ejpmr, 2023,10(10), 484-491

SJIF Impact Factor 6.222

EUROPEAN JOURNAL OF PHARMACEUTICAL AND MEDICAL RESEARCH

www.ejpmr.com

Research Article

ISSN 2394-3211

EJPMR

ANALYSIS OF OBESITY INDEX AND BLOOD PRESSURE IN STUDENTS AGED 7 TO 12 YEARS IN A WESTERN AMAZON CITY

Carlos Alberto Paraguassú-Chaves[1], Helio Franklin Rodrigues de Almeida[2], José Roberto de Maio Godoi Filho[3], Fabricio Moraes de Almeida[4]* and Fábio Robson Casara Cavalcante[5]

[1]Faculdade Instituto Rio de Janeiro (FIURJ), Brasil.
[2,3,4,5]Universidade Federal de Rondônia (UFRO), Brasil.

***Corresponding Author: Dr. Fabricio Moraes de Almeida**
Universidade Federal de Rondônia (UFRO), Brasil.

Article Received on 19/08/2023 **Article Revised on 09/09/2023** **Article Accepted on 29/09/2023**

ABSTRACT

The objective of the study was to describe the obesity rate and possible childhood blood pressure in public and private school students in the city of Porto Velho, state of Rondônia, Western Amazon. Body mass index (BMI) and body composition (skinfolds) protocols were used to assess obesity, and a World Health Organization protocol was used to measure blood pressure. After measuring weight, height, skinfolds at the triceps, biceps, suprailiac, subscapular points and blood pressure measurement, it was found that 16.9% of children from private schools and 11.9% from public schools were overweight and obesity. It was also verified that 11.2% of overweight and obese private school students had high blood pressure, and 12% of public school students had high blood pressure values. It is concluded that children have accentuated degrees of obesity, and a high rate of elevation of blood pressure. There are several factors that can lead to an explanation for the findings, for example, in the obesity variable, it can be said that factors such as a sedentary lifestyle, poor diet and the automation of games can be key factors for this increase in the obesity rate. In the blood pressure variable, other factors may influence, such as genetic factors, ethnicity and the way these children go to school, lifestyle, among others.

KEYWORDS: BMI, Body composition, Blood pressure, Child, Students.

INTRODUCTION

For the World Health Organization - WHO, obesity is a "disease in which excess body fat has accumulated to such an extent that health can be affected", which demonstrates the concern of this entity with the possible consequences of the accumulation of tissues on body.[1] Obesity is also an important risk factor for triggering other diseases such as type II diabetes mellitus, high blood pressure, dyslipidemia, myocardial infarction and stroke.

Childhood obesity is a public health problem that has tripled in recent decades. Currently, almost 15% of Brazilian children are overweight and 5% are obese.[2] The identification of childhood obesity through cross-sectional studies in schoolchildren has become a common practice at an international and national.

The Brazilian Association for the Study of Obesity and Metabolic Syndrome[3] reported that one in ten Brazilian children is obese. In the United States of America this statistic, is even more alarming, four out of ten children are obese or overweight.[4] According to WHO, this number is a serious indicator that childhood obesity has reached epidemic proportions.[5]

This indicator is confirmed by the report of the International Task Force on Obesity, sent to the WHO.[5] Soar, Vasconcelos and Assis,[6] when referring to childhood obesity, states that there are indications that children with relative body fat greater than 30% for girls and 25% for boys present moderate to high risk for the development of coronary diseases.

According to data from a study conducted with 8,020 adolescents, it was revealed that 81% of students from private schools and 65% from public schools are sedentary and perform less than 10 minutes of daily physical activity, remembering that recommended by health professionals, it is at least 60 minutes daily.[7] In the case of children and adolescents, there are 60 minutes of moderate to vigorous activities per day.

This issue is even more serious when high rates of overweight are verified. The combination of poor diet and little physical activity is one of the main causes of obesity, which exposes children and adolescents to health problems ranging from emotional conflicts to cardiovascular changes. With this, it is also valid to say that the health risk related to fat includes, in addition to quantity, its distribution and concentration, mainly in the

abdominal region (intra-abdominal or visceral fat). Visceral fat predisposes a tendency to cardiovascular and metabolic diseases than the total amount of fat.[8]

In the state of Rondônia, Brazilian Amazon, Northern Region of Brazil, despite the lack of data and information and epidemiological studies related to obesity in schoolchildren, making it difficult to predict a possible intervention for future obesity-related diseases, the work of Romalholo[9] developed in city of Cacoal, serves as a guide in the search for an answer to the problem. This author researched the obesity and blood pressure index in students from 7 to 12 years of age in public and private schools in the municipality of Cacoal – Rondônia.

