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Effect of Clinical Education on Child Obesity Biomarkers in Children Visiting a Pediatric Clinic in South Texas

Patricia Lopez

EFFECT OF CLINICAL EDUCATION ON CHILD OBESITY BIOMARKERS IN CHILDREN VISITING A PEDIATRIC CLINIC IN SOUTH TEXAS

A Thesis

by

PATRICIA LOPEZ

Submitted to Texas A&M International University
in partial fulfillment of the requirements
for the degree of

MASTER OF SCIENCE

August 2017

Major Subject: Biology

The Effect of Clinical Education on Child Obesity Biomarkers in Children Visiting a Pediatric Clinic in South Texas

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Approved as to style and content by:

Chair of Committee,	Dr. Fernando G. Quintana
Committee Members,	Dr. Michael R. Kidd
	Dr. Marvin Bennett
	Dr. Alfred K. Addo-Mensah
Head of Department,	Dr. Michael R. Kidd

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ABSTRACT

EFFECT OF CLINICAL EDUCATION ON CHILD OBESITY BIOMARKERS IN CHILDREN ATTENDING A PEDIATRIC CLINIC IN SOUTH TEXAS

(August 2017)

Patricia Lopez, B. S., Texas A&M International University;

Chair of Committee: Dr. Fernando G. Quintana

Obesity in children and adolescents is a serious public health problem, not only in the United States, but throughout all the countries around the world. Obesity can be easily detected and prevented. Education concerning over the dangers of obesity is the key to leading along and healthy life. It can also help maintain normal levels of BMI, systolic blood pressure, diastolic blood pressure, triglycerides, cholesterol, low-density lipoproteins, high-density lipoproteins, glucose and insulin. The main objective of this research is to study the effect of clinical education on child obesity biomarkers in children visiting a pediatric clinic in South Texas. To analyze the data, paired t-test, was used. IBM-SPSS Statistics 20 was used to perform the analysis. Internal Review Board approval for this study was received from the Texas A&M International University IRB committee: Approval No.2012-01-13BMI in Children During Development. The results of this research supports that a pediatrician intervention resulted in a reduction in the mean value of DBP and BMI for visit 1 vs. 2 and BMI for visit 1 vs. 3 and an increase of the mean difference for glucose and HDL for visit 1vs. 2. Glucose, HDL, DBP, LDL and SBP for visit 1 vs. 3 and LDL, glucose and insulin for visit 1 vs. 4. However, In general the results support that the mean values for the variables stayed equal. This means that the children's health did not deteriorate. This study had limitations because it was a retrospective analysis.

DEDICATION

TO:

My Parents

Dr. Isaías López & Dr. Norma Patricia López

My Brother

Isaías López Alarcón, M.B.A.

My Grandmother

María Auxilio Guzmán Paniagua

My Advisor and Professor

Dr. Fernando G. Quintana

And to THE LOVE OF MY LIFE…

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INTRODUCTION

Throughout the United States children obesity is extremely prevalent. Obesity in children and adolescents has increased every year in developing countries throughout the past decade. There are certain factors that should be taken into consideration when determining if someone is either overweight, obese or in their normal weight range. Body mass index, BMI is calculated from a person's height and weight. The body mass of an individual is divided by the square of the body height, and is universally expressed in units of kg/m^2. BMI can be used as a guide to measure body fat and it can indicate if a person is in fact obese. When applied to children, individuals with a BMI percentile lower than 5% are considered underweight, individuals with a BMI percentile of 5% to less than 85% are considered normal weight, individuals with a BMI percentile of 85% to less than 95% are considered overweight and individuals with a BMI percentile of equal to or greater than 95% are considered more than obese (1).

There are several factors that contribute to the increase of obesity in children and adolescents such as having a bad and poor balance diet, the consumption of sweetened beverages like sodas, having unhealthy snacks or meals, family history, genetics, metabolism, and the most important of all, behavior or habits like the lack of exercise and physical activity; all because children are most likely spending more time watching television, playing videogames, and using computers, tablets and telephones. But one of the most important factors that contribute to this undergoing problem is the lack of knowledge that some parents, children, and adolescents have related to the health consequences caused by obesity (2).

Obesity increases the risk of diseases and illnesses, such as cancer, diabetes, and

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This thesis follows the model of *Journal of Pediatric Obesity*.

cardiovascular diseases like high blood pressure, coronary artery disease, heart attacks, strokes, and atherosclerosis. The initial stages of these diseases among children and young adults vary by age, sex, and race (3). Child obesity can lead to many complications. For example, type 2 diabetes and hypertension which can lead to many cardiovascular diseases, metabolic syndrome, dyslipidemia, nonalcoholic fatty liver disease, obstructive sleep apnea, polycystic ovary syndrome and pseudo- tumor-cerebri. (2). Childhood obesity can lead not only to health problems, but also to emotional and psychological problems like depression due to bullying. Bullying is the use of some type of threat, physical or emotional abuse, intimidation or aggression over others and it is a significant problem to children and adolescents.

Obesity can be prevented in many ways. Such as, maintaining a healthy diet, exercise or physical activity, and regular doctor's appointments. Healthy eating does not necessarily mean strict dietary limitations. A healthy diet is considered a low caloric balanced diet. It consists of consuming food from all the different groups of food in the right quantity, e.g., vegetables, fruits, whole grains, fat-free or low-fat dairy products, lean meats, poultry, fish, beans, and nuts, limiting saturated and trans fats, sodium and added sugars (4). Another way to manage this obesity problem is to implement physical activities such as: walking, running, swimming or practicing any kind of sport, for at least 30 minutes a day. Regular physical examinations are also critical to maintaining proper health.

Childhood obesity affects approximately 12.5 million children and teens in the United States, about 17% of the population and it has tripled from 1980s to 1990s (5). Obesity in children is a worldwide problem not only in the United States. The counseling of children and their families about obesity and healthy lifestyle is an essential part of preventive care. Research

has provided direction for health education and had provided abundant information about risk factors and the consequences that are related to obesity and its complications (6).

Ethnicity

Statistics showed that there are 10.5 million Hispanic children under the age of 18 residing in the U.S considering them the fastest growing race in our youth population in the US, and it is predicted they will be the majority race in the near future. The state of Texas is already populated with mostly Hispanics. A study (7) showed that children in this community have a higher prevalence in obesity. A study that compares Hispanics, white, and black children from kindergarten to 8th grade showed that Hispanics got the higher prevalence of obesity.

Effects of School Environment on Obesity

School, from early age, plays a very important role not only in the education of children, but also in their diet. Obesity in children consists is related to the food they eat during school breakfast and lunch. A study (8) has discussed that some solutions may be implemented to lower the prevalence of obesity in children, like the elimination of vending machines containing sugar drinks can really help. After many studies (9) and findings linking child obesity to the not so healthy meal consumption at school, now a days, there are several schools that wanted to improve the quality of the meals provided to the students, then adapted their menu according to the student's needs and health benefits. Another suggestion can be for the children to walk or bike to school. Therefore, they can at least do some physical activity during the day. Also, schools should implement more physical education classes or physical activity programs that can lead to a participation of children not only during school, but after school activities.

A study (8) analyzed the effect of reduction in television time, improved physical activities as well as increasing the intake of fruits and vegetables as a method of reducing weight. The study lasted for 2 years and the results were positive.

In addition, schools should also modify their school menus for breakfast and lunch. They should be modified in a way that the children can enjoy the food, but at the same time provide healthy nutrients. The food menus should include whole grains and fibers and be reduced on unhealthy fats, oils and carbohydrates (10).

Effects of Fast Food Restaurants on Obesity

Fast food restaurants are a serious dilemma when we face obesity problem, not only in children, but also in adults. Now a days, men as women take part of the house holding. Most of the people do not have time to cook, causing them to buy outside food, especially from fast food chains. These meals do not contain healthy ingredients and is mostly processed food.

Studies had demonstrated that the consumption of food away from home can lead to an excess of calorie intake. The result is an increase in obesity due to the large portion sizes of the meals and the content that the food has. Fast foods are full of fat; they are highly processed, have a lot of calories, saturated sugars and trans fats, simple carbohydrates and sodium. Fast foods reduce the quality of the diet that a child consumes. A child is always going to prefer a meal with French fries, ice cream, soda, cookies or a hamburger instead of a salad, yogurt, fruit or a healthier choice. Fast food affects children more than adults because they are the main target of these restaurants. That is why most of these restaurants advertise toys and animated characters as well as playgrounds to attract children as a consumer. Making this the children's first choice instead of a home cooked meal (10).

Marketing and pricing is another factor that fast food restaurants have on their side. A lot of times marketing takes a lot of our attention that we actually want to try what we see. On the other hand pricing is something that affects obesity because fast food restaurants have "junk food" at a better price than a "healthy food." A lot of these restaurants have a dollar menu, so a lot of people prefer to buy several items for that price, than buying a salad that is more expensive than a regular fast food meal, including fries and soda. A study has showed that a substantial proportion of all money spent on food consumed outside the home is spent on fast food restaurants (8).

