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Prevalence of metabolic syndrome and associated cardiovascular risk factors in Guatemalan school children

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Abstract

Objectives—Guatemala is experiencing a nutritional and lifestyle transition. While chronic malnutrition is prevalent, overweight, obesity and chronic diseases have increased substantially in the country. This study was conducted to investigate the prevalence of metabolic syndrome and the associated cardiovascular risk factors in the pre-adolescent Guatemalan population.

Methods—A cross-sectional study was conducted among 302 Guatemalan children (8–13 years old) attending public and private schools in the Municipality of Chimaltenango. Demographic data and anthropometric and blood pressure measurements were collected. A blood sample was taken after an 8-hour overnight fast and analyzed for glucose, triglyceride and high-density lipoprotein cholesterol levels. The data were analyzed to identify factors associated with metabolic syndrome and with its components.

Results—The prevalence of metabolic syndrome in the study population was 2.0%. However, approximately 54% of the children had at least one component of metabolic syndrome, while none had four or five of the components. The three most prevalent risk factors were high triglycerides (43.4%), low HDL cholesterol (17.2%) and obesity (12.3%). Boys were more likely to be obese than girls and rural children were more likely to have higher triglyceride levels than urban children.

Conclusions—Although the prevalence of metabolic syndrome is low, the fact that majority of the children already have at least one component of metabolic syndrome is cause for concern since components of metabolic syndrome can continue into adulthood and increase the risk for chronic diseases later in life. Therefore, immediate action should be taken to address the problem.

Keywords

Cardiovascular risk factors; Guatemala; Mayan ancestry; metabolic syndrome; BMI

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Conflict of Interests

The authors declare that they have no conflict of interests.

Introduction

Guatemala has been experiencing a nutritional and lifestyle transition. While chronic malnutrition is prevalent (50% in children under 5 years); (1) there have been relatively recent substantial increases in overweight, obesity and chronic diseases, such as CVD and diabetes in the country (2–5). This morbidity profile has been named “the double burden” and has been described mostly in developing countries undergoing epidemiological transition. Obesity in childhood increases the risk of obesity during adulthood, and also increases the associated risks of developing cardiovascular disease, diabetes, hypertension, dyslipidemia, cancer, and/or psychological problems later in life (6–7).

According to the Guatemalan National Maternal Infant Health Survey (8), the prevalence of overweight or obesity in women of reproductive age using BMI was 38.9%. Studies in Guatemala have estimated the prevalence of hypertension in adults to be 8.7%, which is the highest of all the Latin American countries (5). Hypertension is one of five cardiovascular risk factors and the presence of any three is designated as metabolic syndrome. According to the National Cholesterol Education Program Adult Treatment Panel III 2007 (9), the five diagnostic traits of metabolic syndrome are: 1. Low high-density lipoprotein cholesterol (HDL); 2. High triglycerides; 3. Elevated blood pressure; 4. Glucose intolerance and 5. Obesity.

The rates of stunting reported among Guatemalan first grade primary school children in 2008 was 45.6% nationally and 53.9% and 40.3% for total and urban Chimaltenango (10). Although stunting is a problem that affects the entire Guatemalan population, significant disparity between Guatemala’s Ladino and indigenous population groups exists (11). In 1999, 43.2% of Guatemalan children under the age of five were stunted, compared to 70%–80% of the indigenous population (12–13). Available data suggest that the Guatemalan Maya are among the shortest people (11) and have the highest percentage of stunting in the World (2). Ironically, an association between stunting and overweight/obesity has been shown to occur in children and adults in populations undergoing nutrition transition in Latin America and elsewhere in the world (14). A link between stunting in childhood and abdominal fatness has been observed in Guatemala (15). In her paper Eckhardt explained that under nutrition and micronutrient deficiencies that result in stunting may result in metabolic adaptations that increase the risk for obesity and chronic diseases later in life (16). In adults, deficiencies in essential micronutrients such as folate and zinc and low fruit and vegetable intake, may increase the risk for chronic diseases such as cardiovascular disease, diabetes and cancer (16).

Therefore, we investigated the existence, and assessed the risk, of metabolic syndrome in school-aged children in Guatemala. Although the study subjects were not selected on the basis of their Mayan ancestry this study population was predominantly (75%) of Mayan ancestry.

