from decreased insulin secretion or the inability of tissues to respond to insulin (Mahan & Escott-Stump, 2004).

Epidemiologic transition

Epidemiologic transition refers to extended change that takes place in the health status and disease profile of societies as a result of the impact of social organisation and economic development (Steyn NP, Bradshaw, Norman, Joubert, Schneider, Steyn K, 2006; Yusuf, Reddy, Ôunpuu, Anand, 2001).

Hypertension

A person is considered to have hypertension if his/her “systolic blood pressure is greater than 150 mm Hg” and his/her “diastolic blood pressure is greater than 90 mm Hg”, age should, however, be taken into account (Mahan & Escott-Stump, 2004).

Nutrients

Nutrients or food are the substances that humans consume and that the body uses to produce energy or to provide building blocks for new molecules or to function in chemical reactions. Nutrients can be divided into macronutrients, micronutrients, oxygen and water (Mahan & Escott-Stump, 2004).

Macronutrients

Protein, fat and carbohydrate are the major organic nutrients, or macronutrients, and are broken down by enzymes into their individual components during digestion (Mahan & Escott-Stump, 2004).

Micronutrients

Vitamins and minerals are considered to be micronutrients and are found in food in very small quantities and form part of human metabolism. It is provided by a person's diet and to ensure adequate vitamin and mineral intake, a variety of food should be eaten to maintain a healthy, balanced diet (Mahan & Escott-Stump, 2004).

Nutrition

Nutrition is the provision of food materials necessary to support life (Mahan & Escott-Stump, 2004).

Self-care

Self-care is the ability of a patient to look after themselves and to manage their disease (Caldwell, Peters & Dracup, 2005).

Urbanisation

Urbanisation is the process whereby more and more people move to and live in cities and the number of people living in rural areas decreases steadily over time (Steyn NP et al, 2006).

1. INTRODUCTION

1.1 Background to the study

The socio-economic status and development of a country have a direct impact on the mortality and morbidity of its people (Yusuf et al, 2001). With industrialisation, disease patterns have changed from previously being dominated by nutritional deficiencies and infectious disease, to chronic diseases of lifestyle, such as cardiovascular disease (CVD), hypertension, cancer and diabetes. This change has become known as ‘the epidemiological transition’ (Yusuf et al, 2001). Different countries in the world are however, affected differently, with developing countries, such as South Africa, being at a different stage of epidemiological transition compared to the more developed and affluent countries (Steyn, Fourie, Bradshaw, 1992; Yusuf et al, 2001).

South Africa is concurrently experiencing epidemiological transition with diseases of lifestyle on the increase, while still being burdened by poverty related diseases as well. In fact, South Africa faces a quadruple burden of disease, characterised by a combination of poverty-related diseases, emerging chronic diseases of lifestyle, high injury rates, as well as the human immunodeficiency virus or acquired immunodeficiency syndrome (HIV/AIDS) pandemic (SteynNP et al, 2006; Stewart, Wilkinson, Becker, Askew, Ntyintyane, McMurray, Sliwa, 2006; Coovadia, Jewkes, Barron, Sanders, McIntyre, 2009). As the overburdened healthcare service providers in South Africa struggle to cope, strategies to prevent chronic diseases of lifestyle (CDL) risk factors are not a priority and adequate care and prevention of CDL are becoming an increasing public health issue (Stewart et al, 2006; Sliwa, Wilkinson, Hansen, Ntyinyane, Tibazarwa, Becker, Stewart, 2008).

The focus of this study is, therefore, on the emerging chronic disease component of this burden and more specifically on nutrition and chronic heart failure as it is manifested in the black population group.

Urban black South Africans represent a population subset that is undergoing rapid social and economic development. This is a population in transition with regards to CDL, both between disease categories as well as within the category of heart disease, with an increase of CVD of which chronic heart failure (CHF) is one (Yusuf et al, 2001).

The major risk factors for CHF are hypertension, left ventricular hypertrophy, atherosclerosis and diabetes (Mahan & Escott-Stump, 2004; Swift, Markandu, Sagnella, He, MacGregor, 2005). Patients affected by CHF are frequently re-hospitalised, have a poor quality of life and high mortality rates (Stewart et al, 2006). CHF is often referred to as a medical problem of epidemic proportions and is a common and very important healthcare issue in both general practice and hospital settings. For patients suffering from CHF, it is a condition both disabling and deadly. CHF is among the most common reasons for unplanned hospital admissions, and mortality from the condition is comparable to or worse than most of the common malignancies. CHF is also a very costly disease, representing a large and growing drain on healthcare resources (Squire, 2008).

Of concern is the fact that in developing countries, CVD is occurring in younger individuals than in the developed countries and as the epidemic advances, the poor is affected the most in both developed and developing countries (Yusuf et al, 2001). Poverty cannot be described in simplistic terms, because it is a multidimensional phenomenon with ideological and political, governance, social, economic, environmental and biological (health) components. It is often characterised by a lack of freedom, education, capabilities, opportunities, employment and equity and results in insufficient sanitation and food supply that leads to malnutrition (both under- and over-nutrition), and increases the risk for developing CVD. The effect of this is felt most by communities with low socio-economic status and living in urban areas (Steyn NP et al, 2006; Vorster & Kruger, 2007; Mayosi, Flisher, Lalloo, Sitas, Tollman, Bradshaw, 2009). The current study population can be described as a poor community residing in an urban area.

The relationship between poverty, under-nutrition and under-development has been acknowledged and understood for many years (Vorster & Kruger, 2007). The relationship between over-nutrition and cardiovascular disease (CVD) is also well established, to the extent that both primary and secondary prevention of CVD are major motivations in the design and implementation of public health and therapeutic dietary recommendations. It is however less known how under-nutrition, a consequence and cause of poverty, is associated with an increase in CVD prevalence in developing countries (Vorster & Kruger, 2007).

Poor people struggling with food insecurity, lack of education and unemployment may have a lack of knowledge about CVD risk factors and little interest in primary prevention, for example, by eating low-fat, high-fibre diets (Vorster & Kruger, 2007). At the same time, the poor will have less access to treatment and secondary prevention, especially in South Africa's healthcare system with its limited resources, already overburdened with HIV/AIDS, tuberculosis and other infectious diseases (Vorster & Kruger, 2007). In addition to these two factors relating to primary and secondary prevention and treatment of CVD, there are several lines of evidence that suggest a strong relationship between malnutrition (both under- and over-nutrition), poverty and CVD:

- 1) The prevalence of under-nutrition and relative high prevalence of stunting among South African children places them at risk for an increased vulnerability to non-communicable diseases (NCD's) later in life.
- 2) An increased number of African women (58.5%) suffering from overweight and obesity, of whom a large percentage are poor and suffer from food insecurity. This may indicate the increased vulnerability to obesity and NCDs because of early malnutrition
- 3) The third line of evidence that nutrition is the link between poverty and CVD comes from the reported detrimental effects of the nutrition transition and the negative effects of urbanisation on the nutrition and health status of black South Africans (Steyn NP et al, 2006; Vorster, Kruger, Margetts, MacIntyre, 2007).

The South African population is made up of many different ethnic and cultural groups, each with its own way of eating and food choices. The black African population is one such an ethnic group, with its own distinct eating patterns and food choices. The diets of people living in rural areas tend to still be higher in carbohydrates (>65% E), lower in fat (< 25% E), lower in sugar (<10% E), and have a higher fibre content, corresponding to the more traditional way of eating. With urbanisation their diet has changed to a more westernised diet with the resultant decrease in carbohydrates and fibre and an increased fat consumption (Steyn NP, 2006).

1.2 Soweto – an overview

The South Western Township, later named Soweto, was developed in the proximity of Johannesburg, South Africa, approximately 100 years ago. It is home to the largest number of urban Black Africans

on the African continent (Stewart et al, 2006; Johannesburg Metropolitan Council, 2009). Soweto has changed since the 1980's. Private housing was developed and tenants could buy the rental houses. They were assisted with government subsidies. It is fully serviced by the Johannesburg Metro council with electricity provided by Escom (Johannesburg Metropolitan Council, 2009).

According to an official census done in 2001, the number of people living in Soweto counted just below 1 million people. This number is rising, as there is a steady influx of migrants (Statistics SA, 2009). It is a population in transition, with old squatter misery and new prosperity existing side by side (Stewart et al, 2006; Johannesburg Metropolitan Council, 2009).



Figure 2.1: A Map of Soweto, Gauteng

According to Stewart et al (2006), data on the population of Soweto has shown a low prevalence for CVD and the underlying risk factors (Stewart et al, 2006). This might however be changing, as several

studies have shown that urbanisation and the nutrition transition in South Africa is accompanied by an increase in the CVD risk factors in Black Africans. More data is however needed to determine whether this increase in CVD risk is related to urbanisation per se or whether socio-economic position influences the nutrition transition and related increase in CVD risk (Vorster et al, 2007). As the traditional diet is abandoned in favour of a Western diet, food choices shift away from complex carbohydrates and higher fibre to foods high in fat with an increased risk for CDL (Bourne, Lambert, Steyn, 2002). However, no research has been done to determine if the diet of Sowetans has indeed changed in this way.

1.3 Study problem

Very little information on food choices, macro and micro nutrient intake and body mass index is available for the population of Soweto and especially for people suffering with CHF. The current study evolved to determine food choices, micro and macro nutrient intake and BMI for a sub-section of this population, namely people who have been newly diagnosed with CHF. One of the objectives of the current study is to make recommendations on food choices and programmes aimed at Black Africans with CHF living in Soweto. These recommendations will also serve as guidelines for health professionals involved in nutritional intervention strategies for people suffering from CHF in a low resource community.

1.4 Motivation for the study

The World Health Organisation (WHO) has estimated that people living in developing countries, such as South African will be affected twice as much, and even more, by non-communicable disease than in developed countries, with poor people living in urban settings being the most vulnerable, thereby increasing demand for chronic disease care and prevention (Mayosi et al, 2009). Thus, studies to investigate the emergence of heart disease in developing countries and among risk populations like the black, urban population of South Africa are of extreme importance. This led to the establishment of The Heart of Soweto (HOS) study, at Chris Hani Baragwanath Hospital. The aim of the HOS study was to investigate and to describe this emerging problem of CVD, and especially heart disease, amongst the black urban African population in Soweto, who presented for the first time to a tertiary-care centre (Sliwa et al, 2008).

However, while diet plays an important role in both prevention and rehabilitation of CHF there has been little focus in the HOS study on the dietary aspect of cardiac disease. In the context of urbanisation, changing lifestyles, poverty, under-nutrition and CVD, it is of extreme importance to gather data on food choices, food availability, cultural preferences, body mass index, as well as micro- and macronutrient intake as nutrition is increasingly recognised as a major modifiable determinant of chronic diseases (WHO/FAO Expert Consultation, 2003). Therefore the current study evolved to gather data on these aspects.

The researcher is a dietitian with a special interest in the treatment of patients with chronic heart failure. She gained working experience as part of a multidisciplinary team treating outpatients with CHF at Chris Hani Baragwanath Hospital. She identified the lack of nutritional data in the HOS study and decided to make a contribution in addressing it through this study.

1.5 Significance of the study

The causes and devastating effects of an epidemic of cardiovascular disease and its end result, chronic heart failure have been well documented in developed countries. But, little data is available from developing countries, such as South Africa, on the added negative impact of cardiovascular disease together with malnourishment and infectious diseases. This is especially true for vulnerable populations, like black South Africans, in whom CVD risk factors were seldom found and who were consequently not targeted for health promotion and prevention strategies (Sliwa et al, 2008).

The study will make a contribution towards redressing the imbalance through providing baseline information on food choices, dietary patterns and nutrient intake of patients with CHF living in a black urban area. Once this information has been gathered and analysed, specific, culturally sensitive and economically viable dietary recommendations can be developed. It is envisioned that these recommendations will improve patient understanding and thus compliance with dietary guidelines. Improved compliance should improve the health of the individual and result in fewer admissions to hospital with a resultant saving of cost for both the patient as well as health services. Furthermore, improved understanding will aid the individual in taking control of his / her own health.

This research will argue that the role of the dietitian in CHF is extremely important, because non-compliance with medications and diet, or both, is the most frequent reason for hospitalisation of persons with chronic heart failure (Colonna, Sorina, D'Agostino, Bovenzi, De Luca, Arrigo, De Luca, 2003). In the researcher's opinion, dietitians in healthcare settings are more often required to spend time with patients requiring more complex nutritional intervention strategies, such as patients with renal failure or diabetes or suffering from traumatic injuries, leaving the patient with CHF mostly to his/her own devices regarding dietary issues. The study will raise awareness on the importance of the role of the dietitian in cardiac rehabilitation. If nutrition education and promotion could be better understood and recognised to be inclusive of behaviour change, then it will be viewed as a necessary component within contemporary cardiac rehabilitation and self-management programmes (Timlin, Shores, Reicks, 2002).

The study aims to create awareness amongst the study population on food choices and their impact on CHF and at the same time increase awareness amongst doctors and other health professionals (through publication) on the benefits of dietary intervention in patients with CHF in South Africa.

Data from this study will examine the influence of age, level of education, employment status and availability of household amenities on food choices and nutrient intake and the resultant risk for developing CHF. Findings from the study could also be used when developing community based programmes to improve healthy food choices.

1.6 Study outline

The aim of this study was to describe the food choices and macro-and micronutrient intake of black, urban Sowetans. All participants in the study were newly diagnosed with chronic heart failure and attended the outpatient cardiac clinic at Chris Hani Baragwanath Hospital. This study also describes the demographic and anthropometric profile of the study population.

Chapter one provides a background to the study and Soweto, presents the study problem, describes why the researcher embarked on the study and explains the possible significance of the study. In Chapter two, the literature relevant to the study is presented.

The research design and methodology is explained in Chapter three. Study results are presented in Chapter four and discussed in Chapter five. In Chapter six the conclusions drawn from the study are summarised and recommendations are made.

1.7 Summary

In South Africa, as in many other developing countries, cardiovascular disease, as well as other chronic non-communicable diseases, is on the increase. While the more affluent white population were targeted for preventative strategies in the past, the African population, who are experiencing rapid urbanisation and nutrition transition, have been neglected in this area. There is a lack of information on dietary choices of these populations. It is therefore important to examine food choices and dietary patterns within this urban black population as possible risk factors for CHF in order to make appropriate recommendations for targeted nutrition interventions.

2 LITERATURE REVIEW

2.1 Introduction

Chapter two comprises of a discussion of the relevant literature and commence with a discussion on the epidemiological transition theory and its relation to the study population and CHF. This is followed by a discussion of the literature on CHF with regards to incidence and prevalence, diagnosis and classification, aetiology, impact on persons suffering from it, management and prevention. Medical management of CHF are briefly described, while the emphasis is placed on nutritional management. This is followed by a discussion on four studies which looked at dietary patterns of black South Africans. The chapter concludes with a short discussion on the challenges health care in South Africa faces and how these might impact on prevention and management of CHF.

2.2 Epidemiological Transition Theory

Socio-economic development leads to demographic and nutritional changes which in turn alters determinants and risk factors of diseases and the categories of diseases that affect a population. Infectious diseases like pneumonia and diarrhoea are replaced by non-communicable diseases, such as CVD (WHO, 2005; Mbewu, 2009). Cardiovascular disease progresses from rheumatic heart disease in younger people in the earlier stages of the transition process to chronic coronary artery diseases in middle age and heart failure in the elderly in stage three and four (Yusuf et al, 2001). Nutritional transition is characterised by a change in food choices and eating patterns from leisurely mealtimes prepared from home-grown and indigenous foods to an increased use of convenience and pre-prepared foods, such as refined foods that are high in salt, sugar and fat and low in fibre and certain micro-nutrients. Many of these foods will replace foods such as maize that has traditionally been used as staples (Steyn NP et al, 2006).

Epidemiological transition is the term used for these changes and it occurs in five stages:

1. Pestilence and famine. High mortality rates as a result of malnutrition, infectious diseases and perinatal complications characterise this stage (Kahn, Garenne, Collinson, Tollman, 2007). This stage is currently being experienced by Sub-Saharan Africa, rural South America and South Asia (Yusuf et al, 2001).

2. Receding pandemics. During this phase mortality rates decline and population growth increases. Diseases of lifestyle such as hypertension increase. This stage is currently experienced in China and other Asian countries (Yusuf et al, 2001; Kahn et al, 2007).

3. Manmade or degenerative disease. Overall mortality rates are low and to a large extent restricted to older age groups. Non-communicable conditions and injuries lead to ill health. Smoking, high fat diets and a sedentary lifestyle are common contributors to degenerative and man-made diseases. Latin America, the former socialist countries and India are currently experiencing stage three (Yusuf et al, 2001; Kahn et al, 2007).

4. Prevention, diagnosis and treatment delay of chronic diseases of lifestyle. Western Europe, North America, New Zealand and Australia have reached this stage. This was seen as the final stage; however, a fifth stage is now proposed.

5. The breakdown of social and health structures through social chaos and war. This leads to the recurrence of the first two stages, while disease of the third and fourth stages are also present. A decrease in life expectancy caused by increasing infectious diseases and violence as well as non-infectious diseases follows (Yusuf et al, 2001).

Different communities in the same country might move through these stages at different speeds. This situation is evident in South Africa. The socio-demographics of South Africa range from industrialised cities with lifestyles reminiscent of that of developed countries to rural areas with traditional lifestyles. However, even in the cities, great discrepancies exist and people are at different stages of transition (Sliwa et al, 2008). Significant to South Africa is the discrepancy in wealth between rich and poor, whereby over 70% of South Africans (mainly black African) are poor or very poor (Mbewu, 2009). The wealthiest group is represented primarily by whites, who primarily occupy stage IV; while coloured, Indian and middle-class white and black South Africans are in stage III. The 70% who are poor are at stage I or II. The challenge for the next twenty years in South Africa is to ensure that the latter group, as they become progressively wealthier, do not enter stage III but pass rapidly through to stage IV. This can most effectively be achieved through health promotion, including primary prevention, delivered at community and primary health care level, focussing on the five major risk factors for CVD, namely smoking, high blood pressure, an unhealthy diet, physical inactivity and obesity (Mbewu, 2009).

In summary, epidemiological transition in South Africa is observed in the two focus areas of this study, namely chronic heart failure and food choices.

2.3 The emergence of cardiovascular disease in developing countries

Non-communicable diseases (NCDs) such as CVD are rapidly becoming major causes of death in developing countries and increasing by approximately 150% by the year 2020 and will account for 66.7% of all deaths, second only to HIV/AIDS (WHO, 2005; Stewart et al, 2006; Vorster et al, 2007; Pieters & Vorster, 2008). This change in disease patterns, to the emergence of more non-communicable diseases such as CVD in developing countries, is caused by social, environmental and economic changes that enable people to buy more food and convenience foods, have wider food choices, improved sanitation and clean water which reduce the incidence of infectious diseases, and improved medical care which means that children no longer die from infectious diseases such as diarrhoea (Stewart & Sliwa, 2009). It can be expected that in the early stages of the transition, people in higher socio-economic positions will carry the highest risk of CVD and other NCDs. However, indications are that as this transition progresses in developing countries, the poor are affected the most (WHO/FAO Expert Consultation, 2003; Vorster et al, 2007).

2.4 Incidence and prevalence of chronic heart failure

Chronic heart failure has become a major public health problem in that, unlike other cardiovascular diseases, the number of people discharged from hospital with a diagnosis of CHF is increasing (Mahan & Escott-Stump, 2004). It is reported by the European Society of Cardiology that CHF in the overall population can be observed in 2% to 3% of the population and asymptomatic ventricular dysfunction is evident in about 4% of the population. This will increase with age and in the 70 to 80 year age group, CHF can be observed in between 10% to 20% of people. CHF also has a high morbidity, with very frequent re-admissions to hospital, as well as a high mortality, with 50% of patients dying within four years after being diagnosed with CHF and 40% of patients admitted to hospital with CHF dying within one year (ESC, 2008; Squire, 2008).

The epidemic of CVD has probably stabilised in developed countries, but developing countries are increasingly suffering from the emerging burden of CVD (Mayosi et al, 2009). Unfortunately, many of these regions, such as South Africa, are still suffering from poverty-related and infectious diseases as well (Stewart & Sliwa, 2009). As populations in South Africa and sub-Saharan Africa undergo

economic development, the disease profile shifts and CVD becomes a growing cause of death and disability (Stewart & Sliwa, 2009). Sub-Saharan Africa can be classified as the poorest region in the world and although most deaths are still caused by HIV/AIDS, CVD, predominantly stroke, is becoming the major cause of mortality amongst adults aged 30 years or older (Stewart & Sliwa, 2009). With mortality rates among males aged 35-64 years in low- and middle-income countries being double than that seen in high-income countries and almost triple for women (Stewart & Sliwa, 2009). This is partly due to the increasing prevalence of the risk factors for CVD in these societies in transition, but also because of other factors like urbanisation, poverty, malnutrition and ethnic factors (Steyn K et al, 2006).

South Africa also suffers under a growing burden of CVD across all population groups. In 2000 deaths due to cardiovascular disease in the respective population groups occurred as follows; blacks (23%), white (41%), coloureds (31%) and Indians (52%) (Vorster et al, 2007). The lower death rate in the African group due to CVD, can be attributed to the higher number of deaths from HIV/AIDS. The question of whether this growing burden of CVD risk factors is related to urbanisation per se or whether socio-economic position influences the nutrition transition and the related increase in CVD risk factors should be further investigated (Vorster et al, 2007).

The Heart of Soweto Study (HOS) was established to investigate and describe the emergent heart disease and resultant burden in Soweto due to the epidemiological transition. Data from the HOS study showed that in 2006, 1960 patients was diagnosed with chronic heart failure. Women (479, 57%) and black Africans (739, 88%) were in the majority. Black African women (n=437) were the largest patient subgroup representing 59% of their ethnic grouping and 52% of the entire cohort (Stewart, Wilkinson, Hansen, Vaghela, Mvungi, McMurray, Sliwa, 2008; Sliwa et al, 2008).

2.5 Aetiology of chronic heart failure

Chronic heart failure (CHF) may result from any number of pathological processes, which lead to abnormal cardiac structure, function or rhythm. The leading causes of chronic heart failure are diseases that damage the heart (Mahan & Escott-Stump, 2004). Additional risk factors are smoking and a lack of exercise (Mahan & Escott-Stump, 2004). However, the principal factors contributing to heart failure varies from population to population. In industrialised societies CHF can be attributed to the high

levels of atherosclerosis, coronary artery disease, hypertension and an increasingly important contribution from Type 2 diabetes mellitus. Idiopathic aetiology, toxins (including alcohol) and atrial fibrillation also plays a role, with a variety of less common causes like amyloidosis, inherited cardiomyopathies, iron overload and peri-partum cardiomyopathy making lesser contributions (Mahan & Escott-Stump 2004; Squire, 2008).

In developing countries there are known relationships between poverty, under-nutrition, underdevelopment, infectious diseases and cardiovascular disease (Vorster & Kruger, 2007; Stewart et al, 2008). However, data from the HOS study of urban black Africans demonstrated a wide range of heart disease that can be attributed to a combination of infectious and non-communicable diseases. Chronic heart failure was attributable to ‘idiopathic dilated cardiomyopathy’ (28%), ‘HIV-related cardiomyopathy’ (4%), ‘peripartum cardiomyopathy’ (4%) and ‘hypertensive heart failure’ (33%), as well as the more affluent forms of CVD (Stewart et al, 2008).

2.5.1 Cardiovascular disease risk factors

Chronic heart failure is frequently the end-result of most forms of cardiovascular disease (De Lorgeril, Salen, Defaye, 2005; Stewart et al, 2008). Thus one can link the risks for CVD to the development of CHF. A connection between certain variables and chronic diseases, such as CVD, diabetes, stroke, cancer and chronic respiratory disease has been established (Yusuf et al, 2001; WHO, 2005). Figure 2.1 illustrates this relationship and the causes of chronic diseases (WHO/FAO, 2003).

