BMI CHANGES, DIETARY INTAKE AND PHYSICAL ACTIVITY OF IMMIGRANTS IN THE USA: AN INVESTIGATION OF A SOUTH AFRICAN POPULATION IN THE GREATER ATLANTA AREA

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by

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DECLARATION OF AUTHENTICITY

I, the undersigned, hereby declare that the work contained in this thesis is my own original work and that I have not previously, in its entirety or in part submitted it at any university for a degree.

1 October 2004

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Ida Viljoen   Date

ABSTRACT

INTRODUCTION: The aim of this study was to investigate post-immigration BMI changes in a South African immigrant population and how dietary intake and habitual physical activity reflect these changes. The study was designed as a cross-sectional, observational survey. Thirty-six volunteers aged 20 - 50 years were included in the sample. Volunteers were South African immigrants in the Atlanta area, USA, who have lived in the USA for more than 6 months but less than 5 years.

METHOD: Subjects were required to complete four questionnaires including a self-administered socio-demographic, physical activity and food frequency questionnaire. The weight history questionnaire containing measurements including height, weight and waist circumference was completed by the investigator.

RESULTS: A significant increase in BMI was indicated for both male (p=0.036) and female (p=0.0009) subjects. The increase in BMI for two age categories, 20-29 years (p = 0.018) and 30-39 years (p = 0.006), was also significant. Forty five percent of females reported an energy intake above the Estimated Energy Requirement (EER) for active individuals. Reported saturated fatty acid intake (13% of TE) exceeded the Acceptable Macronutrient Distribution Range (AMDR). The prevalence of inadequate n-3 and n-6 PUFA as well as fibre intake was high, especially in men. Sixty four percent of the population had a 'low active' physical activity level (PAL).

CONCLUSION: The observed increase in post-immigration BMI implies that the South African immigrant population, similar to other immigrant populations, has adopted to some extent, the lifestyle and dietary habits of the general US population. As a result, the South African immigrant population may also be subject to increased chronic disease risk.

OPSOMMING

INLEIDING: Die doel van hierdie studie was om die veranderinge in liggaamsmassa index (LMI) wat met immigrasie gepaard gaan in 'n Suid-Afrikaanse immigrant populasie te ondersoek, asook hoe die populasie se dieet en fisieke aktiwiteit hierdie veranderinge reflekteer. Die studie was 'n dwarssnit, observasie opname. Die steekproef het bestaan uit 36 vrywilligers (20 - 50 jaar oud). Respondente was deel van 'n Suid-Afrikaanse immigrant populasie in die Atlanta area, VSA, wat vir langer as 6 maande en korter as 5 jaar in die VSA woonagtig was.

METODE: Respondente is versoek om vier vraelyste te voltooi insluitende 'n sosio-demografiese, fisieke aktiwiteit, -en voedsel frekwensie vraelys. Antropometriese metings, insluitende massa, lengte en middel omtrek is deur die navorser op die massa geskiedenis vraelys aangeteken.

RESULTATE: 'n Betekenisvolle toename in LMI vir beide mans (p=0.036) en vroue (p=0.0009) is gevind. Die toename in LMI vir respondente 20-29 jaar (p = 0.018) en 30-39 jaar (p = 0.006) was ook betekenisvol. Vyf-en-veertig persent vroue se energie inname was hoër as die aanbevole daaglikse inname vir aktiewe individue. Die populasie se versadigde vetsuur inname (13% van totale energie) was hoër as die aanvaarbare makronutriënt verspreiding. Die prevalensie vir onvoldoende innname van n-3 en n-6 poli-onversadigde vetsure, asook vesel inname was hoog, veral onder mans. Vier-en-sestig persent van die populasie se fisieke aktiwiteit vlak is geklassifiseer as 'lae aktiwiteit'.

GEVOLGTREKKING: Die waargenome toename in LMI impliseer dat die studie populasie, soortgelyk aan ander immigrant populasies, die lewensstyl en dieet gewoontes van die algemene Amerikaanse populasie tot 'n sekere mate aangeneem het en is dus ook onderhewig aan die gevolglike toename in risiko vir kroniese siekte van lewensstyl.

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ACKNOWLEDGEMENTS

LIST OF ABREVIATIONS

AI	Adequate Intake
AMDR	Acceptable Macronutrient Distribution Range
BMI	Body mass index
BRFSS	Behavioural Risk Factor Surveillance System
CDC	Centre for Disease Control and Prevention (USA)
DRI	Dietary Reference Intakes
EAR	Estimated Average Requirements
EER	Estimated Energy Requirements
FFQ	Food frequency questionnaire
MRC	Medical Research Council of South Africa
MUFA	Mono unsaturated fatty acids
n	Number, referring to sample size
NCHS	National Centre for Health Statistics
NCI	National Cancer Institute
NIH	National Institute of Health
NHANES	National Health and Nutrition Examination Survey
NHLBI	National Heart, Lung and Blood Institute
PUFA	Poly unsaturated fatty acids
RBW	Relative body weight
RDA	Recommended Daily Allowance
RMR	Resting metabolic rate
TEF	Thermic effect of food
$\underline{X}$	Mean
SD	Standard deviation
UL	Tolerable Upper Intake Level
USDA	United States Department of Agriculture

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CHAPTER 1

INTRODUCTION AND PROBLEM STATEMENT

1.1 DISEASE RISKS ALTERATION IN IMMIGRANT POPULATIONS

Each year, more than a million immigrants settle in the United States. Immigration usually accompanies environmental and lifestyle changes in accordance with the customs and habits of the new country of residence [1, 2]. Epidemiological studies have consistently documented this phenomenon. An example is Japanese immigrants in Hawaii who experienced a fifty percent decrease in stomach cancer risk and a three-fold increase in breast cancer risk after just one generation. Research further indicated that Japanese and Mexican immigrants living in the United States have higher rates of cardiovascular disease compared to those living in their home countries and that African Americans who have lived in the United States for several generations have a higher prevalence of hypertension compared to first generation immigrants [2].

Overweight and obesity is a major health issue that is of utmost importance in the alteration of disease risk in immigrant populations. Overweight and obesity have reached epidemic proportions in the United States and is threatening to become a global epidemic. According to the 1999-2000 National Health and Nutrition Examination Survey (NHANES), 64% of adults in the United States are either overweight (BMI$\geq$ 25kg/m²) or obese (BMI$\geq$30kg/m²) [3]. Although smoking is still the leading cause of mortality in the United States (18% of total deaths), poor diet and physical activity (400 000 deaths, 17% of all deaths) may soon surpass tobacco as the leading cause of death (Figure 1.1) [4,5].
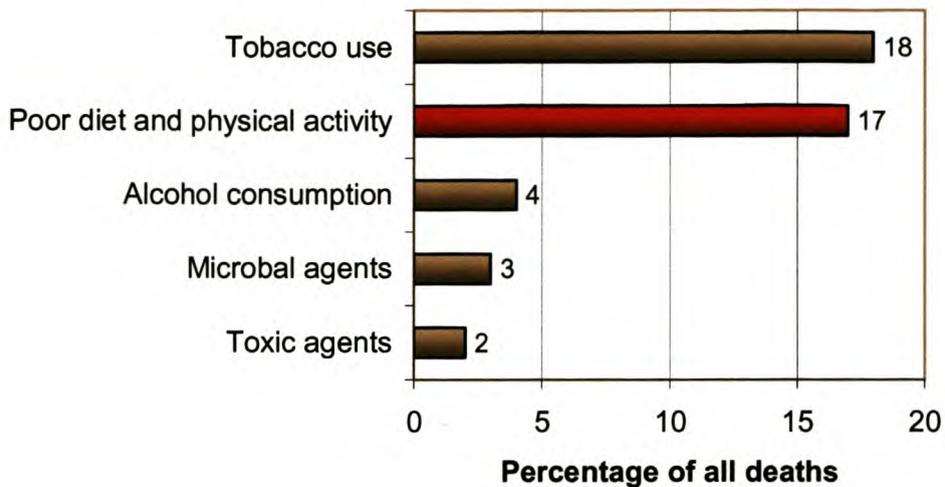
Figure 1.1

Top five actual causes of death as reported to the CDC in 2000

Data from McGinnis and Foege [6]

The U.S. Department of Health and Human Services estimated the direct and indirect cost of overweight and obesity at $122.9 billion in 2002 [7]. Overweight and obesity are associated with increased risk of many chronic diseases including type 2 diabetes, heart disease, stroke, hypertension, osteoarthritis and sleep apnoea [8].

A research study that appeared in the Canadian Journal on public health indicated that the prevalence of excess weight (BMI>25 kg/m²) increased with length of time since immigration for both male and female. Similar trends were evident in an Asian immigrant population in the USA [9, 10]. Another study investigated the influence of the extent of westernisation on a Japanese immigrant population. The study indicated that increased consumption of animal fat and simple carbohydrates is positively associated with extent of westernisation (second and third generation), while the opposite is true for strenuous physical activity. Waist-hip ratio, fasting insulin levels, serum cholesterol and triglyceride levels and prevalence of hypertension also increased with increased westernisation.

These data provide a convincing argument that environmental factors such as change in diet and exercise patterns influence chronic disease risk [11].

1.2 SOUTH AFRICAN IMMIGRANTS IN THE USA

Although exact numbers for South Africans immigrating elsewhere aren't available, there a re i ndications of increased immigration. D ocumented immigrations i n 2 003 were almost 50% more than in 2002 [12]. Nevertheless, South African citizens are part of the rapid growing immigrant population in the United States. As mentioned earlier, several research studies indicated that the chronic disease risk of immigrant populations resembles the chronic disease risks of the general American population and is in general higher than in their country of origin. Immigrant populations in particular are at increased risk for overweight and obesity. This is especially true for immigrant populations whose home country has a lower prevalence of overweight and obesity [10].

According to the 1998 South African Demographic and Health Survey, conducted by the M edical R esearch C ouncil o f S outh A frica (MRC), 2 9% m en and 5 5% w omen were either overweight or obese, 9% men and 29% women were obese [13].
According to the 1999-2000 NHANES data, 67% men and 62% women were either overweight or obese, while 28% men and 34% women were obese (Table 1.1) [3].

Table 1.1:

Comparison of overweight and obesity rates in South Africa and the United States of America

	South Africa 1998-MRC-Health and Demographic Survey [13]	United States of America 1999-2000 NHANES [3]
Overweight	29% (M) 55% (F)	67% (M) 62% (F)
Obesity	9% (M) 29% (F)	28% (M) 34% (F)

These statistics clearly indicate a difference in overweight and obesity rates in US- and South African populations. Taking existing evidence into consideration, South African immigrant populations, similar to other immigrant populations, have an increased risk for weight gain and attendant long-term adverse health outcomes.

1.3 DETERMINANTS OF OBESITY

Factors contributing to obesity, can on the most basic level, be divided into two categories: The first category involves factors relating to the genetic make-up of a human being (internal factors) and the second category relates to the environment in which we function as human beings (environmental factors) (Figure 1.2).

Research advances have stressed the importance of genetic make-up in an individual's susceptibility to obesity, but landmark discoveries of leptin, uncoupling proteins a nd n euro-peptides involved in body weight regulation, cannot sufficiently explain the obesity epidemic. Although humans have evolved excellent physiological mechanisms to defend against body weight loss, they have only weak physiological mechanisms to defend against body weight gain with excess energy consumption [4].

Genes may protect some individuals from becoming obese and contribute to differences in the extent to which obesity occurs, but environmental factors may be overwhelming our genetic defences against obesity [14].

It seems that the culprit is an environment that promotes obesogenic behaviour. Unhealthy diets and sedentary behaviours have been identified as the primary causes of death attributable to overweight and obesity [15]. Our current environment is characterized by an essentially unlimited supply of convenient, relatively inexpensive, highly palatable, energy-dense foods, coupled with low physical activity levels [16].
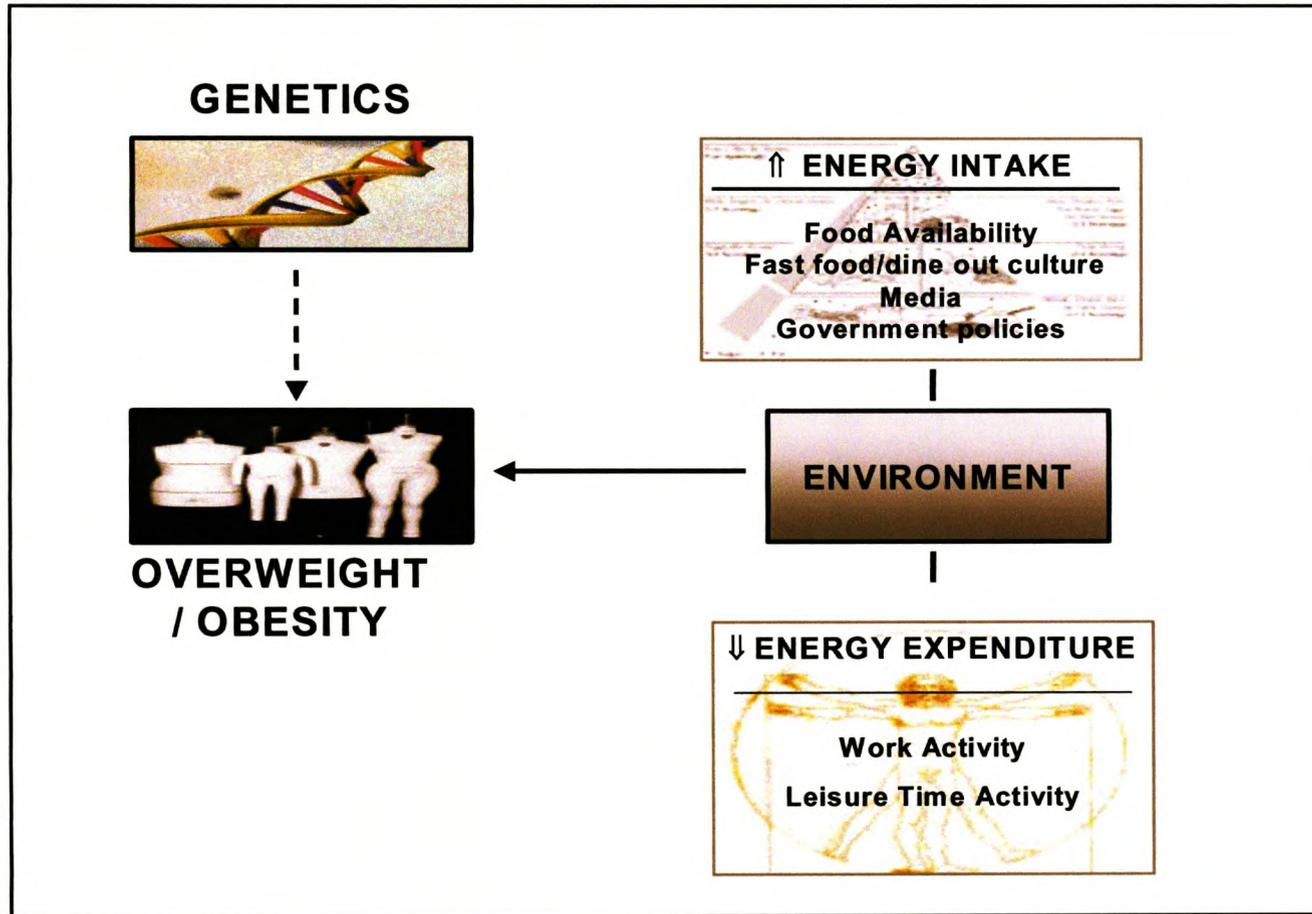
Figure 1.2
Diagrammatical representation of the determinants of overweight and obesity

1.3.1 Environmental factors promoting energy intake

Food availability

A variety of highly palatable, relatively inexpensive food is abundantly available [4]. The per capita energy availability estimates from the U.S. Department of Agriculture (USDA), U.S. Food Supply Series, indicate that energy availability increased by 15% between 1970 and 1994. Consistent with the trends in overweight, most of the ecologic data reviewed suggest that energy intake has increased over the past several decades and is likely a major contributor to increases in average body weight [17, 18].

Increasing portion sizes

There's a growing trend in the US towards larger portion sizes. This is especially evident in highly competitive fast food chains, where 'super sizing' of menu items is commonplace [4]. Market place portion sizes have increased in size and now exceed federal standards. Portion sizes began to increase in the 1970's, rose sharply in the 1980's, and have continued in parallel with increasing body weights [19]. This trend can be attributed to multiple causes, some of them economic. Since the 1970's, the food service industry has become larger, and people have been eating out more; marketing has become more concentrated, and larger numbers of new products have been introduced. From a marketing point of view, oversized packages draw attention to a new product, as research has shown for beer, soft drinks, and fast food. Concern about value also drives the food service industry to offer larger products; many restaurant owners report that customers want more for their money, and customers increasingly choose restaurants on the size of their food portions. In the mid-1950's, McDonalds offered only one size french fries; that size is now considered 'small' and was one third the weight of the largest size available in 2001. In 2001, the 'large' weighs the same as the 1998 'super size' and the 2001 'super size' weighs nearly one-ounce (30 g) more [19, 20].

Fast food/ dining out culture

During the past 20 years (1977-78 - 1994-96), the consumption of food prepared away from home increased from 18% to 32% of total calories. Meals and snacks based on food prepared away from home are generally more energy dense and thus contain more calories per eating occasion. Food eaten away from home was also higher in total fat and saturated fat on a per-calorie basis than food prepared at home. Food eaten away from home also contained less dietary fibre, calcium, and iron [18, 21]. Apart from the American dining out culture, people also rely more heavily on convenience/processed foods, which are generally higher in fat, refined carbohydrates and sodium [16].

Media

The general American population spend a lot of time watching television, a behaviour that is worth mentioning as a contributing factor to weight gain. Television is a powerful source of information, and may have an influence on food choices. The food industry spends around $33 billion a year on advertising [22]. Analyses of commercials during one week of prime-time top-rated network shows indicated that nearly one quarter of the prime time is used for commercials. One third of the commercials shown during this time contain nutrition related information. The analysis further indicates that approximately half of the nutrition related information was misleading or inaccurate [23]. In addition to the promotion of poor eating habits, watching television also contributes to a sedentary lifestyle.