Currently no standard diagnostic criteria of metabolic syndrome exist for children and adolescents. Different studies tend to use slightly different cut-off values for the factors in their estimates of prevalence (17). As a result a modified version of the NCEP ATP III

criteria is most commonly used for the diagnosis of metabolic syndrome in children and adolescents. Using these criteria, the prevalence of metabolic syndrome in a study of pre-pubertal Brazilian school children was found to be 9.3% (17), whereas a study of elementary school children in eastern Kansas in the United States of America found a prevalence of 5% (18). Metabolic syndrome in children is a major concern around the world because studies have shown that components of metabolic syndrome in children can continue into adulthood and increase the risk for developing chronic diseases such as cardiovascular disease, diabetes, hypertension, dyslipidemia, cancer, and psychological problems later in life (6–7). Despite these risks, research is still needed to study how widespread metabolic syndrome and its components are, especially in developing countries.

Very little is known about cardiovascular risk factors in children living in settings that are undergoing urbanization such as Chimaltenango, located in the central Highlands region of Guatemala. Thus, this study was designed to investigate the prevalence of metabolic syndrome and cardiovascular risk factors associated with metabolic syndrome among school children in a population of predominantly Mayan ancestry undergoing rapid urbanization.

Methods

A cross-sectional study was conducted among 8 to 13 year old school children attending public and private schools in the Municipality of Chimaltenango, Guatemala. Chimaltenango is located about 35 miles from Guatemala City and is accessible by a paved road. The entire municipality of Chimaltenango (urban and rural) has about 14,000 primary school students in the 1st to 6th grades; 55% are urban. The study included only 3rd to 6th grade students from 6 main schools in urban Chimaltenango. The study was presented to local school authorities and directors and their approval and support were obtained before contacting the children and their parents. Although the study subjects were not selected on the basis of their Mayan ancestry, approximately 75% of this study population was of Mayan ancestry. Mayan ancestry is based on the report/observation of whether the mother or a grandmother of a child wears typical Mayan clothing or speaks a Mayan language.

The purpose of the study was clearly explained to the children and they were asked for their assent to participate and given informed consent forms to take home for their parents to review and sign if they agreed to allow them to participate. No child participated unless their assent and parental consent were obtained. Participation in the study was voluntary and no incentives were provided. The Institutional Review Board of the University of Alabama at Birmingham, the Ministry of Education of Guatemala and the Comité de Ética Independiente de Hospital Roosevelt in Guatemala approved the study protocol prior to its implementation.

Three hundred and two children gave assent and returned signed parental consent forms and were enrolled in the study. The population assessed is estimated to correspond to about 90% of eligible children available in the 6 schools and about 10% of total school population of urban Chimaltenango. Therefore, the refusal rate in the study was 10% and the most common reason for refusal was fear of blood withdrawal. Following enrolment in the study, demographic data were collected from each student. Anthropometric measurements, such as

weight, height, waist circumference and blood pressure of the children were also taken. Experienced personnel carried out all measurements of all children using the same standardized procedures. Anthropometric and blood pressure measurements were carried out in duplicate and when an inconsistency between the first and second measurements was found (e.g. a difference greater 5 mmHg for blood pressure) a third measurement was carried out and the average of the closest two measurements was used. Weights of the children were measured while they were wearing light clothes and barefooted using a digital scale to the nearest 0.1 kg. Height was measured using the stadiometer seca 213 (Seca GMBH & Company, Hamburg, Germany), which is especially suitable for mobile use and for measuring children, to the nearest 0.1cm. Waist circumference was measured using a non-extensible tape. Body mass index (BMI) was used as an indicator of obesity because BMI was found to be associated with higher levels of the factors of metabolic syndrome later in life by the Bogalusa Heart Study (19).

BMI was calculated using the height and the weight of the children. World Health Organization growth reference charts were used to convert the BMIs to BMI-for-age z-scores (20). The children were then classified into the following categories: children with z-scores greater than 1 were considered overweight or obese; children with BMIs greater than or equal to the 95th percentile ($z = 1.64$) were considered obese; z-scores between -2 and 1 were considered normal and z-scores less than -2 considered thin and severely thin. The height and weight of the children were also converted into z-scores. Again using WHO cutoffs, children with height-for-age z-score less than -2 were classified as stunted while children with weight-for-age z-score less than -2 were classified as being underweight for their age.