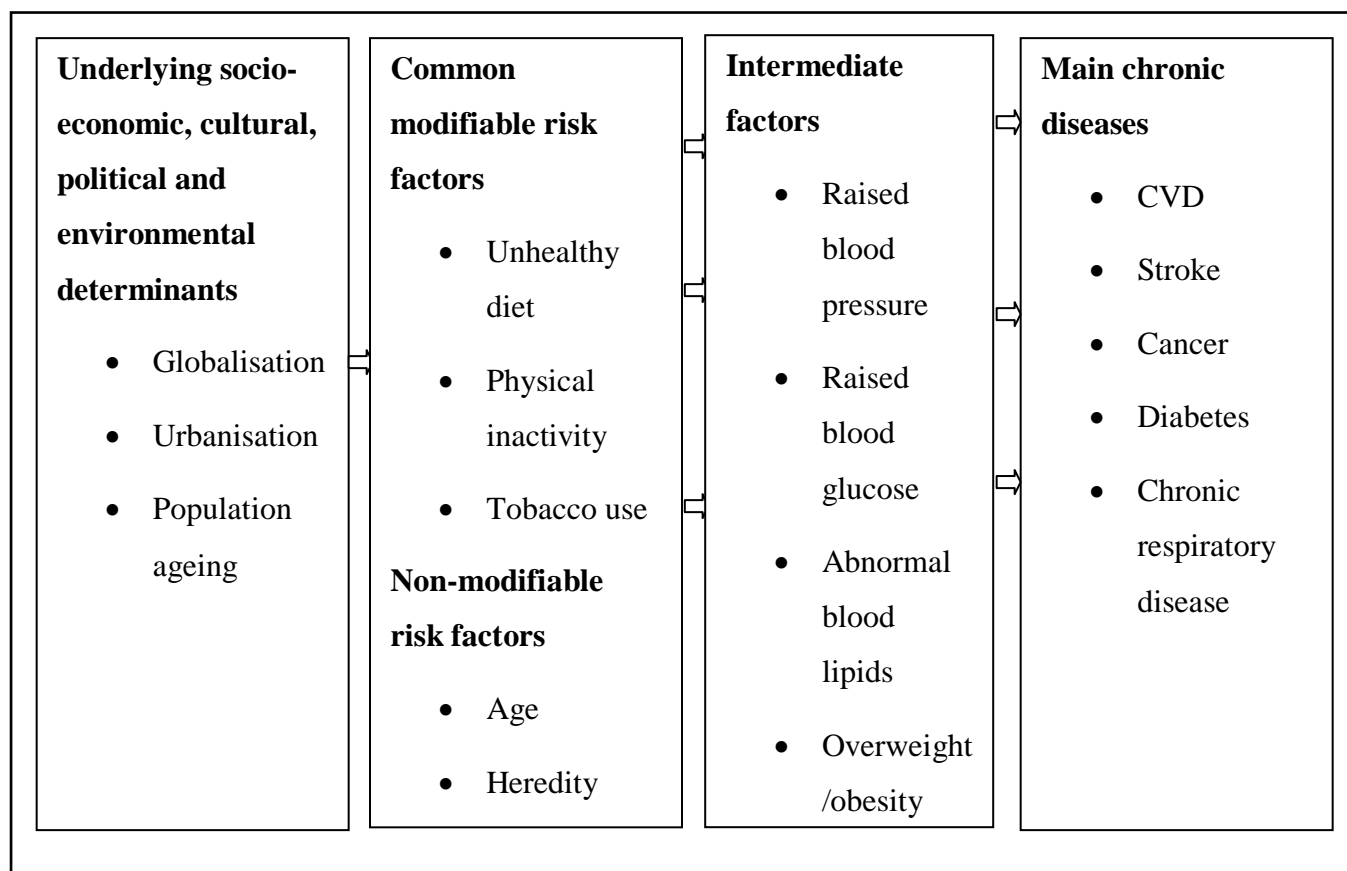


Figure 2.1: Causes of chronic disease (WHO/FAO, 2003)

It is, therefore, important to focus on and to establish healthy lifestyle and nutritional habits throughout all stages of life, starting as early as during pregnancy. A number of factors that can influence the emergence of risk factors for chronic diseases of lifestyle, and also CVD later in life, are present during pregnancy and can have an adverse effect on the foetus and childhood development (Steyn NP et al, 2006).

2.5.2 Poverty and nutrition

Financial security is essential to ensure a regular and adequate supply of a variety of foods, thereby preventing malnutrition (under- and over-nutrition) and reducing the risk of developing chronic diseases of lifestyle (Steyn NP et al, 2006; Vorster & Kruger, 2007). Socio-economic inequities are still present in South Africa and are reflected in the food choices and macro-and micronutrient consumption, as well as the nutritional status of people living in South African (Steyn NP et al, 2006).

A vicious, intergenerational circle exists between poverty and under-nutrition. This cycle is illustrated in Figure 2.2.

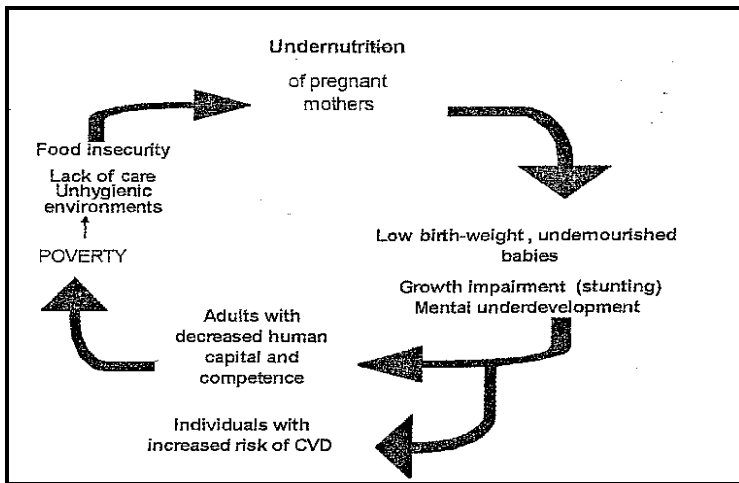


Figure 2.2: The cycle of under-nutrition and poverty (Vorster & Kruger, 2007).

The circle is ‘vicious’ because poverty causes malnutrition, which leads to undernourished individuals who lack the capacity to study and to find work and to break this cycle of poverty and malnutrition in their children. Malnutrition during pregnancy will adversely affect the foetus, leading to, in the short term, compromised growth (stunting), brain development and altered glucose and lipid metabolism. These changes will eventually lead to a reduced ability to learn, lower immune function, lower productivity and an increased risk for non-communicable diseases (NCDs) (Vorster & Kruger, 2007). The high prevalence of overweight and obesity amongst African women (58.5%) of whom a large percentage are poor and suffer from food insecurity, may indicate the increased vulnerability to obesity and NCDs because of early malnutrition. But it also draws attention to the relationship between food insecurity, low-quality diets and obesity, where large portion sizes of low micro-nutrient-dense foods are consumed. It was, however, also shown that inactivity was also related to overweight and obesity in African women (Vorster & Kruger, 2007).

The high prevalence of underweight in children, and obesity in adults, point to the co-existence of under- and over-nutrition, sometimes seen in the same household in developing countries, where mothers or caregivers may be obese while the children are undernourished. This leads to the often-described double burden of under-nutrition-related infections and over-nutrition-related non-

communicable diseases within families, communities and population groups, also experienced within South Africa (Steyn NP et al, 2006; Vorster & Kruger, 2007).

2.5.3 Urbanisation

Increased urbanisation in South Africa can be attributed to a change in social structure, political changes in the country as well as economic factors (Steyn NP et al, 2006). With urbanisation new challenges and problems have to be faced together with a possible improvement in economic circumstances. These challenges include living in squatter camps and informal houses with poor sanitation and sewage disposal, water still has to be carried from one central tap, no electricity, no refrigeration and food has to be cooked on paraffin stoves or wood fires, as well as increased exposure to crime and violence (Steyn NP et al, 2006).

With urbanisation, people have moved away from their families and familiar surroundings with the resultant loss of support structures, as well as having to adjust to a new environment and surroundings. The lifestyle changes that are most frequently observed are an increased sedentary lifestyle and a change in dietary patterns. In rural areas people tend to be more physically active, working in and around their houses, walking to town and to visit friends and children playing outside. In urban areas, transport is more available and shopping centres very accessible and people therefore do not need to walk long distances. Instead of playing sports outside, people stay in to play video games or watch television or sit in front of the computer (Steyn NP, 2006).

A more westernised diet is followed, that is higher in energy, contains more salt, saturated fat and more sugar. The decreased intake of fruit and vegetables has led to a decreased consumption of fibre and vitamins and minerals (Bourne & Steyn, 2000; Steyn NP et al, 2006). In addition increased alcohol and tobacco consumption is seen (Steyn NP et al, 2006). Working longer hours and being away from home for longer periods of time, as well as fast foods being more available and affordable, have led to a change in dietary behaviour (Steyn NP et al, 2006). These changes in lifestyle and diet contribute to increasing levels of chronic diseases of lifestyle risk and therefore an increased risk for CHF (Steyn K et al, 2006).

2.6 Pathophysiology and classification of chronic heart failure

Chronic heart failure (CHF) is a complex syndrome with important co-morbidities, such as arteriosclerosis, diabetes, anaemia, cardiac cachexia and hypertension. It is diagnosed through the presence of the following signs and symptoms: tiredness, exercise intolerance, shortness of breath, signs of fluid retention such as pulmonary congestion or ankle swelling, diagnostic tests indicating an abnormal function or structure of the heart at rest, abnormal neuro-hormonal regulation and unmet metabolic demands (Carlson, Riegel, Moser, 2001; Dunbar, Clark, Deaton, Smith, De, O'Brien, 2005; ESC Pocket Guidelines, 2008).

An algorithm as presented in figure 2.3 is used to describe the pathophysiology of chronic heart failure.

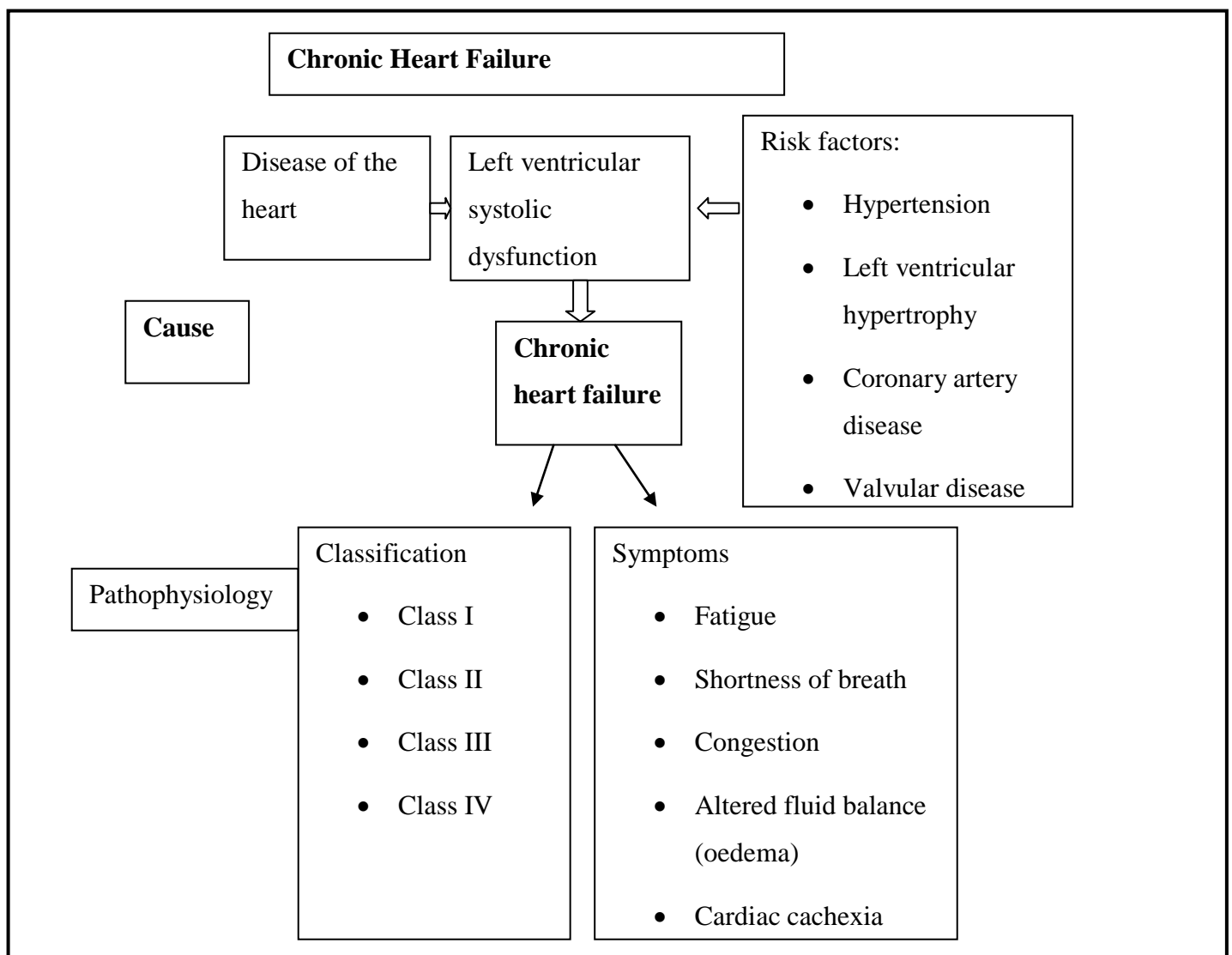


Figure 2.3: Pathophysiology algorithm of chronic heart failure (Mahan & Escott-Stump, 2004).

Diagnostic tests are more sensitive for the detection of patients with CHF and reduced ejection fraction, but less so for patients with preserved left ventricular ejection fraction above 45-50% (Hunt, Abraham, Chin, Feldman, Frances, Ganiats et al, 2005).

The echocardiogram is the most important investigation for heart failure as it can detect the presence, the aetiology, and the severity of heart failure. Echocardiography can provide measures of left-ventricular function that include left-ventricular end diastolic diameter, shortening fraction and ejection fraction. Left-ventricular systolic function is considered to be impaired when the ejection fraction is less than 0.50 (50%) (Lang & Newby, 2008). Most patients with CHF have evidence of both 'systolic' and 'diastolic' dysfunction at rest or on exercise. Patients with 'diastolic' CHF have symptoms and/or signs of CHF and a preserved LVEF above 45-50%, and patients with systolic CHF have symptoms and/or signs of CHF with LVEF <45-50% (Lang & Newby, 2008).

Two classification systems for heart failure have been developed. The European Society of Cardiology (ESC)/ACC/AHA classification is on heart structure and damage (Hunt et al, 2005).

The New York Heart Association (NYHA) classification is based on severity of symptoms (NYHA, 1994). Both classification systems are presented in table 2.1.

Table 2.1: Chronic heart failure classification systems (ESC Guidelines, 2008)

ESC/ACC/AHA Stages of CHF Based on structure and damage to heart muscle (Hunt et al, 2005)	NYHA Functional Classification Based on symptoms and physical activity (NYHA, 1994)
Stage A May progress to CHF, functionality and structure not affected; Symptoms and signs not present.	Class I Able to perform function normally and perform day to day tasks. Activity does not lead to palpitation, tiredness or shortness of breath.
Stage B Heart's structure is affected and may progress to CHF, but symptoms and signs not present.	Class II Functionality and ability to perform tasks are affected. Experience palpitations, tiredness or shortness of breath when performing tasks.
Stage C Heart's structure is affected and known CHF symptoms are present.	Class III Functionality and ability to perform tasks are noticeably affected. Experience palpitations, tiredness or shortness of breath when performing tasks
Stage D Heart's structure severely damaged and known symptoms of CHF present even when patient remains inactive and receiving optimal medical treatment.	Class IV Severe functional disability. Patient experience symptoms when resting which increases when any task is performed.

2.7 Management of chronic heart failure

The short-term goals in CHF management are to relieve symptoms and to improve quality of life, whereas the long-term goals would be to prolong life by lessening, stopping or reversing left-ventricular dysfunction (Mahan & Escott-Stump, 2004). Therapy recommendations correspond to the stage of CHF and involve both pharmacologic and non-pharmacologic care by a multidisciplinary

healthcare team, including a specialist physician, general practitioner, nursing staff, dietitians, psychologists and physiotherapists. It has been shown that a multidisciplinary management approach improves quality of life and saves money (Caldwell et al, 2005). Management includes education and explanation of the disease to the patient, being actively involved, as well as continuous support from family members (Colonna et al, 2003).

Recommendations for patients at high risk of developing CHF (stage A) include, treatment of the underlying conditions (hypertension, hyperlipidemia, thyroid disorders, arrhythmias), avoidance of high-risk behaviours (tobacco, alcohol, illicit drug use), and lifestyle changes (exercise, reduction of sodium intake, healthy diet and nutritional supplements). As the disease progresses, drugs are added in addition to the other recommendations and the last stage may also include medical assistive devices, heart transplantation, continual intravenous therapy, and hospice care at the end of life (Mahan & Escott-Stump, 2004).

Current chronic heart failure (CHF) guidelines provide only a few recommendations for the nutritional management of patients who have CHF. This is primarily because of the limited research available for establishing evidence-based recommendations (Payne-Emerson & Lennie, 2008).

NON-PHARMACOLOGICAL	PHARMACOLOGICAL	
<p>Patient and family education.</p> <p>Monitor body weight to assess changes in fluid balance.</p> <p>Limit fluid intake to < 1.5 L/ day if fluid overloaded despite diuretic therapy.</p> <p>Salt restriction to < 2.4 g per day.</p> <p>Regular exercise within limits of symptoms.</p> <p>Avoid NSAIDs as these may exacerbate fluid retention.</p>	<p>NYHA II</p> <p>1</p> <p>+</p> <p>2</p> <p>+</p> <p>3</p> <p>+</p> <p>4</p>	<p>NYHA III-IV</p> <p>Diuretic</p> <p>ACE-I / ARB (ACE-I intolerance)</p> <p>Beta-blocker</p> <p>Aldosterone antagonist</p>
<p>ADDITIONAL THERAPY FOR SPECIAL INDICATIONS</p>	<p>Hydrazaline + Nitrates (Black African patients)</p> <p>Digoxin (AF, resistant symptomatic heart failure)</p> <p>Warfarin (AF, LV clot)</p> <p>Amiodarone (sustain Sinus Rhythm)</p> <p>Aldosterone antagonist (early post-MI heart failure)</p> <p>ACE-I + ARB (advanced heart failure)</p>	
<p>Biventricular Pacing ± ICD Heart Transplant</p>		

Figure 2.4: Management of CHF according to ESC Guidelines (Hunt et al, 2005)

2.8 Nutritional management of chronic heart failure

Due to the complex nature of CHF management, that involves pharmacological, surgical and mechanical support, the non-pharmacological approaches such as nutrition, has been neglected (Colonna et al, 2003; De Lorgeril et al, 2005). It is important to recognise the role and interactions between nutrients, pathophysiology and treatment of CHF. A link between diet and oxidative stress has been proven, since the body derives its main anti-oxidant defences from the essential nutrients and

therefore oxidative stress might play a role in the development of CHF (De Lorgeril et al, 2005). A decreased intake of macro- and micronutrients contribute to the progression of CHF and therefore, not only should the risk factors of coronary heart disease (the main cause of CHF) be treated, but malnutrition and nutrient deficiencies should also be corrected (De Lorgeril et al, 2005; Von Haehling, Doehner, Anker, 2007).

It is generally accepted that an increased consumption of sodium can be harmful in CHF, but other aspects of the nutrition intervention in CHF has been neglected (De Lorgeril et al, 2005). Available information and recommendations for the nutritional management of CHF is subsequently reviewed.

2.8.1 Macro-nutrient intake

Inflammation and cachexia

The progression from stable CHF to cardiac cachexia is not well understood, but it has been observed that of patients with moderate to severe heart failure, 35% to 53% have malnutrition, known as cardiac cachexia (Mahan & Escott-Stump, 2004; Von Haehling et al, 2007). Because no standardised criteria for cachexia have been established, indicators of body fat stores, protein status, and immunity have all been used. Unlike normal starvation, which is characterised by adipose tissue loss, cachexia is characterized by a predominant loss of lean body mass greater than 10% of the body total. This loss of lean body mass further exacerbates CHF because of the loss of cardiac muscle and the development of a cachectic heart. Cardiac cachexia is associated with a worsening prognosis in CHF (Mahan & Escott-Stump, 2004; Von Haehling et al, 2007; Kalantar-Zadeh, Anker, Horwich, Fonarow, 2008).

Neurohormones and pro-inflammatory cytokines are responsible for the wasting process (Von Haeling, Doehner, Anker, 2007; Payne-Emerson & Lennie, 2008). The intake of essential fatty acids may modulate the inflammatory process (De Lorgeril et al, 2005; Payne-Emerson & Lennie, 2008). Oxidative stress may be involved in the pathogenesis of CHF. Our bodies derive its main antioxidant defences from certain micronutrients, but inadequate levels of macro-and micro-nutrients and the use of diuretic may increase the depletion of these. This depletion is further exacerbated by malabsorption from the gut due to bowel wall oedema and decreased bowel perfusion (De Lorgeril et al, 2005; Von Haehling et al, 2007).

Dietary fats

Evidence has shown a relationship between increased risk factors for CVD, and diets with increased amounts of animal fat and saturated fatty acids, and increased low-density lipoprotein (LDL) and cholesterol levels (De Lorgeril et al, 2005; Lichtenstein, Appel, Brands, Carnethon, Daniels, Franch et al, 2006; Steyn NP et al, 2006; Vorster et al, 2007; Van Horn, McCoin, Kris-Etherton, Burke, Carson, Champagne et al, 2008). The American Heart Association (AHA) recommends that the total fat intake of patients who have CVD should be 30% of their total energy consumption, and intakes of <7% of energy as saturated fat (SFA), <1% of energy as trans fat and <300 mg cholesterol per day and higher amounts of mono-unsaturated fatty acids (MUFA) and poly-unsaturated fatty acids (PUFA) (both n-6 and n-3). Rich sources of n-6 PUFA's are 'vegetable oils such as sunflower', 'corn' and 'safflower oils' and a good source of n-3 PUFA's, is fatty fish (Wolmarans & Oosthuizen, 2001; Van Horn et al, 2008). It is recommended to consume a combined total of 1g of eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) per day, which can most easily be obtained from fatty fish. It is beneficial to eat less red meat, high in saturated fat and to consume fish at least twice a week (Scholtz, Vorster, Marshego, Vorster, 2001; Nicolosi, Wilson, Lawton, Handelman, 2001; Lichtenstein et al, 2006). Fish oil supplements are recognised as an alternative for those who do not consume fish or if contaminated fish is a concern (Payne-Emerson & Lennie, 2008).

Of special interest in CHF is the effect of n-3 fatty acids, in that it may decrease the level of inflammation and subsequently cachexia (Payne-Emerson & Lennie, 2008). Inflammatory cytokines are activated by cell membrane-derived eicosanoids that are synthesised from omega-6 (n-6) fatty acids in the lipid component of cell membranes. In contrast, eicosanoids synthesised from omega-3 (n-3) fatty acids are more immunoneutral. The n-3 fatty acids, particularly EPA and DHA, can competitively inhibit the incorporation of n-6 fatty acids into cell membranes, and thus can lead to a decrease in n-6 derived eicosanoids when consumed in adequate amounts. Therefore, increased consumption of n-3 fatty acids could reduce the production of pro-inflammatory cytokines and potentially aid in the treatment of cachexia and improving left ventricular function (De Lorgeril et al, 2005; Payne-Emerson & Lennie, 2008; Van Horn et al, 2008).

Protein and energy intake

Protein is an essential macronutrient involved in the composition and maintenance of body structure, muscles, and enzymes, as well as body transport, regulatory, and immune systems. There are data to

suggest that certain amino acids may aid in the treatment of cachexia. The observation that branch chain amino acid supplementation could decrease muscle loss associated with extended bed rest has led to speculation that these amino acids could potentially aid in the treatment of cachexia; however, more evidence is needed to support amino acid supplementation in CHF (Kalantar-Zadeh et al, 2008; Payne-Emerson & Lennie, 2008).

The Heart Failure Society of America guidelines recommend that patients with CHF take in adequate amounts of protein for their age, gender and activity level (Hunt et al, 2005). The dietary reference intake for protein in healthy adults is 0.8 g/kg ideal body weight per day; however disease states can increase the body's demand for protein and increase protein turnover (Mahan & Escott-Stump, 2004). The energy needs of patients with CHF depend on their current weight, activity restrictions, and the severity of the heart failure. Overweight patients with limited activity must achieve and maintain an appropriate weight that will not stress the myocardium. For the obese patient, hypocaloric diets (4200 kJ to 6000 kJ) will reduce the stress on the heart and facilitate weight reduction. In the undernourished patient with severe CHF, energy needs are increased by 30% to 50% above basal level as a result of the increased energy expenditure of the heart and lungs; 49 kJ/kg of body weight is often used. Patients with cardiac cachexia may require further increases in energy 1.6 to 1.8 times the resting energy expenditure (REE) for nutritional repletion (Colonna et al, 2003; Mahan & Escott-Stump, 2004; Payne-Emerson & Lennie, 2008).

