



THE UNIVERSITY OF THE WEST INDIES
AT ST. AUGUSTINE, TRINIDAD AND TOBAGO

A Research Paper
Submitted in partial requirements
for HUEC 3012
of
The University of the West Indies

Title: Nutritional Status and Eating habits among Public Primary School Children
aged 9 – 13 years as well as Nutritional Knowledge and Practice of their
Parents/Guardians in Education Districts 2, 3, 4 in St. Lucia

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Year Submitted: 2014

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**NUTRITIONAL STATUS AND EATING HABITS AMONG PUBLIC PRIMARY
SCHOOL CHILDREN AGED 9-13 YEARS AS WELL AS NUTRITIONAL
KNOWLEDGE AND PRACTICE OF THEIR PARENTS/GUARDIANS IN EDUCATION
DISTRICTS 2, 3, 4 IN ST. LUCIA**

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Of

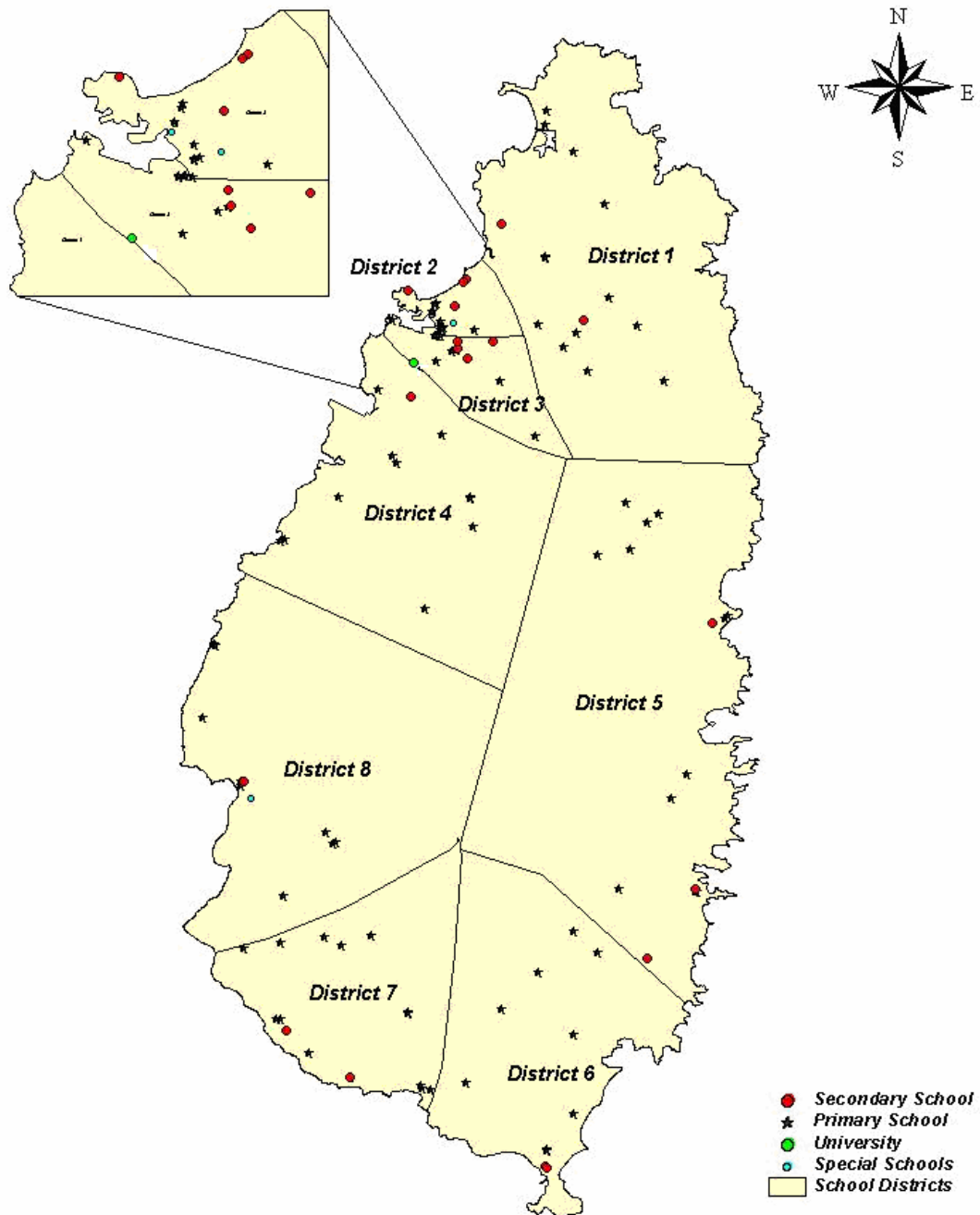
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May 2014

SCHOOLS OF ST LUCIA



ACKNOWLEDGEMENT

First, and foremost I would like to thank the almighty God for his divine direction as to the way forward and for affording me health and strength to produce and deliver everything needed to complete this project.

Foremost I would like to express my gratitude to my project supervisor Dr. Sa'eed Bawa for his continuous support during the process of my thesis, his invaluable direction and patience to accommodate me whenever there was question concerning my way forward. I would like to acknowledge his wealth of knowledge in every subject area within my degree which gave every direction towards my decisions in beginning this project. I appreciate each discussion and feedback which illuminated my way forward.

I owe my profound gratitude to Dr. Marquitta Webb, lecturer, whose direction, intangible assistance, insightful and meticulous comments, and dedication for the past three years in academic support and beyond. Dr. Webb your support with this project made it feel like I was offered a second supervisor. Getting through this thesis required more than academic support and the heart of my lecturers made the journey possible. Dr. Bawa and Dr. Webb have been unwavering in their personal and professional support during the time of this process. Sorry Dr. Webb for invading your office even during your lunch period and not turning me away for this I am truly appreciative. Heartfelt thanks to Dr. George Legall, for your dedication, long hours, patient disposition and professional expertise in the area of data analyzing and interpretation, for this I am grateful.

I would like to express gratitude to the Ministry of Education for their support in providing the necessary documentations and permission to execute this project, also the Ministry of Health St. Lucia for affording me the opportunity to further my studies and making provision for printing of all my relevant documents and the use of the research assistance during the data collection process. Thanks to family and friends for their support in the small and the great which is never gone unnoticed.

This thesis stands as a testament to the dedication of all those mentioned who support made this possible.

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ABSTRACT

Purpose of study

The aim of this research was to investigate the influence of parental nutritional knowledge on food selections by children aged of 9-13 years as well as to determine the rates of overweight and obesity among children in selected primary schools in St Lucia.

Method

Height, weights and waist measurements were obtained from 555 participants of the study. Body Mass index and percentiles established by CDC as well as the WHO growth standards charts for boys and girls 2-20 years were used to determine overweight and/or obesity. Questionnaires were administered pertaining to eating patterns and knowledge for children as well as feeding patterns and nutrition knowledge for parents.

Results

Predominate ethnicity of African descent had the highest proportion of males and females. 61.7% of females and 38.3% males in the age range 10-11 years were classified as overweight according to CDC growth charts ($\geq 95^{\text{th}}$). 60.4% and 39.6% were categorized as overweight in girls and boys, respectively ($\geq 85^{\text{th}}$). Weight to height ratio (WHtR) was highest in females in the category of over-fat 65.2% and obese 90% and males 34% and obese 10%. All participants were within cut off points of 0.5. There were positive correlations in the food selected by the Parents with those selected children $p \leq 0.05$.