Blood pressure was measured by trained medical personnel using a manual sphygmomanometer after children were seated and rested for about five minutes. The first and fifth Korotkoff sounds were recorded as the systolic and diastolic blood pressure respectively. Children with systolic and diastolic blood pressure at or above the 95th percentile based on the United States National Institutes of Health (NIH) pediatric blood pressure charts were classified as hypertensive.

Blood samples from the participants were also taken after an eight-hour over-night fast, stored at -70°C and transported daily for analysis at the research laboratory of the School of Pharmacy and Biological Sciences of the San Carlos University. The blood samples were analyzed for glucose levels, triglycerides and high-density lipoprotein cholesterol. Children with glucose levels at or greater than 100 mg/dL were deemed to have glucose intolerance. Triglycerides levels of at least 110mg/dL were classified as high and HDLC levels of ≥ 38 mg/dL were considered low.

Based on the anthropometric measurements and blood sample analyses, children with any three of the five conditions (low high density lipoprotein cholesterol, high triglycerides, elevated blood pressure, glucose intolerance and obesity) were considered to have metabolic syndrome:.

Statistical Analysis

Statistical analyses were conducted on the overall sample and then separately for boys and girls. Categorical variables were reported as counts and percentages while continuous variables were reported as means and standard deviations. The chi-squared or Fisher's exact tests were used to compare categorical variables while the t-test was used to compare the continuous variables. Multivariable logistic regression was used to identify the demographic and physical activity variables that were significantly associated with metabolic syndrome and also with its components. Six different models were run, with the six response variables being the presence or absence of metabolic syndrome and the five indicators of metabolic syndrome. Variables with p -value ≤ 0.10 in a bivariate model were included in the multivariable model. The explanatory variables were some of the demographic and physical activity variables. Odds ratios (OR) and the p -values for testing the significance of the variables in the model were obtained. All tests with a p -value less than or equal to 5% were deemed statistically significant and all analyses were done using SAS software version 9.2 (SAS Institute, Cary, NC).

Results

The demographic characteristics of the 302 school children by gender are shown in Table 1. Boys made up 47.7% of the sample while girls were 52.3% of the sample. The mean age, which was not significantly different between boys and girls, was 10.4 ± 1.2 years. More than half (52.3%) of the children were between the ages of 8 and 10 years and more than half (64.2%) were in the 4th to 6th grades. Most of the children came from the urban areas (72.5%) compared to the rural areas (27.5%). On average, each household had about four children and three adults. About half (48.7%) of the children's fathers and about 7% of mothers were skilled workers. The number of fathers in professional jobs was double that of mothers. Thus, an overwhelming majority of mothers (83.8%) compared to less than a quarter (23.2%) of fathers, were unskilled workers.

Table 2 shows the anthropometric measurements of the children by gender. Most of the children (94.7%) had normal weight for their age while about 70% had normal height for age. Thus, about 30% were stunted. Height and weight did not differ significantly between boys and girls, but BMI differed significantly ($p=0.02$). About 79% of girls compared to 69% of boys had normal BMI for their age. Approximately 31% of boys compared to 19% of girls were obese or overweight for their age. No boy was thin or severely thin, however 2% of girls were thin or severely thin. Boys and girls also had a significant difference in waist circumference ($p = 0.05$).

Table 3 shows the distribution of gender, weight-for-age, stunting and BMI groups by age category. The majority of the boys (58.33%) were between the ages of 8 and 10 while the majority of girls (53.16%) were between the ages of 11 and 13. The older children were more likely to have low weight for their age than the younger children, 6.94% vs. 3.8% and they were also more likely to have stunted growth than the younger children, 32.64% vs. 27.85%. Hardly any differences in BMI group categories for the two age groups existed. The table also shows that age was significantly different for boys and girls ($p=0.05$). However,

no significant difference existed between boys and girls with regard to low weight-for-age ($p=0.22$), stunting ($p=0.36$) and BMI group ($p=0.92$).