Carbohydrates

An increased consumption of whole-grain products and fibre are associated with improved diet quality and a decreased risk of CVD (WHO/FAO, 2003; Lichtenstein et al, 2006). Soluble or viscous fibres (notably β -glucan and pectin) have been shown to modestly reduce LDL cholesterol and may increase short-chain fatty acid synthesis, thereby reducing endogenous cholesterol production. Insoluble fibre has been associated with decreased CVD (Lichtenstein et al, 2006). The recommended intake of whole-grain products and fruit and vegetables should provide > 25 g per day of total dietary fibre (WHO/FAO, 2003; Lichtenstein et al, 2006).

Fruit and vegetable intake

Fruit and vegetables provide fibre-rich carbohydrate and additionally supply many cardio-protective nutrients (Love & Sayed, 2001; Lichtenstein et al, 2006; Steyn NP et al, 2006). These include potassium (lowers blood pressure), folate (can reduce plasma homocysteine), Vitamin C and many

polyphenolic compounds (with antioxidant activities) and soluble fibre (lowers cholesterol). Green leafy vegetables are also high in magnesium which has been associated with lower CVD risk. The South African Food Based Dietary Guidelines (SAFBDG) and the World Health Organisation (WHO) and the Food and Agriculture Organisation of the United Nations (FAO), therefore, recommends an intake of 5-8 portions (400-600g) of fruit and vegetables daily (Love & Sayed, 2001; WHO/FAO, 2003; De Lorgeril et al, 2005; Vorster et al, 2007; Van Horn et al, 2008).

2.8.2 Micro nutrient intake

It is generally accepted that sodium intake should be restricted in persons with CHF, but it is equally important to recognise and correct malnutrition and deficiencies in specific micronutrients (discussed subsequently), as well as address any comorbidities present that require dietary modifications (Colonna et al, 2003; De Lorgeril et al, 2005; Payne-Emerson & Lennie, 2008).

Sodium

Patients with CHF are required to restrict their sodium intake, because CHF is characterised by sodium retention, hormonal activation and the resultant volume overload (Colonna et al, 2003; De Lorgeril et al, 2005). Inadequate blood flow to the kidneys leads to aldosterone and antidiuretic hormone secretion. Both these hormones act to conserve fluid. Aldosterone promotes sodium re-sorption, and antidiuretic hormone promotes water conservation in the distal tubules of the nephron. Sodium and fluid thus accumulate in the tissues. Even asymptomatic patients with mild heart failure (class I to II) and no congestion can retain sodium and water if consuming a high-salt diet (Mahan & Escott-Stump, 2004; Payne-Emerson & Lennie, 2008).

To manage sodium retention dietary sodium restriction is recommended by the American College of Cardiology/American Heart Association (ACC/AHA) and the Heart Failure Society of America (HFSA), but is only suggested in the European Society of Cardiology (ESC) HF guidelines. However, there is no consensus among the guidelines regarding the suggested level of restriction. The HFSA guidelines recommend a 2 to 3 g sodium restriction for less advanced stages of CHF, and less than 2 g for moderate to severe CHF. The ACC/AHA guidelines call for sodium restriction of 2g only for those who have end-stage CHF. Patients who have less severe HF have a more liberal 3 to 4g restriction. The ESC makes no specific recommendation, but rather suggests that patients who have severe CHF may benefit from limiting sodium intake (Colonna et al, 2003; Payne-Emerson & Lennie, 2008).

In contrast, the 2005 United States Department of Agriculture Dietary Guidelines for Americans and AHA Nutrition Committee 2006 Diet and Lifestyle Recommendations both suggest sodium restriction of less than 2.3g for all healthy Americans (Lichtenstein et al, 2006). However, the logic of recommending a limit that is higher than the recommended level for healthy individuals is questionable (Colonna et al, 2003; Payne-Emerson & Lennie, 2008).

Furthermore, restricting sodium intake may allow for a lower diuretic dose in an individual (Mahan & Escott-Stump, 2004; Payne-Emerson & Lennie, 2008). Another reason to recommend lower sodium intake to black South Africans with CHF is the fact that it has been hypothesised that a too high sodium intake may cause hypertension in genetically susceptible persons (Charlton & Jooste, 2001; Swift et al, 2005). Black hypertensive patients have been found to be more salt sensitive than white hypertensive patients with decreased activity of the sodium-potassium ATPase pump (Charlton & Jooste, 2001; Kollipara, Mo, Toto, Nelson, Schneider, Neily, Drazner, 2006).

In conclusion, it seems that working with patients to achieve a level of sodium intake between 2 to 3 g seems a reasonable recommendation (Colonna et al, 2003; Kollipara et al, 2006; Payne-Emerson & Lennie, 2008).

Fluid

Altered fluid balance complicates assessment and treatment of the patient with CHF, and achievement of a dry weight (without oedema) is a clinical goal (Mahan & Escott-Stump, 2004). But controversy exists around fluid restriction, and it is suggested that fluids should only be restricted in hyponatremic patients. Patients should record daily weights and advise their care providers if weight gain exceeds 1 to 1.5 kg a day, or 2.5 kg in a week. Fluid restriction might help to maintain dry weight (without oedaema) and to reduce the use of large doses of diuretics (Colonna et al, 2003; Mahan & Escott-Stump, 2004; Payne-Emerson & Lennie, 2008). It is recommended that in patients with advanced CHF, fluids should be restricted to 2000 ml per day. This includes certain foods, such as fruit and soup that contain large amounts of water. This, along with sodium restriction and diuretic therapy may restore fluid balance and prevent full-blown CHF (Colonna et al, 2003; Mahan & Escott-Stump, 2004).

Magnesium

Magnesium is an essential mineral that is a co-factor in multiple enzyme systems in the body. It plays a role in nucleotide synthesis, intracellular potassium maintenance, and as a natural calcium channel

blocker (Payne-Emerson & Lennie, 2008). The diuretics used to treat CHF increase magnesium excretion. Magnesium deficiency aggravates changes in electrolyte concentration by causing a positive sodium and negative potassium balance (Mahan & Escott-Stump, 2004; De Lorgeril et al, 2005; Sandek, Doehner, Anker, Von Haehling, 2009).

Deficient intake of magnesium has been found in patients with CHF. Therefore, nutritional education and intervention are of importance. Supplementation of magnesium may also be considered (De Lorgeril et al, 2005; Payne-Emerson & Lennie, 2008).

Calcium

Calcium is a principal component of teeth and bones, but also plays a role in vasodilation, and in vascular and muscle contractility. Chronic deficiencies in calcium intake lead to osteopenia and osteoporosis, and may contribute to cardiac dysrhythmias.

Diets of patients who have CHF have been documented to be deficient in calcium (Mahan & Escott-Stump, 2004; De Lorgeril et al, 2005; Payne-Emerson & Lennie, 2008). Intestinal calcium absorption declines with age, and subsequently the established adequate intake for adults over the age of 50 increases from 1000 mg to 1200 mg. Further, loop diuretics increase excretion of calcium through the kidneys. Additionally, Vitamin D is essential for the absorption of calcium, which has also been found to be deficient in diets of many patients. Thus, patients who have CHF, especially older patients, may benefit from combined calcium and Vitamin D supplementation (Scholtz et al, 2001; De Lorgeril et al, 2005; Payne-Emerson & Lennie, 2008). Caution must however be used and patients on calcium supplementation should be monitored because it may aggravate cardiac arrhythmias (Mahan & Escott-Stump, 2004).

Vitamin D

Vitamin D is a fat-soluble vitamin whose only major function was originally thought to be maintenance of calcium and phosphorus blood levels by stimulating intestinal absorption of these minerals. Now it is believed that Vitamin D insufficiency may play a role in the development of CVD and hypertension through regulation of both parathyroid hormone and the rennin-angiotensin system, and through its influence on myocardial cell proliferation and myocardial hypertrophy (Payne-Emerson & Lennie, 2008). Recent evidence indicated that patients who have CHF have lower circulating levels of 25-hydroxy Vitamin D compared with age-matched case controls (Payne-Emerson & Lennie, 2008).

Lower levels of 25-hydroxy Vitamin D have also been associated with increased severity of CHF. Thus, Vitamin D insufficiency may contribute to the pathogenesis of CHF and adequate intake of Vitamin D is important to maintain normal physiological functioning (Payne-Emerson & Lennie, 2008). Furthermore, darker skinned individuals tend to have lower Vitamin D levels and epidemiological studies have established a link between the development of chronic diseases, as well as certain autoimmune diseases, such as rheumatoid arthritis, systemic sclerosis and systemic lupus erythematoses (Peterlik, Boonen, Cross, Lamber-Allardt, 2009; Toubi & Shoenfeld, 2010).

Selenium

A major function of selenium is protection against oxidative stress, which has been demonstrated to be high in CHF (De Lorgeril et al, 2005; Payne-Emerson & Lennie, 2008). Selenium deficiency leads to decreased activity of antioxidant enzymes, and is compounded by a concurrent deficiency in Vitamin E, another important antioxidant (Mahan & Escott-Stump, 2004; Payne-Emerson & Lennie, 2008; Sandek et al, 2009).

It is suspected that low selenium levels compromise cardiovascular function and influence clinical severity of CHF because of its important role in antioxidant systems. It is, therefore, important to ensure adequate intake of selenium in the diet (De Lorgeril et al, 2005; Payne-Emerson & Lennie, 2008).

Vitamin E

Vitamin E is a fat-soluble vitamin with important antioxidant abilities; however, the benefit of vitamin E supplementation in CHF is debatable (Mahan & Escott-Stump, 2004; De Lorgeril et al, 2005; Payne-Emerson & Lennie, 2008). A randomised, placebo-controlled study demonstrated no benefit of Vitamin E supplementation on oxidative stress, quality of life, natriuretic peptide, or proinflammatory cytokine levels (Payne-Emerson & Lennie, 2008). Furthermore Vitamin E is an essential and safe nutrient when obtained from food, but caution should be used with supplements (Mahan & Escott-Stump, 2004).

Thiamine

Thiamine acts as a coenzyme for carbohydrate and branched-chain amino acid metabolism. Deficiencies of this water-soluble vitamin lead to anorexia, weight loss, muscle weakness, myocardial hypertrophy, myocardial failure, and sodium and water retention (Mahan & Escott-Stump, 2004; De Lorgeril et al, 2005; Payne-Emerson & Lennie, 2008; Sandek et al, 2009). Long-term diuretic use,

malnutrition, advanced age, severe CHF, and frequent hospitalisations have all been associated with thiamine deficiency in patients who have CHF (Colonna et al, 2003; Payne-Emerson & Lennie, 2008). It has been estimated that thiamine deficiency in patients who have CHF, ranges from 13% to 93%. This suggests that supplementation may be beneficial (Payne-Emerson & Lennie, 2008).

Folate and Vitamin B₁₂

Wholegrains and green leafy vegetables are good sources of folate and Vitamin B₁₂ and an increased intake is associated with a decreased risk of CHD (Mahan & Escott-Stump, 2004; Lichtenstein et al, 2006; Van Horn et al, 2008). Folate and B₁₂ are essential for the conversion of homocysteine to methionine, and an inverse relationship exists between intakes of these vitamins and homocysteine levels. Homocysteine is an amino acid that is thought to promote atherosclerosis through several mechanisms, including injury to vascular endothelium and increased oxidative stress. Elevated levels of homocysteine are associated with CHF, and recent evidence suggests that homocysteine is also related to clinical severity and mortality in CHF (Payne-Emerson & Lennie, 2008; Van Horn et al, 2008).

Vitamin C

Vitamin C is water-soluble and important because of its substantial antioxidant properties. It also promotes regeneration of the antioxidant activity of Vitamin E (De Lorgeril et al, 2005; Payne-Emerson & Lennie, 2008; Van Horn et al, 2008). Vitamins C and E were found to be protective with no observed association for carotenoids. There are many beneficial cardiovascular-related effects of Vitamin C in CHF, including improved endothelial function and decreased cardiomyocyte and endothelial apoptosis (Mahan & Escott-Stump, 2004).

Another important function of Vitamin C in patients with CHF is that it reduces ferric to ferrous iron in the intestinal tract to facilitate iron absorption and is involved in the transfer of iron from the plasma transferring to liver ferritin to correct iron deficiency anaemia (Mahan & Escott-Stump, 2004). Although there are limited data, deficiencies of Vitamin C have been found in patients who have CHF. Because, Vitamin C is water soluble, it is therefore very important to ensure adequate daily intake (Colonna et al, 2003; De Lorgeril et al, 2005; Payne-Emerson & Lennie, 2008; Van Horn et al, 2008; Sandek et al, 2009).

Furthermore, one has to take cognisance of the fact that the nutritional management of patients with CHF might be impacted on by co-morbidities with their own dietary requirements (Payne-Emerson & Lennie, 2008).

2.8.3 The impact of co-morbidities on dietary requirements

Nutrition intervention strategies for persons with CHF need to consider the major risk factors and the impact of co-morbidities in the development and progression of CHF.

Arteriosclerosis

Current guidelines recommend that patients who have CHF and arteriosclerosis or hyperlipidemia receive dietary education and intervention based on the Prudent Dietary Guidelines. These guidelines emphasise the reduction of saturated fat intake to less than 7% of total energy, to increase the intake of MUFA's and PUFA's and to reduce the intake of trans fats and cholesterol to less than 300mg per day. It also makes recommendations for the intake of adequate amounts of fruits, vegetables, whole-grains and fibre (Mahan & Escott-Stump, 2004; Lichtenstein et al, 2006; Payne-Emerson & Lennie, 2008; Van Horn et al, 2008).

Diabetes Mellitus

Diabetes mellitus (DM) is considered a major risk factor in the development of CHF. Furthermore, DM increases the risk of hospital readmission and mortality in patients who have CHF, and the progression of CHF may be quickened by hyperinsulinemia, via the promotion of cardiac and vascular hypertrophy (Payne-Emerson & Lennie, 2008). The ACC/AHA and HFSA guidelines include a recommendation for standard treatment and good control of blood glucose. Individualized counselling by a registered dietitian, regarding appropriate carbohydrate, protein and energy intake is recommended (Colonna et al, 2003; Lichtenstein et al, 2006; Payne-Emerson & Lennie, 2008).

Hypertension

Black individuals may be genetically more susceptible to high blood pressure, causing a higher risk of stroke and other CVD's and may hasten the progression of those who have CHF (Payne-Emerson & Lennie, 2008; Swift et al, 2008).

Another CHF risk factor which is impacted on by a person's diet is obesity. Being overweight has a negative impact on CVD risk factors (e.g. increasing LDL, cholesterol levels, blood pressure and blood glucose levels) and thereby increases the risk of developing CHF (Colonna et al, 2003; Lichtenstein et al, 2006).

2.9 Body Mass Index (BMI) and its role in chronic heart failure

The median BMI for adults to achieve and maintain optimal health should be in the range of 18.5-24.9 kg/m² (WHO/FAO, 2003). Obesity, BMI > 30, is associated with increased risk of CHD and the probability of CHF increases in persons that are morbidly obese, BMI > 40 (Colonna et al, 2003; Van Horn et al, 2008). Colonna et al (2003) reports, that when patients with CHF lose weight, an improvement in NYHA functional class has been observed, as well as improvements in systolic and diastolic ventricular function.

2.10 Self-care compliance for patients suffering from chronic heart failure

In CHF self-care involves compliance to nutrition intervention and exercise programme, as well as taking their medication (Carlson et al, 2001). In order to practice optimal self-care it is essential that the patient recognises the signs and symptoms of CHF, most of which are caused by hemodynamic imbalances and are often subtle and difficult to recognise (Carlson et al, 2001; Dunbar et al, 2005). The most common signs and symptoms that people suffering from CHF should be able to recognise are feeling short of breath (dyspnea) or having trouble to breathe, feeling tired and having swollen ankles, feet, legs, abdomen and veins in the neck. Oedema from CHF also causes weight gain, increased urination, and a coughing more, especially at night or when lying down. The cough may be a sign of acute pulmonary oedema, where too much fluid builds up in the lungs. Acute pulmonary oedema requires emergency treatment (Mahan & Escott-Stump, 2004).

Pharmacologic therapy and sodium restriction forms the cornerstones of optimising hemodynamic balance and requires participation, co-operation and compliance from patients. Chronically ill people can find it daunting to simultaneously manage their pharmacologic treatment, dietary intervention strategies and to monitor symptoms (Carlson et al, 2001).

However, successful CHF management includes self-care. Self-care plays an important role in the diminishing of symptoms, functional abilities, prognosis and morbidity. The ability to engage in effective self-care, such as compliance with medication and nutritional guidelines is seen as vital to prevent re-admission to hospital and an improved quality of life (Clark & Lan, 2004). It is therefore of the greatest importance to explain the disease and management thereof to a person suffering from CHF, to ensure improved compliance to treatment (Colonna et al, 2003).

Several studies have identified barriers to successful self management and dietary changes for patients suffering from CHF. Patients are unwilling to change their diet if they do not see the benefit in doing so, or fail to understand the low-sodium dietary guidelines, or find the food tastes bland, or if they do not know how to prepare the recommended foods, or experience little or no support from their families (Neily, Toto, Gardner, Rame, Yancy, Sheffield et al, 2002; Arcand, Brazel, Joliffe, Choleva, Berkoff, Allard, Newton, 2005). Barriers to treatment adherence are found specifically in elderly patients with CHF, increasing deafness, loss of eyesight and functional status due to age-related changes. This is impacted upon even further when combined with low-income, lack of education, unavailability of support, co-morbidities and multiple symptoms and the complexity of treatment (Carlson et al, 2001).

Many patients find it difficult to initiate and maintain a low fat, low-sodium and high fibre diet (Neily et al, 2002; Timlin et al, 2002). Data evaluating the ability of patients with CHF to follow a low-sodium diet are limited, but it has been shown that, as part of a multidisciplinary management programme, improved compliance can be achieved with the assistance of a dietitian (Timlin et al, 2002). Neily et al (2002) found that a lack of knowledge impacts negatively on patients with CHF ability to limit their sodium intake. Furthermore, patients did or could not always read the product labels to determine sodium content of foods. They also struggled to discern between low and high sodium foods (Neily et al, 2002).

Education by a multidisciplinary team and the transmission of current information on the management of the disease to the person suffering with CHF, as well as their support structure is extremely important. The patient, as well as the persons supporting the patient, should be made aware of all the signs and symptoms that might indicate a worsening of the disease, as a lack of recognition of these, may lead to a delay in appropriate treatment. Instructions to the patients and family about the treatment regimens, length of the treatment and the possible side effects of the medication should be concise, but easily understandable (Colonna et al, 2003).

2.11 The importance of nutrition in chronic heart failure patients

Whereas previously, treatment of CHF focused on the alleviation of symptoms, newer treatments and approaches include the prevention of progressive deterioration in heart function. Through prevention and management, medical nutrition therapy for underlying causes (e.g. hypertension, CVD and DM) or

symptomatic relief (e.g. sodium restriction) is of the utmost importance and taking into consideration that the nutritional needs of persons who have CHF, are altered by their co-morbidities, catabolism, weight status, nutritional status and diuretic use (Mahan & Escott-Stump, 2004; Payne-Emerson & Lennie, 2008).

2.12 Dietary patterns in black South Africans

Four studies addressing food choices and dietary patterns in black South Africans could be identified from the literature, the methodologies used in each of these is presented in table 2.2.

Table 2.2: A comparison of methodologies of four studies on food choices and dietary patterns in black South Africans

Methodology	Dikgale Study (Steyn NP, 2006)	The Transition, Health and Urbanisation Study (THUSA) (Vorster et al, 2005)	Black Risk Factor Study (BRISK) (Nel & Steyn, 2002)	Lebowa Study (Nel & Steyn, 2002)
Aim	To examine food choices, nutrient intake and weight status of black adults	To examine the food choices, health status and the effect of urbanisation on a black population	To examine the risk factors for developing CVD in urban black Africans	To determine the nutritional status, amount of food consumed and the nutrient intake of black children
Setting	Rural villages in Northern Province	Urban and rural areas in the North West Province	Cape Town (Western Cape)	Rural villages in the Northern Province
Design	Quantitative, descriptive	Cross-sectional comparative design	Quantitative, descriptive	Quantitative, descriptive
Population	People aged 11 years and older	Apparently healthy men and women	People aged 3-60	Children aged 1-10 years
Sampling	Random	Stratified Random 5 strata for 5 levels of urbanisation: Deep rural, Commercial farms, informal settlements outside major towns or cities, townships and towns or cities	Random	Random
Number of participants	210	1854	1507	483
Measuring instruments	24-hour recall method	Food frequency questionnaires	24-hour recall method	24-hour recall method

There were interesting differences noted when comparing the different studies. The rural black adults in the Dikgale studies had a very low fat consumption and high carbohydrate consumption, typical of the traditional African diet consumed in rural areas (Nel & Steyn, 2002; Steyn NP, 2006). Data from the BRISK and the THUSA studies show the difference in food intake between the urban and rural areas and therefore the impact of urbanisation on food choices and nutrient intake. The black urban participants had a higher intake of fat, sugar, meat and beverages (Vorster, Venter, Wissing, Margetts, 2005; Nel & Steyn, 2002; Steyn NP, 2006). There are certain similarities between the current study and the studies shown in table 2.2. As in the BRISK study and group 3, 4 and 5 of the THUSA study, the current study examined and described the food choices of a black urban population. The BRISK, Dikgale and Lebowa studies used the 24-hour recall method to determine food intake (Steyn NP, 2006).

This method however, relies on the memory of the respondent and intake can sometimes be underreported. It relies on the food intake of the day before, which is not necessarily representative of an individual's usual intake. The deciding factors for the use of the 24-hour recall method in these studies were the large sample size, especially in the BRISK study (n=1507), the short interview time available, the low literacy rate anticipated for the participants and the site of data collection (Katzenellenbogen, Joubert, Abdool Karim, 2004). In this study the researcher, however, decided to use the quantitative food frequency questionnaires (QFFQ) to determine food choices and nutrient intake in the current study, which is similar to the measuring instrument used in the THUSA study. The researcher chose to use the QFFQ, because it gives a better indication of usual food intake than the 24-hour recall (Katzenellenbogen et al, 2004). The researcher also did not foresee a language barrier when interviewing the study participants and had sufficient time for each participant and conducted the interviews in a controlled environment. The Lebowa study data will not be used for comparative discussion of findings in chapter 5 since the population differs from the current study in the respect that they examined children aged 1-10 years. But the Dikgale, BRISK and THUSA study data will be used.

2.13 Poor access to quality healthcare services in South Africa

Adding to the burden of chronic diseases, is the still persistent social and economical inequalities in South Africa due to past legacies of racial and gender discrimination, people having to work away from their homes and the resultant destruction of family life, income inequalities, and increased rates of

crime and violence. Inadequate access to good-quality health services is still a reality for the poor due to financial constraints, having to travel far to healthcare centres and poor care from the healthcare system (WHO, 2005; Steyn K, 2006; Coovadia et al, 2009).

Barriers to appropriate healthcare access faced by the poor in South Africa, includes the inability to subsidise medical treatment from their own pockets, having to lose a day's wages when going to see the doctor or attending a clinic, expensive transport costs, having to travel long distances to access quality healthcare services and facing communication barriers. People moving from one area to another, for example are faced with language and cultural difficulties, as well as having no fixed address and therefore being unable to access healthcare services (WHO, 2005).

The focus has for a long time been on hospital centred healthcare, which carries considerable costs and is often inaccessible and inefficient. Primary healthcare therefore, aims to provide more affordable and accessible medical care, as well as primary prevention for communicable and non-communicable diseases (WHO, 2005; Steyn K, 2006; Coovadia et al, 2009).

An effective health care service should be in place to ensure that prevention strategies and the management of chronic non-communicable diseases can be successfully implemented and maintained (Steyn K, 2006). There are two broad ways of preventing CVD and behaviour change that need to be considered. One way is a population-based primary prevention strategy that aims to create awareness of risk factors and to establish healthy diet and lifestyle practices within a community, such as Soweto. This approach requires awareness campaigns, the changing of government policies and support from government as well as the industry. An example of one such a strategy is the screening of the general public for risk factors of CDL and thereby creating public awareness (Stewart & Sliwa, 2009). The other would be secondary prevention through participation in cardiac rehabilitation programmes and thereby limiting the adverse physiological and psychological effects of chronic heart failure (Timlin et al, 2002).

2.14 Literature Summary

South Africa suffers from a quadruple burden of disease, on the one side diseases related to poverty and malnutrition, and infectious diseases such as HIV/AIDS, and on the other side the emerging diseases of

affluence or non-communicable diseases of lifestyle, which are the result of urbanisation, industrialisation and the adoption of a more Westernised lifestyle. This is exacerbated by the high crime rates and violence in South Africa.