Conclusion

BMI, body fat and WHtR obtained from this study indicate high prevalence of overweight among primary school children. Children showed preferences for high calorie energy dense foods and snacks even with high level of nutrition knowledge. Nutrition education and intervention programs and reevaluation of

existing school feeding program are needed to address the current data on overweight and obesity in St. Lucia.

CHAPTER 1: INTRODUCTION

Statement of the Problem

Childhood overweight and obesity has become a challenging public health problem according to the 2009 data from the World Health Organization. Nutritional disorders are common in children and one of the commonest is childhood obesity. WHO states that the whole world, including developing countries is facing a global epidemic of obesity (De Onis et al., 2010); this epidemic may be attributed to the growth in the fast food industry and the increase in frequency of families dining out. There are also transformations in cultural patterns and transitions from smaller portions to the supersized portions. These transitions in consumption patterns have led to the alteration in dietary patterns of children in developing countries and the rise in childhood overweight and obesity. Accumulating studies on overweight and obesity conducted by the world health organization have shown that the prevalence of overweight and obesity is increasing in the developing countries, which may lead to serious health problems and risk of premature illness later in life (De onis et al., 2010). The current study investigates the relationship between parent/guardians nutritional knowledge and the nutritional status, eating habits and patterns of primary school aged children in St. Lucia.

St. Lucia is an island located northeast of the island of St. Vincent, northwest of Barbados and south of Martinique in the Caribbean. The population is one hundred and sixty-six thousand five hundred and twenty-six (166,526) with a predominantly African black, mixed European descent and small indo-Caribbean population. The Island has an agricultural based sector with the traditional food habits of typically starches including dasheen, yam, breadfruit, plantain and green bananas, animal based products, such as imported meats and poultry, meats and poultry from farm rear animals and locally grown fruits and vegetables

Education is an important human resource development and is governed by the education act which stipulates education is compulsory for all students. The St. Lucia public education system is made of early childhood, public primary, private primary and secondary, public secondary, special education and post-secondary and tertiary education. Public education is compulsory for all children between five (5) to eleven (11) years. The primary school system in St. Lucia comprises of lower primary and upper primary consisting of grades one through to six, with a classroom setting of a thirty-five students maximum. The curriculum comprises of academic, co-curricular and physical education activities. Formal physical education activities are part of the school curriculum and are on designated days of the week for each grade.

School feeding programs are part of the ministry's mandate and at present the ministry of education in collaboration with the student support services provides assistant to students through the school feeding programs stationed at seventy (70) of the respective seventy-five (75) primary schools. Percentages of children benefitting from the school feeding program in the studied education district are as follows: district 2: 18%, District 3: 26% and district 4: 60 % (Statistical Digest 2012). Some schools have opted for the canteen service managed by a private proprietor who offer a selection of high calorie packaged snacks, fast foods and the assortment of sweetened beverages.

Traditionally, parents would provide their children with packed lunches of home prepared sandwiches and meals, consequently, it has become a norm or culturally acceptable that some parents have the choice to continue to provide prepared home lunches or contribute funds to students for the purchasing of snacking item from street side vendors. This change has resulted in the decrease in students accessing the feeding programs or certain schools opting for canteen service.

This shift from home prepared foods has contributed to the prevalence of overweight in children (Taverus et al., 2005). Sealy and Farmer (2011) made reference to the theoretical model by Birch et al. (2009), which stated that the problem of poor eating habits in children is attributed to what they are given

to eat by parents. These food selections set the course for long term eating patterns with either good or low nutritional value foods. Several assumptions can be deduced from the current research literature that unhealthy eating habits and patterns are the beginning of overweight and obesity in children.

Gardner et al. (2010) conducted a study on the prevalence of overweight, obesity and underweight among 5 years old in St. Lucia by three methods of classification and a comparison with historical rates. Overweight and obesity rates were reported as high in the subsample of preschoolers with 15.3% which is three times higher than 1976 rate of 4.3%. Another study done by Zhang et al. (2013), supports the premise that more than half of the overweight children aged two to twenty years become overweight before the age of two.

Studies have shown that the progression of childhood overweight and obesity are major predictors of the onset of adult obesity and the increase in the prevalence of chronic non-communicable diseases. Current literature indicates that a high percentage of children are presenting with BMI past the cut off points and are falling into the categories of overweight and obese. This increase in body weight is alarming as this drastic change is occurring in the most critical period of their growth and development. The epidemic is said to mirror the adult pattern of obesity as that of the developed countries (Gaskin et al., 2007). The assessment of body compositions is a reliable indicator of the onset of overweight and obesity. Some of the parameters used to assess to children includes anthropometric measurements of height and weight; which is used to calculate BMI; Bioelectrical Impedance Analyzer and waist measurements. BMI is plotted against an age-for-sex specific chart according to percentiles. BMI is the best and widely used surrogate measurement of adiposity among indexes derived from height and weight measurements. BMI in children is correlated with direct measures of adiposity, blood pressure and serum concentration of lipids and insulin (Whitaker et al., 1997).

The National Health and Nutrition Survey (NHANES) defines overweight as a BMI at or above 95th percentile for age and for risk of overweight as above 85th percentile but lower than the 95th

percentile. The scores of BMI changes with age and maps out the development of a child and gives an indication of changes in increased dietary intake. The developed and developing countries have experienced a nutrition transition and an increase in incidence of overweight and obesity which have caused a drastic shift in eating habits, this has triggered the change in human biology and thus body composition (Popkin et al., 2011). The increase in the body mass index of children above the recommended percentile are associated with many implications includes Type 2 Diabetes, Hypertension, Heart disease, hyperlipidemia and Atherosclerosis.

Although BMI has been widely used as a measure to estimate body composition in children, it cannot be used to estimate the distribution of body fat, but used as surrogate measurement of adiposity, therefore the use of waist measurement is used to predict the centralized or upper body fat in children, which has been recognized in adults and a better predictor of cardiovascular disease than BMI (Li et al 2006). Central fat or visceral fat is associated with a greater prevalence of metabolic disease. Waist measurement is a useful measure of intra-abdominal fat and has been included as part of the assessment of body composition in children. Since the height and waist circumference of child increases with age the value of 0.50 is used as a cut-off point for all ages (Khoury et al., 2013).

Nutritional status determines body composition therefore these variables presented needed to be studied as to ascertain the preventive measure control the progression of obesity. Eating Patterns becomes habits and habits become established behaviors throughout the individual's life cycle.

Purpose of the Study

The purpose of this study was twofold:

- To examine the influence of parental nutrition knowledge on developing of their children's eating habits;
- To evaluate the rate of childhood overweight and obesity in St. Lucian children and the health implications involved.

Objectives

The objectives of this study were to:

- Determine the children's eating habits and the associated influences of parental nutritional choices;
- Evaluate the influence of children's and parents' knowledge level on selection of healthy foods;
- Assess the present nutritional status and the nutritional implications of the present eating habits and practices.
- Evaluate how the choices and knowledge of parents/guardians may be a major contributor to overweight and obesity.

Hypotheses

- Children eating patterns are developed by parent level of nutrition knowledge and their selections of food items.
- Alternative hypothesis: Children eating patterns are not developed by parent level of nutrition knowledge and their selections of food items.
- The present eating patterns of primary school children aged 9-13 are associated with overweight and obesity.
- Alternative hypothesis: The present eating patterns of primary school children aged 9-13 are not associated with overweight and obesity.

