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AT ST. AUGUSTINE, TRINIDAD AND TOBAGO

A Research Paper

Submitted in partial requirements

for HUEC 3012

of

The University of the West Indies

Title: High-fat food Consumption, Physical inactivity and other selected risk factor for Cariovascular Disease among the Students of the University of the West Indies, St. Augustine Campus

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HIGH-FAT FOOD CONSUMPTION, PHYSICAL INACTIVITY AND OTHER SELECTED RISK FACTORS FOR CARDIOVASCULAR DISEASE AMONG THE STUDENTS OF THE UNIVERSITY OF THE WEST INDIES, ST AUGUSTINE CAMPUS

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ABSTRACT

Objective: Limiting studies exists on obesity as a risk factor for cardiovascular disease in the Caribbean. The purpose of this study is to determine whether, consumption of high fat food and physical inactivity, increases the risk for the development of cardiovascular disease, among the students of the University of the West Indies, St Augustine campus.

Method: Using convenient sampling, 80 males and 116 females (n=196), participated in this study. Students were given a self administered questionnaire containing three sections including anthropometrics, background information and a food frequency questionnaire. The anthropometric measurements included BMI, visceral fat and total body fat percent. Blood pressure was also done. Statistical analyses included descriptive statistics, ANOVA with Post Hoc- Tukey analyses as well a multiple linear regression.

Results: The study showed that most students (74%) purchased meals more than 2 times per week, which usually included fast foods (41.3%). Results show that approximately 62 % of the students report that they were moderately physically active, with 18.4% having a current sedentary lifestyle. Using indicators of obesity including, BMI, total body fat and visceral fat, it was found that in the sample population, total body fat percent was highest among both males and females; with visceral fat and BMI existing within normal range. Greatest linear associations were observed between physical activity and food consumption with visceral fat and total body fat percent, rather than with BMI. It showed that a 1% increase in physical activity can result in a decrease of visceral fat and total body fat by 0.017%. However a 1% increase of frequency of high-fat food consumption can result in a 0.063% increase of visceral fat and total body fat.

Conclusion: The findings suggest that within this population, there are linear associations existing between physical activity and frequency of high-fat food consumption, with total body fat percent and visceral fat.

INTRODUCTION

Background

Global trends of chronic non-communicable diseases (NCDs) have shown significant increases in prevalence, even to the extent of being now considered as an epidemic in many countries. As one of the most significant contributors of death in the world, this public health issue have caught the attention of many governmental agencies worldwide. With alarming statistics emerging through many studies and surveys carried out, many governments and non-profit organizations are now collaborating in their efforts to deal with the exponential rise in incidences of these diseases.

In Latin America and the Caribbean, chronic diseases are currently the leading cause of premature mortality, being responsible for approximately 50 percent of deaths under 70 years. It is also stated that chronic diseases accounts for approximately every two out of three deaths overall (CARICOM 2007). The burden experienced by health care professionals due to disease prevalence or morbidity is increasing, even though there may be reported decreases in deaths. It is explained that alterations in risk factor profiles of any population, in demographics, health care systems and varying social and technological changes, are the factors which influences shifts on the patterns of disease (Partnership 2001). Additionally, the economic burden of management of these diseases continues to grow, resulting in greater amounts being allocated to treatment of cardiovascular disease (CVD) than diseases such as HIV and AIDS. In the United States alone, it is reported, that in 2003, treatment for heart disease and stroke was approximately 350 billion dollars (DeFelice 2005).

Although a significant proportion of these NCDs are preventable, they continue to rise mainly due to the fact that preventive measures that should be implemented on a national and even personal level are not adequate (WHO 2011). An annual ministerial review conference held in 2009 highlighted that, NCDs account for approximately 60 percent of all deaths globally and when combined with injuries or disabilities, accounts for 70 percents of all deaths. These alarming statistics also outline the fact that approximately half of these deaths are found in low and middle income countries (Affairs 2009). During this conference, it encouraged governments to begin taking the responsibility of putting measures in place to alleviate the effects and prevalence of these diseases among individuals.

Non- communicable diseases generally refer to conditions characterised by complex causality, multiple risk factors, a long latency period, a prolonged course of illness, functional impairment or disability and in most cases the unlikelihood of cure (Partnership 2001). This general classification can be further broken down into four main types of non-communicable diseases including, cardiovascular disease, cancers, chronic respiratory diseases and diabetes (Engelgau, et al. 2011).

In relation to the different types of non-communicable diseases existing, the World Health Organization (WHO) (2011) documented that CVD are now the leading causes of both death and disability in the world. The report also indicated that an estimated 17.3 million die from heart disease and stroke in the year 2008. These diseases according to the Centers for Disease Control (2010), are the most common, costly and preventable of all the health problems present in United States of America. In 2005, cardiovascular disease was determined as the underlying or contributing cause in more than 1.37 million (~ 56%) deaths. It was added that in the United States of America, approximately 80 million American adults live with one or more cardiovascular diseases and 38 million being over the age of 60 years (Pujol, Tucker and Barnes 2007). With further analysis, it is documented that in Trinidad and Tobago alone, NCDs are accountable for approximately 78% of all death in the country, with cardiovascular diseases representing 34% of all cases (Organization 2011).

Cardiovascular disease, according to Eugene A Defelice (2005), refers to a group of disease that affects the heart and blood vessels. She further defines cardiovascular disease as conditions which can affect any area of the body, including the brain, neck, chest, abdomen and legs. These diseases include atherosclerosis, hypertension, ischemic heart disease, peripheral vascular disease and heart failure. Developed and exacerbated by many risk factors, if not prevented or managed during the varying stages, can ultimately result in death. Risk factors for CVD include increased blood cholesterol levels (hyperlipidemia), high blood pressure, diabetes mellitus, tobacco use, diet, physical inactivity, obesity, alcohol use and family history of CVD (CDC 2009).

Among the varying risk factors, obesity is one of the most significant of all risk factors in contributing to CVD development. Becoming a global epidemic, obesity in the past 10 years in the United States, dramatically increased, occurring in both children and adults. Its strong associations with comorbidities such as CVD, type II diabetes, hypertension, certain cancers and sleep apnea, obesity shows to be one of the greatest contributor to increase morbidity and reduced life expectancy (Poirier, et al. 2006). In the Caribbean, it is reported that obesity, like the United States, is considered to me the most important underlying cause of death. It is hypothesized that the average individual’s daily energy intake usually exceeds their energy output (Henry 2007). Changes in diet, physical activity and other everyday practices have all contributed to increasing incidences of obesity, more significantly among the younger generation, increasing their probability of CVD development at a younger age. Due to this, it makes it imperative that studies be conducted on the implications of these major risk factors among the young population, so that proper intervention strategies can be put in place to alleviate the problem.

Purpose of the Study

The purpose of this study is to investigate the association between high fat food consumption, physical inactivity and other selected risk factors for cardiovascular disease among the students of the University of the West Indies, St Augustine campus.

Rationale and Statement of Problem

As previously emphasized, cardiovascular disease is becoming a growing issue among many countries. Due to this, it is imperative that each individual do their part to ensure that the growing incidences of this disease are reduced. In Trinidad and Tobago, chronic disease risk behaviour patterns are common. With increasing urbanization and busy lifestyles, many individuals are no longer physically active and they do have altered diets to accommodate their present lifestyle.

Based on observation among the student population of the University of the West Indies, St Augustine campus, such practices, are also common. These common practices include poor diets characterised by high intake of fat, refined carbohydrates; low intake of fruits and vegetables; tobacco smoking and physical inactivity. By extension, average diets of students are usually characterized by high consumption of fast food (KFC, Burgers, Chinese, and French Fries), Indian delicacies (doubles), pastries and even snacks; which contribute to the high fat consumption, specifically saturated fats. Due to this, even though confounding factors may play a role, it can be hypothesized that these practices account for the increased prevalence of overweight and obese students in the university population. With increasing consumption of fats, which has significant implications towards CVDs and obesity, it is also seen that physical activity is minimal among many students.

Although it has been previously noted that CVD usually affects individuals who are more than 50 years of age, it is also proven that the lifestyle that is lived during the younger years of life, directly affects the quality of life experienced in later years. This is due to the fact that in most cases, many of the contributing behavioural patterns are adopted in childhood and adolescence (Rogacheva, et al. 2006). Because of the implications to CVD development, this population has therefore been targeted for research into the association between high fat food consumption, physical inactivity and other selected risk factors for cardiovascular disease among the students of the University of the West Indies, St Augustine campus.

Current statistics for chronic diseases in Latin America and the Caribbean, states that, these diseases are currently the leading cause of premature mortality, being responsible for approximately 50 percent of deaths under 70 years. It is also stated that chronic diseases accounts for approximately every two out of three deaths overall (CARICOM 2007). With increasing sources of literature on the varying manifestations of CVD among different populations, many of the risk factors and its associations are studied. However, there is limiting studies which examines the association of CVD risk factors and risk of CVD development among individuals 70 years and younger, in the Caribbean.

Research Question

What is the association between the frequency of high-fat food consumption, physical inactivity and other selected risk factors for cardiovascular disease, among the student population of the University of the West Indies, St Augustine campus?

Hypotheses

1. Frequency of consumption of high fat foods is associated with increase in the frequency of consumption of fast food among the students of UWI.
2. Lower levels of physical activity and higher consumption of high fat foods are associated with increased obesity, a risk factor for cardiovascular disease.
3. Among the UWI students, lower levels of physical activity, is associated with higher BMI, total percent body fat and visceral fat.
4. Increased total body fat, visceral fat and BMI are associated with increased consumption of high-fat foods.