This age group was chosen for the research, because it is in this age group that hyperplasia of fat cells is likely to occur, it is also a limit age, where physiologically secondary sexual characteristics begin to appear.[10] That is, up to 12 years of age, there are no significant hormonal differences between people of different sexes. The general objective of the study was to describe the obesity rate and possible blood pressure in children aged 7 to 12 years, students from public and private schools in the city of Porto Velho, Rondônia, Western Amazon.

MATERIALS AND METHODS

Type of Study: Descriptive, quantitative, cross-sectional study with 120 (one hundred and twenty) students from public schools in the municipal network and students from private elementary schools in Porto Velho – Rondônia, Western Amazon.

Materials Used: - Analog scale; - Stadiometer and metal board; - Skinfold compass (adipometer); - Sphygmomanometer and stethoscope.

Description of Measurements and Tests Used: Anthropometric variables, weight and height, skinfolds and blood pressure were measured, using a TOLEDO@ brand scale, with a maximum capacity of 150 kg and a minimum capacity of 1.25 (kg with 50g division), stadiometer (Cardiomed from Seca, with a maximum height of 2.20 mm), BMI table[11] 5 fat table[12] and finally the Blood Pressure table.

Body Mass Index (BMI): The BMI method was developed in the last century by Lambert Adolphe Jacques Quetelet (1969), a Belgian mathematician. Its use in adolescents and children began to be more widespread after the publication of[13] who presented percentile values for age and gender. The children were weighed without shoes or socks, wearing the uniforms composed of knit shirt and shorts of the social program of the Instituto Superior de Ciências da Saúde e Ambiente da Amazônia (AICSA), a non-profit scientific, social and cultural research institution. To verify the height, the students were instructed to remain erect, with the head positioned in the midline, knees extended, feet united, arms along the body, shoulders in contact with the wall and in apnea.

Overweight and obesity were calculated using the cutoff points, adjusted for age and gender.

Blood Pressure: to measure blood pressure, a Cardiomed sphygmomanometer was used, measuring in millimeters of mercury (mmHg), aided by a stethoscope and using a comparison table. For this measuremnt, the students were submitted to being seated in a resting position, while they had their right arms relaxed on the table. Three measurements were taken and the average was taken. There was a 1-minute break for each attempt, after which a new attempt was made.

Skinfolds: to measure the percentage of body fat, a device called a plicometer from the brand Cardiomed and a comparison table adapted by Viunisk[12] were used, where the folds of the triceps brachii, biceps brachii, subscapular and supra -iliacus and added together for comparison. The triceps point refers to half the distance between the acromion and the olecranon; must be measured with the arm relaxed in a standing anatomy position. The bicipital point refers to half the distance between the olecranon and the acromion, with the elbow flexed at 90°. It should be measured in an anatomical standing position and with the arm slightly flexed at the shoulder.

The subscapular point is measured at the level of the lowest angle of the scapula, with a caliber of 45º. It should be measured in the standing position of the subject, without muscle contraction. The suprailiac point is determined horizontally above the iliac crest, in the mid-axillary line. In anatomical position, with the abdomen relaxed. These standardizations were proposed by the assessment protocol by Guedes and Guedes.[10],[14]

Inclusion criteria: Schoolchildren aged 7 to 12 years; students enrolled in the municipal public education network and in the private education network; students participating in a social vacation project promoted by Instituto Superior de Ciências da Saúde e Ambiente da Amazônia (AICSA); students without pathologies or under drug treatment. Exclusion criteria: student children with special motor needs; students whose guardians did not consent to participate; students that those responsible for them did not sign informed consent. Ethical Aspects: The research project was submitted to the Research Ethics Committee – CEP of a Federal University of Rondônia and was approved according to Opinion nº 4,456,936.

This age group was chosen for the research, because it is in this age group that hyperplasia of fat cells is likely to occur, it is also a limit age, where physiologically secondary sexual characteristics begin to appear.[10] That is, up to 12 years of age, there are no significant hormonal differences between people of different sexes.

