

Bmi Of Adolescents And Correlation Between School Meals And Obesity

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Joab Oliveira Salomão

Universidade do Estado de Minas Gerais – UEMG,
Unidade Passos – MG, Brasil.

Jônatas Queiroz Ramos

Universidade do Estado de Minas Gerais – UEMG,
Unidade Passos – MG, Brasil.

Hallaf Maxwell dos Santos

Universidade do Estado de Minas Gerais – UEMG,
Unidade Passos – MG, Brasil.

Thaís Helena Veloso Soares

Curso de Medicina. Universidade do Estado de Minas
Gerais – UEMG, Unidade
Passos – MG, Brasil.

Rene Jesus De La Torre Acosta

Prefeitura Municipal de Lagoa Grande – PE, Brasil.

Maria Olímpia Ribeiro do Vale Almada

Universidade do Estado do Mato Grosso-UNEMAT,
Cáceres-MT, Brasil.

1 INTRODUCTION

Food is directly related to the individual's health and quality of life. Food consumption is affected by prices, quantity and availability of food, income among other factors (Almeida, Almada, 2017).

An increase in the prevalence of overweight and obesity and a decrease in the occurrence of malnutrition in Brazil and an increase in chronic noncommunicable diseases (NCDs) are currently observed (Brazil, 2012). According to Ferreira and Aydos (2010), NCDs encompass a number of diseases. Diseases such as diabetes, cancers, and cardiovascular diseases are responsible for 59% of all deaths officially known worldwide and have obesity as a common risk factor.

Obesity in childhood and adolescence is assessed as a growing global Public Health problem, affecting children of diverse ages, gender, ethnicity and family income (Tenorio, Cobayashi 2011). It is the strongest risk factor for obesity in adulthood (Starc, Strel, 2010). The adolescent period is considered an

ABSTRACT

Body mass index of adolescents and correlation between school feeding and obesity.

The aim of the study was to evaluate the nutritional status and the correlation between school feeding, obesity and eating habits of students at a public school in the state of Minas Gerais. Nutritional status was assessed using the Body Mass Index (BMI), which was classified in the BMI curves for age of the World Health Organization (WHO). To evaluate the food consumption were used the the Food Frequency Questionnaire (FFQ), which is one of the most used methods in epidemiological studies. The data was analyzed using the NUT WIN® Software. the student t test was performed for variables with normal distribution, and the Mann Whitney test for variables without normal distribution, where $P < 0.05$ was considered statistically significant. this research showed that School Meals together with the diet can contribute to weight gain, overweight and obesity.

Keywords: Obesity, Adolescents, School feeding.

important period of physical growth and many biological, behavioral, and environmental factors can influence weight and body composition (Kalantari, 2017).

Exogenous causes account for 95% of global obesity cases, the main ones being: the increased availability and intake of hyperlipidic foods; the change from active to sedentary lifestyles; and increased portion sizes (Santos et al., 2017). Such a situation can be observed both in developed countries, such as in the United States, where there is notably a high incidence of obesity, following the example of developing countries in Latin America, which tend to follow the same epidemiological profile (Starc, Strel 2010).

In Brazil, according to the Pesquisa de Orçamentos Familiares (POF) 2008/2009, the frequency of overweight has practically tripled in the last 20 years in school-age children and adolescents. In this context, the National School Nourishment Program (PNAE) is the largest in the country and in the world with this purpose. It aims to contribute to the biopsychosocial growth and development, learning, school performance, and the formation of healthy eating practices through food and nutrition education actions, and the provision of meals that cover their nutritional needs during the school term (FNDE, 2017).

The preparation of school menus and implementation of the program should be done by trained nutritionists, with the participation of the School Meals Council - CAE (Ministério da Educação, 2018). Other mandatory attributions of the professional include: diagnosis of the nutritional status of students; planning, preparation, training of human resources; hygienic and sanitary quality control; coordination and implementation of actions of food and nutrition education (EAN), among others (CFN, 2010).

The school meals menu should cover at least 15% of the daily nutritional needs of regular school students. This means, for example, for students from 5th to 8th grade in regular education, there is an average need of 350 calories (FNDE/CD Resolution No. 32, art. 14)

The objective was to evaluate the correlation between school meals, obesity and eating habits of students in a public school in the municipality of Passos - Minas Gerais.

2 MATERIALS AND METHODS

This is a descriptive cross-sectional observational study. The sampling design adopted was non-probabilistic by convenience. The study was carried out with students from a public school in the municipality of Passos, Minas Gerais. Adolescents from the 9th grade of elementary school to the 3rd year of high school, clinically stable, who were between 14 and 18 years old, and authorized by parents or guardians. Individuals under supervised diet for weight reduction or gain, or any other type of diet, were excluded from the investigation, as well as any individual with a previously diagnosed disease.