General Objective

To determine whether, consumption of high fat food and physical inactivity, increases the risk for the development of cardiovascular disease among the students of the University of the West Indies, St Augustine campus.

Specific Objectives

1. To assess the students consumption of high fat foods, using a food frequency questionnaire data sheet.
2. To determine the level, frequency and duration of physical activity among the UWI students.
3. To determine the prevalence of other selected risk factors for cardiovascular disease among UWI students.
4. To determine the prevalence of obesity among UWI students by using BMI, total percent body fat and visceral fat.
5. To determine whether there is an association between physical activity level and high-fat food consumption frequency with the BMI, total body fat and visceral fat of the UWI students.
6. To determine a linear relationship between physical activity level and high-fat food consumption frequency with the BMI, total body fat and visceral fat of the UWI students.

LITERATURE REVIEW

The prevalence of cardiovascular disease within recent years has grown exponentially, becoming one of the main contributors to death in the world. A new report documented in 2011 by the World Health Organization (WHO), acknowledged that cardiovascular diseases (CVD) are the leading causes of both death and disability in the world, with estimated 17.3 million dying from heart disease and strokes in 2008. It went on to state that although a significant proportion of cardiovascular disease is preventable, they continue to rise mainly due to the fact that preventive measures are not adequate (WHO 2011).

In Trinidad and Tobago, a non-communicable disease (NCD) profile carried out in 2011, indicated that non-communicable diseases are accountable for approximately 78% of all death in the country, with cardiovascular diseases representing 34% of all cases. In 2008, it was estimated that age-standardized death rates per 100 000 for CVD and diabetes were 545.3 and 316.4 in males and females respectively. Among the leading risk factors including tobacco smoking, physical inactivity, elevated blood pressure, blood glucose and cholesterol, and obesity, being overweight or obese was most prevalent (58.1% males and 69.1% females) (Organization 2011).

According to Labarthe (2010), CVD are diseases comprising of major disorders of the heart and the arterial circulation supplying the heart, brain and peripheral tissues (Labarthe 2010). These types of conditions include hypertension, atherosclerosis, ischemic heart disease, peripheral vascular disease and heart failure. Hypertension is a condition which refers to the chronic elevation in an individual’s blood pressure with a reading greater than or equal to 140/90 mmHg. Hypertension may go undiagnosed for many years and can result in congestive heart failure, kidney failure, myocardial infarction, stroke and aneurysms (Pujol, Tucker and Barnes 2007). It has been reported that there were more than 57 356 in the United Sates in 2005, as a direct result of hypertension (Ibid.).

Atherosclerosis, another type of cardiovascular disease, is defined as the thickening of the arterial walls as well as the loss of vascular elasticity. As plaque develop the lumen's vessel becomes narrowed and creates conditions such as myocardial infarction, stroke, coronary artery disease and peripheral vascular disease (Ibid. 298). According to the American Heart Association, current statistics indicates that approximately 13 million individuals are affected by atherosclerosis and its related condition which accounts for more than 500 000 deaths per year (Thom, et al. 2006).

Ischemic heart disease (IHD), also known as coronary artery disease (CAD), refers to the conditions where atherosclerotic plaque restricts up to 50 percent of the lumen of a coronary artery and remains asymptomatic (Pujol, Tucker and Barnes 2007). As blood flow becomes more restricted it usually results in myocardial ischemia and later can account for myocardial infarctions or heart attacks or strokes. It is noted that ischemic heart disease is the most significant killer among Americans, as 20% of all deaths reported in 2003 were due to this condition (Thom, et al. 2006).

According to Pujol, Tucker and Barnes (2007), peripheral arterial disease (PAD), also classified as a CVD, refers to the restriction of blood flow in non-coronary arteries, most commonly found in the pelvis and the legs. This type of disease is very similar in action to that of arteriosclerosis as well as ischemic heart disease. Many studies carried out indicate that peripheral arterial disease usually increases the risk for developing other conditions like myocardial infarction, stroke, unstable angina and even sudden cardiac death (Pujol, Tucker and Barnes 2007).

The term heart failure refers to the pathophysiologic state in which an abnormality of cardiac function is responsible for the failure of the heart to pump blood at a rate commensurate with the requirements of the metabolizing tissues (Denolin, et al. 1983). Statistical reports from 2005 show that approximately 5 million Americans were diagnosed with heart failure, with this disease contributing to 292 215 deaths. Additionally it was shown that heart failure was the underlying cause of death in 58 933 of those deaths (Pujol, Tucker and Barnes 2007).

There are many risk factors which contribute to the development of cardiovascular disease in individuals. Hypertension is classified as a blood pressure reading of ≥ 140/90 mmHg (NHLBI 2003) and this puts a person at increased risk for developing cardiovascular disease. Obesity is another important risk factor which increases the risk of any person for developing CVD. Obesity is therefore considered to be the occurrence of have a body mass index ≥ 30 kg/m^2 (Seidell and Flegal 1997). Dyslipidemia is condition in which individuals may have altered biochemical levels of cholesterol and is also significantly influential in developing cardiovascular disease. This occurrence is commonly influenced by poor dietary habits characterised by high intakes of fats, most specifically saturated fats; and a low intake of fruits and vegetables.

Diabetes mellitus, another risk factor, is a disease where the body's ability to metabolised glucose is impaired. It is characterised by casual plasma glucose concentration ≥ 200 mg/dL, fasting plasma glucose ≥ 126 mg/dL or 2-hour post- prandial glucose ≥ 200 mg/dL during an oral glucose tolerance test (Pujol, Tucker and Barnes 2007). Physical inactivity or a sedentary lifestyle, cigarette smoking, and even a family history of the condition, also puts individuals at risk for developing CVD. Age is also another important risk factor, as it is seen that men who are more than 55 years and women who are more than 65 years are at greater risk.

Studies conducted among children in the United States of America ages 0-19 also supported the facts that prevalence of CVD is increasing. By analysing 1 083 girls and 1 013 boys as part of the SEARCH for Diabetes in Youth study, Rodriguez, et al. (2006) determined the prevalence of risk factors for cardiovascular disease. It was seen that the prevalence of having at least two cardiovascular risk factors was 21%. Prevalence was found to be 7% among children 3-9 years and 25% in youths, 10-19 years of age. Additionally, risk factors seemed to have been more prevalent among girls (23%) than boys (19%), with higher cases seen among American Indians (68%), Asian Pacific Islanders (37%), African Americans (32%) and Hispanics (35%) (Rodriguez, et al. 2006).

CVD is not defined as one specific disease, but, refers to a number of diseases or conditions that affects the heart or the blood vessels. These conditions include arteriosclerosis, coronary artery disease, heart valve disease, arrhythmia, heart failure, hypertension, shock, endocarditis, disorders of the aorta and its branches, disorders of the peripheral vascular system and congenital heart disease (MedicineNet 2001).

CVD, which is already increasing at alarming rate among individuals of all ages, is becoming a topic of study and discussions globally, as governments and public health bodies are seeking to address this issue. An understanding of it pathophysiology, prevalence among varying groups and risk factors are being constantly explored by different researchers, thus providing scientific evidence on this disease. Additionally, it must be noted that, CVD may affect anyone who may develop risk factors for the disease. However, different variables including age and gender also have significant impact on cardiovascular disease development.

In one such study, the association between gender and CVD was investigated; to provide supporting evidence to claims suggesting that non-Caucasians (Africans, Indians, and Hispanics) were at greater risk for developing cardiovascular diseases than Caucasians. In a more recent study Jolly, et al. (2010) presented a strong argument which examined cardiovascular disease prevalence and mortality among African and Caucasian adults across the adult age (35-44 years) and explored potential mediators of these differential disease prevalence rates.

In the cross-sectional study analysis of National Health and Nutrition Examination Survey (NHANES), age- adjusted and age- specific prevalence ratios for cardiovascular disease for Black versus White in adults 35 years and over, were estimated. It was explained that in young adulthood, CVD prevalence was higher in the blacks than it was in the white study population, with a prevalence ratio of 1.9 at a 95 % CI. They proceeded to detail that the prevalence ratio decreased with each decade of advancing age which lead to an ultimate narrowing of the racial gap at older ages. It was seen that 28% of all cardiovascular deaths among blacks occurred in individuals less than 65 years compared to 13% among the white population (Jolly, et al. 2010).

One particular study by Rodriguez- Artalego, et al.(2002) focused mainly on evaluating CVD mortality risk among children. Their aim was to provide insight into the occurrence of this disease among a younger population, as most studies as previous stated, focused on adults more than 65 years. From evaluating 1 112 children from four Spanish countries (Two with high Ischemic Heart Disease and two with low Ischemic Heart Disease), it was seen that there was a high prevalence of overweight (28.9-34.5%) and obesity (8.5-15.7%). Additional analysis using diet recalls indicated diets that were moderately hypercaloric with a range of 2078-2218 kcals/day. This total intake was found to be significantly high in sugar, protein, and lipid intake (45.0-47.3 % kcals/day), particularly saturated fats (16.6-16.9% kcals/day).

The researchers tested the impact of diet specifically high fat diets on the BMI of adolescents and found that the diet directly impacted the high prevalence of overweight and obesity in the young population, which is considered one of the most significant predictors for cardiovascular disease. They also proceeded to detail that if any differences in anthropometric variables and diet among the differing cities are maintained or continued into adulthood, they would contribute to or even increase the IHD mortality rate across the cities (Rodriguez- Artalego, et al. 2002).