Research questions:

- Is the consumption of a high fat high calorie diet by children of primary school aged 9-13 years related to the knowledge level of their parents/guardians in St. Luca?
- Is the increase in body weight and waist circumference associated with the present eating habit of children of primary school 9-13 years in St. Lucia?
- Is there a risk of overweight and obesity in the primary school children in St. Lucia?

Significance of the Study

Obesity is a progressive debilitating condition and the incidence in older children and adolescent are increasing. The Caribbean region like the more developed countries is experiencing this epidemic but due to the limited availability of data on the definite figures and associated factors of childhood obesity the implementation of adequate intervention programs are compromised. The goal of this research was to provide information on the prevalence of overweight and obesity school aged children in St. Lucia and offer insights as to the contributing factors to the associated risk. The research was timely as there is no current data available on the prevalence and associated causes of overweight and obesity in St. Lucia in primary school aged children. The research finding will illustrate the need for implementing intervention program necessary to decrease the incidence of this health risk in the Caribbean and by extension St. Lucia. With data from one study done in preschool children on the prevalence of overweight, obesity and underweight among five year olds suggests that follow up studies are needed to display the progression of overweight and obesity. It is essential, therefore, that other studies should be conducted to estimate other parameters and highlight the effects of unhealthy eating patterns of preadolescents. A highlight of the other studies done in the Caribbean region and the parameters assessed identified with the exclusion of St. Lucia with no present research data available.

The prevalence of Childhood obesity has been studied in the Caribbean (Bonaire islands) by Schwiebbe et al. (2011). Francis et al. (2010) conducted an intervention study on dietary intake and physical activity among primary school children in Trinidad and Tobago, another study done by Gaskin et al (2007) in Barbados on the misconceptions, inactivity and maternal factors may drive obesity among Barbadian adolescent. Jackson et al. (2001) conducted a similar study in Jamaica on nutritional status on 11-12 year old Jamaican children the coexistence of under and over nutrition. Data on the rates of overweight and possible obesity in primary school children in the range of adolescent which have been noted by many studies as this is the age with a greater risk of developing adult onset nutrition related conditions and complications. This research also apporitions possible causes as to the changes in eating habits from the obesigenic environment by the child-parent pairing approach of the survey design.

Although the study by Gardner et al. (2010) have drawn a parallel between the adiposity in preschooler to adolescent, preceding studies which will acknowledge that the extraneous factors such as parental influences, social cognition and recent anthropometric measure in childhood adiposity are possible causes or trends in the obesity epidemic will present an accurate reason to the progression of obesity. This research is the most recent done on this sample population in St. Lucia. The finding of this research will be beneficial to St. Lucia with the implementing of a national food and nutrition policy, standards and protocol in the school feeding programs and school policies to control the sales of processed foods sold in schools.

CHAPTER 2: LITERATURE REVIEW

The World Health Organization defines overweight and obesity as abnormal or excessive fat accumulation that impairs health status of individuals. The preferences for foods high in fat and sugars during the early years of life could be the major contributors to overweight and obesity (Gracia et al., 2012). Cooke (2007), referred to literature by Domel et al. (1996) and pointed out that children's food preferences are strongly associated with their eating patterns. Gracia et al. (2012) also referred to a study done to evaluate the food preferences among children determined that the selections on foods were high in energy, rich in fats and sugars and portion of snacks and meats were bigger than their selection of vegetables (Cooke, 2007)

Cullen et al. (2001) identified the problem of the decrease in the prescribed levels of vegetables and fruits consumption with the risk of the development of chronic disease in the future. Cooke and Wadle (2005) pointed out that the foods children like are rarely of high nutritional value which was presented by evidence of a study done in 4-16 year old where fatty and sugary foods were rated the highest and vegetables the lowest with little age or gender differences.

Presently, WHO has declared that 170 million children under the age of 18 are diagnosed with being overweight ranging from the homes of upper income to lower income families (WHO, 2012). This shift from underweight to overweight is attributed to the nutritional transition into the twentieth century and conversely the energy imbalances between calories consumed and calories expended. Calories

obtained from the increase intake of energy dense foods, those high in fat, nutritionally deficit foods, over consumption of sugar sweetened beverages, and the imbalance of calories expended, the increase in sedentary lifestyles, and physical inactivity. The consequences are notable with the rise in body mass index which is a contributing factor to chronic non communicable disease in younger persons. Obesity is a multi-factorial chronic condition and the most common nutritional disorder in the world (Dehghan et al., 2005).

Recently, the Caribbean region appears to have a steady increase in the BMI of young children and preadolescents. It has been stated that the social, economic and demographic transformations that have occurred in the Caribbean region and the epidemiological transition have been accompanied by changes in dietary patterns and the composition of the diet (Jackson et al. 2001). These projections in the pattern of obesity in the Caribbean should be understood as the responses to the nuances in food intake and activity behaviors will be vital.

Additionally, a study conducted in Barbados on the prevalence of overweight and obesity among adolescents with a sample population of 400 identified 15% boys and 17% girls overweight and 7% boys and 12 % girls obese. Sex of participants was found to have no significant difference in the prevalence of overweight (Gaskin et al., 2007). Gaskin et al. (2007) clarified the point that overweight and obesity is a process that if not detected early it can progress throughout the crucial period of adolescent and become dominant health concern in adulthood.

Jackson et al. (2001) conducted a study in Jamaica and established a connection in the prevalence of overweight in 11-12 year olds with BMI $\geq 85^{\text{th}}$ percentile to be associated with their nutritional status. Further investigation of the results indicates that 11.7% of girls and 8.4% of boys were overweight and a comparable proportion of 9% were obese ($>95^{\text{th}}$ percentile). References were made concerning 19.3% of the sample population who were said to be approaching prevalence rates as those found in the United States (Jackson et al., 2001).

Francis et al. (2007) identified similar trends in the percentile on the reported sample size of approximately 579, where 23% was seen as having a BMI $\geq$ 85th percentile. The leading associated factors were dietary intake and physical activity level among the primary school children. Findings also stated that there was a lower multivariate equation for intervention associated with lower intake level of fried foods, snacks high in fat, sugar, salt and sodas.

In this regard body mass index is one of the most widely used parameter in the assessment of body composition in children. It is used as a surrogate for the measurement of body composition, therefore the combination of other measurements namely, waist circumference and waist height ratio are used. Waist circumference measures the intra-abdominal adiposity; which is made of subcutaneous and visceral fat; and is an important predictor of health complication in both adults and children. Waist circumference is said to be a better indicator of visceral fat than BMI in children (Li et al., 2006). Waist circumference is the most accurate anthropometrical indicator of abdominal fat and is closely correlated to waist hip ratio and waist height ratio. Mokha et al. (2010), confirm that waist height ratio is an easy measurable anthropometric index for the detection of central obesity and to assess the association of cardio-metabolic risk and central intra-abdominal obesity.

As to establish a correlation into effects of overweight and obesity it is hypothesized that other qualitative factors namely parental, environmental, social cognitions and genetics needs to be evaluated and cannot be done independently. Food consumption patterns are complex and the evaluation of one of these factors mentioned does not take into account the multi-dimensional nature of consumption patterns. Environments that promote obesity are termed as obesigenic environments. These environments offer stimulus for the cause and effects relationship which exist and are seen as the root of this epidemic. Obesigenic environment extend access to large quantities of affordable, highly palatable energy dense foods and encourage overconsumption of these foods. In essence obesigenic environments are described as family units, food related and exercise related household practices such as home food supplies, mealtime practices and parental modeling of eating and fitness behaviors.