The number of participants was based on probability sampling, using 95% confidence and 5% margin of error. The students were selected alternately between the classrooms, which at the study site are divided into "A" and "B".

The research procedures were carried out in three stages: anthropometric assessment, application of a food frequency questionnaire, and quantification of the portions served in the school meals. Nutritional

status was assessed by BMI. The adolescent participants were classified according to WHO reference (WHO, 2006).

Height and weight were measured following the procedures detailed by Jelliffe (1968) and World Health Organization (1995). Portable electronic scales and Alturaexata® anthropometry were used. The equipment was properly checked and calibrated every day of field work.

The Food Frequency Questionnaire (FFQ) was used to measure food consumption. It consists of a list of the most commonly consumed foods or foods that form the dietary pattern of a given population, in which the habitual frequency of consumption over a predetermined period is recorded, and may also include specifications of an average portion consumed (Ferreira, 2010). The 3-day food diary was adopted, but adherence was not obtained.

For quantification of the menu, the menus and technical sheets of all preparations offered to students by the state school network were analyzed at the school, which provided per capita information about all ingredients and their quantities. Subsequently, these quantities were tabulated in the Nutrition Software NUT WIN®, extracting the macro nutrient information (proteins, carbohydrates and lipids).

Data entry of food intake data was done in duplicate to ensure correct entry. Prior to data entry, all information was reviewed for errors in the description of foods or preparations consumed, as well as portion size and quantity. The nutritional value of the foods was acquired, for macronutrients and micronutrients.

All statistical analyses related to the nutritional data of the offered diet were performed in a proprietary program developed in Python 3.7.3 language using the Pandas 0.24.2 library. The *student* t-test was applied for variables with normal distribution. The Mann Whitney test for variables without normal distribution. $P < 0.05$ was considered statistically significant. Logarithmic transformations were used to compare nutrient intake data.

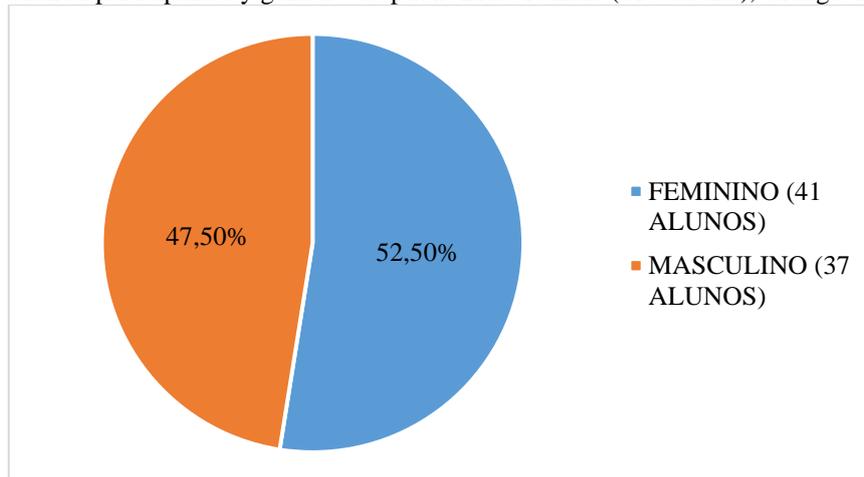
The percentage of calorie intake from carbohydrates, proteins, and lipids was evaluated using Student's t-test, analysis of variance, or the corresponding non-parametric test when non-compliance with any of the assumptions was observed.

The work as well as the Terms of Consent and Informed Consent followed the ethical criteria for research with human beings. It was explained to the participants and their parents or legal guardians that they should give written informed consent to participate (Term of Consent). Each adolescent provided consent, both verbally and in writing (Term of Consent).

3 RESULTS

One hundred and sixty-six students participated in the study, of these, 58 were excluded for not answering the questionnaire completely. Thus, the final sample of the study included 78 participants, of which 41 were female and 37 male (Graph 1).

Graph 1: Distribution of participants by gender – Caption: Blue: Female (41 students), Orange: Male (37 students)



The average age of the students was 15.6 years, ± 1.3 . The minimum and maximum ages were limited from 14 to 18 years, respectively the ages of 14, 16, and 17 years at the 25%, 50%, and 75% cutoff points.

The average weight was 62.53 kilograms, ± 15.08 . The weights were limited to 36.7 and a maximum of 108 kilograms. For the quartiles of 25%, 50% and 75% the values were 52.7, 60.7, and 69.4 kilograms. For height, the mean was 1.69 meters ± 0.1 , with values ranging from 1.52 to 2.1 meters.