A similar study conducted by Zhang, et al. (2010), among the Chinese population, also put forward supporting evidence of high-fat diets increasing the risk of CVD development. In a cross-sectional population survey conducted on 19 003 suburban residents aged 18 to 76 years, it was established that the current Chinese diet, especially in urban areas, is generally high in fat, sodium and energy intake and low in fruit and vegetable intake. Additionally, it was also noted that energy expenditure has declined among the Chinese as urbanization and industrialization have progressed throughout the years.

The researchers highlighted that participants who consumed diets that were high in fat, were more likely to be overweight or obese and develop dyslipidemia unlike vegetarians who had a lower risk of overweight or obesity, diabetes, hypertension, dyslipidemia and metabolic syndrome (Zhang, et al. 2010).

Another study by Savitha and Sandeep (2011), also done within a young population, sort to evaluate the effects of diets and other cardiovascular disease risk factors on the risk of developing cardiovascular diseases. It was highlighted that dyslipidemia along with other factors including diet, obesity and a sedentary lifestyle, increases the risk of an adolescent developing ischemic heart disease in adulthood. This study was carried out by evaluating 50 children whose parents had premature IHD and 50 children without any family history of ischemic heart disease.

For this study, all the children were assessed nutritionally using a 24- hour dietary recall form for a two day period. Their physical activity level was assessed and documented by taking their respective histories. The recommendation for physical activity according to this study stated that children were required to accumulate 60 minutes of physical activity each day and teens should engage in at least 20 minutes of vigorous activity three days and 30 minutes of moderate activity for 5 day a week. If this was not fulfilled, they were considered as having a sedentary lifestyle as per National Association for Sport and Physical Education (NASPE). Additionally other tools used to collect data included percentile charts based on gender, age and height was provided by the Indian Academy of Pediatrics (IAP) and was used for classification.

The significant results obtained from this study indicated that the mean total cholesterol, low-density lipoprotein cholesterol and triglycerides were significantly higher among children who had a family history of CVD as compared to children without any family interest. This therefore indicated that family history of CVD increases the risk of cardiovascular disease development in individuals. Additionally the researchers established a connection between increasing incidences of dyslipidemia and elevated BMI, a high- fat diet and also a sedentary lifestyle. Further parallels were developed as the BMI was found to be higher in the children with a family history for ischemic heart disease than that of the 50 controls (Savitha and Sandeep 2011).

Another significant study was conducted by Amin- Shokravi, Rajabi and Ziaee (2010) which also sort to find correlations between physical activity and CVD risk. The aim of the study was to look at the effects of a 12- week exercise program on the risk of cardiovascular disease and fitness of middle aged Iranian women. In this randomised controlled trial study, the training group (n= 20) participated in a high intensity running exercise, on a treadmill. This was done at 70-80 % of maximum heart rate for 30 minutes per day for 3 days per week. Additionally, the control group (n= 20) were required to maintain their habitual lifestyle of exercise and dietary practices.

Their hypothesis stated that active women with regular and low to moderate intensive physical activity are exposed to reduced risk of CHD and stroke and in general, health problems. It was proven through measurements of BMI, waist/hip ratio, blood pressure, total cholesterol and lipoprotein subtractions before and after the 12 weeks. As a result, it was found that the systolic and diastolic blood pressure, 10-yr risk of CHD and triglyceride levels was decreased. Additionally, there was a subsequent increase in HDL-C levels in the group that underwent the physical training. Further results in the study, also was able to highlight that due to increased physical activity among the women, it resulted in a subsequent reduction in the Framingham risk scores which was used to calculate CVD risk (Amin- Shokravi, Rajabi and Ziaee 2011).

A scientific statement made by the American Heart Association sort to explore the correlation between obesity and CVD risk. It was stated in this review that obesity is strongly associated with many co-morbidities including cardiovascular disease, type II diabetes, hypertension, certain cancers and also sleep apnea. More significantly as previously indicated in other studies, obesity is considered an independent risk factor for CVD with risk factors being documented in the younger population (Poiner, et al. 2006).

Another study carried out on adolescent subjects also sort to develop links between obesity and their risk for cardiovascular development. A follow-up study was conducted for a 31.5 year period on 227,003 Norwegian boys and girls between ages 14-19 years. During the duration of the study it was registered that a there was a total of 7 516 deaths. With controls having a BMI range between the 25th and 75th percentile, it was reported that a BMI greater than the 95th percentile in adolescents predicted adult mortality rates in both sexes. The researchers pointed out that there was a 30% increase in all-cause mortality in both males and female subjects, when the baseline BMI was between the 85th and 95th percentile and 80% higher in BMI above the 95th percentile (Engeland, et al. 2003).

Theoretical Framework

Studies carried out to establish relationships between the risk factors for cardiovascular disease and the subsequently development of these diseases are numerous. In comparison to many published literature it is evident that the motivation to perform certain actions can be attributed to existing external factors which influence and shape certain behavioural patterns. In this study, the chosen sample population exhibits most of the patterns that are already published in the literature including consumption of high fat foods, lack of physical activity and other behaviour patterns such as smoking. It is also seen, that factors such as knowledge and attitudes towards certain behaviours cannot directly identify their actions.

In this light, based on the parameters of this study, the use of the Social Cognitive Theory's principle can be applied. The Social Cognitive Theory (SCT), also known as the Social Learning Theory, explains behaviour as a model, where behaviour, personal factors such as cognitions, and the environment interact constantly (Boyle and Holben 2010). Cognition can be referred to as the knowledge and awareness that people have of their environment and the judgements they make related to it. This means that any deviations or changes in one of the parameters can implicate the others. This process is known as reciprocal determinism (Boyle and Holben 2010). This model as it relates to this study explains how certain behaviours of any individual are obtained and continuously maintained. This means, that a person’s knowledge of outcomes due to certain practices, for example poor diet and increased risk for heart attacks, would not be solely influential in their behaviour or eating pattern. Rather, interactions with the environment, in the social realm (family, friends and peers) and physical realm (school environment) may be more influential in their action. In relation to this study, the social cognitive theory centres on specific targeted behaviours rather than on knowledge and attitude.

METHODOLOGY

Subjects/ Participants

In this cross- sectional study, a sample of the student population of the University of the West Indies, St Augustine campus, was used. To obtain a representative sample of the entire student population, a three step process was done. Firstly, the percentage of students who consumed high fat foods and who were not physically active was initially estimated. After an estimation of the percentages, the margin of error was then adjusted at a five percent level (95% Confidence Interval), and the equation $n = \frac{Z\propto/_2\, \hat{p}\, \hat{q}}{d^2}$ was used; where n = the sample population, p = percentage of student doing the particular action, q = percentage of students not doing the particular action and d^2 = margin of error. This equation was used to determine the number of students in each of the categories. Finally, in obtaining the sample size that would be able to represent the student population, the larger of the two numbers calculated was used.

The sample population comprised of one hundred and ninety six (196) students with males (n= 80) and females (n=116). Using a convenient method of sampling students were chosen to fulfil the required sample size based on the ease of access to the participants. Eligibility criteria for selection included that students were required to be a registered student of the University of the West Indies, St Augustine campus. However there were exclusions made to students who were registered to the University's Open Campus. Additional criteria for exclusion included, pregnant women and administrators or staff of the university.

Data Collection

A questionnaire was generated to collect the relevant information needed. The questionnaire contained three main sections including demographics and anthropometrics, background information and a food frequency questionnaire. The demographics and anthropometric data sheet was used to collect essential information about the subjects which was needed for further analyses. These included sex, age, ethnicity and anthropometric data such as weight, height, body mass index (BMI), percent total body fat, visceral fat and vitals like blood pressure. Questions regarding living arrangements, food consumption patterns, family history of related diseases and physical activity assessment were incorporated into the second section identified as background information. The final section was the food frequency questionnaire, which consisted of 30 food items. A rating scale indicating frequency of consumption of the varying items was utilized, which ranged from never, rarely, sometimes, most times to always.

Procedure

Data collection as previously mentioned was collected using a convenient sampling method. This method allowed for only students who were willing to participate in the study to be included. This was done until the required sample size of 196 was met. This self- administered questionnaire only required the subjects to select the relevant answers to each question. Anthropometric and other data however were collected by the researcher using the relevant equipment.

Weight and Body Composition Analysis

Body weight (kg), BMI (kg/m^2), visceral fat (%) and percent total body fat (%) were obtained using a Bioelectrical Impedance Analysis scale. In this process, the subjects were instructed to remove all cellular phones, jewellery and other metals in their possession. Additionally, they were also requested to remove their shoes and socks before weighing. After calibrating the scale specific to the individual, they were then required to stand and subsequent readings taken.

Blood Pressure

Blood pressure was measured using a digital, self- inflated blood pressure kit. To accurately measure the blood pressure, subjects were required to sit in a relaxed position, with legs uncrossed for a 5- 10 minute period. This was to ensure that the blood pressure can become stabilized. Duplicate measurements of blood pressure were taken on each individual to obtain an average. For this study, the term borderline hypertension was defined with a systolic blood pressure of 130- 139 mmHg, and a diastolic blood pressure of 85-89 mmHg. Added to that, hypertension was therefore characterised by a systolic blood pressure of more than 140 mmHg and a diastolic blood pressure of 90 mmHg or more (Carretero and Oparil 2000).

Statistical Analyses

Statistical analyses were carried out using the Statistical Package for the Social Sciences (SPSS) Software, version 16.0 for Windows and Microsoft Office Excel 2007. Any data that was not acquired from the questionnaire were subsequently assigned a missing data values. This was done so that all cases could be accounted for to provide accurate statistical analyses. To develop a single unit for food consumption frequency, a food score was calculated, by summing up all of the food variables to get a total score for each individual. This score, was then categorised according to level of frequency to create groups for which statistical tests could be run.