In fact, interactions in this environment are particularly between parents. However, mother and child bonding are seen during food related activities which encourage the development of eating habits during childhood. Because of this authority that the parents possess it leads to these persisting eating patterns and serves as the basis for these adult dietary behaviors.

On the other hand a habit is defined as an acquired behavior pattern regularly followed until it has become almost involuntary. Habits are formed early in life and is said to be one of the major determinant of food choices later. A Childs' eating habit is mostly shaped by parental influence and socialization and thus remains established throughout. Nevertheless due to the level of parental interaction and the formation of food consumption patterns, the influences in the home environment is constituted to have on noticeable effects on eating habits. In this respect of behavioral interaction and the learnt behaviors of eating habits the theory of social cognitive is adapted. Social cognitive deals with behaviors learnt from observation and interaction in their environment and behavioral responses to the environment. This theory provides a suitable framework which studies the home environment in the context of reciprocal determinism (Bredbenner et al., 2010).

Theoretical Framework

Social cognitive approach

The social learning theory postulated by Albert Bandura analyzes individual behavior on the basis of this concept of reciprocal determinism. According to the Merriam Webster dictionary, determinism is used to signify the production of effects caused by events that happen before them, rather than the events determined by the individual who is seen to have limited ability to make choices or control them.

Reciprocal determinism is a view of a person's environmental interaction in which the environment and one's behavior and internal personal factors influence each another, it also indicates that behavior results from the interaction of persons and situation rather than from either factor alone (Myers

2010). Bandura proposed as part of his social cognitive perspective on personality that a person's behavior, environment and thinking are inextricably connected. Alternatively McGowan et al. (2013), drew a parallel between habits are behaviors that are repetitive and become automatic and are enacted without conscious attention (Mc Gowan et al., 2013).

Albert Bandura stated from his finding of social cognitive theory in relation to reciprocal determinism that his conceptual view is that person and environmental factors do not function independently but as determinants, thus they determine each other. It is also noted that behavior and environmental conditions function as reciprocally interacting determinants. Bandura (1978) contended that only the mind creates, when reality fails to acknowledge the other determinants in the environment that partly influences what people attend to perceive or think. It is therefore presupposed that individuals' decisions on choices of food consumed and eating behavioral pattern developed by virtue of prior influences.

This theory is used as a model of change and to creating intervention programs targeted towards behavior therefore social cognitive theory has emerged as the dominant model for understanding and modifying health habits.

Bandura's Triadic Reciprocal Determinism

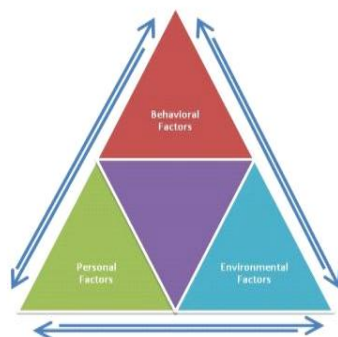


Figure1. Reciprocal Determinism by Redmond et al. (2014)

<https://wikispaces.psu.edu/display/PSYCH484/7.+Self-Efficacy+and+Social+Cognitive+Theories>

Reciprocal determinism also postulates that behavior including dietary behavior is as a result of environmental and personal factors and in turn effects of these factors are in constant reciprocal relationships (Cullen et al., 2001).

The theory further substantiate that behavior is as a result of the simultaneous interactions of a person's characteristics, behavior and the environment within which the behavior is performed, and that the individual have the ability to transform and create environments with the characteristic they desire (Bredbenner et al., 2010). Conversely the relationship between parent preferences and the child eating habits is examined using the rational choice theory which states the idea that individuals have preferences and choose according to those (Benson and Mokhtari, 2011). This theoretical framework cannot be excluded as it observes behavior which is parallel or a major determinant to parental selections, choices and children eating habits.

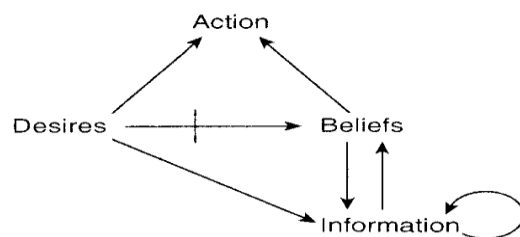


Figure 1.

Elster and Jon (2009): "interpretation of Rational Choice." *Occasions: Interdisciplinary Studies in Humanities* 1(1); DOI:10.1077/1043463108099347

Subsequently, habits can be seen as determinants of the environments in which they dominate as a result the socialization of children into and environment creates many feeding behaviors as these behaviors are replicated during the bonding period between parents and children.

Parental approach

Specifically, parents are seen as role models and gatekeepers (Mc Gowan et al., 2013) whose influence are dominant in the food and exercise behaviors of their children, consequently children imitate parents and the extent to which the parents eating healthy and exercise are enforced will predict the behavior of the child independent of what the child is allowed to do (Andrews et al., 2010). Eating habits or patterns have been the major indicator of the nutritional status of a child from the beginning of complimentary feeding to the more established eating habits in adolescence and adulthood. Habits are formed early in life and reinforces the decisions of food choices and dietary patterns later in life. Furthermore global changes lead to nutritional transitions and an increased rate of overweight and obesity which are observed in the developing countries with its many accompanying consequences. WHO has termed this a worldwide public health challenge of the 21st century. This nutritional transition is superimposed with and increase consumption of fats, sweeteners of unhealthy snacks, fast foods and soft drinks compared to traditional diets characterized by higher intake of high fiber cereals (WHO, 2012). Gracia et al. (2012) extrapolate from other studies that children from families with overweight and obesity problems prefer foods high in fat, seldom select vegetables and encourage a sedentary lifestyle. These high fat selections are commonly seen when dining out, which is defined as eating food outside the home where fast foods are most like to be fried and a source of saturated fats (Taverus et al., 2005).

San Juan (2006) intervene and promulgate that the revolution of children's lifestyle and dietary habits can be largely attributed to the changes in family and social environment, the family education level and socio economic. He validates his reasons with studies which have supported that the mother's education level is a predictor of type and quality of the child's diet, also it has be found that children of educated families tend to consume balanced meals and healthier food choices. McGowan et al. (2013)

displayed indifference to San Juan (2006) when it was noted that with reference to knowledge based intervention studies where parents are given nutrition information and taught nutrition practices which presumed to translate into better feeding practices are not consistent with education given, however knowledge based interventions are inadequate in the area of behavior and have limitation in feeding practices (McGowan et al., 2013).

The home environment is managed by parents; predominately the mother; and is the ideal environment where availability and accessibility determines the consumption of significant amounts of calories and nutrients, thus the choices and preferences of foods such as fruits and vegetables are positively associated with availability at home. Cullen et al. (2001), substantiated this view with the finding of his research which established a statistically significant positive correlation on the consumption of fruits and vegetables with the availability at home.