Chronic heart failure is a major public health problem in South Africa with a high morbidity and mortality rate. The appropriate and timely diagnosis and treatment by a multidisciplinary team, involving pharmacological and non-pharmacological management plays an important role in the morbidity and mortality of someone with CHF. Because chronic heart failure is mostly the end point of cardiovascular diseases, the focus should not only be on the management of the disease, but also on the prevention. Nutrition intervention strategies and the intake of adequate and appropriate macro- and micronutrients are important in the prevention of adverse effects and the progression of the disease.

It is therefore important to determine the effect that the nutrition transition in South Africa, and especially in this black urban group with CHF, will have on their food choices, dietary patterns and lifestyle. Data from studies done in South Africa on black population groups shows that the traditional way of life and food choices are exchanged for a more Westernised diet with urbanisation, with the result that chronic diseases of lifestyle are increasing towards epidemic proportions.

In order to examine and describe the changes in food and dietary intake patterns of rural and urban black South Africans, studies shown in table 2.3 was undertaken. Through understanding this health and nutrition transition, appropriate recommendations for the prevention of chronic diseases can be made to government and to individuals.

3 METHODOLOGY

3.1 Introduction

In this chapter the study methodology is discussed. The chapter commences with the study aim and objectives and then the setting is described. The choice of design is explained. Then the determination of a study population, sampling procedure and selection of participants are presented. Following that the measuring instruments and pilot study are discussed. This is followed by a description of how data was collected and analysed. The chapter concludes with a description of the ethical considerations taken in the study.

3.2 Study Aim

The aim of the study was to describe the food choices and macro-and micronutrient intake of black, urban Sowetans, newly diagnosed with chronic heart failure, who attend the outpatient cardiac clinic at Chris Hani Baragwanath Hospital.

3.3 Study Objectives

The objectives of the study were:

- a) To describe the demographic profile of the study population.
- b) To describe the food choices of the study population.
- c) To determine actual levels of macro- and micronutrient intake of the study population and compare it to the ‘population goals for preventing diet-related chronic diseases’ as recommended by the WHO/FAO (WHO/FAO, 2003).
- d) To evaluate the macro- and micronutrient intake of the study population against current dietary recommendations available for CHF, from the literature.
- e) To assess body mass index (BMI) of the study population.

3.4 Study Design

This was a descriptive study that made use of quantitative methods of data collection.

The aim of this study was to describe characteristics, e.g. demographic profile, food choices and macro-and micronutrient intake of the study cohort, as well as any significant differences between men and women in this study. The quantitative paradigm was chosen for this study since it emphasises measurement and quantifying variables (Katzenellenbogen et al, 2004; Domholdt, 2005). The

researcher wanted to measure macro- and micronutrient intake, as well as the BMI of the study population.

3.5 Study setting

The study was performed at the outpatient cardiac clinic of Chris Hani Baragwanath Hospital (CHBH). CHBH, is a tertiary hospital, with 3500 beds and is situated on the main road between Johannesburg and going into Soweto (Stewart et al, 2006). According to data from Stewart et al (2008), CHBH managed 129 633 inpatients in 2006 (35% via the Department of Medicine). The Cardiology unit which is staffed by cardiologists and internal medicine specialists, who are training to become cardiologists treat more than twenty thousand inpatients (e.g. referred from general medical wards) and outpatients (e.g. referred from the diabetic clinic), as well as those patients referred from the 12 local primary care clinics per year.

There are 12 primary health care clinics in Soweto. At the majority of these, patients are seen by primary health care nurses. Patients go to these primary health care clinics as a first point of diagnosis and treatment. They are screened and diagnosed by the primary health care nurses and treated for common ailments, e.g. headache, colds and flu, diarrhoea, uncomplicated hypertension and diabetes. Should the primary health care nurse find that the patient needs more specialised treatment and diagnostics, he/she will refer the patient to a relevant outpatient clinic at CHBH. At the outpatient clinic at CHBH, patients will be seen by a doctor and treated or if cardiac problems are suspected, the patient will be send for further diagnostic investigations and referred to the cardiac clinic for consultation with a cardiologist (Stewart et al, 2006). Patients also receive lifestyle and dietary education from a nursing sister and a registered dietitian, when newly diagnosed, and thereafter every three months or as necessary. During these routine diagnostic and treatment procedures cardiac failure is identified when present. Patients with cardiac failure are followed up at a primary health care clinic in their area and only complicated cases are referred to the outpatient cardiac clinic at CHBH (Interview with Professor Sliwa on 29 January 2009).

3.6 Study population

Newly diagnosed patients with chronic heart failure, who attended the outpatient cardiac clinic at CHBH between 04 June 2008 and 27 August 2008, a convenient study period for the researcher, formed the study population.

3.6.1 Inclusion criteria

The following patients were included:

- Patients newly diagnosed with chronic heart failure, treated at the outpatient cardiac clinic at CHBH, who have not received any dietary education at CHBH from a doctor, nurse or dietitian.
- Black Africans
- Living in Soweto
- Older than 18 years

Diagnosed with moderate-severe CHF (i.e. stages C and D), defined by the European Society of Cardiology criteria, confirmed via echocardiography or radionuclide ventriculography result of impaired left ventricular systolic function (left ventricular ejection fraction (LVEF) < 45%

3.6.2 Exclusion criteria

The following patients were excluded:

- All patients diagnosed with chronic heart failure while inpatients at CHBH, since they would have received dietary education from a member of the multidisciplinary team
- Patients diagnosed with CHF already under treatment and who have received education
- Patients who are not black Africans
- Patients who live outside Soweto
- All patients who are not cognitively able to complete the questionnaire
- Those who did not give their consent

3.6.3 Sampling

Study patients could not be sampled from an appointment list, since patient's who attended the outpatient cardiac clinic at CHBH, during the time of the study, did not make appointments, but would come to the clinic, get a number and queue to see the doctor. Thus, since the population were not known to the researcher and could not be identified at the beginning of the study, consecutive sampling (a form of convenience sampling) (Domholdt, 2005), was used to identify all patients newly diagnosed with CHF who attended the outpatient clinic on Wednesdays and Thursdays in the period 04 June 2008 to 27 August 2008 and adhered to the inclusion criteria of the study. One hundred and ninety six (196) patients were identified in this way. In order to keep numbers at manageable proportions for a mini thesis, further sampling of this group were done to identify four participants per day and to end with a

final group of 100 study participants. Stratified random sampling procedures were followed. Patients were stratified according to gender. A detailed description of the sampling process is given below.

Patients attended the outpatient cardiac clinic from Monday to Thursday. The researcher collected data on 25 consecutive Wednesdays and Thursdays to ensure enough participants. She chose to collect data on Wednesdays and Thursdays, since those days were the busiest with the most patients attending the outpatient cardiac clinic. Patients routinely took their folders home with them, therefore sampling had to be done on the same day as data collection and this was also the reason for sampling daily groups of patients instead of the entire group – since the entire group was not known to the researcher at the beginning.

On arriving at the clinic patients presented their folders to the administration officer. During the administration process each patient was allocated a number. Once registration had been completed they were asked to wait for their turn to see the doctor. The researcher utilised this waiting period for data collection as this period did not interfere with their schedule. This was done firstly to ensure that patients did not incur extra time or transport costs nor be faced with the inconvenience of coming to the clinic for a second time for the study. Secondly, this method ensured that patients could take their script to the pharmacy (which routinely has long waiting lines at CHBH) without further delay after having seen the doctor.

After the administrative process had been completed the researcher accessed the folders of the patients. From the folder she determined which of the patients attending that day adhered to the inclusion criteria of the study and then included them in the study population for that particular day. The numbers allocated to these patients were put into two boxes, one for male and one for female patients. From each of these boxes, the researcher then drew two numbered cards. Should any of the patients drawn, had refused to participate, the researcher would have gone back to the boxes and drawn again. But all participants drawn, agreed to take part in the study. This was done on each study day until the researcher had interviewed 100 patients with heart failure. Table 3.1 illustrates the patients interviewed by the researcher and the number of patients included in the study according to stratified random sampling.

Table 3.1: Sampling of study participants

Date	Nr of patients attending on that date	Newly diagnosed patients (inclusion criteria)	Nr excluded (not adhering to other inclusion criteria)	Nr adhering to inclusion criteria FEMALE	Nr adhering to inclusion criteria MALE	Nr who refused to participate	Nr interviewed
04/06/2008	54	19	45	5	4	0	4
05/06/2008	62	15	55	4	3	0	4
11/06/2008	56	18	51	3	2	0	4
12/06/2008	48	12	42	4	2	0	4
18/06/2008	47	9	41	3	3	0	4
19/06/2008	57	14	50	4	3	0	4
25/06/2008	54	18	46	5	3	0	4
26/06/2008	55	15	49	4	2	0	4
02/07/2008	58	14	50	5	3	0	4
03/07/2008	60	16	52	4	4	0	4
09/07/2008	62	19	53	5	4	0	4
10/07/2008	58	15	48	6	4	0	4
16/07/2008	56	13	49	4	3	0	4
17/07/2008	57	14	49	5	3	0	4
23/07/2008	54	12	46	4	4	0	4
24/07/2008	55	10	48	4	3	0	4
30/07/2008	57	15	49	5	3	0	4
31/07/2008	58	15	48	6	4	0	4
06/08/2008	62	13	51	7	4	0	4
07/08/2008	48	11	41	4	3	0	4
13/08/2008	52	12	44	5	3	0	4
14/08/2008	46	9	40	3	3	0	4
20/08/2008	52	14	43	5	4	0	4
21/08/2008	54	15	46	5	3	0	4
27/08/2008	62	18	52	6	4	0	4
TOTAL:	1384	355	1188	115	81	0	100

Patients attending the outpatient cardiac clinic at CHBH, but who were not included in the study because they did not adhere to inclusion criteria, consisted of, 808 patients diagnosed with CHF already under treatment and who have received education, 175 patients who were not ethnic Africans and 205 patients who lived outside Soweto. There were no patients who did not have the skills to complete the questionnaire.

3.7 Data collection instruments

Data was collected with the following tools discussed below.

3.7.1 Demographic data questionnaire (Appendix I)

A demographic data questionnaire was developed by the researcher in order to obtain information from the study population on: gender, age, education, diagnosis, ejection fraction, occupation, income and other demographic details. The researcher used the following five steps to develop the questionnaire;

- Drafting – items that the researcher wanted to know of the population group, e.g. gender, age, education, diagnosis, ejection fraction, occupation etc, were included in the questionnaire.
- Expert review – once the draft was written, the researcher subjected the questionnaire for review to her supervisor and a statistician, knowledgeable on research methods and the topic under study. This was to check for content validity.
- First revision – after the expert review, the researcher made revisions to the questionnaire based on the feedback.
- Pilot study – the researcher then piloted the questionnaire on other black African patients with heart failure in Soweto, who did not form part of the study population, for face validity and understandability.
- Final revision – the researcher then added items, reworded questions, eliminated items and revised the format of the questionnaire as indicated by the pilot study (Katzenellenbogen et al, 2004; Domholdt, 2005).

Demographic data will be used to provide the reader with background information on the study population and to compare demographic data with nutrient intake.

3.7.2 Quantitative Food Frequency Questionnaire (Appendix II)

A Quantitative Food Frequency Questionnaire (QFFQ) is a validated questionnaire to determine food choices and consumption. The previously validated QFFQ used in this study was developed by a

researcher at Northwest University. This QFFQ has previously been used to evaluate the food choices of the African population living in the North West Province, South Africa, as part of the THUSA study (MacIntyre, Venter, Vorster, Steyn, 2000; Katzenellenbogen et al, 2004). The quantitative QFFQ was validated in an African population by applying statistical methods (MacIntyre et al, 2000). It includes 139 types of food and records how often a type of food is consumed as time/s per day, per week, per month, as well as preparation methods. Quantities of food were determined by using pictures of standardised portions of the most commonly consumed foods (e.g. maize meal porridge, rice, meat etc.). The researcher also used standardised cups, teaspoons etc. to measure portion sizes. The patients were also asked to name foods which they use that are not included in the questionnaire and point out any questions that were unclear or difficult to understand.

The QFFQ was administered through interview by the researcher, who is a registered dietitian.

3.7.3 Body Mass Index (BMI) (Appendix III)

The participant's body mass index (BMI) was calculated through a standard formula (appendix III) utilising a person's weight and height (Mahan & Escott-Stump, 2004). Weight was measured with a calibrated seca 767 electronic scale that weighs up to 200 kg, in graduations of 0.1 kg, and height was measured with a seca 220 telescopic measuring rod, attached to the scale, in graduations of 1 mm according to acceptable standardised methods (Katzenellenbogen et al, 2004). To prevent interrator bias all measurements was done by the researcher on the same scale, with the same measuring rod. All participants were weighed and measured with their clothes on, but without their shoes. The researcher took one measurement of the patient's weight and height with the calibrated scale and measuring rod.

3.7.4 Translation

Both the demographic data questionnaire and the QFFQ were available only in English. A research nurse was available to translate questions into other languages, had this been necessary. However, all participants seen by the researcher could understand and speak English and were happy to conduct the interview in English.

3.7.5 Pilot study

A pilot study was done, as a test run of certain aspects of the main study. It provided an in-depth look at the questionnaires with the aim of improving its quality (Katzenellenbogen et al, 2004; Domholdt, 2005).

The demographic data form as well as the QFFQ was piloted on five in-patients with heart failure at CHBH. They did not form part of the study population. They adhered to all other inclusion criteria.

The researcher conducted the interviews in the 'Heart of Soweto Study' room within the outpatient cardiac clinic at CHBH, where she planned to perform interviews for the main study as well.

The researcher explained the nature of the study and asked the patients to sign the information and consent forms. This was done for all patients during the pilot study as well as during the data collection. The patients were then weighed and measured, and the BMI calculated. The demographic data coding form was administered.

None of the five patients listed extra food for the QFFQ, and the patients were able to give quantities of food with the help of the food pictures. Each interview took 30 minutes to conduct. The researcher analysed the five QFFQ's with the Medical Research Council (MRC) 'Food Finder 3', 2007, programme. For each patient a daily intake was calculated, and this was analysed into macro- and micronutrient intake, and the data exported to an Excel spreadsheet. The demographic data questionnaire was coded and translated into a demographic and clinical profile of the study population. The data was also recorded on an excel spreadsheet. The researcher found question number 10 to be unclear, and it was changed to include an option for "all" or "most of the above".

It was found that the data gathered were sufficient to address the aims and objectives of the study and the venue proofed suitably private and without distractions to be utilised in the main study.

3.8 Data collection

Permission was obtained from the medical superintendent at CHBH to perform the study on hospital premises and to access the patient folders from CHBH (Appendix VI). On each study day, folders of attending patients were accessed and sampling done as described. After sampling was completed, contact was made with the sampled participants to determine if he/she was willing to participate in the study. If they were willing, the researcher explained the study, answered any questions and asked them to sign the informed consent form (Appendix IV). All participants sampled, agreed to take part in the study. The researcher completed all data collection in the 'Heart of Soweto Study' room, a private and quite room.

No translation was necessary, as all participants could understand and speak English. Demographic data was collected by the researcher using the demographic data questionnaire. The demographic data questionnaire was developed by the researcher for this study and thus not tested for reliability or validity. The researcher determined usual food consumption using the validated quantitative food frequency questionnaire (QFFQ) (MacIntyre et al, 2000). The researcher did objective measurements of weight and height, using a calibrated electronic seca 797 scale and a seca 220 telescopic measuring rod. The researcher followed the same procedure each time when measuring weight and height; all participants had to take off their shoes, but kept their clothes on. Participants were instructed to stand comfortably with their heads erect. The entire process took 45 – 60 minutes per participant. On completion the researcher thanked participants for their time and participation in the study.

3.9 Data analysis

Demographic data was organised on a spreadsheet from where it is presented to the reader with the use of tables and figures. Data from the QFFQ's was organised and analysed into macro- and micronutrient intake by using the MRC 'Food Finder 3' programme. This is a software programme developed by the Medical Research Council for the analysis of food intake of South Africans (MacIntyre et al, 2000). Daily nutrient intake was also compared to the Dietary Reference Intakes through this programme. Body weight and height were used to calculate BMI. Data is presented through tables and figures where appropriate. Data were analysed using StatSoft, Inc. (2009). STATISTICA (data analysis software system), version 9.0 (www.statsoft.com), by Justin Harvey of the University of Stellenbosch, Centre for Statistical Consultation.

The spread of data, standard deviation, medians and means were given where applicable. Statistical significance has been determined through student's T-test, the Pearson Chi-squared test and the Fisher-S Exact test. The student's T-test was used in the case of continuous variables i.e. for variables not measured in categories, but on a continuous scale, for example age. Categorical variables (such as risk factors and nutrient intake) were analysed using the Pearson Chi-squared test and the Fisher-S Exact test. A p value of 0.05 was seen as statistically significant.

3.10 Ethical considerations

The study was accepted by the Committee for Human Research of the University of Stellenbosch, (N08/02/044). Permission was also obtained from the medical superintendent of CHBH to perform the

study on the premises and to have access to patient folders (Appendix VI). Written informed consent was obtained from all participants before data collection commenced. The study was explained to participants and all their questions answered before they were asked to sign the consent form (Appendix IV). Participation was voluntary and refusal to participate did not affect their future treatment at CHBH in any way. The information and consent form was translated into Zulu and available (Appendix V). However all participants could read and speak English, and felt comfortable to be informed about the study in English, and to sign an English consent form.

Patient confidentiality was guaranteed at all times. Research numbers and not patient names were documented on questionnaires. Only the researcher has access to information. Although information will be published, individual identities will not be disclosed. There were no physical or emotional harm or risks involved. Participants were not paid to participate in the study. They also did not incur any costs, as the researcher saw the participants on the same day that they had to come to the clinic for their regular outpatient visits. Where it became clear through the assessment that a participant needed intervention, the researcher provided dietary counselling on appropriate food choices. Furthermore, participants are followed up at the cardiac clinic after three months by the doctor as well as the researcher. All data will be kept safely at the researcher's home for five years.

3.11 Summary

The aim of the study was to describe the food choices and macro-and micronutrient intake of black, urban Sowetans, newly diagnosed with chronic heart failure, who attended the outpatient cardiac clinic at Chris Hani Baragwanath Hospital. This was done using a descriptive study methodology that made use of quantitative methods of data collection. Ethics clearance, permission from CHBH and written consent from participants were obtained. All data was collected by the researcher in English.

4 RESULTS

4.1 Introduction

In this chapter the results of the study will be presented. Firstly the demographic and clinical profile of the study participants is described. This is followed by a description of food choices and macro-and micronutrient intake of participants. This data is compared to the recommended daily intake and therapeutic recommendations for individuals suffering from heart failure. Finally the BMI of the participants is presented.

4.2 Demographic details of study participants

Table 4.1 summarises the demographic profile of the study cohort. The study participants were evenly balanced for gender with four (4) more female than male participants. This is to be expected since the sampling process stratified participants according to gender.

Table 4.1: Socio-Demographic profile of the study cohort

	Men n=48	Women n=52	All participants n=100
Age			
Mean age (years)^{1=SD}	51±13 ¹	47±17 ¹	49
Formal education			
No formal schooling	1 (3%)	6 (12%)	7
Primary schooling	15 (31%)	11 (21%)	26
Some secondary schooling	28 (58%)	30 (58%)	58
Grade 12	1 (2%)	3 (7%)	4
Post matriculation qualification	3 (6%)	1 (2%)	4
Employment status			
Employed	20 (42%)	3 (6%)	23
Unemployed	17 (35%)	39 (75%)	56
Pensioner	11 (23%)	10 (19%)	21
Household income			
R0-R5000	46 (96%)	50 (96%)	96
R5001-R10 000	2 (4%)	2 (4%)	4
Amenities			
Electricity	46 (96%)	48 (92%)	94
Running water	48 (100%)	47 (90%)	95
Appliances (stove, fridge, freezer)	33 (69%)	32 (62%)	65

Women were, with a mean age of 47, slightly younger than their male counterparts who had a mean age of 51 (see table 4.1). The mean age of the study population was 49 years and the majority of participants were in the 40 – 60 years age group, while 30% of the study population was younger than 40 years. Overall unemployment in this study cohort was high at 56%, with 35% of men and 75% of women in the economically active group (18-65 years) being unemployed. Most households in this study had running water (95%), and electricity (94%). Furthermore, 65% of participants reported that

they had appliances, such as a stove, fridge and freezer in the house. With regards to educational level (table 4.1), 58% of both men and women had some secondary schooling and 8% of men and women had grade 12 or tertiary qualifications. Six percent of men had a postgraduate qualification versus 2% of women. Data from this study shows that the level of education has an effect on the macro- and micronutrient intake of the study population. Table 4.2 shows a trend of decreased consumption of total energy (up to level 3 in men) and certain macronutrients, such as total protein, carbohydrates and fat with an increased level of education of participants.

Table 4.2: Impact of educational level on macro- and micronutrient intake

		Education level ²					
Nutrient Intake	Gender	1	2	3	4	5	p-value
Number (n)(%)	Men	1(2%)	15(31%)	28(58%)	1(2%)	3(6%)	
	Women	6(12%)	11(21%)	30(58%)	3(6%)	1(2%)	
Energy (kJ)	Men	16770.07	9553.66	8169.32	14839.7	10854.2	0.22
	Women	12037.41	11497.53	8680.51	8557.11	8896.9	0.23
Protein (g)	Men	135.83	72.51	62.30	189.8	108.21	0.18
	Women	113.73	99.46	69.32	68.42	78.65	0.25
CHO (g)	Men	512.82	319.27	269.05	389.95	326.09	0.50
	Women	363.43	361.16	283.15	277.65	281.12	0.19
Added sugar (g)	Men	95.42	59.58	48.42	76.48	61.49	0.50
	Women	68.28	63.72	49.06	50.17	34.19	0.99
Total fat (g)	Men	115.95	66.34	59.07	121.96	82.46	0.19
	Women	89.16	85.04	62.42	62.38	67.8	0.35
Vitamin D (mcg)	Men (5)*	10.54	4.88	4.08	3.39	4.11	0.33
	Women (5)*	5.40	5.26	4.18	4.12	3.41	0.52
Vitamin C (mg)	Men (90)*	34.42	47.83	60.07	43.2	50.37	0.62
	Women (75)*	47.18	56.86	54.23	58.97	92.63	0.41

Mg (mg)	Men (420)*	637.71	353.18	301.52	445.15	366.62	0.11
	Women (320)*	420.83	413.27	320.99	311.96	334.31	0.44
Vitamin E (mcg)	Men (15)*	17.18	9.31	8.52	12.53	10.12	0.41
	Women (15)*	11.53	10.45	8.93	8.77	8.49	0.71
Folate (mcg)	Men (400)*	302.75	169.34	165.14	339.5	224.66	0.33
	Women (400)*	240.28	223.22	179.51	173.81	153.22	0.49
Iron (mg)	Men (11)*	13.85	9.81	9.01	18.29	12.37	0.38
	Women (18)*	12.66	11.96	9.64	9.46	7.92	0.68
Vitamin B6 (mg)	Men (1.7)*	2.24	1.35	1.20	2.41	1.65	0.08
	Women (1.3)*	1.77	1.75	1.27	1.26	1.08	0.42
Pantothenate (mg)	Men (5.0)*	9.03	4.78	4.38	6.31	5.16	0.21
	Women (5.0)*	5.93	5.53	4.44	4.51	4.64	0.28
Niacin (mg)	Men (16)*	23.17	13.83	13.18	28.5	18.50	0.37
	Women (14)*	19.44	17.34	13.83	13.90	10.66	0.64
Selenium (mcg)	Men (55)*	70.47	37.60	31.65	87.54	52.26	0.43
	Women (55)*	55.90	51.55	34.95	34.46	43.91	0.27
Sodium (mg)	Men (500)*	2812.16	2127.33	2009.17	1947.9	2028.13	0.71
	Women (500)*	2184.94	2372.86	2012.98	2020.55	2293.67	0.04
Potassium (mg)	Men (2000)*	4595.94	2402.57	2037.78	4034.9	2825.08	0.02
	Women (2000)*	3179.25	2991.39	2185.08	2152.02	2365.06	0.29
Calcium (mg)	Men (1200)*	1767.07	639.57	451.69	183.93	425.06	0.01
	Women (1200)*	693.46	659.52	455.84	455.31	932.24	0.23

²Education level key: 1= No formal schooling; 2 = Primary schooling; 3 = Some secondary schooling; 4 = Grade 12; 5 = Post matriculation qualification

*Recommended Nutrient Intakes (WHO/FAO, 2003)

4.3 Heart Failure profile of the study participants

As shown in Table 4.3, dyspnoea indicative of NYHA functional class II or III was present in 68% of the participants and one had class IV dyspnoea.