Effects of Income on Obesity

The income of a person also is reflected on obesity. A diet of a low income person cannot be compared to a high income person. According to the department of agriculture, approximately 23.5 million persons in urban and rural areas of the US live on food deserts, low- income areas without access to healthy foods (8). They do not have access to large supermarkets or even small stores, markets, farms, or a community-supported agriculture.

Other research had demonstrated that the lowest cumulative incidence of obesity according to socioeconomic status was among children from the wealthiest 20% of families than those in all the other socioeconomic quintiles and the highest was among children from the middle socioeconomic quintile (6). This is likely because, wealthy people have the money to buy nutritious food in order to follow a balance, proper and healthy diet. On any super market the most expensive food is the healthiest. An example can be fruit or vegetables, if you buy normal products the price is not as high as organic fruits or vegetables, the price can be as double or triple as a normal fruit price. Also white meat, as tilapia, shrimps, salmon, etc. are more expensive than red meat, which is not bad for our system, but it is not as healthy as white meats.

Finally, a socioeconomics research (9) demonstrated that children with reduced priced or free lunch meals in school had a more prevalence of overweight and obesity and that at least one of their family members had Diabetes type 1 or 2. This is likely because, they have easy access to food, and it was mentioned before, these meals are not the healthiest choice.

Biomarkers

BMI

Obesity is the overall accumulation of fat in the body. The excess of adiposity, too much adipose tissue for good health, can be determined using the body mass index or BMI. BMI is a measure of human body shape calculated based on an individual's weight and height and it provides a reliable indicator of body fat for most people and is used to screen for weight categories by dividing the body mass of an individual by the square of the body height. This index is a widely applied method for determining obesity by physicians to evaluate an individual's anthropometric and nutritional status. BMI can be used to catalog individuals as normal weight, overweight, obese and more than obese (3).

The levels of BMI percentiles used in the pediatric clinical practice are: a) individuals with a BMI lower than 5% are considered underweight, b) individuals with a BMI 5% to less than 85% are considered normal weight, c) individuals with a BMI of 85% to less than 95% are considered overweight and d) individuals with a BMI equal to or greater than 95% are considered more than obese (1).

Some studies indicate that the BMI of children or adolescents are influenced by age, gender, race and even body type (11). BMI measurement can be important to the control of weight, depending on the height of an individual; we can get the appropriate weight. However,

research has shown that BMI is not always a reliable estimate of body fat because it can't distinguish between fat and muscle (12).

Blood Pressure

Blood pressure (BP) is defined as the force exerted by blood against a unit area of a blood vessel wall and it is expressed in millimeters of mercury (mm Hg). A sphygmomanometer can be used to take BP measurements. The first sound heard indicates the systolic pressure and the second one indicate the diastolic pressure. Normal BP in children ages from premature to twelve years are described in Table 1 below.

Table 1Normal Heart Rate, Blood Pressure and Respiratory Rate Ranges.

Age	Heart Rate (beats/min)	Blood Pressure (mm Hg)	Respiratory Rate (breaths/min)
Premature	120-170 *	55-75/35-45†	40-70†
0-3 mo	100-150 *	65-85/45-55	35-55
3-6 mo	90-120	70-90/50-65	30-45
6-12 mo	80-120	80-100/55-65	25-40
1-3 yr	70-110	90-105/55-70	20-30
3-6 yr	65-110	95-110/60-75	20-25
6-12 yr	60-95	100-120/60/75	14/22
12 ≥yr	55-85	110-135/65/85	12-18

Kleigman, R.M., et al. *Nelson Textbook of Pediatrics*. 19th ed. Philadelphia: Saunders, 2011.

High BP or hypertension is a major cause of morbidity and mortality in the United States. Hypertension is a chronic condition in which BP levels in the arteries are elevated (13). Hypertension is defined as BP of 140/90 mm Hg or above and it is a serious condition that can become deadly if left untreated. It is the primary cause of strokes, kidney failure, heart attacks and congestive heart failure. High sodium consumption, lack of physical inactivity, use of tobacco, age, race, heredity, and obesity are the most common risk factors of high BP (14). The

prevalence of high BP in the United States increases with age. The rate of change in BP is related to the rapid height and weight changes that occur during infancy through adolescence. Studies have shown that it is more common for a child or adolescent to have hypertension when the parents have it, and that more than 70% of adults age 60 or older suffer from high BP; making it a very common condition (14).

Systolic blood pressure SBP is defined as the measurement of the pressure exerted on our arteries and vessels when the ventricles contracts, in other words it is the pressure exerted when the heart is in systole. BP is reported as a ratio, for example 120/80, the numerator 120 mmHg is the systolic pressure. The denominator 80 mmHg represents the diastolic pressure. Diastolic blood pressure (DBP) reflects the pressure during ventricular relaxation. In adults the normal SBP is below 120 mmHg and has become the major criterion for the diagnosis, staging and treatment of hypertension in adults (15). Maintaining systolic and diastolic blood pressure at normal levels is important as we age, therefore it is important that children and adolescents know the different ways they can achieve this goal. That's why it is important for them to be informed and comprehend that exercising and eating balanced meals will help elongate their lives.

Triglycerides (TGL)

Triglycerides, TGLs, are composed of a glycerol molecule and 3 fatty acids. Human cells use them as an energy source and they are necessary to maintain an adequate health level. TGLs are excellent markers to detect or predict cardiovascular diseases. Abnormal levels of TGLs do not appear suddenly, but change progressively throughout the life cycle (16).

Triglyceride levels can be measured by a triglyceride laboratory test. A fasting blood sample is needed. The American College of Sports Medicine reports that normal triglyceride levels for children under the age of 18 are less than 150 mg/dL. Borderline, high and very high

triglyceride levels are measured at 150 to 199 mg/dL, 200 to 499 mg/dL, and greater than 500 mg/dL, respectively. According to a study done in 1999 the TGL levels are substantially higher among white children than among black children and they tend to increase with age among whites (17).

Elevated levels of triglycerides may indicate the presence of certain diseases and conditions such as: diabetes, fatty liver, pancreatitis, kidney diseases and hypothyroidism. Factors that can elevate triglycerides levels include: obesity, physical inactivity, diets high in carbohydrates, drinking alcohol, estrogen, birth control pills, and genetic disorders. Triglyceride levels can be controlled to some extent by lifestyle modifications, for example: losing weight, watching calorie intake, smoking cessation, becoming more physically active, eating right. On occasion medications may be required to control TGLs (18).

Total Cholesterol

Cholesterol is an essential substance for every living organism. The liver is the primary organ responsible for the production of cholesterol, but an individual can also get cholesterol from the adrenal glands, intestines, reproductive organs and from different sources of food such as: cheese, egg yolks, beef, pork, poultry, and shrimp. Cholesterol is responsible for the production of new tissue cells, certain hormones (testosterone, progesterone, estrogens, cortisol and aldosterone) and vitamin D. It serves as a cell transporter and helps in the digestion of food and protects our nerves.

Obesity is responsible for most of BMI, systolic blood pressure, diastolic blood pressure, triglycerides, low-density lipoproteins, high-density lipoproteins, glucose and insulin level changes and cholesterol cannot be the exception. Studies have demonstrated that obesity and cholesterol levels in children are generally related to each other (18).

Cholesterol cannot be dissolved in the blood, so it has to be transported through the bloodstream by carriers called lipoproteins. There are two types of lipoproteins that carry cholesterol to and from the cells. High density lipoprotein HDL and low density lipoprotein. LDL, they are known as the good cholesterol and the bad cholesterol. LDL is the "bad" cholesterol because it contributes to the fatty buildups in arteries while the HDL is the "good" cholesterol because it acts like a scavenger, carrying LDL cholesterol away from the arteries and back to the liver. In order to be healthy both lipoproteins have to be at a normal range. LDL & HDL are not cholesterol at all but just transporters.

A cholesterol screening measures the levels of HDL, LDL and triglycerides. The cholesterol screening test results show the levels of cholesterol in milligrams per deciliter of blood (mg/dL). It is recommended to fast, avoid consuming food, beverages or medications usually for 9 to 12 hours before taking the test. If for some reason fasting is not appropriate, only the total cholesterol and HDL cholesterol levels will be usable, because the levels of LDL and triglycerides can be affected by what you have recently consumed. The normal, borderline and abnormal levels of total cholesterol, LDL and HDL in children from ages 2 to 9 are shown in Table 2 below.

Table 2 Cholesterol Normal Ranges.

	Total Cholesterol	**LDL Cholesterol**	**HDL Cholesterol**
Normal	Less than 170	Less than 120	Above 60
Borderline	170- 199	120- 144	40- 60
Abnormal	200 or higher	145 or higher	Less than 40

Barton D. Schmitt, MD, author of "My Child Is Sick," American Academy of Pediatrics Books, and by Robert Brayden, MD, Professor of Pediatrics, University of Colorado School of Pediatric Medicine Advisor 2014.

Levels of lipids and lipoproteins among children and adolescents are correlated with age, obesity, and other characteristics and they may vary by sex and race/ethnicity (17). Also

cholesterol concentrations in children and adolescents have long been known to predict adult cholesterol levels because it is more likely for children to suffer high or low concentrations due to their parent's influence (19).