RESULTS

The selection of the sample number was of 120 students of both sexes and in the age group of 7 to 12 years. Tje first 60 students from public schools and 60 from private schools who fit the inclusion term were selected, being 50% nale and the Other Half female (50%), with a margin of error of approximately 0.5%.[15]

Data analysis

The research subjects consisted of 120 children aged between 7 and 12 years of both genders. Of this sample, 60 were male and 60 were female (Table 1).

Table 1: Distribution by gender, age group, absolute Values and Percentages.

Gender	Age Group	Sample	percentage	Total
Male	7-12 years	60 students	50%	
Female	7-12 years	60 students	50%	
				120 students

Source: authors.

According to table 2, for each age (in the age group studied), 5 (five subjects for both public and private schools and for both genders were selected, making a total of 20 student children per age group.

Table 2: Distribution of subjects according to age, gender and place where they study.

age/year	Public school (male)	Public school (female)	Private school (male)	Private school (female)	Total/n	Total/ %
7	5	5	5	5	20	16,16
8	5	5	5	5	20	16,16
9	5	5	5	5	20	16,16
10	5	5	5	5	20	16,16
11	5	5	5	5	20	16,16
12	5	5	5	5	20	16,16
	30	30	30	30	120	100

Source: authors.

Table 3: Weight measurements: Female and Male, according to age.

Variable	(weight)	Female gender (private school) n = 30					
Age		7	8	9	10	11	12
N		5	5	5	5	5	5
Weight (kg)	min value	17	22	18	24	30	31
	max value	38	52	43	55	64	81
	median	22	29,5	28,4	34	42	47
	Average	23,7	31,9	30,3	34,9	43,3	50,8
	+-dp	5,7	8,4	8,1	8,0	8,8	12,7

Variable	(weight)	Male gender (private school) n = 30					
Age		7	8	9	10	11	12
N		5	5	5	5	5	5
Weight (Kg)	min value	17	21	21	23	28	31
	max value	39	38	44	57	83	72
	Median	25	29	31	34	43	48,5
	Average	25,7	29	31,6	36,6	45	51,8
	+-dp	5,6	4,3	6,7	10,7	11,5	10,5

Variable	(weight)	Female gender (public school) n = 30					
Age		7	8	9	10	11	12
N		5	5	5	5	5	5
Weight (kg)	min value	16	19	23	24	27	30
	max value	45	29	54	45	61	53
	Median	24,5	24,5	31	30,5	37	41
	Average	26	23,9	32	33	38,8	43

	+-dp	6,7	2,5	7,9	5,7	9,7	7,5

Variable	(weight)	Male gender (public school) n = 30					
Age		7	8	9	10	11	12
N		5	5	5	5	5	5
Weight (kg)	min value	20	20	24	25	30	30
	max value	53	40	52	50	53	67
	Median	28	28,5	29	32,5	40	45
	Average	29,2	28,4	30,5	33,8	38,8	44,7
	+-dp	8,4	5,1	6,7	6,7	6,4	9,0

Source: authors.

Table 4: Measures for height: Female and Male, according to age.

Variable	(stature)	Female gender (private school) n = 30					
Age		7	8	9	10	11	12
N		5	5	5	5	5	5
Stature (cm)	min value	109	118	112	131	140	142
	max value	133	148	149	167	171	169
	Median	123	126,7	135	139	150	156
	Average	122,5	128,6	134,7	143,5	152,9	155,6
	+-dp	6,3	6,8	8,8	10,9	9,9	7,6

Variable	(stature)	Male gender (private school) n = 30					
Age		7	8	9	10	11	12
N		5	5	5	5	5	5
Stature (cm)	min value	107	115	126	134	135	146
	max value	136	135	144	159	163	171
	Median	122	130,5	133,5	144,5	148,5	155,5
	Average	121,9	129,9	133,9	143,6	149,6	155,9
	+-dp	6,8	5,5	4,6	7,7	7,5	7,9

Variable	(stature)	Female gender (public school) n = 30					
Age		7	8	9	10	11	12
N		5	5	5	5	5	5
Stature (cm)	min value	113	120	128	130	136	146
	max value	145	136	144	150	168	162
	Median	124	127,5	133,5	142	146	151,5
	Average	125,8	127,7	134,7	142	148,5	152,7
	+-dp	8,3	3,5	5,3	6,2	9,5	2,8

Variable	(stature)	Male gender (public school) n = 30					
Age		7	8	9	10	11	12
N		5	5	5	5	5	5
Stature (cm)	min value	116	118	124	125	140	140
	max value	143	140	148	157	158	178
	Median	128	130	134,5	140,5	147	155,5
	Average	128,7	130,1	134,8	141,2	147,7	155,5
	+-dp	8,8	5,4	3,8	8,2	5,5	9,2

Source: authors.