Table 4 shows the prevalence of metabolic syndrome and its associated cardiovascular risk factors, and the percentages of children who had any number of the risk factors by gender. Overall, the prevalence of metabolic syndrome was 2.0% with no significant difference between boys and girls ($p=0.3$). Almost 54% of all the children had at least one of the risk factors. The most prevalent risk factors were high triglycerides (43.4%), low HDL cholesterol (17.2%) and obesity (12.3%). More boys than girls had low HDL cholesterol (18.8% vs. 15.8%) or were obese (17.4% vs. 7.0%) while more girls than boys had high triglyceride levels (46.8% vs. 39.6%). High triglyceride ($p=0.91$) and low HDL cholesterol ($p=0.3$) levels did not differ significantly between boys and girls. However, obesity levels were significantly different between boys and girls ($p=0.004$). All the children who had metabolic syndrome were obese (16.2%).

Data on children's diet, level of activity and feelings about healthy foods are shown in Table 5. A marginally significant difference ($p = 0.08$) existed between boys and girls in the time they spent playing daily, with boys playing longer. Although the difference was not statistically significant, girls spent more time watching TV than boys. With regard to diet, more than 70% of the children reported that they were happy eating healthy foods like fruits and vegetables and drinking water. On average the children consumed about two servings of fruits and vegetables per day.

Table 6 shows the associations between metabolic syndrome, its five components and the following demographic and physical activity variables: gender, age (divided into 8–10 and 11–13 years), hours spent playing, hours spent watching TV, urban/rural location and number of children in the household. Hours spent playing and watching TV were dichotomized using their means of two hours and five hours, respectively. Of the explanatory variables, number of children in the household was the only significant predictor ($p=0.03$) of metabolic syndrome. With an additional child in the household, the odds of metabolic syndrome declined by 57%. Gender and number of children in the household were significant predictors ($p=0.01$) of obesity. The odds of boys being obese were 2.71 times that of girls and with an additional child in the household, the odds of obesity declined by 32%. Children from the rural areas had 78% higher odds of high triglycerides than children from the urban areas. Age group was a significant predictor ($p = 0.04$) of low HDLC. The odds of low HDLC for children in the 11–13 yr age group were 92% higher than for children in the 8–10 yr age group. None of the demographic or physical activity variables were found to be significant predictors of high levels of glucose or high blood pressure.

Discussion

Metabolic syndrome predicts total, cardiovascular, and coronary heart disease mortality (21). The prevalence of metabolic syndrome in this sample of Guatemalan school children was found to be 2.0%. This prevalence is closer to that of the 5.0% found for elementary

school children in eastern Kansas in the US (18), but much lower than the 9.3% found for pre-pubertal Brazilian children (17).

The finding that about 54% of all the children have at least one of the components of metabolic syndrome and none had four or five of the components is similar to the findings in the study by Dubose et al., who also found that 50% of elementary school children had at least one of the components of metabolic syndrome and none had five of the components (18). The fact that the majority of the children in our study had at least one component of metabolic syndrome indicates a burgeoning problem since studies have shown that even 1 or 2 components of metabolic syndrome in children can continue into adulthood (22,7) and increase mortality from cardiovascular and coronary heart disease (23–26). The high percentage of children with one or more risk factors can also be an indicator of problems with their parents. This is because findings in a study suggested that risk factors of CVD in children may identify increased risk of CVD among their parents (27). In a cross-sectional study conducted in seven urban Latin American populations the rates of metabolic syndrome were found to range from most prevalent in 27% in Mexico City to 14% in Quito. The rates for Barquisimeto, Santiago, Bogota, Lima and Buenos Aires were 26%, 21%, 20%, 18%, and 17%, respectively. For Guatemala, Gregory et al. found that the prevalence of metabolic syndrome was 17%, 24%, and 28% in agricultural-rural, nonagricultural-rural, and urban men, respectively and 44 and 45% in rural and urban women (28).

Our findings that high triglycerides and low HDL cholesterol were the most prevalent components of metabolic syndrome are in agreement with other studies (20, 27). In general, this population of children reported an average of less than two hours/week of play and more than four hours/week of watching TV. These data indicate a very sedentary life at this early stage of life and can be a risk factor for chronic diseases in adult life.