Scaglioni et al. (2008) also expressed the view of parents providing the environments for their children's early food and eating experiences, which includes the parent own eating habits and behaviors, this fosters the development of the child eating practices and eating behaviors (Scaglioni et al., 2008). Vereecken et al. (2010) introduced a qualitative approach to the causes of eating patterns with his finding from focus groups conducted. A summary of the findings from this approach suggests that food rules and previous food rules continues to exert influence on eating choices through to adolescence. In Vereecken review of the literature he reported on a study done by Van de Horst et al which identified that stricter parenting practices on food choices were associated with less soft drink consumption in adolescents. On the other hand review of other studies revealed that the consumption of high fat and sweet or sweetened foods were common among adolescents who were more permissive in their families at the age of ten (Vereecken et al., 2010).

Boutelle (2006) gave cognizance to the reality that the family is the primary contributor to the development of obesity as parents have a greater influence to their children's eating and physical activity, purchasing of different foods, family meal frequency and food socialization practices.

To this end, the role of the parent is paramount in the development of the child's food preferences and energy intake. It can therefore be hypothesized that a child's eating behavior gives direction as to their pattern of growth and development. This role affects the nutritional status and eating habits of a child and is a gauge to the outcome of the child health status. Parents can create an environment for healthy eating behaviors and weight maintenance, or an environment that may promote the overweight or disordered eating. Therefore the evaluation of the knowledge and practices of parents may offer some insight as to the development of the many adult onset chronic diseases seen in childhood. Parents may feel it is against nature to deny their child something as fundamentally nurturing as food, thus offering the child a less nutritious food choice.

In summary, food has become more than a biological necessity but an emotional expression of love insecurity and control (Snoek et al., 2007), thus the justification of the family based intervention; which emphasizes reasonable and coordinated goals for both parent and child; can be a logical approach for prevention and treatment options in childhood obesity.

Dietary intake approach

The composition of a child's diet is a determinant of the nutritional and health status, therefore energy and nutrient intakes are important according to dietary recommendation for age. In addition children's preferences are strongly related to their choices of foods and consumption patterns. This statement affirms the notion that children like what they know and eat what they are familiar with. Studies recognized that the earlier and broader the experience the healthier the child's diet (Cooke. 2007). In reiteration of the nutritional transition statement, the shift from the home prepared meals might have a positive association with obesity as the consumption of the meal choice is common source of saturated fat

(Taverus et al., 2005). Brown and Ogden (2004) drew a parallel between two studies one in the United States and the other in the United Kingdom which produces similar results of the high consumption of total fats, saturated fats and cholesterol in 10-11 year old and scrutinized the diet of the western world.

Equally important is the effects of dietary fiber on chronic disease in adults which is well documented but the gaps still exist on the relationship between fiber and childhood health. Nevertheless functional fibers when added to food have shown to have a health benefit despite this, foods based on their high fiber content are not well accepted by children. Fiber is defined as non-digestible carbohydrates and lignin that are intrinsic and intact with plants including the plant non-starch polysaccharides. One potentially rich source of dietary fibers is whole grain products and whole grain intakes which have been shown to have a positive link to health outcomes. NHANES analysis of children showed the reduced risk of overweight and obesity associated with whole grain intake driven by the dietary fiber content of the grains. High level of body fatness was associated with low levels of dietary fibers in other studies in children. Of relevance here is the research of fruit and vegetable consumption in children by Mathias et al. (2011), who indicated that despite the present initiative of 5 a day of fruits and vegetables have seen the manifestation of low intakes of both fruits and vegetables. He then postulates the inclusion of fruits and vegetables as part of the main meal to increase intake. This intervention study is aligned with the correlation establish by Ledoux et al. (2011) on the protective effect of fruits and vegetable consumption on adiposity by displacing energy dense foods.

Obesity is associated with type 2 diabetes and the dietary inclusion of dietary fiber may have a preventive effect and may also attenuate the symptoms of type 2 diabetes (Kranz et al., 2012). With mutual relevance is the consumption of sugar sweetened beverages. Consumption of sweetened beverages is the leading source of added sugar in the diet of a wide range of racial and ethnic groups, and the increase in consumption is at tandem with the prevalence of obesity in the developed countries. Data provided by a previous study reveals that adolescents consume more than 300 calories per day from these products which contributes to 15% of their daily energy intake. An intervention study of displacing sugar

sweetened beverages in the home with non-caloric beverages was used as a strategy to decrease consumption, a significant change was reported ($p=0.045$) in BMI (Ebbeling et al., 2012). Moreover, Bennett et al. (2009) clarified the point that obesity is attributed to the overconsumption of energy dense, nutrient poor foods and sweetened beverages.

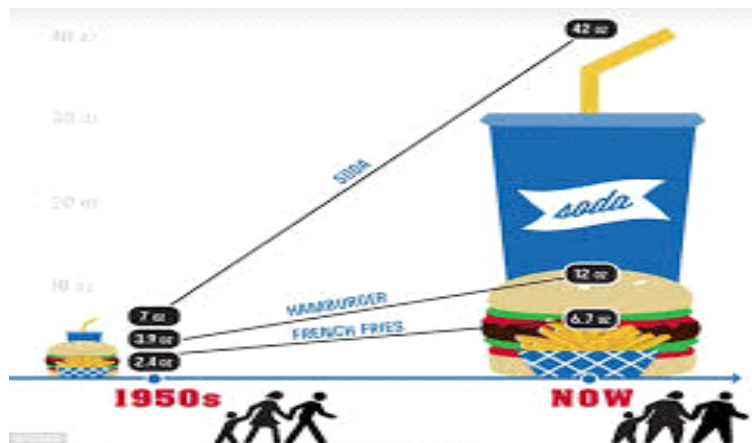


Figure 2. Showing then and now family size fast food portions (2012).
 “Science/Technology/Health”.<http://allthingscensored.blogspot.com/2012/05/portion-sizes-then-and-now.html>

Genetic approach

Finally, food preferences are developed from genetically determined predispositions to like sweet and salty flavors and dislikes of sour and bitter taste. Recognition of this phenomenon raises the possibility that from birth genetically predispositions are modified by experience. Therefore, an individual eating pattern and habits is influenced by their knowledge of an attitude towards this behavior (Scaglioni et al., 2008). These authors elaborated further and revealed that BMI and growth is influenced by genes, diet composition and by parental control and feeding practices, also the innate mechanisms that regulate appetite can be modified by experience. In later studies, Scaglioni et al. (2011) emphasized the plausibility of genetic when he revealed data from a twin study which establishes that a coefficient for

heritability of food types with the influences of genes on food preferences strong for protein foods, moderate for fruits and vegetables.

Silventoinen et al. (2009) displayed in difference with the statement that heritability of BMI and waist circumference is significantly modified by physical activity. He elaborated further and pointed that genetics and environmental factors such as physical activity and dietary lifestyles do not act independently but influence each other. Mustelin et al. (2009) also attested to the fact that a high level of physical activity decreases the additive gene component of BMI and waist circumference.

Svensson et al. (2010) gave cognizance to Whitaker (1996) and Temple (2006) who indicated that obesity “run” in families and suggests that the home environment supports the expression of this genetic potential. Svensson et al. (2010) further conceptualized that children with two obese parents are at high risk of obesity than those with one or no obese parents. Study noted that early onset of obesity is associated with hypothalamic obesity or high genetic obesity vulnerability, thus it is justified that eating behaviors of children and adolescents are shaped by parenting eating behaviors (Boutelle et al., 2006).

Additionally, Papoutsakis and Dedousis (2007) clarified the point that gene play a decisive role in the etiology of childhood obesity under the permissive circumstances of the obesigenic environment and offered to explain the cause as the increase in energy intake and decrease in physical activity.

