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INVESTIGATING CHILDHOOD OBESITY IN A HINDU TRINIDADIAN POPULATION

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Siddhi Sankar

Supervised by Anisa Ramcharitar-Bourne

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Abstract

The implication of childhood obesity in Trinidad and Tobago has raised concerns for its prevention but little evidence exists for diverse diet practices of ethnic groups in Trinidad and Tobago. Worldwide, vegetarianism has been praised for its protective effects against obesity. The primary goal of this study is to determine the prevalence of excess adiposity in Hindu school-aged and adolescent population of the Tunapuna-Piarco Regional Corporation as well as determine the association that exists between vegetarian and non-vegetarian diets in relation childhood obesity. Also a qualitative analysis of lifestyle and dietary practices determined clues for obesity prevention. The cross-sectional survey used a self-administered food frequency and lifestyle questionnaire and collection of anthropometric measurements. A convenient sample of 12 temples was selected and a total of 173 participants volunteered. Prevalence of obesity was determined by calculating BMI from weights and heights, Waist Circumference (WC) to Height Ratio and Body Fat Percentage (BF %) readings. The results were analysed using SPSS version 22.

Overall prevalence of excess adiposity was 30.2% of participants aged 10-18years. Non-vegetarians (20%) were more obese than vegetarians (12.1%), with average BF% of 29.4% and 26% respectively. Males (47.4%) had significantly higher BF%, WC and Height. Obese and underweight participants consumed higher levels of meat; non-vegetarians consumed more fast food, fruit and starch than non-meat eaters. Home-cooked meals were eaten daily by 67.5% of participant and 2.9% eating out daily. Physical activity requirements were met by 57.8% of the population. New and alarming frequencies of excess adiposity were concluded, thus this thesis should be treated as pilot study to guide extensive multi-sectorial research and policy change in the near future.

Chapter 1- Introduction

1.0 Background

Obesity is one of the principal public health challenges of the 21st century, which increases the risk for escalating prevalence of chronic non-communicable diseases, an underlying cause of death. This global burden of obesity may be pre-empted by curbing the incidence of childhood obesity since overweight and obese children are at greater risk of adult obesity (Serdula, et al. 1993). Because of this, there is an amplified need for assessment, diagnosis, intervention and prevention of overweight status for children of developing countries.

The implication of obesity in Trinidad and Tobago has amounted to the increased total of public spending to approximately TT\$400 million (Trinidad and Tobago Ministry of Health (MOH) 2011). However, numerous authors state that these numbers can be reduced with time and proper prevention and intervention practices.

International research has developed relationships between the types of food consumed and nutritional status with respect to excess adiposity in children (Matthews, Wein and Sabate 2011). As a result of these two factors, it can be seen that the association between food consumed and obesity should be explored further to provide more data in curbing the increasing prevalence of childhood obesity in Trinidad and Tobago. Thus, the primary goal of this study is to determine a relationship between different diets and excess adiposity through anthropometric assessment and diet examination in Hindu school-aged children attending religious institutions in the Tunapuna-Piarco Regional Corporation in Trinidad.

1.1 Problem Statement (Rationale)

In 2014, the situation of childhood obesity further developed when the Minister of Health- Dr. Fuad Khan addressed the research from the University of the West Indies which produced results a significant quantity of school-aged children were at risk for obesity. He promised to examine the statistics of childhood obesity in both rural and urban areas, as well as collaborate with the Ministry of educations and the newly established National Schools Dietary Services Ltd (NSDSL) with the aim of changing the quality of food made available to children of the system. For the aforementioned developments to take place a systematic analysis of the existing diets of the children should be done and prospective diet plans and alternative lifestyle changes should be proposed.

1.2 Purpose of the Study

In light of recent observations, a need to identify the nutritional implications of diet on excess adiposity in children is vital. This paper is concerned with the association between childhood obesity in Hindu school-aged vegetarian and semi-vegetarians of the Tunapuna-Piarco Regional Corporation district in Trinidad. The main purpose of this study is to determine a relationship between different diets and overweight and obesity prevalence through anthropometric assessment and diet examination. The exploration of diet and lifestyle aims to obtain clues for prevention of excess adiposity in school-aged children. Together, the findings would validate the significance of international findings in the Trinidadian population as well as begin filling the void in epidemiological research in childhood obesity in the Caribbean.

1.3 Research Question

This research will address the following questions:

- 1) What is the nutritional status of Hindu school-aged children of the Tunapuna-Piarco Regional Corporation, in relation to the obesity pandemic?
- 2) How does diet and lifestyle of vegetarian and semi-vegetarian impact on the risk for excess adiposity in Hindu children?
- 3) What preventative measures can be taken to reduce the risk for excess adiposity in Hindu children in Tunapuna-Piarco Regional Corporation?

1.4 Objectives of the Study

This research is an attempt to improve health and economic development and planning in Trinidad and Tobago associated with the childhood obesity epidemic in prevention and intervention. The objectives are as follows:

- To estimate the prevalence of overweight and obesity in the Trinidadian Hindu school-aged and adolescent population
- To assess the weight status of Hindu school-aged Trinidadian children, using the nutrition assessment techniques of Body-Mass Index (BMI) for Age, Body Fat Percentage (BF %) through Bioelectrical Impedance Analysis (BIA) and Waist to Height Ratio, in relation to non-meat consumption and low-meat consumption practices.
- To determine the associations between practiced diets and excess adiposity.
- To obtain clues for prevention of overweight in Hindu vegetarian and non-vegetarian Trinidadian school-aged children.

1.4 Hypotheses

This research paper hypothesizes that:

1. H_0 : There is no association between vegetarianism and obesity in the Trinidadian Hindu school-aged and adolescent population
 H_1 : An association exists bet vegetarianism and obesity in the Trinidadian Hindu school-aged and adolescent population
2. H_0 : There is no association between gender and anthropometric data for obesity in the population studied.
 H_2 : An association exists between gender and anthropometric data for obesity in the population studied.

1.5 Significance of Research

- The pandemic of childhood obesity in the Caribbean is not researched in detail when compared to international studies. More research in this field would prove beneficial into making developmental changes to improve the economy and public health of the region.
- Presently there is no published research on the diet of school-aged children in relation to excess adiposity.
- Very little research has been done on the prevalence of vegetarians in Trinidad and Tobago and the impact of their lifestyles with excess adiposity risk.
- This study is the first of its kind in Trinidad and Tobago and can be treated as a pilot study, a starting point from which ethnical and belief influenced differences in dietary

practices can be considered as predetermining factors of a healthier way of life in the Caribbean.

A need to fill these voids has steered this project in the direction which it was taken.

1.6 Methodology

The aforementioned aims will be accomplished through:

- Anthropometric assessment using National Health and Nutrition Examination Survey (NHANES) anthropometry procedures manual (Center for Disease Control and Prevention (CDC) 2007).
- Food Frequency Questionnaire (FFQ) derived from certified and verified international surveys used to determine the nutritional statuses of children and adults in the field of obesity.
- Statistical analysis of collected data using IBM Statistical Package for the Social Sciences (SPSS) version 12.

1.7 Organization of Research

The manuscript is set within the area of childhood obesity and its prevention, but has particular focus on the effects of vegetarian and semi-vegetarian diets on the nutritional risk for the lifestyle disease in the Caribbean territory of Trinidad. It is divided into seven (7) chapters, where each explores a particular aspect of the systematic process adapted in generating findings for the correlation. A brief overview is as follows:

Chapter 1: The introduction summarizes the background information of the topic, states the problem that is sought to be solved, the objectives that are proposed to explain the relevant problem as well as a brief description of the layout of the thesis.

Chapter 2: This section reports on the existing literature in the fields of childhood obesity and vegetarian diets and serves as a collaboration of information to summarize theories and synthesize data to generate a sound foundation for the study. It also explains in detail terms relevant to the study and pertinent work of bodies credible to field. The literature review is systematically organized to provide information to address the concerns expressed in the research objectives.

Chapter 3: The methodology provides the various steps, criteria and the relevant justifications for generating solutions for the research questions.

Chapter 4: Results of the research are presented and explained to the reader in an organized manner in accordance with the research objectives. The use of diagrams and charts make this section comprehensive to the reader.

Chapter 5: A discussion of obtained results are analysed through meta-analysis with existing data which was referenced in the literature review.

Chapter 6: Overall finding are presented and conclusions are drawn. Possible explanations of results generated are expressed. The strengths and short comings of the research project are discussed in detail with emphasis on the methodology and answering of research questions.

Chapter 7: Concluding remarks and recommendations on the projects are made. References and citations are stated logically, according to the Chicago Manual of Style (CMS) 16th Edition.

Chapter 2- Review of Literature

2.1 Definition of Childhood Obesity

“The abnormal or excessive fat accumulation that may impair health is classified as overweight and obesity” (World Health Organization (WHO) 2013).

Childhood obesity is determined using the measure of body-mass index as a reasonable indicator of body-fatness estimation for most children and adolescents. According to the Centre for Disease Control and Prevention in the USA, excess adiposity is classified into two main categories: overweight and obesity. Since children still undergo growing, the CDC-sex specific growth charts are used to classify a child/adolescent (aged 2-19) into categories of underweight, healthy, overweight or obese using percentiles. (Center for Disease Control and Prevention 2012)

Overweight is defined as a BMI at or above the 85th percentile and lower than the 95th percentile for children of the same age and sex

Obesity is defined as a BMI at or above the 95th percentile for children of the same age and sex

(Center for Disease Control and Prevention 2012)

(See Appendix for Charts)

2.2 Causes of Childhood Obesity

W.H.O. indicates that excess adiposity is a lifestyle disease primarily caused by an energy imbalance between the caloric intake and expenditure. The organization links childhood obesity to key factors including changes in diet and lifestyle. (World Health Organization (WHO) 2013)

Diet:

Numerous studies show that diet can be related to increased risk of obesity (Matthews, Wein and Sabate 2011). The WHO (2013) states that globally, an increase in energy dense foods especially those high in fat contribute to excess adiposity. Literature is replete with references to lowered consumption of processed and fast foods, the switch to high fibre and low fat foods in order to prevent the increased risk of obesity.

Lifestyle:

A report by the CDC indicated the effects of lifestyle in the form of different factors, including behavioural, the food environment and legislative, which influence the risk of obesity in children. Behaviourally speaking, the authors refer to the effects of high consumption of sugar sweetened beverages, “Screen-time,” and the controlled eating habits of family-style meals. (US Department of Health and Human Services 2011). Empty calories gained from leading source of excess sugar in the diets of children is due to beverages like soft drinks and juice drinks (Reedy and Krebs-Smith 2010), which if not expended in through physical activity is converted to excess fat.

Physical activity is promoted for positive health and fitness in children by the US Department of Health and Human Services. Without the aspect of physical activity in their lifestyle, children show greater body fatness levels, lower levels of cardiovascular fitness, weaker muscle and bone

development and increased symptoms of anxiety and depression. They indicate that it is never too early for children to develop risk factors for chronic non-communicable disease through the influence of their lifestyle. The department recommends for all children and adolescents ages 6-17 years to participate in at least one hour aerobic physical activity per day (US Department of Health and Human Services 2008).

However, physical activity is demoted in life priorities due to the increased importance put on sedentary activities like watching television, using the computer and even studying. The documents by the CDC in 2011, also assessed that high-school students view an excess of 3 hours of television per day, not including the time spend on other sedentary or low aerobic expenditure activities. The 2007 Global School-based Health Survey reported that 74.3% of the students surveyed did not engage in physical activity in their leisure time. Girls (81.6%) were significantly more inactive than boys (66.7%) (Pan American Health Organization (PAHO) 2012)

The document sheds light on the effect of the child/adolescent's food environment, referring to their consumptions patterns in and out of the home. The community food environment is important for the child since studies show that lack of access to healthy foods increases the risk for obesity, as well as increased access to convenient stores and fast-food restaurants, further reducing dietary quality (US Department of Health and Human Services 2011).

2.3 Implications of Childhood Obesity

Childhood Obesity a Global Concern

In the factsheet WHO stated that the rated of obesity in the world has doubled since the year 1980 with more than 1.4 billion adults over the age of 20 begin classified as overweight and

approximately 500 million being obese in 2008. This epidemic is classified as a cause for concern since excess adiposity (including overweight and obesity) in persons is linked to more death worldwide, and predisposes individuals to the development of non-communicable diseases such as hypertension, type two Diabetes Mellitus, cancers and many more. WHO also stated that worldwide, approximately 35% of adults over the age of twenty (20) were overweight and 11% were obese. It was estimated that particularly in urban settings of low and middle-income countries, more than 30 million overweight children live (World Health Organization (WHO) 2013). Childhood obesity is therefore treated as a high priority by all international health organizations since overweight and obese children are at greater risk of adult obesity (Serdula, et al. 1993), (Freedman, et al. 2005).

Obesity in the Caribbean

It has been observed that Caribbean countries have seen decrease in mortality and morbidity in children due to infectious disease. However, as the economies developed steadily, a par amounting increase has occurred in both excess adiposity and the nutrition-related non-communicable diseases in adults (Xureb, et al. 2001). Compiled data from the Caribbean Food and Nutrition institute in 1999 indicated growing prevalence of overweight in adolescents between the ages of 10 and 19 years (Figure 2.3 a).

More recently, research for childhood obesity in the Caribbean was compiled by Schwiebbe et al. 2011 who provided a comparative table of overweight and obesity in children and adolescents in the Caribbean and the United States of America (Figure 2.3b). the authors stated that based on various research until 2008, the prevalence of excess adiposity (including overweight & obesity) in Caribbean countries, but to varying degress among the islands. In 2008, the authors noted that

St. Lucia, Jamaica and Barbados had less than 30% overweight boys and girls whereas in the island of Aruba and Trinidad and Tobago, overweight was more prevalent.

