Objective: to analyze the relationship between blood pressure levels, body mass index and dietary habits of children.

Method: cross-sectional study, with 126 children, in the age group of 6-12 years, of a private school in the municipality of Aracaju/SE, which responded to a questionnaire. The classification of nutritional status was defined by the BMI index /age and blood pressure, according to the VI Brazilian Hypertension Guidelines. The data were submitted to statistical analysis simple and multivariate analysis. The study was approved by the Ethics in Research, CAAE-0150.0.000.107-08.

Results: it was observed that 16.6% of prevalence of overweight; 18.2% of obesity; significant association between body weight and arterial hypertension; predominance of sweets consumption in the snacks. Conclusion: there was a high prevalence of overweight children with high blood pressure, which can be related to the frequent consumption of industrialized products, rich in calories and sodium. Descriptors: Child Health; Obesity; Hypertension; Nutritional Status.
Obesity is a serious chronic disease that, in recent years, suffered real revolution in concepts. Before understood as arising from the gluttony, lack of willpower, weakness of character or a result of a psychological disorder, now, had its pathophysiology bases clarified. It was then defined as a disease of genetic susceptibility, influenced by the environment, with metabolic mechanisms changed, favoring a positive energy balance and weight gain.¹

Excess weight is a risk factor for the onset of various diseases, proportionally increased to the accumulation of body fat. Among the most common diseases associated with obesity are: diabetes mellitus (obesity increases three times the chance of a person presenting this disease); systemic hypertension (the obese person has double the chances of becoming hypertensive); dyslipidemia, increased triglycerides and total cholesterol at the expense of LDL (bad cholesterol) and decrease in HDL (protective factor); orthopaedic problems and dermatological; sleep apnea (decreases productivity and increases the risk of accidents); some forms of cancer (colon, breast, prostate and ovaries); also, there is the occurrence of emotional problems and social, in which we highlight: discrimination, stigmatisation and difficulty of relationship with the opposite sex.²

The participation of schools and teachers in the learning process of healthy life habits is essential in combating overweight/obesity. In a study conducted in the city of Piracicaba (SP), it was observed that the motivation in relation to approach the theme nutrition education was associated positively the ability of teachers to innovate in teaching strategies; such as "garden teachings", “snacks” and “community educational fairs", which allowed for school apply the findings to their own advantage. However, even though it is evident the lack of discussions with students about the association of nutrition/food with physical activity. The results attest to the need for schools to better address the topics of food, nutrition and physical activity.³

As far as the school participation, family intervention becomes necessary for the encouragement of the practice of physical activity by the children and choice of healthy eating habits. Parents should encourage the child to exercise; however, respecting both the limitations such as the choice of activity that most pleases. Healthy eating habits have to be constructed within the family, by the example given by parents to children.¹⁴

Childhood obesity is manifested mainly by positive energy balance given by the consumption of foods with high caloric value and low nutritional quality associated with the sedentary lifestyle. In the last few decades, it appears that, due to lack of time the country, always busy with the work and the ease of obtaining of industrialized products, children tend to eat poorly, and to remain, in their free time, in front of the TV, playing video games, contributing to a sedentary lifestyle. As a result, these children tend to gain weight and become obese. In 2000, the number of children with excess weight, throughout the world, was of 45 million. The Brazilian rates ranging from 8% in the public schools, to 30%, in private.⁶⁶

The risk of childhood obesity causing bad repercussion in adult life is quite high. Childhood obesity is strongly associated with the development of coronary problems in adult life. In an American study with children of school age, the high BMI was a risk factor for increased mortality before the age of 55 years of age.⁷

The hypertension has ceased to be exclusivity of adults and it has become common among children and adolescents. It is estimated that on average 3% of individuals between 3 and 18 years of age have high blood pressure levels. In addition to the genetic traits of predisposition, risk factors associated with inadequate habits of life can lead to this disease. In this context, the excess weight in childhood is one of the main causes for hypertension.⁶ It is common knowledge that the arterial hypertension in childhood is a predictor of hypertension in adult life, that is, children and adolescents with blood pressure levels above the 90th percentile often become adults with hypertension.⁷⁸

Studies on the nutritional status of children in Sergipe Brazil are scarce or little known and this fact has motivated this study. Its importance is due to the large and growing number of overweight people, in particular children, which are the target audience of advertisements for sweets with high caloric value and low nutritional quality and activities that introduce the sedentary lifestyle. Furthermore, the conduct of research within the school and tool of extreme importance for the understanding of the dynamics of nutrition.

