

# CHAPTER 1 – INTRODUCTION

## 1.1. BACKGROUND AND MOTIVATION

The prevalence of cardiovascular disease (CVD) and its risk factors in developed countries have been well documented (Lopez *et al.* 2006). However, new data on the prevalence of CVD in developing countries are now emerging. A systematic analysis of population health data found that, when dividing countries into two categories, that is, countries with low and middle income in one category and countries with high income in the other, ischaemic heart disease (IHD) and cerebrovascular disease (stroke) were the leading causes of death in both of these groups. Together they were responsible for more than one fifth of all deaths worldwide. The large majority of deaths due to IHD (5.7 million of the 7.1 million total deaths) were in the lower- and middle-income countries (Lopez *et al.* 2006). Coronary artery disease (CAD), a major component of IHD, was always considered to be rare in the black South African population, but studies are showing an increase in prevalence with urbanisation (Akinboboye *et al.* 2003; Seftel, 1978; Vorster, 2002). Urbanisation can be defined as the rapid and massive migration to cities from rural areas. Owing to the historically low prevalence of CAD, less is known about the aetiology, risk factor profile and clinical presentation in black South Africans than in Caucasians.

With urbanisation, there is an increase in socio-economic status, which is usually accompanied by an increase in risk factors for CAD, such as obesity and increased dietary intake of total fat and saturated fat, as has been observed in the North West province of South Africa (THUSA study) as well as in other developing countries (Steyn *et al.* 2005; Vorster *et al.* 2005). When looking at the dietary intake in the South African population, there have been shifts in diet intake to a less prudent diet over the past two decades (Bourne *et al.* 2002). These shifts are occurring with increased momentum, particularly in the black South African population, where with urbanisation, there has been a definite increase in fat consumption and a decrease in carbohydrate consumption. Shifts towards a more westernised diet have, however, also been observed in rural communities (Bourne *et al.* 2002; Vorster *et al.* 2005). It is difficult and challenging, however, to evaluate the independent role of diet in CVD in communities undergoing urbanisation, as there are numerous other changes in lifestyle that are occurring simultaneously during the process of urbanisation. Besides dietary intake, these changes include decreased physical activity, increased psycho-social stress and multiple other socio-economic changes (Popkin, 2002a).

Within this context of urbanisation, therefore, the role of diet in the aetiology of CAD is expected to be a complex one.

Earlier studies examining the effect of diet on CVD as well as the effect of urbanisation on diet focused on the analysis of nutrient intake only. After large-scale studies revealed the failure of single-nutrient supplementation to protect against CVD (Bjelakovic *et al.* 2008) and cancers (Omenn *et al.* 1996; The Alpha-Tocopherol Beta Carotene Cancer Prevention Study Group, 1994), the need to develop a more holistic view of food intake became evident. Foods are biochemically complex and contain compounds that may interact with each other. By investigating not only nutrients but also foods and dietary quality, the complexity of dietary behaviours and interactions are taken into account. Diet quality involves the assessment of both the quality and the variety of the entire diet, allowing the examination of associations between whole foods, food groups and health status, rather than just nutrients. Diet quality is measured by scoring food patterns in terms of how closely they align with national dietary guidelines, as well as how diverse the variety of healthy choices is within the core food groups. Some of the scoring systems also allow both protective dietary patterns and unfavourable intakes to be identified (Thiele *et al.* 2004; Wirt & Collins, 2009).

There is a large body of evidence showing the role that diet, particularly the westernised diet, plays in the development of CAD (Van Horn *et al.* 2008). Evidence from prospective studies has shown that dietary patterns are associated with increased risk of CHD and that diets high in saturated fatty acids, cholesterol and animal fat increases low-density lipoprotein (LDL) cholesterol levels (Krauss *et al.* 2000). On the other hand, certain dietary patterns such as the Mediterranean diet have been shown to be protective against CVD (Menotti *et al.* 1999; Trichopoulou *et al.* 1994). Potential biomarkers for CVD, such as blood pressure, thrombogenicity and inflammation, have been identified, and the effect of dietary patterns on these markers is being researched extensively (Van Horn *et al.* 2008). At present, no data exist on the dietary intake in black South Africans with diagnosed CAD. Most of the data available regarding the role of diet in CVD examine risk factors in healthy volunteers.

The main aim of this thesis, therefore, will be to investigate the relationship between dietary intake and CVD risk in black South Africans within the context of urbanisation. This aim will be addressed by looking at two study populations. One is the Prospective Urban and Rural Epidemiological (PURE) study population, comprised of approximately 1000 rural and 1000 apparently healthy urban black South African volunteers, in which a comparison will be made between the rural and the urban community with regard to the association of dietary intake with CVD risk factors. The other population, in which the role of dietary intake in diagnosed CAD will be elucidated, comprises black urbanised South Africans with angiographically

defined CAD, from the Charlotte Maxeke Johannesburg Hospital and Chris Hani Baragwanath Hospital (Heart of Soweto Study). Dietary intakes will be investigated using not only nutrient analysis but also comparison of food groups. Additionally, this thesis will investigate the use of predefined diet quality scores in a non-Western population undergoing urbanisation (PURE).

The results of this study will help in identifying risk factors, with special emphasis on dietary habits that are important or that play a vital role in the development of CAD in the urbanised black population of South Africa. These results will enable current strategies aimed at prevention programmes to be re-evaluated to determine whether the appropriate risk factors are being addressed and emphasised. It should also help explain to what extent the increasing prevalence of CAD is related to the dietary habits of this population.