Therefore dietary habits formed in childhood are likely to persist into adulthood, hence, unhealthy diets in childhood has implications for health throughout the life course (Clarke et al., 2007)



Figure 3. Gene-Diet Interaction in Obesity

Thomas and Susan (2013). "UCLA Researchers Show Link between Diet, Genetics and Obesity." *Science Tech Daily*. <http://scitechdaily.com/ucla-researchers-show-link-between-diet-genetics-and-obesity/ttp/>:

The importance of proper nutrition during childhood has been is overemphasized as the likelihood of one of the most common disorder of obesity in childhood is realized. Children choose foods high in fat, sodium and sugar as they are familiar and are sustained by the one determinant of their intake and food selection. Parents guide and direct the selection of meals and provide choices to the child taste and preferences, and may counteract the balance for healthier and more nourishing choices. As a result of this observed pattern of feeding the issues are examined and emphasized, therefore the involvement of nutritional intake and obesity is multi-causal and multifactorial and substantiates the need for many perspectives into this epidemic. Despite the abundance of data on the prevalence of obesity and the possible causes or even the outcomes, still there is much complacency as to the urgency of the epidemic. The epidemic has been recognized as not being restricted to the developed countries and warrants much research in the developing countries. The Caribbean region necessitates current data as to ascertain the direction to prevention and decreasing the occurrence of overweight and obesity in childhood.

CHAPTER 3: METHODOLOGY

Subjects

Participants were of primary school aged 9-13 years of African, indo-Caribbean and mixed descent, enrolled in grades 5 and 6. All schools were selected using random sampling from the Ministry of Education statistical database on public primary schools students enrolled in grades five and six in education districts two, three and four.

This cross sectional study was reviewed and approved by the St. Lucia Medical and Dental Association ethical committee and permission was given by the Ministry of Education and Health. All participants included in this research were provided written informed consent.

Study Design

Participants were randomly selected using statistical data provided by the Ministry of Education St. Lucia of grade 5 and 6 from three of the eight education district within the seventy-five primary schools on the island. Within each of the selected district a subset of 11 schools were chosen to represent both urban and rural area. The samples were drawn using Multi-stage stratified random sampling techniques. Stratification was based on the division of urban and rural areas within the three education districts. Four resident schools within each district (cluster) were randomly selected with a sample size of thirty-six to forty students per school. The selection process was done randomly with the assistance of school teachers and principals. Selection was done based on school register in some schools and computerized random selection in other schools. Sampling was first performed in the cluster approach among the primary schools of three (3) education districts in which the geographical location and socioeconomic status are consistent. Secondly, students were selected based on the enrollment in fifth and sixth grade. One class each from the respective grades was selected and where a school had only one of each grade, every student was given an opportunity to participate. One hundred of the sample population of 480 was parent-child pairs.

The study was on nutritional habits, eating patterns of children and parent nutritional knowledge on the population of 9 to 13 years old (n=380) and parents 30 to 50 years old (n=175). The theoretical sample size was set at 840. The present study included 555 participants ages 9-13 and parents 30-50 .

Data Collection

Participants who returned written consent forms were allowed to complete a questionnaire of seventeen (17) questions on eating habits and dietary intake, each question was explained and students were instructed on omission of name to maintain confidentiality. Questionnaires were structured to obtain food preferences and nutrition knowledge where photographs of foods were included in the questionnaire. Parent questionnaire consisted of thirty (30) closed ended questions which included knowledge of nutritional foods, attitude on foods and preferences of child in categories of sweetened drinks, fruit juices, local fruits and vegetables packaged snacks and fried foods.

Demonstrations were done as to the usage and proper positioning on the Bioelectrical Impedance Analyzer and Stadiometer. Body height was measured to the nearest cm without shoes or hair ornaments using a portable stadiometer where participants were measured standing barefoot, in light clothing, body weight was assessed using a Bioelectrical Impedance Analyzer machine which provided body mass index (BMI) and percentage (%) of body fat, Waist circumference was measured midway between the lower rib and the iliac crest using a non-stretchable (Myotape) measuring tape. Participants were categorized into percentiles using WHO BMI for age growth charts where BMI for age was plotted and body fat was categorized according to TANITA body fat reference curves chart for children 7-18 years. Participants were instructed via school principals prior to data collection on the criteria for using the BIA machine which included fasting for 2 hours and exclusion if participant had a pacemaker.

Data Analysis

Description statistics were presented as the mean and standard deviation of demographics. To test the associations between BMI, body fat and waist height ratio, frequencies were done using chi-square test. Fisher exact test was used to obtain p-value and the association between variables of parental and child food preferences. Linear regression was used to analyze the relationship between the age, gender, consumption patterns of the participants with BMI. Binary logistic regression analysis was performed to show the correlation of parental demographics and dependent variable of eating habit. Parents and children knowledge question scores were compared using paired sample t-test. All tests were considered statistically significant at p-value less than 0.05. Data was analyzed using Statistical Procedures for Social Sciences (SPSS Inc. Chicago Illinois USA), version 12.0; software.

CHAPTER 4: RESULTS

A sample of 420 students was selected to participate in the study; and of these 379 responded giving a response rate of 90.2%. Table 1 gives the frequency distribution of selected demographic variables. As seen respondents were predominately females; mainly of African black descent (n=290; 76.5%), and mostly aged 10-11 years (n=313; 82.6%).

Table 1a: Demographic and characteristic of Respondents.

Variables	N	%	p-value
Sex:			0.864
Male	161	42.5	
Female	218	57.5	
Ethnicity:			0.722
African/Black	290	76.5	
East Indian	6	1.6	
Mixed	82	21.6	
Other	1	0.3	
Age (yrs)			0.757
9	12	3.2	
10	150	39.6	
11	163	43	
12	49	12.9	
13	5	1.3	

Of 298 questionnaires distributed to the parents/guardians/wards of students in the sample only 94 (31.5%) were returned. The frequency distribution of selected parent/guardian/ward-related demographic variables is given in Table 1 b. The table shows that more than half of the parents/guardians/wards were between 28 and 38 years of age, 32% had a tertiary education, and 69.0% had an annual income of less than US\$10,000.

Table 1b: Demographics of Participating Parents

Variable	n	%	Mean $\pm$ SD
Age			38.97(7.09)
28 -38	48	55.4	
39 -49	37	31.1	
50 and above	9	9.6	
Education Level			2.59(1.188)
Primary	19	19.6	
Secondary	36	37.1	
Technical	10	10.3	
Tertiary	31	32.0	
Income Level/yr			1.92(1.594)
9,999 or less	60	69.0	
10,000 - 18,999	6	6.9	
19,000 - 29,999	5	5.7	
30,000 - 39,999	5	5.7	
40,000 - 49,999	6	6.9	
50,000 and above	5	5.7	

Table 2 gives the mean and standard deviation of age (in years) height in cm, and weight in kilograms of children. The age difference between boy and girls was not statistically significant. However, there were statistically significant differences between them with respect to height ($p \leq 0.001$); girls being taller and heavier than boys ($p = 0.002$).