Table 4.3: Heart failure profile of the study cohort

	Men n=48	Women n=52	Total n=100
NYHA Class I	13 (27%)	18 (35%)	31
NYHA Class II	30 (63%)	24 (46%)	54
NYHA Class III	5 (10%)	9 (17%)	14
NYHA Class IV	0 (0%)	1 (2%)	1

Left ventricular systolic dysfunction values varied from 10% to 45% for the study population. The mean LVEF for both the men and the women in this study population was 35%, therefore clinically presenting with systolic heart failure, 36% of participants presented with LVEF <30.

4.4 Prevalence of known risk factors

Table 4.4 summarises the risk factor profile for CHF of the current study population. It shows that hypertension was highly prevalent in both sexes, with 58% of men and 63% of women being hypertensive. Hypertension had no statistically significant impact (p=0.66) on left ventricular systolic dysfunction (LVEF).

Table 4.4: Prevalence of risk factors for CHF in the study population

	Men n= 48	Women N=52	Total n=100	p-value (student's T-test) (Impact on LVEF)
Hypertension	28 (58%)	33 (63%)	61	0.66
Diabetes	3 (6%)	6 (12%)	9	0.95
Coronary artery disease	6 (13%)	4 (8%)	10	0.06
Left ventricular hypertrophy	8 (17%)	10 (19%)	18	0.39
Smoking	20 (42%)	1 (2%)	21	0.38
Passive smoking	8 (17%)	15 (29%)	23	0.42
Body Mass Index (>25)	31 (65%)	33 (63%)	64	0.09

According to Table 4.4 less than 20% of the study population suffered from DM (9%), coronary artery disease (10%) and left ventricular hypertrophy (18%). Table 4.4 further shows that none of these conditions had a statistically significant impact on LVEF. Smoking was the third most common risk factor in men as 42% of them were smoking. This study found a higher smoking rate amongst men (42%) than women (2%). At 17%, fewer men were exposed to passive smoking than women of whom 29% were exposed to passive smoking. Smoking had no statistically significant impact ($p=0.38$) on LVEF. The BMI of study participants are presented in table 4.5. It shows that 48% of men and 44% of women were overweight, while 17% of men and 19% of women were obese. On the other hand 9% of women and 4% of men had a BMI of <19 and could be classified as being undernourished and having cardiac cachexia. BMI had no statistically significant impact on the LVEF ($p=0.0916$) in this study population.

Table 4.5: Weight classification in adults according to BMI (Mahan & Escott-Stump, 2004)

Classification	BMI (kg/m²)	BMI study Men (n=48)	BMI study women (n=52)	Risk of co-morbidities (e.g. CVD, DM, obesity, hypertension)
Underweight	<18.5	2 (4%)	5 (9%)	Low (risk of other clinical problems increased, e.g. cardiac cachexia)
Normal range	18.5 – 24.9	15 (31%)	14 (27%)	Average
Overweight	25.0 – 29.9	23 (48%)	23 (44%)	Increased
Obese class I	30.0 - 34.9	5 (10%)	5 (10%)	Moderate
Obese class II	35.0 – 39.9	2 (4%)	3 (6%)	Severe
Obese class III	≥ 40.0	1 (2%)	2 (4%)	Very severe

4.5 Self-care management

Table 4.6: Compliance to treatment

	Men n=48	Women n=52	Total n=100
Take medication as prescribed	48 (100%)	52 (100%)	100
Follow a heart healthy diet	7 (15%)	10 (19%)	17
Daily weight monitoring	4 (8%)	2 (4%)	6

Table 4.6 shows that 100% of both men and women reported taking their medication as prescribed by the doctor. However, only 23% of women, and 17% of men was aware of, and restricted their daily fluid intake, and only 4% of both men and women weighed themselves daily to determine any fluid retention. Only 19% of women, and 17% of men was aware of heart healthy dietary guidelines and tried to follow these.

4.6 Food choices

Table 4.7 summarises the daily food consumption of the cohort as measured by the QFFQ according to gender.

Table 4.7: Mean daily food consumption of study participants according to the Quantitative Food Frequency Questionnaire

Foods/Food Groups	Men (n=48) Mean daily intake g/day	Women (n=52) Mean daily intake g/day	p-value (Fisher-S Exact test) (Difference between intake of men and women)
Carbohydrate-rich foods			
Maize meal (g)	614	504	0.18
Maltabella (g) *	43	81	0.04
Oats (g)	24	18	0.48
Potatoes (g)	68	48	0.09
White bread (g)	20	15	0.55
Brown/wholegrain bread (g)	67	68	0.90
Cereals – refined (g)	13	17	0.61
Cereals – wholegrain (g)	5	5	0.72
Mageu (ml)	56	23	0.86
Added Sugar (g)	22	18	0.44
Sweets & chocolates (g)*	14	23	0.01
Cakes and biscuits (g)	21	15	0.43
Cold drinks (sweetened) (ml)	245	192	0.42
Protein-rich foods			
Meat, chicken, fish, eggs (g)*	148	111	0.01
Milk and milk products (ml)*	165	113	0.04
Legumes (g)	7	6	0.53
Peanut butter (g)	4	3	0.21
Cheese (g)	4	3	0.16
Organ meat (g)	12	8	0.26

Fruit & Vegetables			
Fruit (Fresh) (g)	150	141	0.69
Vegetables (Fresh) (g)	71	75	0.61
Margarine on bread (g)			
	12	13	0.82
Salt			
Added salt and processed foods			
Salt added to cooked food (g)*	2	2	0.02
Salted snacks (g)	10	11	0.69
Take away foods (g)*	11	4	0.05
Sauces & condiments	4	4	0.82
Stock cubes	1	1	0.89
Packet soup	2	2	0.25
Processed meat (g)	28	20	0.13

*Significant difference in intake between men and women ($p < 0.05$)

This study cohort continued to eat the more traditional carbohydrate foods such as maize porridge, oats and maltabella, but these staples were also supplemented by highly refined carbohydrate sources, such as added sugar, sweets and chocolates, cakes, biscuits and cold drinks. Table 4.7 shows a significant difference ($p > 0.05$) in the intake between the men and the women of the study cohort in the following foods, maltabella ($p=0.04$), sweets and chocolates ($p=0.01$), meat ($p=0.01$), milk and milk products ($p=0.04$), salt added to food ($p=0.02$) and take away foods ($p=0.05$), with the men having a higher intake of meat, milk, milk products and take away foods than women, but consuming less maltabella, sweets and chocolates.

Table 4.8: Most popular foods consumed daily by men women

Food	Percentage Male	Mean Portion size per day (g)	Percentage Female	Mean Portion size per day (g)
Vegetables	100	71	98	75
Meat/Chicken	98	148	98	111
Maize M	96	614	94	504
F Fruit	96	150	94	141
Potatoes	90	68	87	48
Milk & Milk products	89	165	82	113
Margarine on bread	81	12	79	13
B/ WW Br	75	67	79	68
Sugar, white	75	22	73	18
Peanut Butter	71	4	54	3

Table 4.8 lists the food items eaten by most of the participants (>70% of the group). It shows that 96% of the men and 94% of the women eat maize meal daily. Furthermore sugar, meat, margarine on bread, milk and milk products as well as fruit and vegetables are amongst the top ten foods consumed daily by more than 70% of the study participants.

Table 4.8 shows that 100% of men and 98% of women ate vegetables daily, with a mean daily portion size of 71g and 75g, respectively. Fresh fruit is consumed by 96% of men and 94% of women with a mean daily portion size 150g and 141g respectively. It has to be noted that, although both the men and women consumed fruit and vegetables daily, their intake was far less than the 400 – 600 g per day, as recommended by the SADG and the WHO/FAO (Love & Sayed, 2001; WHO/FAO, 2003).

4.7 Macro-nutrient intake

The macro- and micro-nutrient intakes of the study population were compared to the ‘population nutrient intake goals for preventing diet-related chronic diseases’ as recommended by the WHO/FAO, since current CHF guidelines provide only a few recommendations because of limited research

available for establishing evidence-based recommendations (De Lorgeril et al, 2005; Payne-Emerson & Lennie, 2008). Most of the study participants (85%) were classified as NYHA class I & II, and therefore still in the early stages of the disease, where recommendation would focus on treatment of underlying conditions (e.g. hypertension, hyperlipidemia) and prevention of risk of co-morbidities (e.g. diabetes mellitus, obesity) (Mahan & Escott-Stump, 2004). The WHO/FAO guidelines are aimed at developed, as well as developing countries and populations in transition (WHO/FAO, 2003).

Table 4.9 shows the mean intakes of some macronutrients selected because of their known effects on cardiovascular disease risk and their role in the progression and management of CHF as compared to World Health Organisation (WHO) and the Food and Agriculture Organisation of the United Nations (FAO) recommendations for men and women, as well as the difference between men and women's consumption of macronutrients in this study (WHO/FAO, 2003).

Table 4.9: Macro- nutrient intake of study participants in comparison to WHO/FAO recommended intakes (WHO/FAO, 2003)

Macro-nutrient	Mean daily intake Men (n= 48)	WHO (men) (WHO/FAO, 2003)	p-value (Fisher-S Exact test) (actual intake compared to WHO)	Mean daily intake Women (n=52)	WHO (women) (WHO/FAO, 2003)	p-value (Fisher-S Exact test) (actual intake compared to WHO)
Energy (KJ)	9724*	12159	0.00	8323*	9282	0.01
Protein (g)	85*	56	0.00	62*	49	0.00
% Total Energy	15%	15-20%		13%	15-20%	
Total CHO (g)	313*	190	0.00	281*	140	0.00
% TE	55%	55-75%		57%	55-75%	
Dietary fibre (g)	19	20	0.26	19	20	0.12
Added sugars (g)	5.72	<10%	0.19	4.9	<10%	0.25
Total fat (g)	68*	57	0.02	58	62	0.39
%TE	30%	30-35%		30%	30-35%	
Saturated fat (g)	23* (9%)TE	<10% TE	0.00	17*(8%) TE	<10% TE	0.00
MUFA (g)	24*(9%) TE	>10% TE	0.00	19 (9%) TE	<10% TE	0.00
PUFA (g)	16*(6%) TE	7% TE	0.00	16 (7%) TE	7% TE	0.00
Cholesterol (mg)	319	300	0.51	250*	300	0.05

* Significant difference between actual intake and the ‘population nutrient intake goals for preventing diet-related chronic disease’ as recommended by FAO/WHO (WHO/FAO, 2003).

Table 4.9 shows that men and women consumed less energy, but more protein than the intakes recommended by the Food and Agriculture Organization of the United Nations (FAO) and the World Health Organization (WHO) (WHO/FAO, 2003). Protein comprised a similar percentage of total energy intake (around 13% versus 15%) for men and women (table 4.9). The consumption of carbohydrates for both men and women (54-57% of total energy) were within the recommended intakes by the FAO/WHO (WHO/FAO, 2003). However added sugar intake was low (<10%E) and, fibre

intake was moderately low. Both women and men consumed <30%E from fat. Consumption of saturated fats for both groups was less than 10% of total energy. The total fat intake seen in this CHF cohort was within recommended levels (<30% total energy) (WHO/FAO, 2003).

4.8 Micro-nutrient intake

Table 4.10 shows the mean intakes of micro-nutrients selected because of their known effects on cardiovascular disease risk and their role in the progression and management of CHF as compared to the World Health Organisation (WHO) and the Food and Agriculture Organisation of the United Nations (FAO) recommendations for ‘population nutrient intake goals for preventing diet-related chronic diseases’ for men and women (WHO/FAO, 2003).

Table 4.10: Micro-nutrient intake of study participants in relation to WHO/FAO recommended intakes (WHO/FAO, 2003)

Micronutrient	Mean Daily intake Men (n=48)	WHO (men) (WHO/FAO, 2003)	p-value (Fisher-S Exact test) (actual intake compared to WHO)	Mean Daily intake Women (n=52)	WHO (women) (WHO/FAO, 2003)	p-value (Fisher-S Exact test) (actual intake compared to WHO)
Ca (mg)	555*	400	0.004	415*	400	0.01
Vitamin D (mcg)	4*	5	0.000	4*	5	0.01
Vitamin C (mg)	71*	90	0.05	66	75	0.07
Mg (mg)	346*	420	0.003	305	320	0.30
Vitamin E (mcg)	9*	15	0.000	9*	15	0.00
Folate (mcg)	215*	400	0.000	179*	400	0.00
Vitamin B6 (mg)	1.3*	1.7	0.0003	1.2	1.3	0.233
Selenium (mcg)	46*	55	0.03	32*	55	0.00
Sodium (mg)	2237*	500	0.05	1919*	500	0.00
Potassium (mg)	2360*	2000	0.008	2024	2000	0.82
Vitamin B12 (mcg)	8*	2.4	0.02	6*	2.4	0.04
Pantothenate (mg)	6	5.0	0.16	4.5	5.0	0.08
Biotin (mcg)	37*	30	0.02	33	30	0.29
Fe (mg)	11	11.0	0.53	9*	24	0.00
Riboflavin(mg)	1.4	1.3	0.30	1.1	1.1	0.55
Niacin (mg)	17	16	0.20	13	14	0.20
Thiamine (mg)	1.3	1.2	0.22	1.1	1.1	0.83
Vitamin A (RE) (mcg)	1014	600	0.08	940*	600	0.02

Significant difference between actual intake and intakes as recommended by the WHO/FAO $p < 0.05$ (WHO/FAO, 2003).

Sodium Intake

Sodium intake in this study cohort was above recommended intake levels (500 mg/day) as recommended by the FAO/WHO (WHO/FAO, 2003), due to salt being added to food, as well as the intake of processed food, but within the recommended intake for sodium restriction for CHF, for men and women (2237 mg and 1919 mg/day respectively, $p < 0.05$) (Charlton & Jooste, 2001; Mahan & Escott-Stump, 2004; Payne-Emerson & Lennie, 2008). Sodium chloride (table salt) is approximately 40% sodium and 60% chloride. The men in the study consumed significantly higher amounts of sodium, 2237mg ($p = 0.05$), than recommended by the FAO/WHO (WHO/FAO, 2003). Sodium intake of the women in the study was higher, 1919 mg/day ($p = 0.00$), than recommended by the FAO/WHO (WHO/FAO, 2003).

Potassium

As seen in Table 4.10, the intake of potassium for men, 2360 mg/day ($p = 0.01$), was more than the recommended intakes by the FAO/WHO. Women also consumed sufficient amounts of potassium, 2024 mg/day ($p = 0.82$) (WHO/FAO, 2003).

Calcium

Intakes of calcium for men, 555 mg/day ($p = 0.004$), were more when compared to recommendations by the FAO/WHO. The women in the study cohort also consumed sufficient amounts of calcium, 415 mg/day ($p = 0.61$) when compared to the recommendations of the FAO/WHO (WHO/FAO, 2003).

Magnesium

Magnesium intake of the men in the study cohort was inadequate, 346 mg/day ($p = 0.003$), but adequate for the women, 305 mg/day ($p = 0.30$).

Vitamin D

Both men, 4 mcg/day ($p = 0.00$), and women, 4 mcg/day ($p = 0.01$), in the study cohort had inadequate intakes of Vitamin D.

Selenium

Both men and women have inadequate intakes of selenium, 46 mcg/day ($p = 0.03$), with especially a low intake for women, 32 mcg/day ($p = 0.00$).

Folate and Vitamin B12

Folate intakes were inadequate for both men, 215 mcg/day ($p=0.00$) and women, 179 mcg/day ($p=0.00$), in this study, however Vitamin B12 intakes were adequate in both groups.

Vitamin C

Both the men, 71 mg/day ($p=0.05$) and women, 66 mg/day ($p=0.07$) in this study had insufficient intakes of Vitamin C.

Iron

Women had an inadequate intake of iron of 9 mg/day ($P=0.00$).

4.9 Summary

The most significant clinical finding is the inadequate intake of certain nutrients and the moderate salt consumption, although it is way above the “minimum” requirement of 500 mg per day as recommended by the WHO/FAO, it is within the moderately restrictive intake of 2 -3 g per day (Charlton & Jooste, 2001; WHO/FAO, 2003; Mahan & Escott-Stump, 2004; Payne-Emerson & Lennie, 2008). Salt added to food and take-away foods contribute to the increased intake of salt as well as to the high intake of saturated fatty acids. Although both the women and the men in the study ate fruit and vegetables daily (216 – 221 g), the consumption was much less than the 400- 600 g as recommended by the SADG and the WHO/FAO (Love & Sayed, 2001; WHO/FAO, 2003). The low consumption of fruit and vegetables and a high consumption of refined carbohydrates contribute to the significantly low intake of magnesium and Vitamin C of the men in the study, as well as reduced consumption of folate for both the men and the women. Overall, the pattern of dietary consumption observed is likely to be a major contributor to a pattern of sub-optimal health outcomes (i.e. premature mortality and recurrent morbid events) found in these patients with CHF from Soweto.

5 DISCUSSION OF FINDINGS

5.1 Introduction

In this chapter the findings of the study is discussed and compared to relevant literature findings. Firstly the demographic details of the study participants are discussed. This is followed by a discussion of the heart failure profile and risk factors of the participants. The importance of self-care management and food choices in CHF is expanded on and this is followed lastly, by a discussion of the macro- and micronutrient intake of the study participants.

5.2 Demographic details of study participants

5.2.1 Gender

The literature indicates higher chronic heart failure prevalence rates in men than in women. According to The Rotterdam study, where data was prospectively collected from 7983 participants between the ages of 55 and older, the prevalence of heart failure in men was 8.0% and in women 6.0% (Bleumink, Knetsch, Sturkenboom, Straus, Hofman, Deckers et al, 2004). Data from the HOS study, however, has shown a different pattern in an urban African cohort, with more black African women than men presenting with CHF (Stewart et al, 2008). Since the current study population was stratified for gender these trends could not be compared to findings in the study.

5.2.2 Age

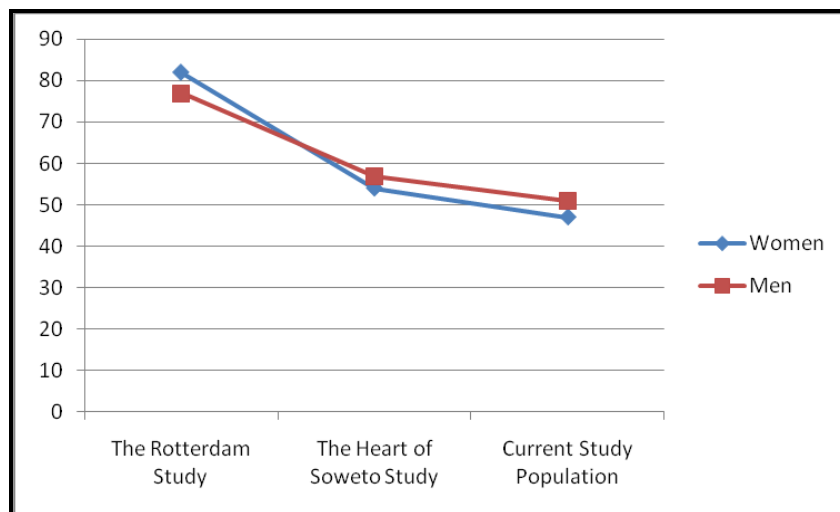


Figure 5.1: Comparison of mean ages between three study populations.

Data from the Rotterdam study showed that the incidence rate for CHF increased markedly with an increase in age from those aged 55-59 years to those aged 90 years or older for both men and women (Bleumink et al, 2004). Figure 5.1 illustrates a downward trend for age between The Heart of Soweto (HOS) study done between January 1 to December 31, 2006 (Sliwa, et al, 2008) and the Rotterdam study. The HOS study findings on age were similar to that of the current study, although a further downward trend is seen with participants in the current study on average about 5 years younger (figure 5.1). This trend is further noticeable in the fact that 25% of the study population in the HOS was younger than 40 years, while 30% of the population in the current study is younger than 40 years (Sliwa, et al. 2008). Possible reason for this might be that people are being affected at an even younger age or that the sampling was done earlier in the disease stage in the current study than in the HOS study. The current study only included patients newly diagnosed with CHF, whereas the HOS study included patients of longer standing (Stewart et al, 2008). This trend needs to be investigated further.

As shown in figure 5.1 the entire cohort in the HOS study as well as in the current study is typically two decades younger than that seen in high income countries, where there are very few people suffering from CHF below the age of 45 years. In the Rotterdam Study the mean age at the onset of heart failure was 70.4 years. Furthermore these figures from a developed nation shows that the mean onset age for women is older than for men (82.5 and 77.5 years, respectively), whereas in the two South African studies the mean age of onset for women was lower than for their male counterparts (Bleumink et al, 2004). This finding is confirmed by Mbewu (2009) who found that more than half of CVD deaths in African countries occur amongst people between 30 and 69 years of age, and aged 5-10 years below the equivalent group in Europe and North America.

This difference in onset ages between citizens from developed nations and black Africans can, according to literature, be attributed to broad diversity of heart disease attributable to a combination of infectious and non-communicable diseases (NCD) (Stewart et al, 2008). Data from the HOS study showed that the present spectrum of heart disease in Soweto ranges from infectious diseases that are usually expected in African populations, like rheumatic heart disease (RHD) to non-communicable diseases that are often reported in high-income countries(Sliwa et al, 2008).

5.2.3 Level of education

According to Gaffney's Local Government in South Africa 2009-2011 (Gaffney, 2009), the levels of education in the City of Johannesburg, is as follows:

- 3.4% have not attended school
- 14.7% attended only primary school
- 65% having some secondary schooling and grade 12
- 9.5% have tertiary qualifications (Gaffney, 2009)

This is fairly similar to findings in the current study although slightly fewer participants in the current study (4%) held tertiary qualifications. A possible explanation for this trend is the fact that the mean age of the study population is 49 years of age, and that surveys has shown that older persons have considerably lower levels of education (Steyn et al, 2006). Another possibility might be the fact that Soweto is a peri-urban area. The South African Demographic and Health Survey (SADHS) (2003) shows that people who live in urban areas have higher levels of education as compared to those living in non-urban areas and that more people living in urban areas have achieved a tertiary qualification than those living in rural areas, because of better access to tertiary institutions. Another possibility might be that people with tertiary qualifications have medical aids and would therefore have access to private hospitals (Steyn K, 2006).

Educational level has been shown by literature to impact on various health related aspects such as poverty levels, nutrition and lifestyle. Households whose heads have no education have a poverty rate of nearly 80%, compared to only 7% among those households where the head has at least a completed secondary education. Moreover, poverty is much deeper among households with poorly educated heads (Vorster et al, 2007). The majority of black people still suffer from the inequalities of the past with lower economic status, which impacts negatively on food choices and food supply. This leads to inadequate intake of macro- and micronutrient and increase the risk factors for chronic diseases, such as CVD, hypertension, DM and CHF. Furthermore CHF is a disabling disease, with patients being unable to perform physical labour (Squire, 2008). Higher levels of education and the possibility of sedentary work will enable a person with CHF to stay in the workforce and earn a living for a longer time.

Data from this study show that the level of education has an effect on the macro- and micronutrient intake of the study population. Table 4.2 shows a trend of decreased consumption of total energy and certain macronutrients, such as total protein, carbohydrates and fat with increased level of education by participants. It shows however, no statistical significance as the sample size is relatively small for both men (n=48) and women (n=52) and participants for different educational levels are unevenly grouped. Women consume significantly more sodium ($p=0.04$) as their level of education increases and men consumes significantly less potassium ($p=0.02$) and calcium ($p=0.01$) as their level of education increases. This might be explained by a tendency to consume more processed and pre-prepared foods as the level of education increases and economic circumstances improve.

Results from the Transition, Health and Urbanisation Study (THUSA) study showed that with urbanisation, increased income and increased education, there were marked and sustained increases in some CAD risk factors, notably total serum and LDL cholesterol levels in men and women, and BMI in men. But their results also showed that those with the highest income level (R3 000 plus per month) and those with the highest education level (Grade 12 plus after-school academic training), mostly had lower serum glucose levels, lower systolic blood pressures, and in women, lower BMIs, as well as increased micronutrient intakes. A possible reason for this is that the health transition in Africans is at a stage where the burden of CAD and other NCDs is carried by those with a lower socio-economic position (Vorster et al, 2007). Data from this study supports that theory, as macronutrient intake is increased at the lower levels of education, and micronutrient intake remains deficient across all levels of education.

There seems to be an increased awareness regarding food choices and risk factors for chronic diseases of lifestyle with higher education levels. Sodium intake remained more or less the same from the lower to the higher education levels, but there is decreased intake of potassium with higher levels of education, which indicate increased consumption of processed foods and less consumption of fruit and vegetables. This trend is common in urban areas, where there are an abundance of processed foods (Maunder, Matji, Hlatshwayo-Molea, 2001).