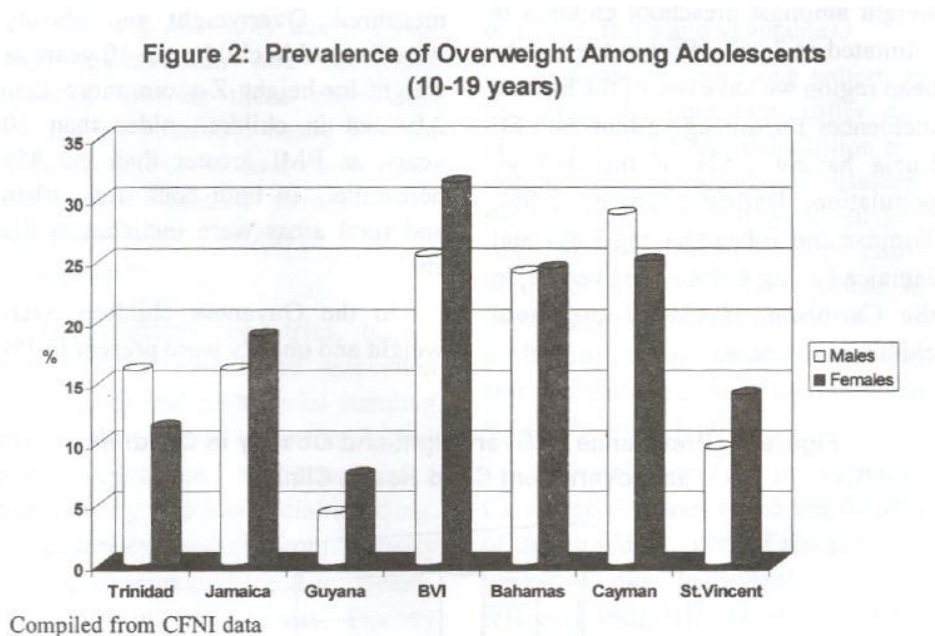


Figure 2.3a : Compiled data from CFNI in 1999 on overweight in adolescents in the Caribbean (Xureb, et al. 2001)

Table 2: Prevalence of overweight including obesity in children and adolescents in the Caribbean and the United States of America as defined by International Obesity Task Force (IOTF) criteria (7)

Country	Age years	Boys %	Girls %	n	Study year
Children					
Jamaica (9)	7-8 & 11-12	3.0-8.3	4.4-11.1	306	< 2000
St Lucia (8)	5	15.2	18.7	425	2006/2007
Bonaire	6-11	24.1	32.5	1052	2008
Unites States (2)	6-11	31.7	37.5	1037	2003/2004
Aruba (12)*	6-11	38.9	39.3	367	2004
Trinidad and Tobago (11)**	5-6 & 8-9	24.0-64.0	37.0-76.0	1934	1999
Adolescents					
Tobago (17)	12-18	11.9	19.1	3749	1999/2000
Barbados (10)	11-16	22.0	29	400	< 2006
Bonaire	12-16	28.1	34.4	817	2008
United States (2)	12-17	38.3	34.5	1736	2003/2004

* recalculated using IOTF cut off values. The original article used criteria from the National Center for Health Statistics (USA); ** prevalence in children of African descent.

Figure 2.3b : Comparative Table Showing Results from Schwiebbe et. al, 2011.

The Status of Childhood Obesity in Trinidad

The Pan American Health Organization (PAHO) in 2001 commented that obesity is the primary contributing factor in the relationship following 1999 CFNI statistics that 31.4% of Trinibagonians were pre-obese and 16.8% were obese (Food And Agricultural Organization of the United Nations (FAO) 2003).

The most recent Health Status Report for Trinidad and Tobago, published by the Ministry of Health in 2011, revealed that studies at the University of the West Indies show a significant increase in the prevalence of childhood overweight and obesity in school aged (5-17 years) children in Trinidad (Ministry of Health 2011). In a newspaper article published prior, the minister provided figures that in 2011, Dr. Fitzroy Henry, Director at Caribbean Food and Nutrition Institute (CFNI) showed that 23% of primary school children in Trinidad and Tobago were overweight/ obese while 25% of secondary school student were overweight/ obese (Trinidad and Tobago Newsday 2011).

In response to the statistics obtained from UWI in 2011 (Trinidad and Tobago Newsday 2011), the Minister of Health in Trinidad and Tobago, Dr. Fuad Khan noted the public expenditure on drugs for the treatment of chronic non-communicable diseases and cancer amount to approximately TT \$400 million a growing figure since 2004 from TT\$34 million dollars and TT\$121.8 million in 2009 (Trinidad and Tobago Ministry of Health (MOH) 2011), all which could be improved through the curbing of the underlying cause, obesity.

In 2013, the Food and Agricultural Organization of the United Nations (FAO) amended its report, stating that Trinidad and Tobago ranked fifth in the world for obesity, with 30% if its population having a BMI over 30 (Trinidad Express 2013).

In 2014, the situation of childhood obesity further developed with the Minister of Health- Dr. Khan promising to examine the statistics of childhood obesity in both rural and urban areas, as well as collaborate with the Ministry of Education and the recently established National Schools Dietary Services Ltd (NSDSL) with the aim of changing the quality of food made available to children of the system. On his behalf, on another occasion Dr. Anjanie Sharma concretized an alarming increase in the prevalence of childhood obesity in Trinidad and Tobago and stressed that education, lifestyle change and social influences are contributors to the rise in numbers. She also noted that the ministry had strategies of curbing childhood obesity in place, including “Wee Fit” and “Healthy Me” camps for children since 2013, as well as actions put in place by Regional Health Authorities in accommodation of special child cases in overweight and non-communicable diseases (Trinidad Express 2014).

2.4 Relevance of Vegetarianism in Obesity Studies

The lifestyle of the vegetarian is one in which the burden of childhood obesity in children and adolescents is reduced through increased consumption of plant and plant-based foods (Sabaté and Wien 2010), producing generally satisfactory and protective nutritional statuses against excess adiposity. (P. Newby 2009). With the dawn of a “semi-vegetarian” lifestyle evolving in the western world it has also become relevant to consider the effect of a diet with low meat consumption (Gilsing, et al. 2013). Though the research is limited in amount, their contributions have left insightful details that food and lifestyle contribute to protective health effects.

Vegetarianism & the Vegetarian Diet

The vegetarian diet is described as “consisting wholly of vegetables, fruits, grains, nuts and sometimes dairy products” (Merriam-Webster's Incorporated 2014) and can be classified into different categories based on different food consumption patterns. Semi-vegetarians are graded

based on low-meat-consumption, avoiding meat, poultry and fish most of the time. Pescovegetarian, consume fish and dairy, but omit the poultry and meats. Lacto-ovo-vegetarians exclude all meat elements but eat dairy (including butter, cheese and yogurts) and eggs. The final classification of vegetarians is the strictest form, called vegans, where all animal products and by-products are eliminated from the diet (Pribis, Pencak and Grajales 2010).

Haddad et. al. (1999), proposed a theory of the vegetarian food guide pyramid, highlighting the features of a healthful vegetarian diet. It was describes as one which is abundant in plant food including grains, legumes, vegetables, fruit, nuts, seeds, plant oils, sweeteners, herbs and spices. Increased benefits were suggested to be obtained from unrefined and minimally processed foods since they contain more vitamins, minerals and dietary fibres. Fat intakes by vegetarian may derived from plant or animal source, depending on the type of vegetarian diets followed. Plants sources were described as being high in unsaturated fats, essential fatty acids, antioxidants and photo-chemicals, while some dairy products are high in saturated fat.

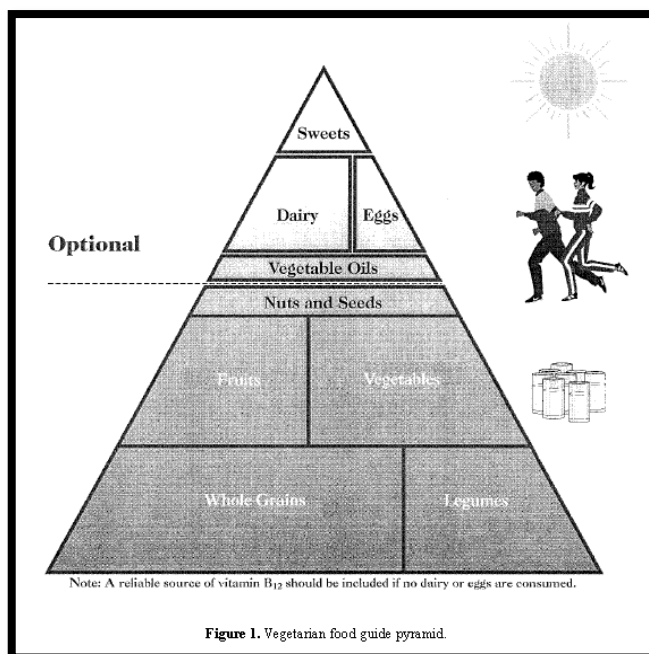


Figure 2.4a Vegetarian Food Guide Pyramid

The concept of protective effect of vegetarian and plant-based diets against childhood obesity was brought forth by Sabate and Wien (2010) where three (3) root causes were identified for the notion. First, the avoidance of meat was proposed since the diet was lower unsaturated fat, fatty acids and calorie density, which are all beneficial when it comes to weight management. Secondly, non-deitary lifestyle factors including smoking, physical activity, educational level may influence body weight. Finally, the greater intake or varitey of plant food evolves into a significant influence on primary prevention of obesity and a secondary prevention through weight loss and management.

The report showed that animal foods (meats and dairy products/eggs) are associated with an increase risk of overweight whereas plant foods are either protective or show no association.

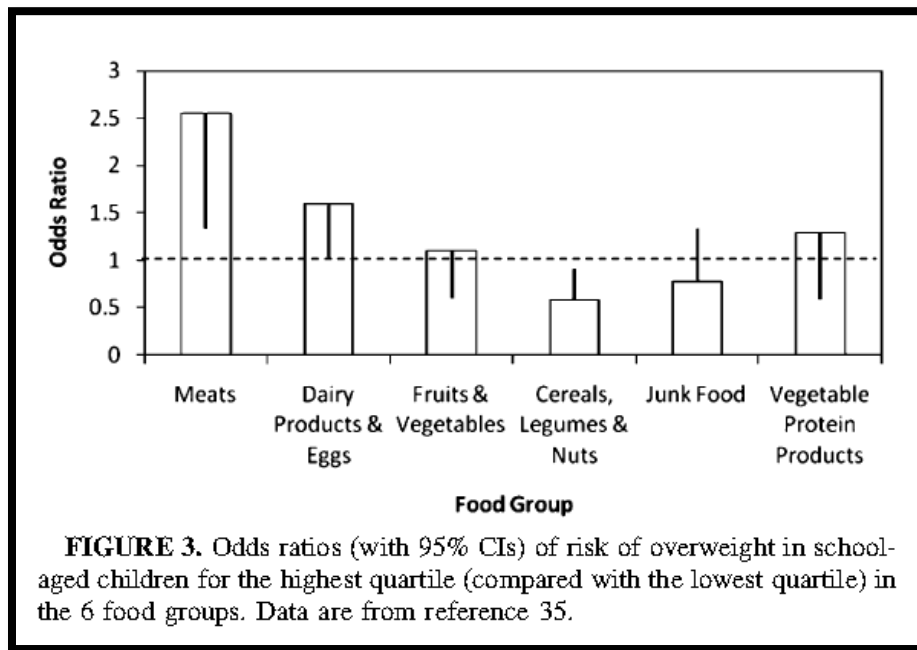


Figure 2.4.b Comparison of Odds Ratio for Risk of Overweight Food Groups Eaten

(Sabaté and Wien 2010)

The study concluded that given the difficulty in curbing adult obesity a sensible solution would be to prevent it from happening through reducing the rise in childhood obesity into adulthood and that plant-based diets are an effective strategy to subsequently decrease adverse health effects in adulthood. Authors call for international, national and local policies to be warranted to support social marketing of plant-based diets and promotes vegetarian-like dietary patterns (Sabaté and Wien 2010).

Previously, Newby et al (2005) studied that the nutrient intake across three (3) groups of vegetarians showed significant differences in level of risk for overweight and obesity. Notably, the vegetarian groups that were examined had higher intakes in fruit, vegetables and fibre and lower intakes of fat and protein. Though this pattern is expected from vegetarian groups, due the increase in plant-based foods, the subject of the study were leaner and presented a lower risk for overweight and obesity, despite higher total carbohydrate intakes that is recommended in popular weight loss diets. The article suggested that high-carbohydrate diets may be protective against obesity since, plant-based diets are often higher in fibre such as in fruit, vegetables and whole grain. In the study, self-identified vegetarians, semi-vegetarians and vegan showed lower risk for overweight and obesity than omnivores (Newby, Tucker and Wolk 2005). Thereby supporting the conclusions made by Sabate and Wien (2010).

Matthews, Wein and Sabate (2011), further illustrated that a protective association is produced between plant-based food groups and obesity in child and adolescent obesity whereas dairy is associated directly with rise in risk. This conclusion was in accordance with the previous article in 2010. Of the food groups examined, grains show consistent protective effects from overweight since they are described to be nutrient dense, high in complex carbohydrates and fibre, which support satiety and leanness. Another study by Newby (2009) substantiates that there

is a protective effect between Ready-to-eat breakfast cereal consumption and reduce risk for childhood obesity, but insignificant results were obtained for normal food group like high-protein foods, fruit, grain, vegetables and fibre.