Besides Total Cholesterol level, Cholesterol ratio is another measurement that can notify the doctor or the patient if a healthier diet or lifestyle is needed. This ratio reveals what amount of your total cholesterol is "good." The Cholesterol ratio of a patient can be calculated by dividing the total cholesterol by the HDL number. According to the American Heart Association the cholesterol ratio should not exceed 5mmol/L and the ideal cholesterol ratio is 3.5mmol/L. Researchers and doctors suggest that cholesterol ratio is a better predictor of heart disease that is why this ratio has an important role in this variable. Also, some people may find it easier to remember their cholesterol ratio (one number) rather than their HDL and LDL total numbers.

The low-density lipoproteins or LDL concentrates cholesterol on the walls of the blood vessels, which causes the blockages of atherosclerosis, when plaque builds up in the arteries. LDL seems to promote atherosclerosis especially if the LDL particles are small, dense, and prone to oxidation (20).This can lead to major life-threatening problems such as strokes and heart attacks.

As HDL passes through the bloodstream it removes "bad" cholesterol from where it does not belong. In other words, it carries cholesterol from other parts of the body and brings them back into the liver for breakdown, removal or reuse. Having high levels of HDL reduces the risk of heart disease and some other disorders, but having low levels increases the risks. HDL searches and removes LDL and reduces, reuses, or recycles LDL cholesterol by transporting it to the liver where it is reprocessed. Abnormalities in HDL values in adults increase the risk for cardiovascular diseases, and studies have shown that the prevalence in children has advanced

over the last two decades. That is why pediatric screening and lifestyle changes such as nutrition and exercise are important considerations in order to control the levels of HDL and LDL (16).Studies have shown that the average LDL cholesterol level is higher among girls over boys (17).

Glucose

There are 4 major types of biomolecules: carbohydrates, lipids, proteins, and nucleic acids. Carbohydrates can be further classified in 3 major groups, which are monosaccharides, disaccharides and polysaccharides. The most common monosaccharide is glucose. Glucose can be obtained by gluconeogenesis or by the food we ingest. For example: pasta, bread, fruit, cereals and some vegetables. Carbohydrates are broken down into monosaccharides in the small intestine. They are absorbed into the blood stream after digestion and travel to every part of the body to fulfill its essential purpose (21).

Glucose is needed as an important energy source by many cells and organs in our body, for example the brain and muscles. Although many cells use fat for energy, the brain, nerve cells, and developing red blood cells cannot (22). Studies have shown that from birth to 4 years, the rate of glucose utilization by brain tissue increases markedly, to the extent that by 4 years, per unit weight of brain it is twice that of the adult. This high rate of glucose utilization remains until 9–10 years. By age 16-18 the cerebral metabolic rate declines. As the brain of a child is both relatively bigger and per unit of weight more active than the adults, children may be particularly responsive to the provision of glucose, the major fuel of the brain as was mention before (23).

All of elevated levels or overconsumption of sugars have been the concern of many health problems. Individuals consume added sugar foods for example: candies, non- diet soft drinks, sweets, cakes, cookies, etc., which contributes to an excess of calories (21). According to

the American Diabetes Association having high levels of glucose in the body can cause kidney failure, damage your circulatory system leading to a heart attack, poor vision and hypoesthesia. On the other hand, the low level of glucose can cause kidney failure, low blood pressure, liver disease such as cirrhosis, complications in the pituitary gland, Addison's disease and hypothyroidism.

Glucose metabolism deteriorates more rapidly in children than in adults, meaning that the identification of early metabolic defects is important in order to prevent the development of possible diseases at later age (24). In adults the normal glucose levels are typically less than 100 milligrams per deciliter in the morning or before eating. This level is called the fasting blood glucose or sugar level. Normal glucose levels 1 to 2 hours after eating are typically less than 140 milligrams per deciliter. The normal levels of glucose in children according to the American Diabetes Association are: a) children from birth to age 5, normal blood sugar targets are 100 to 200mg/dL, b) children that are between the ages of 5 and 11, normal blood sugar targets are 70 to 150mg/dL,and c) for children12 or older, healthy glucose levels are essentially the same as those of adults: near 70 mg/dL when fasting and 150 mg/dL after meals.

Insulin

Insulin is a polypeptide hormone produced in the pancreas by beta cells. This hormone is important to the body because when it binds to a receptor in the membrane of an adipocyte or muscle cells promotes the attachment of channels to the cell membrane that allow the diffusion of glucose in to provide energy or for glucose storage. When insulin arrives, it signals the cells to activate glucose transporters (22).

When we take in food and glucose enters to the blood stream, the pancreas makes the right amount of insulin to move glucose into the cells. When this process cannot be realized as it

supposed to, is when it is said that an individual have diabetes. There are two type of diabetes: insulin-dependent diabetes mellitus, also known as type 1 or juvenile diabetes, and non-insulin dependent diabetes mellitus, also known as diabetes type 2 can also be insulin dependent. Insulin plays an important role on individuals with diabetes types 1 and 2. In people with type 1 diabetes, the pancreas no longer produce insulin, due to the destruction of insulin-producing beta cells in the pancreas. Type 1 diabetes is an autoimmune disease, so the body itself attacks and destroys the beta cells. Because insulin is not being produced properly patients need to be injected several times every day or receive insulin through an insulin pump. While people with type 2 diabetes produce insulin, but their cells do not respond to it as well as they should. Some people with type 2 diabetes require oral medication for diabetes or insulin shots to help their body use glucose for energy. By injecting insulin into the body it acts on glucose in a similar way as if the body would produce it and helps reduce the amount of glucose in the bloodstream getting it to where is needed for energy (22).

Insulin resistance, which is mainly present in patients with diabetes type 2, is when the cells build a resistance to insulin, even though there is insulin in the bloodstream, it is not enough to unlock the cell to allow glucose to enter. As a result, it takes more insulin to find the right key to unlock the cell for glucose, making it more difficult for the cell to get energy. Studies have reported that obese children show signs of insulin resistance, low-grade systemic inflammation and dyslipidemia, which are risk factors of cardiovascular diseases, but is believed that insulin resistance is the central factor of the development of the disease (25). At the present time there is interest in the evaluation of insulin resistance in obese children and adolescences, due to the fact that information is limited about its prevalence (25). Having high levels or low levels of insulin

only causes high or low level of glucose. Normal levels of insulin in children are described below.

Table 3Insulin normal levels of Children and Adolescents

Biomarker	Children 0.5 to 4 years old	Children 5 to 10 years old	Children 11 to 15 years old
Insulin Mean	4.54*mIU/ml*	9.45*mIU/ml*	16.30*mIU/ml*

Lopez P, Faz M., Quintana, F/G., Ph.D., Cervantes, F. MD Relationship between BMI and Biomarkers in Children Attending a Pediatric Clinic in South Texas. Data not published.

Obesity is an important health problem that has to be taken in consideration in order to prevent new generations from it. The prevalence of obesity is increasing and healthcare professionals have developed new ways to prevent and treat this problem. All or most of clinical and physicians interventions have similar treatment strategies, focusing on the patient's everyday life and behavioral modification. Therefore, intervention programs are designed to give the patient education about obesity and the consequences this problem may have as well as information and orientation on healthy eating.

To understand the effect of clinical intervention we propose to test the following hypotheses:

Biomarkers levels for BMI, blood pressure, triglycerides, cholesterol, LDL, glucose and insulin are expected to decrease after clinical intervention, while the exception of HDL are expected to increase.

METHODS

This study is based on clinical data obtained from 1,366 children visiting a South Texas pediatric clinic from 2000 to 2003. During the visit to the clinic, pulse, respiratory rate, temperature, age, gender, systolic pressure, diastolic pressure, weight, and height were obtained. BMI percentile was calculated for each child. A blood sample was collected and sent to different private laboratories to determine the levels of triglycerides, cholesterol, LDL, HDL, glucose and insulin. Subjects were classified into two categories: 1) overweight (individuals with a BMI of 85% to less than 95%)and 2) obese (individuals with a BMI equal to or greater than 95%). These groups were based on the CDC growth charts, which are the most commonly used indicator to measure the size and growth patterns of children and adolescents in the U.S. (1).

Interventions

Two types of diets were advice for children categorized as overweight or obese. The first one was a diet that the children have to take to their school. The school should provide the subject with a specific breakfast and lunch. The diet had instructions which included decreased simple carbohydrates, no flavored milk, no fruitjuice, no cookies, no pizza, no fries, no sport drinks, and the children were to be offered water, diet drinks, or regular milk. The second diet was for the parents to follow at home. The only food that was not allowed for patients to consume were any type of junk food, for example: donuts, pastries, cookies, French fries, chips, chocolate, candy, regular soft drinks, popcorn, flour tortillas and white bread. The doctor recommended to the parents to avoid buying that type of food, in order to prevent their consumption. The foods that were limited to once a week with an appropriate serving size were pizza, hamburgers and one corn tortilla for each meal. Pinto beans, baked or boiled potatoes, rice, corn or pastas were recommended for them to accompany with meat and no more than two

separate servings a day. For breakfast it was recommended for the child to have rice cereal (no sugared cereals), but it was preferable to give them eggs with one piece of toast and regular milk. The fruits allowed were: melons, bananas, mangos, watermelon, peaches, cherries, plums, apples and grapes. There were no limits on meat, eggs, chicken or fish. Other types of allowed food included: cheese, peanuts, almonds, pears, oranges, jicama, cucumber, grapefruit and all types of vegetables except carrots and beets. For drinks, regular milk, soymilk, almond milk and all diet drinks were allowed on the diet.

