https://doi.org/10.4995/reinad.2021.13769

THE SOCIAL DETERMINANTS OF HEALTH AND THE NUTRITIONAL STATUS OF STUDENTS FROM A CITY IN THE BRAZILIAN AMAZON

(Determinantes sociales de la salud y el estado nutricional en la Amazonía brasileña)

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Abstract

An individual's nutritional condition influences his/her development, but the prevalence of unhealthy eating habits alters nutritional balance and triggers several health complications, which are also influenced by social determinants of health. For this reason, this study aimed to analyze the social determinants of health and the nutritional status of students from a public elementary and high school in a neighborhood on the outskirts of Belém, Pará State, Brazil. Along with the collection of anthropometric measures, an epidemiological and food census was used, following widely accepted protocols tested in the Amazon region, as well as an individual clinical evaluation. Z score and descriptive statistics were performed. 55 students were measured, 30 female and 25 male, with an average age of 13 years old, average BMI of 19.66 for the female group and 19.38 for the male, with 4% of the boys having “severe delay ”, while 3.7% of girls reported a“ delay ”in their growth. 13.3% of girls and 25% of boys drink alcohol. The students showed general physical status without major complications, there were no obese individuals, but there is a potential risk for the condition. However, because it is a peripheral area, the social determinants of health may strongly allow the processing of other nutritional diseases, such as malnutrition and especially stress, since we identified a student who self mutilates, and many others who experience daily violence and low life perspectives.

Keywords: Overweight, Obesity, Adolescents, Anthropometry, Amazonia, Brazil.

Resumen

La condición nutricional de un individuo influye en su desarrollo, pero la prevalencia de hábitos alimenticios poco saludables altera el equilibrio nutricional y desencadena varias complicaciones de salud y que también están influenciadas por los determinantes sociales de la salud. Por esta razón, este estudio tuvo como objetivo analizar los

determinantes sociales de la salud y el estado nutricional de los estudiantes de una escuela primaria y secundaria pública en un barrio en las afueras de Belém, Estado de Pará, Brasil. Junto con la recopilación de medidas antropométricas, se utilizó un censo epidemiológico y alimentario, siguiendo protocolos ampliamente aceptados probados en la región amazónica, así como una evaluación clínica individual. Se realizó puntuación Z score y estadística descriptiva. Se midieron 55 estudiantes, 30 mujeres y 25 hombres, con una edad promedio de 13 años, un IMC promedio de 19.66 para el grupo femenino y 19.38 para el hombre, con un 4% de los niños con retraso severo, mientras que el 3.7% de Las niñas informaron un "retraso" en su crecimiento. El 13,3% de las niñas y el 25% de los niños beben alcohol. Los estudiantes mostraron un estado físico general sin complicaciones mayores, no hubo individuos obesos, pero existe un riesgo potencial para la afección. Sin embargo, debido a que es un área periférica, los determinantes sociales de la salud pueden fuertemente permitir el procesamiento de otras enfermedades nutricionales, como desnutrición y especialmente estrés, desde que identificamos un estudiante que se auto mutilan, y muchos otros que experimentan violencia diaria y baja esperanza de vida.

Palabras clave: Sobrepeso, Obesidad, Adolescentes, Antropometría, Amazonia, Brasil.

1. INTRODUCTION

The Amazon, in the last decades, has become a unique region for the nutritional status study, since obesity levels in adults and young people, malnutrition among children and adolescents, as well as the lack of health services in countless localities in the Brazilian Amazon, such as in the Pará State, are currently elevated (Silva et al., 2016).

The nutritional status expresses a balance between the need the body has and the nutrient supply for adequate metabolic functioning and, therefore, it is associated with the health of individuals, such as that of the child, whose nutrition state can directly interfere in their growth (Bertin et al., 2010). However, the presence of dietary patterns considered unhealthy can alter the individual's nutritional status by promoting changes in body composition and biochemical parameters (Rocha et al., 2017).

Such changes triggered, above all, by a diet rich in sugars, fats, refined foods and low in complex carbohydrates and fibers, combined with a sedentary lifestyle and social conditions influenced by a lower Human Development Index (IDH), violence and lack of education, contribute to the obesity scenario prevalence, in increasingly alarming numbers among children and adolescents. The estimated values worldwide for this weight condition are 60 million in 2020 (Monteiro et al., 2015; Malinski & Voser, 2015).