It is important to take into account that the presence of one or two risk factors of metabolic syndrome such as overweight or increased triglycerides in this population coexists with a high prevalence of short stature. Thirty percent of the children in this study were stunted. Although this rate of stunting is lower than the national percentage of 45.6%, or the 53.9% and 40.3% reported for total and urban Chimaltenango (10). However, this high rate of stunting in this young population is a marker of early malnutrition and even prenatal malnutrition, and has been shown to predispose individuals to the development of metabolic syndrome especially when exposed to high-risk factors such as sedentary lifestyles and poor diets (29). Our results can be explained by the fact that the study population is predominantly urban (72.5%). In the last decade, overweight has become highly prevalent in the Guatemalan adult population, mostly in the urban areas. The findings that 12% of this population living in areas under rapid urbanization is overweight or obese and 43% have high triglycerides highlight the high risk for this population to develop chronic diseases later in life.

Another significant finding of our study is that children in larger families were less likely to be affected by metabolic syndrome and obesity than children in smaller families. The reduced risk of metabolic syndrome with additional children in the family may indicate less financial resources available to purchase high fat/high carbohydrate, energy-dense processed

foods that contribute to the risk for metabolic syndrome. We also found that boys were more likely to be obese than girls. This is an unexpected result because our data show that on average, even though not statistically significant, girls spent less time playing and more time watching TV each week than the boys.

Since this is a predominantly urban population, in which agrarian chores are not a significant component of the physical activity, such chores do not explain differences across genders. These data would suggest that the boys have a more active lifestyle, which usually helps to prevent obesity. However, dietary factors may explain the higher obesity among boys and need to be investigated.

The odds of high triglycerides (TGs) were 78% higher for children from rural areas than from urban areas. High TGs are usually related with higher BMIs, high abdominal adipose tissue (subcutaneous and visceral) and high dietary intake of carbohydrates (30). Children in the rural areas, in addition to being more prone to greater BMI, are more exposed to high consumption of carbohydrates (including sucrose) from maize and legumes. These levels often exceed 60% of the level considered at higher risk for metabolic syndrome. The relatively monotonous diet of rural Guatemala is characterized by high consumption of tortillas made of maize, black beans and coffee with sugar, which typically provide a predominant source of energy as carbohydrates (40–70%). High TG in this rural population may reflect higher risk for metabolic syndrome later in life and would need to be studied in long-term studies.

Although the findings of this study reflect the situation in terms of prevalence of risk factors for metabolic syndrome in a predominantly Mayan ethnic population near metropolitan Guatemala City, our study likely reflects the situation of other urban settlements under rapid urbanization and modernization in the Western Highlands of Guatemala. However, other studies should be conducted in the same region with larger samples to record the nutrition trends and prevalence of factors of metabolic syndrome and to make recommendations for a larger population.

The main limitation of the study is the small sample size. We could possibly have seen statistically significant associations between some of the demographic and physical activity variables with some of the components of metabolic syndrome in a larger sample. Another limitation is that we did not collect information on the number of children from the same family that participated in the study, which could be a factor that contributed to obesity in the study.

The prevalence of metabolic syndrome found in this study for children in Chimaltenango may still seem to be relatively lower than that found in other countries. However, the lower prevalence of metabolic syndrome should not be a reason for lack of immediate action since the majority of children already have at least one component of metabolic syndrome (mostly overweight and high triglycerides), coexisting with short stature. The individual components of metabolic syndrome can be problematic if they get carried into adulthood. Therefore, we recommend that authorities put into place programs that will promote healthy eating and more active life styles, especially for children in rural areas. If it is not already the case, we

will recommend that school feeding programs make the effort to serve healthy foods to children for free or at subsidized rates. Nutrition and physical activity programs should be developed to target parents since the rates we have seen in the children may be pointing to problems with the parents. These programs should significantly impact and possibly reverse the trend toward metabolic syndrome and cardiovascular and other chronic disease problems in the future.

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Table 1

Demographic characteristics of the study population by gender

Variable	All n = 302	Boys n = 144	Girls n = 158	P value
Age	10.4 ± 1.2	10.3 ± 1.1	10.5 ± 1.2	0.11
Age Groups	n (%)			0.05
8–10	158 (52.3)	84 (53.2)	74 (46.8)	
11–13	144 (47.7)	60 (41.7)	84 (58.3)	
Number of Children in Household	3.8 ± 1.9	3.6 ± 1.7	3.9 ± 2.0	0.23
Number of Adults in Household	3.1 ± 1.8	3.2 ± 1.8	3.0 ± 1.8	0.45
Grade	n(%)			0.83
1 – 3	108 (35.8)	55 (38.2)	53 (33.5)	
4 – 6	194 (64.2)	89 (61.8)	105 (66.5)	
Location	n(%)			0.51
Urban	219 (72.5)	104 (72.2)	115 (72.8)	
Rural	83 (27.5)	40 (27.8)	43 (27.2)	
Father's Occupation	n(%)			
Professional	54 (17.9)			
Skilled	147 (48.7)			
Unskilled	70 (23.2)			
Dead/Sick/Traveled/No Response	31 (10.3)			
Mother's Occupation				
Professional	27 (8.9)			
Skilled	20 (6.6)			
Unskilled	253 (83.8)			
Dead/Sick/Traveled/No Response	2 (0.7)			