It was also recommended that the subjects: 1) not skip meals and try not to eat between meals, if very hungry eat jicama, cucumber, or pork skins, 2) exercise at least 30 minutes, 3 to 4 times a week. In addition, causes, risk factors and some complications concerning obesity were briefly addressed such as femoral epiphysis and diabetes, and information on healthy lifestyles and healthy habits were discussed. The subjects were to be monitored by a physician once a month.

Statistical Analysis

This research consists in the study of the effect that the clinical interventions have on biomarkers of the general patients respectively: girls, boys and both of them combined. The data was sorted by BMI percentiles into 2 different groups: 1) Individuals with a BMI percentile of 85% to less than 95% considered overweight and 2) individuals with a BMI percentile of equal to or greater than 95% considered more than obese. These groups were based on the CDC growth charts, which are the most commonly used indicators to measure the size and growth patterns of children and adolescents in the U.S. (1).

The data was analyzed using a paired comparison of means (paired t-test). The paired t-test is commonly used to test differences among means taken from the same individual at different times (26). The statistical significance was defined as $\alpha < 0.05$.

IBM- SPSS Statistics 20 was used to perform the statistical analysis. The results are presented by a developed macro using Microsoft Word Excel 2010. Internal Review Board approval for this study was received from the Texas A & M International University IRB committee: Approval No.2012-01-13BMI in Children During Development. Pediatric Obesity Journal guidelines were used to format this thesis.

RESULTS

Means, standard deviations and sample sizes for overweight and obese boys' and girls' together, overweight and obese boys and overweight and obese girls for visit 1, visit 2, visit 3 and visit 4 are reported below on tables 4, 5, 6, 7, 8 and 9.

Table 4 Means and Standard Deviations for overweight boys and girls for visit 1, visit 2, visit 3 and visit 4.

	Visit 1, n = 93	Visit 2, n=93	Visit 3, n=36	Visit 4,n=11
SBP	111.29 ± 12.37	110.67±12.82	114.62±12.73	110.18±12.29
DBP	61.12±10.36	62.46±10.16	64.88±10.63	60.27±7.82
BMI	88.49±29.19	86.58±10.57	86.00±14.01	90.40±10.29
TOTAL CHOLESTEROL	158.8±39.18	157.49±30.50	161.53±33.69	158.45±27.89
TRIGLYCERIDES	88.21±11.93	84.96±40.86	103.68±55.65	81.73±33.24
HDL	47.48±61.99	45.64±12.49	42.26±13.70	46.00±13.65
LDL	99.34±61.99	280.64±1246.71	99.15±24.47	96.18±22.05
GLUCOSE	85.6±10.63	87.48±8.10	87.89±7.92	88.91±4.78
INSULIN	7.69±8.37	9.98±12.96	9.57±5.03	13.31±10.72

Table 5 Means and Standard Deviations for obese boys and girls for visit 1, visit 2, visit 3 and visit 4.

	Visit 1, n =310	Visit 2, n=310	Visit 3, n=121	Visit 4,n=48
SBP	119.57±13.77	119.55±12.97	121.41±13.39	116.09±12.05
DBP	67.49±10.71	66.08±10.16	65.46±10.01	64.00±12.47
BMI	99.82±2.03	98.48±4.84	98.86±4.99	96.90±3.08
TOTAL CHOLESTEROL	156.40±30.41	160.33±29.79	158.06±27.69	153.27±32.39
TRIGLYCERIDES	87.49±51.22	97.66±58.66	94.12±60.54	114.89±84.66
HDL	42.96±10.51	43.02±11.45	40.76±9.41	41.14±11.50
LDL	95.96±27.16	96.98±25.43	98.75±26.48	89.25±27.02
GLUCOSE	85.19±7.91	85.07±8.02	86.91±8.02	86.36±7.41
INSULIN	13.88±10.61	14.23±10.43	17.05±11.17	13.07±9.95

No difference was found for overweight boys and girls for visit 1 vs. visit 2 for the following biomarkers SBP (Diff=-.625, p=.629), DBP (Diff=1.862, p=.139), BMI (Diff=-2.0972, p=.081), Total Cholesterol (Diff=-2.067, p=.394), TGL (Diff=-3.966, p=.481) HDL (Diff= -1.854, p=.127), LDL (Diff=182.554, p=.174), glucose (Diff= 1.6923, p=.223) and insulin (Diff=2.204, p=.164). They were not significantly different (Table 10).

Table 6 Means and Standard Deviations for overweight boys for visit 1, visit 2,visit 3 and visit 4.

	Visit 1, n = 41	Visit 2, n=41	Visit 3, n=20	Visit 4,n=5
SBP	112.22±12.63	111.75±13.96	114.74±14.71	115.40±15.57
DBP	60.57±9.46	62.47±9.48	65.79±9.22	64.20±7.98
BMI	88.54±2.30	85.52±12.09	82.44±15.45	86.67±12.58
TOTAL CHOLESTEROL	159.28±32.34	157.08±30.93	164.05±38.89	160.40±34.46
TRIGLYCERIDES	87.35±41.44	82.88±43.29	100.47±57.25	75.80±34.19
HDL	47.18±12.55	45.33±13.53	42.05±15.68	50.00±16.45
LDL	93.92±27.63	308.12±1345.26	101.92±28.09	95.40±23.96
GLUCOSE	85.24±5.05	88.00±5.68	86.05±6.06	87.60±5.41
INSULIN	5.97±4.57	7.81±5.79	8.41±3.64	6.42±2.72

Table 7 Means and Standard Deviations for obese boys for visit 1, visit 2, visit 3 and visit 4.

	Visit 1, n = 163	Visit 2, n=163	Visit 3, n=59	Visit 4,n=25
SBP	117.04±13.51	117.00±13.02	119.35±12.77	114.96±13.24
DBP	65.45±10.72	65.21±10.20	63.37±9.25	63.24±14.15
BMI	97.18±2.05	96.39±4.93	97.15±2.73	97.85±2.08
TOTAL CHOLESTEROL	161.59±29.54	163.75±29.05	163.25±26.55	158.17±34.11
TRIGLYCERIDES	99.94±56.05	107.09±64.26	116.29±73.23	113.96±83.27
HDL	45.04±10.79	43.61±10.59	42.89±10.31	43.13±14.55
LDL	96.57±25.96	98.98±25.92	96.21±27.38	92.37±31.86
GLUCOSE	86.73±7.84	87.59±6.94	88.22±8.62	86.44±8.32
INSULIN	11.16±10.01	12.70±10.57	12.86±11.85	9.74±6.14

Table 8 Means and Standard Deviations for overweight girls for visit 1, visit 2, visit 3 and visit4.

	Visit 1, n =52	Visit 2, n=52	Visit 3, n=16	Visit 4,n=6
SBP	110.54±12.25	109.85±11.97	114.47±10.20	105.83±7.63
DBP	61.57±11.12	62.46±10.74	63.73±12.43	57.00±6.57
BMI	88.46±2.33	87.39±9.34	88.46±12.97	96.00±1.41
TOTAL CHOLESTEROL	158.44±26.85	157.82±30.47	158.33±26.66	156.83±24.47
TRIGLYCERIDES	88.87±37.74	86.62±39.16	107.73±55.25	86.67±34.79
HDL	47.71±11.55	45.90±11.72	42.53±11.24	42.67±11.25
LDL	103.51±78.95	258.66±1175.41	95.65±19.35	96.83±22.62
GLUCOSE	85.88±13.55	87.08±9.63	90.19±9.47	90.00±4.38
INSULIN	9.01±10.24	11.62±16.30	11.06±6.23	20.20±11.52

Table 9 Means and Standard Deviations for obese girls for visit 1, visit 2, visit 3 and visit 4.