In Brazil, children and young people also live with nutritional implications arising from an inappropriate diet when it comes to the quantity and quality ingested and, with that, there is a significant increase in excess weight in these age groups (Kneipp et al., 2015). Therefore, the child and youth population in these conditions are vulnerable to the development of numerous health risk factors, such as dyslipidemia, systemic arterial

hypertension, type 2 diabetes, sleep apnea, metabolic syndrome, as well as bone, mental and cardiovascular diseases when adults (Gaya et al., 2019).

Thus, interdisciplinary actions at schools about healthy feeding habits and physical activities are essential (Malinski & Voser, 2015), since school spaces allow health promotion in a cultural, social and environmental approach (Bezerra et al., 2017). Consequently, this study aimed to analyze the social determinants of health and the nutritional status of students from a public elementary and high school in a neighborhood on the outskirts of Belém, Pará State, Brazil, in order to assess the situation of this population and how it can presumably develop nutritional diseases.

2. METHOD

This work was a project from the Institutional Program of Scientific Initiation Scholarships for High School, from the partnership between Pará State University and the CNPq (National Council for Scientific and Technological Development), directly linked to the Brazilian Ministry of Science and Technology, Project No. 800225/2016-3). It gave us the possibility to have five scholarship holders, in which each one was entitled to R$100.00 Reais/monthly during the term of this project (2017-2018).

The study was conducted at the Professor Antônio Gomes Moreira Júnior Elementary and High Public School, located in the Val de Cans neighborhood, on the outskirts of Belém, Pará State. This school represents one of the public schools present in the Paraíso dos Pássaros housing complex and provides elementary and high school to various age groups, with year/age distortion. It has a weakened physical structure, as well as numerous reports of violence in its community.

For the collection of individual, family and environmental information, we used structured questionnaires, formal and non-formal interviews, and participant observation. For the anthropometric data sample, the internationally accepted and described procedures by Weiner & Lourie (1981) and Frisancho (2008) were considered. The variables obtained with the help of calipers, anthropometers, metallic measuring tapes and scales were: height, weight, tricipital, subscapular and suprailiac skinfolds; triceps, calf, waist and hip circumferences.

Anthropometric measurements were used in conjunction with an epidemiological and food census from a population sample, which provided the necessary data for the assessment of the general health characteristics and nutritional status of the studied group following protocols already widely tested in the Amazon and internationally (Frisancho, 2008; Dufour & Teufell, 1995; Silva, 2001; Silva, 2006). An individual clinical evaluation was carried out, which included an anamnesis to survey the past medical history and information about drug use, as well as a complete physical examination comprising an evaluation of the general aspect, heart and respiratory rate, in addition to blood pressure measurement.

In the evaluation of qualitative and quantitative data, Z score and descriptive statistics were performed. Data processing was carried out with the aid of the Who Anthro Plus program available on the World Health Organization website and of BioStat Software. All participants, including interested families, signed the Free and Informed Consent Form, following the parameters of Resolution 196/96 of the National Health Council (CNS). This research was approved by the Research Ethics Committee of the Pará State University, under Presentation Certificate to Ethics Appreciation (CAAE) Number 83176817.6.0000.5174.

3. RESULTS AND DISCUSSION

Many were the adversities to make this project be accomplished. The first mishap we faced was the training of interested students to participate. Many did not know what the term "Junior Scientific Initiation Scholarship" meant and often confused it with a common "bag". After explaining these details, the person responsible for the project had to literally go after the students, since many did not trust that the scholarship was true.

We understand this first problem was due to the fact that, in many public schools, it is common for people from outside the community, usually from companies, to enter schools and visit all rooms inviting students to take numerous courses, and in the years of the execution of this project, there was specifically, a group of people publishing an internship at a famous bank, that students would not need to pay for it, in addition to other advantages. However, this was just an excuse for students to enroll in their course, paying different amounts, in order to obtain an internship at this bank. We can classify it as a misleading advertisement. Therefore, we had a lot of difficulty in getting people, students and legal guardians to believe in the project.

When we finally got students interested in being scholarship holders, we had to explain in detail that the project was not to win a “bag” or any other object, but rather, it was a paid participation via the Brazilian government in a scientific project, together with the Pará State University. In addition, when students got interested, we ran into the absence of their official documents, such as the CPF – Individual Taxpayer Register, which is a document made by the government and serves to identify taxpayers.