5.2.4 Employment

Employment levels influence poverty trends and hence food insecurity (Bonti-Ankomah, 2001). There is wide consensus that the unemployment rate in South Africa is too high, and are still on the increase (Steyn, NP et al, 2006; Statistics SA, 2001; Statistics SA, 2009). According to Statistics South Africa (www.statssa.gov.za, 2009) unemployment rates in Gauteng increased in 2001, with 38.3% of males and 53.9% of females being unemployed. Table 5.1 shows that the rate of unemployment in this study population is higher than that reported by Statistics SA, 2004 (www.statssa.gov.za, 2009). This is especially true for women, who have an unemployment rate of 20% higher than the provincial figure for 2001 (www.statssa.gov.za, 2009).

Table 5.1: Comparison of unemployment rates (Statistics SA, 2004)

Black African (Percentages)	Employed	Unemployed	Pensioner
Men (Gauteng)	38.0	38.3	23.7
Men (Study population)	42.0	35.0	23.0
Women (Gauteng)	31.4	53.9	15
Women (Study population)	6.0	75.0	19.0

There may be a couple of reasons for the higher unemployment rate of the women in this study. firstly, it could mean that the higher unemployment rate amongst women in South Africa is exacerbated in this study cohort by the fact that CHF is a disabling disease. The second possible reason may be that this is a study cohort of urban African women, and that less African women are employed when compared to women of other population groups (Steyn NP et al, 2006).

5.2.5 Household incomes

It can be expected that in the early stages of the nutrition transition, people with a higher socio-economic status will carry the highest risk of CAD and other NCDs. However, there are indications from Mexico, Brazil and Chile that as the nutrition transition progresses, the burden shifts to the poor (Vorster et al, 2007). Data from this study showed that the majority of the participants (96% of men and 96% of women) earned less than R5000 per month. Household income was only measured for two categories, R0-R5000 and R5001-R10 000 and can therefore not reflect the impact of household

income on the consumption of macro- and micronutrients in this study. Table 5.2 shows that the majority of people living in Johannesburg fall within the no income bracket for the period 2009 to 2011 (Gaffney, 2009).

Table 5.2: Monthly income for the population of Johannesburg 2009-2011 (Gaffney, 2009)

Income Bracket	Percentage of Johannesburg population
No income	37.6%
R1-R400	3.5%
R401-R800	5.0%
R801-R1600	11.6%
R1601-R3200	9.8%
R3201-R6400	7.1%

One of the reasons why people move from a rural to an urban area, such as Johannesburg and Soweto, could be to improve their economic situation. But as Table 5.2 illustrates, improved social position is not necessarily the outcome of urbanisation (Vorster et al, 2007). Data from the THUSA study showed that as income increased with urbanisation, some of the CVD risk factors also increased, such as total serum and LDL cholesterol levels in men and women, and BMI in men (Vorster et al, 2007).

5.2.6 Household characteristics

Household characteristics are an important reflection of the socio-economic status of a household, as well as the environmental health implications (Steyn et al, 2006). Access to electricity, running water and household appliances has an impact on food choices, meal planning and a household's food budget and hygiene. Access to electricity and the availability of a refrigerator and/or deepfreeze, mean that food can be bought in advance, in bigger quantities and can be stored. Lack of household appliances, especially a refrigerator, means that fresh food, such as meat, chicken, fruit and vegetables have to be bought almost daily. A household can usually save money by buying in bulk and storing/freezing food, planning meals and buying in advance, and by using leftover food again. Whether a household has a stove with an oven and a microwave, or only a two plate stove, also affects food preparation methods. According to Steyn, et al (2006), more households have access to basic services.

Most households in this study have running water and electricity and 65% of participants reported that they have appliances, such as a stove, fridge and freezer in the house. These figures are higher than overall figures for SA. Two-thirds of households in SA have access to piped water, 41% in the dwelling and a further 26% in the yard (SADHS, 2003). Overall 77% of households have access to electricity and 88% of urban households have access to electricity and 74 percent of households own a refrigerator (SADHS, 2003) (Gaffney, 2009).

5.3 Heart Failure profile of the study participants

Data from the HOS study reported that the mean LVEF of the study participants was 45%, thus 10% higher than for the current study population. Possible reasons for this could be a much larger sample size (n=844) in the HOS than in the current study and therefore, more people with advanced heart failure. It might be that in the HOS study a larger number of people with CHF were detected only at a later stage than in the current study, where only patients newly diagnosed with CHF were included, and therefore still in the earlier phase of the disease.

The HOS findings further showed that 54% of patients a measurable left ventricular ejection fraction had moderate to severe systolic dysfunction, and that 29% of patients had impaired diastolic function (Stewart, et al, 2008). The severity of the condition of most participants in the HOS and current study can probably be attributed to the fact that CHBH is a tertiary hospital and the only provider of specialist cardiac services for Soweto. Therefore this study cohort reflects only those who were referred for specialist care and those with more advanced forms of CHF.

5.4 Prevalence of known risk factors

5.4.1 Hypertension

Raised blood pressure (BP), a major risk factor in CVD and CHF, is commonly found in black Africans. Steyn NP (2006) reports that, hypertensive heart disease death rates among blacks were about three times higher than those for coloureds and Indians and nearly ten times higher than the rate for whites in South Africa. The prevalence of hypertension in 61% of study participants correlates with findings from the HOS study, where 60% of their cohort presented with hypertension. It highlights the role of hypertension in the development of CHF and the fact that management and prevention forms than integral part of CHF prevention strategies in urban Africa (Stewart et al, 2008). Similarly data

from the United States of America (USA) and Europe shows that among hospitalised patients with CHF, a history of hypertension is present in 53% to 72% of patients (Gregg & Fonarow, 2008). Data observed in South African patients is consistent with the hypothesis that hypertension among these groups is affected by sodium intake (Charlton & Jooste, 2001). Data from this study reports an increased consumption of sodium, which places the participants in this study at a greater risk for developing hypertension that may lead to CHF.

5.4.2 Diabetes Mellitus

Although diabetes mellitus (DM) is considered a major risk factor in the development of CHF, it was found not to be a big risk for the current study population since 6% of men and 12% of the women has DM. Data from the HOS study shows that 9% of patients with heart failure were found to have diabetes mellitus (Sliwa et al, 2008).

5.4.3 Coronary artery disease

Coronary artery disease (CAD) blocks the flow of blood to the coronary arteries and, therefore, a sufficient supply of oxygen to the heart and is caused by atherosclerosis, which can affect any artery of the body. Risk factors for CAD also include hypertension, high cholesterol, smoking and diabetes (Payne-Emmerson & Lennie, 2008). Again current study findings correlates with data presented from the Heart of Soweto Study, where 10% of patients presented with coronary artery disease as primary diagnosis (Sliwa et al, 2008). Several studies have shown that urbanisation and the nutrition transition in South Africa are accompanied by an increase in the CAD risk factors in Africans (Steyn et al, 2006; Vorster et al, 2007; Mbewu, 2009).

In this study population CAD showed a statistically marginally significant impact ($p < 0.06$) on left ventricular systolic dysfunction and can therefore be seen as a possible risk factor to consider. Prudent dietary guidelines and lifestyle modifications (e.g. stop smoking and increase physical activity) therefore should be strongly recommended to this black urban population group.

5.4.4 Left ventricular hypertrophy

Besides the mechanisms that allow rapid modulation of heart function in response to varying workloads, there is also the physiological capacity to alter structure and function (called remodelling) in the face of a chronic alteration in heart workload (or wall stress). Thickening of the ventricular wall

(hypertrophy) can be considered adaptive because it serves to reduce the wall stress that is increased with increasing volume. Ventricular hypertrophy or dilatation or both can occur in myocardial diseases leading to chronic heart failure (Hunt et al, 2005). Of the study participants, 17% to 19% had left ventricular hypertrophy and the mean LVEF of the participants in the current study was 35%.

5.4.5 Smoking

According to Salojee (2006), there are currently about 5 million smokers in South Africa, of which 42% is men and 11% is women. According to Sliwa et al (2008), 51% of patients in the Heart of Soweto Study, had a history of smoking, compared to the 21% in the current study. One possible reason for the lower levels of smoking reported in the current study might be due to under reporting. Another reason might be that the researcher did not ask the more detailed questions regarding smoking, namely, the use of snuff and chewing of tobacco.

5.4.6 Physical inactivity

Steyn NP et al, (2006) reported that South Africans tend to be very inactive (>90%), at work and during leisure times. The most prominent CHF symptom is an increased intolerance to physical activity with marked tiredness and shortness of breath. Accordingly in this study cohort, a total of 54% of participants was classified as NYHA class II with slight limitation of physical activity, and 14% as NYHA class III with marked limitation of physical activity (see table 4.3). While inactivity levels are high in the current study population (96%) one must be careful when recommending physical activity, taking into consideration the potential benefits, as well as risks involved for each individual (WHO/FAO, 2003).

According to Sliwa et al (2008), in CHF certain muscles, particularly in the legs, may become weak due to reduced blood flow and reduced activity and this might have as much of an impact on mobility and activity tolerance as does a weak heart. Although physical exercise is not part of standard care for patients with CHF and guidelines to improve functional ability has not been established yet, an appropriate and structured exercise programme might increase someone's exercise capacity and therefore be of benefit. When recommending exercise as part of the management of CHF, care should be taken with the exercise prescription. It should be carefully worked out and implemented by an experienced rehabilitation team and/or biokineticist (Colonna et al, 2003; Sliwa et al, 2008).

5.4.7 Body Mass Index (BMI)

In this study population, 48% of men and 44% of women were overweight and 17% of men and 19% of women were obese. It might therefore, be concluded that study participants might have underreported their usual food consumption, as their reported consumption of energy, fat and sugar were not increased. High rates of overweight and obesity are documented for South African adults, with 58.5% of African women and 25.4% of African men being reported as overweight or obese. Overweight and obesity are accepted risk factors for CVD, hypertension, DM and CHF and result when the energy consumption is more than the energy output through physical activity (Vorster et al, 2007).

In the current study, 9% of women and 4% of men had a BMI of <19 and could be classified as being malnourished and having cardiac cachexia. CHF progresses to cardiac cachexia when the balance between catabolism and anabolism is impaired and is associated with a bad prognosis (Colonna et al, 2003; Mahan & Escott-Stump, 2004). Nutritional support in patients with advanced CHF, poor nutritional status and who are presenting with cardiac cachexia, would include sufficient energy and protein intake to correct catabolism and to promote weight gain. Should a patient with a advanced CHF, present with a poor appetite and oral intake, nutrition and vitamin supplements can be considered, as well as eating smaller amounts of food more frequently (Colonna et al, 2003; Mahan & Escott-Stump, 2004).

5.5 Self-care management

The importance of self-care and compliance with treatment protocols is discussed under 2.5 in the literature review. The results of this study demonstrate low self-care abilities amongst the participants. These figures can possibly be attributed to the fact that the researcher included only newly diagnosed patients, who have not received dietary or any other education on heart failure management as yet. They therefore had difficulty recognising their CHF symptoms and had limited knowledge as to their treatment regimen. According to Carlson et al (2001) self-care behaviour will improve with educational intervention programmes and as patients have more experience of their symptoms. The current study findings clearly suggest that participants need to be educated on these issues and confirm literature emphasis on the importance of education of patients with CHF with regards to management of the disease.

5.6 Food choices

Data on food choices show some heartening findings such as the continued use of carbohydrate foods such as maize porridge, oats and maltabella. However, although still within acceptable ranges, there were also consumption of highly refined carbohydrate sources, such as added sugar, sweets and chocolates, cakes, biscuits and cold drinks which might increase triglyceride levels and promote insulin resistance and obesity (Slavin, Jacobs, Marquart, Wiemer, 2001).

Table 5.3: A comparative table of food choices of black South Africans according to four studies

Food	Dikgale Study (black rural) g/day (Nel & Steyn, 2002)	THUSA Study (black transition-informal settlements) g/day (Vorster et al, 2005)	Current Study (black urban) g/day	BRISK Study (black urban) g/day (Nel & Steyn, 2002)
Maize Porridge	948	427	559	371
Brown Bread/Rolls	178	70	68	142
White Bread/Rolls	220	34	18	183
Sugar (added)	36	35	39	32
Meat/chicken/fish/eggs	139	96	130	152
Milk and milk products (ml/d)	121	213	139	254
Legumes	292	22	7	161
Fruit	217	141	146	318
Vegetables	222	78	73	111
Added fat (vegetable oils)	9	13	13	21

With urbanisation a change in food choices, as shown in Table 5.3, can be observed. The black rural population group (Dikgale study) had a very low intake of added fat and a high intake of maize

porridge, which is typical of the traditional African diet. In the transition phase (THUSA) there is a decrease in the consumption of maize porridge and as the nutrition transition progresses in the black urban population groups the intake of maize porridge decrease even more to 371 g/day in the BRISK study (Nel & Steyn, 2002; Steyn NP, 2006). Results of the current study show higher figures than both BRISK and THUSA for maize consumption. It is unsure what caused this difference.

In South Africa, maize has always been the major part of most meals, with added dried beans, vegetables and small amounts of meat/chicken or fish. It has been considered an economic source of dietary energy and the basis of adequate diets in the past. As shown in Table 5.3 there is a decrease in the consumption of maize porridge with urbanisation, but is still consumed in high amounts in all the black population groups as compared to data from the Coronary Risk Factor Intervention Study (CORIS) for a white population in the Western Cape Province, who consumed 285 g of cereals per day (Steyn NP, 2006). This is in line with the SAFBDG recommendations, to 'make unrefined starches, cereals and grains the basis of most meals' (Vorster, Love, Browne, 2001; Lichtenstein et al, 2006).

As shown in table 5.3 there is an increase in the consumption of meat, chicken, fish, eggs from the rural Dikgale study, from 139 g/day to 152 g/ day in the urban BRISK study. There is also an increase in the consumption of milk and milk products in the urban population group, where the rural Dikgale population took in 121 ml/day as compared to 254 ml/day for the urban population in the BRISK study (Nel & Steyn, 2002; Steyn NP, 2006). This increased consumption of meat, milk and milk products contributes to a higher intake of saturated fat. It is noticeable that the population in the current study has a very low intake of milk and milk products, an average intake of 139 ml/day as compared to at least 400 ml/day as recommended for the South African population (Scholtz et al, 2001). Table 5.3 also shows inadequate consumption of milk and milk products for the other groups. This raises concern for inadequate calcium intake and the risk for osteoporosis in these population groups (Scholtz et al, 2001; De Lorgeril et al, 2005).

In the current study, the intake of maize porridge is 559 g/day, intake of meat is 130 g/day, which fall between rural and urban data. This compares to data from the THUSA study for a black population in transition living in informal settlements, and being poor (Vorster et al, 2007).

The consumption of cold drinks and refined foods with extra sugar in has risen markedly in recent years adding extra energy to individual's diets and contributing to weight gain (WHO/FAO, 2003; Lichtenstein et al, 2006). The intake of added sugar, cakes and biscuits, sweets and chocolates, as well as cold drinks were (22 g, 18 g; 21 g, 15 g; 14 g, 23 g; 245 ml, 192 ml) for men and women in this study respectively, which still falls within acceptable limits (WHO/FAO, 2003).

In only two of the studies in Table 5.3 the consumption of fruit and vegetable are adequate, for the rural population, Dikgale study and for the urban population (BRISK). In the current study population the consumption of fresh fruit and vegetables fell short of the daily amount of 400g of fruit and vegetables recommended by the WHO/FAO (WHO/FAO, 2003). Data from the THUSA study, for a black population in transition, showed similar results to the current study, with inadequate intake of fruit and vegetable (Vorster et al, 2005). According to Steyn NP, et al (2006) black rural adults had the most prudent diet according to international guidelines and consumed two main meals per day consisting of maize porridge with spinach, pumpkin and green leafy vegetables, as well as fruits, contributing to a sufficient intake of fruit and vegetables daily (Love & Sayed, 2001; Steyn NP, 2006).

During the transition phase there is a tendency to consume less fruit and vegetables as can be seen in the current study population and the population from the THUSA study, both groups consuming 219 g of fruit and vegetables per day. Barriers to eating sufficient amounts of fruit and vegetable daily might be due, on the one hand to affordability and on the other hand to availability. In rural areas fruit and vegetables might be more available as it can easily be grown in gardens at home. But for people living in informal settlements in South Africa, the trend is that all fruit and vegetables are bought (Love & Sayed, 2001).

Food security is impacted on by many aspects. Basically it implies access to enough food to ensure health (Jacobs, 2009). Poverty continues to be the main factor in household food insecurity and a main contributing factor to both over- and under-nutrition (Steyn, NP et al, 2006). Household food security is dependent on the wealth of the household. A high percentage of spending from poor households is on food. Thus they are more vulnerable than wealthier households to inflation of food prices (Jacobs, 2009).

The South African Food Based Dietary Guidelines (SAFBDG) addresses nutritional issues, but compliance with recommendations is not readily achieved by disadvantaged urban populations, as many poor households and people living in informal housing areas cannot afford to buy sufficient quality and quantities of food (Vorster & Nell, 2001; WHO/FAO, 2003). Barriers to following the SAFBDG recommendation for many South African households might be financial constraints, availability of food, household taste preferences, long commuting distances to work which result in choices of take –away foods and snacks that are generally high in salt, sugar and fat, as well traditional/habitual food choices and/or preparation methods (Bourne et al, 2002; Love, Maunder, Green, 2008). Positive change may be confined to the more affluent sector of the population (Love & Sayed, 2001; Vorster et al, 2007).

5.7 Macro-nutrient intake

Previous studies outline clear differences in nutrient intake between rural areas of South Africa where more ‘traditional’ food patterns may still apply and the urban areas, which are undergoing very rapid epidemiological transition, and where poor quality ‘Westernised’, with increased fat, sugar and salt content and decreased unrefined carbohydrates and fibre, diets are more the norm (Bourne et al, 2002; Steyn NP et al, 2006; Vorster et al, 2007). These changes are all associated with an increased risk for CVD, hypertension, DM and CHF.

Table 5.4: Comparison of macro-nutrient intake in current study and three other dietary studies done in South Africa

Dietary factor	WHO goals % of energy (WHO/FAO, 2003)	Dikgale Study (black rural) (Nel & Steyn 2002)	THUSA Study (black -transition) (Vorster et al, 2005)	Current Study (black urban)	BRISK Study (black urban) (Nel & Steyn, 2002)
Energy (MJ)		6.2	9.3	9	7.2
Total fat	15-30%	16.4	25	30	26
SFA	<10%	4.05	-	8.5	8.9
PUFAs	6-10%	3.8	-	6.5	5.9
P/S ratio	<1.0	0.94	0.93	0.76	0.66
CHO	55-75%	67	65	56	62
Added sugar	<10%	4.7	6.5	5.31	12.7
Protein	10-15%	14.9	12	14	14.2
Cholesterol	≤300 mg/d	131	306	285	-

It has been shown that with increased urban exposure, the dietary fat intake of black South African populations has increased from 15% energy in 1940 to about 30% energy in 1990 (Wolmarans & Oosthuizen, 2001; Vorster et al, 2005). This is consistent with the trend for higher total fat and saturated fat consumption seen with urbanisation throughout South Africa (Wolmarans & Oosthuizen, 2001). As shown in Table 5.4, the consumption of total fat is almost doubled in the black urban study population (BRISK) (30%) as compared to the black rural population in the Dikgale study (16.4%) (Nel & Steyn, 2002; Steyn NP, 2006). There is also an increase in the intake of saturated fatty acids and decreases in the polyunsaturated/saturated fat ratios shown in Table 5.4. Cholesterol intake in the Dikgale study population is very low, 131 mg per day, and can probably be attributed to the increased consumption of legumes as a source of protein, but intake of cholesterol increases markedly in the current study population and the people residing in an informal settlement (THUSA study) (Nel &

Steyn, 2002; Steyn NP, 2006; Vorster et al, 2007). These were the only three changes (fat, saturated fat and cholesterol intake) in the entire set of data that are associated with increased risk for CVD and CHF.

A moderate-fat diet, with total fat intake contributing 30% to the total energy, a low intake of saturated fat (SFA) (<7% of total energy), low intake of trans fat and higher intake of mono-unsaturated fat (MUFA) and poly-unsaturated (PUFA) content will lower lipid levels or maintain optimal levels. The study participants in this study consumed 8.5% (>7% of total energy) of saturated fat and should therefore be advised to eat meat and chicken without fat and to use low fat milk and milk products. Both men and women in this study consumed 9% of total energy from MUFA and 6% and 7% respectively from PUFAs. They should therefore be encouraged to increase their intake of MUFA and PUFA. Canola oil is high in MUFA and also affordable and can therefore be recommended. Less expensive sources of PUFA, such as sardines, can also be recommended as part of a healthy diet (Wolmarans & Oosthuizen, 2001).

Protein consumption comprised a similar percentage of total energy intake across all four study population as seen in Table 5.4. It is however important to note that the consumption of legumes is higher in the rural populations than in the urban population groups and that this contributes to a large extent to the total protein intake. Some more affordable sources of plant protein, notably legumes, rich in many nutrients, were not selected in quantity by the current study population. A reason for this might be that people do not know how to prepare legumes (Steyn NP, 2006). In the current study the participants are taking in sufficient amounts of protein. The dietary reference intake for protein in healthy adults is 0.8 g per kg of ideal body weight per day, however, disease states can increase the body's demand for protein and increase protein turnover (Payne-Emerson & Lennie, 2008). Meat, fish, chicken or eggs are rich source of protein and good sources of all the important micronutrients such as riboflavin, calcium, thiamine, iron and zinc and the omega-3 fatty acids and can be eaten daily as part of the recommendations of the SADG and the WHO/FAO. It should preferably be low fat meat, or chicken without the skin and be prepared without any added fat (Sholtz et al, 2001; WHO/FAO, 2003; Lichtenstein et al, 2006).

Consistent with recommendations to ‘make starchy foods the basis of most meals’, all population groups, as shown in table 5.4, consumed sufficient amounts carbohydrate (56-67% of total energy). It is however, of concern that the contribution of fruit and vegetables to the total carbohydrates, were less than recommended as part of a healthy diet by the SADG and the WHO/FAO (Vorster & Nell, 2001; WHO/FAO, 2003). However added sugar intake was low (<10%E), except in the black urban BRISK study population who had an increased intake of added sugar (Nel & Steyn, 2002).

5.8 Micro-nutrient intake

In men, in the current study, the mean intake of magnesium and of Vitamin C, D, E, folate, Vitamin B6 and selenium was inadequate. Mean intakes of these nutrients were also inadequate in women although mean intake of Vitamin D was only marginally low and intake of magnesium was adequate, probably due to a higher intake of fibre rich foods. Calcium intake was adequate for both men and women when compared to recommendations by the WHO/FAO, but would be inadequate if compared to the daily recommended intakes (DRI's) of 1200 mg/d (WHO/FAO, 2003; Mahan & Escott-Stump, 2004). The mean intake of iron in women was only 50 percent of the level recommended while, mean intakes of riboflavin, pantothenate, biotin, niacin, potassium and Vitamin A were adequate for both men and women. Intake of dietary sodium were increased for both men and women ($p < 0.05$). Data reported from the THUSA study, showed trends of improved micronutrient intakes from rural to urban groups (Vorster, et al, 2005).

Sodium intake

Management of CHF requires the restriction of sodium intake, since excessive sodium intake may worsen the symptoms of CHF by causing fluid retention and by restricting sodium intake the diuretic dose might be lowered (Payne-Emerson & Lennie, 2008). The sodium intake of the study participants was above the recommended intake levels (500 mg per day) as recommended by the FAO/WHO (WHO/FAO, 2003), but within the recommended intake for sodium restriction for CHF of 2000 – 3000 mg per day (Charlton & Jooste, 2001, Colonna et al, 2003; WHO/FAO, 2003; Payne-Emerson & Lennie, 2008).

Most of the sodium in the current study came from bread and the consumption of processed and convenience foods and the use of high salt stock cubes and sauces. The role of bread is consistent with

other South African findings where salt in pre-prepared foods, cereal foods and bread contributes to around one quarter of total salt intake (Charlton & Jooste, 2001).

Figure 5.2 lists the 8 food items that contributed the most salt to the diets of the study population. The researcher compared it to data from a study done by Kollipara et al (2006) on African Americans.