	Visit 1, n =147	Visit 2, n=147	Visit 3, n=62	Visit 4,n=29
SBP	116.98±14.12	115.47±12.90	116.80±13.96	114.85±11.05
DBP	66.78±10.71	62.08±9.89	65.92±10.61	63.15±10.13
BMI	97.02±2.02	95.57±4.72	94.57±6.28	95.96±3.49
TOTAL CHOLESTEROL	162.24±31.44	161.12±30.61	161.56±28.91	149.58±28.64
TRIGLYCERIDES	98.84±45.40	96.97±51.63	99.15±45.03	109.23±79.68
HDL	43.63±10.18	43.88±12.36	42.77±8.56	39.65±7.24
LDL	98.08±28.50	97.40±24.96	98.88±25.79	88.13±20.66
GLUCOSE	84.23±7.80	84.94±8.89	85.60±7.26	87.07±6.18
INSULIN	13.66±11.11	13.97±10.27	15.03±10.45	17.28±11.75

Table 10 Paired Samples Test for Overweight Boys and Girls Visit 1 Vs. Visit 2

		Paired Differences					t	df	p
		Mean Difference	Std. Deviation	Std. Error	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	SBP	.62	11.51	1.28	-1.93	3.18	.48	79	.629
Pair 2	DBP	-1.86	11.15	1.24	-4.34	.62	-1.49	79	.139
Pair 3	BMI PERCENTILE	2.09	10.03	1.18	-.26	4.45	1.77	71	.081
Pair 4	TOTAL CHOLESTEROL	2.06	22.77	2.41	-2.73	6.86	.85	88	.394
Pair 5	TRIGLYCERIDES	3.96	52.90	5.60	-7.17	15.11	.70	88	.481
Pair 6	HDL	1.85	11.36	1.20	-.54	4.24	1.53	88	.127
Pair 7	LDL	-182.55	1257.99	133.34	-447.55	82.44	-1.36	88	.174
Pair 8	GLUCOSE	-1.69	13.16	1.37	-4.43	1.04	-1.22	90	.223
Pair 9	INSULIN	-2.20	14.29	1.56	-5.32	.91	-1.40	82	.164

(*) Significant Difference

Significant difference was observed for DBP (Diff= -2.32, p= .003) and BMI (Diff= -1.03, p= .003). Both biomarkers showed a decreased in mean differences. The results for SBP (Diff= -.21, p= .807), HDL (Diff=- .69, p= .284), Total Cholesterol (Diff= .53, p= .727), TGL

(Diff=1.76, p= .544), LDL (Diff= 1.12, p= .420), Glucose (Diff= .82, p= .140) and insulin (Diff=.68, p= .295) were not significantly different (Table 11).

Table 11 Paired Samples Test for Obese Boys and Girls Visit 1 Vs. Visit 2

		Paired Differences					t	df	p
		Mean Difference	Std. Deviation	Std. Error	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	SBP	-.21	14.01	.88	-1.53	1.96	.24	248	.807
Pair 2	DBP	-2.32	12.11	.76	.81	3.84	3.03	248	.003*
Pair 3	BMI PERCENTILE	-1.03	4.44	.28	.48	1.59	3.68	248	.000*
Pair 4	TOTAL CHOLESTEROL	.53	26.59	1.54	-3.57	2.49	-.34	296	.727
Pair 5	TRIGLYCERIDES	1.76	49.81	2.90	-7.47	3.94	-.60	294	.544
Pair 6	HDL	-.69	11.18	.65	-.58	1.98	1.07	294	.284
Pair 7	LDL	1.12	23.86	1.39	-3.86	1.614	-.80	293	.420
Pair 8	GLUCOSE	.82	9.55	.55	-1.91	.27	-1.47	295	.140
Pair 9	INSULIN	.68	10.68	.65	-1.98	.60	-1.04	264	.295

(*) Significant Difference

Table 12 Paired Samples Test for Overweight Boys Visit 1 Vs. Visit 2

		Paired Differences					t	df	p
		Mean Difference	Std. Deviation	Std. Error	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	SBP	-1.31	9.74	1.64	-2.03	4.66	.79	34	.430
Pair 2	DBP	2.08	8.09	1.36	-4.86	.69	-1.52	34	.137
Pair 3	BMI PERCENTILE	-3.03	11.85	2.12	-1.31	7.38	1.42	30	.165
Pair 4	TOTAL CHOLESTEROL	-2.69	25.75	4.12	-5.65	11.04	.65	38	.518
Pair 5	TRIGLYCERIDES	-5.07	55.25	8.84	-12.83	22.98	.57	38	.570
Pair 6	HDL	-1.56	11.92	1.91	-2.30	5.43	.81	38	.418
Pair 7	LDL	218.99	1363.30	218.30	-660.92	222.93	-1.00	38	.322
Pair 8	GLUCOSE	2.80	7.29	1.15	-5.13	-.46	-2.42	39	.020*
Pair 9	INSULIN	1.91	6.06	1.02	-4.00	.16	-1.87	34	.070

(*) Significant Difference

The results observed in Table 12 with reference to overweight boys for visit 1 vs. visit 2 indicate that glucose (Diff=2.80, p=.020) showed a significant difference with a increase in mean difference. SBP (Diff=-1.31, p=.430), DBP (Diff=2.08, p=.137), BMI (Diff=-3.03, p=.165), Total Cholesterol (Diff=-2.69, p=.518), TGL (Diff=-5.01, p=.570), HDL (Diff=-1.56, p=.418), LDL (Diff=218.99, p=.322) and insulin (Diff=1.91, p=.070) were not significantly different.

The results observed in Table 13 with reference to obese boys for visit 1 vs. visit 2 indicate that HDL (Diff=-1.71, p=.021) showed a significant difference with a decrease in mean difference. While for DBP (Diff=-.39, p=.693), BMI (Diff=-.72, p=.074), SBP (Diff=.57, p=.638), Total Cholesterol (Diff=2.03, p=.326), TGL (Diff=5.96, p=.126) LDL (Diff=2.71, p=.136), glucose (Diff=1.14, p=.109) and insulin (Diff= 1.24, p=.174) were not significantly different.

Table 13 Paired Samples Test for Obese Boys Visit 1 Vs. Visit 2

		Paired Differences					t	Df	p
		Mean Difference	Std. Deviation	Std. Error	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	SBP	.57	13.95	1.21	-2.96	1.82	-.47	132	.638
Pair 2	DBP	-.39	11.38	.98	-1.56	2.34	.39	132	.693
Pair 3	BMI PERCENTILE	-.72	4.63	.40	-.07	1.52	1.80	131	.074
Pair 4	TOTAL CHOLESTEROL	2.03	25.57	2.06	-6.10	2.03	-.98	153	.326
Pair 5	TRIGLYCERIDES	5.96	48.11	3.87	-13.62	1.69	-1.53	153	.126
Pair 6	HDL	-1.71	9.11	.73	.26	3.17	2.33	152	.021*
Pair 7	LDL	2.718	22.41	1.81	-6.29	.86	-1.50	152	.136
Pair 8	GLUCOSE	1.14	8.85	.71	-2.56	.26	-1.61	153	.109
Pair 9	INSULIN	1.24	10.71	.91	-3.04	.55	-1.36	137	.174

(*) Significant Difference

No difference was found for overweight girls for visit1 vs. visit 2 for the following biomarkers SBP (Diff=-.08, p=.963), DBP (Diff=1.68, p=.394), BMI (Diff=-1.39, p=.301), Total

Cholesterol (Diff=-1.58, p=.587), TGL (Diff=-3.10, p=.673), HDL (Diff=-2.08, p=.188), LDL (Diff=154.13, p=.361), glucose (Diff=.82, p=.721) and insulin (Diff=2.41, p=.362). They were not significantly different (Table 14).

Significant difference was observed for DBP (Diff=-4.55, p=.394) and BMI (Diff= -1.38, p=.001). Both biomarkers showed a decreased in mean differences. The results for SBP (Diff=-1.12, p=.394), Total Cholesterol (Diff=-1.06, p=.644), TGL (Diff=-2.82, p=.515), HDL (Diff=.40, p=.714), LDL (Diff=-.60, p=.777), glucose (Diff=.46, p=.591) and insulin (Diff=.08, p=.930) were not significantly different (Table 15).

Table 14 Paired Samples Test for Overweight Girls Visit 1 Vs. Visit 2

		Paired Differences					t	df	p
		Mean Difference	Std. Deviation	Std. Error	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	SBP	-.08	12.80	1.90	-3.75	3.93	.04	44	.963
Pair 2	DBP	1.68	13.14	1.96	-5.63	2.26	-.86	44	.394
Pair 3	BMI PERCENTILE	-1.39	8.50	1.32	-1.29	4.07	1.04	40	.301
Pair 4	TOTAL CHOLESTEROL	-1.58	20.40	2.88	-4.21	7.37	.54	49	.587
Pair 5	TRIGLYCERIDES	-3.10	51.54	7.29	-11.55	17.75	.42	49	.673
Pair 6	HDL	-2.08	11.01	1.55	-1.05	5.21	1.33	49	.188
Pair 7	LDL	154.13	1182.74	167.26	-490.26	181.99	-.92	49	.361
Pair 8	GLUCOSE	.82	16.38	2.29	-5.43	3.78	-.35	50	.721
Pair 9	INSULIN	2.41	18.16	2.62	-7.68	2.86	-.92	47	.362

(*) Significant Difference

Table 16 results with reference to overweight boys and girls for visit 1 vs. visit 3 indicate that HDL (Diff=- 4.23, p=.037) showed significant difference with a decrease in the mean

difference. While SBP (Diff=2.25, p=.236), DBP (Diff=3.68, p=.152), BMI (Diff=-3.09, p=.288), Total Cholesterol (Diff=5.02, p=.172), TGL (Diff=7.79, p=.451), LDL (Diff=-7.79, p=.661), glucose (Diff=2.77, p=.060) and insulin (Diff=.50, p=.811) were not significantly different.