Table 5: BMI measurements of Female and Male children, according to age.

Variable	(BMI)	Female gender (private school) n = 30					
Age		7	8	9	10	11	12
N		5	5	5	5	5	5
BMI (kg/m2)	min value	13	15	11	14	13	14
	max value	25	27	23	24	27	37
	Median	16	19	15	16	18	20
	Average	16	19	16,4	16,6	18,6	20,9

	+-dp	2,9	3,3	3,1	2,8	3,2	5,1

Variable	**(BMI)**	**Male gender (private school) n = 30**					
Age		7	8	9	10	11	12
N		5	5	5	5	5	5
BMI (kg/m2)	min value	11	14	14	12	16	14
	max value	30	23	24	27	33	27
	Median	16	16	16,5	16	18,5	21
	Average	17,7	16,9	17,6	17,9	19,7	21
	+-dp	4,4	2,3	3,0	4,7	3,9	3,3

Variable	**(BMI)**	**Female gender (public school) n = 30**					
Age		7	8	9	10	11	12
N		5	5	5	5	5	5
BMI (kg/m2)	min value	14	12	14	13	13	14
	max value	23	17	26	22	22	22
	Median	15,5	14	16,5	15,5	17	16,5
	Average	16	14,4	17,1	15,6	16,7	17,7
	+-dp	2,6	1,4	3,2	2,0	2,5	2,8

Variable	**(BMI)**	**Male gender (public school) n = 30**					
Age		**7**	**8**	**9**	**10**	**11**	**12**
N		5	5	5	5	5	5
BMI (kg/m2)	min value	13	13	14	14	15	15
	max value	26	22	26	22	22	24
	Median	16	16	16	16	17	18
	Average	17	16,3	16,7	16,3	17,5	18,1
	+-dp	3,1	2,1	3,0	2,3	2,4	2,5

Source: authors. Legend: Body Mass Index (BMI)

The weight results of female and male children from private schools, according to age, were as follows: at the age of 7 years, female median weight 22 and for males 25, at the age of 8 years 29.5 for girls and 29 for boys, at the age of 9 years, 28.4 for girls and 31 for boys, at the age of 10 years, 34 for girls and 34 for boys, at the age of 11 years 42 for girls and 43 for boys and at the age of 12 years, 47 for girls and 48.5 for boys. The children's height reached the following results, the median of 123 for female children at the age of 7 years and 122 for males. Median of 126.7 for 8-year-old girls while for boys it was 130.5. For the age of 9 years, girls had a median of 135 and boys, 133.5. At the age of 10, girls had a median of 139 while boys had a median of 144.5. At the age of 11, girls had a median of 150 to 148.5 for boys and 12-year-olds had a median of 156 for girls and 155.5 for boys.

The Body Mass Index of female and male children from private schools, according to age, present the following results: The median BMI for girls aged 7 years was 16 and for boys 16. The median for the age of 8 years was 19 for girls and 16 for boys. At the age of 9 years, girls had a median of 15 and boys, 16.5. At the age of 10, girls have a median of 16 and boys also 16, while at the age of 11, girls have a median of 18 against 18.5 for boys. As for the age of 12, girls appear with a median of 20 and boys with 21.

As for the body mass of boys and girls who study at a private school, a significant interaction between gender and age was verified ($p<0.05$), and also with the progression of age, it showed that the values kept increasing from 7 to 12 years for boys and among girls, there was an increase outside the average between the ages of 7 and 8 years, which caused an apparent decrease between the ages of 8 and 9 years.

It can be seen that the average annual gain rate of boys was approximately 5.0 kg/year, which represents around 19% of average increase in body mass, while in the case of girls this rate was approximately 4.7 kg/year or around 17.9% average annual gain between the two consecutive age groups. With regard to height, a correlation with gender and age was verified ($p<0.01$), however, regarding the effect of gender, no significant differences were observed between genders within the same age group ($p>0.05$). Similar to body mass, height increased significantly with advancing age. The average annual gain rate of boys in height was approximately 6.7 cm/year (5.0%), while girls obtained an approximate average annual gain of 6.0 cm/year (4.7%), between two consecutive age groups.