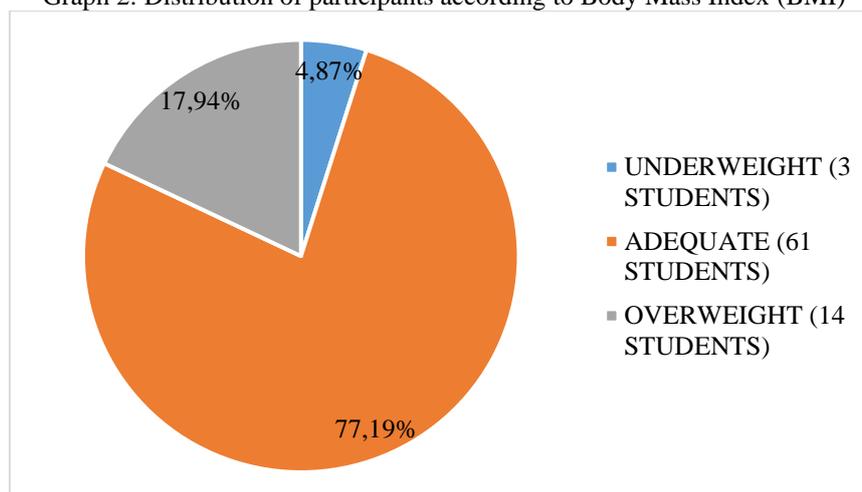
From the weight and height data, the Body Mass Index (BMI) was calculated, which averaged 21.5 Kg/m^2 (Adequate), ± 4.1 with minimum and maximum values between 13.2 and 36.6 Kg/m^2 respectively, as seen in table 1.

Table 1. Weight, height and BMI values with mean, standard deviation, minimum, maximum, and quartiles of the participants.

| Variables | Weight (kilograms) | Height (meters) | BMI (kg/m^2) |
|--------------------|--------------------|-----------------|-------------------------|
| Average | 62,53 | 1,69 | 21,50 |
| Standard Deviation | 15,08 | 0,10 | 4,12 |
| Minimum | 36,70 | 1,52 | 13,28 |
| 25% | 52,70 | 1,64 | 18,59 |
| 50% | 60,75 | 1,68 | 21,13 |
| 75% | 69,47 | 1,75 | 23,10 |
| Maximum | 108,00 | 2,10 | 36,60 |

For the diagnosis according to the Body Mass Index (BMI), it was observed that most participants, $N=61$ (78.20%), with an adequate nutritional status, 4.87% ($N=3$) underweight, and 17.94% ($N=14$) overweight (Graph 2).

Graph 2: Distribution of participants according to Body Mass Index (BMI)



According to the Food Frequency Questionnaire (FFQ), the mean amount of macronutrients (Protein, Carbohydrates, and Lipids) was 88.14; 223.43, and 88.02 grams, respectively. In this questionnaire we also arrived at the amount of Calories (kcal) ingested by the participants, with the mean value of 2039.58 grams, and standard deviation of 244.69 grams (Table2).

Table 2 - Values of Protein, Carbohydrates, Lipids, and Calories expressing also the means, standard deviations, minimum, maximum, and quartiles of the participants.

| Variables | Proteins (Grams) | Carbohydrates (Grams) | Lipids (Grams) | Calories |
|--------------------|------------------|-----------------------|----------------|----------|
| Average | 88,14 | 223,43 | 88,02 | 2039,58 |
| Standard Deviation | 25,25 | 43,39 | 15,60 | 244,69 |
| Minimum | 44,12 | 143,20 | 58,62 | 1487,44 |
| 25% | 67,01 | 193,82 | 76,98 | 1905,38 |
| 50% | 86,97 | 220,76 | 88,40 | 2047,66 |
| 75% | 108,13 | 260,15 | 96,99 | 2135,86 |
| Maximum | 159,04 | 337,49 | 126,84 | 2736,53 |

The food groups most consumed by the students are respectively: cereals, breads and tubers; meats and eggs; sweets, snacks and sweets. Cooked rice, cooked meat, and chocolate/bread candy were the most consumed foods by each group. Thus, all the foods in these groups represent 1,283 of the total caloric intake, showing in percentage terms 62.3%.

As for the consumption of ultra-processed foods, of the 78 participants, 62 reported consuming these foods at least once in the past 6 months, of which 21 reported eating daily.

The foods that provide the most protein are cooked chicken and cooked beef, representing a total average of 22.67 grams of total protein intake or 25.72%. As for the consumption of carbohydrates it was possible to observe that the most consumed food sources of this macronutrient are boiled rice and French bread being consumed by 73 out of 78 participants. The main source of lipid used was olive oil, which was mostly used for salad dressings.

The preparations with the lowest consumption were from the groups of greens and vegetables, with approximately 50% of the participants reporting that they do not have the habit of eating foodstuffs from this group. Thus, the least consumed foods in the students' daily lives were spinach, peas, and chard, with

only 17, 30, and 33, respectively, of the participants reporting consumption at least once in the past 6 months.