Government policies

An interesting and controversial viewpoint is that government policies are partially responsible for an environment that contributes to increased overweight and obesity in the US. A special news report, titled *'who's to blame? Obesity in America: How to get fat without really trying'* that aired on national television in December 2003 addressed this issue. The reports showcased the contradicting opinions of parties involved as well as some interesting facts about government funding that support and promote less healthy eating habits.

The US government has been subsidizing farmers ever since the depression of the 1930's to save them from financial ruin. In 2003 the government spent roughly $20 billion on agriculture. The issue is not spending billions on agriculture though, but weather dietary guidelines and nutritional concerns are reflected in fund allocation. Although there are no known studies available analysing the impact of agriculture subsidies on population health, the following facts are available:

American farmers produce nearly twice as much food needed for domestic consumption. According to data from the Department of Agricultural and the Environmental Working Group, subsidies allocated for fat and oil production, are twenty fold the funds allocated for fruit and vegetables. As a result of the overproduction of raw materials (corn oil and high fructose corn syrup) the processed food industry is stimulated, causing the market to overflow with new high calorie, high fat products. According to the report, more than 2,800 new candies, desserts, ice creams and snacks were introduced to the market in 2002, compared to 230 new fruit and vegetable products [22].

In summary, above-mentioned factors contribute to an environment promoting increased energy intake, and especially increased fat intake. The annual per capita availability of fats and oils increased by 22% between 1970 and 1995, where cooking oil, used for deep frying in fast food restaurants and other away-from-home eating establishments, contributes largely to this increase [16]. Most North Americans rely on a diet that derives a higher proportion of its energy from fat than recommended (37% - 40% vs. <30%) [24]. Thus, the amount of dietary fat largely contributes to the phenomena of weight gain in a population.

1.3.2 Environmental impact on physical activity

Daily energy expenditure consists of three components namely resting metabolic rate (RMR), the thermic effect of food (TEF), and the energy expended in physical activity. A substantial inter-individual variation in RMR, and inter-as well as intra-individual variations exist in TEF, but no evidence exists that either a low RMR or a low TEF are major contributors in the aetiology of human obesity.

In contrast, there are substantial data to suggest that physical inactivity is associated with obesity and increased chronic disease risk and premature mortality [25].

For the purpose of this study, two physical activity categories were considered: physical activity in the work setting and leisure-time physical activity [8, 26, 27, 28].

Work/occupational related physical activity

All evidence point to decreasing levels of work/occupation related physical activity. Data available from a study in Finland reported a decline in work-related physical activity by 225kJ/day between 1982 and 1992. Similarly, there is reason to believe that household related physical activities has declined rapidly over the past two to three decades considering the proliferation of energy-saving devices such as washing machines, dishwashers, computers, remote control devices, and microwave ovens. The increased use of prepared foods also effect the daily energy expenditure [14].

Leisure time physical activity

Data from the 1988-2002 Behavioural Risk Factor Surveillance System (BRFSS) indicated a decrease in leisure time physical activity levels especially after 1996. The report also indicated that women, older adults, and the majority of racial/ethnic minority populations have the greatest prevalence of leisure-time physical inactivity [25].

1.4 STUDY AIM AND SCOPE

The aim of this study was to examine post-immigration changes in BMI of a South African immigrant population and how dietary intake and physical activity reflect these changes. This research was limited to South African immigrants residing in the Atlanta area and who have lived in the USA for more that 6 months, but less than 5 years.

1.5 SIGNIFICANCE OF THE STUDY

Overweight and Obesity have reached epidemic proportions in the United States. This phenomenon represents a serious threat to health because of the increased risk of developing many chronic diseases [29].

The US immigration population is also growing dramatically, making the health status of racial/ethnic minorities an increasingly important public health issue. Immigration to the US is usually accompanied by environmental and lifestyle changes that coincide with markedly increased chronic disease risk of the general American population.

Existing studies on immigrant populations focused on the impact of immigration on nutritional status and dietary behaviour of immigrants from Asian, Indian and Hispanic decent [9, 30, 31, 32]. These populations typically followed a more active lifestyle and diet lower in fat and refined carbohydrates, and higher in fibre, fruits and vegetables in their country of origin [1] - considerably different from the dietary behaviour and lifestyle of the majority of the general US population.

To date no information is available on the influence of immigration on the nutritional status, dietary behaviour and physical activity of South African immigrants in the United States.

Knowledge regarding weight changes in the South African immigrant population and the contribution of environmental factors can be used to empower South Africans and other immigrant populations to make sensible food choices and lifestyle changes, which in turn will have an impact on the healthcare cost to the individual and, in the long term, contribute to saving billions in government healthcare costs.

This knowledge can also be applied to the existing weight problem in the general American and populations the world over.

CHAPTER 2

METHODOLOGY

2.1 STUDY DESIGN AND ETHICS

2.1.1 Study design

The Study was designed as a cross sectional, descriptive, observational survey. A quantitative approach was followed, with provision for qualitative responses from respondents. Study techniques used for data collection included questionnaires as well as objective anthropometric measurements.

2.1.2 Ethics

A Research protocol for this study was submitted to and approved by the Committee for Human Research of the Health Sciences Faculty of the University of Stellenbosch, Tygerberg, South Africa (Ref No 2003/066/N). After explanation of the purpose of the study as well as the procedures to be followed during the data collection session, subjects signed an informed consent form (Appendix 2). Subject confidentiality was ensured throughout the research process.

2.1.3 Recruitment and sample selection

An overview of the research methodology is indicated in Figure 2.1. The population of interest for this study was South African immigrants living in the Atlanta area. The population qualified for this study included South African immigrants aged 20 - 50 years, and who had been living in the US for more than 6 months, but less than 5 years. The participants were also willing to answer interviewer-administered questionnaires, and to undergo anthropometric measurements including weight, height and waist circumference. At the time of the study no official database existed

for the South African population in the Atlanta area. In order to recruit subjects for the study, the following methods were followed:

Since the Internet is widely used and a fast and effective communication medium, information regarding the study was published on key websites used by South African expatriates. Information published on the websites included a proposed title for the study, an indication of what was expected of the subjects and the investigator's contact details (Appendix 1). The following websites were used:

http://www.rsa-oversears.com

http://www.sa-usa.com

http://www.toyboxco.com

South African interest organizations in Atlanta were also notified of the project. The organizations include:

- South African grocery store in Atlanta
- South African Club in Atlanta (http://saclubatl.org)

A period of three months (January to March 2003) was allowed for response from subjects. A total of 52 subjects responded to the invitation to participate in the study. Thirty-six of the volunteers (16 male and 20 female) met the inclusion criteria and were included in the study sample.

DATA ANALYSIS (Dec 2003)
- Socio-demographic data
- Weight history data
- Physical activity data
- Food frequency data

FFQ ANALYSIS (Aug 2003)
Scanning, editing and analysis of questionnaires

DATA COLLECTION (May-Jul 2003)
- Socio-demographic data
- Weight history data (1999-2000 NHANES Weigh history questionnaire)
- Physical activity data (Baecke habitual physical activity questionnaire)
- Food frequency data (88 GP FFQ - Harvard Medical School)

SAMPLE SELECTION, EXCLUSIONS
n=36

RECRUITMENT (Jan-March 2003)
n=52

Progress

Jan '03   Feb   Mar   Apr   May   Jun   Jul   Aug   Sep   Oct   Nov   Dec '03

Figure 2.1
Flow diagram of research study

2.2 DATA COLLECTION AND ANALYSES

Following recruitment, data collection took place between May and July 2003 (Figure 2.1). The investigator contacted each subject via telephone or email to confirm interest in participating in the study and to further explain the purpose and nature of the study. During this first contact an appointment was schedule for a data collection session at the participant's convenience.

During the data collection session subjects were given the opportunity to ask questions. All subjects signed an informed consent form (Appendix 2). A study specific, adapted version of the standard informed consent form provided by the Faculty of Health Sciences of the University of Stellenbosch was used.

Participants were required to complete a total of four questionnaires. The socio-demographic-, habitual physical activity- and food frequency questionnaires were self-administered. The investigator administered the weight history questionnaire for all subjects. Completion of the questionnaires took approximately 45 minutes. After completion of the questionnaires, weight, height and waist circumference were measured by the investigator and recorded on the weight history questionnaire.

2.2.1 Socio-demographic questionnaire

The socio-demographic questionnaire collected basic socio-demographic information. Information collected include date of birth, date of arrival in the US, age, gender, race, marital status and highest level of education (Appendix 3). The three age categories specified include the following age groups 20 - 29 years, 30 - 39 years and 40 - 50 years.

2.2.2 Weight history questionnaire

The weight history questionnaire (WHQ), used in the 1999-2000 NHANES, was adapted for this study and used to measure post-immigration BMI changes in the study population (Appendix 4).

The NHANES is a survey conducted by the National Centre for Health Statistics (NCHS), Centres for Disease Control and Prevention (CDC). This survey has been designed to collect information about the health and diet of people in the US. The WHQ provides data on several questions related to bodyweight. Data collected includes information on past and current weight, self-perception of weight, desire for weight change and intentional weight change and weight loss/maintenance methods. The original WHQ was adapted for the purpose of this study. Changes to the original WHQ questionnaire include the following:

The last seven questions of the questionnaire did not apply to this study, and were excluded form the questionnaire. The second change involved the wording of a question collecting information on the weight of the subject in the past. The question was changed from 'How much did you weigh *a year ago*' to 'How much did you weigh *on arrival in the USA*'. The post-immigration weight and height was objectively measured and not self-reported as in the original questionnaire. In addition to objectively measured weight and height, waist circumference was also recorded on this questionnaire, this was the last modification made to this questionnaire. The changes introduced in the questionnaire were considered to be of minor significance and hence the questionnaire was accepted as being validated.

The difference between objectively measured post-immigration weight and self-reported weight on arrival in the USA was used to determine weight changes in subjects. Positive values indicated weight gain, and negative values indicated weight loss. Weight gain was quantified in three categories: Less than 5kg, 5-10 kg and > 10 kg. The National Institute of health (NIH) BMI classification was used [33]. The classification system distinguishes between three levels of obesity (Class I-III). For the purpose of this study all subjects with a BMI > 30kg/m² were classified as obese, no differentiations were made for different classes of obesity.

Table 2.1 BMI Classification	
Classification	**BMI (kg/m²)**
Underweight	<18.5
Normal	18.5 – 24.9
Overweight	25-29.9
Obese	>30
Data from the Department of Health and Human Services, National Institute of Health (NIH) [33]	

2.2.3 Habitual physical activity questionnaire

The Baecke questionnaire of habitual physical activity was used to collect physical activity data (Appendix 6). This questionnaire has been validated in several investigations and has been shown to be an easily administered and accurate instrument [28]. In Validation studies the Baecke questionnaire showed the highest correlation coefficient with physical activity level (PAL) as measured with doubly labelled water as the criterion [34] [35].

The questionnaire included 16 questions covering three components of physical activity: physical activity at work, sports during leisure time, and physical activity during leisure time excluding sport [28].

Most questions were scored on a 5-point Likert scale, with descriptions ranging from 'never' or 'sometimes' to 'very often'. Three additional questions required reporting the type of sporting activity and both the number of hours per week and the number of months per year in which the responded participated in that activity. The scoring of the questionnaire included specific scoring criteria for each of the three sections: work, sport, and leisure indices. Each section could receive a minimum score of 5 points with a maximum of 15 points for the total activity index [28]. The physical activity index scores, that resulted from the questionnaire, could be used to derive rankings of individuals by physical activity.

In order to evaluate the population's physical activity levels (PAL), the physical activity scores were converted to a PAL as previously described by Saris et al [36] and

is indicated in Table 2.2. Four PAL categories are specified, ranging from *'sedentary'* to *'very active'* (Table 2.3) [37].

Table 2.2

Conversion table for physical activity levels

Non-occupational Activity Level	Occupational Activity Level					
	Light		Moderate		Heavy	
	Male	Female	Male	Female	Male	Female
Non-Active	1.4	1.4	1.6	1.5	1.7	1.5
Moderately Active	1.5	1.5	1.7	1.6	1.8	1.6

Data from Saris et al.[36]

Physical activity indices were converted to PAL between 1.4 and 1.8 using the conversion table (Table 2.3) [36].

Table 2.3

Physical activity level categories

Sedentary	PAL*≥ 1.0 -< 1.4
Low active	PAL ≥ 1.4 - < 1.6
Active	PAL ≥ 1.6 - < 1.9
Very active	PAL ≥ 1.9 - <2.5

Data from NICUS [37]

* PAL = Physical Activity Level

According to the PAL conversion table (Table 2.3), **occupational activity** could be rated as light, moderate or heavy. The occupational activity level comprised of the work index obtained from the habitual physical activity questionnaire. A work index of 0-2 was classified as light, >2-3 as moderate and >3-5 as heavy (Table2.4).

Table 2.4	
Conversion of work index to occupational activity level	
Work Index	**Occupational Activity Level**
0-2	Light
>2-3	Moderate
>3-5	High

According to the PAL conversion table (Table 2.3), **non-occupational activity** level could be rated as non-active or moderately active [36]. Non-occupational activity level comprised of the sum of sport and leisure indices obtained from the physical activity questionnaire. A sum of less than five was classified as non-active and a sum of five or more was classified as moderately active (Table2.5).

Table 2.5	
Conversion of leisure and sport indices to non-occupational activity level	
Leisure + Sport Index	**Non-occupational activity level**
</=5	Non-active
5-10	Moderately active

2.2.4 Food frequency questionnaire

A modification of the Willet FFQ was used to collect information on dietary intake (Appendix 7) [38]. Three versions of the semi-quantitative FFQ have been developed at Harvard University and are available for research purposes. The questionnaire has originally been created to be used as a self-administered, mailed questionnaire. Reproducibility and validity of the questionnaires have been examined on a continuous basis by comparing its estimates with those of diet records or multiple 24-hour recalls and with relevant biochemical indicators of nutrient intakes. Such Studies have been conducted among adults of all ages and both sexes, and among a variety of socio-economic groups. The results of the validation studies have indicated that the method is remarkably robust; similarly valid results have been obtained from virtually all groups that have been studied [39, 40, 41, 42].

The following three versions of the FFQ are available:
 -88GP (used in this study, appendix 7)
-80 Out
-97 GP
The main difference is the length of the questionnaires. The three questionnaires are compared in Table 2.6.

Table 2.6

Comparison of three versions of the Harvard food frequency questionnaire

Properties	80 GP	88GP	97GP
Length	3 pages 61 Foods	4 pages 126 Foods	20 pages 138 Foods
Cost (Including coding and analyses)	$5/questionnaire	$5/questionnaire	$13/questionnaire
Advantages		• Includes an *'other food'* open ended section • Good range of food choices	• Broadest range of food choices • Includes low fat and non fat food items • Larger print for visually impaired
Limitations	• Does not have an *'other food'* open ended section • Limited range of food choices compared to 88GP and 97GP		• The questionnaire is long • Expensive

Data from Harvard School of Public Health, Department of Human Nutrition [39]

The scannable questionnaires were obtained from Channing Laboratories, Department of Medicine, Birmingham and Women's Hospital/Harvard Medical School. Respondents were asked to fill out the food frequency questionnaires together with the socio-demographic, weight history and habitual physical activity questionnaires. After completion, the FFQ were returned to Harvard for scanning, editing and analysis.

The four-page questionnaire queried 126 foods. For each food, a commonly used unit or portion size was specified, and participants were asked to indicate for each food how often, on average, they had consumed the amount specified during the past year. Nine responses were possible, ranging from *'never or less than once a month'* to *'six or more times per day'*. The questionnaire include a number of open-ended questions to assess the consumption of certain nutrients by asking such questions as the type of margarine used, the form of fat used for baking and frying, the brands and types of cooking oils and the cold breakfast cereals consumed and vitamin supplementation used [39]. It also included an open-ended section for foods not listed in the questionnaire. Values for the nutrient amounts in foods were obtained from the Harvard University food composition database, derived from the USDA resources [38, 39, 43]. The cereal, margarine and vitamin databases are updated every four years. USDA data is uploaded annually into the database for foods and oils. Nutrient intakes are computed by assigning a daily frequency weight [39].

This study focussed on increase in population BMI and the consequential increased chronic disease risk, therefore analyses for nutrients that may have an impact on chronic disease risk when over -or under consumed were included in this study (Table 2.7).

Table 2.7

Nutrient analyses included for this study

Nutrients	Relevance to chronic disease risk
Macronutrients	
Total energy intake	
Carbohydrates	Macronutrients, particularly fat and carbohydrate are known to play a role in the risk of chronic diseases. Chronic over -and under consumption of these macronutrients is associated with risk of coronary heart disease, diabetes, cancer and obesity [37].
• *Sucrose*	
• *Fibre*	
Protein	
Fat	
• *SFA*	
• *PUFA (n-6 and n-3)*	
• *MUFA*	
Micronutrients	
Vitamin A	Adequate anti-oxidant intakes decrease cancer risk. The cancers for which there is evidence of a protective effect include those of the lung, colon and rectum, breast, oral cavity, oesophagus, stomach, pancreas, uterine cervix, and ovary [44].
Vitamin C	
Vitamin E	
Selenium	
Vitamin B6 and Folate	High homocysteine plasma concentrations increases risk of arteriosclerosis, and circulating concentrations of homocysteine are related to levels of folate and Vitamin B6. Lower levels of folate and vitamin B6 thus confer an increased risk of arteriosclerosis [45].
Calcium, phosphorus, Magnesium, Vitamin D	The prolonged deficiency or excess of one or combination of several may increase risk of osteoporosis [46]. Adequate calcium intake may also protect against colon cancer [44].
Iron	Iron deficiency anaemia is a concern with inadequate iron intake. Iron deficiency impairs physical work capacity in men and women by up to 30% [47]. There may be a relationship between coronary heart disease and high serum ferritin levels [37].

The Dietary Reference Intakes (DRI) [37] used to evaluate nutrient intake are indicated in Table 2.8. The Acceptable Macronutrient Distribution Range (AMDR) was used to evaluate macronutrient distribution. Total energy intake was compared to the DRI for energy by active individuals [37], as well as to the mean energy intake for men and women recorded in the 1999-2000 NHANES [15]. The Estimated Average Requirement (EAR) and adequate intake (AI) levels were used for the evaluation of micronutrient intake [37].