In Brazil, recently, it was established when a child is born, in order to register it in a registry office, the guardian must already present this code. First, it is provided on a sheet whose printing disappears or deteriorates quickly, and the number, which is mandatory for registering the fellow on official platforms, is not viable. Many were unable to participate because they had only this completely blank sheet, deteriorated by rain, flooding and other domestic accidents.

The State School Prof. Antônio Moreira Júnior is very precarious, in addition to difficulties with the staff as: absence of teachers from some disciplines that have not been allocated by the Pará State Department of Education, and also great deficiencies and physical irregularities, such as the classrooms, being in deplorable conditions, with living spaces of doves and bats, falling ceilings, broken blackboards, lack of chairs, even to the teachers.

None of the rooms has fans which were working properly, what makes classrooms extremely hot and unpleasant for everyone, some have no lights and so when it is around 4 pm ahead, it starts becoming dark so the students have to be dismissed due to the inconvenience of studying this way. Unfortunately, these are characteristics that are beyond the control of those responsible for the school, but are very common to several schools in the Pará State (Figure 1).

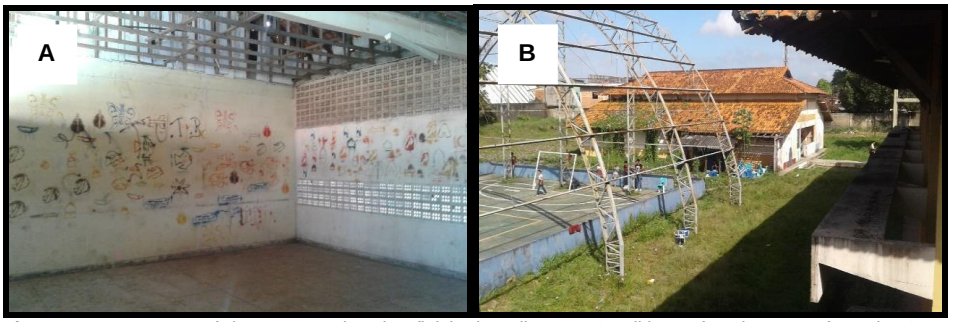

Figure 1: A: Structure of the uncovered and unfinished stadium. B: Conditions of a classroom from the State School Professor Antônio Gomes Moreira Júnior, Belém, Pará State, Brazil.
Source: Field Research - Filgueiras, 2018.

Regarding social issues, the majority receive Bolsa Família (83.2%), which is the most important and frequent government transfer program, but they affirm they have another source of income, earning on average up to a minimum wage (R$954.00 in 2018). Despite this, the financial situation is weak because 44% live on rent and use what is left to buy food. In this frame, the food served at school is extremely important to the students.

All houses are made of brickwork, with internal bathroom. The use of water is by public supply or wells (7.6%). The light is supplied by the private company of the Pará State, but many said that they make clandestine electrical light connections due to the high price charged. 80% of the parents or guardians said they had incomplete primary education. When health problems occur, they try to go to the Paraíso dos Pássaros Basic Health Unit, which is next to the school, but they claim they most of the times use teas, oils, ointments for their minor ailments, since consultations with doctors take a long time to happen.

In relation to the nutritional status, 55 students were measured, being 30 female and 25 male. This analyzed sample, even though small, but still important, does reflect our Amazonian population, and has significant relevance, since it has never been studied before, besides, if we do not talk or write about them we would never know what such populations face. The average age of the participants was 13 years old and the variables height and weight were normally distributed in both sexes. As for the mean and standard deviation (*sd*) of height and weight variables, female group had 1.53 m (*sd = 0.09*) and 46.45 kg (*sd = 10.60*), respectively, and male showed 1.58 m (*sd = 0.13*) and 48.65 kg (*sd = 14.79*), respectively.

From the deviation analysis, it was noticed participants' height has low variation, unlike weight, which proved to be quite discrepant, given the high standard deviation of the means in both sexes. There were no differences between these variables, since when statistically comparing the mean height and weight for each sex, the *t* test (0.05), corresponded to t = 3.4838.

Regarding Body Mass Index (BMI), this is configured as an anthropometric index used almost consensually to assess nutritional status of an individual (Abrantes et al., 2003), nonetheless, BMI must be related to other variables that match the distribution of fat, as individuals differ in terms of body composition and dispersion of adipose tissue (Castro et al., 2004).