The article, (Matthews, Wein and Sabate 2011) continues to add that nuts, although high in fat content, they are a vital source of protein in the vegetarian diet, with low saturated and transfat and are associated with weight gain. Foods that are a good source of fibre and protein, tend to be more protective against obesity, achieving satiety and removal of extra unabsorbed fat.

Confounding results like these were not new in research of literature since, examination of several variables at one time were examined, reducing the precision of assumptions regarding the benefit of vegetarian and semi-vegetarian diets (Matthews, Wein and Sabate 2011), (P. Newby 2009). It was ascertained that studies in non-white populations were mandated since understanding the dietary habits in diverse ethnic groups is required to address health disparities.

Vegetarianism and Religion in Trinidad

In Trinidad and Tobago, there are 3 main religions which advocate the vegetarian lifestyle to their followers, namely, Hindus, Seventh Day Adventists and the Rastafarian religions. According to the demographic census of 2010 in Trinidad and Tobago, the most populated religion was Hinduism, followed by Seventh-Day Adventists, then Rastafarian (Trinidad and Tobago- Ministry of Planning and Sustainable Development 2011).

There is no documented evidence on dietary lifestyles of followers on these religions in Trinidad and Tobago, but it is evident that it exists. International literature is concentrated on to develop the conceptual framework of these beliefs in relation to vegetarianism.

Vegetarianism is a fundamental moral in Hindu notion, entrenched in the spiritual objective to maintain a balanced state of mind and body. Since Hindu scriptures glorify nonviolence, a meatless diet is crucially important in the successful practice of worship and meditation. Vegetarianism has never been a requirement for Hindus and thus modern Hindus consume more meat than before. However, the ideals state that non-vegetarian food may be harmful to one's health and the environment (Srivastava 2007). Ramaswamy (1993), claimed that observations in the United States show that despite a large amount of Hindu parents live in the Western world, the value however is not passed down to children.

The magazine article also divulges into other religions of the world and the link with vegetarianism, stating that the Seventh day Adventists were the first official vegetarian Christians. Today, half of all Seven Day Adventists are vegetarian (Srivastava 2007). The Protestant denomination is perceived to be the largest and most significant group of vegetarian Christians, with a published record Americans of enjoying better health. The belief was founded by Ellen White who frequently addressed the significance of the vegetarian diet, likening it with holistic development (Davidson 2003). Similar to the previously discussed Hinduism, Adventists link vegetarianism with ethical, ecological, eschatological and spiritual issues.

Another, but less popular documented religion that promulgates the meatless practice is Rastafarianism which supports its belief with the anatomical make up as well as the nutritious and associated physical effects of a vegetarian diet and the human body. Referencing human teeth, and the gastrointestinal tract to those of the herbivorous creatures, the "Rasta" culture further evidences of the unsuitability digestion of flesh by human beings (Adande 2003). Rastafarians try to eat only Ital food (a salt-less and 'vegetarian' diet of Rastas). They exclude

meats in most cases (especially pork) and crustaceans; however they opt for a lacto-ovo or pescatarian vegetarian lifestyle (International Vegetarian Union 2010).

Chapter 3- Methodology

3.0 Background

A cross-sectional study was carried out among Hindu school-aged children that attended participating temples in the Tunapuna-Piarco Regional Corporation, Trinidad from February to March 2014. After seeking parental permission for participation in the study, anthropometric measurements were obtained by the researcher. The distribution of a food frequency questionnaire, inclusive of lifestyle pertaining questions followed. Statistical analysis was then performed on data using SPSS version 12.0.

3.1 Population

The target population for this correlation was Hindu school-aged children who attend community temples within the Tunapuna-Piarco Regional Corporation (TPRC) of Trinidad, predominantly of East-Indian origin.

The municipality of Tunapuna-Piarco is a vast, with its borders stretching along the popular East-West Corridor of Trinidad. It is the home of the University of the West Indies, innumerable commercial and social operations (Tunapuna/Piarco Regional Corporation 2010). The TPRC is the only district in Trinidad which falls within two of the major regional health authorities and thus results obtained from the survey would provide insightful information to national development.

Hindu religious boards have set up offices throughout the length and breadth of Trinidad and Tobago, with a dense population of institutions (including school, temples and community centres) in the district. Hinduism is one of the practised faiths in Trinidad which advocates the

principle of a vegetarian lifestyle and thus, examining the children of this ethnic sub-group would shed light on discrepancies from existing literature.

As described by CDC in their growth charts, a child may be defined between the ages 2-20 years old (Center for Disease Control and Prevention 2012). In Trinidad, the schooling system is divided into two parts, primary and secondary. Ages of primary school children vary between 5 and 11, when their tuition continues in the secondary institution for a following 5-7years. On completing studies at both these levels, students are estimated to be 18years old. The 10-18 year age group was targeted because the children would be better equipped with knowledge to participate in the proposed food frequency questionnaire. The same age group was also researched in various reports.



Figure 3.1 Map of Trinidad showing the Area of Selected Population- Tunapuna/Piarco Regional Corporation (Highlighted in Red)

The Trinidad and Tobago- Ministry of Planning and Sustainable Development (2011), expressed the population demographics in the census report of 2011. Adapting relevant information from this report to generate a population size, it was determined that a total of 3,774 children of both sexes (1,871 girls and 1,903 boys), between the ages of 10 and 19 years, and of the Hindu belief populated the municipality of the Tunapuna-Piarco Regional Corporation.

3.2 Sample Selection

The sample selected for this research was in accordance with the main aim of generating the prevalence of obesity in the Hindu school-aged children population of the Tunapuna-Piarco Regional Corporation, with special attention to varying diets practiced with respect to the consumption/ non-consumption of meat.

Ideally, to generate a sample size, a formula should be employed to determine the study sample size (University of the West Indies 2008). However these formulas were unable to give the sample size needed to collect the data, since very little population data has been collected on all components of the population. A sampling frame therefore was not established.

Alternatively, the method of selecting a convenient random sample of accessible temples within the district was selected to carry out the pilot study in this field. No complete list of religious institutions and community centres could have been provided by the Central Statistics Office, the Tunapuna-Piarco Regional Corporation, or by the leading Hindu-boards.

Twelve (12) vibrant community religious centres were identified to volunteer service for participation in the study. The executive of the temples indicated regular attendance by school-aged children which stratified the sample of this study to those present in the temples on the day the research was being conducted. (See Appendix for list of Hindu Institutions of the Sample).

Inclusion criteria therefore were all Hindu school-aged children (10-18years) attending the participating temples on the set date for the data collection to occur, within the Tunapuna/Piarco Regional Corporation.

Exclusion Criteria were children below and over the age field examined (i.e. <10 , >18 years) and non-Hindus.

In total, 195 children were obtained for participation in the survey. However, in some cases, parental permission was not granted, further reducing the sample size to 181. Furthermore data collected was reduced since some participants dropped out after anthropometric measurements were taken, these questionnaires were then annulled.

3.3 Study Design (Instruments)

The study was designed to collect type main types of data: (1) Anthropometric data and (2) Dietary data. The use of food frequency questionnaires to develop an overall idea of the consumption patterns of overweight and obese children is needed to determine a direction in which changes are to be made.

3.3.1 Anthropometric Data

Anthropometric data collection involved the use of the National Health and Nutrition Examination Survey's (NHANES) Anthropometric procedures manual to determine the height (cm), weight (kg), body fat percentage and waist circumference in (cm) for each participant (Center for Disease Control and Prevention (CDC) 2007).

According to the CDC definition of childhood obesity, Body-Mass Index (BMI) for age is a determinant for nutritional status and is dependent on the percentile which the subject's BMI places on the CDC-growth charts (Center for Disease Control and Prevention 2012).

(See Appendix for CDC Gender Specific BMI for AGE Graphs to determine Nutritional Status for Obesity).

BMI uses a combination of both height and weight to calculate the average body fatness which is compared against standard charts to produce a result of a subject's nutritional status. Instruments used for the collection of this data were a stadiometer and a Tanita Body Composition Analyzer (Model: TBF 604).

$$\text{Body Mass Index} = \frac{\text{Weight (kg)}}{[\text{Height (m)}]^2}$$

(World Health Organization (WHO) 2013)

Overweight is defined as a BMI at or above the 85th percentile and lower than the 95th percentile for children of the same age and sex

Obesity is defined as a BMI at or above the 95th percentile for children of the same age and sex

(Center for Disease Control and Prevention 2012)

The article by Dietz and Bellizzi (1999) met-analysed coefficients of body fat percentage using the “gold-standard”- dual-energy x-ray absorptiometry (DXA) and underwater weighing and found that DXA measurements are comparable coefficients with BMI to determine body fatness in children (Dietz and Bellizzi 1999). Body mass index to assess the global prevalence of obesity in children and adolescence was approved by the International Obesity Task Force in June of

1997 in Dublin. The workshop concluded that despite the decreased validity of the 2-component model of fatness measurement, BMI standards in children and adolescents are a reasonable and suited measure for the population.

The second method determining body fatness employed in this study was the use of bioelectrical impedance analysis (BIA) to produce the percentage body fat of the child. In 1992, BIA was investigated by Young and Sinha to be able to produce “good estimates” of body composition for the West Indian population between the ages of 8 and 21 years old (Young and Sinha 1992). Distinct age-gender associations exist for percentage body fat in children. In the US, median percentage body fat at 18years is 17.0% and 27.8% for boys and girls respectively (Laurson, Elsenmann and Welk 2011). The premise of using this alternative body fatness measurement was because, BMI ,principally a 2-component model of measuring body fat, does not distinguish between increased body mass in the form fat, muscle, body or water – hence leading to a misclassification (Mc Carthy, Cole, et al. 2006).

The final method of determining the nutritional status of children was through calculation of the waist circumference (WC) to height (Ht) ratio (WHtR). A flexible measuring tape was used in obtaining the WC from each participant, and a stadiometer for height in centimetres. Waist circumference has been shown to be a perceptive and exact indicator of excess abdominal body fatness in children (Mc Carthy and Ashwell 2006). WHtR is calculated by dividing the WC (cm) by the Ht (cm) to produce a value expressed as a decimal number. This proportionality suggests that the increase in height of a growing child is linear and should be maintained with a correlated waistline. WHtR is expected to plateau at age 18 (for both sexes) and a cut-off value of 0.500 is proposed by researchers in order to lower the risk of childhood obesity. Further progress has

been made in using the WHtR in predicting nutritional status applying the theory of the Ashwell Shape Chart, suitable for both sexes above the age of 5 years old (Ashwell 2011).

3.3.2 Questionnaire Design

The questionnaire distributed to collect information for this study was structured in two parts and contained a total of 21 fixed-alternative questions which was ordered from particular to general format with the age group, education level and ethnicity of the study population in mind. (See appendix for full questionnaire).

A Food frequency questionnaire adapted from reputable and certified questionnaires to suit the population and to determine the results needed. The first component was a Food Frequency Questionnaire (FFQ) adapted from four (4) validated questionnaires of previous studies; (Matthews, Wein and Sabate 2011), (Newby, Tucker and Wolk 2005), (Gilsing, et al. 2013), (University of Aberdeen 2006). A non-quantitative selective questionnaire was prepared with clear and simple instructions and was administered to all participants. Frequency choices were defined as everyday (daily), 5-6 times per week, 2-4 times per week, once a week (weekly), once per month and never. The foods on the questionnaire were divided according to the Caribbean Food Groups (Caribbean Food And Nutrition Institute n.d.) and further sub-divided into food categories using guidance from Matthews, Wein and Sabate (2011), Newby, Tucker and Wolk (2005) and the the vegetarian food guide pyramid framework document (Haddad, Sabate and Whitten 1999).

In the design of the questionnaire, the consideration that most children do not prepare their own foods lead to the omission of the “Fats and Oils” food group, however, typically used butter, margarine, spreads and cheeses were considered under the “dairy” food group. Thus the

food groups used were: Starches, Legumes, Vegetables, Fruits, Dairy, Meats and Poultry. An additional food category was included to find out the consumption patterns of “fast/convenient foods and food products”, including sugar sweetened beverages, salty snack foods and sweets like desserts and candies. Each food category was well exemplified so that they may be related easily to the child participants.

The second part of the questionnaire focused on lifestyle practices that often influence diet and risk for obesity. Some of these characteristics paid attention to were frequency of consumption of home-cooked meals, frequency of “eating out”, the practiced diet of the participant (vegetarian or non-vegetarian), frequency of meat consumption, beverage choice, factors which influence choice of meals, daily estimated level of physical activity & “Screen time” (in hours), demographic factors like education level, and the perception of knowledge on the topic of obesity and current diet.

The questionnaire was developed and pre-tested twice- first with only 5 children, changes were made and pretested again with 5 children, 2 of which were the same from the first pre-test. The children selected for the pre-test did not participate in the survey and were of varying ages of the defined age group. The questionnaire was designed to be self-administered, however supervision was necessary to answer any concerns the participants may have had.

The second part of the questionnaire was used for documenting anthropometric data from each participant.

3.4 Data Collection Process

Data collection took a period of approximately 5 weeks and spanned the dates of February 16th until March 18th, 2014.

A research team of two (2) visited the selected institutions on a pre-arranged date to collect data in the form of anthropometry and dispense questionnaires. All instruments were standardized before the examination and the balances were zero calibrated using the manuals. Another precaution taken was the sanitizing of instruments before, during and after measurements were taken.