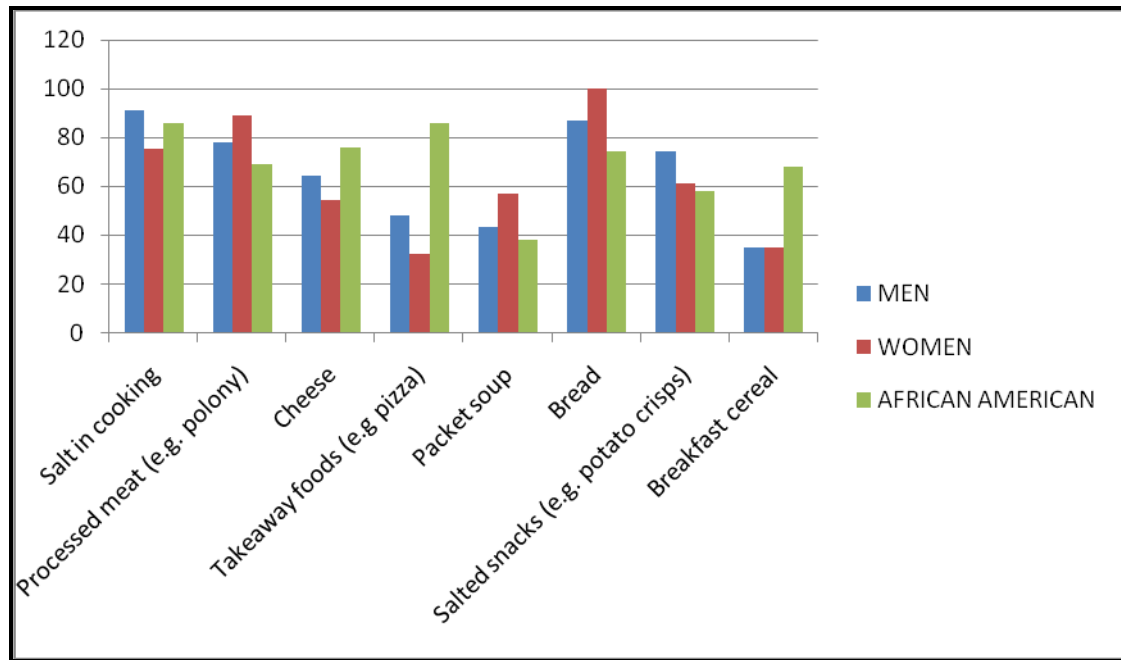


Figure 5.2: Comparison of the consuming patterns of the eight foods contributing most to mean sodium intake between the current study population and an urban African-American population.

Figure 5.2 shows an increased intake of processed meat, bread, salted snacks, packet soup and added salt to cooking in the current study population, which is similar to the urban African-American population. There is however, a difference in the intake of cheese and takeaway foods. The urban African-American population consume more of these foods than the current study population. Possible barriers to adherence to a healthy low salt diet, have been identified by previous studies: lack of knowledge regarding high salt foods and healthy affordable alternatives, lack of available educational materials directed towards different cultural groups, perceptions that meals prepared without added salt were tasteless and boring and lack of support for dietary change from family members (Neily et al, 2002; Arcand et al, 2005; Kollipara et al, 2006). Compliance might be improved with education, reading of food labels to determine the salt content of products, by providing recipes and encouraging patients to be innovative when preparing food and to use herbs and spices instead of

adding lots of salt, packets of soup and stock cubes to their food (Charlton & Jooste, 2001). Nutrition education should, therefore, focus on foods that are varied, available, affordable, culturally acceptable and popular as well as consistent with low salt, low fat, high fibre guidelines (Maunder et al, 2001; Lichtenstein et al, 2006).

Potassium

In the body, the ratio of sodium (in the extracellular fluid) to potassium (in intracellular fluid) is about 2:3 (Mahan & Escott-Stump, 2004). As seen in Table 4.10, the intake of potassium in relation to sodium is too low in the current study population, due to the increased consumption of processed food and the inadequate intake of fruits, vegetables and unrefined cereals. Hypertension and increased plasma fibrinogen are major risk factors for stroke and cardiovascular disease and are prevalent in the black population. Of added importance are the salt-sensitivity hypothesis in the black population and the diminished sodium-potassium ATPase pump in black hypertensive patients (Charlton & Jooste, 2001). Some diuretics increase potassium excretion and it is therefore recommended to ensure adequate intake of fruit and vegetables, since plant foods are good sources of potassium, and may reduce the sodium-potassium ratio and therefore the risk of hypertension (Vorster & Nell, 2001, WHO/FAO, 2003; Mahan & Escott-Stump, 2004).

Calcium

Intakes of calcium for both men and women in the study cohort were adequate when compared to recommendations by the WHO/FAO (WHO/FAO, 2003). It is however, important to monitor calcium intake as Payne-Emerson & Lennie (2008) reported that the calcium intake of persons with CHF tend to be low and that it might be beneficial to supplement their diets with a combination of calcium and Vitamin D.

Magnesium

Magnesium intake by the men in the study cohort was inadequate, but adequate for the women. Women probably showed an adequate intake of magnesium due to the increased intake of high fibre foods, such as maltabella. Table 4.7 shows that they consumed significantly more ($p=0.0149$) maltabella than men. An inadequate consumption of magnesium will be exacerbated by the losses from diuretics used to treat CHF and impact negatively on prognosis (Mahan & Escott-Stump, 2004). Good sources of magnesium are, seeds, nuts, legumes, unrefined cereals and whole grains and dark

green vegetables (Mahan & Escott-Stump, 2004). As can be seen from the food choices of the study cohort, intake of these foods is inadequate as seen in table 4.7. Dietary education and intervention is therefore very important.

Vitamin D

Both men and women in the study cohort had inadequate intakes of Vitamin D as shown in table 4.10. Data reported by Steyn NP (2006) on dietary intake of South Africans support these findings of deficient intake of Vitamin D, especially in rural women. Vitamin D status and supply is impacted on by exposure to sunshine, diet and underlying health conditions and Vitamin D deficiency may be a risk factor for CVD, hypertension and CHF. Furthermore, darker skinned individuals tend to have lower Vitamin D levels and epidemiological studies have established a link between the development of chronic diseases, as well as certain autoimmune diseases, such as rheumatoid arthritis, systemic sclerosis and systemic lupus erythematoses (Payne-Emerson & Lennie, 2008; Peterlik, Boonen, Cross, Lamber-Allardt, 2009; Toubi & Shoenfeld, 2010).

Selenium

Both men and women have inadequate intakes of selenium, with an especially low intake for women. Major sources of selenium are Brazil nuts, seafood, kidney, liver, meat and poultry. Grains vary in selenium content depending on where they were grown (Mahan & Escott-Stump, 2004). The current study population consumed small amounts of organ meat and limited amounts of peanut butter as shown in table 4.7, but not Brazil nuts, which are all excellent sources of selenium

Folate and Vitamin B₁₂

Folate intakes were inadequate for both men and women in this study however Vitamin B₁₂ intakes were adequate in both groups as shown in table 4.10. Good sources of folate are, liver, green leafy vegetables, whole wheat bread, dried beans, lean beef and potatoes (Mahan & Escott-Stump, 2004). Folate consumption for the study population would therefore be inadequate, since they had low intakes of vegetables, organ meat and legumes. The low intake of folate might lead to elevated levels of homocysteine in the current study population, which are associated with CHF (Payne-Emerson & Lennie, 2008).

Vitamin C

Both the men and women in this study had insufficient intakes of Vitamin C as shown in table 4.10. This can be attributed to a lower than recommended intake (400g) of vegetables and fruit per day. The mean intake for men and women in this study cohort were (220 and 210 g/day respectively). Other studies done in South Africa reported similar findings. Black urban dwellers reported low and infrequent consumption of vegetables and fruits (Love & Sayed, 2001). The reasons given for a low consumption of vegetables and fruit include, that it is too expensive and not always available due to seasonality (Love & Sayed, 2001).

Iron

Women had an inadequate intake of iron, of more than 50% less than the recommended levels by the FOA/WHO (WHO/FAO, 2003). An inadequate intake of iron causes anaemia, which can cause CHF or worsen the progression of the disease. It increases the metabolic demand of the heart and is a common finding in patients suffering from CHF and it is associated with an adverse prognosis (Lang & Newby, 2008). This is impacted on even further by the insufficient intake of Vitamin C of the study participants, as Vitamin C facilitate the absorption of iron (Mahan & Escott-Stump, 2004).

5.9 Summary

CHF has a profound effect on morbidity and mortality and the fact that the age of onset are younger in the current study population, as well as in the broader Soweto, than in high income countries, is of particular concern. The burden of CVD is currently carried by those with a lower socio-economic status. This is impacted upon even further when people move from rural to urban areas and especially those living in informal settlements. There is a change in diet from the traditional way of eating to a more western high fat, refined carbohydrate, low micronutrient diet. Barriers such as financial restraints, exposure to processed foods and insufficient knowledge have a negative effect on following a healthy diet and lifestyle.

6 CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

It is noticeable that the study participants were typically two decades younger than their counterparts in developed countries, with a mean age of 49 years. Their level of education was mainly at a secondary school level, but at the same time substantial rate of unemployment was documented. When compared to data from the THUSA study, it seems that this study population can be categorised as being in transition and being at the lower end of the socio-economic spectrum and that urbanisation had impacted negatively on their food choices and macro- and micronutrient intake.

The fact that these unhealthy food choices were investigated in a group of newly diagnosed patients with CHF, would lead one to the conclusion that the whole of this black urban population might be making unhealthy food and lifestyle choices. The recommendations would therefore, not only be aimed at CHF patients, but at the broader community. The pattern of dietary consumption observed in this specific group of patients is likely to impact negatively on their health outcomes in the form of premature mortality and recurrent morbid events. The study participants consumed more salt than the “minimum” recommendations by the WHO/FAO, but still within the guidelines for restricting sodium. Increased intakes related to consumption of bread, processed and take-away foods and the use of high salt stock cubes and sauces. The data presented also show that, in men, the mean intake of magnesium and of Vitamin C, D, E, folate and selenium was inadequate. This can be attributed to reduced intake of wholegrain starches, fruit and vegetables. Mean intakes of these nutrients were also inadequate in women, although mean intake of Vitamin B6 was only marginally low. The women in the current study had an iron intake of only 50 percent of the level recommended, which put them at risk for developing anaemia. Almost halve of the study population was overweight, which places them at risk for developing hypertension, CVD, DM and has an adverse effect on CHF.

The data presented shows that black Sowetans living with heart failure might be in the early stages of the nutrition transition and while continuing to eat some of the more ‘traditional’ carbohydrate foods such as maize porridge, oats and maltabella, their food choices were affected by urbanisation. Their diets were being supplemented by highly refined carbohydrate sources, such as added sugar, sweets and chocolates, cakes and biscuits and cold drinks. It also shows that black urban Sowetans with CHF

consume only around one piece of fruit and one vegetable serving per day. Whereas the traditional rural diet is low in fat and high in unrefined carbohydrates, vegetables and fruit, consisting mainly of maize porridge with leafy green vegetables, spinach and/or pumpkin with a high consumption of legumes and fruit when available. The data observed from this study therefore, shows a need for specific dietary recommendations that is culturally sensitive and economical for this population group for the prevention and management of CHF.

6.2 Recommendations

6.2.1 A community-based intervention programme

Data from the current study has shown damaging food choices in a young black urban population newly diagnosed with CHF. The study population is young in comparison to high income country ages, and also young in comparison to the epidemiological health transition theory. There is a link between food choices, dietary patterns and CVD and thus CHF. One can, therefore, postulate that different dietary patterns in this group might have postponed the onset of the disease and will improve health outcomes.

The researcher would suggest a community-based intervention programme for the prevention of chronic non-communicable diseases run by a team of community health workers, including primary healthcare nurses, nutritionist working in the community, social workers and occupational therapists. The programme should focus on the prevention of risk factors, involving and engaging the community. Such an integrated community-based programme, of which an example is shown in table 6.1, would aim to reach the general population in Soweto, as well as primary health care clinics and community centres (Steyn K, 2006).

Table 6.1: An example of what a community-based dietary intervention programme for chronic non-communicable disease prevention in Soweto might look like

Programme	A community-based dietary intervention programme in Soweto
Aim	To empower people to make healthy food and lifestyle choices
Inputs	<p>A Inter-disciplinary healthcare team</p> <p>Community leaders and members</p> <p>Primary health care clinics in Soweto</p> <p>Community centres and Libraries</p> <p>Financial support in the form of research grants or sponsorship from government or private companies</p>
Outputs	<p>Interactive culturally appropriate cooking classes to practically illustrate how the dietary guidelines can be implemented, e.g. a low salt, low fat chicken dish that can be prepared on a gas plate</p> <p>Show people how to draw up basic meal plans, grocery lists and to do budget planning</p> <p>Shopping tours as discussed under 6.2.2</p> <p>Develop educational material that is concise, clear and culturally appropriate for the Soweto community, consisting of information on the disease, diagnosis, symptoms, medical treatment plan and medication, diet and lifestyle guidelines, good and bad food choices, reading food labels, ideas for meals and snacks.</p> <p>Material should make use of illustrations and pictures.</p> <p>Supporting Sowetans with CHF to start their own food gardens and using home-grown seasonal vegetables and fruit by showing a successful example of an established food garden at Pimville primary care clinic supported by Woolworths.</p>
Outcomes and outputs	<p>Increased awareness on risk factors for chronic non-communicable diseases.</p> <p>Sustained diet and lifestyle changes.</p> <p>Improved compliance to treatment</p> <p>Establishing sustainable resources, such as food gardens</p> <p>Decrease morbidity and mortality caused by unhealthy dietary habits</p> <p>Increase quality of life</p>

6.2.2 Recommendations to dietitians and nutritionists in primary care who work with black urban Africans

Because motivation to change behaviour and maintain changes diminishes with time after being diagnosed with chronic heart failure, dietitians should design interventions to reinforce behaviour change success. Ongoing, appropriately timed, culturally appropriate interventions that help maintain levels of self-efficacy are needed (Timlin et al, 2002).

First, registered dietitians at Universities and those involved in training of dietetic students should develop multicultural counselling competencies and educational material. This should include awareness of cultural food choices, preferences and preparation methods specific to different ethnic groups. Although being able to read the nutritional analysis label on a product might improve the compliance to the dietary guidelines, many cultural foods may not be prepared from a recipe and therefore have a nutritional analysis handy (Kollipara et al, 2006).

Second, ensure dissemination of information to healthcare workers and dietitians working in the community. Information on high-sodium, high fat, refined carbohydrate core foods specific to black urban patients with heart failure in Soweto as can be obtained from this study, should be used to broaden the knowledge base of this patient population about healthy dietary guidelines and sodium restriction. Additionally, being able to identify ethnic foods high in sodium, high in fat and with refined carbohydrates will allow dietitians and nutritionists working in the community to adjust recipes so that people in that community will be able to use it. For example, organising a shopping tour at a local supermarket in Soweto, pointing out food products that can be included as part of a healthy food basket, teaching participants to read food labels, and creating recipes that is culturally appropriate, economical and adhere to the dietary guidelines, - stir fry chicken breast with spinach, carrots, pumpkin and tomato served with samp and beans. An example would be, to organise such shopping tours at supermarkets in Soweto, to involve the participants of such a shopping tour in a competition to find local recipes that can be adjusted to the dietary guidelines and to then ask the supermarket to sponsor the development of such recipes and to keep these in the supermarket.

6.2.3 The development of a chronic heart failure management programme

Non-compliance to medical and nutritional therapies can be avoided through an appropriate CHF management programme run by a inter-disciplinary team with the resultant reduction in hospital readmission rates and improved quality of life (Arcand, et al, 2005). The researcher, therefore, would like to make the following recommendations for the development of a comprehensive heart failure management programme in CHBH:

1. Education on the management of CHF to the inter-disciplinary team who manages the treatment of the patient in order to provide appropriate information and educational material on the disease and management strategies to a person suffering from CHF and his/her family.
2. Practical sessions with a dietitian looking at healthy food and lifestyle choices, how to read food labels and meal planning.
3. An interactive cooking class to promote dietary compliance in a practical manner, namely how to reduce salt in food by using herbs and spices, how to decrease intake of saturated and trans fats and to increase consumption of fibre and fruit and vegetables, given by a registered dietitian.
4. To assist with the establishment of support groups at local community centres and libraries where patients and family members can share experiences, ideas and motivate and support one another.

6.2.4 Recommendations for further studies

More research is needed and possible research projects could be:

- To develop, establish and evaluate outcomes of a chronic heart failure management programme as suggested under 6.2.3.
- To develop, implement and evaluate outcomes of a community-based intervention programme, as presented in 6.2.1, focusing on the prevention of risk factors for chronic non-communicable diseases in primary health care clinics and community centres in Soweto.
- A comparative study between newly diagnosed and longstanding CHF patients to determine the differences in knowledge, diet and treatment practices and compliance to their treatment programme.

The current study has demonstrated a lack of adherence to the recommended food choices and nutrient intakes. The researcher was not able to determine the reasons for this and would, therefore, recommend that the results of this study be used as a pilot study and that a bigger study should be undertaken that will also include aspects, such as knowledge, attitude and reasons for food choices. It

would be of interest to explore the effects on food choices of media exposure to Western processed foods. Barriers to knowledge regarding the selection and preparation of more healthy foods, also needs more research. .

6.3 Limitations of the study

This study was performed at the outpatient cardiac clinic of CHBH, in Soweto a mainly black urban area. The researcher did not explore at this stage, food choices, dietary practices and macro-and micronutrient intake in other patient populations living with chronic heart failure. Study patients could not be sampled from an appointment list, since patient's who attended the outpatient cardiac clinic at CHBH, during the time of the study, did not make appointments, but would come to the clinic, get a number and queue to see the doctor. Thus, since the population were not known to the researcher and could not be identified at the beginning of the study, consecutive sampling (a form of convenience sampling) (Domholdt, 2005), was used to identify all patients newly diagnosed with CHF. Since this was a quantitative study one would have preferred probability sampling in order to ensure that the sample is representative of the study population.

The study did not explore the effects of gender roles (women still buy and prepare most of the food in Soweto), effects of differences in average household income, seasonal variance or the availability of food in Soweto. These factors limit the extrapolation of these data to other patient populations and communities. The researcher used only one measure to determine usual food consumption, namely the QFQ, in a study where the aim was to determine macro- and micronutrient intake and did not determine the reasons why certain food choices were made, such as knowledge, attitude and resources. While this study design is on par with similar studies in the literature as discussed in the literature review a qualitative component would have added extra depth and richness to the study results. The researcher recommends that this is added in future studies of this nature.

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8 APPENDICES

8.1 Appendix I

DATA CODING FORM

(Demographic, employment and social & medical information)

Demographic details:

Research identity number:

2. Gender:

1	M	
2	F	

3. D O B: _____

4. Marital Status:

1	Never married	
2	Married	
3	Divorced	
4	Widowed	
5	Separated	
6	Co-habitate	

5. Educational status:

1	No formal schooling	
2	Primary schooling	
3	Some secondary schooling	
4	Grade 12	
5	Post graduate degree	

Employment details:

6. Employment:

(a) Sedentary employment:

1	Employed	
2	Unemployed	
3	Pensioner	

(b) Physical employment:

1	Employed	
2	Unemployed	

7. Income bracket

1	R 0 – R 5000	
2	R 5001 – R 10 000	
3	R 10 001 – R 15 000	
4	R 15 001 – R 20 000	
5	R 20 001 – R 25 000	
6	> R 25 000	

Household information:

8. Number of people in the house:

1	1 person	
2	2 persons	
3	3 persons	

4	4 persons	
5	5 persons	
6	6 persons	

If more than 6 persons, how many? _____

Amenities available:

9. Do you have electricity available?

1	Yes	
2	No	

10. Do you have any of the following?

1	Stove	
2	Microwave	
3	Fridge	
4	Freezer	

11. Do you have running water?

1	Yes	
2	No	

Exercise:

12. On average how many hours do you spend on exercise per week?

1	None	
2	1 hours	
3	2 hours	
4	3 hours	
5	4 hours	
6	> 4 hours	

13. Do you walk more than 3 km per day to get to work/ shops etc.

1	Yes	
2	No	

Medical information:

14. Risk factors:

1	Hypertension	
2	Diabetes mellitus	
3	Coronary artery disease	
4	Left ventricular hypertrophy	

15. New York Heart Association classification :

1	Class I	
2	Class II	
3	Class III	
4	Class IV	

16. Do you smoke?

1	Yes	
2	No	

If yes, how many cigarettes per day? _____

17. Are you exposed to passive smoking?

1	Yes	
2	No	

18. Do you take your medication daily as prescribed?

1	Yes	
2	No	

19. Have you received dietary education?

1	Yes	
2	No	

20. Do you follow a heart healthy diet as explained to you?

1	Yes	
2	No	
3	Sometimes	

21. Are you on a fluid restriction?

1	Yes	
---	-----	--

2	No	
---	----	--

22. Do you keep to your fluid restriction?

1	Yes	
2	No	
3	Sometimes	

23. Do you weigh yourself weekly?

1	Yes	
2	No	

8.2 Appendix II

Subject number _____ Interviewer _____

QUANTITATIVE FOOD FREQUENCY QUESTIONNAIRE

INTRODUCTION:

Greeting

Thank you for agreeing to participate in this study. Here we want to find out what kind of foods you regularly eat and drink. This information is important to know, as it will tell us whether anything you eat or drink played a role in the fracture you have experienced.

Please think carefully about the food and drink you have consumed during the past four weeks. I will now go through a list of foods and drinks with you and I would like you to tell me:

if you eat or drink the food

how the food or drink is prepared

how much of the food you eat or drink at a time

how many times a day you eat or drink it and if you do not eat it every day, how many times a week or a month you eat or drink it.

To help you describe the amount of a food you eat or drink, I will show you pictures of different amounts of the food and drinks. Please say which picture is the closest to the amount you eat or drink, or if it is smaller, between sizes or bigger than the pictures.

THERE ARE NO RIGHT OR WRONG ANSWERS.

EVERYTHING YOU TELL ME IS CONFIDENTIAL. ONLY YOUR SUBJECT NUMBER APPEARS ON THE FORM.

IS THERE ANYTHING YOU WANT TO ASK NOW?

ARE YOU WILLING TO GO ON WITH THE QUESTIONS

INSTRUCTION

Circle the subject's answer. Fill in the amount and times eaten in the appropriate columns.

I shall now ask you about the type and the amount of food you have been eating in the last few months. Please tell if you eat the food, how much you eat and how often you eat it. We shall start with maize meal porridge.

Do you eat maize meal porridge? 1 YES NO

If YES, what type do you have at home?

Brand name _____

Don't know _____ 2

Grind self _____ 3

If brand name given, do you usually use this brand YES 1 2 NO 3 DON'T KNOW

Where do you get your maize-meal from? (May answer more than one)

Shop 1

Employer 2

Harvest and grind self 3

Other - specify _____ 4

Don't know 5

FOOD	DESCRIPTION	Amount	TIMES EATEN				CODE	AMOUNT/ DAY
			Per day	Per week	Per month	Seldom / Never		
Maize-meal porridge	Stiff (pap)						e4225 4250	
Maize-meal porridge	Soft (slappap)						e4225 4250	
Maize-meal porridge	Crumbly (phutu)						e4225 4250	
Ting								
Mabella Coarse Fine Rice	Stiff						4082	
Mabella	Soft						4082	
Oats							4032	

FOOD	DESCRIPTION	Amount	TIMES EATEN				CODE	AMOUNT/DAY
			Per day	Per week	Per month	Seldom / Never		
Breakfast cereals	Brand names of cereals at home now: (5) Don't know _____							

Do you pour milk on your porridge or cereal? YES 1 NO 2
 If YES, what type of milk (whole fresh, sour, 1%, fat free, milk blend.) _____

INSTRUCTION: Show subject examples.

If YES, how much milk?							
------------------------	--	--	--	--	--	--	--

Do you pour sugar on your cereal/porridge/mabella 1 2
 YES NO

If YES, how much sugar?							9012	
Samp	Bought						4077	
	Self ground						4073	
Samp and beans							A014	

Are the amounts of samp and beans the same as in the picture? YES NO
 If no, do you use more beans than in the picture or less? MOR LES

Samp and peanuts							A013	
------------------	--	--	--	--	--	--	------	--

Are the amounts of samp and peanuts the same as in the picture? YES NO
 If no, do you use more peanuts than in the picture or less? MOR LES

Rice	White						4040	
------	-------	--	--	--	--	--	------	--

	Brown						4134	
	Maize rice						4043	
Pastas	Macaroni						4062	
	Spaghetti							
	Other:							

You are being very helpful. Can I now ask you about meat?