## **1.2. AIMS AND OBJECTIVES**

The main aim of this thesis is to determine the association between dietary intake and CVD risk in black South Africans in the context of urbanisation.

### **The objectives of this thesis are to:**

- Investigate the aetiology of CAD in black South Africans.
- Evaluate the dietary habits of rural and urban black South Africans by:
  - using nutrient and food group intakes as well as diet quality scores,
  - evaluating the use of predefined diet quality scores in a black African population in transition,
  - determining the role of diet in CVD risk in the context of urbanisation.
- Investigate the role of diet in diagnosed CAD patients in the context of urbanisation using nutrient and food group intakes.

### 1.3. STRUCTURE OF THESIS

This thesis is in article format. Following this introductory chapter, Chapter 2 gives an overview of the relevant literature, focusing on the following: the risk factors for CVD, assessment of CVD risk, the role of diet in CVD, and assessing dietary intake. This chapter provides additional background information necessary for the interpretation of the data from the articles in this thesis.

Chapter 3 is an article with the title: "Risk factor profile of coronary artery disease in black South Africans." This article was published in the *South African Heart Journal*, 2011: 8: 4-11. It addresses the risk factor profile and dietary intake of 40 angiographically defined CAD patients compared with that of 20 controls matched for age and body composition.

Chapter 4 is an article with the title: "The use of predefined Diet Quality Scores in the context of urbanisation in the South African PURE study". This article has been submitted for publication to *Public Health Nutrition*. It addresses the association between dietary intake and CVD risk by making use of two diet quality scores to assess dietary intake. The limitations of using currently available predefined diet quality scores in a population in a non-Western developing country are also addressed.

Chapter 5 is an article with the title: "The role of dietary patterns in coronary artery disease in urbanised black South Africans". This article has been submitted for publication to *Public Health Nutrition*. It addresses the role of dietary patterns in CAD patients compared with their role in an urbanised reference population at low risk for developing CVD. Dietary patterns are assessed by investigating nutrient and food group intake.

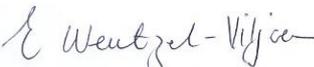
Chapter 6, the final chapter, provides a discussion of the results, drawing conclusions and making final recommendations regarding the research topic.

The relevant references of Chapters 3, 4 and 5 are provided at the end of each chapter according to the instructions given to authors by the specific journal in which the article will be or has been published. The references used in the unpublished Chapters 1, 2 and 6 are provided according to the mandatory style stipulated by the North-West University at the end of the thesis.

## 1.4. CONTRIBUTIONS OF THE AUTHORS TO THE ARTICLES PRESENTED IN THIS THESIS

The contributions of the researchers involved in the studies presented in this thesis are given in the following table.

**Table 1.1** List of members within the research team and their contributions to this study

Name and signature*	Affiliation	Role in the study
Mrs RC Dolman (PhD candidate) 	CEN within the School for Physiology, Nutrition and Consumer Science of the NWU	Collection of QFFQ and physical activity questionnaires of CAD patients and controls Responsible for literature reviews, statistical analysis, interpretation of data and writing up of publications and thesis
Prof. M. Pieters (Promoter) 	CEN within the School for Physiology, Nutrition and Consumer Science of the NWU	Supervisor of R. Dolman, assisted with data collection of the PURE study, statistical analysis, interpretation of results and co-authored Chapters 3, 4 and 5.
Prof. J.J. Jerling (Co-promoter) 	CEN within the School for Physiology, Nutrition and Consumer Science of the NWU	Co-Supervisor of R. Dolman, assisted with data collection of the PURE study, interpretation of results and co-authored Chapters 3, 4 and 5.
Prof. E. Wentzel Viljoen (Assistant-promoter) 	CEN within the School for Physiology, Nutrition and Consumer Science of the NWU	Co-Supervisor of R. Dolman, responsible for the collection, coding, analysis and cleaning of dietary intake data for the PURE-study, assisted with interpretation of results and co-authored Chapters 4 and 5.
Prof. F. Raal 	Carbohydrate and Lipid Metabolism Research Unit, University of the Witwatersrand	Planned (designed the study protocol) and coordinated data collection of the CAD case-control study and co-authored Chapters 3 and 5.
Dr. L. Ntyintyane 	Carbohydrate and Lipid Metabolism Research Unit, University of the Witwatersrand	Planned (designed the study protocol) and collected data for the CAD case-control study and co-authored Chapters 3 and 5.
Prof. K. Sliwa 	Director: Soweto Cardiovascular Research Unit, University of the Witwatersrand Director: Hatter Institute for Cardiovascular Research in Africa, University of Cape Town	Planned (designed the study protocol) for the Heart of Soweto study and co-authored Chapters 5.
Prof. A. Kruger 	AUTHeR within the Faculty of Health Science of the NWU	Planned (designed the study and approved the final protocol) and coordinated data collection of the PURE-study and co-authored Chapters 4 and 5.
Prof E. Feskens 	Division of Human Nutrition; Wageningen University; Wageningen; The Netherlands.	Assisted with statistical analysis, co-author of Chapter 4.
*With my signature I declare that I approved the above-mentioned articles, that my role in the study, as indicated above, is representative of my actual contribution and that I hereby give consent that it may be published as part of the PhD thesis of Mrs R. Dolman		

CEN: Centre of Excellence for Nutrition; NWU: North-West University; AUTHeR: Africa Unit for Transdisciplinary Health Research