Informed consent was obtained from the institution (temple) officials via phone calls and signed letters. The age of the children was also considered for participation in the survey, thus it was necessary to dispense parental consent forms to inform the parent/ guardian of the child's participation in the study as well as the procedures that were going to take place. A phone number was made available for any further enquiries. The overall consent for participation was well received.

Anthropometric Measurements:

The following guidelines in taking measurements from the subjects:

1. Standing height was measured using a stadiometer with a fixed vertical backboard and an adjustable head piece, in order to assess the maximum vertical height of each participant. Hair ornaments, shoes and socks (in some cases) were removed and the subject was instructed to stand on the platform with his/her back against the vertical board, heels together toes apart. Head, shoulder blades, buttocks and heels were set in contact with the backboard. The head was aligned in the Frankfort horizontal plane and the stadiometer's

head piece was brought down after the participant took a deep breath in. The results were captured and documented to the nearest 0.1 centimetre.

2. Abdominal (Waist) Circumference for the participants was taken from the participants using a flexible measuring tape at the level of the narrowest point between the lower coastal border and the iliac crest. In the cases where there was no obvious narrowing, measurement was taken at the midpoint between both landmarks. Subjects were not required to remove any clothing since the environment in which these measurements were done (in most cases) was open and less private. This factor can be considered a limitation of the study.
3. Weights and body fat percentage were produced using the same instrument. Without shoes, sock and jewellery, subjects were instructed to step on to the calibrated scale which produced, weight in kilograms and body fat percentage. Participants were requested not to eat or drink for 3hours before the test, and to avoid strenuous exercise from the morning of the test. Using the Tanita Body Composition Analyzer, the participants were instructed to step on the scale with their feet on the electrodes, look straight ahead and take a deep breath in. The machine produced the results that were desired and they were recorded.

Questionnaire Data Collection:

Dietary information was collected from 173 Hindu school-aged children between and inclusive of the ages of 10 and 18 years old who attended the temples. The questionnaire was designed to be self-administered, however supervision was necessary to answer any concerns the participants may have had. Participants were directed to abide by the simple instructions of questionnaire. This was carried out in groups with the subjects in order to save time, however

precautions were taken to reduce the communication between the participants to avoid bias and inaccurate results.

3.5 Data Analysis Method

Data analysis for this project was done using the SPSS programme version 22. Questionnaire responses and anthropometric data collected were coded and entered into the program.

A combination of descriptive and inferential statistics was used to analyse the data collected from sample participants (see Appendix II for Data Coding sheet). Described as the most straightforward was of presenting facts, descriptive statistics assists in making decisions, usually emphasizing the role of qualities or characteristics of a population for a known variable. In contrast to this, inferential statistics draw conclusions from data and produce answers for test hypotheses for sample data. Means and standard deviations (SD) for continuous variables and frequencies (number and percent) were generated for categorical some variables.

The assessment of the normality of the data was done as a prerequisite for statistical testing. For data that was normal, parametric testing was done. A series of graphs and charts were generated using the data set, as well a cross tabulation and correlations analyses were run to produce results of significance. Independent samples t-tests, Pearson's correlation and chi-square testing were some of the statistical analyses used in the testing of data to determine relationship between data.

A confidence interval of 95% was set for significant results, i.e. when $p < 0.05$, results would be considered to be statistically significant.

Chapter 4- Results

Overall, there were 173 participants who completed both parts of the research (questionnaire & anthropometric measurements). Descriptive data of the population are shown in Table 4.1. Out of 173 participants, 82 (47.4%) were male and 91 (52.6%) female. Mean age for the population was approximately 13 years for both genders. The questionnaire determined that 53.8% of the participants attended primary school while 46.2% were secondary school students. The majority of the population sampled were non-vegetarian with an approximate ratio of 2:1. Although more than half of the population possessed a healthy weight status, a total of 30.6% were victims of excess adiposity (overweight and obese). Cross tabulation showed that in primary and secondary schools, excess adiposity was 31.2% and 30% respectively.

Table 4.2 described the anthropometric results between genders. The average BMI for girls with age was 22.13 kg/m^2 (20.13SD) while boys were 20.93 kg/m^2 (12.26 SD). The means for WHtR were 0.45 and 0.47 for females and males respectively. The mean percentage body fat for the population was 28.30% with a SD of 11.16. When 2-tailed independent samples t-tests were run and equal variances were assumed p-values of 0.024, 0.013 and 0.052 were obtained for height, waist circumference and body fat percentage respectively. The means of BMI, WHtR and BF% for vegetarians were 22.65 kg/m^2 (24.5 SD), 0.44 and 26.09% (10.65%SD) while non-vegetarians weighed in with 21.01 kg/m^2 (6.08 SD), 0.45 and 29.40% (11.28% SD) respectively (Shown in Table 4.3 and Table 4.4).

Graph 4A shows that of all the participants, more are relatively aware of the issue of obesity (69.9%), the remaining 30% did not know or have never heard of the term “obesity”. The Pearson Chi-Square value for this cross tabulation is 0.251 and $p = 0.615$.

Table4.1 Descriptive percentage value of selected characteristics of the study population (n=173)

Report		
	Frequency	Percent (%)
Hindu (%), n	173	100
Gender (%), n		
Male	82	47.4
Female	91	52.6
Centre Name (%), n		
1. Ramgoolie Shiwalaya	11	6.4
2. Pasea Sai Center	23	13.3
3. Lakshmi Narayan Bhakti Mandali	15	8.7
4. Bamboo Hindu Temple	21	12.1
5. Bharatiya Vidya Abhyas Mandali	13	7.5
6. Sukh Shanti Bhakti Mandali	18	10.4
7. El Dorado Shiv Mandir	14	8.1
8. Gyan Prakaash Mandir	16	9.2
9. St. Helena Shiva Mandir	8	4.6
10. Carapo Hindu Temple	20	11.6
11. ISKON Arouca	5	2.9
12. Maha Vishnu Mandir Da'badie	9	5.2
Level of Education (%), n		
Primary School	93	53.8
Secondary School	80	46.2
Diet Status		
Vegetarian	58	33.5
<i>Vegan</i>	<i>1</i>	<i>0.6</i>
<i>Lacto-ovo Vegetarian</i>	<i>54</i>	<i>31.2</i>
<i>Pescatarian</i>	<i>3</i>	<i>1.7</i>
Non-Vegetarian	115	66.5
BMI for Age Category (%), n		
Underweight	25	14.5
Healthy	95	54.9
Overweight	23	13.3
Obese	30	17.3

Table4.2 Comparison of Anthropometric means by gender

Report								
Gender of Child		Age (yrs)	Weight in kg	Height in cm	Body Mass Index	WC (cm)	WHtR	Body Fat Percentage
Female	Mean	12.96	47.19	151.41 ^a	22.13	68.07 ^b	0.45	26.85 ^c
	N	91	91	91	91	91	91	91
	Std. Deviation	2.69	20.46	10.53	20.13	12.92	0.071	12.26
Male	Mean	13.21	52.43	155.87 ^a	20.93	72.89 ^b	0.47	29.94 ^c
	N	82	82	82	82	82	82	81
	Std. Deviation	2.34	18.18	15.07	4.94	12.26	0.066	9.59
Total	Mean	13.08	49.68	153.53	21.56	70.36	0.4578	28.30
	N	173	173	173	173	173	173	172
	Std. Deviation	2.52	19.53	13.04	14.96	12.80	0.069	11.16

^a One-tailed p-value after running independent samples t-test value of 0.00, 2-tailed t-test value of 0.024 with equal variances assumed

^b 2-tailed t-test p-value of 0.013 with equal variances assumed

^c One-tailed p-value after running independent samples t-test value of 0.052, 2-tailed t-test value of 0.070 with equal variances assumed

Of the 121 respondents who are aware of obesity, 42 were vegetarian and 79 were non-vegetarian. Further cross tabulation of data produced Graph4B, showing of those familiar with the term “obesity,” weight status was: 14 Underweight (11.5%), 68 Healthy (56.1%), 17 Overweight (14.2%) and 22 Obese (18.2%). The remaining 30% of participants that were not familiar with the term, 11, 27, 6, and 8 were underweight, healthy, overweight and obese respectively. The Pearson Chi-Square value obtained for this test was 2.769 where the minimum expected count was 6.91 and $p=0.429$ for all cases.

Table4.3 Comparison of Anthropometric Data by Different Diet Status using Means and SD

Report				
Veg/NonVege		Body Mass Index	Body Fat Percentage	Height to Waist Ratio
Vegetarian (Vegan, Lacto-ovo, Pesco)	Mean	22.6534	26.0930	.4454
	N	58	57	58
	Std. Deviation	24.48662	10.65080	.06342
Non-Vegetarian	Mean	21.0109	29.4000	.4640
	N	115	115	115
	Std. Deviation	6.08959	11.28331	.07114
Total	Mean	21.5616	28.3041	.4578
	N	173	172	173
	Std. Deviation	14.96282	11.15628	.06902

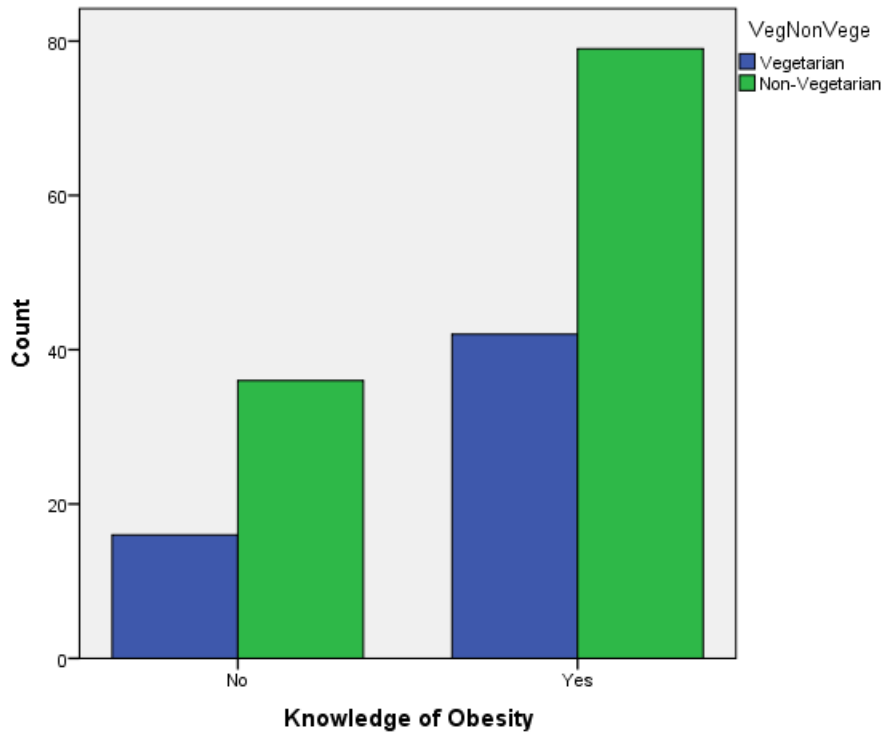
Table4.4 Pearson Correlation for Anthropometric Data by Different Diet Status

Correlations					
		VegNonVege	Body Mass Index	Body Fat Percentage	Height to Waist Ratio
VegNonVege	Pearson Correlation	1	-.052	.140	.127
	Sig. (2-tailed)		.497	.067	.095
	N	173	173	172	173

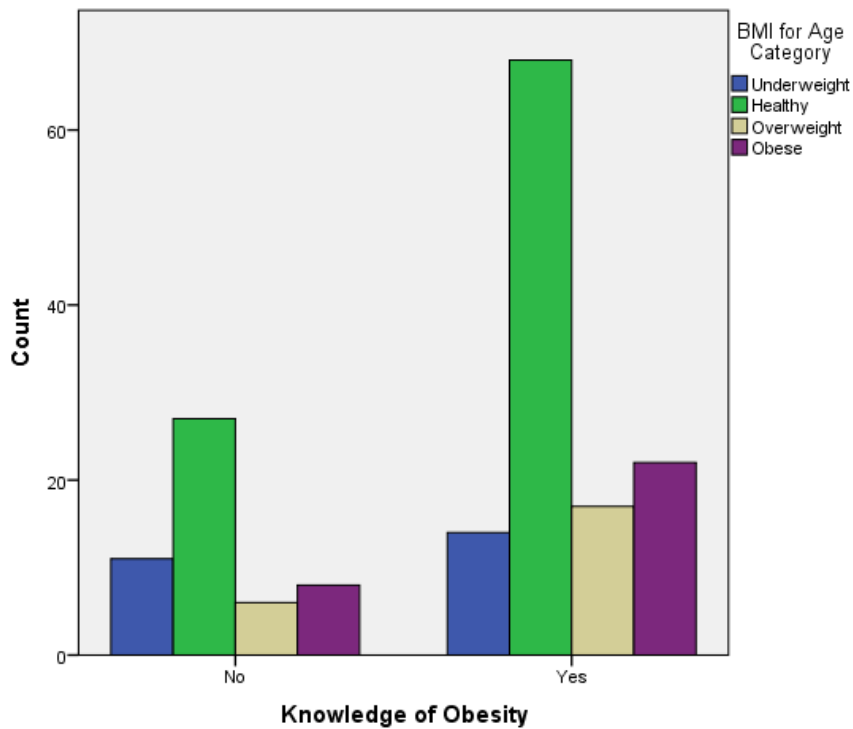
** . Correlation is significant at the 0.01 level (2-tailed).