The average BMI was 19.66 (*sd = 3.31*) for the female group and 19.38 (*sd = 3.40*) for the male group. When BMI "versus" participant age is associated, there was no record in the "obesity" category, although, in both sexes, individuals were at "risk of overweight" and 10.3% of girls were "overweight" (Table 1), with overweight, in turn, being intrinsically associated with Systemic Arterial Hypertension (SAH) and cardiovascular diseases (CVD) (Cassiano et al., 2019).

Therefore, when dealing with CVD, BMI and waist circumference (WC) relation, according to Oliveira et al. (2010), allow assessing possible cardiac complications, in addition to providing estimates of prevalence of overweight and obesity (WHO, 1997), with males being the most prone to risks (Costa et al., 2017). In addition, in view of the increase in childhood abdominal obesity and early metabolic disorders, the observation of physical development is essential (Filho et al., 2014) and such anthropometric relationships enable this monitoring, as they are simple, low cost and reliable (Fontanive et al., 2002).

Another consequent factor of overweight and that is influenced by a sedentary lifestyle and genetics, according to Câmara et al. (2019), is Diabetes Mellitus 2 (DM2), which prevalence among adolescents has raised due to the increase in glycemic levels associated with BMI and weight (Amaral et al., 2016). Furthermore, according to the Guidelines of the Brazilian Diabetes Society (2016), the union of all risk factors, such as SAH and DM2, can result in the metabolic syndrome, adding, when it concerns the child or adolescent, the cardiovascular events and early mortality.

Table 1: BMI/Age relation of the students from Professor Antônio Gomes Moreira Júnior Elementary and High Public School, Belém, Pará State, Brazil.

BMI/AGE	MALE		FEMALE	
	N	%	N	%
Thinness	0	0	0	0
Normal	20	80	21	69
Overweight Risk	5	20	6	20,7
Overweight	0	0	3	10,3

Obesity	0	0	0	0
TOTAL	***25***	***100***	***30***	***100***

Source: Authors, 2018.

When it comes to Height “versus” Age relation, 4% of the boys had “severe delay”, that is, very low height for age, while 3.7% of the girls denoted only a “delay”, which also means a low height for age. In the female group (Figure 2 - A) it is possible to perceive an inverse growth trend when observing the ages of 15 and 16 years old, which concentrate individuals of short stature. In the male group (Figure 2 - B), even though the 18-year-old range had concentrated more individuals with high height, it is observed a very irregular distribution of this variable between ages, making it hard to predict any growth trend.

Height is related to both external and genetic factors, and the short stature perceived in the present study can present as causes, intrinsic and nutritional factors, therefore, due to the relevance of food in physical development, careful evaluations of the role of public policies in the nutrition of individuals (Romani & Lira, 2004), especially when assessing schoolchildren's diet should be done.

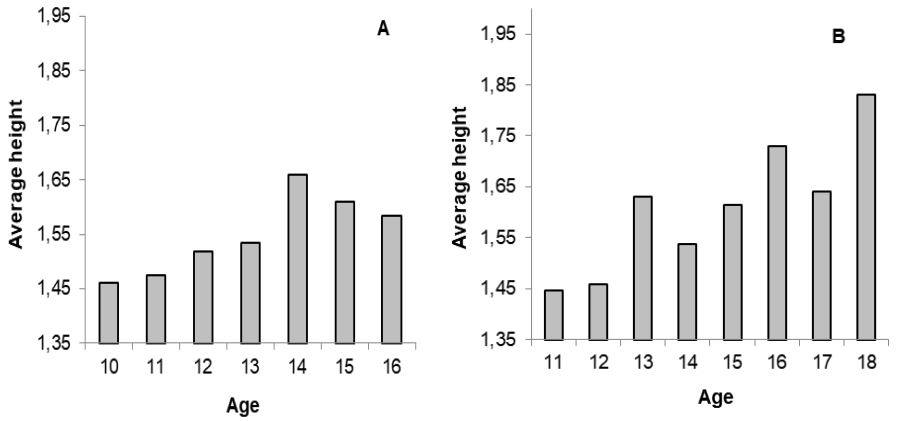

Figure 2: A) Female Average height *“versus”* age distribution. B) Male average height *“versus”* age distribution of the students from the Professor Antônio Gomes Moreira Júnior Elementary and High Public School, Belém, Pará State, Brazil.
Source: Authors, 2018.