Consequently, the BMI, which is the relationship between weight and height, was also shown to accompany the two variables, the average annual gain rate of boys and girls in BMI was approximately 0.74

kg/m2 (4.1%) and 1. 05 kg/m2 (6.9%) respectively. This descriptive analysis of the anthropometric profile was also carried out for children who study in public schools with measurements of weight, height and body mass index (BMI) for boys and girls aged 7 to 12 years.

The weight results of female and male children from public schools, according to age, were as follows: at the age of 7 years, female gender, median weight 24.5 and for the male 28, at the age of 8 years 24.5 for the girls and 28.5 for the boys, at the age of 9 years, 31 for the girls and 29 for boys, at age 10, 30.5 for girls and 32.5 for boys, at age 11 37 for girls and 40 for boys and at age 12, 41 for girls and 45 for boys. The children's height reached the following results, the median of 124 for female children aged 7 years and 128 for male children. Median of 127.5 for 8-year-old girls while for boys it was 130. For the age of 9 years, the girls had a median of 133.5 and the boys 134.5. At the age of 10, girls had a median of 142 while boys had a median of 140.5. At the age of 11, girls had a median of 146 to 147 for boys and 12-year-old children had a median of 151.5 for girls and 155.5 for boys.

The Body Mass Index of female and male children from public schools, according to age, present the following results: The median BMI for girls at age 7 years was 15.5 and for boys 16. The median for age 8 years was 14 for girls and 16 for boys. At the age of 9, the girls had a median of 16.5 and the boys, 16. At the age of 10, the girls had a median of 15.5 and the boys, 16.3, while at the age of 11, the girls had a median of 17 against 17 Of the boys. As for the age of 12, girls appear with a median of 16.5 and boys with 18.

As for the body mass of boys and girls who study in public schools, an interaction between gender and age was also verified ($p<0.05$), and also with the progression of age it was shown that the values kept increasing from 7 to 12 years for the boys. There was a decrease only between the ages of 7 and 8 years among girls and boys, but this was not significant. It can be seen that the average annual gain rate for boys was approximately 3.16 kg/year, which is equivalent to approximately 10% of average increase in body mass, while in the case of girls this index was approximately 3. 25 kg/year around 12% average annual gain between two consecutive age groups.

Height was found to correlate with gender and age ($p<0.01$), however, regarding the effect of gender, no significant differences were observed between genders within the same age group ($p>0.05$).

The results showed a prevalence of high blood pressure, 11.2% in private school students and 12% in public school students.

Regarding the prevalence of high blood pressure, compared to overweight groups, the values were significant for both classes of students ($p<0.001$) for children who study in private schools and also for those who study in public schools. When comparing the rate of children with high blood pressure, the total number of black and brown children with high blood pressure was 26.7% and children declared as white 11.6%.

DISCUSSION OF RESULTS

For Guedes and Guedes,[10] physical growth reports health characteristics in children and adolescents with regard to past (height) and current (body mass) nutritional aspects, being an excellent variable when compared with population normative values, to express the health condition of a given population or community, especially when compared to appropriate references.

According to Soar, Vasconcelos and Assis,[6] girls present a peak of development, growth and sexual maturation earlier than boys, therefore, at this age, girls' growth tends to be faster than boys'. There is a very strong influence between food, lifestyle and constant motor stimulation to enhance physical growth. This is evident when it comes to the fact that the female samples from the private school had a higher performance in height than the girls from the public school. Authors such as[16],[17] agree with the findings.

For boys, it was verified in absolute terms, a superiority of results between the present study and the reference of the National Center Health Statistics - NCHS ages of 10, 11 and 12 years, with tendency to accentuate in older ages, that is, when it comes to height, both boys from private and public schools appear with the same indicators (155.5 and 155.5 respectively). These results contradict the National Health and Nutrition Survey carried out in 1989,[18] where it was observed that the Brazilian male population had 4 cm less in relation to international references, reflecting unfavorable conditions for growth.