Graph4C displayed that of 58 vegetarians 12 (20.7%) were underweight, 33 (56.9%) healthy, 6 (10.3%) overweight and 7 (12.1%) obese, in contrast with 115 non-vegetarians with 11.3% underweight, 53.9% healthy, 14.8% overweight and 20% obese. Pearson's Chi-Square test value for this cross-tabulation produced a result of 4.382 with p=0.223.

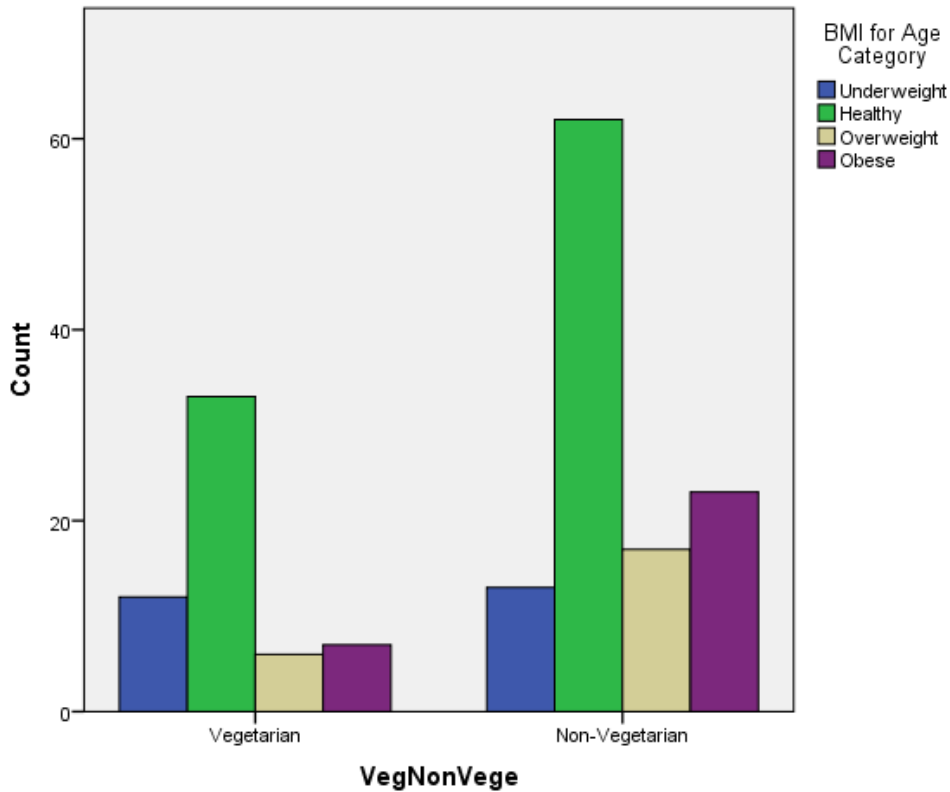
Graph4A Comparing Frequency of Knowledge of Obesity to Diet Status



Graph4B Comparing Frequency of Knowledge of Obesity to Weight Status



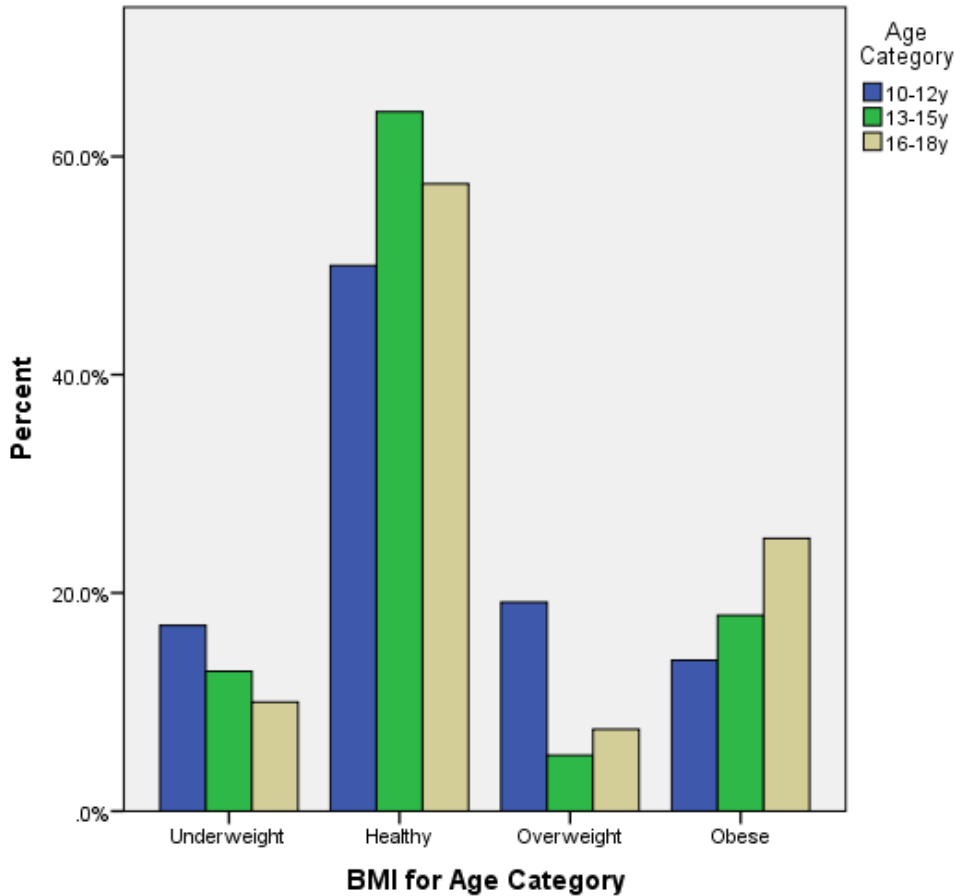
Graph4C Comparing Weight Status Frequency by Diet Status



From Graph4D, it appears that the percentage of underweight children and the percentage of children with total excess adiposity is highest in the age category of 10-12 years. In the Pearson Chi-Square test in cross tabulation for these two variables, a value of 9.531 with a p value of 0.146 was obtained.

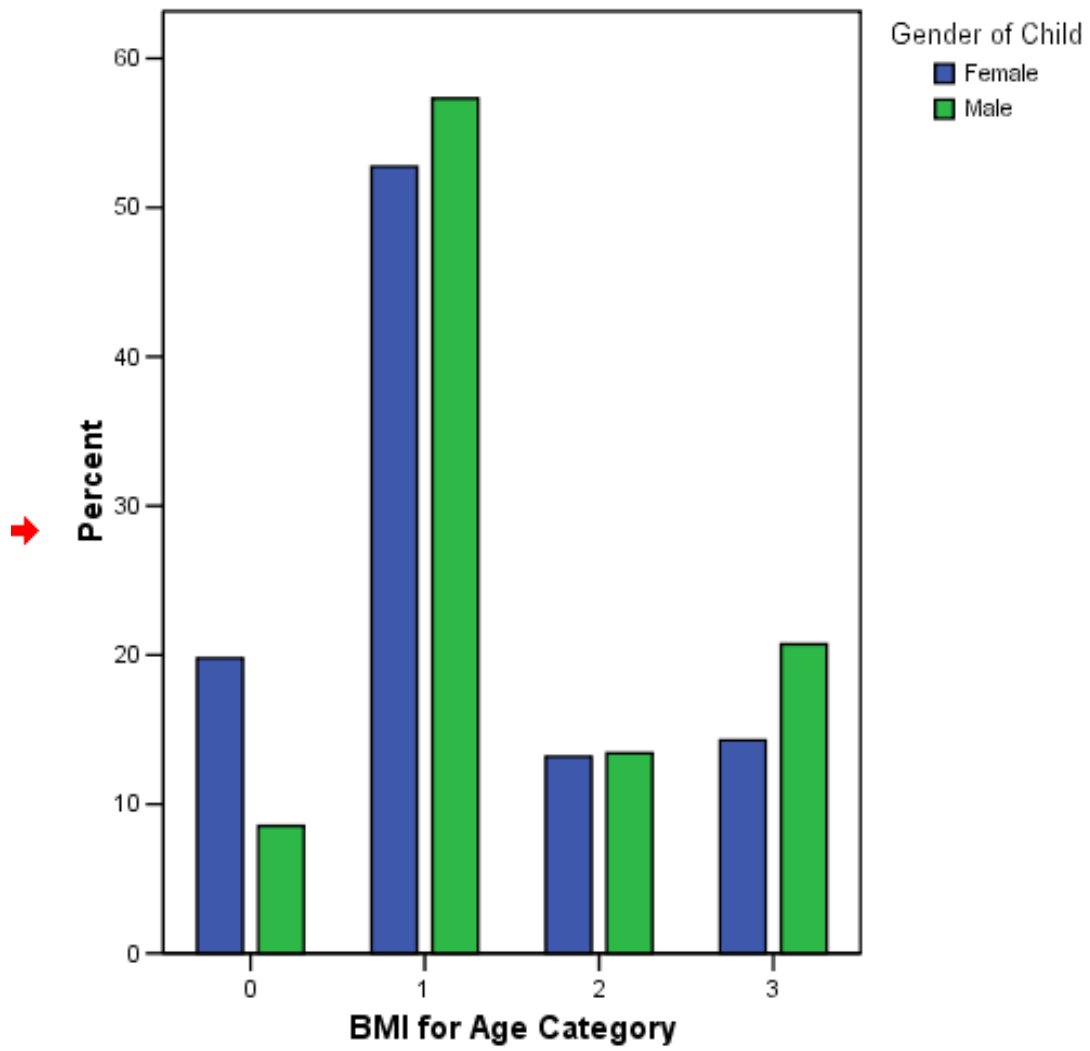
Graph4E compares the weight status of genders and depicts that (for BMI for Age Category: 0=Underweight, 1=Healthy, 2=Overweight, 3=Obese), with a close percentage of both males and females being healthy.

Graph4D Showing Weight Status for Participants of Varying Ages

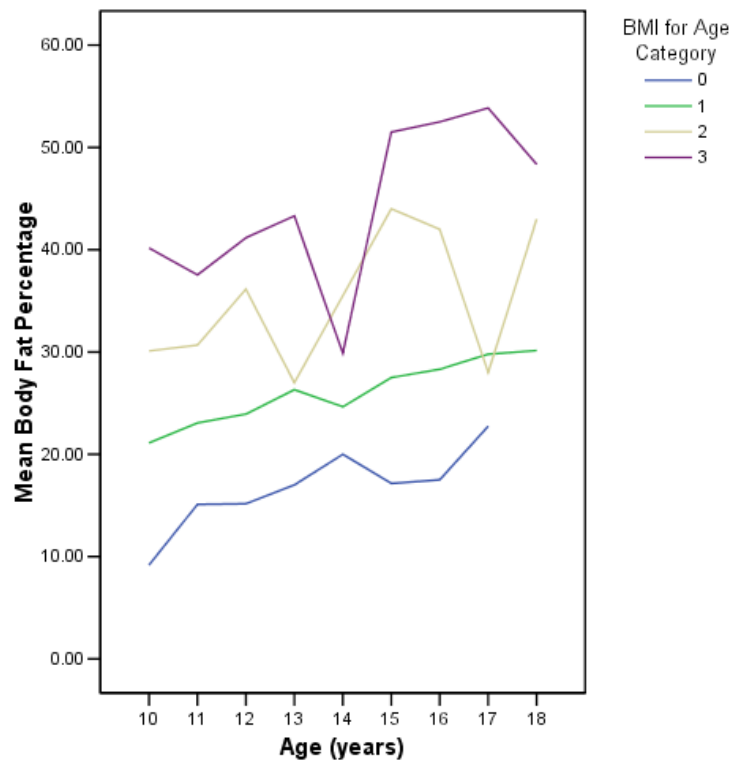


As shown in Graph4F, the mean difference in weight status in the form of BMI for Age Category varies throughout the population over different age groups ranging from 10 years to 18 years old. For each category of weight status, i.e. underweight (0= blue), healthy (1= green), overweight (2=yellow) and obese (3= purple), a corresponding change in BF% is depicted on the graph. healthy was 20% and underweight was a low of 10%. Peak values for underweight category were at the age of 18 while the low was at 10 years. Overweight mean BF% records climaxed over 40% for age 15 and dipped to about 25% for participants of 13 & 17 years. The highest BF% value for the obese category was at about 52% for age 17 and lowest at 30% for age 14

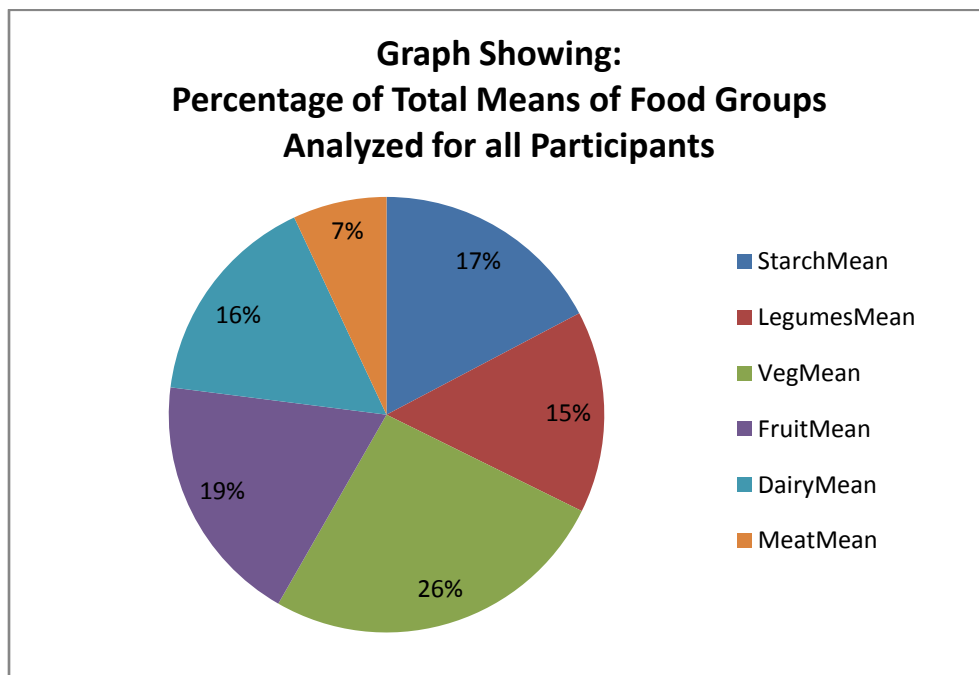
Graph4E Comparing Weight status by Gender.