Table 2

Anthropometric measurements of the study population by gender

Variable	All n = 302	Boys n = 144	Girls n = 158	P value
Weight(Kg)	33.6 ± 9.1	34.3 ± 9.6	33.0 ± 8.7	0.24
Weight-for-Age n (%)				
Normal	286 (94.7)	139(96.5)	147(93)	0.21
Low	16 (5.3)	5(3.5)	11(7)	
Height (cm)	134.0 ± 8.9	133.6 ± 9.0	134.3 ± 8.9	0.47
Height-for-Age n (%)				0.08
Normal	211(69.9)	108(75)	103(65.2)	
Stunted	91(30.1)	36(25)	55(34.8)	
BMI(Kg/m ²)	18.5 ± 3.7	19.0 ± 4.4	18.0 ± 3.0	0.02
BMI-for-Age n (%)				
Normal	225 (74.5)	100 (69.4)	125 (79.1)	0.02
Obese or Overweight	74 (24.5)	44 (30.6)	30 (19.0)	
Thinness or Severe Thinness	3 (1.0)	0 (0)	3 (1.9)	
Waist Circumference (cm)	63.3 ± 10.0	64.5 ± 11.8	62.2 ± 7.9	0.05

Table 3

Distribution of gender, weight-for-age, stunting and BMI groups by age category

Variable	All	Age Groups		P value
		8–10	11–13	
	n = 302	n = 158	n = 144	
Gender	n(%)			0.05
Boys	144(47.68)	84(58.33)	60(41.67)	
Girls	158(52.32)	74(46.84)	84(53.16)	
Low Weight for Age	n(%)			0.22
No	286(94.7)	152(96.2)	134(93.06)	
Yes	16(5.3)	6(3.8)	10(6.94)	
Stunted Growth	n(%)			0.36
No	211(69.87)	114(72.15)	97(67.36)	
Yes	91(30.13)	44(27.85)	47(32.64)	
BMI Group	n(%)			0.92
Obese/Overweight	74(24.50)	40(25.32)	34(23.61)	
Normal	225(74.50)	116(73.42)	109(75.69)	
Thinness/Severe Thinness	3(0.99)	2(1.27)	1(0.69)	

Table 4

Metabolic syndrome indicators of schoolchildren in Guatemala by gender

Variable	All n = 302	Boys n = 144	Girls n = 158	P value
BMI	18.5 ± 3.7	19.0 ± 4.4	18.0 ± 3.0	0.02
BMI status (obesity) n(%)				0.004
< 95 th Percentile (Kg/m ²)	265 (87.8)	119 (82.6)	147 (93.0)	
95 th Percentile (Kg/m ²)	37 (12.3)	25 (17.4)	11 (7.0)	
Systolic blood pressure	99.9 ± 10.4	100.7 ± 10.4	99.1 ± 10.3	0.18
Diastolic blood pressure	63.5 ± 8.7	63.4 ± 9.2	63.6 ± 8.2	0.84
Blood pressure status n(%)				0.3
< 95 th Percentile (mmHg)	296 (98.0)	140 (97.2)	156 (98.7)	
95 th Percentile (mmHg)	6 (2.0)	4 (2.8)	2 (1.3)	
Triglycerides	113.6 ± 47.7	110.9 ± 48.9	116.2 ± 46.6	0.33
Triglycerides status n(%)				0.91
< 110 mg dL	171 (56.6)	87 (60.4)	84 (53.2)	
110 mg dL	131 (43.4)	57 (39.6)	74 (46.8)	
HDL Cholesterol	46.5 ± 9.1	46.2 ± 9.5	46.9 ± 8.8	0.53
HDLC Status n(%)				0.3
>38 mg dL	250 (82.8)	117 (81.3)	133 (84.2)	
38 mg dL	52 (17.2)	27 (18.8)	25 (15.8)	
Glucose	74 ± 10.4	75.5 ± 10.7	72.5 ± 10.0	0.01
Glucose Status n(%)				0.46
100 mg dL	297 (98.3)	141 (97.9)	156 (98.7)	
> 100 mg dL	5 (1.7)	3 (2.1)	2 (1.3)	
Metabolic Syndrome n(%)				0.3
Yes	6 (2.0)	4(2.8)	2(1.3)	
No	296 (98.0)	140(97.2)	156(98.7)	
Number of risk factors n(%)				
1	101(33.4)	43(29.9)	58(36.7)	
2	56(18.5)	31(21.5)	25(15.8)	
3	6(2.0)	4(2.8)	2(1.3)	
4	0(0.0)	0(0.0)	0(0.0)	
5	0(0.0)	0(0.0)	0(0.0)	