Table 2.8	
Nutrients and Dietary Reference Intakes used for evaluation	
Total energy intake	
	-EER [a] for active individuals [35]
	-1999-2000 NHANES [b] data [15]
Macronutrient distribution	AMDR [c]
-Protein, carbohydrate, fat	
Macronutrient intake	AI [d]
Carbohydrates	
-Fibre	
Fat	
-Saturated, MUFA, Omega-6 PUFA, Omega-6 PUFA	
Micronutrient intake	
-Vitamin A, Vitamin C, Vitamin E, Selenium, Vitamin B6, Folate, Phosphorus, Magnesium, Iron, Zinc	EAR [e]
-Calcium and Vitamin D	AI [d]

Data from NICUS [37]
[a] EER = Estimated Energy Requirements
[b] NHANES = National Health and Nutrition Examination Survey
[c] AMDR = Acceptable Macronutrient Distribution Range
[d] AI = Adequate Intake
[e] EAR = Estimated Average Requirements

2.2.5 Anthropometry

A registered dietician performed all anthropometric measurements by using standardized equipment and techniques. All measurements were performed twice, the average recorded and the process repeated in the case of discrepancies. Height, weight and waist circumferences were measured.

Weight was measured to the nearest 0,1 kg using a standardized electronic scale (Taylor 5550, Taylor precision products, China) and height was measured to the nearest 0.1cm using a portable stadiometer (SECA 208; Vogel and Halk, Hamburg, Germany). Subjects were weighed and measured without shoes and in one light layer of clothing. All measurements were taken between 18h00 and 21h00 to control for circadian variation. Height measurements were done with the subject standing with feet together, upright and the head placed in the Frankfort plane. The scale was regularly controlled for zero reading between measurements.

Waist circumferences were measured to the nearest 0,1cm with a tape measure pulled firm over light clothing, but not causing indentation. Waist circumference was measured at the smallest area below the rib cage and above the umbilicus after a normal expiration by the subject and without indenting the skin [48].

2.3 STATISTICS

Socio-demographic, weight history and physical activity data was captured electronically with Microsoft Excel and controlled for precision of data transfer with regular cross-referencing. Food frequency questionnaires were scanned, coded and prepared for analyses by Channing Laborotaries, Harvard University. Analysed data was returned to the investigator in Microsoft Excel format for further analyses. Means and standard Deviations (SD) were calculated for all parameters. The Wilcoxen signed –rank test and Kruskal Wallis test were performed using STATISTICA analysis software (Version 6, Statsoft, Tulsa, OK, USA).

The Wilcoxon signed-rank test was used to compare BMI on arrival in the US and post-immigration BMI. The Kruskal-Wallis test was used to compare parameters between BMI -and age categories. The level of significance was set at $p < 0.05$ and applied to all tests.

CHAPTER 3
RESULTS

3.1 SAMPLE CHARACTERISTICS

3.1.1 Socio-demographic

The sample included 16 male and 20 female subjects. All subjects included in the sample were Caucasian. Three age categories were distinguished. Seven (20%) subjects were aged 20 – 29 years, 17 (47%) were between 30 - 39 years and 12 (33%) were between 40 - 50 years. Three categories were established for length of time since immigration. Seven (19.4%) subjects had been in the US 0 - 2 years, 21 (58.3%) for 2 - 4 years and 8 (22.2%) for 4 - 5 years. Eighty three percent of the subjects were married. Seventeen (47%) of the sample population had a post graduate education, 8 (22%) had a tertiary education and 11 (34%) a high school education (Table 3.1).

Table 3.1		
Socio-demographic characteristics of the sample population (n=36)		
Demographic Factor	**Number of subjects**	**Percentage (%)**
Gender		
Male	16	44
Female	20	56
Age		
20-29	7	20
30-39	17	47
40-50	12	33
Length of stay in USA		
0-2 years	7	20
2-4 years	21	58
> 4 years	8	22
Marital Status		
Never Married	4	11
Married	30	83
Separated/Divorced	1	3
Widowed	1	3
Education level (highest)		
High school	11	31
Tertiary Education	8	22
Post Graduate Education	17	47

3.1.2 Anthropometry

In describing the findings of this study, *post-immigration* weight or BMI is defined as the objectively measured weight or BMI of subjects after a period of immigration (6 months to 5 years after arrival in the US), whereas *on arrival* weight or BMI is defined as the self-reported weight or BMI on arrival in the US.

Three anthropometric indicators (height, weight and waist circumference) were used to describe the sample population's post-immigration anthropometry. Twelve subjects (33%) were classified as overweight (BMI>25kg/m²) and 8 (22%) as obese (BMI>30kg/m²).

To assess abdominal fat content, an independent indicator of risk factors and ailments associated with obesity, the waist action level 2 values were used to evaluate the population waist circumferences. Waist circumferences equal or above 102 cm for men and equal or above 88cm for women are considered waist action level 2 (high risk people that should reduce their weight) [49]. The mean waist circumference for males was 94cm, 19% had a waist circumference equal or above 102cm. Female subjects had a mean waist circumference of 82.4 cm, 20% had a waist circumference equal or above the 88cm.

3.2 POST-IMMIGRATION WEIGHT CHANGES IN SAMPLE POPULATION

3.2.1 BMI on arrival vs. post-immigration BMI

The Wilcoxon signed rank test was used to compare BMI on arrival and post-immigration BMI. The populations post-immigration BMI (26.6 kg/m²) was significantly higher (p=0.0002) than BMI on arrival (25.2 kg/m²). The difference in BMI on arrival and post-immigration BMI was significant for both male (p=0.036) and female (p=0.0009) subjects (Figure 3.1). Male BMI on arrival (28.3 kg/m²) in the US was significantly higher (p = 0.003) than female BMI on arrival (22.6 kg/m²)
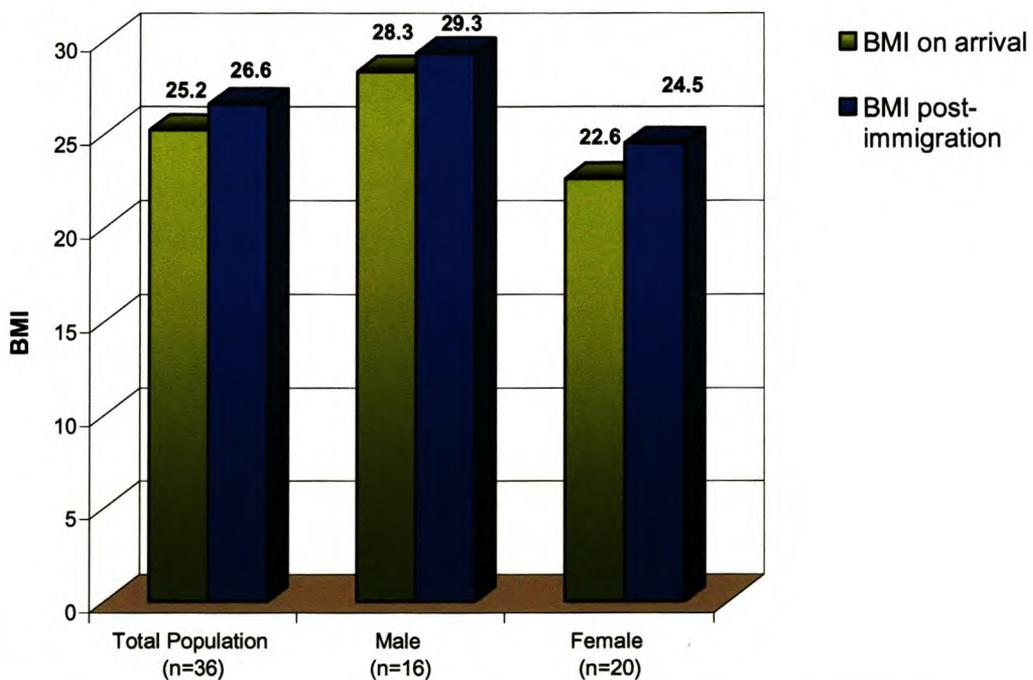
Figure 3.1

Post-immigration BMI increase for total population and gender

BMI increase significant for total population (p<0.01)

BMI increase significant for males (p<0.05)

BMI increase significant for females (p<0.01)

Male BMI on arrival significant higher than female BMI on arrival (p<0.01)

Post-immigration BMI increase for three age categories is indicated in Figure 3.2. Subjects aged 20 - 29 years (n=7) had a mean BMI of 25.5 kg/m² compared to 22.4 kg/m² on arrival. Subjects aged 30 - 39 years (n=17) had a mean BMI of 26.5 kg/m² compared to 25.1 kg/m² on arrival and subjects aged 40 - 50 years (n=12) had a mean BMI of 27.4 kg/m² compare to 26.8 kg/m² on arrival. The increase in BMI was significant for subjects aged 20 - 29 years (p=0.018) and 30 - 39 years (p=0.006), but not for subjects aged 40-50 years (p=0.52). The difference in BMI on arrival in the US for the three age categories was not significant (p=0.14).

The effect of length of stay in the USA on BMI increase was also considered. Three categories for length of stay in the USA were indicated: 6months-2years, 2-4years and 4-5years. There was not a significant difference (p=0.789) in post-immigration BMI increase for the three time frame categories indicated.
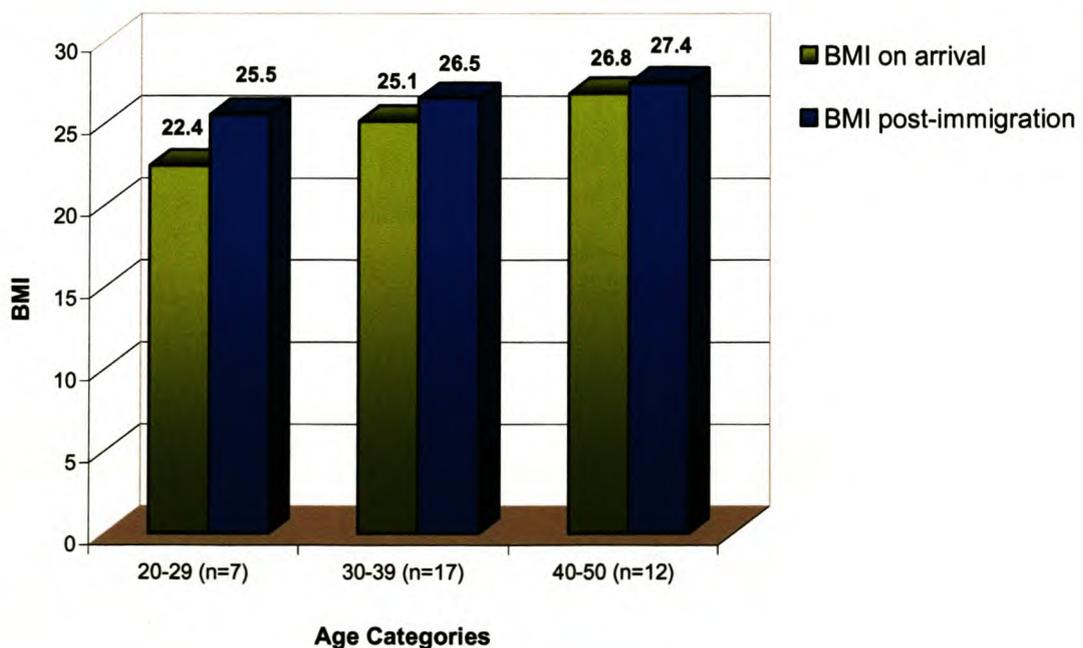
Figure 3.2

Post-immigration BMI increase for three age categories

BMI increase significant for subjects 20-29 (p<0.05)

BMI increase significant for subjects 30-39 (p<0.01)

BMI increase for subjects 40-50 NS

Difference in BMI on arrival for three age categories NS

3.2.2 Prevalence of overweight and obesity

The prevalence of overweight and obesity for the general South African population, US population and for the study population on arrival and post-immigration is compared in Figure 3.3. The prevalence of overweight and obesity in South Africa (1998-MCR-Health and Demographic Survey) [13] is 46%, compared to 64% for the USA (1999-2000 NHANES) [3]. The prevalence of overweight and obesity for the sample population **on arrival** in the US was 36% and increased to 56% **post-immigration**.
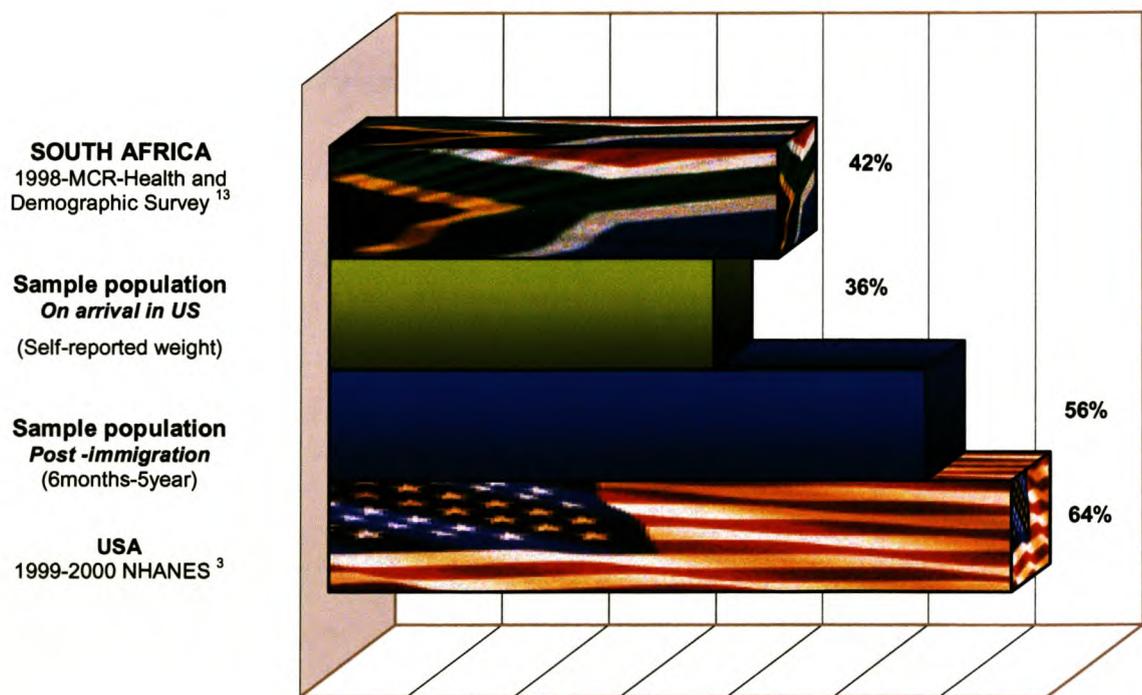
Figure 3.3

The increase in prevalence of post-immigration overweight and obesity in the study population, compared to the prevalence of overweight and obesity in the South African and US populations

3.2.3 BMI classification on arrival in the US vs. post-immigration

BMI distribution for total population on arrival in the US and post-immigration is indicated in Figure 3.4. On arrival in the USA, 4 (11%) of the subjects were classified as underweight (BMI<18.5 kg/m²), 19 (52.8%) were in the normal range (BMI=18.5-24.9 kg/m²), 7 (19.4%) were classified as overweight (BMI=25-29.9 kg/m²), and 6 (17.7%) were classified as obese (BMI>30 kg/m²). According to post-immigration BMI values, 1 (2.8%) subject was classified as underweight, 15(41.7%) in the normal range, 12 (33.3%) as overweight and 8 (22%) as obese. BMI distribution for male and female subjects on arrival in the USA, and post-immigration is indicated in Figure 3.5. On arrival in the USA 6 (38%) male subjects were within the normal range, 5 (32%) were overweight and 5(32%) were obese, post-immigration 5 (32%) were within the normal range, 6 (38%) were classified as overweight and 5 (32%) as obese. On arrival in the USA, 4 (20%) females were underweight, 13 (65%) were within the normal range, 2 (10%) were overweight and 1(5%) was obese. Post-immigration 1(5%) female was underweight, 10 (50%) within the normal range, 6 (30%)overweight and 3 (15%) obese.
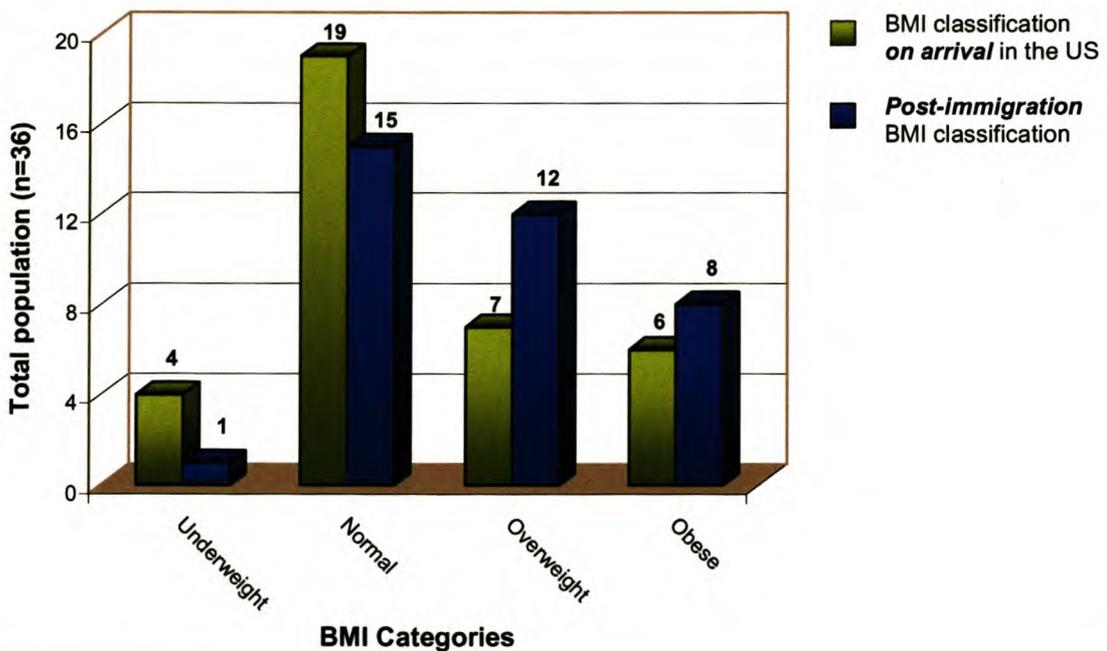
Figure 3.4