The results obtained, were analyzed using frequency tables chi-square, Analyses of Variance Analysis (ANOVA) and general linear regression models. Frequency tests were run on the general data to create percentages and frequencies to describe the various characteristics of the sample population. Additionally, the chi-square test, used to provide significance on relationships between categorical variables, were used to examine significant relationships between sex, physical activity, frequency of physical activity, duration of physical activity and high-fat food consumption frequency with BMI, total body fat percent and visceral fat respectively.

Analysis of Variance Analysis (ANOVA) was another type of statistical test used in the study, which provided data on significant differences of means of variables. Three separate tests were conducted to test if there were any variations in the means of BMI, total body fat percent and visceral fat. Finally, the general linear regression analysis was used to generate a model to show relationships between two or more variables, with use of a linear equation. This type of model uses the formula of $y= m(x) +c$, which seek to determine the type of relationship that the x value (independent variable), has on the y value (dependent variable). Due to the fact that all the data needed did not have units assigned to them, the log values were taken. This was done by using Microsoft Excel to convert the values into the respective log values. Once obtained, the regression models were run in SPSS to determine associations for BMI, total body fat percent and visceral fat, with physical activity level and high-fat food consumption score.

RESULTS

Demographic Characteristics

Table 1 provides the demographic data results obtained in the study. The sample size used in this study, comprised of 196 students with 40.8% (n=80) males and 59.2% (n=116) females. It was found that of all the respondents, a large majority of the sample was between the ages of 19-29 years (94.4%), with the remaining 4.6% of the population being between the ages of 30-49 years.

Additionally, there were small variations in ethnicities in the study, as students of African descent (n= 96), contributed to 49.0% of the entire sample, with ethnic group classified as other (n= 51) accounting for 26.0%. This group classification included ethnicities that were mixed and was not able to be categorized in distinct ethnicities. East Indians represented 47% of the sample with no Hispanics or Chinese as part of the study.

Living status of the students who were surveyed, showed that most students (49.5%) lived at home, i.e. with family or even their extended family. Furthermore, it was found that only 23.0% of the students lived on the various halls of residences on the UWI campus.

Table 1: Table Showing Demographic Profile of the Study Population

Variable	Category	Frequency	Percent (%)
Sex	Male	80	40.8
	Female	116	59.2
Age	≤ 18	2	1.0
	19-29	185	94.4
	30-49	9	4.6
	≥ 50	0	0.0
Ethnicity	East Indian	47	24.0
	African	96	49.0
	Chinese	0	0.0
	Hispanic	0	0.0
	Caucasian	2	1.0
	Other	51	26.0
Living Status	Renting Off-Campus	54	27.6
	Renting On-Campus (Halls)	45	23.0
	At Home (Family/Extended Family)	97	49.5

Meal Consumption Patterns

From the results shown in table 2, it is shown that 62.2% of the students (n=122) reported that most of their meals consumed for the week was prepared at home. The cafeterias of the university, which commonly offers foods such as burgers, french fries and fried chicken, sub sandwiches and barbecued meats, was seen to provide meals for 28.6% of the students (n=56).

Additionally, most students who purchased food (46.4%), reported that they purchased food approximately 2-3 times per week, with an additional 24.6 % (n=54) of students, reporting that they purchased meals four times and more per week. The minority of students (3.1%) reported that they never purchase food.

From the four main categories of cuisine analyzed, it was also noted that 41.3% of students (n=81) consumed fast food and 34.7% (n=68) consumed foods from Creole cuisine. Additionally, Chinese cuisine was consumed by 9.7% of the sample.

Table 2: Table Showing Meal Consumption Patterns of the Study Population

Variable	Category	Frequency	Percent (%)
Preparation of Meals	At Home	122	62.2
	At UWI Cafeterias	56	28.6
	At Fast Food Restaurants	18	9.2
Purchased Meals	Never	6	3.1
	Once per week	45	23.0
	2-3 times per week	91	46.4
	$\geq$ 4 times per week	54	27.6
Food Type	Chinese Cuisine	19	9.7
	East Indian Cuisine	28	14.3
	Creole Cuisine	68	34.7
	Fast Food	81	41.3

General Descriptive Statistics

Table 3 below, describes the mean values of the various anthropometric and blood pressure measures of the population. Within this sample, it was found that mean BMI was 24.09 $\pm$ 4.89 kg/m^2, classified as a normal to high BMI. Furthermore, it was noted that this mean was calculated from a range of 15.09 to 40.08 kg/m^2. Total body fat percentage among the students was reported to be an average of 29.71 $\pm$ 9.81 % with the highest percentage being 53.9%. Visceral which ranged from 1 to 18, had a mean value of 5.07 $\pm$ 2.93.

Table 3: Table Showing Anthropometic and Blood pressure Characteristics of the Sample Population

Variable	Minimum Value	Maximum Value	M	SD
Height (m)	1.42	2.12	1.69	0.12
Weight (kg)	39.36	137.45	69.49	16.80
BMI (kg/m^2)	15.09	40.08	24.09	4.89
Total Body Fat (%)	7.90	53.90	29.71	9.81
Visceral Fat	1.00	18.00	5.07	2.93
Systolic BP	88	169	115.96	12.86
Diastolic BP	51	104	69.41	7.90

Abbreviations: M, Mean; SD, Standard Deviation

CVD Risk Factor Prevalence

Table 4 illustrates the prevalence of selected risk factors for CVD among the sample population. The risk factors included, blood pressure, family history of related diseases, smoking and physical activity level among the students. As a result, it was found that the majority of the sample (n=177), had a normal blood pressure reading, accounting for 90.3% of the students.

Additionally among all the related diseases based on family history, it was reported that the most prevalent disease was heart attack, which was prevalent in 79.6% of the student's family history (n=156). Stroke was also seen to be another prevent disease, as 74.0 % of the students (n=145) reported that this disease was apparent in their immediate family.

Within the sample, smoking, another disease risk factor, was not found to be prevalent among the students. It was seen that the majority of the students were non-smokers (n=145). Furthermore, 62.2% of the students (n=122) were observed to be moderately active. Students with a sedentary lifestyle however, only comprised of 18.4 % of the students (n=36) with the minority, being athletic (n=12).

Table 4: Table of Prevalence of Selected Risk Factors for CVD

Variable	Category	Frequency	Percent (%)
Blood Pressure [a]	Low	15	7.7
	Normal	177	90.3
	High	4	2.0
Family History	Type II Diabetes Mellitus	76	3.8
	Heart Attack	156	79.6
	Stroke	145	74.0
	Hypertension	95	48.5
Smoking	Smokers	27	13.8
	Non-Smokers	169	86.2
Physical Activity Level	Sedentary	36	18.4
	Moderate Activity	122	62.2
	Vigorous	26	13.3
	Athletic	12	6.1

[a] Number do not total 196 because of missing data

Table 5 describes the prevalence of obesity based on the anthropometric measures used to classify obesity. From the results, it was noted that most of the students tested (46.9%), were categorized by having a normal BMI value. Additionally, students who were overweight and obese were found to make up 33.7% and 8.2% of the population respectively. Total body fat percentage, which was another measure of obesity, showed that 17.9% males and 33.7% females had a very high total body fat percent; while 13.3% of males and 20.9% of the females had normal total body fat percentage. Visceral Fat however, was found to be within the normal range for the majority of the students, as it was seen that 92.9% of the students had normal visceral fat.

Table 5: Table of Anthropometric Characteristics and Classification of UWI students

Variable	Category	Frequency	Percent (%)
BMI Category	Underweight	22	11.2
	Normal	92	46.9
	Overweight	66	33.7
	Obese	16	8.2
Total Body Fat	Male Low (<8)	1	0.5
	Male Normal (8- 19.9)	26	13.3
	Male High (20- 24.9)	20	10.2
	Male Very High (> 24.9)	35	17.9
	Female Low (<21)	7	3.6
	Female Normal (21- 32.9)	41	20.9
	Female High (32.9-38.9)	0	0
	Female Very High (>38.9)	66	33.7
Visceral Fat	Normal	182	92.9
	High	14	7.1

Figure 1 is a column graph which shows the variations in BMI among male and female students. From the graph, it can be seen that females were found to have BMI values that was in the normal range more than that of the male students. Additionally, similar percentages among both genders were found in the BMI classification of overweight. It was seen that 16.3% males were overweight while 17.3% females, fell into this category.