Table 5

Diet, exercise and feelings about healthy foods by gender

Variable	All n = 302	Boys n = 144	Girls n = 158	P value
Time Spent Playing (Hours/Week)	1.9 ± 1.5	2.0 ± 1.6	1.7 ± 1.3	0.08
Hours Played/Week n(%)				0.06
mean = 2	235(77.8)	106(73.6)	129(81.7)	
> mean = 2	67(22.2)	38(26.4)	29(18.4)	
Time Spent Watching TV(Hours/Week)	4.7 ± 5.3	4.4 ± 5.1	4.9 ± 5.4	0.44
Hours Watched TV/Week n(%)				0.46
mean = 5	297(98.3)	141(97.9)	156(98.7)	
> mean = 5	5(1.7)	3(2.1)	2(1.3)	
Regular Diet (Number of Portions/Day)				
Meat,Fish,Poultry,eggs,beans	1.5 ± 0.7	1.4 ± 0.7	1.5 ± 0.7	0.65
Dairy	1.6 ± 1.0	1.6 ± 0.8	1.7 ± 1.2	0.29
Fruits	2.1 ± 1.2	2.1 ± 1.3	2.1 ± 1.0	0.99
Vegetables	1.6 ± 0.8	1.6 ± 0.8	1.6 ± 0.8	0.58
Bread/Carbohydrates	1.7 ± 0.9	1.7 ± 1.0	1.7 ± 0.8	0.51
Feelings about healthy foods n(%)				
Fruits				0.89
Happy	238 (78.8)	113 (78.5)	125 (79.1)	
Unhappy	64 (21.2)	31 (21.5)	33 (20.9)	
Vegetables				0.98
Happy	220 (72.9)	105 (72.9)	115 (72.8)	
Unhappy	82 (27.2)	39 (27.1)	43 (27.2)	
Water				0.67
Happy	221 (73.2)	107 (74.3)	114 (72.2)	
Unhappy	81 (26.8)	37 (25.7)	44 (27.9)	

Table 6

Odds Ratios and p-values of effects for the association between metabolic syndrome (MS), its indicators, demographic and exercise factors

Metabolic Syndrome (MS) or MS Indicator	Gender (female)	Age Category (8–10 yrs)	Hours Played/Week (2hrs)	Hours Watched TV/Week (5hrs)	Urban/Rural (urban)	Number of Children
Referent						
MS	1.98(0.37)	4.24(0.09)	2.21(0.28)	2.41(0.24)	0.35(0.43)	0.43(0.03)*
Obesity	2.71(0.01)*	1.03(0.94)	0.93(0.86)	1.08(0.86)	0.42(0.10)	0.68(0.01)*
High Triglycerides	0.74(0.21)	1.57(0.06)	1.06(0.83)	0.77(0.38)	1.78(0.03)*	0.94(0.35)
Low HDLC	1.30(0.40)	1.92(0.04)*	1.17(0.66)	0.93(0.85)	1.76(0.09)	1.01(0.93)
High Glucose	1.80(0.42)	1.83(0.41)	0.24(0.27)	1.33(0.74)	0.26(0.30)	0.85(0.50)
High Blood Pressure	1.87(0.37)	0.72(0.63)	0.85(0.84)	1.08(0.93)	0.80(0.79)	0.88(0.58)

* Significant association (p<0.05)