The knowledge about the eating habits, physical activity and blood pressure levels can subsidize prevention strategies of nutritional disorders in children, anchored in health education and nursing. In this sense, the study
of the variables that may interfere with the measures for the prevention of childhood obesity and its consequences. Therefore, this study aims to analyze the relationship between blood pressure levels, body mass index and dietary habits of children.

**METHOD**

Article prepared from the monograph << State health and nutrition in children in a private school >> submitted to the Nursing Department, Federal University of Sergipe/UFS. Aracaju-SE, Brasil. 2009. The monograph is part of the study << Pressure patterns and prevalence of asthma among schoolchildren in Aracaju, Brazil >>.

A cross-sectional, descriptive, field, developed in the period April to May 2008, in a private school in the city of Aracaju (SE), where they are enrolled 175 students. This school was selected to develop a nutritional education project, of its own initiative, with the children of the elementary school, including theoretical-practice classes and the dissemination of educational/informative material, involving the performance of nutritionists, teachers and parents of students.

The meeting was held with the teachers and parents and/or guardians in order to provide explanations on the research. The press release about the research and the end of Free and Informed Consent Form (ICF) were sent to parents and guardians to request formal authorization. With this, the sample included students who returned with the consent signed, totaling 126/175 (72%) children, aged 6 to 12 years.

A questionnaire was applied structured forms for each student, whose questions were adapted from a previously published study. The evaluation of the variety of food was made by the indication of the presence or not of the food in each meal and analyzed in accordance with the distribution recommended by the food guide pyramid.

To facilitate the analysis, the authors grouped foods from the food pyramid in: cereals, fruit, vegetables, meat and eggs, milk and dairy products, legumes, oils and fats. Were created even more four groups that are related to the industrialized products, they were; group of sweets (sugar, chocolate, filled cookie and candy), savory (pastel, drumstick, corn-based snacks, etc.), Sandwichs (ham, sausage, sausage, peperoni) and artificial drinks (soft drinks, chocolate, juices).

The second step involved the measurement of anthropometric measurements (weight and height) and blood pressure (BP); following recommendations from the literature. The weight (kg) was obtained only once, with the children using the least amount of clothing possible digital scale (PLENNA®) with accuracy of 100 g. They waived 350 g of the measure of body mass of children who at the time of the measurement were wearing jeans. This value was obtained by the average weight of two children's jeans. For the measurement of the stature of a stadiometer (SECA®), with millimeter precision, was affixed to a wall surface without baseboard and a 90° angle to the floor. The measurement was performed twice with the children barefoot and with the neck, the buttocks and heels touching the wall. The average value of the two measurements was used in the analyses. The date of birth of the children was recorded from the record of enrollment in the school.

For the classification of nutritional status, the index BMI/age was used. The classification by percentile was adopted, with the following cut-off points: low weight for percentile < 3; eutrophy to percentile > 3 and < 85; overweight risk for percentile ≥ 85 and < 97; and overweight percentile ≥ 97.

The value of the BP was estimated from the average of three measurements with a minimum interval of 30 seconds, in the sitting position, with the right upper limb at the time of the right atrium, after a rest of at least 5 minutes. A sphygmomanometer duly calibrated was used according to the rules and standards of the National Institute of Metrology Standardization and Industrial Quality (Inmetro). It had an inflatable compression pressure gauge bracelet corresponding to 40% of the arm circumference, length of scholarship involving 80-100% of the individual's arm cuff (7 cm for children aged 5 to 8 years and 9.5 cm for children aged 8 to 14 years), rubber bulb and stethoscope for pediatric use.