How many times do you eat meat, chicken or fish? Per day: _____

Per week? _____

Other? Specify: _____

CHICKEN, MEAT, FISH

FOOD	DESCRIPTION	Amount	TIMES EATEN				CODE	AMOUNT/DAY
			Per day	Per week	Per month	Seldom / Never		
Chicken	Boiled						1521	
	Fried: in batter/crumbs						1634	
	Not coated						1520	
	Roasted/grilled						1520	

Do you eat chicken skin Always 2 3 Sometimes never

Chicken bones stew							A003	
Chicken feet							A004 1609	
Chicken offal							1610	
Red meat:	How do you like meat?							
	With fat							
	Fat trimmed							
Red meat	Fried							

	Stewed						A001	
	Mince with tomato and onion						1585	
Beef Offal	Intestines: boiled, nothing added						1616	
	Stewed with vegetables							
	Liver						1515	
	Kidney						1518	
	Other specify:							
What vegetables are usually put into meat stews?								
Wors / sausage	Fried						1526	
Bacon							1501	
Cold meats	Polony						1514	
	Ham						1564	
	Viennas						1531	
	Other - specify							
Canned meat	Bully beef						1535	
	Other specify:							
Meat pie	Bought						1548	
Hamburger	Bought						A015	

FOOD	DESCRIPTION	Amount	TIMES EATEN				CODE	AMOUNT/DAY
			Per day	Per week	Per month	Seldom / Never		
Pilchards in tomato/chilli/brine	Whole						2557	
	Mashed with fried onion						A005	
Fried fish	With batter/crumbs						2509	
	Without batter/crumbs						2523	
Other canned fish	Tuna						2547	
	Pickled fish Other:						2562	
Fish cakes	Fried						2531	
Eggs	Boiled/poached						1001	
	Scrambled						1025	
	Fried						1003	
Dried beans/peas/lentils (10)	Soup						3033	
	Salad						3508	
Soya products eg. Toppers	Brands at home now (5) Don't know _____ — Show examples						3527	

WE NOW COME TO VEGETABLES

How often do you eat vegetables?

Per day? _____

Per week? _____

Other? Specify: _____

FOOD	DESCRIPTION	Amount	TIMES EATEN				CODE	AMOUNT/DAY
			Per day	Per week	Per month	Seldom / Never		
Cabbage	How do you cook cabbage?							
	Boiled, nothing added					8066		
	Boiled with potato and onion and fat					A006		
	Fried, nothing added					A007		
	Boiled, then fried with potato, onion					A006		
	Other: Don't know							

FOOD	DESCRIPTION	Amount	TIMES EATEN				CODE	AMOUNT/ DAY
			Per day	Per week	Per month	Seldom / Never		
Spinach/morogo/ other green leafy	How do you cook spinach?							
	Boiled, nothing added					8071		
	Boiled fat added					8209		
	Boiled with onion/tomato and fat					A011		
	- onion, tomato & potato							
	- with peanuts							
	Other: Don't know							
Tomato and onion 'gravy'	Home made - with fat - without fat					A012 A016		
	Canned					8221		
Pumpkin	How do you cook pumpkin?							
	Cooked in fat & sugar					A010		
	Boiled, little sugar and fat					A009		
	Other:							

	Don't know							
Carrots	How do you cook carrots?							
	Boiled, sugar & fat						8129	
	With potato/onion						A008	
	Raw, salad						8015	
	Chakalaka							
	Other: Don't know							
Mealies/Sweet corn	How do you eat mealies?							
	On cob						8033	
	Off cobb - creamed sweet corn - whole kernel						8034 8261	
Beetroot salad	Home made						8005	
	Bought							

FOOD	DESCRIPTION	Amount	TIMES EATEN				CODE	AMOUNT/ DAY
			Per day	Per week	Per month	Seldom / Never		
Potatoes	How do you cook potatoes?							
	Boiled/baked with skin						8046	
	- without skin						8045	
	Mashed						8187	
	Roasted						8189	
	French fries						8048	
	Salad Other:						8236	
Sweet potatoes	How do you cook sweet potatoes?							
	Boiled/baked with skin						8057	
	- without skin						8214	
	Mashed							
	Other: Don't know							
Salad vegetables	Raw tomato						8059	
	Lettuce						8031	

	Cucumber							8025	
Other vegetables, specify:									

FRUIT:

How often do you eat fruit?

Per day? _____

Per week? _____

Other? Specify: _____

Apples/Pears	Fresh							7001	
	Canned pears							7054	
Bananas								7009	
Oranges/naartjie								7031	
Grapes								7020	
Peaches	Fresh							7036	
	Canned							7038	
Apricots	Fresh							7003	
	Canned							7004	
Mangoes	Fresh							7026	

FOOD	DESCRIPTION	Amount	TIMES EATEN				CODE	AMOUNT/DAY
			Per day	Per week	Per month	Seldom / Never		
Guavas	Fresh Canned						7021 7023	
If subject eats canned fruit: Do you have custard with canned fruit:			1		2			
			<input type="checkbox"/> YES	<input type="checkbox"/> NO				
Custard	Home made Ultramel						0004	
Wild fruit/berries	Specify type						7070	
Dried fruit	Types:							
Other fruit								

BREAD AND BREAD SPREADS

How often do you eat bread and rolls?

Per day? _____

Per week? _____

Other? Specify: _____

Bread/Bread rolls	White						4001	
-------------------	-------	--	--	--	--	--	------	--

	Brown						4002	
	Whole wheat						4003	

Do you spread anything on the bread? 1 2 3

		Always	1	2	Sometimes	3	Never	
Margarine	What brand do you have at home now? _____ _____ Don't know _____ Show examples							
Peanut butter								6509
Jam/syrup/honey								9008
Marmite/Fray Bentos								9501
Fish/meat paste								1512

FOOD	DESCRIPTION	Amount	TIMES EATEN				CODE	AMOUNT/DAY
			Per day	Per week	Per month	Seldom / Never		
Cheese	Type:						0010	
Achaar							A017	
Other spreads:	Specify							
Dumpling							4001	
Vetkoek							4057	
Provita, crackers, etc.								
Mayonnaise/salad dressing	Number of spoons _____ / number in family						6573	

DRINKS:

Tea							9514	
Coffee							9513	
Sugar/cup tea or coffee							9012	
Milk/cup tea or coffee	What type of milk do you use in tea and coffee?							
	Fresh/long life whole						0006	
	Fresh/long life 2%						0069	
	Fresh/long life fat free						0072	

	Whole milk powder Brand _____ _____							0009	
	Skimmed milk powder Brand _____ _____							0008	
	Milk blend Brand _____ _____							0068	
	Whitener Brand _____ _____							0039	
	Condensed milk							0002	
	Evaporated milk							0003	
	None								
Milk as such	What type of milk do you drink as such?								
FOOD	DESCRIPTION	Amount	TIMES EATEN				CODE	AMOUNT/ DAY	
			Per day	Per week	Per month	Seldom / Never			
	Fresh/long life whole						0006		
	Sour / Maas						0006		
Milk drinks Brand	Nestle _____ _____						0023		

	Milo_____							

	Flavoured							
	milk_____							
	Other_____							

Yoghurt	Drinking yoghurt						0044	
	Thick yoghurt						0020	
Squash	SweetO						9013	
	SixO						9013	
	Oros/Lecol with						9002	
	sugar						9013	
	- artificial						9002	
	sweetener							
	Kool Aid							
	Other							
Fruit juice	Fresh/Liquifruit/Ceres						0535	
	Tropica						0089	
	Show examples							
Fizzy drinks	Sweetened						9001	
Coke, Fanta	Diet						9013	
Mageu/Motog							9562	
o								
Home brew							9516	
Tlokwe							9516	
Beer							9506	
Spirits							9510	
Wine red							9508	

Wine white							9518	
Other specify								

SNACKS AND SWEETS:

Potato crisps							8049	
Peanuts	Raw						6001	
	Roasted						6007	
Cheese curls: Niknaks etc.							4076	
Raisins							7022	

FOOD	DESCRIPTION	Amount	TIMES EATEN				CODE	AMOUNT/DAY
			Per day	Per week	Per month	Seldom/ Never		
Peanuts and raisins							6007 7022	
Chocolates	Name_____						9024	
Candies	Sugus, gums, hard sweets						9009	
Sweets	Toffees, fudge, caramels						9014	
Biscuits	Type							
Cakes & tarts	Type							
Scones							4029	
Rusks							4160	
Savouries	Sausage rolls Samoosas Biscuits eg bacon kips Other:						1534 4196 4162	
Jelly							9004	
Baked pudding							4181	
Instant pudding							4066	

Ice cream							6507	
Sorbet							6516	
Other Specify:								

SAUCES / GRAVIES / CONDIMENTS

Tomato Sauce Worcester sauce							9505	
Chutney							9524	
Pickles							8176	
Packet soups							4069	
Others:								

WILD BIRDS, ANIMALS OR INSECTS (hunted in rural areas or on farms)

Wild fruit								

MISCELLANEOUS: Please mention any other foods used more than once/two weeks which we have not talked about:

FOOD	DESCRIPTION	Amount	TIMES EATEN				CODE	AMOUNT/DAY
			Per day	Per week	Per month	Seldom/ Never		

Salt use:

What type of salt do you use? _____

The next few questions are to find out if you use salt, where you use it and how much you use?

Do you add salt to food while it is being cooked?

Always 1	Sometime s 2	Never 3	Don't know 4
-------------	--------------------	------------	--------------------

Do you add salt to your food after it has been cooked?

Always 1	Sometime s 2	Never 3
-------------	--------------------	------------

Do you like salty foods eg. salted peanuts, crisps?

Very much 1	Like 2	Not al all 3
-------------------	-----------	--------------------

Do you use any of the following:

	Name of product	Amount/d ay
Vitamins/vitamins & minerals		
Tonics		
Health foods		
Body building preparations		
Dietary fibre supplement		
Other: specify		

THANK YOU FOR YOUR COOPERATION AND PATIENCE

GOOD-BYE!

8.3 Appendix III

Body Mass Index (BMI)

The Quetelet's index (W / H^2), the most widely used height-weight index is commonly referred to as body mass index (BMI) and is a validated measure of nutritional status. BMI measurement requires weight and height measurements. Based on the result, it can indicate overnutrition or undernutrition. BMI can be calculated using the following formula:

$$\text{BMI} = \text{WEIGHT (KG)} \div \text{HEIGHT (M)}^2$$

Obesity is categorized into three BMI *grades*:

- *grade I* (25 to 29.9)
 - *grade II* (30 to 40)
 - *grade III* (40+)
-
- A BMI of 27 or more indicates obesity and an increased risk of developing health problems.
 - A BMI of < 19 indicates cardiac cachexia

8.4 Appendix IV

INFORMATION AND INFORMED CONSENT DOCUMENT

TITLE OF THE RESEARCH PROJECT:

Food choices and macro- and micronutrient intake of Sowetans with heart failure.

REFERENCE NUMBER: N08/02/044

PRINCIPAL INVESTIGATOR: S.S. PRETORIUS

ADDRESS: 18 CURVY RD
BLAIRGOWRIE
RANDBURG
JOHANNESBURG
2123

CONTACT NUMBER: 082 908 6814

DECLARATION BY PARTICIPANT:

I, the undersigned.....(name) [ID
No:]
of
..... (address).

A. HEREBY CONFIRM AS FOLLOWS:

1. I was invited to participate in the abovementioned research project which is being undertaken under the auspices of the Centre for Rehabilitation Studies, Faculty of Health Sciences, Stellenbosch University.

2. The following aspects have been explained to me:

2.1 Aim:

The aim of the study is to describe food choices of black, urban Sowetans, with heart failure, who attend the outpatient cardiac clinic at Chris Hani Baragwanath Hospital and to develop culturally sensitive dietary guidelines for this population.

2.2 Background to the research project:

The study will be used to determine food choices, nutrient intake and body mass index of participants. Once this information has been gathered and analysed specific and culturally sensitive dietary guidelines will be developed. It is envisioned that these guidelines will improve patient understanding and thus compliance with dietary guidelines. Improved compliance will improve the health for the individual and result in fewer admissions to hospital with a resultant saving of cost for both the patient as well as the health services.

2.3 Procedures:

That if I decide to take part in the study:

- 1) I will be asked to sign this informed consent form stating that I fully understand the nature of the study and that I have freely agreed to participate in the study.
- 2) I will be requested to provide information for the Demographic data form, which will be completed by the researcher. Demographic data will also be obtained from my file, e.g gender, age, address, diagnosis, ejection fraction, etc.
- 3) I will be requested to provide information for the Food Frequency Questionnaire, which will be administered by the researcher. The FFQ determines food choices, availability and consumption. It includes 139 food choices from all food groups. Included is frequency of food consumption, categorized as time/s per day, per week, per month, as well as preparation methods.
- 4) My height and weight will be measured by the researcher to determine my body mass index.

2.4 Possible benefits:

Findings from the study will be used to develop culturally sensitive dietary guidelines for the population. You as a participant are welcome to get one of these guidelines free of charge from the researcher once it has been completed.

You will also receive personalised dietary education from the researcher after completion of the Quantitative Food Frequency Questionnaire.

Should you have a need for further dietary counselling the researcher will refer you to the Department of Human Nutrition at CHBH.

2.5 Risk:

There are no risks associated with participation of the study.

2.6 Confidentiality:

Confidentiality will be guaranteed at all times. Each participant will receive a study number, this instead of names will be used on all forms and documents. Your identity will not be made known to anybody else. Only the researcher will have access to the data. The need for confidentiality has been explained to translators and they will not disclose any particulars to another person.

2.7 Access to findings:

Findings can be accessed through the researcher.

2.8 Voluntary participation/refusal/discontinuation:

- 1) That I am under no obligation to take part in the study.
- 2) That I volunteer to take part in the study of my own free will and may withdraw my consent at any time during the study.
- 3) That refusing to take part in the study or withdrawal from the study at a later stage will in no way affect my treatment at Chris Hani Baragwanath Cardiology Clinic.

2.9 Remuneration:

That I will not receive any remuneration for participation in the study.

2.10 Cost:

That I will not incur any cost by participating in the study, except transport costs to CHBH. To minimise this the researcher will try to make appointments on the same days that I have to come to the clinic for my regular follow up visits.

2.11 Ethical considerations/Rights of the participants

That the study has been approved by the medical superintendent of the Chris Hani Baragwanath Hospital and by the Ethics Committee of Stellenbosch University (Registration number). The study will be conducted according to the ethical guidelines and principles of the

international Declaration of Helsinki, South African Guidelines for Good Clinical Practice and the Medical Research Council Ethical Guidelines for Research.

2.11 Publication:

- 1) That the researcher will make the general findings available to Chris Hani Baragwanath Hospital Cardiology Unit, but not specific information regarding specific individuals.
- 2) The researcher will act on the findings of the research and motivate for action.
- 3) That findings will be publishes as a thesis and in relevant scientific journals.

The information above was explained to me by *(name of relevant person)* in Afrikaans/*English/Zulu/*Other and I in command of this language/*it was satisfactorily translated to me by *(name of translator)*.

I was given the opportunity to ask questions and all these questions were answered satisfactorily. No pressure was exerted on me to consent to participation and I understand that I may withdraw at any stage without any penalization.

B. HEREBY CONSENT VOLUNTARILY TO PARTICIPATE IN THE ABOVE-MENTIONED PROJECT.

Signed/confirmed at on20

(place) *(date)*

.....
Signature or right thumb print of participant *Signature of witness*

STATEMENT BY OR ON BEHALF OF INVESTIGATOR(S):

I....., declare that

- I explained the information given in this document to.....*(name of participant)*
- He/she was encouraged and given ample opportunity to ask any questions

- This conversation was conducted in _____ and no translator was used

Signed/confirmed at on20

(place) (date)

.....
Signature of participant

.....
Signature of witness

8.5 Appendix V

INFORMATION AND INFORMED CONSENT DOCUMENT IN ZULU

TITLE OF THE RESEARCH PROJECT:

Food choices and macro- and micronutrient intake of Sowetans with heart failure.

REFERENCE NUMBER: N08/02/044

PRINCIPAL INVESTIGATOR: S.S. PRETORIUS

ADDRESS: 18 CURVY RD

BLAIRGOWRIE

RANDBURG

JOHANNESBURG

2123

CONTACT NUMBER: 082 908 6814

DECLARATION BY PARTICIPANT:

I, the undersigned.....(name) [ID

No:]

of

..... (address).

A. HEREBY CONFIRM AS FOLLOWS:

1. Ngicelwe ukungewela isifundo e sichazwe ngaphezulu, phantsi kwe Centre for Rehabilitation Studies, Faculty of Health Sciences, Stellenbosch University.

2. Loku skulandelayo kuchazelwe kimi:

2.1 Inhloso:

Inhloso Yesifundo ukuthi sihlaziye izihhlobo zokudla kwaba mnyama. Base malokishini ase Soweto, abaphethwe isifo snehliziyo. Aba hamba umtholampilo e Chris Hani Baragwanath Hospital, kanye nomhlahlandlela walo mphakathi, ukukhulisa amasiko.

2.2 Imwelaphi Yophenyo Lesifundo:

Isifundo sizosetshenziswa ukuchaza inzinhlabo zokudla imisololo nezisindo zomzimba (BMI) kwaba mbandakanyekayo uma leminigwano seziqokelelwe yahlaziywa ngukwamasiko. Kuyiphupho lami ukuthi lemigomo ithuthukise ukuzwisisa kwezigulu nokulandela nokudla ngokufanekekileyo. Loku kuzothuthukisa impilo kuloyo naloyo / kumuntu ngamunye, bese kuba ne miphumela kwi mfuluwenza yoku labiswa esibhedlela, nokuwonga imali kumguli noma izibhedlela.

2.3 Inqubo:

Uma ngivuma ukungenela lesisifundo:

- 1) Ngizocelwa ukuba ngisayinde ipheshana elishoyo ukuthi ngiyizwa ngokugcwele imvelaphi yesifundo nokuthi ngiyavuma ukuzibandakanya nalesisifundo ngokuthanda kwami.
- 2) Ngizolelwa ukuba nginikeze imininingwano ye demographic data form elizogwaliswa umphenyi. I demographic data izokhishwa emqulwini wami, isibonelo: ubulili, iminyala, ikheli, isifo, uhlobo lomjovo nokunye.
- 3) Ngizolelwa ukunikeza ulwazi nge Food Frequency Questionnaire ezobe yenganyelwe umphenyi. I Food Frequency Questionnaire iyona ebhekela izinhlobo nhlobo zokudla okukhona kanye nokusetshe nzisiwe. I faka izinhlobo nhlobo zokudla eziyikhulu namashumi amathathu nesishiya ga lolunye, kusukela kuwo wonke amaqoqo okudla, okufkiwe ukudla okukhona okubekwe ngaphans, ntengezikhathi ngosuku, ngeviki, ngenyanga kanjalo nezindlela zokulungiselela.
- 4) Ubude bami nesisindo kuzo kalwa umphenyi ukuze athole isindo somzimba wonke.

2.4 Imvuzo Engatholakala

Okutholakele esifundweni kuyosetshenziswa ekukhuliseni indlela yokudla kwa masiko emphakathini. Wena njengo mngenzi uvumelekile ukuthola eyodwa yalazizindlela ngaphandle kokukhokha kumphenyi, uma seyiqedliwe.

Uyobuyele ufundiswe kabanzi ngendlela yokudla kumphenyi ngemuva kwe Quantitative Food Frequency Questionnaire. Uma ufuna ukwazi kabanzi ngendlela yokudla, umphenyi uzokuthumela ku Department of Human Nutrition at CH Baragwanath Hospital.

2.5 Ubungozi:

Abukho ubungozi obuhlanganiswe nokungenela isifundo.

2.6 Okuyemfihlo

Okuyimfihlo kuyoqinisekuswa ngasosonke isikhathi umngenzi ngamunye uyothola inombolo yesifundo ezosetshenziswa esikhundleni segama, kumafomu kanye nesikunikiwe. Isimo sakho angeke saziwe omunye umuntu, kuzoba umphenyi kuphela onelungelo ku data. Isidingo semfihlo sichazwe otolika ukuthi angeke badelele imininingwano yomuntu ngamunye.

2.7 Imvume Kokutholakele

Okutholakele kungatholwa kumphenyi.

2.8 Ukungenela Ngokuthanda/ ukunqaba/ ukungaqhubeki

1. Ukuthi angikho ngaphansi kwengcindezi ukuba ingzenye yesifundo.
2. Ukuthi ngizingenele ngokwami esifundweni, kanti futhi yimina ozohlehla noma inini ngesikhathi sesifundo.
3. Ukuthi nginqabe ukuba ingzenye yesifundo, noma ngihlehlele emuva esifundweni ngokuqhubeka kwesi khathi. Izobe ingekho indlela yokhukhubaza unyango lwami e C H Baragwanath Cardiology Clinic.

2.9 Imiklomelo

Ukuthi angeke ngithole umklomelo/imbadalo ngokungenela isifundo.

2.10 Ukubiza / Amani / Intengo

Ukuthi angeki ngikhokhe ukungenela lesisifundo ngaphandle kwezindleko zezokuthutha ku CH Baragwanath Hospital. Ukwehlisa lokhu umpheny uzozamba ukwenza isikhathi ngelanga elifanayo nalolu engizobe ngize ngalo emtholampilo ukulandela indlela yokuvakasha.

2.11 Indlela / Imigomo / Yokuzi Phatha / Amalungelo Omngeneli

Ukuthi isifundo sigunyazwe unsumpa wezamazambani wasesibhedlela, CH Baragwanath Hospital ebambisene nekomidi lokuziphatha lase Stellenbosch University.

Inombolo yokungengela N08/02/044. Isifundo siyobe sihlolwa ngendlela yemigomo yokuziphatha kanye neqiniso lezangaphandle Declaration of Helsinki, ningizumu African Guidelines for Good Practise and The Medical Research Council Ethical Guidelines for Research.

2.12 Okukhishiwe

1. Ukuthi umphenyi uzositholela okukhona e Chris Hani Baragwanath Hospital Cardiology unit kodwa hhayi okuqondene nolwazi oluphatelene nokuqondene ngamunye.
2. Umphenyi uzothatha isinyathelo ngokutholakale kuphephenywa kanye nokugquguzela ukwenza.
3. Ukuthi okutholakele kuyo khishwa njengenkulamo emayelana nephephandaba le sayensi.

Ulwazi olunqenhlala / ngaphezulu la chazwa kimi u

Nganikezwa ithuba lokubuza imibuzo kanti yonke imibuzo yaphendulwa ngokuneusayo.

Akunangcindezi eyayiwumgomo/ umthetho kimina wokuthi ngiyavumelana nokubamba iqhaza kanti mina ngazwisisa ukuthi ngingahlehlela emuva noma inini ngaphandle kokugwetshwa.

B. HEREBY CONSENT VOLUNTARILY TO PARTICIPATE IN THE ABOVEMENTIONED PROJECT.

Signed/confirmed at on20

(place)

(date)

.....

.....

Signature or right thumb print of participant

Signature of witness

STATEMENT BY OR ON BEHALF OF INVESTIGATOR(S):

I....., declare that

- I explained the information given in this document to.....(*name of participant*)
- He/she was encouraged and given ample opportunity to ask any questions
- This conversation was conducted in and no translator was used

Signed/confirmed at on20

(place)

(date)

.....
Signature of participant

.....
Signature of witness

8.6 Appendix VI

Appendix VI

S.S. Pretorius
MPhil Rehabilitation
Centre for Rehabilitation Studies
University of Stellenbosch
Student number: 15001857
Cell: 082 908 6814

14 April 2008

Medical Superintendent
Chris Hani Baragwanath Hospital
Soweto

To whom it may concern

RE: APPROVAL FOR RESEARCH STUDY AT THE CARDIOLOGY CLINIC OF CHBH

I am currently enrolled for a masters degree at the University of Stellenbosch for MPhil in Rehabilitation. A protocol has been submitted for approval of the study to the Committee for human research of University of Stellenbosch. The study will only commence once it has been accepted by the committee.

Title: Food choices and macro- and micronutrient intake of Sowetans with heart failure.

Aim: The aim of the study is to describe food choices of black, urban Sowetans, with heart failure, who attend the outpatient cardiac clinic at Chris Hani Baragwanath Hospital and to develop culturally sensitive dietary guidelines for this population.

Timeframe of study: 01 June 2008 – 31 August 2008

Area where study will be conducted: Cardiology clinic

The researcher will try to make appointments on the same day that participants have to come to the clinic for their regular out patient visits, so as to cause no disruption to services in the clinic and to avoid incurring extra costs to the patients.

Should it become clear through the assessment that a participant need intervention, the researcher will provide immediate counselling.

A copy of the study protocol can be provided, should you wish to see this. Please contact me for any further information.

Yours sincerely
Sandra Pretorius