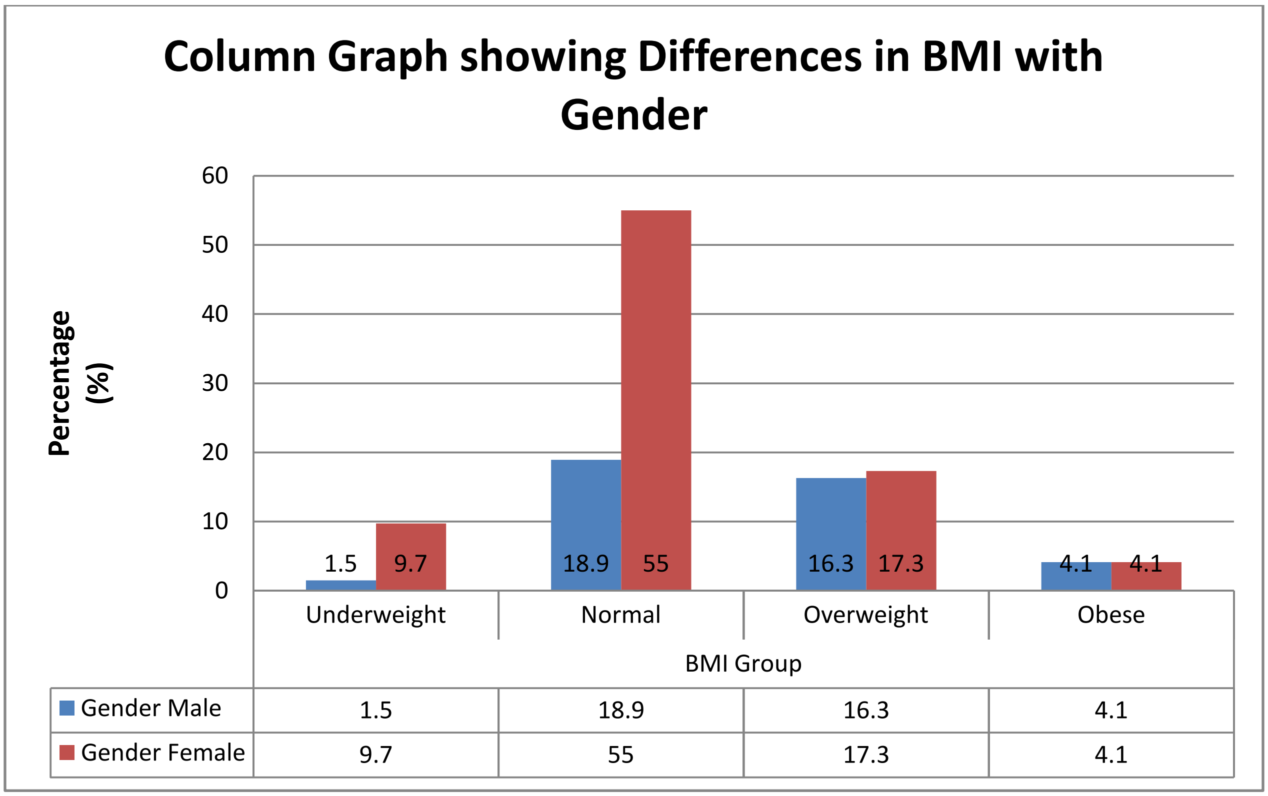


Figure 1: Showing the Comparison of BMI among Gender of the Students

The students risk based on family history of related diseases increasesd based on the number of diseases present in their family history. The bar chart shows, that 40.8% of the students had a tripled risk, since there was a family history of three of the related diseases. On the contrary no risk was found among 6.1% of the students who had no reported family history of diseases.

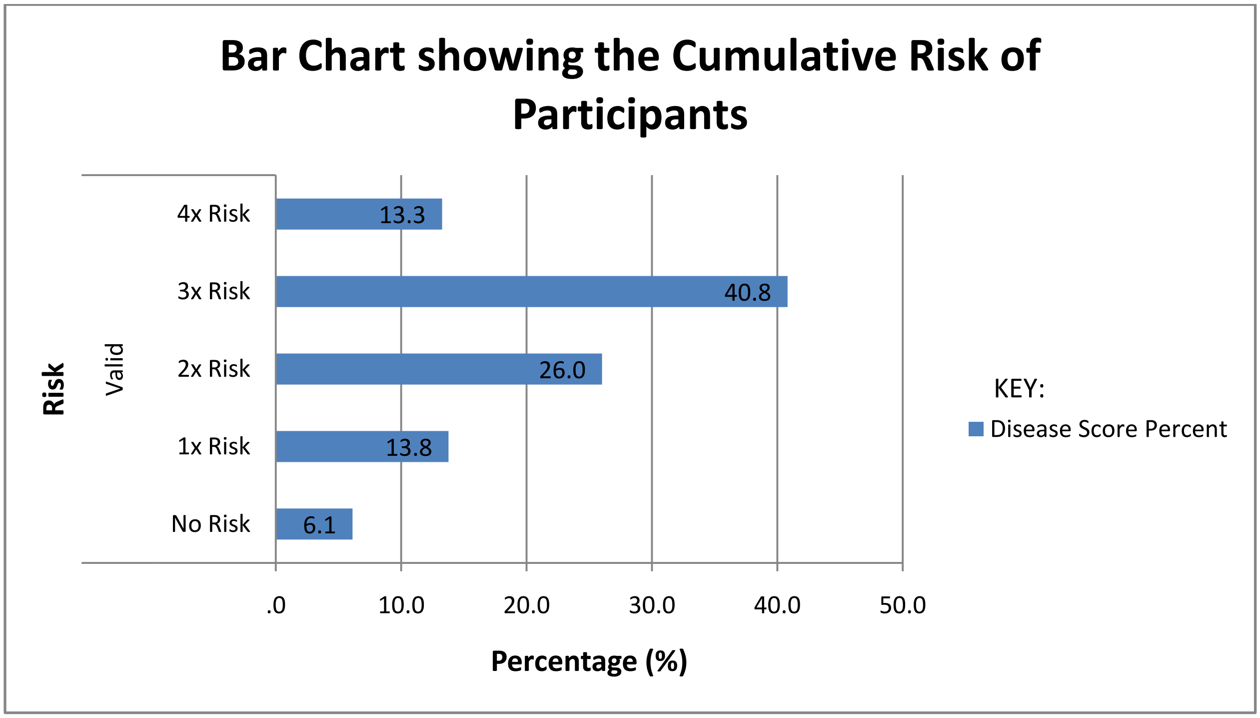
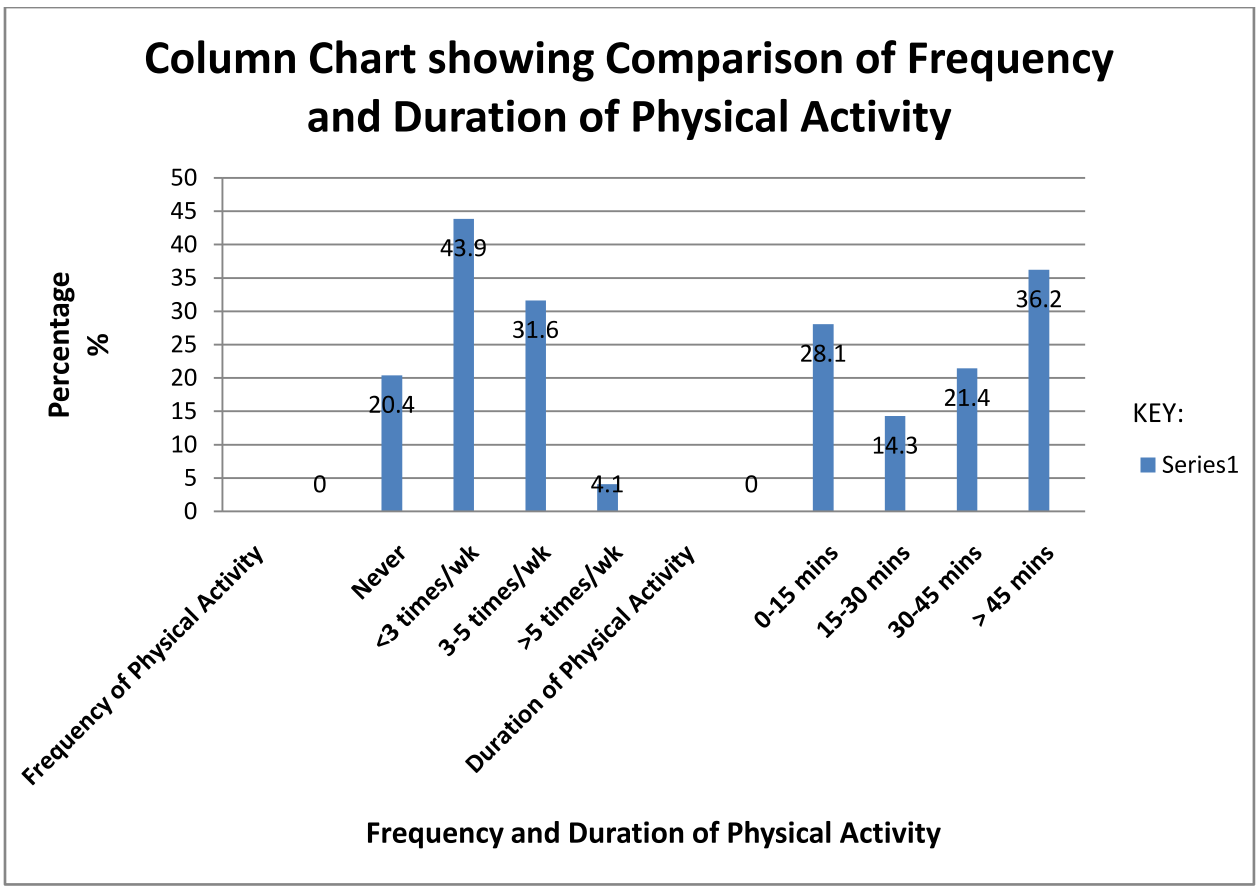


Figure 2: Percentage of Students and the Cumulative Risk based on CVD Related Disease.

From the column chart below, 31.6% of the students reported that they were participating in some form of physical activity at least three to five times every week. However the majority of them were physically active less than three times for the week (43.9%), with 20.4% of the students not being physically active. However, the minority was found to be physically active, engaging in activity for more than five times every week.