Graph4F Displaying the Mean Body Fat Percentages for Weight Status at different Ages

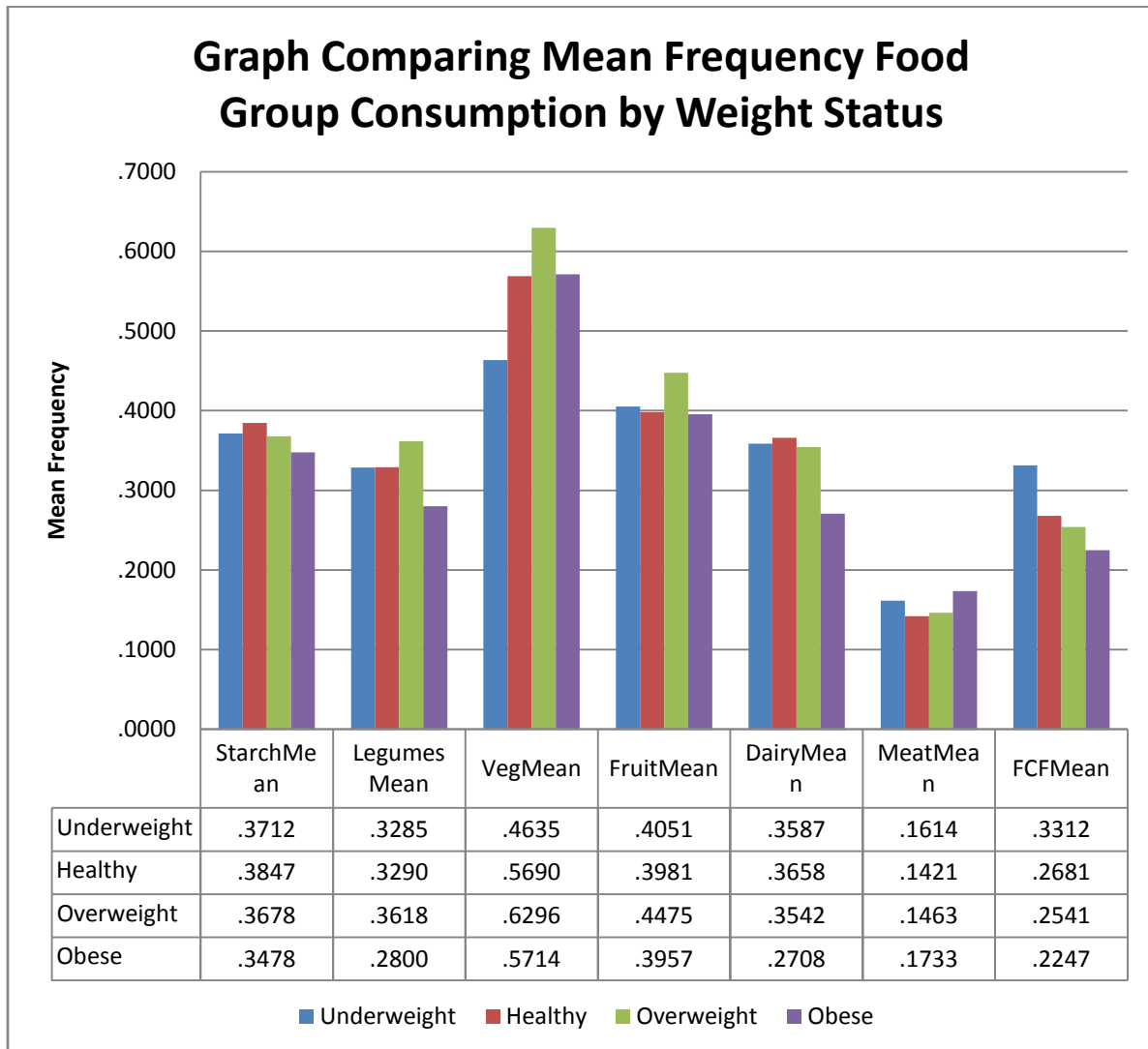


Graph4G Showing Total Means of Food Groups Analyzed for all Participants

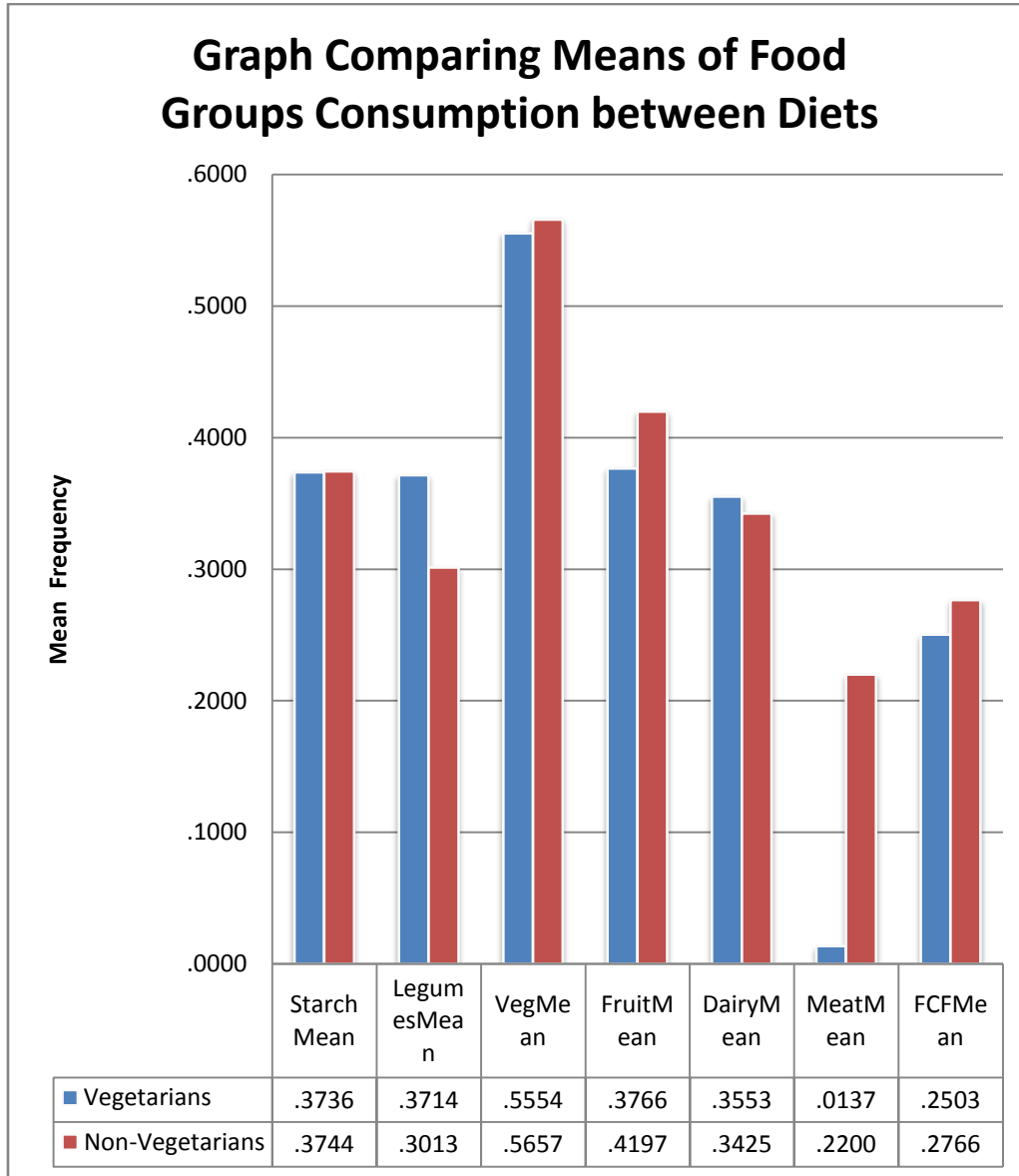


The food frequency questionnaire provided data depicted in Graph4G that, of the entire population, the daily diet was 17% starch, 15% legumes, 26% vegetables, 19% fruit, 16% dairy and 7% meat. The results in Graph4H, shows that obese and underweight participants consume higher amounts of meat. No significant difference was observed between the groups and consumption patterns.

Graph4H Comparing the Mean Frequencies of Food Consumption by Weight Status

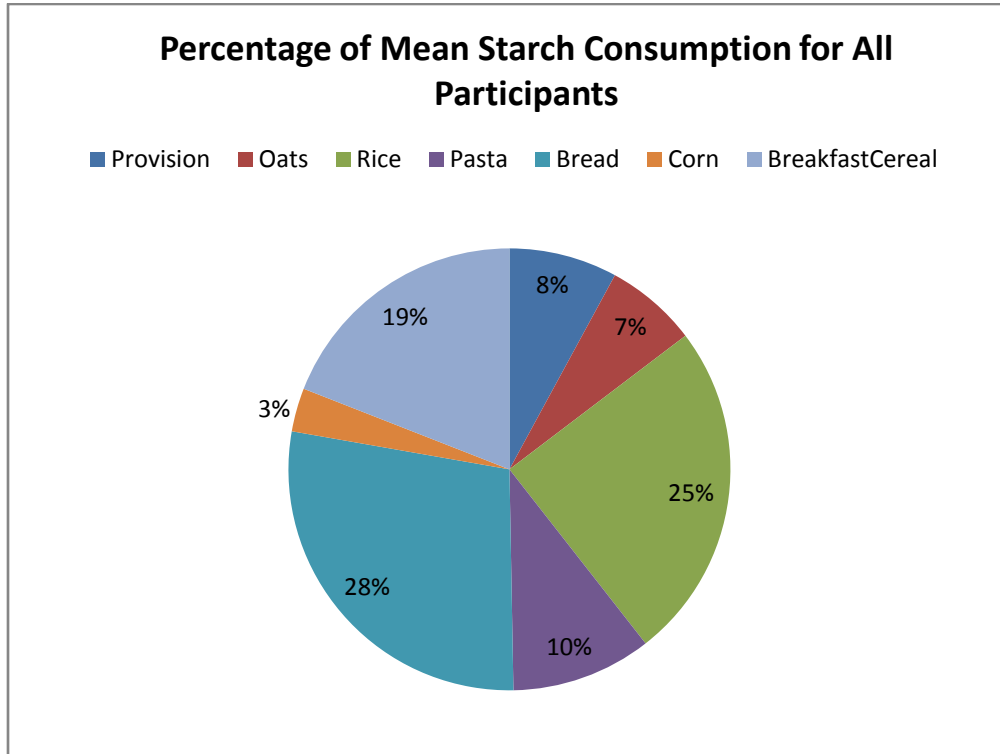


Graph4I Comparing the Means of Foods Consumed by Diet Practised

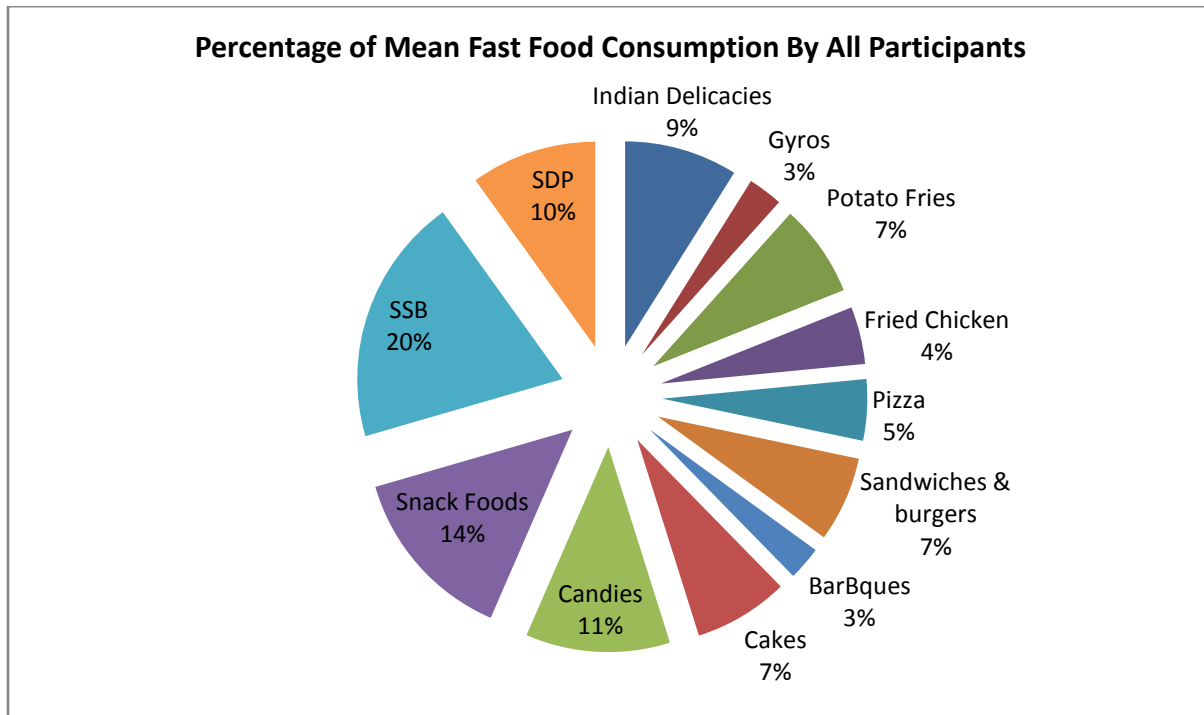


Results shown in Graph4I reveal that Vegetarians consume a greater amount of legumes and dairy than non-vegetarians, while non-vegetarians consumed greater amounts of fast food, fruit and vegetables. Starch consumption for both groups appear to be relatively the same with the largest percentage of starches being obtained from refined starch products like bread and bread-like products (28%), rice (25%) and ready-to-eat breakfast cereals (19%) (Graph4J).