The average value of the BP measurements was analyzed in accordance with the table of values of BP for percentiles 90 and 95 for gender, age and height. Being considered as cut-off points: normal, for systolic blood pressure (SBP) and diastolic blood pressure (DBP) < p 90; borderline between percentiles 90 and 95; and hypertension when above the level relative to the 95th percentile.

The Epi-info software, version 6.0, was used for the storage and analysis of data. The descriptive statistics were averages (μ), standard deviation (dp) and frequency percentage (%). The Pearson's Chi-square test
was used to evaluate the level of association between the variables tested. Differences were considered significant when \( p < 0.05 \).

The research protocol was approved by the Ethics Committee for Research Involving Human Beings of HU/UFS, because it meets the determinations of CNS resolution No.196/96 (CAAE - 0150.0.000.107 - 08).

**RESULTS AND DISCUSSION**

Study participants were 126 (one hundred and twenty-six) children, there were 52 (41.9%) were female and 74 (58.1%) were male, aged between 6 and 12 years of age, who were enrolled in the 2nd and 5th year, and is more frequently than students in year 4 (38.9%). The most affected age group was 7 to 10 years.

The overall prevalence of overweight was 16.6% and obesity in 18.3%. Girls had higher percentage of overweight (23.1%), while, in boys, obesity was more common (25.7%) (Tab. 1).

### Table 1. Nutritional status of children aged 6 to 12 years of age, according to BMI for age and gender, in a private school. Aracaju, SE, 2008.

<table>
<thead>
<tr>
<th>Nutritional Status (BMI/age)</th>
<th>Boys</th>
<th>Girls</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low weight</td>
<td>2</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Eutrophic</td>
<td>44</td>
<td>34</td>
<td>78</td>
</tr>
<tr>
<td>Overweight</td>
<td>9</td>
<td>12</td>
<td>21</td>
</tr>
<tr>
<td>Obesity</td>
<td>19</td>
<td>4</td>
<td>23</td>
</tr>
<tr>
<td>Total</td>
<td>74</td>
<td>52</td>
<td>126</td>
</tr>
</tbody>
</table>

According to Table 2, the majority of children without excess weight (63.4%) also had high pressure. The reverse situation occurred in students with weight above the recommended, of which 65.9% had hypertension. We detected that the hypertension was present in almost half of the sample, 59/126 (46.8%) children, and 36/126 (28.6%) boys and 23/126 (18.2%) girls (Tab. 2).

### Table 2. Association between nutritional status and blood pressure in children from 6 to 12 years of age, in a private school. Aracaju, SE, 2008.

<table>
<thead>
<tr>
<th>Blood Pressure</th>
<th>Nutritional Status</th>
<th>Without excess weight</th>
<th>With excess weight</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td>Without SAH</td>
<td>52</td>
<td>63.4</td>
<td>15</td>
<td>34.1</td>
</tr>
<tr>
<td>With SAH</td>
<td>30</td>
<td>36.6</td>
<td>29</td>
<td>65.9</td>
</tr>
<tr>
<td>Total</td>
<td>82</td>
<td>100.0</td>
<td>44</td>
<td>100.0</td>
</tr>
</tbody>
</table>

The data showed that the excess weight is associated with the development of hypertension and who do not have excess weight can be regarded as a protective factor against hypertension in these children (Tab. 2). We evaluated also the variety of the consumption of different food groups in main meals and the data were presented in accordance with the order of higher frequency of consumption (Tab. 3). It was found that at breakfast, the first three groups most often cited were “cereals”, “milk and derivatives” and “fruit”, however there was also the presence of the group “sweet” (4th) and “artificial drinks” (5th). With regard to lunch and dinner, there was the presence of any of the groups of industrialized food among the five most frequent (Tab. 3).