Additionally, it was seen that 36.2 % of the students reported that they engaged in physical activity for more than 45 minutes. One the other hand, it was found that 28.1 % of the students engaged in little to no exercise, as they reported 0 to 15 minutes of exercise.

Figure 3: Showing Frequency and Duration of Physical Activity Among the Sample Population



Chi-Square Analysis

Table 6 is a Chi- Square table which highlights any significant relationships between the various variables. From the result it was seen that when observing relationships for the BMI of the students, gender was found to have the only significant relationship with BMI (P= 0.031). Total body fat percent however, had significant relationships between gender, physical activity and the duration of physical activity. These relationships had a p- value of 0.000, 0.007 and 0.011 respectively. Similar to BMI, it was seen that visceral fat only had significant relationships with gender, having a p-value of <0.01.

Table 6: Showing Chi-Squared Relationships between Gender, Physical Activity Level, Frequency and Duration, and Food Consumption Frequency with BMI, Total Body Fat Percent and Visceral Fat

Dependant Variable	Independent Variable	Chi Squared Value	P- Value [b]
BMI [a]	Gender	8.907	0.031**
	Physical Activity Level	9.213	0.418
	Physical Activity Frequency	1.964	0.992
	Physical Activity Duration	7.802	0.554
	Food Frequency	10.826	0.288
Total Body Fat Percent	Gender	188.087	0.000***
	Physical Activity Level	36.020	0.007***
	Physical Activity Frequency	25.855	0.103
	Physical Activity Duration	34.335	0.011**
	Food Frequency	14.801	0.676
Visceral Fat	Gender	21.862	0.000***
	Physical Activity Level	0.184	0.980
	Physical Activity Frequency	1.496	0.683
	Physical Activity Duration	2.707	0.439
	Food Frequency	0.399	0.940

a. Calculated as weight in kilograms divided by height in meters squared

b. P values for X^2 test for categorical values where: *** Significant at 1%; ** Significant at 5%; * Significant at 10%

ANOVA Analysis

From the results of Table 7, it was seen that at a 5% level of significance, there were significant differences in the mean of BMI among the males and females of the study. From the results it was seen that males reported had a higher BMI that the females.

Table 7: ANOVA Table Showing Differences in Means among Sex, Physical Activity Level, Frequency and Duration and Food Frequency with BMI

Dependent Variable: BMI of the Participants

Independent Variable	F-Value	P- Value	Means
Sex	8.689 **	0.04	Male- 25.306 Female- 23.24
Physical Activity	1.876	0.135	Sedentary- 24.183 Moderate- 23.652 Vigorous- 24.661 Athletic- 26.989
Physical Activity Frequency	0.653	0.582	Never- 24.051 <3 times/wk- 23.604 3-5 times/wk- 24.675 >5 times/wk- 24.926
Physical Activity Duration	0.788	0.502	0-15mins- 23.251 15-30mins- 24.803 30-45mins- 23.903 >45mins- 24.486
Food Frequency	0.238	0.870	1-25 Score- 21.460 26-50 Score- 24.032 51-75 Score- 24.155 76-100 Score- 26.293

*** Significant at 1%; ** Significant at 5%; * Significant at 10%

Results from the ANOVA test between physical activity, gender and food consumption with the total body fat percent of the students show, that statistical significances were observed where there were differences in means among sex, physical activity, and frequency of physical activity and duration of physical activity. It was found that, at a p-value of 0.000, females had a higher total body fat than males. Table 8 shows that significant differences in the means were also found among the categories of physical activity level (p=0.015), physical activity frequency (p=0.046) and physical activity duration (p=0.040).

Table 8: <u>ANOVA Table Showing Differences in Means among Sex, Physical Activity Level, Frequency and Duration and Food Frequency with Total Body Fat Percentage</u>

Dependent Variable: Total Body Fat Percent of Participants

Independent Variable	**F-Value**	**P- Value**	**Means**
Sex	75.079***	0.000	Male- 23.489 Female- 34.005
Physical Activity	3.565**	0.015	Sedentary- 32.867 Moderate- 30.039 Vigorous- 25.642 Athletic- 25.750
Physical Activity Frequency	2.713**	0.046	Never- 32.928 <3 times/wk- 29.480 3-5 times/wk- 28.732 >5 times/wk- 23.738
Physical Activity Duration	2.832**	0.040	0-15mins- 32.453 15-30mins- 30.461 30-45mins- 29.452 >45mins- 27.449
Food Frequency	0.868	0.459	1-25 Score- 17.000 26-50 Score- 29.713 51-75 Score- 29.704 76-100 Score- 36.400

*** Significant at 1%; ** Significant at 5%; * Significant at 10%

From the Post Hoc test carried out on total body fat percentage of the students, as seen in Table 9, the significant association between BMI and physical activity was seen for sedentary students and those who had an athletic lifestyle. At a 5% significance level, it was found that students, who had a sedentary physical activity level, had a great total body fat percentage, with a mean difference of 7.2244.

When comparing the categories for frequency of physical activity among the students, differences amongst the means were only established in this test, at a 10% significance level. It was found that a mean difference of 9.1900 was found between the categories of those who reported to have never exercised with those who exercise more than 5 times per week. This showed that those who never exercised had higher total body fat percentages.

Physical activity duration also resulted in significant differences in the mean among the various categories. The results indicates that, at a 5% significance level, the difference in the mean of 5.0034 was found to be between students who engaged in physical activity 0-15 minutes per exercise to those who exercised for more than 45 minutes; showing a higher total body fat percent among the students who never exercised.

Table 9: Post Hoc Tests to Determine Pair Variables with Significance Mean Differences

Dependent Variable: Percent Total Body Fat
Tukey HSD

				95% CI Interval	
Variable (I)	**Variable (J)**	**Mean Difference (I-J)**	**Sig.**	**Upper Bound**	**Lower Bound**
Physical Activity Level	**Physical Activity Level**				
Sedentary	Moderate Activity	2.8273	0.422	-1.9691	7.6238
	Vigorous Activity	7.2244**	0.023	0.7159	13.7328
	Athletic	7.1167	0.130	-1.3128	15.5461
Frequency of Physical Activity	**Frequency of Physical Activity**				
Never	< 3 times per week	3.4473	0.255	-1.325	8.2871
	3-5 times per week	4.1952	0.150	-0.9333	9.3238
	>5 times per week	9.1900*	0.075	-0.6041	18.9841
Duration of Physical Activity	**Duration of Physical Activity**				
0-15mins	15-30 mins	1.9920	0.815	-3.8788	7.8628
	30-45 mins	3.0003	0.439	-2.1817	8.1824
	>45 mins	5.0034**	0.025	0.4609	9.5459

** Mean Difference is significant at 0.05 level

* Mean Difference is significant at 0.1 level

ANOVA tests done for significances with the visceral fat of the students, showed that significant differences in the means was only found among the sex of the students. From the table below it was seen that, at a significance at both the 5% and 1% level (p= 0.000), males had a higher visceral fat than female.

Table 10: Table of ANOVA showing Significance of Means among Variables

Dependent Variable: Visceral Fat of Participants

Independent Variable	**F-Value**	**P- Value**	**Means**
Sex	59.610	0.000***	Male- 6.775 Female- 3.897
Physical Activity	1.859	0.138	Sedentary- 4.778 Moderate- 4.861 Vigorous- 5.808 Athletic- 6.500
Physical Activity Frequency	0.993	0.397	Never- 4.650 <3 times/wk- 4.919 3-5 times/wk- 5.581 >5 times/wk- 4.875
Physical Activity Duration	1.744	0.159	0-15mins- 4.400 15-30mins- 5.500 30-45mins- 4.929 >45mins- 5.507
Food Frequency	0.324	0.808	1-25 Score- 3.000 26-50 Score- 5.075 51-75 Score- 5.055 76-100 Score- 6.500

*** Significant at 1%; ** Significant at 5%; * Significant at 10%

Regression Analysis

Table 11b represents a table of coefficients which shows linear relationships between the variables. Significance at a 1% level (p= 0.000) show that there is a linear relationship between physical activity, food consumption frequency and the students' total body fat percent when adjusted for gender and ethnicity. It was seen from the results, that a 1% increase in physical activity, can result in a marginal decrease of 0.017 % in the total body fat. On the other hand, a 1% increase in high- fat food consumption can cause a marginal increase of 0.063% in the total body fat percent.

Additionally, the results also show that with a significant value of 0.799, physical activity of the students has the largest predicted influence on changes of the total body fat percentage. Furthermore, this explains that based on the R^2 value of 0.269, physical activity and the food frequency score accounts for 26.9% of the variations found in the visceral fat among the students. From the results it was also indicated by the Beta values, which, after adjusting for gender and ethnicity, ethnicity (0.480) and food consumption frequency (0.125) had the greatest predictive strength of the entire regression model. This means that these variables strongly influences that students total body fat more than physical activity.