BMI classification on arrival in the US and post-immigration for total population
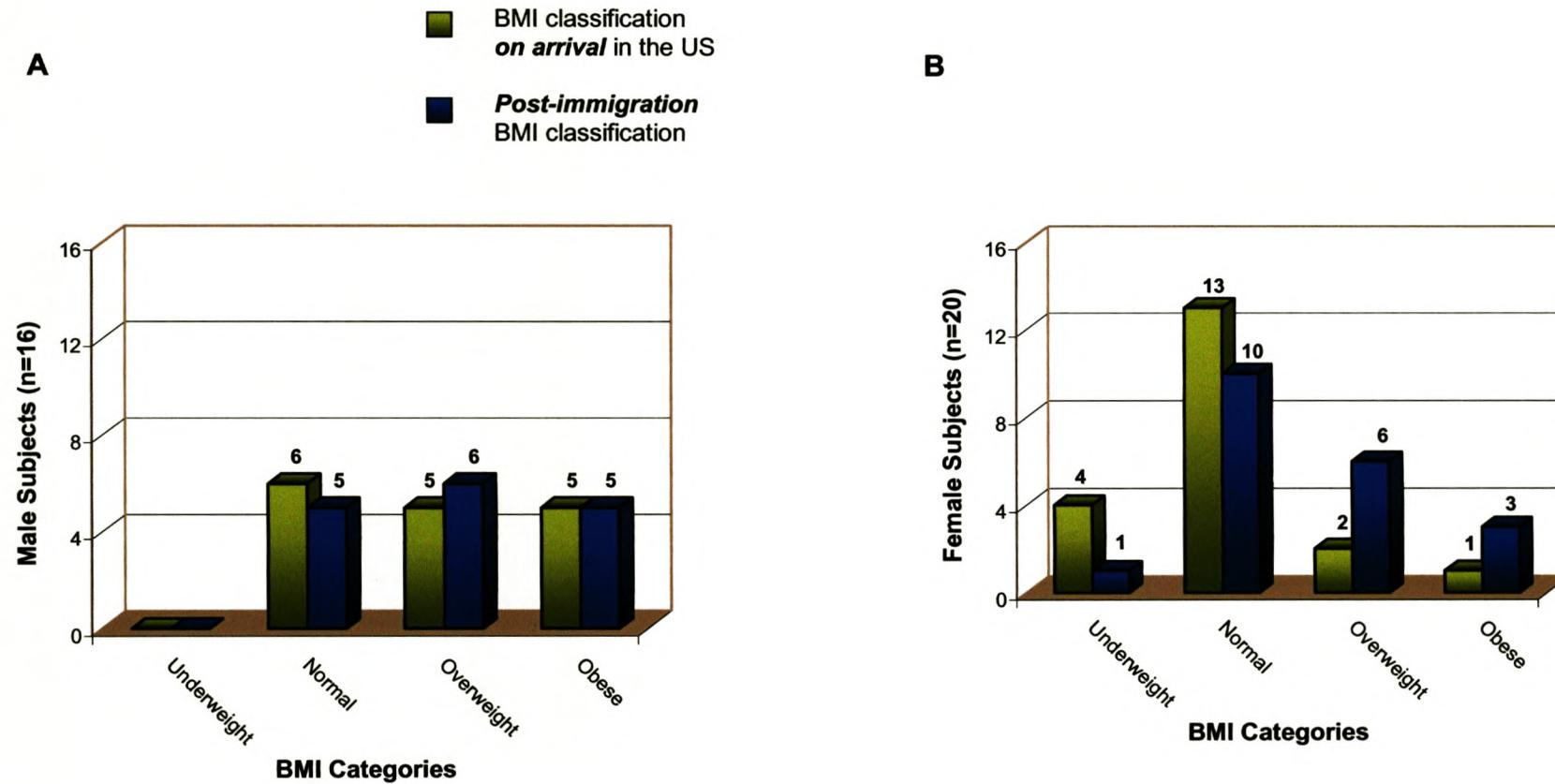
Figure 3.5

BMI classification on arrival in the USA and post-immigration for male (A) and female (B) subjects

3.2.4 Prevalence of post-immigration weight loss/gain

Post-immigration weight changes for the total population are indicated in Figure 3.6. Study results indicated that 27 (75%) subjects gained weight, 5 (14%) stayed exactly the same and 4 (11%) subjects lost weight. Two of the subjects lost more than 5kg.
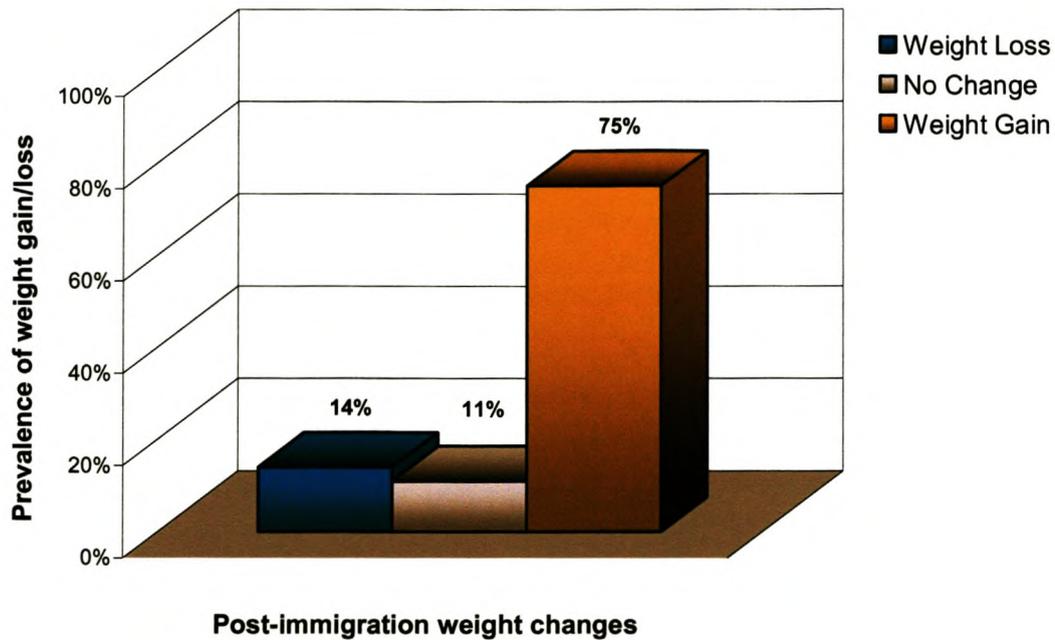
Figure 3.6
The prevalence of weight gain, weight loss and unchanged weight for total population

The prevalence of post-immigration weight loss and weight gain is indicated in Figure 3.7 by gender (A), BMI categories (B) and age (C). The prevalence of weight gain was similar (75%) in male and female subjects. All subjects (100%) classified as underweight on arrival in the USA gained weight. Three (16%) subjects classified within the normal BMI range gained weight, 3 (16%) lost weight and 13 (68%) stayed the same. Five (71%) subjects classified as overweight gained weight and 2 (29%) have lost weight. Five (83%) subjects classified as obese on arrival in the US gained weight and the weight of 1 (17%) remained the same. All (100%) subjects aged 20 - 29 gained weight. The prevalence of weight gain in subjects aged 30 – 39 years was 88% (n=15) and the prevalence of weight loss was 12% (n=2). Five (42%) subjects aged 40 – 50 gained weight, 3 (25%) lost weight and the weight of 4 (33%) subjects remained the same.
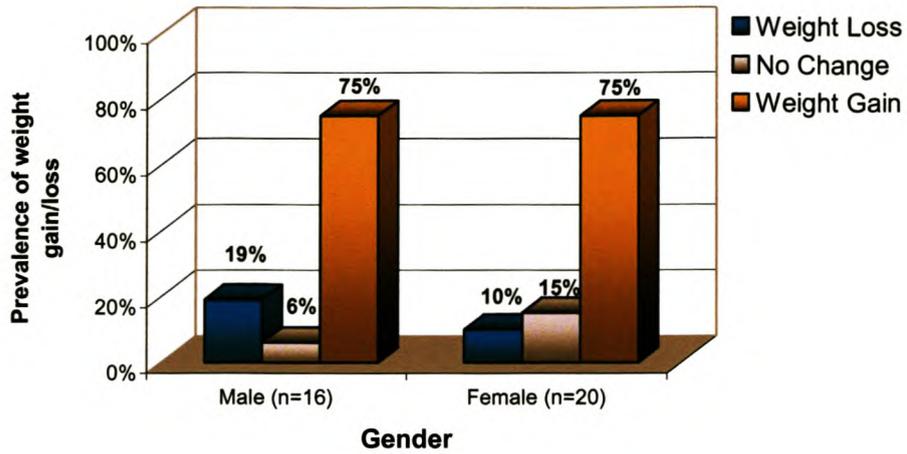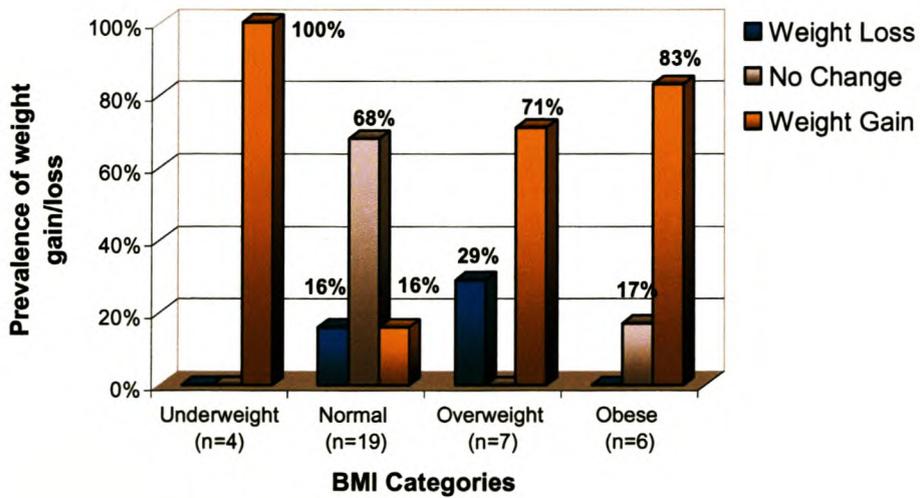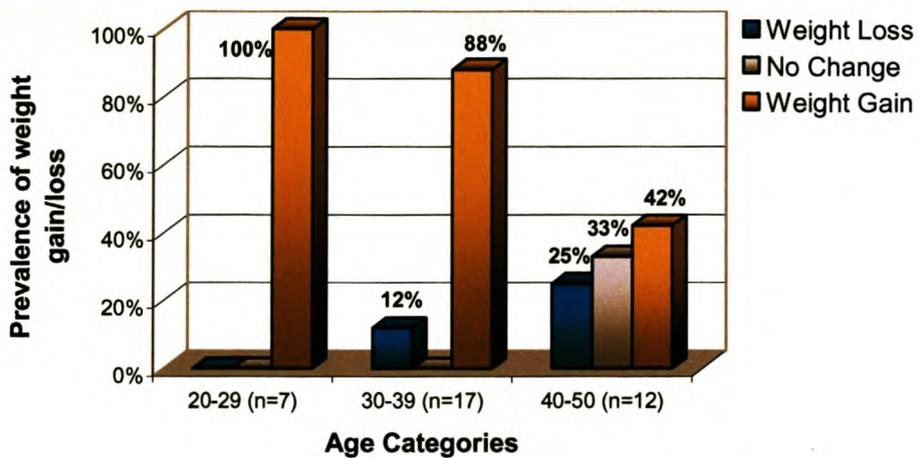
Figure 3.7

The prevalence of post-immigration weight loss, weight gain and unchanged weight by gender (A), BMI categories (B) and age (C)

3.2.5 Extent of weight gain

Three categories were established for the extent of weight gain. The extent of weight gain for total population is indicated in Figure 3.8. A total of 27 (75%) subjects gained weight, 14 (52%) gained 0.1-5kg (x = 2.9kg), 8 (30%) gained 5-10kg (x = 6.5kg) and 5 (18%) gained >10kg (x = 14.3kg).
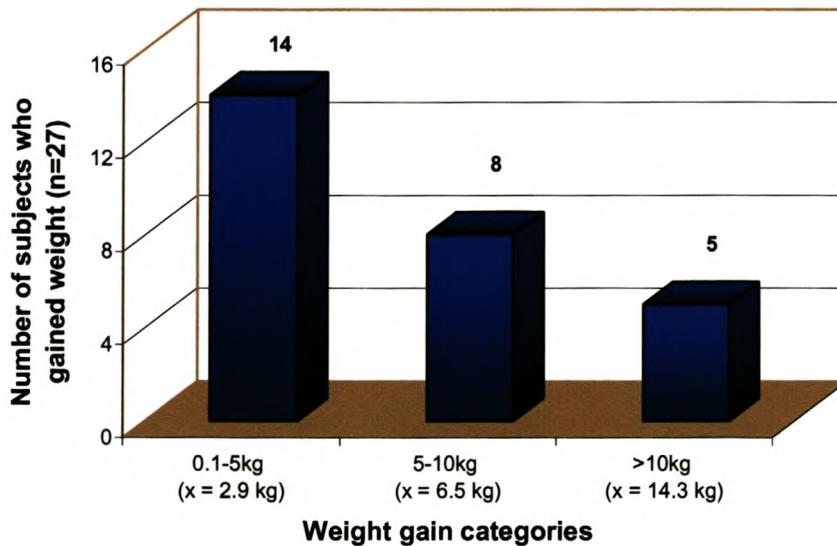
Figure 3.8

The extent of weight gain in study population

The calculated mean weight gain and weight loss are indicated in Figure 3.9 by gender (A), BMI categories (B) and age (C). The mean weight gain for females (6.9 kg) was higher than for males (5.4 kg), but the difference was not significant (p=0.58). The mean weight loss for females was 2 kg compared to 5.8 kg for males. The mean weight gain for subjects initially classified as obese was the highest (8.1 kg), followed by subjects classified as overweight (7.2 kg), and underweight (5.9 kg). The mean weight gain for normal weight subjects was the lowest (5.4 kg). There was not a significant difference (p = 0.69) in mean weight gain for BMI categories. The mean weight loss for subjects classified as overweight on arrival was 8.3 kg followed by normal weight subjects (1.6 kg). Subjects classified as underweight and obese did not loose weight. The mean weight gain for subjects aged 20 - 29 years was the highest (8.5 kg), followed by subjects aged 30 - 39 years (5.4kg) and 40 - 50 years (5.6 kg). The Difference in weight gain for the three age categories was not significant (p=0.14). The mean weight loss for subjects aged 30 – 39 years was 5 kg and 3.6 kg for subjects aged 40 - 50 years.

A
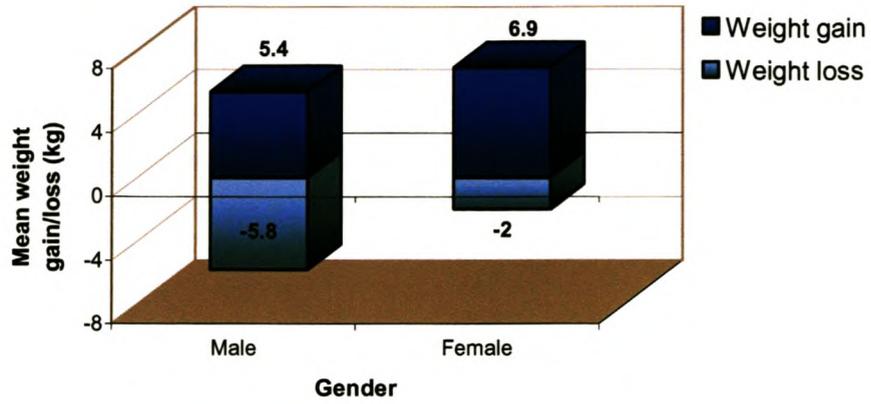
B
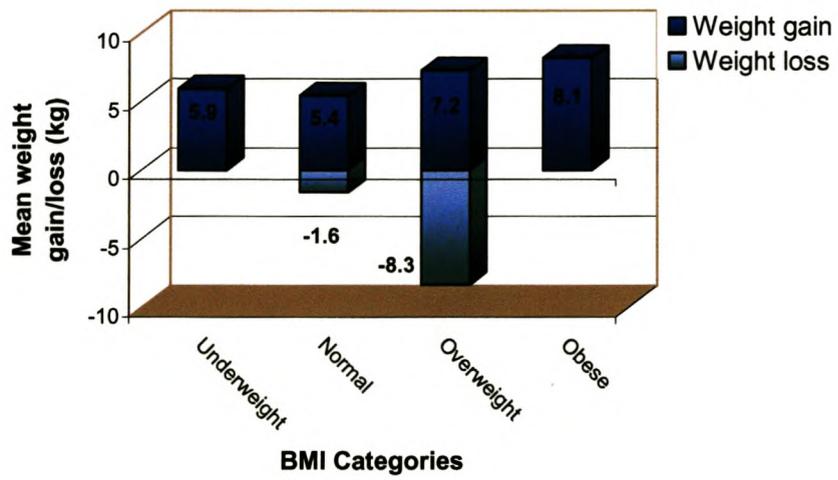
C
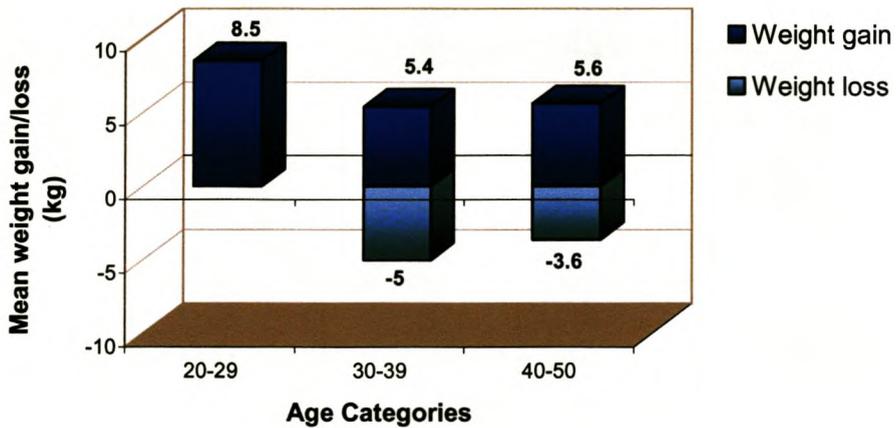
Figure 3.9