Together with the professionals who work directly with the meals, a survey of which preparations are served in the institution was carried out, using the technical sheets, it was possible to calculate the energy and macronutrient values served (Table 3).

Table 3. Values of Protein, Carbohydrates, Lipids and Calories of the institution's menu.

| Preparation | Carbohydrates (g) | Proteins (g) | Lipids (g) | Calories (Kcal) |
|--------------------------------|-------------------|--------------|------------|-----------------|
| Bolognese Pasta | 60,26 | 16,91 | 10,32 | 401,59 |
| Creamy potato and carrot soup | 51,84 | 12,42 | 7,98 | 328,89 |
| Rice with broccoli and chicken | 68,62 | 18,31 | 7,60 | 416,17 |
| Baião de três | 62,39 | 19,97 | 8,58 | 406,72 |
| Carrot Cake | 58,11 | 10,18 | 19,19 | 445,84 |
| Scrambled | 65,24 | 16,01 | 8,71 | 403,38 |
| Colored rice with ground beef | 69,28 | 16,07 | 7,76 | 411,26 |
| Fruit Salad | 55,97 | 10,38 | 8,01 | 337,49 |
| Polenta Bolognese with beans | 63,25 | 18,04 | 9,82 | 413,55 |
| Bean soup | 72,94 | 14,30 | 7,16 | 413,36 |
| Rice with sausage and broccoli | 69,25 | 14,64 | 8,33 | 410,53 |
| Cow with rice | 67,31 | 14,74 | 7,82 | 398,57 |
| Fruit Vitamin and cookie | 65,63 | 10,19 | 11,16 | 403,69 |
| Wonder Beans | 60,97 | 20,46 | 10,64 | 421,50 |

4 DISCUSSION

The school has the duty to disseminate appropriate practices that provide the control of nutritional deficiencies and the reduction of child malnutrition according to Conceição et al. (2010), as was observed in the institution.

School meals are an element present in the identity of the public school network, incorporated into the daily lives of students who in some cases have this meal as the only source with a considerable contribution of nutrients, balanced and balanced, as pointed out by Mota and Mastroeni (2013).

On the other hand, for students who have adequate food outside the school environment, it can represent a considerable increase in the daily caloric intake, going beyond the 15% recommended by the National School Nutrition Program, a situation observed in the study site.

Due to adverse situations such as poor acceptance or near expiration date of some ingredient, there are minor changes in the menu, as pointed out by Issa et al (2014).

The presence of the nutritionist in School Feeding is determined and regulated by the Federal Council of Nutritionists (CFN), through the CFN resolution n. 465/2010, which provides for the attributions of the professional in the School Feeding Program (PAE). However, there is a deficit in the number of professionals hired for this service, as pointed out by Honório and Batista (2015).

According to Santos (2017), the changes in Brazilian families' eating habits and the supply of ultra-processed foods around schools influence schoolchildren's food choices. Longo e Silva et al. (2012) point

out that failures in the production process of infant food, for example, in the preparation, portioning, or in the practices of offering food, directly influence children's food consumption.

The most recurrent nutritional diagnosis among students aged 14 to 18 years was eutrophic, totaling 79.2% of participants, similar data were pointed out by Marcia and collaborators (2011). The average energy intake was 2,039 kcal, similar data were found by Veiga and collaborators (2013) who obtained 2,198 kcal as average consumption by the public of the study.

Several methods can be used for the estimation of individual food intake. The method chosen was the Food Frequency Questionnaire, which was later transformed into daily consumption, as was Pedraza, Menezes (2015). The choice of this method was mainly due to its versatility for the study site and participants. However, like other assessment methods, this one is also subject to some degree of underreporting, as Gomes (2017) reports in his research.

In turn after analysis, calculations and estimates it was observed that the school meals served with 400 average calories per serving which represent 20% in the average daily intake of the participating students, and may contribute in this way to weight gain. Similar data were found by Silva, Gregório(2011).

5 CONCLUSION

An increase in the consumption of foods rich in simple carbohydrates and sugars was observed, but new study methods are needed to observe these relationships, since methods that require the participants to write down were not well accepted by this public.

The most consumed preparations were cereals, breads and tubers; meats and eggs; sweets, snacks and treats the foods, being the least consumed foods the components of the group of vegetables and legumes, thus presenting in practice the reality of nutritional transition. The menus offered at the study site are at odds with the literature that recommends a daily caloric average to be offered in the morning.

School meals fulfill their role, but it is necessary a greater observation of the individual characteristics of each region, which makes the role of the nutritionist indispensable in school institutions, a characteristic not found in the study site. There are still several paths to follow about the relationship between school meals and obesity, and this research is one of them.

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