Table 11a: ANOVA Table showing significance of the regression models

ANOVA [c]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	1.815	2	.908	6.875	.001[a]
	Residual	25.478	193	.132		
	Total	27.293	195			
2	Regression	7.758	4	1.939	18.962	.000[b]
	Residual	19.535	191	.102		
	Total	27.293	195			

a. Predictors: (Constant), Log of Food, Log of Physical Activity

b. Predictors: (Constant), Log of Food, Log of Physical Activity, Ethnicity of Participants, Sex Of Participants

c. Dependent Variable: Log of Body Fat

Table 11b: Linear Regression Table showing coefficients of each of the variables of the model

Regression Significance= 0.000

Coefficient= 2.476

Coefficients [b]

Variable	B	B (Beta Value)	P-Value
Physical Activity	- 0.017	- 0.017	0.796
Food Frequency Score	0.063	0.125	0.045
Gender	0.015	0.077	0.211
Ethnicity	0.370	0.480	0.000

R^2 = 0.269

a. Predictors: (Constant), Log of Food Score, Log of Physical Activity, Age of Participants and Ethnicity of the Participants

b. Dependant Variable: Log of Total Body Fat Percent

Table 12a also represents a table of coefficients, showing linear relationships between the variables. Significance at a 1% level (p= 0.000) also show that there is a linear relationship between physical activity, food consumption frequency and the students' total body fat percent adjusting for gender and ethnicity. The results indicate that a 1% increase in physical activity can result in a marginal decrease of 0.017 % in visceral body fat. On the other hand, a 1% increase in high- fat food consumption can cause a marginal increase of 0.063% of visceral body fat.

Additionally, the results also show that with a significant p-value of 0.799, physical activity of the students has the largest predicted influence on changes of the total body fat percentage. Furthermore, this explains that based on the R^2 value of 0.269, physical activity and the food frequency score accounts for 26.9% of the variations found in the visceral fat among the students. This model, as seen in figure 12b, also indicated that ethnicity and food consumption frequency, with Beta values of 0.480 and 0.125 respectively, had the greatest predictive effect on the visceral fat of the students.

Table 12a: ANOVA Table showing significance of the regression models

ANOVA [c]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	1.815	2	.908	6.875	.001[a]
	Residual	25.478	193	.132		
	Total	27.293	195			
2	Regression	7.758	4	1.939	18.962	.000[b]
	Residual	19.535	191	.102		
	Total	27.293	195			

a. Predictors: (Constant), Log of Food, Log of Physical Activity

b. Predictors: (Constant), Log of Food, Log of Physical Activity, Ethnicity of Participants, Sex Of Participants

c. Dependent Variable: Log of Visceral Fat

Table 12b: Linear Regression Table showing coefficients of each ofthe variables of the model

Regression Significance= 0.000

Coefficient= 2.476

Coefficients [b]

Variable	B	β (Standardized Co-efficient)	P-Value
Physical Activity	- 0.017	- 0.017	0.796
Food Frequency Score	0.063	0.125	0.045
Gender	0.015	0.077	0.211
Ethnicity	0.370	0.480	0.000

R^2 = 0.269

a. Predictors: (Constant), Log of Food Score, Log of Physical Activity, Gender, Ethnicity

b. Dependant Variable: Log of Visceral Fat

DISCUSSION

Within recent years, it has been noted that there has been increasing incidences of CVD within the Caribbean and Latin American territory, that CVD are now considered to be the leading causes of both death and disability in the world. (WHO 2011). This current state can be as a result of a combination of factors which may interact, thus increasing an individual's risk for development of CVD. This study, suggests that increase consumption of foods commonly considered being high in fat and level of physical activity directly increases the students BMI, total body fat percent and their visceral fat. These variables, measures a person's overall obesity level, which is one of the independent risk factors for determining CVD risk among individuals (Hubert, et al. 1983).

It was found, that of the total study population, which consisted of 40.8% males and 59.2% females (Table 1) ; 74 % of the students purchased meals from fast food restaurants at least two times and more (Table 2). Additionally, most significantly, consumption of purchased food mainly included fast foods, such as burgers, fried chicken and fries and even pizzas, which accounted for 41.3 % of the students. Although actual intake was not measured, rather the frequency of these meals that are commonly known to be high in fat; it has been noted that these dietary pattern have been directly associated with increased risk for obesity on many studies (Phillip, et al. 2012). Similar studies done and mentioned of by Bowman, et al. (2004), in a population of children and adolescents show, that by comparing children who consumed fast food to those who did not, it was seen that there was higher consumption of total and saturated fats. They further mentioned that this nutrient profile is reflective of common foods such as burgers, french-fried potatoes and meats, which are common among the study population (Bowman, et al. 2004).

Despite more than half the population (62.2%) reporting that they engage in physical activity, the data suggest that the majority of students live a sedentary to moderately active lifestyle (Table 4). When compared to the frequency and level of physical activity however, a more detailed representation of the actual level of physical activity was given. It was found that among the students most students never engaged in physical activity or was physically activity less than three times per week with 28.1% of the students reporting that length of the activity lasted up to 15 mins (Figure 2). Although no lipid and glucose profiles were conducted to show any associations with cholesterol and glucose levels to risk for CVD, the implications for increased CVD risk from obesity data can still prove useful. Significant and recent studies was conducted to provide this link to show that decreases in physical activity, is associated with increased risk for conditions related to metabolic syndrome, which can further implicated CVD risks.

One such study, carried out by Sacheck, Kuder and Economos (2010) on college students was done to determine the overall effect of physical activity compared to body composition on serum glucose and the students' blood lipid profile. The results indicated that more than 60% of the population was seen to have had higher than desirable body fat percentages. From the study, it was shown that total body fat percentage was related to higher cholesterol and HDL levels in amongst the both genders. Additionally, it was indicated that in women this increased percentage can be associated with higher triglycerides with subsequent decreases in the HDL levels. Significant tests done were able to prove that increased physical activity can have a positive impact on increasing HDL levels and decreasing triglycerides in women, and glucose in men. As a result, these lipid changes can have significant impact on overall CVD risk (Sacheck, Kuder and Economos 2010).

To determine an individual’s risk for CVD, it is noted that other risk factors must be taken into account. In this study, it was found that the most prevalent risk factor among those that were measured, was a family history of related diseases, including type II diabetes mellitus, heart attack, stroke and hypertension. Additionally, anthropometric measures which provided classification showed that students had an increase risk based on their total body fat percentages that were recorded (Table 5). It was inferred that the students risks would increase based on the count of diseases related to CVD that were existent within their immediate family lineage. Based on this method, most students were found to have a three and four fold increase in CVD risk as they reportedly had a three or more related diseases existing in their family (Figure 1). Data suggests that, heart attacks and strokes were most prevalent with type II diabetes mellitus being the least prevalent among the students (Table 4).

The significant results obtained from a study by Savitha and Sandeep (2011) also indicated that family history was significant in further implicating CVD risk. They saw that the mean total cholesterol, low- density lipoprotein cholesterol and triglycerides were significantly higher among children who had a family history of CVD as compared to children without any family interest. This therefore indicated that family history of CVD increases the risk of cardiovascular disease development in individuals. Additionally the researchers established a connection between increasing incidences of dyslipidemia and elevated BMI, a high- fat diet and also a sedentary lifestyle. Further parallels were developed as the BMI was found to be higher in the children with a family history for ischemic heart disease than that of the 50 controls.

Obesity, which is considered to be an independent indicator of CVD risk, was found to be prevalent among the students in the study. Assessed by the student BMI, total body fat percentage and visceral fat, it was found that although not in the majority of the sample population, many students were found to be overweight and obese with high percentages of body fat. Of all the measures, the total body fat percentage was found to be the greatest indicator of obesity among the students. In this study, the results indicated that more than 50% of the total study population had a high total body fat percentage (Table 5). These occurrences, being indicated in both genders, were more indicative of obesity, despite the fact that most students (46.9 %) were classified as having a normal weight. As it relates to increasing CVD risks, supporting evidence is presented in similar epidemiological studies, which was done to study the prevalence of obesity and its role in CVD development.

It has been proven that body fat distribution as well as BMI can considerably impact on triglyceride levels. One such NHANES study carried out on 5610 participants between 1999 and 2004 indicated that there was a relationship between BMI and triglyceride concentrations. It was found that increases in BMI of more than 30 kg/m^2 ($\geq$ 83% of the study population), there was related increases in triglyceride levels of more than 150 mg/dL. This was also found among youths, in another NHANES study conducted from 1999-2006, where it was shown that participants who were overweight and obese also had elevated triglyceride levels, which had further impact on CVD risks (Miller, et al. 2011).

From the study conducted, there were no observed significant differences, when comparing the differences among the means of BMI with physical activity level, frequency and duration, and frequency of high fat food consumption. However, gender seem to have been the only variable that showed to have had differences in BMI, where it was found that males students reportedly had higher BMIs than the female students, as seen in Table 6. The same results were obtained for comparing visceral fat of the students to the different variables (Table 9). This therefore indicates that from this study that between BMI and the other independent variables, which included the three components of physical activity (level, duration and frequency) and frequency of the high fat food consumption, there were no statistical differences in BMI among the various categories. This inferred that BMI was within the same range among individuals, regardless of what was consumed and physical activity among the students. One study done to develop a relationship between physical activity and BMI reduction also found results consistent with this study. In a meta- analysis study conducted on children from elementary school, it was shown that there were no remarkable changes in BMI of the children with interventions for physical activity (Harris, et al. 2009).

However, these results were found to be contradictory to many studies that were previously carried out. One such study, aimed at determining how effective an intervention for weight loss and physical activity would be on reduction in BMI of severely obese participants. In this single-blinded randomized trial, a one-year intensive lifestyle intervention of diet and physical activity was embarked upon. As a result, both groups (initial physical activity and delayed activity) saw decreases in their BMI after the intervention was complete. This conclusion inferred that increasing physical activity and changes in diet can result in markedly lowered BMI as well as favourable changes in cardiometabolic risk factors (Goodpaster, et al. 2010).