In the case of public schools, the National School Feeding Program (PNAE) is still running, which is linked to the objective of providing adequate food for students, so that there would be no damage in the student development or learning and meet nutritional needs (Brasil, 2015). However, Leão et al. (2018), noted in schools in Abaetetuba, Pará State, inadequate values of macronutrients and micronutrients, with no compliance with the amount of calories recommended by the National Education Development Fund.

Associated with the disregard both in the distribution of school food and in the quality of the food served in public schools, other studies point to socioeconomic factors as cause of interferences in the physical development of some individuals in the northern region of the country. For example, the research carried out by Engstrom & Anjos (1999) and César et al. (2009), who, all of them, indicated nutritional deficiencies as the cause of the condition.

When analyzing the other anthropometric measurements of the students (Table 2), the geminal, waist circumference and hip circumference values were the ones that showed the greatest variations between the individuals measured in both sexes. However, when considering the values and classification of waist circumference for children and adolescents, proposed by Fernández et al. (2004), both girls and boys did not show values greater than 90% and, therefore, were not obese.

The other anthropometric measures are necessary, as they give greater accuracy to the study, for example, the correlation between waist circumference and metabolic changes in adolescents was identified (Pani et al., 2011), which generates an important signal for future risks of disease development (Faria et al., 2014). In addition, the hip circumference, associated to the waist circumference, is also an important indicator in the case of CVD (Cassiano et al., 2019).

Another relevant measure for determining the individual's physical composition is the verification of the skinfold, since it is a non-invasive, effective and low-cost measure and unlike BMI, this measure is able to determine the individual's nutritional status by separating lean from fat mass, besides being applicable regardless of age group (Gonçalves & Mourão, 2008). Therefore, the relevance of using the method in the present study.

Table 2: Body measures of the students from the Professor Antônio Gomes Moreira Júnior Elementary and High Public School, Belém, Pará State, Brazil.

MEASURES (cm)	MALE		FEMALE	
	Average	***Sd***	***Average***	***Sd***
Mid-upper Arm Circumference	22.7	3.7	22.3	3.7
Triceps Skinfold	14.5	3.9	18.6	7.3
Subscapular Skinfold	14.0	5.3	15.7	6.1
Suprailiac Skinfold	15.6	5.5	16.0	5.2
Geminal Skinfold	16.4	7.4	20.9	15.1
Leg Circumference	29.9	5.1	31.6	10.4
Waist Circumference	66.9	7.9	64.4	7.8
Hip Circumference	76.9	8.7	75.5	8.3

Source: Authors, 2018.

When assessing the female group anamnesis, 40% said they did not have any type of pathology; all the interviewees denied being smokers; however, 13.3%, with an average age group of 14 years old, said they use alcohol. On physical examination, 76.7% showed a good general condition, with 86.7% showing intact, hydrated skin, without lesions, normal-implanted hair, normal-colored mucous membranes, with an average heart rate of 72 beats per minute, being heard in all participants heart sounds, rhythmic, normophonetic, in 2 steps, without murmur, with an average respiratory rate of 18 respiratory incursions per minute, eupneic.

Regarding the male group anamnesis, 32% said they had no pathologies, all participants denied being smokers, but 25%, aged 13 years old, said they ingested alcoholic beverages. On physical examination, 72% showed a good general condition, with 96% showing full, hydrated skin, without lesions, normal-implanted hair, normal-colored mucous membranes, with an average heart rate of 77 beats per minute and rhythmic, normophonetic heart sounds, in 2 stages, without murmur, when the cardiac foci were heard. In addition, the subjects examined showed an average respiratory rate of 18 breaths per minute, with an eupneic rhythm.

armful behavioral habits tend to start in adolescence, causing chronic diseases and constituting one of the main causes of death among adolescents (WHO, 2014). Silva et al. (2019) found out the average age at which alcoholic beverages start to be consumed, distilled or not, is approximately 13.7 years old, a value close to that identified in this study. At the same time, according to the Brazilian Institute of Geography and Statistics (IBGE) (2016), alcohol consumption has an early onset and it is more common in public than private schools, with the female public consuming more, diverging from results found. In nutritional terms, alcohol consumption is related to weight gain, due to its high caloric content and interference with appetite, providing a rapid imbalance in the individual's weight (Barbosa et al., 2019).