Table 15 Paired Samples Test for Obese Girls Visit 1 Vs. Visit 2

		Paired Differences					t	Df	p
		Mean Difference	Std. Deviation	Std. Error	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	SBP	-1.12	14.09	1.30	-1.47	3.71	.85	115	.394
Pair 2	DBP	-4.55	12.59	1.17	2.23	6.86	3.89	115	.000*
Pair 3	BMI PERCENTILE	-1.38	4.20	.38	.61	2.15	3.56	116	.001*
Pair 4	TOTAL CHOLESTEROL	-1.06	27.65	2.31	-3.50	5.64	.46	142	.644
Pair 5	TRIGLYCERIDES	-2.82	51.38	4.32	-5.73	11.37	.65	140	.515
Pair 6	HDL	.40	12.99	1.09	-2.55	1.75	-.36	141	.714
Pair 7	LDL	-.60	25.31	2.13	-3.60	4.81	.28	140	.777
Pair 8	GLUCOSE	.46	10.28	.86	-2.17	1.24	-.53	141	.591
Pair 9	INSULIN	.08	10.67	.94	-1.95	1.79	-.08	126	.930

(*) Significant Difference

Significant difference was observed for BMI (Diff=-1.78, p=.001) and glucose (Diff=1.62, p=.029. Were BMI showed a decrease and glucose an increase in mean difference. The results for SBP (Diff=2.07, p=.126), DBP (Diff=-.88, p=.457), Total Cholesterol (Diff=1.53, p=.518), TGL (Diff=-1.47, p=.758) HDL (Diff=-.13, p=.873), LDL (Diff=2.80, p=.203), and insulin (Diff=.44, p=.696) were not significantly different (Table 17).

Significant difference was observed for DBP (Diff=6.76, p= .008) and LDL (Diff=12.87, p= .009).Both biomarkers showed an increased in mean differences. The results for SBP (Diff=4.23, p= .078), BMI (Diff=-7.00, p= .206), Total Cholesterol (Diff=7.47, p= .162), TGL

(Diff= .89, p= .953), HDL (Diff= -4.10,p=.168), LDL (Diff=12.87, p= .009) glucose (Diff= .60, p= .611), and insulin (Diff=1.37, p= .143) were not significantly different (Table 18).

Table 16 Paired Samples Test for Overweight Boys and Girls Visit 1 Vs. Visit 3

		Paired Differences					t	Df	p
		Mean Difference	Std. Deviation	Std. Error	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	SBP	2.25	10.52	1.86	-6.04	1.54	-1.20	31	.236
Pair 2	DBP	3.68	14.18	2.50	-8.80	1.42	-1.47	31	.152
Pair 3	BMI PERCENTILE	-3.09	13.29	2.83	-2.80	8.98	1.09	21	.288
Pair 4	TOTAL CHOLESTEROL	5.02	21.03	3.60	-12.36	2.30	-1.39	33	.172
Pair 5	TRIGLYCERIDES	7.79	59.59	10.22	-28.58	13.00	-.76	33	.451
Pair 6	HDL	-4.23	11.33	1.94	.28	8.18	2.17	33	.037*
Pair 7	LDL	-7.79	102.77	17.62	-28.06	43.65	.44	33	.661
Pair 8	GLUCOSE	2.77	8.58	1.43	-5.68	.12	-1.94	35	.060
Pair 9	INSULIN	.50	11.58	2.08	-4.74	3.74	-.24	30	.811

(*) Significant Difference

Table 17 Paired Samples Test for Obese Boys and Girls Visit 1 Vs. Visit 3

		Paired Differences					t	Df	p
		Mean Difference	Std. Deviation	Std. Error	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	SBP	2.07	13.52	1.34	-4.75	.59	-1.54	100	.126
Pair 2	DBP	-.88	11.93	1.18	-1.46	3.22	.74	101	.457
Pair 3	BMI PERCENTILE	-1.78	4.80	.50	.77	2.78	3.53	90	.001*
Pair 4	TOTAL CHOLESTEROL	1.53	25.72	2.36	-6.22	3.15	-.64	117	.518
Pair 5	TRIGLYCERIDES	-1.47	51.43	4.77	-7.98	10.93	.30	115	.758
Pair 6	HDL	-.13	9.17	.84	-1.53	1.80	.16	117	.873
Pair 7	LDL	2.80	23.66	2.18	-7.13	1.52	-1.28	116	.203
Pair 8	GLUCOSE	1.62	8.03	.73	-3.07	-.17	-2.21	119	.029*
Pair 9	INSULIN	.44	12.00	1.14	-2.71	1.82	-.39	109	.696

(*) Significant Difference

Table 18 Paired Samples Test for Overweight Boys Visit 1 Vs. Visit 3

		Paired Differences					t	Df	p
		Mean Difference	Std. Deviation	Std. Error	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	SBP	4.23	9.27	2.25	-9.00	.53	-1.88	16	.078
Pair 2	DBP	6.76	9.14	2.21	-11.46	-2.06	-3.04	16	.008*
Pair 3	BMI PERCENTILE	-7.00	15.23	5.07	-4.71	18.71	1.37	8	.206
Pair 4	TOTAL CHOLESTEROL	7.47	22.31	5.11	-18.22	3.28	-1.46	18	.162
Pair 5	TRIGLYCERIDES	.89	64.89	14.88	-32.17	30.38	-.06	18	.953
Pair 6	HDL	-4.10	12.47	2.86	-1.90	10.11	1.43	18	.168
Pair 7	LDL	12.87	19.10	4.38	-22.08	-3.66	-2.93	18	.009*
Pair 8	GLUCOSE	.60	5.18	1.15	-3.02	1.82	-.51	19	.611
Pair 9	INSULIN	1.37	3.66	.89	-3.25	.51	-1.54	16	.143

(*)Significant Difference

Table 19 Paired Samples Test for Obese Boys Visit 1 Vs. Visit 3

		Paired Differences					t	Df	p
		Mean Difference	Std. Deviation	Std. Error	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	SBP	4.04	12.90	1.84	-7.74	-.33	-2.19	48	.033*
Pair 2	DBP	-1.34	11.22	1.60	-1.87	4.57	.84	48	.405
Pair 3	BMI PERCENTILE	-.60	2.68	.40	-.20	1.40	1.50	44	.141
Pair 4	TOTAL CHOLESTEROL	3.49	25.43	3.36	-10.24	3.25	-1.03	56	.305
Pair 5	TRIGLYCERIDES	5.62	46.90	6.26	-18.18	6.93	-.89	55	.373
Pair 6	HDL	-.03	9.47	1.25	-2.48	2.55	.02	56	.978
Pair 7	LDL	2.52	20.84	2.78	-8.10	3.05	-.90	55	.369
Pair 8	GLUCOSE	1.84	7.50	.98	-3.81	.12	-1.87	57	.066
Pair 9	INSULIN	1.67	9.76	1.32	-4.33	.99	-1.25	53	.214

(*) Significant Difference

The results observed in Table 19 with reference to obese boys for visit 1 vs. visit 3 show that SBP (Diff= 4.04, p=.033) significant difference with an increase in mean difference. While

DBP (Diff=-1.34, p= .405), BMI (Diff=-.60, p= .141), Total Cholesterol (Diff= 3.491, p= .305),. TGL (Diff=5.62, p= .373), HDL (Diff=-.03, p=.978), LDL (Diff= 2.52, p= .369), glucose (Diff=1.84, p= .066), and insulin (Diff=1.67, p= .214) were not significantly different

No difference was found for overweight girls for visit 1 vs. visit 3 for the following biomarkers SBP (Diff=-.00, p= 1.000), DBP (Diff=.20, p=.966), BMI (Diff=-.38, p= .907), Total Cholesterol (Diff=1.93, p= .708), TGL (Diff= 16.53, p= .247), HDL (Diff= -4.40, p=.115), LDL (Diff= -33.97, p=.407), glucose (Diff=5.50, p= .066) and insulin (Diff=-.56, p=.903) They were not significantly different (Table 20).