In relation to snacks (data not presented in table), the food group more frequent was the “sweet” (54.0% in the morning and 51.6% afternoon), mainly, filled cookies. There was no difference in the order of frequency of food consumption between the morning and afternoon snacks: “Fruit” (2nd), “cereals” (3rd), “dairy products” (4th) and “artificial drinks” (5th). It is, also, the fact that the majority of children (83.2%) reported taking the school snack from home.

**Table 3. Foods consumed by children aged 6 to 12 years of age, the main meals, in a private school. Aracaju, SE, 2008.**
Despite the high percentage of children with overweight and obesity found in this study, it was observed that was proper practice of sports. Only 31.0% of the children did not practice physical activity. Of the total, 69.0% used at least twice a week, being more frequently; swimming, rhythmic gymnastics and soccer.

The games preferred by respondents in this study were those considered low energy expenditure as a computer game, doll and stroller (73.8%). The site most used for completion of the meals was in front of the TV, which accounted for almost half of all responses (48.4%). The study addressed the knowledge that the children had on healthy nutrition. The association for the consumption of healthy foods, such as fruit and vegetables, in addition to the rice and beans, the responses were more frequent among children (83.3%).

The results show that overweight and obesity were relevant. The prevalence of overweight in children in this study was 37.8% in boys and 30.7% in girls, a percentage above that found in the literature; the example of Sorocaba, SP, Brazil where the rate of weight above the recommended among children 7-11 years was 22%. Data on the prevalence of childhood obesity show that in Midwest region, with overweight in 18.7% of girls and 10.5 % of boys.15 in the South, the prevalence of overweight reached 22%.  

It is believed that the small sample size of this study may have overestimated the percentage. However, these results will meet the activities developed in the school used as study environment. The students of this institution are offered disciplines that address nutrition and healthy eating practices, with the aim of reducing the prevalence of excess weight. Revealed a high prevalence of hypertension in the children studied, affecting half of the sample, which can cause the early onset of atherosclerosis and left ventricular hypertrophy (LVH) in adulthood, these being strong independent risk factors for mortality.  

<table>
<thead>
<tr>
<th>Order of consumption</th>
<th>Breakfast</th>
<th>Lunch</th>
<th>Dinner</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st</td>
<td>Cereals (bread)*</td>
<td>Cereals (rice, noodles)</td>
<td>Cereals (cassava, Yam, noodles)</td>
</tr>
<tr>
<td>%</td>
<td>65.9</td>
<td>99.2</td>
<td>94.4</td>
</tr>
<tr>
<td>2nd</td>
<td>Milk and dairy products</td>
<td>Meat and Eggs (beef, chicken and fish)</td>
<td>Meat and Eggs (beef and chicken)</td>
</tr>
<tr>
<td>(cheese, yogurt)</td>
<td>59.5</td>
<td>92.9</td>
<td>51.6</td>
</tr>
<tr>
<td>3rd</td>
<td>Fruits and juices (passion fruit, orange and apple)</td>
<td>Legumes (beans)</td>
<td>Milk and dairy products (milk and yoghurt)</td>
</tr>
<tr>
<td></td>
<td>31.7</td>
<td>81.0</td>
<td>39.7</td>
</tr>
<tr>
<td>4th</td>
<td>Sweets (milk biscuits)</td>
<td>Vegetables (salads)</td>
<td>Legumes (soup)</td>
</tr>
<tr>
<td></td>
<td>26.2</td>
<td>32.5</td>
<td></td>
</tr>
<tr>
<td>5th</td>
<td>Artificial Drinks (chocolate, mixed juices)</td>
<td>Fruits and juices (passion fruit and orange)</td>
<td>Oil and fats (butter)</td>
</tr>
<tr>
<td></td>
<td>18.3</td>
<td>18.3</td>
<td>15.1</td>
</tr>
</tbody>
</table>

* In parentheses, the most consumed foods in each group.