Physical activity, high-fat food consumption frequency and gender, when compared using total body fat however was found to have had more significances among the means of the various categories. The results showed that all variables, except for food consumption, indicated differences among the total body fat percent. After running a post hoc test to determine where the statistical differences lied, it was found that frequency of physical activity however, was not as statistically significant as the others. Unlike BMI, it was found that females had higher total body fat percentages, with a mean of 34.005. Additionally, sedentary students were reported to have had higher means of total body fat that those who engaged in physical activity with a mean difference. This was also consistently proven, as it was found that there were higher total body fat percentages among students who never exercised or had an exercise interval of 0-15 minutes. Increased physical activity as shown in this study, relates to the decrease in total body fat and thus a decrease risk for CVD as a result. These results are supported as other studies also prove that an increase in physical activity can bring about decreases in weight and body fatness, thus reducing the risk of CVD development.

A study conducted by Amin- Shokravi, Rajabi and Ziaee (2010) also sought to find correlations between physical activity and CVD risk. Through measurements of BMI, waist/hip ratio, blood pressure, total cholesterol and lipoprotein subtractions before and after the 12 weeks, it was found that the systolic and diastolic blood pressure, 10-yr risk of CHD and triglyceride levels as a result of decreased total body fat was decreased. Additionally, there was a subsequent increase in HDL-C levels in the group that underwent the physical training. Further results in the study, also was able to highlight that due to increased physical activity among the women, it resulted in a subsequent reduction in the Framingham risk scores which was used to calculate CVD risk (Amin- Shokravi, Rajabi and Ziaee 2011).

In the scope of this study, no prediction of linear relationships could have been constructed for BMI since there were no significant relationship between the parameters of food consumption and physical activity of the students with their BMI. However this was found for both the total body fat percent and visceral fat of the students. After adjusting for the gender and ethnicity, it was found in both instances that as physical activity increases, there is expected to be a marginal decrease of visceral fat as well as total body fat percent. On the contrary, the predictive equation shows that any increase in food consumption of foods that are high in fat, can result in increase of the visceral fat and total body fat percent.

Limitations

During conducting this study, there were many limitations which may have implicated the final outcomes achieved. Firstly, time was one of the biggest constraints to ensuring that the study is completed, which did not allow for the in depth analysis to be carried out on the topic of interest. Additionally, resources for measurements especially, were also a limiting factor in this study. As a result, participants were required to subjectively estimate some of the required information. Due to this it may have resulted in some of the relevant data being skewed and results altered. Another limitation may have occurred while doing actual measurements. Since the equipment used for anthropometric measurements relied on many factors such as no metal, no shoe or socks and even proper hydration status; if these conditions were not properly met, then results could have been changed. Also the questionnaire included a food frequency questionnaire; however because of the time constraints and type of study conducted, an extensive food frequency chart may not have been ideal. This meant that foods were required to be omitted to produce a good questionnaire fit for the population.

The type of sampling method used, that is convenient sampling, may not have allowed for a proper representation of the students population to be measured. This therefore means that the findings obtained from this study, cannot be accurately applied to all populations until further and more extensive testing is carried out.

Another limitation experienced was with respect to the interpretation and subjective response of the data on the questionnaire. If not properly understood, the response given may not be an accurate account of what is actual. This by extension also covers the fact that the type of questionnaire, required students to recall foods consumed within the month. This type of method, it subject to human error as the students may not have been able to remember all the foods consumed and the time frame, and thus resort to estimations.

Recommendations

1. The scope of this study investigated dietary and activity patterns in relation to obesity, a risk factor for cardiovascular disease. Since the direct risk of cardiovascular disease was not studied, it is recommended that further research is conducted in this population to determine the risk of students to CVD development.

2. Additionally, it is recommended that more awareness programs be set up around campus to educate students on the prevalence of the major diseases and provide them with information that they may be able to make more informed diet and physical activity decisions.

3. Regular health fairs should be held where students are able to access free check-ups to obtain knowledge of their nutritional status; as well as advice on ways to bring about change once needed.

4. Another recommendation with regards to this study, it to begin the process of making and implementing policies on the campus which can stimulate a conducive environment, where a wider variety of healthier options of foods can be available to students.

CONCLUSION

Obesity as an independent risk factor for CVD is becoming more prevalent globally. Our study on the relationships of diet and physical activity on obesity adds to the already increasing body of literature on the topic. As seen in the results, measures of obesity, including BMI, total body fat percent and visceral fat, were all found to be high among the student population. The increasing frequency of consumption of foods that are commonly known to be high in fat, as well as decreasing physical activity among UWI students, appears to have significant effects on individual's body fatness.

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APPENDICES

Appendix A- Sample Questionnaire

Participant Code #:________

Dear UWI student: The following is a questionnaire which is aimed at collecting data towards a final year research project. The aim is to collect data on food and beverage consumption patterns and specific health indices.

The questionnaire contains three (3) sections which include demographic and anthropometric information; food frequency questions; and other relevant questions. Please answer all questions by placing a tick (√) in the relevant spaces provided.

Thank you for your kind cooperation and time.

Section I – Demographic and Anthropometric Data Sheet

1. Sex : Male ☐ Female ☐
2. Age: ≤ 18 ☐ 19-29 ☐ 30-49 ☐ ≥ 50 ☐
3. Ethnicity: East Indian ☐ African ☐ Chinese ☐ Hispanic ☐ Caucasian ☐ Other ☐
4. Height (cm) : ____________
5. Weight (lbs): ____________
6. BMI(kg/m^2): ____________
7. Waist Circumference (cm): ____________
8. Vis Fat (%): ____________
9. Total Body Fat (%) ____________
10. Blood Pressure: Right Arm ______ / _____

    Left Arm ______/ _____

Section II – Background Information

11. Where do you live during the semester?

Renting Off-Campus ☐ Renting On-Campus (Halls of Residence) ☐

At home (Family/Extended family) ☐

12. Where are most of your meals consumed for the day prepared? (2 or more meals)

At home ☐ At UWI cafeterias ☐ At fast food restaurant ☐

13. How often do you purchase food?

Never ☐ Once per week ☐ 2-3 times per week ☐ ≥ 4 times per week ☐

14. What type of food do you most often eat?

Chinese Cuisine (e.g. Chow Mein, Spring rolls, wantons) ☐

East Indian Cuisine (e.g. Roti, Doubles) ☐

Creole Cuisine (e.g. Pelau, Yvette's pies) ☐

Fast Food (e.g. KFC, Subway, Burgers) ☐

15. How often do you consume sweetened beverages?

Rarely (1-2 times/mth) ☐ 1-2 times/wk ☐ 3-4 times/wk ☐ > 4 times/wk ☐

16. Do you have an immediate family history of any of the following conditions (grandparents, parents, siblings) :

Type II Diabetes ☐

Heart Attacks ☐

Stroke ☐

Hypertension ☐

17. (a) Do you smoke?

Yes ☐ No ☐

(b) If yes, which of the following best describes how often you smoke?

Occasionally (1/mth) ☐ 1-3 times/wk ☐ 4-6 times/wk ☐ Daily ☐

18. Which of the following BEST describes your usual physical activity level?

Sedentary ☐ Moderate Activity ☐ Vigorous Activity ☐ Athletic ☐

19. Which of the following BEST describes how frequently you exercise?

Never ☐ < 3 times/wk ☐ 3-5 times/wk ☐ >5 times/wk ☐

20. Which of the following BEST describes how long you exercise in one exercise session?

0-15 mins ☐ 15-30 mins ☐ 30-45 mins ☐ >45 mins ☐

Section III – Food Frequency Questionnaire

		Time				
No.	**Food Item**	**Always** 7times/wk	**Most times** 5-6 times/wk	**Sometimes** 2-4 times/wk	**Rarely** ~ 1-2 times/mth	**Never**
1	Fresh Squeezed Juice -No sugar added- (Vegetable juice, Fruit juice)					
2	Sport Drinks (Gatorade, Powerade)					
3	Energy Drinks (Red Bull, Monster, Full Trottle)					
4	Milk-sweetened milk or tea (Soy, Almond milk, Cow's milk, Rice milk)					
5	Milk beverages (Suppligen, Choc-nut, Nesquick, etc.)					
6	Soda (Busta, Coke, Cannings, Sprite)					
7	Fruit Juice Drink (Orchard, Fruta, Party Mix, Tang, Kool Aid, etc.)					
8	Hot Beverages (Tea, coffee, cocoa, etc) with sugar					
9	Alcoholic Beverages (Beer, Liquor etc)					
10	Wine (Commercial, Homemade etc)					
11	Stir Fries (Rice, Noodle, Vegetables etc)					
12	Fried Appetizer (Wantons, Spring Rolls etc)					
13	Chinese Style Meats (Shrimp, Chicken etc)					
14	Callaloo					
15	Pies (Yvette's pies, Jamaican Patties, Bakery pies or puffs etc)					

Section III- Food Frequency Questionnaire Cont'd

		Time				
No.	**Food Item**	**Always** 7times/wk	**No.**	**Food Item**	**Always** 7times/wk	**No.**
16	Macaroni Pie, Sheppard's Pie etc					
17	Mayo Salad (Potato, Macaroni, cole slaw etc)					
18	Stewed Meats					
19	Oil-down, Pelau, fried plantains					
20	Chokas (Tomatoes, Egg Plant, Ockra etc) in oil					
21	Roti (Dhalpourie, Paratha, Sada)					
22	Fried Appetizer (Doubles, Aloo Pie, Saheena)					
23	Sweet Fried Desserts (Bharfi, Kurma)					
24	Curried Meats					
25	Burgers (Burger Kings, Wendy's, etc.)					
26	French Fries					
27	Pizzas, Calzones					
28	Meats (Fried meats, BBQ)					
29	Pastries (Donuts, Tarts)					
30	Sub Sandwiches with dressing					