Table 20 Paired Samples Test for Overweight Girls Visit 1 Vs. Visit 3

		Paired Differences					t	Df	p
		Mean Difference	Std. Deviation	Std. Error	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	SBP	-.00	11.69	3.01	-6.47	6.47	.00	14	1.000
Pair 2	DBP	.20	18.04	4.65	-10.19	9.79	-.04	14	.966
Pair 3	BMI PERCENTILE	-.38	11.63	3.22	-6.64	7.41	.11	12	.907
Pair 4	TOTAL CHOLESTEROL	1.93	19.59	5.06	-12.78	8.91	-.38	14	.708
Pair 5	TRIGLYCERIDES	16.53	53.02	13.69	-45.89	12.83	-1.20	14	.247
Pair 6	HDL	-4.40	10.13	2.61	-1.21	10.01	1.68	14	.115
Pair 7	LDL	-33.97	152.02	39.25	-50.21	118.16	.86	14	.401
Pair 8	GLUCOSE	5.50	11.11	2.77	-11.42	.42	-1.97	15	.066
Pair 9	INSULIN	-.56	17.07	4.56	-9.29	10.42	.12	13	.903

(*) Significant Difference

The results observed in Table 21 with reference to obese girls for visit 1 vs. visit 3 show that only BMI (Diff= -2.93, p=.002) was significantly different with a decrease in the mean difference. While SBP (Diff= .23, p=.906), DBP (Diff=-.45, p= .795), Total Cholesterol (Diff=

-.29, p= .930), TGL (Diff=-8.10, p= .258), HDL (Diff=-.22, p= .842), LDL (Diff=3.06, p= .364), glucose (Diff=1.41, p= .196) and insulin (Diff= -.73, p=.693) were not significantly different

No difference was found for overweight boys and girls for visit 1 vs. visit 4 for the following biomarkers SBP (Diff=-4.60, p=.216), DBP (Diff=.80, p=.822), BMI (Diff=.40, p=.935), Total Cholesterol (Diff=12.63, p=.117), TGL (Diff=-15.81, p=.117), HDL (Diff=-2.00, p=.357), LDL (Diff=-34.49, p=.539), glucose (Diff=4.27, p=.054) and insulin (Diff=5.98, p=.068).They were not significantly different (Table 22).

Table 21 Paired Samples Test for Obese Girls Visit 1 Vs. Visit 3

		Paired Differences					t	Df	p
		Mean Difference	Std. Deviation	Std. Error	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	SBP	.23	13.95	1.93	-4.11	3.65	-.11	51	.906
Pair 2	DBP	-.45	12.64	1.73	-3.03	3.93	.26	52	.795
Pair 3	BMI PERCENTILE	-2.93	6.03	.89	1.14	4.72	3.29	45	.002*
Pair 4	TOTAL CHOLESTEROL	-.29	26.05	3.33	-6.37	6.96	.08	60	.930
Pair 5	TRIGLYCERIDES	-8.10	54.89	7.08	-6.08	22.28	1.14	59	.258
Pair 6	HDL	-.22	8.96	1.14	-2.06	2.52	.20	60	.842
Pair 7	LDL	3.06	26.17	3.35	-9.76	3.63	-.91	60	.364
Pair 8	GLUCOSE	1.41	8.54	1.08	-3.59	.75	-1.30	61	.196
Pair 9	INSULIN	-.73	13.81	1.84	-2.96	4.43	.39	55	.693

(*) Significant Difference

No difference was found for obese boys and girls for visit 1 vs. visit 4 for the following biomarkers SBP (Diff=-.205, p=.918),), DBP (Diff=.872, p=.658), BMI (Diff=-.9487, p=.078), Total Cholesterol (Diff=-2.0682, p=.680), TGL (Diff=3.7955, p=.751),), HDL (Diff=-.9773, p=.559) LDL (Diff=-.1389, p=.976), glucose (Diff=1.370, p=.276) and insulin (Diff=.365, p=.847).They were not significantly different (Table 23).

Table 22 Paired Samples Test for Overweight Boys and Girls Visit 1 Vs. Visit 4

		Paired Differences					t	Df	p
		Mean Difference	Std. Deviation	Std. Error	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	SBP	-4.60	10.93	3.45	-3.22	12.42	1.33	9	.216
Pair 2	DBP	.80	10.89	3.44	-8.59	6.99	-.23	9	.822
Pair 3	BMI PERCENTILE	.40	10.28	4.60	-13.17	12.37	-.08	4	.935
Pair 4	TOTAL CHOLESTEROL	12.63	24.44	7.36	-29.05	3.78	-1.71	10	.117
Pair 5	TRIGLYCERIDES	-15.81	63.88	19.26	-27.09	58.73	.82	10	.431
Pair 6	HDL	-2.00	6.87	2.07	-2.61	6.61	.96	10	.357
Pair 7	LDL	-34.49	179.74	54.19	-86.26	155.24	.63	10	.539
Pair 8	GLUCOSE	4.27	6.48	1.95	-8.62	.08	-2.18	10	.054
Pair 9	INSULIN	5.98	9.10	2.87	-12.49	.53	-2.07	9	.068

(*) Significant Difference

Table 23 Paired Samples Test for Obese Boys and Girls Visit 1 Vs. Visit 4

		Paired Differences					t	Df	p
		Mean Difference	Std. Deviation	Std. Error	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	SBP	-.20	12.34	1.97	-3.79	4.20	.10	38	.918
Pair 2	DBP	.87	12.20	1.95	-4.82	3.08	-.44	38	.658
Pair 3	BMI PERCENTILE	-.94	3.27	.52	-.11	2.01	1.80	38	.078
Pair 4	TOTAL CHOLESTEROL	-2.06	33.00	4.97	-7.96	12.10	.41	43	.680
Pair 5	TRIGLYCERIDES	3.79	78.76	11.87	-27.74	20.15	-.32	43	.751
Pair 6	HDL	-.97	11.00	1.65	-2.36	4.32	.58	43	.559
Pair 7	LDL	-.13	30.76	4.63	-9.21	9.49	.03	43	.976
Pair 8	GLUCOSE	1.37	8.42	1.24	-3.87	1.13	-1.10	45	.276
Pair 9	INSULIN	.36	11.86	1.87	-4.15	3.42	-.19	39	.847

(*) Significant Difference

Significant difference was observed for LDL (Diff=26.00, p=.048) with an increase in mean difference. While the results for SBP (Diff=-3.75, p=.625), DBP (Diff=4.00, p=.547), BMI

(Diff=-3.33, p=.691), Total Cholesterol (Diff=21.20, p=.054), TGL (Diff=-29.20, p=.503), HDL (Diff=1.20, p=.735), glucose (Diff=2.40, p=.305) and insulin (Diff=-.40, p=.833) were not significantly different (Table 24).

Table 24 Paired Samples Test for Overweight Boys Visit 1 Vs. Visit 4

		Paired Differences					t	Df	p
		Mean Difference	Std. Deviation	Std. Error	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	SBP	-3.75	13.81	6.90	-18.23	25.73	.54	3	.625
Pair 2	DBP	4.00	11.80	5.90	-22.78	14.78	-.67	3	.547
Pair 3	BMI PERCENTILE	-3.33	12.58	7.26	-27.92	34.59	.45	2	.691
Pair 4	TOTAL CHOLESTEROL	21.20	17.56	7.85	-43.01	.61	-2.69	4	.054
Pair 5	TRIGLYCERIDES	-29.20	88.86	39.74	-81.14	139.54	.73	4	.503
Pair 6	HDL	1.20	7.39	3.30	-10.38	7.98	-.36	4	.735
Pair 7	LDL	26.00	20.70	9.25	-51.70	-.29	-2.80	4	.048*
Pair 8	GLUCOSE	2.40	4.56	2.03	-8.06	3.26	-1.17	4	.305
Pair 9	INSULIN	-.40	3.96	1.77	-4.52	5.32	.22	4	.833

(*) Significant Difference

No difference was found for obese boys for visit 1 vs. visit 4 for the following biomarkers SBP (Diff=-1.90, p=.506), DBP (Diff=1.75, p=.524), BMI (Diff=.10, p=.867), Total Cholesterol (Diff=2.08, p=.797), TGL (Diff=.16, p=.990), HDL (Diff= -.12, p=.959), LDL (Diff=5.24, p=.494), glucose (Diff=.12, p=.951) and insulin (Diff=-1.56, p=.514).They were not significantly different (Table 25).

The results observed in Table 26 with reference to overweight girls for visit 1 vs. visit 4 show that only insulin (Diff=12.36, p= .029) was significantly different with an increase in the mean difference. SBP (Diff= -5.16, p= .261), DBP (Diff=-1.33, p=.774), BMI (Diff=6.00, p=.105), Total Cholesterol (Diff=5.50, p= .657), TGL (Diff=-4.66, p=.781), HDL (Diff=- 4.66,

p=.099), LDL (Diff=-84.90, p= .426) and glucose (Diff=5.83, p= .127) were not significantly different.