Mean weight gain and loss for gender (A), BMI categories (B) and age (C)

3.2.6 Prevention of weight gain

Eighty one percent (n=21) of the subjects indicated that they tried to prevent weight gain. The most frequently used methods used to prevent weight gain were exercise 23 (79%), followed by decreased energy intake 21 (72%) and decreased fat intake 14 (48%) (Figure 3.10).
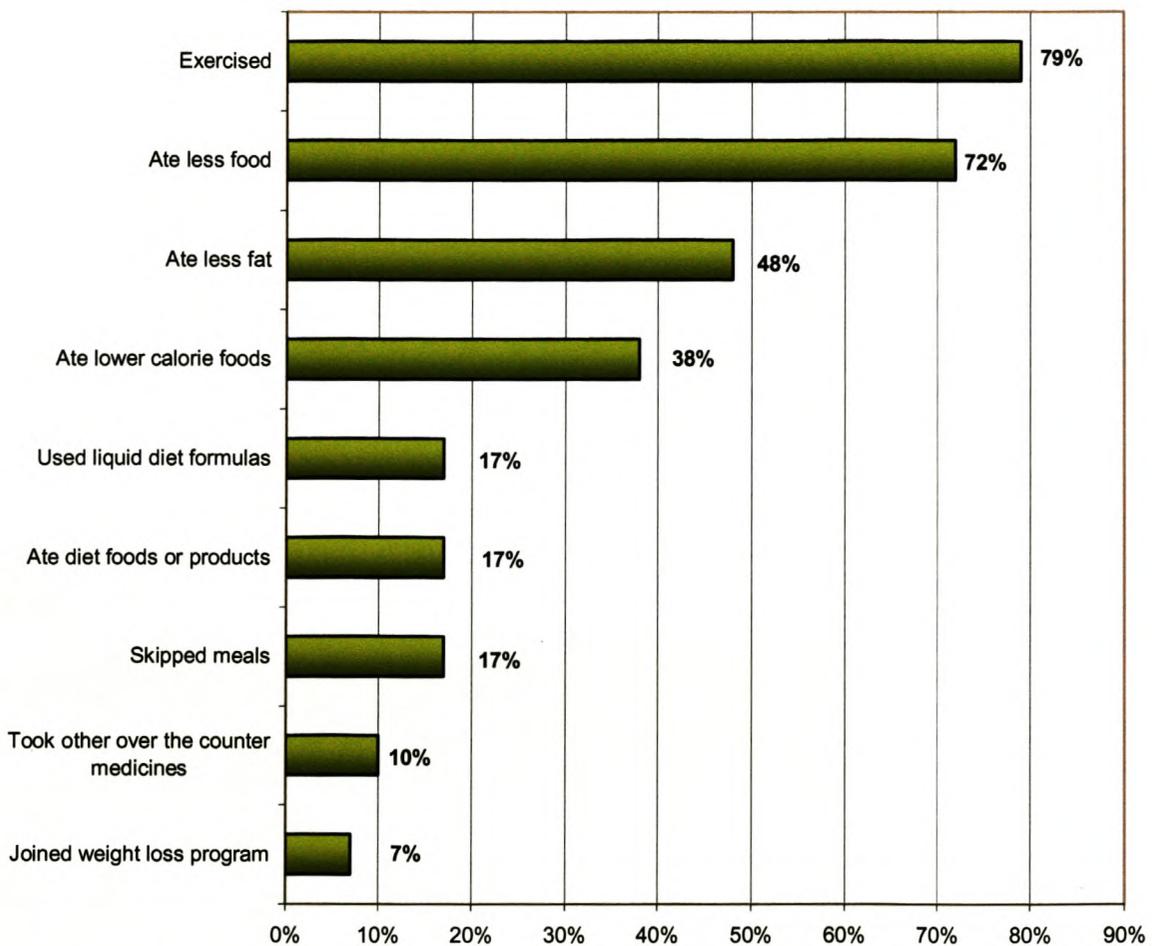
Figure 3.10

The most frequently used methods to prevent weight gain

3.3 DIETARY INTAKE

3.3.1 Macronutrient intake

Total energy intake (kcal/kJ), protein (g), carbohydrate (g), added sugar (g) and fibre (g) -intakes are indicated in Table 3.2. The mean energy intake for male subjects was 2 033 kcal and 2 197 kcal for females. In Figure 3.11 energy intake for male and female subjects is compared to the EER for active individuals [37], as well as the mean energy intake recorded for male and female in the 1999-2000 NHANES [15]. Energy intake for all male subjects was below the EER, while the prevalence of female subjects with an energy intake above the EER was 45%. The prevalence of energy intake above the recorded mean energy intake for USA men and women in the 1999-2000 NHANES was 13% for male and 70% for female subjects respectively. The mean fibre intake for all male subjects (100%) and 65% of female was inadequate (below AI).

Table 3.2

Macronutrient intake for total population and gender

Macronutrients	Recommended EER/AI	Total Population (n=36) Mean (SD)	Male (n=16) MEAN (SD)	Female (n=20) MEAN (SD)
Total Energy Intake (kcal)[a] (EER for active individuals)	3 067 (M) 2 403 (F)	2 124 (643)	2 033 (486)	2 197 (751)
Total Energy Intake (kJ)	12 881 (M) 10 093 (F)	8 921 (2701)	8 539 (2041)	9 227 (3154)
Total Energy Intake (kcal)[b] (1999-2000 NHANES)	2 618 (M) 1 877 (F)	2 124 (643)	2 033 (486)	2 197 (751
Total Energy intake (kJ)	10 996 (M) 7 883 (F)	8 921 (2701)	8 539 (2041)	9 227 (3154)
Protein (g)	-	97 (31)	91 (22)	101 (37)
Carbohydrate (g)	-	256 (95)	247 (76)	236 (110)
Added sugar (g)	-	51 (27)	50(26)	51 (29)
Fibre (g)[c]	38g/day (M) 25g/day (F)	21 (7)	19 (5)	22 (8)

Table 3.2 (cont'd)

Macronutrient intake for total population and gender

Macronutrients	Recommended DRI/AI	Total Population (n=36) Mean (SD)	Male (n=16) MEAN (SD)	Female (n=20) MEAN (SD)
Total fat (g)	-	80 (32)	75 (25)	82 (37)
Omega-6 PUFA (g) [c]	17g/dag (M) 12g/dag (F)	11 (4)	10 (4)	11 (5)
Omega-3 PUFA (g) [c]	1.6g/dag (M) 1.1g/dag (F)	1.5 (0.6)	1.4 (0.5)	1.5 (0.7)

[a] EER for active individuals.[37]

[b] Mean reported energy intake 1999-2000 NHANES.[15]

[c] Adequate Intake among Dietary Reference Intakes for fibre, omega-6 -and omega-3 PUFA was used.[37]
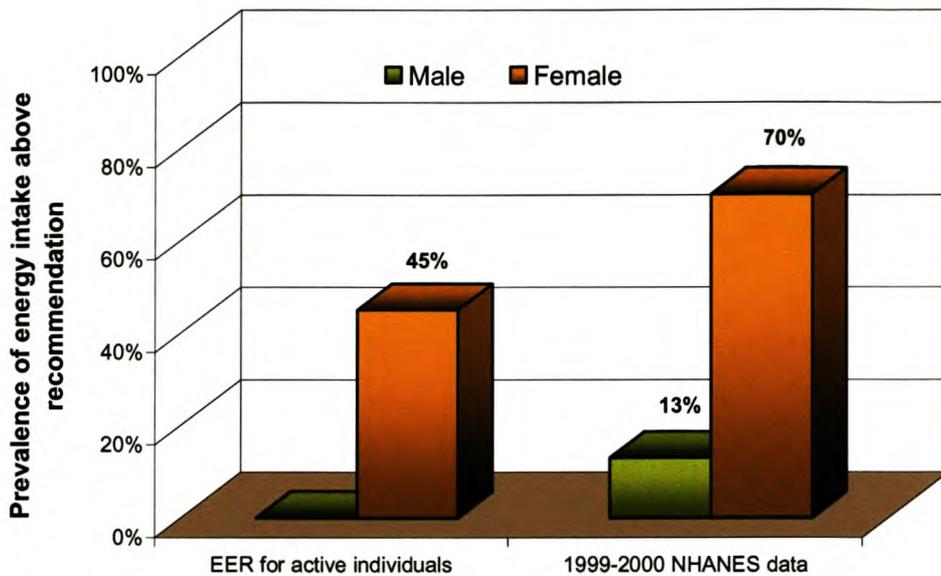
Figure 3.11

The prevalence of energy intake above the EER for active individuals; and energy intake above the mean recorded energy intake (1999-2000 NHANES)

The mean energy intakes for BMI categories (post-immigration classification) are indicated in Table 3.3 and for age in Table 3.4. Reported mean energy intake for normal weight (2 084 kcal) and overweight (2 109 kcal) subjects was higher than for subjects classified as obese (1 876 kcal). The difference in reported energy intake for BMI categories was not significant (p = 0.99). Subjects aged 20 - 29 years (n=7) had a mean energy intake of 2 162 kcal, subjects aged 30 - 39 years (17) had a mean intake of 2 276 kcal and subjects aged 40 - 50 years (n=12) a mean intake of 1 727 kcal. The mean energy intake for subjects aged 20 – 29 years and 30 – 39 years was significantly higher (p =0.04 and p = 0.02 respectively) than for subjects aged 40 – 50 years.

Table 3.3

Mean energy intake for three BMI categories

BMI classification	Energy intake (kcal) Mean (SD) [kJ]
Normal (n=15)	2 084 (532) [8 752]
Overweight (n=12)	2 109 (801) [8 858]
Obese (n=8)	1 876 (607) [7 879]
Difference in energy intake between BMI categories NS	

Table 3.4

Mean energy intake for three age categories

Age category	Energy intake (kcal) Mean (SD) [kJ]
20-29 (n=7)	2 162 (793) [9 080]
30-39 (n=17)	2 276 (617) [9 559]
40-50 (n=12)	1 727 (506) [7 253]
Significant difference in energy intake between 20-29 and 40-50 (p<0.05) Significant difference in energy intake between 30-39 and 40-50 (p<0.05)	

3.3.2 Macronutrient distribution

The m acronutrient d istribution i s i ndicated i n T able 3 .5 for t otal p opulation a nd b y gender. The population's carbohydrate and protein intake was within the AMDR. Added sugar intake was also within the AMDR. The population's mean fat intake contributed 34% to total energy intake, this is still within the acceptable range, but close t o t he u pper l imit o f 3 5%. T otal S FA i ntake c ontributed 1 3% t o t otal e nergy intake, which exceeded the AMDR of 10%. Thirty-eight percent of males and 45% female subjects exceeded the AMDR of 35% for total fat intake, while 88% male subjects and 80% female subjects exceeded the AMDR for SFA (figure 3.12). The population's n-6 PUFA and n-3 PUFA intake contributed 5% and 0.6% respectively to total energy intake, this distribution was within range, but at the lower limits. Omega-6 PUFA intake below recommended AI was recorded in all (100%) male and in 50% of female subjects, while inadequate intake of omega-3 PUFA was recorded in 69% male and 30% female subjects (figure 3.13). The average distribution for mono-unsaturated fatty acids (MUFA) was 13% and within the recommended range of 10-15% [50].

Table 3.5

Macronutrient distribution for total population and gender

Macronutrient Distribution	AMDR	Total Population (n=36)	Male (n=16)	Female (n=20)
Protein (%)	10-35%	18%	18%	18%
Carbohydrates (%)	45-65%	48%	49%	48%
Added sugar	< 25%	10%	10%	9%
Total fat (%)	20-35%	34%	33%	34%
Saturated fat	< 10%	13%	12%	13%
MUFA [a]	10-15%	13%	13%	13%
Omega-6 PUFA	5-10%	5%	5%	5%
Omega-3 PUFA	0.6-1.2%	0.6%	0.6%	0.6%

[a] Dietary guidelines for healthy American adults, American Heart Association [50]
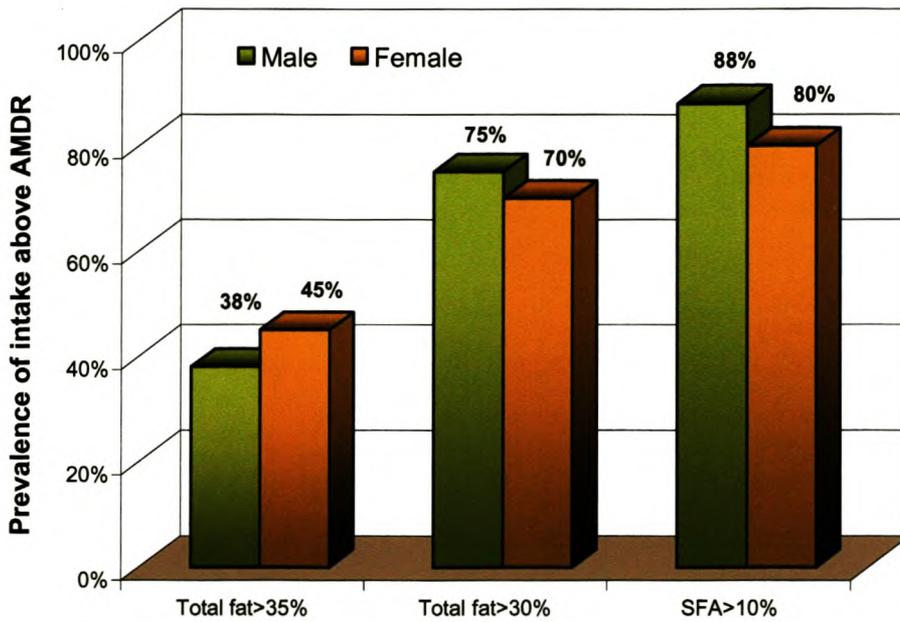
Figure 3.12

The prevalence of total fat intake > 35% of Total Energy (TE); > 30% of TE and SFA > 10% of TE
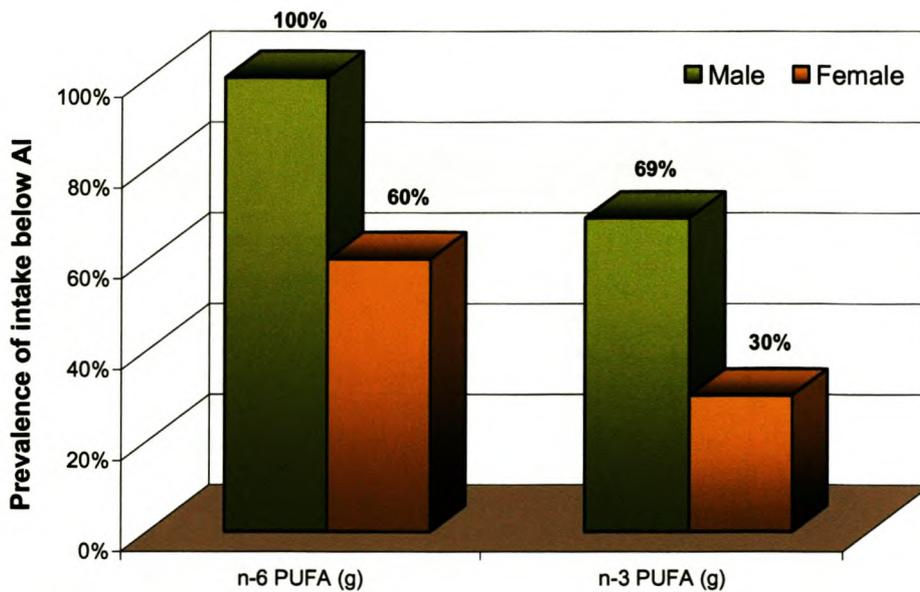
Figure 3.13

The prevalence n-6 –and n-3 PUFA intake below the recommended intake (AI)

3.3.3 Micronutrient intake

Micronutrient intake for total population and gender is indicated in Table 3.6. The EAR and AI (for calcium and Vitamin D) were used to evaluate intakes. The prevalence of micronutrient intakes above the Upper Limit (UL) is indicated in Figure 3.14 (A) and prevalence of intakes below the EAR/AI is indicated in Figure 3.14 (B). Intakes above the Upper Limit (UL) were recorded for vitamin A (56% male and 85% female subjects), zinc (6% male and 5% female subjects) and for folate (35% male and 40% female subjects). Intakes below the EAR/AI were recorded for **vitamin C** (13% male and 5% female subjects), **vitamin D** (31% male and 5% female subjects), **vitamin E** (50% male and 25% female subjects), **folate** (13% male and 5% female subjects), **calcium** (63% male and 20% female subjects), **phosphorus** (69% male subjects), **magnesium** (50% male and 15% female subjects) and **zinc** (6% male and 5% female subjects).

Table 3.6

Micronutrient intake for total population and gender

Micronutrients	EAR	Tot Population (n=36) Mean (SD)	Male (n=16) Mean (SD)	Female (n=20) Mean (SD)
Vitamin A (µg)	625 µg/day (M) 500µg/day (F) **UL*=3 000 µg/day**	4 245 (2 005)	3 780 (2 237)	4 617 (1 769)
Vitamin E (mg)	12 mg/day **UL=1000 mg/day**	61 (103)	71 (110)	53 (100)
Vitamin C (mg)	75 mg/day (M) 60 mg/day (F) **UL=2 000 mg/day**	249 (239)	277 (325)	227 (144)
Vitamin B6 (mg)	1.1 mg/day **UL = 100 mg/day**	12 (28)	15 (39)	9 (14)
Folate (µg)	320µg/day **UL = 1000µg/day**	925 (634)	779 (543)	1042 (689)
Selenium (mcg)	45 µg/day **UL=400 µg/day**	8 (21)	14 (29)	3 (11)
Calcium (mg) [a]	1000 mg/day **UL=2500 mg/day**	1099 (440)	944 (393)	1222 (445)

Table 3.6 (cont'd)

Micronutrient intake for total population and gender

Micronutrients	EAR	Tot Population (n=36) Mean (SD)	Male (n=16) Mean (SD)	Female (n=20) Mean (SD)
Phosphorus (mg)	580 mg/day **UL=4g/day**	1504 (431)	1429 (351)	1564 (486)
Magnesium (mg)	330 mg/day (M) 255 mg/day (F) **UL=350 mg**	383 (103)	375 (104)	388 (105)
Vitamin D (µg/day) [a]	5 µg/day **UL=50 µg/day**	11 (7)	9 (7)	12 (8)
Iron (mg)	6 mg/day (M) 8.1 mg/day (F) **UL=45 mg/day**	20 (12)	15 (6)	24 (15)
Zinc (mg)	9.4 mg/day (M) 6.8 mg/day (F) **UL=40 mg/day**	20 (9)	20 (11)	19 (8)

[a] Adequate intake among Dietary Reference Intakes for calcium and Vitamin D was used [37]

* UL = Tolerable Upper Intake Level.