Table 2: Mean of Selected Means (Std dev)

		Boys (n= 161)	Girls (n= 218)	p-value
Age (yrs)	mean $\pm$ SD	10.81 (± 0.831)	10.61 (± 0.737)	0.757
Height	mean $\pm$ SD	147.344 (± 8.99)	150.492 (± 8.99)	≤ 0.001
Weight	mean $\pm$ SD	40.082 (± 9.97)	43.692 (± 12.72)	0.002

Food preferences of 94 parent-children were examined and tested for association between preferences of parent and child. Results are shown in Table 3. As indicated in Table 3 the food consumption patterns/preferences of children were similar to those of their parents except for juice drinks ($p = 0,875$), sugary foods ($p = 0.497$), fatty foods ($p = 0.99$), water ($p = 0.99$), salty foods ($p = 0.62$) and whole wheat bread ($p = 0,764$).

Table 3: Comparison of Child Preferences and Parent perception about their Children Preferences

Food Item	Percentage preferring		p- value
	Parent	Child	
100% Juice	90	62.0	≤ 0.001
Juice Drink	64	66	0.875
Milk	72	93	≤ 0.001
Yogurt	82	49	≤ 0.001
Soft Drinks	56	91	≤ 0.001
Local Fruits	86	66	≤ 0.001
Local Vegetables	78	30	≤ 0.001
Sugary Foods	94	92	0.497
Fatty Foods	88	89	1
Packaged snacks	67	25	≤ 0.001
Salty Foods	88	79	0.062
Water	90	91	1
Peas and Beans	92	79	≤ 0.001
Ground Provision(staples)	85	93	0.018
Whole wheat bread	60	57	0.764
Fast Foods	85	43	≤ 0.001
Fried Foods	78	89	0.019
Green Salad	76	82	0.319
Food from Animals	36	93	≤ 0.001

Parent-child nutritional knowledge score obtained using a paired t-test to compare means of equivalent questions on healthy food choices. Parents had a mean score of 77.1368 ± 9.347 and children 79.23 ± 6.794 , with no significant differences between parents and children in terms of nutritional knowledge.

Association between parent and child dietary intake:

As seen in table 4 the mean average intake of red vegetables was 0.71 ± 0.557 , yellow vegetables 1.26 ± 0.704 and green vegetables 3.08 ± 1.563 . Non-consumption of Red fruit mean of 1.73 ± 0.600 , yellow fruits 2.41 ± 0.937 and green fruits

Table 4: Mean values of non-consumption of Fruits and Vegetables

Kind and Color	%	Mean ($\pm$ SD)	Kind and Color2	%3	Mean ($\pm$ SD)4
Red Vegetables	31.4	0.71(0.557)	Red Fruits	7.4	1.73 (0.600)
Yellow Vegetables	14.8	1.26(0.704)	Yellow Fruits	7.1	2.41 (0.937)
Green Vegetables	6.9	3.08 (1.563)	Green Fruits	15.8	1.47 (0.762)

Figure 1 shows percentages of children who do not consume fruit and vegetables by fruit/vegetable color. The figure suggests that, apart from yellow vegetables, more than three-quarters of the children consumed both red, yellow, and green fruit and vegetables

Figure 1: Percent of Children Not Consuming Fruits and Vegetables by Fruit/Vegetable Color

Means of respondents who ate a balance meal which included the Caribbean six food groups of staples, legumes, food from animal sources, fruits and vegetables and fats and oils was obtained. Examination of food consumption by food groups showed that 66.5% of students reported regular consumption of items for each of the six food groups while 31.4% consumed less food in the category of the recommended six food groups. However binary logistic regression showed that none of the variables; income (OR = 1.120, 95% CI (0.792, 1.584)), employment status of parent (OR = 0.939, 95% CI (0.734, 1.203)), and highest level of education of parent (OR = 0.960, 95% CI (0.629, 1.464)) was (n) a useful predictor of the likelihood that a child would have a balanced diet regularly.

As indicated in Figure 2, 61.8% of females were overweight, while the weight of 38.3% of male students exceeded the WHO suggested $\geq 85^{\text{th}}$ percentile overweight value. Also 60.4% of females and 39.6% males were obese ($\geq 95^{\text{th}}$ percentile as per WHO age and gender specific reference).

Figure2: Body fat classification gender specific in St. Lucian children 9-13yrs. Girls had higher classification ($\geq 95^{\text{th}}$)

No significant differences were found among age groups and ethnicities with respect to body fat percentage. However, body fat percentages differed significantly between males and females in the population. Linear regression analysis showed that none of the variables, namely consumption of sweetened beverages, foods and snacks high in sodium, foods high in fat, activity level, age and gender had an influence on the increase in BMI. However, a two sample t-test showed that the mean BMI of children who consumed salty foods was higher than that of children who did not consume salty foods ($p = 0,012$)

Figure 3 shows the distribution of body fat percentage according to the TANITA reference chart for children 7-18 years, age and gender specific. 90% of respondent females were obese for age, 78.6 were of healthy weight, and 63.4 in the under-fat for age and gender. More females (34.8% over-fat) were obese than males (10%).

Figure 3: Sex and Age Specific Body Fat (%) in Primary School Participants 9-13yrs

CHAPTER 5: DISCUSSION

The nutritional status and eating habits of primary school children were studied to gain insight into the nutritional knowledge of children to ascertain determinants of their present nutritional status. The knowledge of their parents was also evaluated as to determine their current nutritional knowledge and the impact of that knowledge on the children's food choices and habits. The demographics of the primary school sample population were predominately black which is similar to the general population. There were a higher proportion of girls to boys in primary school population studied, whereas in the public primary school population the percentages are 50.1% of males and 49.9% females. This may be attributed to the dropout rate of males from primary school. Boys had a higher mean age than girls as explained in the Ministry of Education St. Lucia Statistical digest as there were 62% of male repeaters which may account for the 13 year olds in the primary education system. Girls had a higher mean height and weight compared to boys, which is in agreement with the data by Jackson et al. (2001). This discrepancy is brought about by earlier growth spurt in girls than in boys.

The Island health sector focuses on the education of the six food groups as part of the curriculum adopted from the Caribbean Food and Nutrition Institute (CFNI) which establishes an adequate base for the concluded findings of the 66.5% of participants who consumed and had knowledge of a balanced diet when associated between parent-child eating habits. On the contrary, in the absence of adequate parent child pairing there is no justifiable reflection of sufficient dietary percentages. Notwithstanding, the theoretical approaches which attests to the influences that parents have on the behavioral patterns on their children's feeding environment and the choices these reinforced behaviors were observed.

In addition, in the fruit and vegetable consumption patterns, there was a higher mean of non-consumers of green vegetables and yellow fruits. An important theoretical assumption ascertained by Cullen et al. (2001), which ascribes that the low consumption of fruit and vegetables is as a result of the several personality characteristics which predicts their preferences. Despite nutrition education at schools,

the uses of locally grown fruits and vegetables as a means of incorporating them into their children dietary patterns still remains a challenge. A strong argument in favor of this point is drawn by McGowan et al. (2013) in the intervention studies which revealed that habits are formed from repeated behavior and are automatic. McGowan et al. (2013) further imputed that these habits is obviously interrelated with behavior response rather than the parents being given nutrition information and taught these nutritional practices, therefore it is concluded that feeding practices are consistent with behaviors and not entirely on knowledge. In addition, parents' nutritional knowledge was paired with children nutritional knowledge where no significance in knowledge was seen. Nevertheless, nutritional knowledge can be imparted, but without associated behavior the outcome of healthier choices will not be appreciated. Conclusions of this analysis is that parents feeding patterns are based on behavior and not on knowledge of nutritional foods

The Parents' perception of food items has a distinct tendency to reflect children's preferences of these food items, most noticeable, in this study as the parents' perception of their children's preferences of foods had significant associations particularly in energy dense food. The high caloric food choices which are attributed to the risk of overweight and obesity were of significant importance as high fat, high salt foods, foods high in animal sources and sweetened beverages consumption was a reflection of parents eating habits.