Table 25 Paired Samples Test for Obese Boys Visit 1 Vs. Visit 4

		Paired Differences					t	Df	p
		Mean Difference	Std. Deviation	Std. Error	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	SBP	-1.90	12.53	2.80	-3.96	7.76	.67	19	.506
Pair 2	DBP	1.75	12.06	2.69	-7.39	3.89	-.64	19	.524
Pair 3	BMI PERCENTILE	.10	2.63	.58	-1.33	1.13	-.17	19	.867
Pair 4	TOTAL CHOLESTEROL	2.08	39.24	8.01	-18.65	14.48	-.26	23	.797
Pair 5	TRIGLYCERIDES	.16	61.60	12.57	-26.17	25.84	-.01	23	.990
Pair 6	HDL	-.12	11.84	2.41	-4.87	5.12	.05	23	.959
Pair 7	LDL	5.24	37.00	7.55	-20.87	10.38	-.69	23	.494
Pair 8	GLUCOSE	.12	9.79	2.00	-4.26	4.01	-.06	23	.951
Pair 9	INSULIN	-1.56	10.48	2.34	-3.34	6.46	.66	19	.514

(*) Significant Difference

Table 26 Paired Samples Test for Overweight Girls Visit 1 Vs. Visit 4

		Paired Differences					t	Df	p
		Mean Difference	Std. Deviation	Std. Error	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	SBP	-5.16	9.98	4.07	-5.31	15.64	1.26	5	.261
Pair 2	DBP	-1.33	10.78	4.40	-9.98	12.64	.30	5	.774
Pair 3	BMI PERCENTILE	6.00	1.41	1.00	-18.70	6.70	-6.00	1	.105
Pair 4	TOTAL CHOLESTEROL	5.50	28.52	11.64	-35.43	24.43	-.47	5	.657
Pair 5	TRIGLYCERIDES	-4.66	38.92	15.89	-36.18	45.52	.29	5	.781
Pair 6	HDL	-4.66	5.64	2.30	-1.25	10.59	2.02	5	.099
Pair 7	LDL	-84.90	239.92	97.94	-166.88	336.68	.86	5	.426
Pair 8	GLUCOSE	5.83	7.80	3.18	-14.02	2.36	-1.83	5	.127
Pair 9	INSULIN	12.36	8.31	3.71	-22.68	-2.03	-3.32	4	.029*

(*) Significant Difference

The results observed in Table 27 with reference to obese girls for visit 1 vs. visit 4 show that only glucose (Diff=3.39, p= .014) showed significant difference with an increase in mean difference. While results for SBP (Diff=-.04, p= .987), DBP (Diff=-.36, p= .882), BMI (Diff= -1.28, p=.175), Total Cholesterol (Diff= -4.15, p=.400), TGL (Diff= 5.19, p=.762), HDL (Diff= -2.61, p= .162), LDL (Diff=-24.66, p= .280) and insulin (Diff=4.30, p= .106) were not significantly different.

Table 27 Paired Samples Test for Obese Girls Visit 1 Vs. Visit 4

		Paired Differences					t	df	p
		Mean Difference	Std. Deviation	Std. Error	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	SBP	-.04	11.90	2.38	-4.87	4.95	.01	24	.987
Pair 2	DBP	-.36	11.98	2.39	-4.58	5.30	.15	24	.882
Pair 3	BMI PERCENTILE	-1.28	4.18	.91	-.61	3.19	1.40	20	.175
Pair 4	TOTAL CHOLESTEROL	-4.15	24.74	4.85	-5.84	14.14	.85	25	.400
Pair 5	TRIGLYCERIDES	5.19	86.52	16.96	-40.13	29.75	-.30	25	.762
Pair 6	HDL	-2.61	9.24	1.81	-1.11	6.34	1.44	25	.162
Pair 7	LDL	-24.66	113.80	22.31	-21.29	70.63	1.10	25	.280
Pair 8	GLUCOSE	3.39	6.81	1.28	-6.03	-.74	-2.63	27	.014*
Pair 9	INSULIN	4.30	12.80	2.56	-9.58	.98	-1.68	24	.106

(*) Significant Difference

DISCUSSION

Education is an essential tool in order to enable the individual's comprehension of the relationship between obesity and health. The patient should be educated about obesity and the doctor should convey a full explanation about the complications and consequences that obesity may have on their health, as well as how to prevent it. The lack of education and information about obesity is likely to compromise the patient's ability to make choices about their nutrition and health.

When you compare the means for systolic blood pressure, diastolic blood pressure, total cholesterol, triglycerides, high density lipoprotein, low density lipoprotein, glucose, and insulin all are within normal margins (Tables 1, 2 and 3).

The comparison between overweight boys and girls from visit 1 vs. visit 2 showed that none of the variables were significantly different. The comparison between obese boys and girls together from visit 1 vs. visit 2 showed that only DBP and BMI supported the hypotheses proposed due to the fact that they showed a significantly decrease in their means. The comparison between overweight boys from visit 1 vs. visit 2showed that there was significant difference for glucose; however this was an increase in glucose. Meaning that the hypothesis tested was not supported. The comparison between obese boys from visit 1 vs. visit 2 showed that only HDL had a significantly difference, but the hypothesis was not supported by due to the fact that there was a decrease in HDL. The comparison between overweight girls from visit 1 vs. visit 2 showed that none of the variables were significantly different. On the other hand, obese girls from visit 1 vs. visit 2 showed significant decrease differences for DBP and BMI; supporting the hypotheses proposed.

The comparison between overweight boys and girls together from visit 1 vs. visit 3 showed that only HDL had significant difference, but there was a decrease in mean difference suggesting that the intervention had no effect on this biomarker. The comparison between obese boys and girls together from visit 1 vs. visit 3 showed a significant difference only in BMI and glucose. With these observations it can be concluded that the hypotheses proposed was only supported by BMI because it showed a decrease on mean differences, while glucose showed an increase in mean difference. The comparison between overweight boys from visit 1 vs. visit 3 showed that, there was only significant difference for variables DBP and LDL, but with an increase in the mean difference for both, meaning that the hypotheses proposed were not supported by these results. The comparison between obese boys from visit 1 vs. visit 3 showed that only SBP had a significant difference, but with an increase in the mean. With this observation it can be concluded that the hypothesis proposed was not supported by the result. The comparison between overweight girls from visit 1 vs. visit 3 showed that none of the variables were significantly different. On the other hand obese girls from visit 1 vs. visit 3 showed significant difference for BMI; supporting the hypothesis proposed because a decrease in mean difference was observed.

The comparison between overweight boys and girls from visit 1 vs. visit 4 did not show a significant difference in any of the variables as well as in obese boys and girls together from visit 1 vs. visit 4.The comparison between overweight boys for visit 1 vs. visit 4 showed that only LDL had significant difference, but with an increase in mean. The hypothesis was not supported by this result. The comparison between obese boys from visit 1 vs. visit 4 did not showed any significant difference at all in any of the variables tested. The comparison between overweight girls for visit vs. visit 4 only showed significant difference in insulin with an increase in mean

difference concluding that the hypothesis proposed was not supported by this result. On the other hand obese girls from visit 1 vs. visit 4 also showed significant differences only in one variables; glucose. With an increase in mean difference, the hypothesis tested was not supported for glucose result.

Other studies (2) indicate that there is a positive effect when parents and children have knowledge about the subject. The Division of Endocrinology and Metabolism from the department of pediatrics in Siriraj Hospital at Mahidol University conducted an investigation among obese children. The main purpose of the research was to educate participants and their parents about the causes, risk factors and health consequences caused by obesity, as well as to raise awareness of obesity related complications. The methods used in this research are similar to the ones used in this thesis. There were some tests performed including: an oral glucose tolerance test, blood pressure, lipid proteins and liver function, among many others, followed by an interview with the physician who provided information about the causes and complications of obesity, a healthy and active lifestyle, and healthy eating habits. Nine months later, group based sessions were held for them and their parents. In each session a topic was presented to them. There were 9 sessions designed with the purpose to inspire and motivate participants to adopt and adapt to a healthier lifestyle over a long term. A significant reduction of waist circumference, percentage weight for height, weight Z-score, BMI, and percentage total fat was observed in this research. These results are comparable to some of the results presented in tables 10to 27 related to BMI, and DBP. In our study there were significant differences for other biochemical characteristics such as glucose, insulin, SBP, DBP, BMI, HDL, and LDL. However, they did not support the hypotheses.

Another study (21) investigated the effect of physician's advice using a 3 year BRFSS data - a survey of health risk behaviors. The researchers focused in two basic ways to lose weight: 1) eat fewer calories and 2) exercise. The participants were divided into overweight and obese sample. The results unequivocally suggest a statistical significant effect of physician's advice to decreased weight; this result is comparable with the reduction in BMI that we observed for the comparisons observed from visit 1 vs. visit 2 and for visit 1 vs. visit 3.

CONCLUSION

The results of this research supports that a pediatrician intervention resulted in a reduction in the mean value of DBP and BMI for visit 1 vs. 2 and BMI for visit 1 vs. 3 and an increase of the mean difference for glucose and HDL for visit 1 vs. 2; glucose, HDL, DBP, LDL and SBP for visit 1 vs. 3; and LDL, glucose and insulin for visit 1 vs. 4. However, In general the results support that the mean values for the variables stayed the same. This means that the children's health did not deteriorate.

This study had limitations because it was a retrospective analysis. For future research a careful experimental design must be developed. It should include an adequate sample size, a control group and more than four doctor visits.

It is also recommended for children to do exercise like walking, running, swimming or practicing any kind of sport for at least 30 minutes a day at least 2 days a week. Drink at least 2 liters of water a day and try to have a low caloric balanced diet. Finally, it is recommended to attend periodically to physical examinations to the pediatrician, so children can be monitored in order to maintained a proper health or detect obesity.

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VITA

Patricia López
10113 Caballo Dr.
Laredo, TX 78045
Day/Evening Phone: 956-242-8590
Email: patricia_lopez08@hotmail.com

Education

- Universidad Autónoma de Guadalajara

Medico Cirujano- 2016/ Present

- Texas A&M International University

Master of Science in Biology – 2011/ Present

- Texas A&M International University

Bachelor of Science in Biology – 2011

- United High School

High School Diploma- 2007