According to Manning,[19] body dimensions are largely determined by heredity. Therefore, height is an inherited characteristic, susceptible to being influenced not only by nutritional factors, but also by environmental factors, ethnic and socioeconomic differences. According to age, body elements reveal a different growth rate, leading to changes in body proportions, characteristic of each of the development periods. An example is that from 6 years old until the onset of puberty, the child continues to grow, but the pace is much slower, constant and gradual than before or after this period.[20]

Paraguassú-Chaves et al[21] carried out a cross-sectional study on the anthropometric profile in the State of Rondônia, and the result showed that 12.5% of private school students had BMI outside normal standards and 9.5% of school students public also had altered BMI. Oliveira et al[22] carried out a cross-sectional study, showing that 10% of students in the private network

were overweight and 7% were obese, in the public network 8% were overweight and 2% were obese

Moura[23] studied the profile of obesity in students in the city of Campinas in São Paulo, where through a cross-sectional study evaluating obesity through BMI, the values of students from the private network were also higher, 12% for students from the private network and 7% for public school students.

The WHO recommends the use of skinfold measurements to be related to BMI values, as it is known that high BMI values can occur without necessarily being related to high levels of body fat.

In the present study, when comparing the percentage of fat among male students, there was a very significant difference, where in all age groups surveyed there was an increase in the rate of students from private schools. According to authors such as,[24] a study carried out with 2,400 French children aged 7 to 12 years, a higher incidence of obesity was noted in children in the lower classes. For.[25] the socioeconomic level interferes in the prevalence of overweight and obesity insofar as it determines the availability of food and access to information. In developing or underdeveloped countries where food availability is a major problem, childhood obesity is more prevalent in higher socioeconomic classes. In developed countries, where even low-income individuals have access to food, a lower prevalence of childhood obesity can be found in high-income classes, due to greater access to information about healthier dietary patterns and physical activity.[9]

With regard to Blood Pressure values, those found in the present study were within the average found by other national and international studies, which have found prevalence values with wide variation – from 1.2 to 13%. Methodological differences, number of measurements used, different reference criteria, in addition to hereditary issues and the ways these children are brought to school are the main causes of this variability.[9]

The findings of Blood Pressure are high and worrying values, because according to Nieman[26] the cardiorespiratory capacity of a subject must be directly related to the health continuum. In a study carried out in Maceió by Moura,[23] in a cross-sectional study with students aged 7 to 14 years, it shows a direct association between obesity and blood pressure, where the results of SAH were 9.4%.

The study carried out correlating obesity and blood pressure, showed a close relationship between obesity and increased blood pressure.[27] Thus, these results lead to concerns, since values considered inadequate in this function of the organism can predispose an individual to a series of risk factors susceptible to the development of several cardiovascular diseases, among other health complications.[28]

A comparative study between blood pressure and obesity in low-income people found that 30% of the surveyed population was overweight, of which 25% had high blood pressure. The study demonstrates that a possible increase in blood pressure is independent of social issues, family income and education, since this study was carried out with low-income people [21] As for the higher blood pressure index in children of black ethnicity, a study carried out in Bahia, by Lopes[29] showed that black and mulatto ethnicity is a strong indicator for predisposition to possible arterial hypertension, and the same study also shows that with this increase in blood pressure, blacks can more easily develop problems related to kidney issues.

CONCLUSION

It is concluded that students who study in the private school system have a higher obesity index, assessed by BMI, than public school students. The variable corporal composition (percentage of fat) had an increase in the indices of the pupils of the private school in relation to the one of the public school.

The median weights of both girls and boys who study in private schools are superior to girls and boys who study in public schools. Girls from private schools are also, mainly between 11 and 12 years old, taller than girls from public schools.

Private school students had higher values of obesity, this is due to possible uncontrolled eating. Another factor that can influence would be the lifestyle, where private school students lead a more sedentary life.

The anthropometric profile is similar to studies carried out in other Brazilian states and in other contexts. That factors such as lifestyle are extremely conditioning or determinant in the results found.