The consumption of local fruits and vegetables, peas and beans, whole-wheat products were also significant, notwithstanding that the selection of the high caloric foods increases the adiposity and risk of overweight and obesity. In fact, Scaglioni et al. (2011) presented a strong argument in the favor of this finding with evidence from twins' studies where coefficient factors were obtained to validate the premise that genetic influences were associated with the heritability of certain food types. In addition, evidence showed that there was a strong coefficient for protein food and a moderated coefficient for fruit and vegetable. In this respect Scaglioni et al. (2011) stated that feeding behaviors early in life have been shown to be associated with adiposity (Scaglioni et al., 2011) Fundamentally, an association was confirmed and can be deduced that parents are the dominate factor in the eating patterns, food selections

and preferences of their children. Equally important is the data revealed by the Ministry of education on the percentages of students benefitting from the existing school feeding programs, it can be inferred that there is an increase in the purchasing power of children to select food items of their choice or the rise in thriving canteens which are delineated for further research.

To assess the Nutritional status of the primary school children 9-13 year olds, weight and heights were measured and compared to the WHO growth references. There were higher percentages of females to males in the overweight and obese category, which can be justified from studies done in the Caribbean by Francis et al. (2010), Gaskin et al. (2007) and Jackson et al. (2001). Therefore, this can be generalized as the population of primary school children in St. Lucia has a higher percentage of females compared to males. Fundamentally, the findings of 60.4% and 61.7% of overweight and obese females and 38.3% and 39.6% of overweight and obese males, corroborate that overweight and obesity is high among the primary school aged children of St. Lucia.

Waist height ratio is an indicator of metabolic risk factors and central adiposity, <0.5 represents the cuts off points. Participants with normal BMI percentile category had a Waist height ratio of <0.5 , additionally, participants in the overweight and obese by BMI percentile had a WHtR of <0.5 which suggests that all participants were within normal values according to the cut of points. It is important to note that since BMI measurement cannot differentiate between fat mass and fat free mass therefore an increase in BMI might not reflect central adiposity. No associations were establish with waist height ratio as perceived. Similar finding was reported by Khoury et al. (2013) where fifty-five percent of obese classified by BMI with WHtR <0.5 and ninety-seven percent of normal participants WHtR <0.5 and established that the clinical utility of waist height ratio is an indicator of central obesity whereas BMI cannot distinguish between fat free and fat mass which serves as an indicator of anatomical distribution of fat.

In spite of the present findings the increased waist circumferences among the overweight and obesity participants is of clinical significance as current studies have confirmed this as a measure to assessment of, an as an indicator of central adiposity and metabolic syndrome and consequently chronic non-communicable diseases.

The evidence of this research suggest that there is high incidence of overweight and obesity in the sample population of children 9-13 which points to the seriousness of this findings regarding the many risk factors associated with overweight and obesity outlined in the literature. Another important implication is that of the content of the meals offered in the school feeding programs and the choices of offered in the canteen services mentioned may be a contributing factor to the changes in the body compositions in primary school children. Nutritional knowledge is not being used by parents to make healthier choices in their children food selection which is seen in the findings. The transition from traditional meal to more energy dense meals as in seen in St. Lucia also can affect the eating patterns of the children.

The social cognitive theory which postulates reciprocal determinism is evident in the findings of this research as the preferences of parents determines the preferences of their children it is also concretized with the rational choice theory where findings suggest there was nutritional knowledge among parents and children and demographics of the parents showed not significant association with dietary patterns of their children proposes that the factor of choice is used which seem to supersede the nutritional knowledge of the parents.

Limitations

Although the findings of this research is assuring in identifying new methods to education and dietary guidelines implementation, the limitations must be considered. The sample size for parent-child pairing was too small and as a result association which might have been found with demographics of parental income, education level and age was limited. Due to missing data from parent and child questionnaires correlations could not have been successfully established. In this respect, the administering of the survey by the researcher to the parents would have been beneficial and would limit the issues of unanswered or question which needed to be further explained to the participating parents, this would also have eliminated low returns of parent questionnaires as they would be collected immediately.

Furthermore, since there was insufficient anthropometric data for parents, the establishing of association with child BMI classifications to parents BMI classifications was not feasible. This variable of parental BMI would have substantiate current literature and reinforce the correlation of the onset of overweight and obesity in their children and the influence of parental weight on the severity of the condition.

The use of 3 day food records from child participants should have been included as part of data collection instrument to ascertain caloric and Macro and Micronutrient intakes as food frequencies only represent food combined into groups to consider their nutrient similarities. This also takes into account that the child participant would be describing their consumption pattern and individually identifying their likes and dislikes and not within categories. The use of a food frequency could be used in combination with the other survey design

CHAPTER 6: CONCLUSION AND RECOMMENDATIONS

The results of this study expounds the complexity of the pandemic of overweight and obesity and the multi-factorial causes associated with its prevalence in the Caribbean. This St. Lucian study exposes the effects of globalization and the nutritional transition faced in the less developed countries. The incidence of overweight and obesity is alarming with a high percentage of pre-adolescence of primary school age being above the 85th and 95th percentile. In addition the age that the pandemic of overweight and obesity is occurring is consistent and noticeable with the early onset of adult health complications.

These findings illustrate that the nutrition transition from traditional eating habits to the more westernized pattern of eating are apparent in the households in St. Lucia, hence the increase in the consumption pattern of energy dense food items in the home setting and school lunches. In essence the quality of the St. Lucian diet of staples, locally grown fruits and vegetables, peas and beans and foods from animals has transposed with the replacement of high salt, high sugar energy dense food items. Contrariwise, parents are seen to be the promoters of these items as their preferences in selection are in tandem with their children. In comparison, the eating patterns of the parents are a reflection of the children's eating patterns and habits which is an indication that parental involvement is a dominate factor in their children's' nutritional status.

Specifically are the choice selections of parents despite their level of nutritional knowledge, educational background and income level. This suggests that choices will dictate decisions regardless of the above mentioned factors, therefore governmental involvement in policies to standardized school feeding and school lunches should be the way forward.

The findings of this study indicate that the incidence of overweight and obesity thereby emphasizes that there is a nutritional dilemma faced in St. Lucia among the primary school aged children.

Recommendations

- Governmental involvement in making policies which fosters relationships within the health and agricultural sector to make available healthier and an affordable choice to lower income families.
- This information can be useful to develop targeted interventions aimed at the introduction of school based dietary programs especially a more sustainable school feeding program to eliminated the inclusion of other food options as maintain a standardized feeding pattern.
- Promotion of eat and grow local initiative and continuance of the education programs but with added initiatives of follow up assessments and incentives.
- Another possible area of future research would be to investigate why the increase in high calorie packaged snacks with the existence of the school feeding program implemented in primary schools.
- Further studies in the area of child nutrition since more information of dietary habits would help establish a greater degree of accuracy on the matter of association with nutritional status and parental influences.
- Weight management intervention programs for those at risk of being overweight and recommendation for activity guidelines for children

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