Excess body mass is a predisposing factor for arterial hypertension, which may be responsible for 20% to 30% of the cases.13 The early detection of arterial hypertension in children, as well as the appropriate intervention is required to reduce the morbidity and mortality.7,17 Childhood obesity and explained, many times, by eating habits and the children’s physical activity level. With respect to the dietary habits in the intervals between meals, has been seen in studies a high consumption processed foods such as candy, chips, sausages and soft drinks.14,17

In this study, sweets (mainly filled cookies) and artificial drinks (chocolate, soft drinks and fruit juices artificial) were among the five groups most frequently consumed, in the morning and afternoon snacks. In addition, fruit, cereals and dairy products were the other groups most often cited, showing that there is an enhancement of these foods as options for snacks, probably arising from the activities of nutrition developed by the school.

The São Paulo experience with elementary school students, in which we applied nutrition education content, demonstrated that when the topic of “food and nutrition” is incorporated into the planning of lessons, this allows students to apply learning for their own sake of health3. However, for that these experiences are incorporated into the habits of the lives of children and it is necessary that the family, as well as the school, be an active agent in the process of training.3,5

When we analyzed the main meals, lunch was the best meal that presented a variety of foods. The first five food groups cited are in accordance with the recommended by the distribution of the food pyramid.10 At dinner, predominated food sources of proteins (meat and eggs, milk and dairy products and legumes). These foods when consumed in excess can contribute with higher total calorie consumption.10 There is controversy about the effects of calcium on iron absorption, however, a Chilean study showed that high doses of calcium may impair intestinal absorption of iron (heme and non-heme).
which can occur when there is excessive consumption of dairy and meat. 18

In relation to the practice of sports, the majority of children were performing physical activities at least twice per week, being that, around 18%, practiced sports three or more times per week. In a similar survey, 57% of the children had physical activity and, in the same way that the present study, there was no association with obesity. 20 In the study in Vitória de Santo Antônio (PE), 70% of teenagers practiced physical activity, but these, contradictorily, presented five times increased risk of being obese compared to sedentary. 21

In this study, there was a preference for activities that require little physical effort, which could contribute to a sedentary lifestyle. However, as the majority of the students practiced sports, it is presumed that the sedentary lifestyle is not a predisposing factor for excess weight. In Sorocaba, SP Brazil only 27% of the respondents habitually practiced sports, while 60% said they spend more than two hours per day in front of the TV. It was found, in this case, that half of the students were sedentary, but with weight within recommended range. 14

Another factor that may be related to obesity and the realization of meals in front of the TV (48.4%), which characterizes an act detrimental to health, since children attentive to TV do not control the amount of food ingested. In the children from São Paulo, subjected to verification of calorie expenditure, 63.1% ate meals in front of the TV and ate cookies, savory snacks and soft drinks during these periods, although the fruits, juice and bread had a prominent role in child preference. 9

The lack of knowledge about basic concepts of healthy eating and commonly reported as a factor contributing to poor eating habits. 20 However, in this study, the majority of children reported good level of knowledge on this subject, in concordance with the São Paulo study, which identified appropriate level of knowledge about nutrition even in obese children. 20

In order to achieve a satisfactory result in changes in lifestyle and adoption of healthy eating practices, it is recommended that health education actions are guided in the exchange of experiences and not the simple transfer of information as an isolated method of health education. 22

**CONCLUSION**

The qualitative assessment of food options in different meals showed positive characteristics for lunch and dinner, but breakfast and snacks occurred the frequent presence of industrialized products.

The occurrence of these types of foods in the diet of children may have contributed with high prevalence of overweight and hypertension, possibly by promoting a consumption rich in calories and sodium.

It is necessary to conduct studies that assess the amount of food eaten mainly industrialized products and the energy expenditure of daily activities. These data together will estimate more precisely the energy balance of these children.

This study confirmed the importance of nutrition education, contemplating both eutrophic children as the overweight/obesity, highlighting the importance of a healthy diet is varied and working concepts of quantities. Nutrition education should propose the collective construction of knowledge, through planning participatory teaching with integration between the healthcare team, the school, the child and the family.

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