Graph4J Percentage of Mean Starch Consumption for All Participants



Graph4K Chart comparing Percentage of Mean Fast Food Consumption by All Participants



Analysis derived that 11% of the daily diet of total participants were contributed by fast or convenient foods. From the data in Graph4K, sugar sweetened beverages contributed 20%, the largest group empty calorie foods consumed by the sample, closely followed by salty snack food consumption and candies with 14% and 11% per day respectively. 26% of the population confirmed that in contrast to their water consumption, sugar sweetened beverages were more prominent in their diet.

Table 4.5 clearly describe responses collected for practiced eating patterns in the lifestyle in Hindu Trinidadian school-aged and adolescents by gender. 67.6% of the population consumed home-cooked meals daily while only 1.2% never had home-cooked meals. The frequency of eating out was more prevalent in girls throughout the study while boys consume a meat more frequently during the week. Boys generally participated in more physical activity than girls for all ages per day, and girls recorded more screen-time per day.

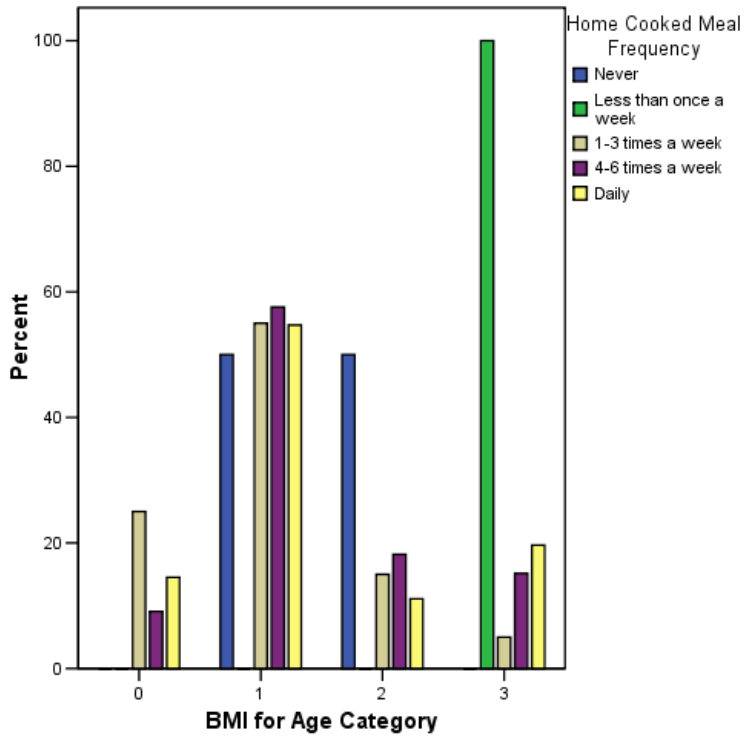
The association between weight status and frequency of home-cooked meals in Graph4L related overweight and obesity is greatly linked with higher percentages of eating home-cooked meals less than once a week/never. Graph4M explains that a healthy weight status is as a result of a high percentage of never eating out and a low percentage of eating-out daily. Excess adiposity is observed to be most prevalent in those that eat-out 4-6 times a week or more.

Over 80% of participants responded positive to participation in physical activity with about 42% engaging in 1hour or more per day (Graph4N and Graph4O). The mean BF% obtained for respondents with enough physical activity was 28.3% (10.6 SD) while those engaging in enough physical activity had a mean BF% 28.3% (11.9SD). Independent samples t-test for normal

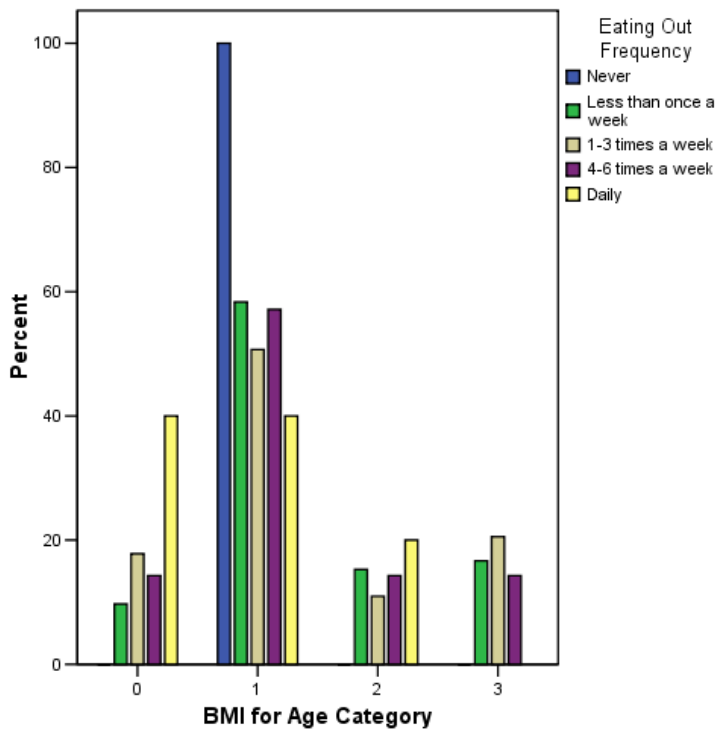
Table4.5 Percentage value of Lifestyle characteristics by Gender

Report						
	Total Frequency	Gender Frequency		Gender %		Total Percent (%)
		Female	Male	Female	Male	
Frequency of Home Cooked Meal per week						
Never	2	1	1	0.58	0.58	1.2
Less than Once a Week	1	0	1	0.00	0.58	0.6
1-3 times a week	20	10	10	5.78	5.78	11.6
4-6 times a week	33	19	14	10.98	8.09	19.1
Daily	117	61	56	35.26	32.37	67.6
Frequency of Eating Out per week						
Never	2	0	2	0.00	1.16	1.2
Less than Once a Week	72	40	32	23.12	18.50	41.6
1-3 times a week	73	37	36	21.39	20.81	42.2
4-6 times a week	21	10	11	5.78	6.36	12.1
Daily	5	4	1	2.31	0.58	2.9
Frequency of Meat Eating per week						
Never	50	20	30	11.56	17.34	28.9
Less than Once a Week	30	17	13	9.83	7.51	17.3
1-3 times a week	53	30	23	17.34	13.29	30.6
4-6 times a week	29	16	13	9.25	7.51	16.8
Daily	11	8	3	4.62	1.73	6.4
Amount of Physical Activity per Day						
10minutes or less	22	13	9	7.51	5.20	12.7
20-30minutes	47	29	18	16.76	10.40	27.2
40-50 minutes	31	7	14	4.05	8.09	12.1
1hour or more	73	32	41	18.50	23.70	42.2
Amount of Screen Time per Day						
10minutes or less	21	15	6	8.67	3.47	12.1
20-30minutes	28	9	19	5.20	10.98	16.2
40-50 minutes	24	10	14	5.78	8.09	13.9
1hour or more	100	57	43	32.95	24.86	57.8

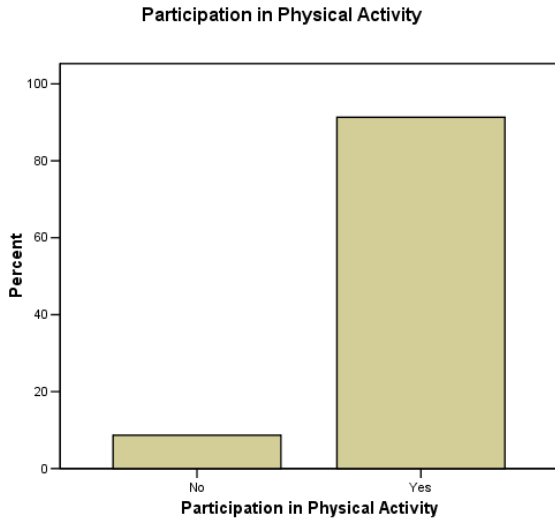
Graph4L Compared Weight status by Frequency of Home-Cooked Meals



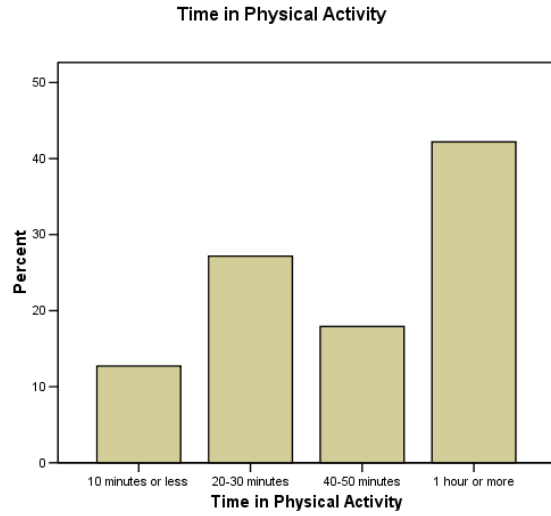
Graph4M Compared Weight status by Frequency of Eating-out



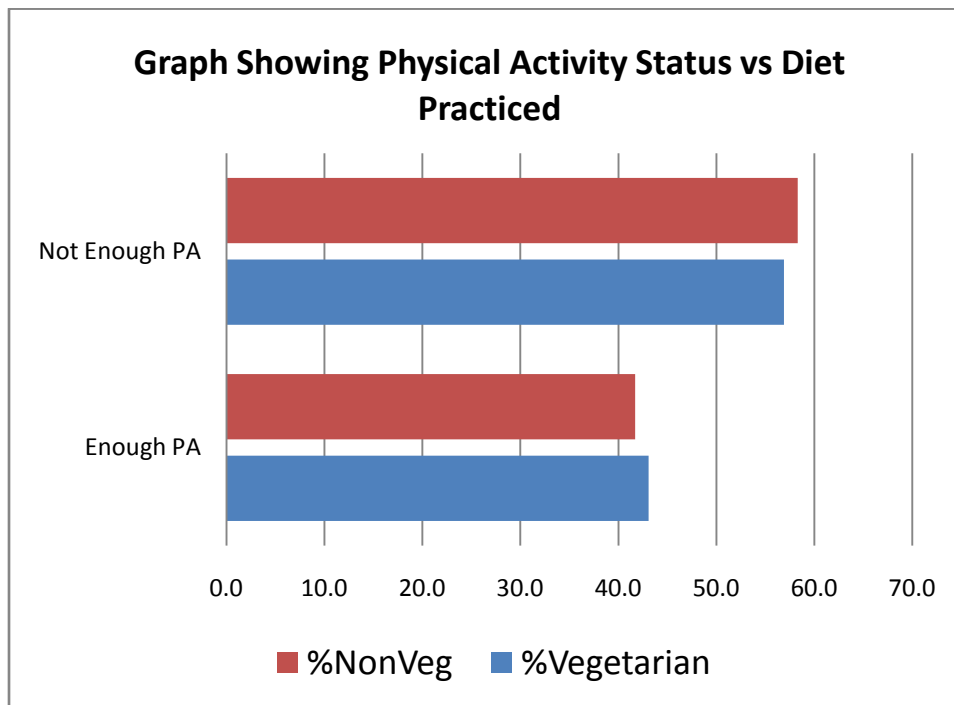
Graph4N Shows Percentage Participation in Physical Activity