Although there were no schoolchildren who declared themselves to be smokers in this study, it is relevant to observe the age at which there is a predominance of people who have already tried cigarettes, is between 16 and 17 years old (IBGE, 2016), having as main factors, media influences, social circles and the family environment. Besides, there may be a naturalization of the habit, depending on the environment in which the young person is inserted (Teixeira et al., 2017). Thus, as alcohol, cigarettes are also more present in public schools, but, as distinction, it is more common between the male public (IBGE, 2016).

Faced with this scenario, in Brazil, there is the National School Health Survey (PeNSE), carried out in collaboration between the Ministry of Health and the IBGE, with the aim of directing public policies to combat risk factors for young people (IBGE, 2009). Nevertheless, from the PeNSE program 2015, it was found that certain risk factors faced an increase rather than a reduction, such as the use of various drugs - including tobacco derivatives - and the increase in the consumption of unhealthy foods. Therefore, the need for effective actions to improve this scenario is not being fully met (Reis et al., 2018).

As for the measurement of students' blood pressure and considering the values and the classification for this age group, proposed by the Brazilian Society of Cardiology (SBC) in 2016, boys presented average values of 108 mm/Hg and 69 mm/Hg, whereas girls denoted 102 mm/Hg and 70 mm/Hg, for systolic and diastolic pressure, respectively. Thus, when considering the average age of 13 years old, sex and height, it was noticed the measured values are below the 95th percentile (p), that is, they are normotensive, according to the SBC. However, it is worth mentioning that a single measurement is not enough to diagnose an adolescent with hypertension. For this reason, a detailed anamnesis, physical examination and the request for complementary exams are essential.

In relation to the blood pressure, we identified a 13-year-old student with altered blood pressure. We took the case to the school board and requested the presence of those responsible three times, but unfortunately, there was no response from them. We asked the student himself and he said he lived with his parents but both worked full time and only returned very late. He also said that most of the time he was kept alone at home, but he was waiting for his grandmother to come from the countryside to be with him. This is a very common picture for students at this school, many have said they live with grandparents, uncles/aunts, with a father or a mother, but many times are left alone, since their guardians work full time, or are left under the responsibility of neighbors.

The change in blood pressure in adolescents is commonly linked to behavioral factors, such as physical inactivity, poor diet and excess body fat (Moura et al., 2004). Besides, socioeconomic factors are also related to hypertension, according to Ribeiro et al. (2006), when verifying that the higher the socioeconomic level, the greater the probability the individual has excess subcutaneous fat, a variable that can be associated with SAH, but it is not determinant for it.

In this perspective, Gonçalves et al. (2016), identified there is a high prevalence of hypertension among adolescents in Brazil, and from the Study of Cardiovascular Risks in Adolescents (ERICA), carried out by Bloch et al. (2016), it was possible to identify the lowest incidence of SAH is in the North and Northeast regions of the country, while the highest incidence is found in the South and in older males.

We also can relate we found out during a service the case of a student who was self-mutilating. The volunteer nurse identified the case and we took it to the school board again for appropriate action. Due to this peculiar situation, we prepared a Mental Health project that would be applied in the first semester of 2018 but due to the teacher strike, this could not happen in viable time.

Lastly, for several moments we had to stop our project due to the flood that occurred inside the service room, which at the same time was the Special Education room, where the students with some sort of physical or intellectual necessity were accompanied. In addition, the school is in a place considered dangerous due to the high death rates of young people who are involved with drugs and. During the time this project was executed, three students had been murdered. Another picture that we present is that during the course of the project, although fair and understandable, there were countless

stoppages by teachers, in addition to the strike of more than 30 days, which resulted in the public's distance from this project.

4. CONCLUSION

The student population studied in this project showed a general physical condition without major complications. No obese individuals were registered, but there are some participants at potential risk for the condition. The students showed short stature, which can be related to the socioeconomic as well as to the social determinants of health of the region. Nevertheless, it was found alcoholic beverages were consumed by both sexes, which engenders the need for more effective anti-drug policies. After all, peripheral areas are extremely susceptible to the ills of society, which govern the quality of life of these students and fit them in situations that allow the processing of nutritional diseases, such as malnutrition and/or obesity in a long therm.

We can conclude, from a bioanthropological perspective, that Social Determinants of Health, such as living in precarious socio-environmental conditions, having low educational level and for this a low chance for employability and better wages, little access to health services and experiencing daily violence, can make a heavy pressure on the lives of these students and nearby communities, resulting in health problems such as overweight, obesity and other chronic diseases and stress, which may be reflected in low quality of life.

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