54
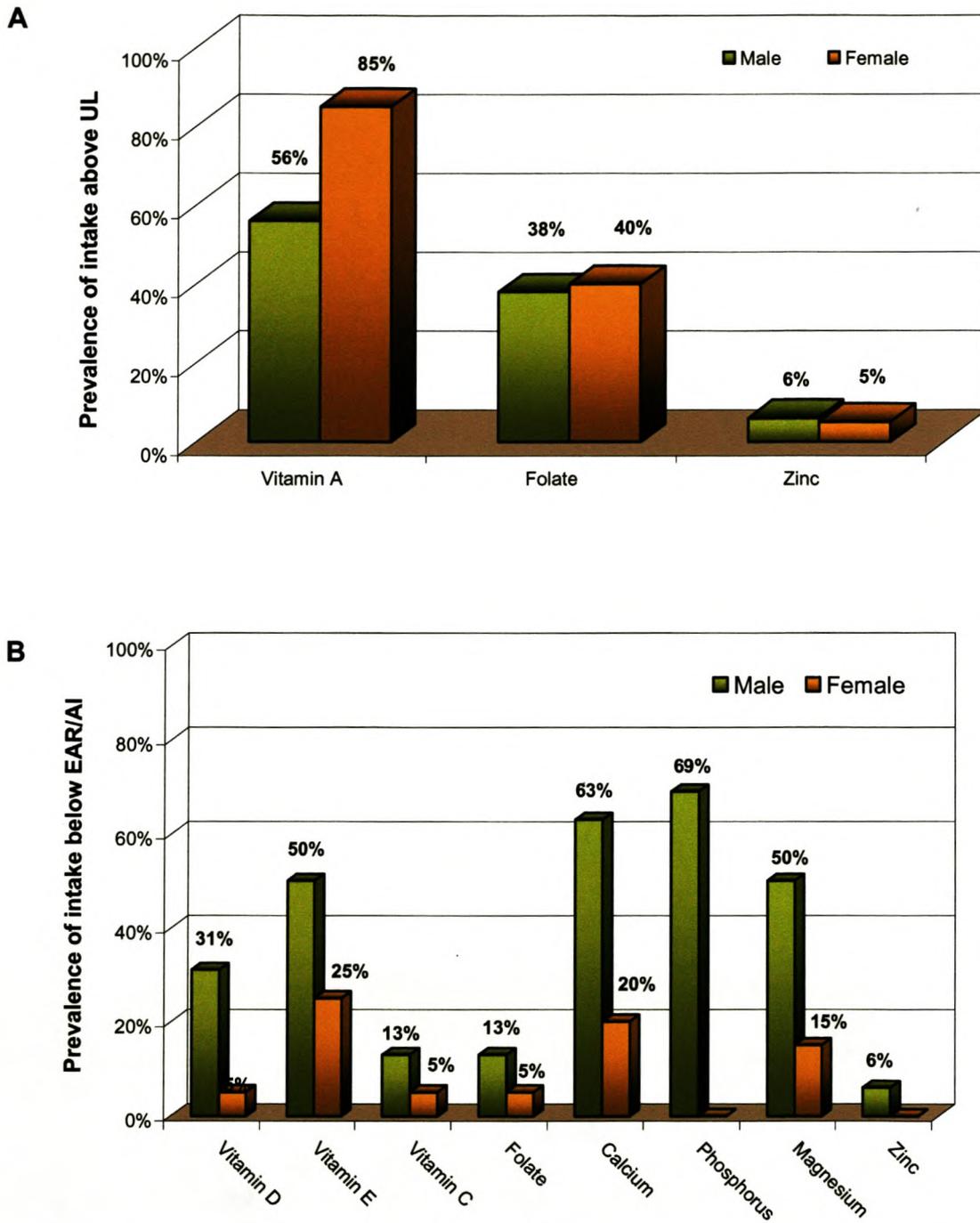
Figure 3.14

The prevalence of micronutrient intake above the UL (A) and below the EAR/AI (B)

3.4   PHYSICAL ACTIVITY

3.4.1 Baecke habitual physical activity indices

Three subjects were eliminated from the physical activity calculations due to incomplete questionnaires.

Table 3.7 shows the values for three physical activity categories (work, sport and leisure time) as well as the total physical activity index for total population and gender. A minimum score of 1(lowest level of activity) and a maximum of score of 5 (highest level of activity) could be attained for the work, sport and leisure indices respectively. The total physical activity score is the sum of the three activity indices. A minimum score of 3 and a maximum score of 15 could be attained for the total activity score. The total physical activity score for female subjects (7.59) was slightly higher than for male subjects (7.09), but the difference was not significant (p = 0.22). Leisure time activity index was significantly higher (p = 0.02) for females than for males.

| Table 3.7 | | | | |
| **Physical activity indices for total population and gender** | | | | |
Physical Activity Category	**Total Population (n=36) Mean (SD)**	**Male (n=16) Mean (SD)**	**Female (n=20) Mean (SD)**	**p-value**
Work Index (1-5) [a]	2.5 (0.87)	2.56 (1.06)	2.48 (0.71)	0.88
Sport Index (1-5) [a]	2.49 (0.77)	2.42 (0.76)	2.54 (0.80)	0.36
Leisure Index (1-5) [a]	2.36 (0.67)	2.11 (0.59)	2.58 (0.68)	0.02 [c]
Total Score (3-15) [b]	7.36 (1.64)	7.09 (1.39)	7.59 (1.84)	0.22

[a] A score of 1-5 for work, sport and leisure indices could be obtained, where 1 = the lowest activity and 5 = the highest activity.

[b] A score of 3 – 15 for total score could be obtained, where 3 = the lowest activity and 5 = the highest activity.

[c] Leisure time activity index for females was significantly higher then for males (p<0.05)

Physical activity indices for three BMI categories (post-immigration classification) are indicated in Table 3.8. Subjects classified as obese reported a work index (2.95) higher than normal weight and (2.17) and overweight (2.55) subjects. The difference was not significant (p=0.90). Normal weight subjects reported a higher sport index (2.7) than overweight (2.33) and obese (2.19) subjects. Overweight subjects scored higher on leisure time physical activity (2.53) than normal weight (2.25) and obese (2.13) subjects. The total activity score was the highest (7.40) for overweight subjects.

Table 3.8

Physical activity indices for three BMI categories

Physical Activity Category	Normal (n=14) Mean (SD)	Overweight (n=10) Mean (SD)	Obese (n=8) Mean (SD)	P value (p<0.05)
Work Index (1-5) [a]	2.17 (0.84)	2.55 (0.96)	2.95 (0.83)	0.90
Sport Index (1-5) [a]	2.70 (0.64)	2.33 (0.99)	2.19 (0.78)	0.12
Leisure Index (1-5) [a]	2.25 (0.64)	2.53 (0.95)	2.13 (0.58)	0.09
Total Score (3-15) [b]	7.12 (1.22)	7.40 (2.44)	7.27 (1.35)	0.66

[a] A score of 1-5 for work, sport and leisure indices could be obtained, where 1 = the lowest activity and 5 = the highest activity.

[b] A score of 3 – 15 for total score could be obtained, where 3 = the lowest activity and 5 = the highest activity.

Physical activity indices for three age categories are indicated in Table 3.9. Subjects aged 40 - 50 years had the highest total physical activity score (7.90), followed by subjects aged 20 - 29 years (7.63) and 30 - 39 years (6.71).

Table 3.9				
Physical activity indices for three age categories				
Physical Activity category	**20-29 (n=7)** **Mean (SD)**	**30-39 (n=15)** **Mean (SD)**	**40-50 (n=11)** **Mean (SD)**	**P-value** **(p<0.05)**
Work Index (1-5) [a]	2.55 (0.55)	2.33 (0.96)	2.74 (1.01)	0.38
Sport Index (1-5) [a]	2.57 (0.45)	2.13 (0.51)	2.84 (1.09)	0.13
Leisure Index (1-5) [a]	2.5 (0.58)	2.25 (0.51)	2.32 (0.92)	0.62
Total Score (3-15) [b]	7.63 (1.01)	6.71 (1.12)	7.90 (2.37)	0.19
[a] A score of 1-5 for work, sport and leisure indices could be obtained, where 1 = the lowest activity and 5 = the highest activity. [b] A score of 3 – 15 for total score could be obtained, where 3 = the lowest activity and 5 = the highest activity.				

3.4.2 Physical activity level conversion

Physical activity scores derived form the Baeck habitual physical activity questionnaire were converted to a physical activity level (PAL). The conversion of work, sport and leisure indices to a PAL is described in detail Chapter 2. Activity indices were converted to two PAL categories: *low active (PAL≥1.4-<1.6)* or *active (PAL≥1.6-<1.9)* [36]. The prevalence of 'low active' and 'active' physical activity levels are indicated in Figure 3.15 for total population and gender (A), BMI categories (B) and age (C). Sixty-four percent of the total population were classified in the 'low active' PAL category. Seventy four percent females were classified as 'low active' compared to 50% for males. The prevalence of a 'low active' PAL among normal weight (71%) and overweight (70%) subjects were similar, but higher as the prevalence reported by obese subjects (50%). The prevalence of 'low active' PAL was higher for subjects aged 30 – 39 years (73%) than for subjects aged 20 – 29 years (57%) and 40 – 50 years (55%).

A
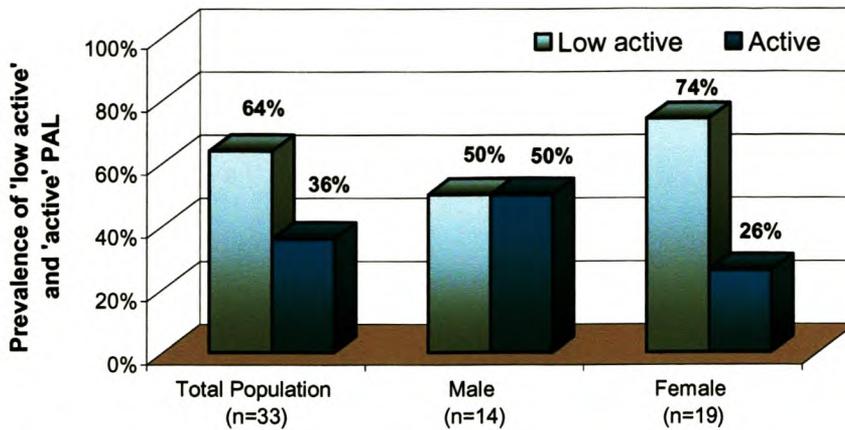
B
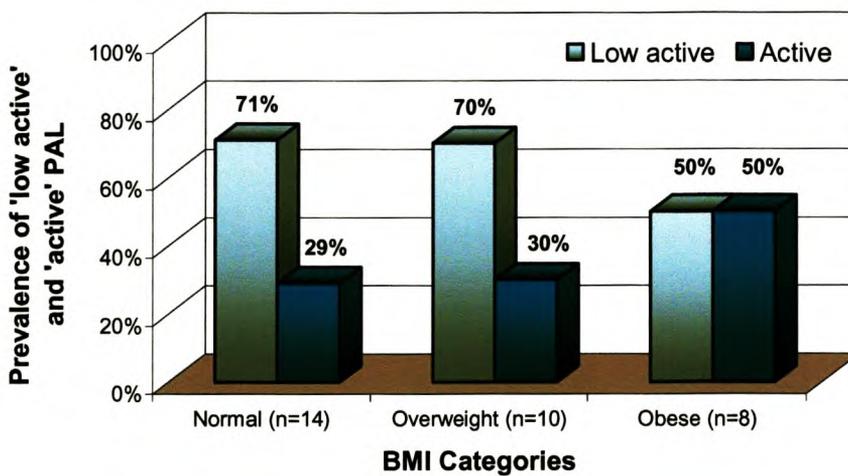
C
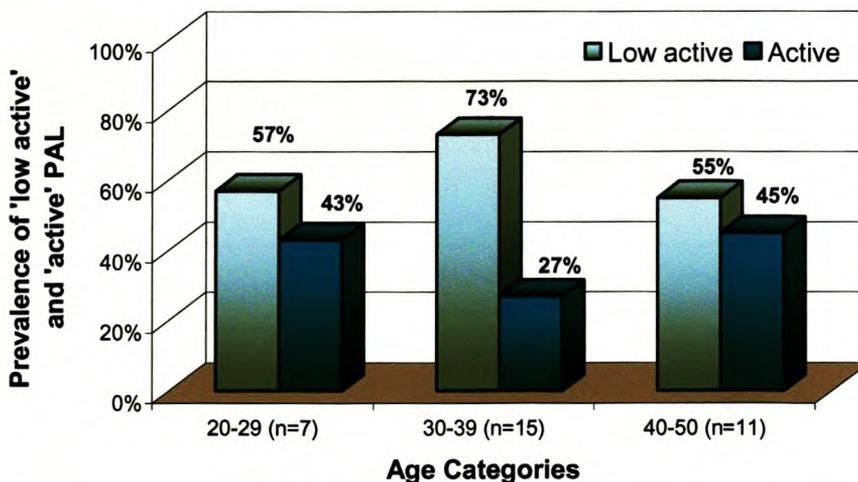
Figure 3.15

The prevalence of 'low active' and 'active' PAL indicated for total population and gender (A), BMI categories (B) and age (C)

CHAPTER 4

DISCUSSION

This study is the first cross sectional, descriptive, observational survey to investigate post-immigration BMI changes in a South African immigrant population. The main finding of this study is the significant increase in post-immigration BMI for both male and female subjects. Similar trends were reported by a Canadian study of 11, 818 men and women. The latter study demonstrated an increase in excess weight (BMI ≥ 25 kg/m²) with length of stay for male and female immigrants. The increase in excess weight was measured over three time intervals: 0-4 years, 5-10 years and >10 years post-immigration. The increase in excess weight over the three time intervals was significant (p<0.01) for both male and female [9]. The present study demonstrated a similar trend with a 20% increase in post-immigration prevalence of overweight and obesity. Although the prevalence of post-immigration weight gain was similar for male and female subjects, females gained more weight than males and the increase in BMI for females was higher, although not significantly (p = 0.55), compared to increase in male BMI. This can partially be explained by differences in mean BMI between male and female on arrival in the US. The mean reported BMI for male subjects on arrival in the USA (28.3 kg/m²) was significantly higher (p = 0.003) compared to female BMI (22.6 kg/m²). Evidence for an association between a higher initial body weight (and therefore a higher BMI) and a decreased probability for major (excessive) weight gain amongst men support the smaller increase in BMI of male subjects in the present study [50, 51, 52]. This phenomenon seems to be age related as well from the findings in our study. Older subjects, with a higher reported mean weight and BMI on arrival in the US, demonstrated a smaller increase in post-immigration BMI and vice versa. Several studies demonstrated similar trends and greater weight increases in subjects who were in their early to mid twenties [29, 50, 51, 53, 54, 55]. Length of stay in the USA in the present study didn't seem to be related to post-immigration BMI changes. However, evidence does exist for an association between increased body weight and length of stay [9].

Although 81% of subjects indicated that they attempted to prevent weight gain, 75% gained weight. Factors contributing to weight gain leading to overweight and obesity

are complex and interrelated and may include genes, metabolism, behaviour, environment, culture and socio-economic status. This study focused on dietary intake and physical activity as contributing factors to this phenomenon. Since this study was designed as a cross-sectional survey, post-immigration changes in diet and physical activity could not be assessed. Longitudinal data is necessary to track these changes.

A total energy intake above the EER for active individuals was prevalent in females only. In addition, more women (75%) were classified as 'low active' than men (50%). These findings support the higher increase in female BMI as well as increased weight gain in female subjects. The mean energy intake recorded for females was higher than for males. This may be ascribed to overestimation for women and underestimation for men by the FFQ, a known limitation of this questionnaire [29]. Obese subjects reported a lower , although not significantly lower (p = 0.99) energy intake than normal weight and overweight subjects. This could be explained by the tendency of obese people to underreport energy intake. Several studies demonstrated a positive association between underreporting of nutrient intake and obesity [56, 57, 58, 59]. Underreporting of energy intake is also more prevalent in obese than overweight and normal weight subjects [59]. Overreporting of PA may have also been present for subjects classified as obese [60]. The mean reported energy intake for younger subjects was higher and coincide with a higher prevalence of subjects with a 'low active' PAL, especially subjects aged between 30 – 39 years. This finding correlates with the higher prevalence of weight gain in younger adults demonstrated by this study.

The study also demonstrated a high prevalence for subjects exceeding the AMDR for SFA (84%) and for subjects with inadequate n-3 PUFA (50%) and n-6 PUFA (75%) intake. The population's relative high total fat intake increases their risks of various cancers, particularly breast, colon and prostate cancer [44]. High SFA and low n-6 – and n-3 PUFA put them at an increased risk for coronary heart disease [44]. A high prevalence of inadequate fibre intake was also observed for both male (100%) and female (65%) subjects. Increasing evidence suggest that inadequate fibre intake is associated with increased risk for colon cancer [44]. In addition to inadequate fibre intake, the reported mean calcium intake for males was also below the recommended

intake. Although insufficient calcium intake could be attributed to underreporting, male subjects could be at an increased risk for colon cancer, since optimal calcium intake may play a protective role in colon cancer [44]. The prevalence of inadequate nutrient intake was higher for male than for female subjects. This again could be ascribed to underestimation by the FFQ mentioned earlier in the discussion [38].

The estimated intakes for vitamin A, E and C were well above the EAR (ranges from 660% of EAR for vitamin A to 303% of EAR for vitamin C). This phenomenon could be ascribed to overestimation (around 25%) by the FFQ for vitamin A, vitamin E, vitamin C, Vitamin B6 and sodium. Overestimation for these micronutrients is a documented limitation of the questionnaire [38].