Graph4O Shows Percentage of Participants vs Time in Physical Activity

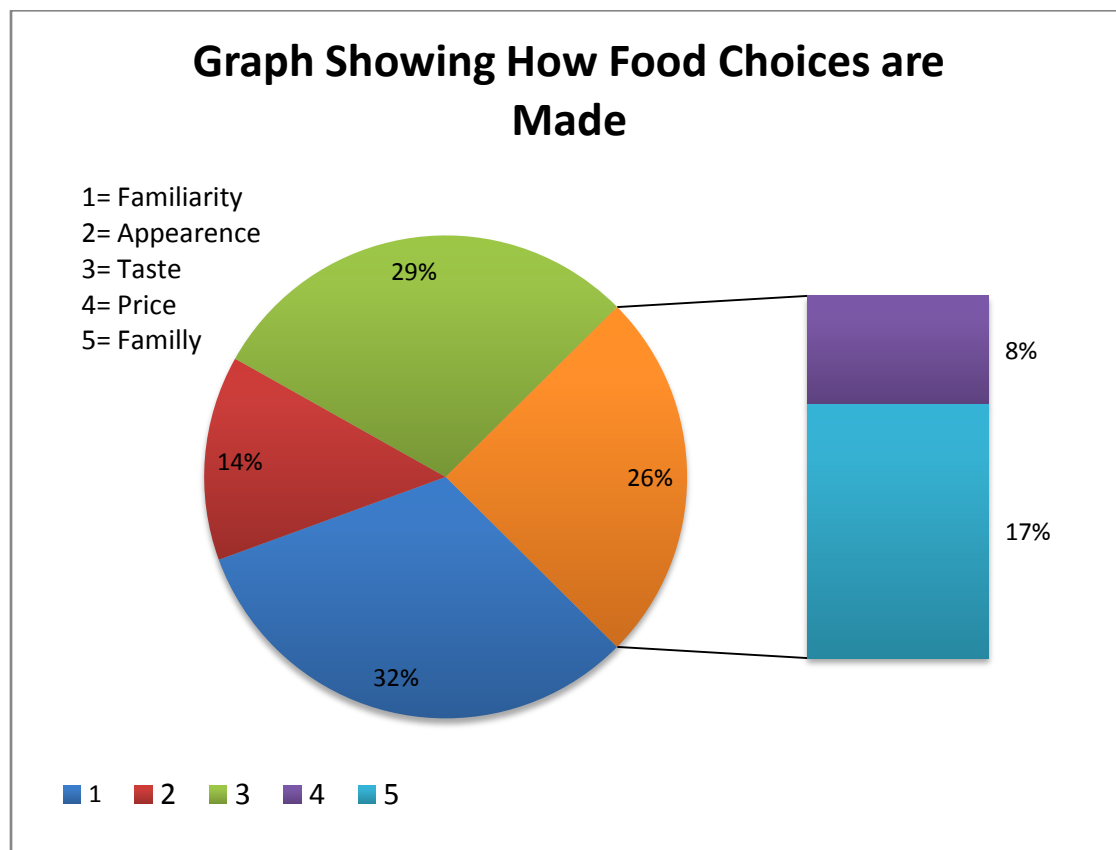


Graph4P Depicting Percentage population Physical Activity status vs diet practiced



variances produced a 2-tailed p-value of 0.992.. Graph4P clearly depicts for the non-vegetarian population, 58.3% doesn't not get enough physical activity white 41.7% does. In vegetarians, 43.1% engage in enough physical activity and 56.9% does not.

Graph4Q Showing Factors Contributing to Food Choice



The pie chart in Graph4Q expounds on the methods by which children choose the food they eat. The majority choose food by familiarity with what they eat (32%), followed closely by 29% of respondents choose food by taste. The least used method of choosing foods is by price (8%).

Chapter 5- Discussion

The prevalence of excess adiposity in Hindu Trinidadian school-aged children within the Tunapuna-Piarco Regional Corporation (30.6%) is broadly similar to the recent results of the FAO reports of 2013 and of CFNI (2011) with a prevalence of 31.2% in primary schools and 30% in secondary schools using BMI to determine weight status. The modelling employed in this study provided differing results from the case by CFNI (2011) since the survey population extended beyond stratified sampling of the Hindu belief in temples rather than the general school-aged and adolescent populations of the school education system.

Along with the use of BMI for determining weight status, anthropometric measurements of waist circumference to height ratio (WHtR) and body fat percentage were calculated to provide alternative estimates for risk of obesity in children. While the average BMI for females were higher, no significant relationship was found. The mean WHtR for both genders were found to be protective against obesity, being below 0.5 as recommended in the literature (Ashwell 2011). However, significant relationships were discovered between genders for height, waist circumference and body fat percentage when 2-tailed independent sample t-tests were run and equal variances were assumed. Boys were significantly taller; girls on average had a significantly smaller waist circumference but a higher average body fat percentage. Nevertheless, females were observed to be more underweight while the population possessed a greater total percentage of males with excess adiposity (Graph4E).

Using the CDC guidelines for body fat composition, obesity was most prevailing in the adolescent population of ages 16-18years and healthiest participants were in the age bracket of 13-15 years, though statistical significance was weak for the observation (Graph4D). At age 10 an obese child (according to CDC guidelines) was found to have approximately 40% BF, while

overweight BF% was approximately 30%, healthy was 20% and underweight was a low of 10%. Ogden (2011), in the article entitled, “Smoothed Percentage Body Fat Percentiles for U.S. Children and Adolescents” estimated that the mean levels BF% for children at the age of 13 should be 25% for males and 32% for females. The results of this study state at a mean age of approximately 13 years, boys have 30% BF while girls have mean of approximately 27% BF. The “healthy” BMI category was observed to be lowest for children aged 10 years and highest for age 18,; thus it can be inferred that younger Hindu school-aged males in Trinidad are at greater risk for childhood obesity.

In the present study, prevalence of overweight and obesity were higher among non-vegetarian when compared with vegetarians (including vegan, lacto-ovo and pescetarians) – observed in Graph4C. This was also observed in the Netherland’s Cohort Study on vegetarians and low meat-consumers, where on average, the number of vegetarians were limited in the study population (Gilsing, et al. 2013). Pearson’s correlation and chi-square values negate a strong significance between these two variables. Unlike gender, no significant correlation was observed between the diet practised by children and anthropometric measurements for Pearson’s correlations. It should be noted that significant correlations between WHtR, BF% and diet status may exist if the sample size was bigger since p-values of 0.095 and 0.067 were obtained.

Data on diet and lifestyle collected through the use of the food frequency questionnaire (FFQ) allowed for the primary analysis of consumption patterns through the use of descriptive mean percentage values. Because the number of vegetarian in this population was small, the sample size, did not efficiently allow for the dietary associations between excess adiposity among subgroups of vegetarians and to detect significant associations.

It was observed from the analysis of our data that vegetables (raw and cooked) were overall the most integral part of the general population's diet followed by the consumption of fruit, starch and dairy. Vegetarians consumed the larger amount of dairy and legumes which was consistent with research results from The Netherland's Cohort Study. Vegetarians and the sub group pescetarians were found to consume the largest amount of fruits, vegetables and starches, but the results from this study were incoherent. The cross sectional analysis of dietary and lifestyle data would show that non vegetarians would produce a higher BMI than vegetarians (Sabate and Wien 2010) and animal foods were associated with the increased risk of excess adiposity whereas plant foods were protective or show no association. Newby (2009) presented similar findings on the road of plant food diets in protecting against childhood obesity. Like the present study, most cross-sectional studies failed to adequately report a relationship with substantial evidence. More research is need with the use of an extensive, quantitative food frequency questionnaire to obtain comparable results.

The frequency of eating meat was not significantly related to the increased risk for obesity and overweight, but may have been affecting by the size of the sample that participated in the study and other demographic factors that were not considered like economical status of the family, and the parental/guardian influence on food choice. The CDC indicated that the food environment to which a child is exposed is directly related to their risk for childhood obesity. This is influenced by mentioned factors of sedentary activity, snacking patterns and exposure to unhealthy foods that are high in calories but low in protective nutrients.

Mathews et.al.2011 linked foods consumed to the risk of child and adolescent overweight statuses, in particular low nutrient-dense foods (fast food / junk food / convenient food,) with a positive significant linear relationship. In present study mean frequencies of fast and convenient

foods were greater in non-vegetarians. Also there was a positive relationship between the consumption of fast and convenient foods to the prevalence excess adiposity within the population. The analysis derive that 11% of the daily diet of total participants was contributed by low nutrient dense foods which may contribute to excess adiposity. Results generated state that the largest group of empty calories was from sugar sweetened beverages, snack food and candies.

Higher percentages of eating home-cooked meals less than once a week/never was positively correlated to the risk of excess adiposity in the Hindu Trinidadian school-ages and adolescent population. The majority of the sample reported low consumption of food that were not prepared home, however literature from the CDC (2011) states that the community food environment with respect to the availability of fast food, cost and lack of access to ready-to-eat healthful foods is a positive power influencing childhood obesity. Advance exploration on the availability of healthful foods within the community food environment is vital for the reduction in childhood obesity since confounding result on the relation between excess adiposity and the food environment was produced by this study.

Knowledge of obesity within the population is regarded in literature as an important factor in prevent the onset of its occurrence (Center for Disease Control and Prevention 2012). Approximately 70% of the population is knowledgeable about obesity but no significant association was found between the knowledge of obesity and the diet. Education of the topic was found to have no statistical significance with weight status in this population since $p\text{-value} = 0.429$. Pribis et.al. in research determined that nutritional knowledge positively affect the attitude and acceptance of a vegetarian lifestyle. They suggested that increased nutritional knowledge between the protective natures of a vegetarian lifestyle may lead to reduction of nutritional

misconceptions about healthy foods. Further research is therefore required in the field of the educational knowledge of obesity within the Hindu Trinidadian population.

For a healthy child and adolescent population, the CDC recommends at least one hour of physical activity per day. Despite the majority of the population engaging in the recommended amount of physical activity per day, the prevalence of excess adiposity in the population read high according to international standards (30%). Interestingly, for this ethnic sample, no significant differences were observed between the vegetarian and non-vegetarian populations and their physical activity levels.

The limitations of this research were extensive with the prime contributing factor being time associated with the cross-sectional design. Access to a calculated sample was unfeasible since the whereabouts and movements of these children are not known. A possibility to attain the sample would have been through the schools in the region; however a red-tape were drawn through this method because approval to conduct research was not granted within the time frame. The population, however, had a slim ethnic distribution of consumption patterns and lifestyle characteristics, which should facilitate the identification of vegetarianism and disease risk in future etiological studies.

Though a plethora of information could be obtained from the FFQ that was used in the study, the time period for data analysis prove to be a challenging criteria to meet. It was able to assess the diet of children within the past three months and provide data on diet and lifestyle. A few disadvantages exist with the non-quantified characteristic of the instrument restricting the data that could have been collected. However it provided a general idea and was able to point out differences in the population.

The data collection failed to collect enough demographic data which may further explain results described like economical status of the family/home the child comes from, the independence level of the child/adolescent in choosing, preparing or purchasing their own foods. The age group 10-18 was carefully chosen since these children are able to decide on their food intake; however the factor of the food environment was omitted from consideration.

It should be noted that nearly 5% of the children who identified themselves as vegetarians, actually reported to consume fish, meat or poultry on the FFQ. Similar findings were reported in the past, and declared the self reporting of vegetarianism as an inefficient means of estimating vegetarian prevalence. When dealing with children, other studies have shown that inconsistencies with answers are prevalent. Younger children are less able to answer technical questions such as the food frequency questionnaire involved in this study. The ability of the younger age groups to comprehend the questionnaire was taken into considered during the pre-testing of the tool; however, individual understanding of the questions would have varied from child to child, resulting in inconsistencies in results. Newby (2009) notes that dietary behaviour is complex and special attention to social and cultural norms which influence dietary choices and preferences would better equip nutrition educators in shining light on the link between nutrition and obesity. Time affected this since the ability for young children to participate in long surveys is difficult, since they easily get bored, and in the case of this FFQ, hungry.

An important methodological issue when making comparisons with existing research on the health effects of vegetarian diets and its link with excess adiposity is the lack of relevant data which exists in the population that was being studied. Trinidad and Tobago, as a nation is relatively new to the world of published research and systematic record keeping. Difficulties were extensively met in obtaining existing information on the population, thus resulting in the

use of a convenient sample. Nevertheless, the study was able to discover small amounts of data that should serve as a starting point for research on ethnic differences within the cosmopolitan population of the nation.

Chapter 6- Conclusions & Recommendations

In Trinidad and Tobago, the implications of childhood obesity have been recognised as daunting on the health of the general public in relation to sky-rocketing rates of non-communicable diseases. The vegetarian lifestyle, throughout the world has sparked debate in the eyes of nutrition and medical authorities whether protective effects exist in the prevention of obesity and by extension the prevalence of non-communicable diseases. This study investigated the prevalence of obesity in the Hindu school-aged children and adolescent population within the Tunapuna-Piarco Regional Corporation of Trinidad and determined that 30.1% of the Hindu child and adolescent population between the age of 10 and 18 years were at risk for excess adiposity in the form of overweight and obesity.

Anthropometric measurements found that of primary school Hindu children, a total of 17% were overweight and 14.2% obese and an alarming 8% and 21% of secondary school Hindu adolescents were overweight and obese respectively. Average BMI for the population of average age 13 years was 21.56 kg/m² and WHtR of 0.45. This study also determined that the vegetarian diet allowed for the observation of a reduced average BMI, BF% and WHtR for vegetarian children and adolescents, however with the small sample size, no statistical significance was obtained. No significant protective association was determined between vegetarian and non-vegetarian diets for protection against childhood obesity within the Hindu population.

Despite the lack of statistically significant detail obtain from paper, clues obtained through access to previous research was obtained for the reduction of excess adiposity. Both vegetarian and non-vegetarian Hindu school-aged children and adolescents are required to reduce their

average body fat composition through the use of high plant-based diets, reducing the intake of sugar sweetened beverages and snack foods, increase physical activity and consider the health benefits of a vegetarian diet.

Pen ultimately, the curbing the increasing rate of childhood obesity in Trinidad within the Hindu community is still vague and requires deep and extensive analysis of the population. Efforts must be directed toward determining the quality of existing diets followed by the children and by extension their families and should be recorded as part of the national database for promoting preventative health rather than curative. Filed knowledge of the frequency of types of food consumed by nationals of different ethnic background should be kept in order to develop sample meals plans for the diverse eating styles of the local population.

Finally, reducing the burden of childhood obesity and eliminating health disparities will require food policy changes both at the regional and national level, in order to ensure that healthful foods are affordable and accessible to children practicing diverse, specialized and general diets. Awareness should be promoted through the nutritional education on the risk of obesity and its prevention at all levels of education, a trend which is still in the beginning stages of planning and implementation by the Government of Trinidad and Tobago.