Immigration to the US encompasses many changes and challenges for the immigrant. In the process of adapting to their new environment, immigrants are inclined to adopt dietary behaviours and lifestyle of the general US population [1, 2]. Several studies reported increased consumption of meals away form home, increases in total energy intake from salty snacks and soft drinks [61] that translate to a diet high in fat and refined carbohydrates and low in fruit and vegetables [1, 2]. Although data from the Behavioural Risk Factor Surveillance System (BRFSS) indicated an increased prevalence (1990-1998) of those engaged in recommended levels of activity, 75% of the US population still reported insufficient or no physical activity [62]. Adoption of the US dietary habits and sedentary lifestyle is evident in the dietary intake and PAL trends observed in the current study.

With immigration, immigrants are immersed in a fast food culture where a cornucopia of fast food chains compete for the consumer's dollar by offering large portions of high fat foods at low cost. Supermarket shelves are also filled with a large selection of convenience foods high in fat, refined carbohydrates and sodium. The media may also be contributing to the phenomena of weight gain. Television and radio are powerful sources of information, and may influence amongst others, consumers' food choices. The food industry has an advertising budget of around $33 billion a year [20], mostly spent on the marketing of processed food products, especially novelty items, to the American public and indubitably not on the promotion of fruit and vegetable consumption. The media is often the consumer's main source of nutrition knowledge

and food choices are often based on this distorted knowledge base. Analyses of primetime television food commercials indicated that approximately half of the nutrition related information is either misleading or inaccurate [23]. The results of this study also indicated that 47% of subjects had a post-graduate education. A higher level of education may imply demanding, high stress jobs, more time spend at work, little to no activity at work and less time for sport and leisure time physical activity, as well as a tendency to rely more heavily on convenience foods.

A significant increase in BMI was observed in a relatively short post-immigration period of five years. These finding emphasizes the importance of addressing the issue of increasing prevalence of overweight and obesity in populations the world over. Populations, especially immigrant populations need to be educated and empowered to make better food and lifestyle choices in an environment that promotes the opposite. Overweight and obesity are associated with increased risk of many chronic diseases, and implied increase in healthcare cost. The increased prevalence of overweight and obesity in the study population implies an increase in chronic disease risk.

Study Limitations

A number of limitations in this study should be kept in mind in the evaluation of the results. The small sample size of the population studied can result in wide data variability and imprecise trends. At the time of the study no official database existed for the South African immigrant population in the Atlanta area, the only geographic area of the USA studied. As a result the sample was selected from a group of volunteers. The study may thus be subject to volunteer bias. Another limitation was the self-reported weight used to calculate BMI on arrival in the US; this data is subject to both recall and social desirable bias. The time frame considered for post-immigration weight gain (6 month – 5 years) may also have introduced bias, since initial post-immigration adjustments and the effect of age may have influenced the observed trends.

CHAPTER 5

CONCLUSION AND RECOMMENDATIONS

5.1 CONCLUSIONS

This study investigated post-immigration BMI changes in a South African immigrant population in the Atlanta area, and how these BMI changes reflect dietary intake and physical activity of the population.

This study demonstrated a significant increase in BMI post-immigration for both male and female subjects. Increase in Post-immigration BMI was also significant for two age categories, 20-29 years and 30-39 years of age. Subgroups (men and older adults) that reported higher initial body weights or BMI on arrival had a propensity to gain less weight than subjects with a lower body weight or BMI on arrival. Observed trends in post-immigration BMI changes are similar to weight gain trends documented for the general US population. Relatively high fat intake and high prevalence of energy intake above the EER, especially in women, as well as fairly low physical activity levels observed in the population support the increase in post-immigration BMI.

The increase in BMI, dietary inadequacies and general low physical activity level indicated that the South African immigrant population, similar to other immigrant populations, had adopted to some extent, the dietary habits and lifestyle of the general US population and are therefore subject to increased chronic disease risk, especially certain cancers and coronary heart disease.

This study was limited by its small sample size and the conclusions cannot be extrapolated to other immigrant populations. The sample consisted of volunteers and is not representative of the South African immigrant population in the Atlanta area. The conclusions are only applicable to the primary sample population, namely white South African immigrants residing in the Atlanta area for more than six months but less than five years.

5.2 RECOMMENDATION

A longitudinal study on a larger sample would give more insight in to the BMI changes as well changes in dietary habits and physical activity of the population.

A database of South African immigrants should be established. This will allow for improved sampling and sampling stratification in terms of age and gender.

In this study, weight on arrival was self-reported. Although it has been found that self-reported weight is reasonably accurate, weight should be measured objectively in future studies.

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APPENDIX 1

SAMPLE RECRUITMENT NOTE

NUTRITION RESEARCH PROJECT

I'm planning a research project as part of my Masters Degree in Nutrition. The proposed title of the study is:

"The prevalence and extend of weight gain in adult South African immigrants in the Atlanta Metro Area"

To gather valid information I need as many South Africans as possible in the **Atlanta Area** to be included in the study. Information for the research will be gathered by means of a questionnaire via e-mail. Please e-mail me your **name**, **e-mail address** and **county** if you are interested to be included in the study, and also inform your fellow South Africans! All information will be handled confidentially.

Please feel free to contact me if you have any questions regarding the study.

Ida Viljoen

Tel: 404 808 5849

E-mail: ida@uitweb.co.za

APPENDIX 2

INFORMATION AND INFORMED CONSENT

FACULTY OF HEALTH SCIENCES
STELLENBOSCH UNIVERSITY

TITLE OF THE RESEARCH PROJECT:
BMI changes, dietary habits and physical activity of immigrants in the USA: An investigation of a South African population in the Atlanta Metro Area.

REFERENCE NUMBER:

PRINCIPAL INVESTIGATOR: IDA VILJOEN

Address: 400 GALLERIA PARKWAY, SUITE 1500
ATLANTA, GA 30339
USA

DECLARATION BY THE PARTICIPANT:

I, THE UNDERSIGNED, ... *(name)*
of   (Town, State and zip code)

....

....   (Address).

A.   **HEREBY CONFIRM AS FOLLOWS:**
  1.   I was invited to participate in the abovementioned research project, which is being undertaken by the Department of *HUMAN NUTRITION*, Faculty of Health Sciences, Stellenbosch University.
  2.   The following aspects have been explained to me:
       2.1   **Aim:** The aim of this study is to investigate BMI changes in relation to dietary behavior and physical activity in South African immigrants living in the Atlanta Metro Area.
       2.2   **Procedures:** For the purpose of this study, the following anthropometric measurements will be made:
             ▪   Weight
             ▪   Height
             ▪   Waist circumference

     Participants will also have to fill out a questionnaire consisting of the following components:
             ▪   Socio-demographic information
             ▪   Weight History Questionnaire
             ▪   Habitual Physical activity questionnaire
             ▪   Diet history questionnaire

     Abovementioned procedures will take approximately one hour in total.
     Approximately one hundred participants will be interviewed for this research project.

     2.3 **Confidentiality:** Patient identification information will be omitted from study related material to ensure participant confidentiality.
     Information provided to the researcher will only be used for the specified study, and will not be shared for any other purposes or projects.

       2.3   **Voluntary participation/refusal/discontinuation:** *Participation in this research project is voluntary and the participant may consequently refuse to participate, and the participant may discontinue participation at any time.*

  3.   The information above was explained by
         IDA VILJOEN in English and I'm in command of this language. I was given the opportunity to ask questions and all these questions were answered satisfactorily.
  4.   No pressure was exerted on me to consent to participation and I understand that I may withdraw at any stage without any penalization.

5.   Participation in this study will not result in any additional costs to myself.

B.   HEREBY CONSENT VOLUNTARILY TO PARTICIPATE IN THE ABOVEMENTIONED PROJECT

Signed/confirmed   at ....   on ....
                                          (place)   *(date)*

....

Signature of participant   *Signature of witness*

STATEMENT BY INVESTIGATOR:

I, *IDA VILJOEN*, declare that
  - I explained the information given in this document to ....
    (Name of participant) he/she was encouraged and given ample time to ask me any questions;

Signed   at ....   on ....
                                 (place)   *(date)*

....

Signature of investigator   *Signature of witness*

IMPORTANT MESSAGE TO PARTICIPANT:

Dear participant,

Thank you for your participation in this study. Should, at any time during the study you require any further information with regard to the study, kindly contact:

Ida Viljoen
Telephone: 404-808-5849 or
Email: ida@uitweb.co.za

APPENDIX 3

SOCIO-DEMOGRAPHIC QUESTIONNAIRE

BMI changes, dietary habits and physical activity of immigrants in the USA: An investigation of a South African population in the Atlanta Metro Area.

Date: | D | D | M | M | Y | Y |

Subject number: | | | |

Birth Date: | D | D | M | M | Y | Y |

Date of arrival in USA: | M | M | Y | Y |

Address: _____

City   State   Zip code

Please mark the appropriate box with a cross (X) in the gray area.

Age:

1	2	3
20-29	30-39	40-50

Gender:

1	2
Male	Female

Race:

1	2	3	4	5
Black	Caucasian	Coloured	Indian	Other-Specify

Marital status:

1	2	3	4	5	6	7
Unmarried	Married	Divorced	Separated	Widowed	Living Together	Other - Specify

Highest level of education:

1	2	3	4
High School	Tertiary Education	Post Graduate Education	Other-Specify

APPENDIX 4

WEIGHT HISTORY QUESTIONNAIRE

BMI changes, dietary habits and physical activity of immigrants in the USA: An investigation of a South African population in the Atlanta Metro Area.

Subject number: ☐☐☐

1. Current Weight, Height and Waist circumference

Weight ☐☐☐ , ☐ Kg ☐☐☐ , ☐ lb   Height ☐ , ☐☐ m ☐ , ☐☐ feet

Waist Circumference ☐☐☐ , ☐ cm   Waist Circumference ☐☐ in.

Please mark the appropriate box with a cross (X) in the gray area.

---

2. Do you consider yourself now to be…

1	2	3
Overweight	Underweight	About the Right weight

3. Would you like to weigh…

1	2	3
More	Less	Stay about the same

4. How much did you weigh on arrival in the USA?

☐☐☐ , ☐

OR

☐☐☐ . ☐ Lb

For office use only		
[Current Weight] - [Weight on arrival] = ☐☐☐		
1	2	3
Weight loss	No Change	Weight gain
If Weight loss (-) ≥ 10lb/4.55 kg → **Answer 5** If Weight gain (+) → **Answer 4a** No change → **Answer 8**		

> If your weight has ***stayed the same*** since arrival, please proceed to ***Question 8***
>
> If you have ***lost weight*** since arrival in the US, please proceed to ***Question 5***
>
> If you have ***gained weight*** since arrival, please to proceed to ***Question 4a***

4a) How much weight did you gain?

1	2	3
0-10lb/0-5kg	10-20lb/5-10kg	>20lb/>10kg

5. Was the change between your current weight and weight on arrival intentional?

1	2
Yes	No

6. During the past 12 months have you tried to loose weight?

1	2
Yes	No

7. How did you tried to loose weight? [Mark all applicable options with a cross (X)]

Ate less food (amount)	
Switch to foods with lower calories	
Ate less fat	
Exercised	
Skipped meals	
Ate 'diet' foods or products	
Used a liquid diet formula such as Slimfast or Oprifast	
Joined a weight loss program such as weight watchers, Jenny Craig, Tops, or overeaters anonymous	
Took diet pills prescribed by a doctor	
Took other pills, medicines, herbs, or supplements not needing a prescription	
Took laxative or vomited	

8. During the past 12-month have you done anything to keep you from gaining weight?

1	2
Yes	No

9. What did you do to keep from gaining weight? [Mark all applicable options with a cross (X)]

Ate less food (amount)	
Switch to foods with lower calories	
Ate less fat	
Exercised	
Skipped meals	
Ate 'diet' foods or products	
Used a liquid diet formula such as Slimfast or Optifast	
Joined a weight loss program such as weight watchers, Jenny Craig, Tops, or overeaters anonymous	
Took diet pills prescribed by a doctor	
Took other pills, medicines, herbs, or supplements not needing a prescription	
Took laxative or vomited	

APPENDIX 5

HABITUAL PHYSICAL ACTIVITY QUESTIONNAIRE

BMI changes, dietary habits and physical activity of immigrants in the USA: An investigation of a South African population in the Atlanta Metro Area.

Subject number: ☐☐☐

Please answer the following questions by making a cross (X) in the column on the right, next to the answer that most accurately describes your activity at work.

WORK INDEX			X
1. What is your main occupation	Clerical work, driving, shop keeping, teaching, studying, housework, medical practice, any occupation requiring an university education	1	
	Factory work, plumbing, carpentry, and farming	3	
	Dock work, construction work and professional sport	5	
2. At work I sit	Never	1	
	Seldom	2	
	Sometimes	3	
	Often	4	
	Always	5	
3. At work I stand	Never	1	
	Seldom	2	
	Sometimes	3	
	Often	4	
	Always	5	
4. At work I walk	Never	1	
	Seldom	2	
	Sometimes	3	
	Often	4	
	Always	5	
5. At work I lift heavy loads	Never	1	
	Seldom	2	
	Sometimes	3	
	Often	4	
	Always	5	
6. After work I'm tired (physically)	Very often	5	
	Often	4	
	Sometimes	3	
	Seldom	2	
	Never	1	
7. At work I sweat	Very often	5	
	Often	4	
	Sometimes	3	
	Seldom	2	
	Never	1	

8.	In comparison to others of my own age I think my work is physically	Much heavier	5	
		Heavier	4	
		As heavy	3	
		Lighter	2	
		Much lighter	1	
FOR OFFICE USE ONLY				
Calculate Work Index		[(6-(points for sitting)) + Σ(point for other 7 parameters)]/8		

Please answer the following questions by making a cross (X) in the column on the right, next to the answer that most accurately describes your sport activities.

SPORT INDEX				
9. Do you play sports		Yes		
		No		
If **YES**, please answer the following questions by making a cross (X) in the column on the right, next to the answer that most accurately describes your sport activity. If **NO** go directly to **question 10**.				X
a)	What sport do you play <u>most</u> frequently?	Billiards, bowling, sailing, golf, walking	LI	0.76	
		Cycling, dancing, swimming, tennis, running, aerobic exercises, downhill skiing.	MI	1.26	
		Boxing, basketball, football, rugby, rowing, cross-country ski.	HI	1.76	
		Other:			
b)	How many hours do you play a week?	< 1 hour	0.5	
		1-2 hours	1.5	
		2-3 hours	2.5	
		3-4 hours	3.5	
		> 4 hours	4.5	
c)	How many months do you play in a year?	< 1 month	0.04	
		1-3 months	0.17	
		4-6 months	0.42	
		7-9 months	0.67	
		> 9 months	0.92	
d)	What sport do you play <u>second most</u> frequently?	Billiards, bowling, sailing, golf	LI	0.76	
		Cycling, dancing, swimming, tennis	MI	1.26	
		Boxing, basketball, football, rugby, rowing	HI	1.76	
		Other			
e)	How many hours do you play a week?	< 1 hour	0.5	
		1-2 hour	1.5	
		2-3 hours	2.5	
		3-4 hours	3.5	
		> 4 hours	4.5	
f)	How many months do you play in a year?	< 1 month	0.04	
		1-3 months	0.17	
		4-6 months	0.42	
		7-9 months	0.67	
		> 9 months	0.92	

FOR OFFICE USE ONLY			
Calculate simple sport score	[(a)x(b)x(c)x(d)x(e)x(f)]		
Simple Sport Score (9)	Sport score >/= 12	5	
	Sport score 8 to < 12	4	
	Sport score 4 to < 8	3	
	Sport score 0.1 to <4	2	
	Sport score = 0	1	
	No	1	
10. In comparison with others of my own age I think my physical activity during leisure time is	Much more	5	
	More	4	
	The same	3	
	Less	2	
	Much less	1	
11. During leisure time I sweat	Very often	5	
	Often	4	
	Sometimes	3	
	Seldom	2	
	Never	1	
12. During leisure time I play sports	Never	1	
	Seldom	2	
	Sometimes	3	
	Often	4	
	Very often	5	
FOR OFFICE USE ONLY			
Calculate Sport Index	[∑(Points for all 4 parameters)]/4		

Please answer the following questions by making a cross (X) in the column on the right, next to the answer that most accurately describes your leisure time activity.

LEISURE INDEX			X
13. During leisure time watch television	Never	1	
	Seldom	2	
	Sometimes	3	
	Often	4	
	Very often	5	
14. During leisure time I walk	Never	1	
	Seldom	2	
	Sometimes	3	
	Often	4	
	Very often	5	
15. During leisure time I cycle	Never	1	
	Seldom	2	
	Sometimes	3	
	Often	4	
	Very often	5	
16. How many minutes do you walk and/or cycle per day to and from work, school and shopping?	< 5minutes	1	
	5-15 minutes	2	
	15-30 minutes	3	
	30-45 minutes	4	
	>45 minutes	5	
FOR OFFICE USE ONLY			
Calculate Leisure index	[(6-points for TV watching))+∑(remaining 3 items)]/4		

FOR OFFICE USE ONLY	
Work Index	
Sport Index	
Leisure Index	
Total Index	

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APPENDIX 6

FOOD FREQUENCY QUESTIONNAIRE

■■ **DIET ASSESSMENT** ■■

ID:

1. Do you currently take multiple vitamins? (Please report individual vitamins under question 2.)

○ No ○ Yes ⟶ If yes, a) How many do you take per week? ○ 2 or less ○ 6-9 ○ 3-5 ○ 10 or more

b) What specific brand do you usually use? ⟶

Specify exact brand and type

2. Not counting multiple vitamins, do you take any of the following preparations:

a) Vitamin A?

○ No ○ Yes, seasonal only ○ Yes, most months — If Yes,

How many years? ⟶ ○ 0-1 yr. ○ 2-4 yrs. ○ 5-9 yrs. ○ 10+ yrs. ○ Don't know

What dose per day? ⟶ ○ Less than 8,000 IU ○ 8,000 to 12,000 IU ○ 13,000 to 22,000 IU ○ 23,000 IU or more ○ Don't know

b) Vitamin C?

○ No ○ Yes, seasonal only ○ Yes, most months — If Yes,

How many years? ⟶ ○ 0-1 yr. ○ 2-4 yrs. ○ 5-9 yrs. ○ 10+ yrs. ○ Don't know

What dose per day? ⟶ ○ Less than 400 mg. ○ 400 to 700 mg. ○ 750 to 1250 mg. ○ 1300 mg. or more ○ Don't know

c) Vitamin B₆?

○ No ○ Yes ⟶ If yes,

How many years? ⟶ ○ 0-1 yr. ○ 2-4 yrs. ○ 5-9 yrs. ○ 10+ yrs. ○ Don't know

What dose per day? ⟶ ○ Less than 10 mg. ○ 10 to 39 mg. ○ 40 to 79 mg. ○ 80 mg. or more ○ Don't know

d) Vitamin E?

○ No ○ Yes ⟶ If yes,

How many years? ⟶ ○ 0-1 yr. ○ 2-4 yrs. ○ 5-9 yrs. ○ 10+ yrs. ○ Don't know

What dose per day? ⟶ ○ Less than 100 IU ○ 100 to 250 IU ○ 300 to 500 IU ○ 600 IU or more ○ Don't know

e) Selenium?

○ No ○ Yes ⟶ If yes,

How many years? ⟶ ○ 0-1 yr. ○ 2-4 yrs. ○ 5-9 yrs. ○ 10+ yrs. ○ Don't know

What dose per day? ⟶ ○ Less than 80 mcg. ○ 80 to 130 mcg. ○ 140 to 250 mcg. ○ 260 mcg. or more ○ Don't know

f) Iron?

○ No ○ Yes ⟶ If yes,

How many years? ⟶ ○ 0-1 yr. ○ 2-4 yrs. ○ 5-9 yrs. ○ 10+ yrs. ○ Don't know

What dose per day? ⟶ ○ Less than 51 mg. ○ 51 to 200 mg. ○ 201 to 400 mg. ○ 401 mg. or more ○ Don't know

g) Zinc?

○ No ○ Yes ⟶ If yes,

How many years? ⟶ ○ 0-1 yr. ○ 2-4 yrs. ○ 5-9 yrs. ○ 10+ yrs. ○ Don't know

What dose per day? ⟶ ○ Less than 25 mg. ○ 25 to 74 mg. ○ 75 to 100 mg. ○ 101 mg. or more ○ Don't know

h) Calcium? (Include Calcium in Dolomite.)

○ No ○ Yes ⟶ If yes,

How many years? ⟶ ○ 0-1 yr. ○ 2-4 yrs. ○ 5-9 yrs. ○ 10+ yrs. ○ Don't know

What dose per day? ⟶ ○ Less than 400 mg. ○ 400 to 900 mg. ○ 901 to 1300 mg. ○ 1301 mg. or more ○ Don't know

i) Are there other supplements that you take on a regular basis? Please mark if yes:

○ Folic acid ○ Cod liver Oil ○ Iodine ○ Beta-Carotene ○ Other (please specify):

○ Vitamin D ○ Copper

○ B-Complex Vitamins ○ Omega-3 Fatty-acids ○ Brewer's Yeast ○ Magnesium

3. For each food listed, fill in the circle indicating how often on average you have used the amount specified during the past year.

DAIRY FOODS	Never, or less than once per month	1-3 per mo.	1 per week	2-4 per week	5-6 per week	1 per day	2-3 per day	4-5 per day	6+ per day
Skim or low fat milk (8 oz. glass)	○	○	Ⓦ	○	○	Ⓓ	○	○	○
Whole milk (8 oz. glass)	○	○	Ⓦ	○	○	Ⓓ	○	○	○
Cream, e.g. coffee, whipped (Tbs)	○	○	Ⓦ	○	○	Ⓓ	○	○	○
Sour cream (Tbs)	○	○	Ⓦ	○	○	Ⓓ	○	○	○
Non-dairy coffee whitener (tsp.)	○	○	Ⓦ	○	○	Ⓓ	○	○	○
Sherbet or ice milk (½ cup)	○	○	Ⓦ	○	○	Ⓓ	○	○	○
Ice cream (½ cup)	○	○	Ⓦ	○	○	Ⓓ	○	○	○
Yogurt (1 cup)	○	○	Ⓦ	○	○	Ⓓ	○	○	○
Cottage or ricotta cheese (½ cup)	○	○	Ⓦ	○	○	Ⓓ	○	○	○
Cream cheese (1 oz.)	○	○	Ⓦ	○	○	Ⓓ	○	○	○
Other cheese, e.g. American, cheddar, etc., plain or as part of a dish (1 slice or 1 oz. serving)	○	○	Ⓦ	○	○	Ⓓ	○	○	○
Margarine (pat), added to food or bread; exclude use in cooking	○	○	Ⓦ	○	○	Ⓓ	○	○	○
Butter (pat), added to food or bread; exclude use in cooking	○	○	Ⓦ	○	○	Ⓓ	○	○	○

AVERAGE USE LAST YEAR

Please turn to page 2

Page 2

3. (Continued) Please fill in your average use, during the past year, of each specified food.

Please try to average your seasonal use of foods over the entire year. For example, if a food such as cantaloupe is eaten 4 times a week during the approximate 3 months that it is in season, then the average use would be once per week.

FRUITS	Never, or less than once per month	1-3 per mo.	1 per week	2-4 per week	5-6 per week	1 per day	2-3 per day	4-5 per day	6+ per day
Raisins (1 oz. or small pack) or grapes	O	O	W	O	O	D	O	O	O
Prunes (½ cup)	O	O	W	O	O	D	O	O	O
Bananas (1)	O	O	W	O	O	D	O	O	O
Cantaloupe (¼ melon)	O	O	W	O	O	D	O	O	O
Watermelon (1 slice)	O	O	W	O	O	D	O	O	O
Fresh apples or pears (1)	O	O	W	O	O	D	O	O	O
Apple juice or cider (small glass)	O	O	W	O	O	D	O	O	O
Oranges (1)	O	O	W	O	O	D	O	O	O
Orange juice (small glass)	O	O	W	O	O	D	O	O	O
Grapefruit (½)	O	O	W	O	O	D	O	O	O
Grapefruit juice (small glass)	O	O	W	O	O	D	O	O	O
Other fruit juices (small glass)	O	O	W	O	O	D	O	O	O
Strawberries, fresh, frozen or canned (½ cup)	O	O	W	O	O	D	O	O	O
Blueberries, fresh, frozen or canned (½ cup)	O	O	W	O	O	D	O	O	O
Peaches, apricots or plums (1 fresh, or ½ cup canned)	O	O	W	O	O	D	O	O	O

VEGETABLES	Never, or less than once per month	1-3 per mo.	1 per week	2-4 per week	5-6 per week	1 per day	2-3 per day	4-5 per day	6+ per day
Tomatoes (1)	O	O	W	O	O	D	O	O	O
Tomato juice (small glass)	O	O	W	O	O	D	O	O	O
Tomato sauce (½ cup) e.g. spaghetti sauce	O	O	W	O	O	D	O	O	O
Red chili sauce (1 Tbs)	O	O	W	O	O	D	O	O	O
Tofu or soybeans (3-4 oz.)	O	O	W	O	O	D	O	O	O
String beans (½ cup)	O	O	W	O	O	D	O	O	O
Broccoli (½ cup)	O	O	W	O	O	D	O	O	O
Cabbage or cole slaw (½ cup)	O	O	W	O	O	D	O	O	O
Cauliflower (½ cup)	O	O	W	O	O	D	O	O	O
Brussels sprouts (½ cup)	O	O	W	O	O	D	O	O	O
Carrots, raw (½ carrot or 2-4 sticks)	O	O	W	O	O	D	O	O	O
Carrots, cooked (½ cup)	O	O	W	O	O	D	O	O	O
Corn (1 ear or ½ cup frozen or canned)	O	O	W	O	O	D	O	O	O
Peas, or lima beans (½ cup fresh, frozen, canned)	O	O	W	O	O	D	O	O	O
Mixed vegetables (½ cup)	O	O	W	O	O	D	O	O	O
Beans or lentils, baked or dried (½ cup)	O	O	W	O	O	D	O	O	O
Yellow (winter) squash (½ cup)	O	O	W	O	O	D	O	O	O
Eggplant, zucchini, or other summer squash (½ cup)	O	O	W	O	O	D	O	O	O
Yams or sweet potatoes (½ cup)	O	O	W	O	O	D	O	O	O
Spinach, cooked (½ cup)	O	O	W	O	O	D	O	O	O
Spinach, raw as in salad	O	O	W	O	O	D	O	O	O
Kale, mustard or chard greens (½ cup)	O	O	W	O	O	D	O	O	O
Iceberg or head lettuce (serving)	O	O	W	O	O	D	O	O	O
Romaine or leaf lettuce (serving)	O	O	W	O	O	D	O	O	O
Celery (4" stick)	O	O	W	O	O	D	O	O	O
Beets (½ cup)	O	O	W	O	O	D	O	O	O
Alfalfa sprouts (½ cup)	O	O	W	O	O	D	O	O	O
Garlic, fresh or powdered (1 clove or shake)	O	O	W	O	O	D	O	O	O

EGGS, MEAT, ETC.	Never, or less than once per month	1-3 per mo.	1 per week	2-4 per week	5-6 per week	1 per day	2-3 per day	4-5 per day	6+ per day
Eggs (1)	O	O	W	O	O	D	O	O	O
Chicken or turkey, with skin (4-6 oz.)	O	O	W	O	O	D	O	O	O
Chicken or turkey, without skin (4-6 oz.)	O	O	W	O	O	D	O	O	O
Bacon (2 slices)	O	O	W	O	O	D	O	O	O
Hot dogs (1)	O	O	W	O	O	D	O	O	O

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3. (Continued) Please fill in your <u>average use</u>, during the past year, of each specified food.

MEATS (CONTINUED)	Never, or less than once per month	1-3 per mo.	1 per week	2-4 per week	5-6 per week	1 per day	2-3 per day	4-5 per day	6+ per day
Processed meats, e.g. sausage, salami, bologna, etc. (piece or slice)	O	O	W	O	O	D	O	O	O
Liver (3-4 oz.)	O	O	W	O	O	D	O	O	O
Hamburger (1 patty)	O	O	W	O	O	D	O	O	O
Beef, pork, or lamb as a sandwich or mixed dish, e.g. stew, casserole, lasagne, etc.	O	O	W	O	O	D	O	O	O
Beef, pork, or lamb as a main dish, e.g. steak, roast, ham, etc. (4-6 oz.)	O	O	W	O	O	D	O	O	O
Canned tuna fish (3-4 oz.)	O	O	W	O	O	D	O	O	O
Dark meat fish, e.g. mackerel, salmon, sardines, bluefish, swordfish (3-5 oz.)	O	O	W	O	O	D	O	O	O
Other fish (3-5 oz.)	O	O	W	O	O	D	O	O	O
Shrimp, lobster, scallops as a main dish	O	O	W	O	O	D	O	O	O

BREADS, CEREALS, STARCHES	Never, or less than once per month	1-3 per mo.	1 per week	2-4 per week	5-6 per week	1 per day	2-3 per day	4-5 per day	6+ per day
Cold breakfast cereal (1 cup)	O	O	W	O	O	D	O	O	O
Cooked oatmeal (1 cup)	O	O	W	O	O	D	O	O	O
Other cooked breakfast cereal (1 cup)	O	O	W	O	O	D	O	O	O
White bread (slice), including pita bread	O	O	W	O	O	D	O	O	O
Dark bread (slice)	O	O	W	O	O	D	O	O	O
English muffins, bagels, or rolls (1)	O	O	W	O	O	D	O	O	O
Muffins or biscuits (1)	O	O	W	O	O	D	O	O	O
Brown rice (1 cup)	O	O	W	O	O	D	O	O	O
White rice (1 cup)	O	O	W	O	O	D	O	O	O
Pasta, e.g. spaghetti, noodles, etc. (1 cup)	O	O	W	O	O	D	O	O	O
Other grains, e.g. bulgar, kasha, couscous, etc. (1 cup)	O	O	W	O	O	D	O	O	O
Pancakes or waffles (serving)	O	O	W	O	O	D	O	O	O
French fried potatoes (4 oz.)	O	O	W	O	O	D	O	O	O
Potatoes, baked, boiled (1) or mashed (1 cup)	O	O	W	O	O	D	O	O	O
Potato chips or corn chips (small bag or 1 oz.)	O	O	W	O	O	D	O	O	O
Crackers, Triskets, Wheat Thins (1)	O	O	W	O	O	D	O	O	O
Pizza (2 slices)	O	O	W	O	O	D	O	O	O

CARBONATED BEVERAGES

Consider the serving size as 1 glass, bottle or can for these carbonated beverages.

OTHER BEVERAGES

BEVERAGES		Never, or less than once per month	1-3 per mo.	1 per week	2-4 per week	5-6 per week	1 per day	2-3 per day	4-5 per day	6+ per day
Low Calorie (sugar-free) types	Low calorie cola, e.g. Tab with caffeine	O	O	W	O	O	D	O	O	O
	Low calorie caffeine-free cola, e.g. Pepsi Free	O	O	W	O	O	D	O	O	O
	Other low calorie carbonated beverage, e.g. Fresca, Diet 7-Up, diet ginger ale	O	O	W	O	O	D	O	O	O
Regular types (not sugar-free)	Coke, Pepsi, or other cola with sugar	O	O	W	O	O	D	O	O	O
	Caffeine Free Coke, Pepsi, or other cola with sugar	O	O	W	O	O	D	O	O	O
	Other carbonated beverage with sugar, e.g. 7-Up, ginger ale	O	O	W	O	O	D	O	O	O
	Hawaiian Punch, lemonade, or other non-carbonated fruit drinks (1 glass, bottle, can)	O	O	W	O	O	D	O	O	O
	Decaffeinated coffee (1 cup)	O	O	W	O	O	D	O	O	O
	Coffee (1 cup)	O	O	W	O	O	D	O	O	O
	Tea (1 cup), not herbal teas	O	O	W	O	O	D	O	O	O
	Beer (1 glass, bottle, can)	O	O	W	O	O	D	O	O	O
	Red wine (4 oz. glass)	O	O	W	O	O	D	O	O	O
	White wine (4 oz. glass)	O	O	W	O	O	D	O	O	O
	Liquor, e.g. whiskey, gin, etc. (1 drink or shot)	O	O	W	O	O	D	O	O	O

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3. (Continued) Please fill in your average use during the past year, of each specified food.

SWEETS, BAKED GOODS, MISCELLANEOUS	Never, or less than once per month	1-3 per mo.	1 per week	2-4 per week	5-6 per week	1 per day	2-3 per day	4-5 per day	6+ per day
Chocolate (bars or pieces) e.g. Hershey's, M&M's	O	O	W	O	O	D	O	O	O
Candy bars, e.g. Snickers, Milky Way, Reeses	O	O	W	O	O	D	O	O	O
Candy without chocolate (1 oz.)	O	O	W	O	O	D	O	O	O
Cookies, home baked (1)	O	O	W	O	O	D	O	O	O
Cookies, ready made (1)	O	O	W	O	O	D	O	O	O
Brownies (1)	O	O	W	O	O	D	O	O	O
Doughnuts (1)	O	O	W	O	O	D	O	O	O
Cake, home baked (slice)	O	O	W	O	O	D	O	O	O
Cake, ready made (slice)	O	O	W	O	O	D	O	O	O
Sweet roll, coffee cake or other pastry, home baked (serving)	O	O	W	O	O	D	O	O	O
Sweet roll, coffee cake or other pastry, ready made (serving)	O	O	W	O	O	D	O	O	O
Pie, homemade (slice)	O	O	W	O	O	D	O	O	O
Pie, ready made (slice)	O	O	W	O	O	D	O	O	O
Jams, jellies, preserves, syrup, or honey (1 Tbs)	O	O	W	O	O	D	O	O	O
Peanut butter (Tbs)	O	O	W	O	O	D	O	O	O
Popcorn (1 cup)	O	O	W	O	O	D	O	O	O
Nuts (small packet or 1 oz.)	O	O	W	O	O	D	O	O	O
Bran, added to food (1 Tbs)	O	O	W	O	O	D	O	O	O
Wheat germ (1 Tbs)	O	O	W	O	O	D	O	O	O
Chowder or cream soup (1 cup)	O	O	W	O	O	D	O	O	O
Oil and vinegar dressing, e.g. Italian (1 Tbs)	O	O	W	O	O	D	O	O	O
Mayonnaise or other creamy salad dressing (1 Tbs)	O	O	W	O	O	D	O	O	O
Mustard, dry or prepared (1 tsp)	O	O	W	O	O	D	O	O	O
Pepper (1 shake)	O	O	W	O	O	D	O	O	O
Salt (1 shake)	O	O	W	O	O	D	O	O	O

4. How much of the visible fat on your meats do you remove before eating?
- ○ Remove all visible fat
- ○ Remove majority
- ○ Remove small part of fat
- ○ Remove none
- ○ (Don't eat meat)

5. What kind of fat do you usually use for frying and sautéing? (Exclude "Pam"-type spray)
- ○ Real butter
- ○ Margarine
- ○ Vegetable oil
- ○ Vegetable shortening
- ○ Lard

6. What kind of fat do you usually use for baking?
- ○ Real butter
- ○ Margarine
- ○ Vegetable oil
- ○ Vegetable shortening
- ○ Lard

7. What form of margarine do you usually use?
- ○ None
- ○ Stick
- ○ Tub
- ○ Spread
- ○ Low-calorie stick
- ○ Low-calorie tub

8. How often do you eat food that is fried at home? (Exclude the use of "Pam"-type spray)
- ○ Daily
- ○ 1-3 times per week
- ○ 4-6 times per week
- ○ Less than once a week

9. How often do you eat fried food away from home? (e.g. french fries, fried chicken, fried fish)
- ○ Daily
- ○ 1-3 times per week
- ○ 4-6 times per week
- ○ Less than once a week

10. How many teaspoons of sugar do you add to your beverages or food each day? ——→ ___ tsp.

11. What type of cooking oil do you usually use? ——→ ___ Specify type and brand

12. What kind of cold breakfast cereal do you usually use? ——→ ___ Specify type and brand

13. Are there any other important foods that you usually eat at least once per week?

Include for example: paté, tortillas, yeast, cream sauce, custard, horseradish, parsnips, rhubarb, radishes, fava beans, carrot juice, coconut, avocado, mango, papaya, dried apricots, dates, figs.

(Do not include dry spices and do not list something that has been listed in the previous sections.)

Other foods that you usually use at least once per week	Usual serving size	Servings per week
(a)		
(b)		
(c)		
(d)		