REFERENCES

1. Organização Mundial da Saúde. *Estatísticas da Saúde Mundial, 2019;* 2019.
2. Carnaval PE. *Medidas e Avaliação em Ciências do Esporte*. Rio de Janeiro. Editora Sprint, 2000.
3. Associação Brasileira para o Estudo da Obesidade e da Síndrome Metabólica. *Diretrizes brasileiras de obesidade* / ABESO – Associação Brasileira para o Estudo da Obesidade e da Síndrome Metabólica, *2016;* 4.
4. Viuniski N. *Obesidade infantil: um guia prático para profissionais da saúde*. Rio de Janeiro: EPUB, 1999.
5. World Health Organization. *Obesity: preventing and managing the global epidemic*. WHO, Geneva WHO/NUT/NCD, 1999; 99.
6. Soar C, Vasconcelos FAG, Assis MAA. A relação Cintura Quadril e o perímetro da cintura associados ao índice de massa corporal em

estudos em escolares. *Caderno de Saúde Pública*, 2004; 20 (6): 1609-16.
7. Anjos LA, Veiga GV, Castro IRR. Distribuição dos valores do índice de massa corporal da população brasileira até 25 anos. *Revista Panamericana de Salude Publica*, 1998; 3(3): 164-173.
8. Koga CR. *Estado Nutricional de escolares de 7 a 10 anos de idade: diagnóstico e comparação de métodos*. São Paulo; (Dissertação de Mestrado – Faculdade de Saúde Pública da Universidade de São Paulo/USP), 2005.
9. Romanholo RA. *Índice de Obesidade e Pressão Arterial em Estudantes de 07 a 12 anos da rede pública e privada do município de Cacoal – RO*. Universidade de Brasília-UnB (Dissertação de Mestrado em Ciências da Saúde). Brasília, 2007.
10. Guedes DP, Guedes JER. *Crescimento, composição corporal e desenvolvimento motor de crianças e adolescentes.* São Paulo: CLR Balieiro, 1997a.
11. Cole TJ. Establishing a standart definitiona for child overweight and obesity worldwide: international survey. *BMJ*, 2000; 320: 1240-3.
12. Viuniski N. *Obesidade infantil – guia prático*. Rio de Janeiro: EPUB.
13. Must A, Dallal GE, Dietz WH. Reference data for obesity: 85th and 95th percentiles of body mass índex (wt/ht$^{2)}$ and tríceps skinfold thickness – a correction. *Am J Clin Nutr*, 2000; 1991: 54 - 773.
14. Guedes DP, Guedes JER. *Crescimento físico de crianças e adolescentes do município de Londrina (PR), Brasil*. Kinesis, 1997b; 18: 91-106,.
15. Martins GA. *Manual para Elaboração de Monografias e Dissertações*. São Paulo: Atlas, 2000; 2.
16. Bouchard C. *Atividade Física e Obesidade*. Barueri, SP. Editora Manole, 2003.
17. Magill RA. *Aprendizagem Motora, conceitos e aplicações*. São Paulo, SP. Editora Edgard Blucher Ltda, 2000.
18. Instituto Nacional de Alimentação e Nutrição – INAN – Ministério da Saúde. Pesquisa Nacional Sobre Saúde e Nutrição. *Condições Nutricionais da População Brasileira*. Brasília: INAN, 1993.
19. Manning AS. *O desenvolvimento da criança e do adolescente*. São Paulo: Cultriz, 1981.
20. Papalia DE, Olds SW. *O mundo da criança: Da infância à adolescência*. São Paulo: McGran Hill do Brasil, 1981.
21. Paraguassú-Chaves CA et al. Perfil Antropométrico de Escolares em Rondônia. *Debate em Ação: Discussão Científica*, 2022; 1: 56-78.
22. Oliveira CL, Mello MT, Cintra IP, Fisberg M. Obesidade e síndrome metabólica na infância e adolescência. *Revista de Nutrição*, Campinas, 2004; 17, 2: 237-245. abr/jun.
23. Moura AA et al. Prevalência de pressão arterial elevada em escolares e adolescentes de Maceió. *J. Pediatr*. (Rio de Janeiro), Porto Alegre, v. 80, n.1, 2004. Disponível em: <HTTP:??www.scielo.br/scielo. Acesso em, 2022; 10.
24. Bellisle F, Rolland-Cachera M-F, Deheeger M, Guilloud-Bataille M.Obesity and food intake in children: Evidence for a role of metabolic and/or behavioral daily rhythms. *ELSEVIER*, 1988; 11, 2: 111 – 118.
25. Silva RCR, Malina RM. Sobrepeso, atividade física e tempo d televisão entre adolescentes em Niterói, Rio de Janeiro, Brasil. Brasília: *Revista Brasileira de Ciência e Movimento*, 2003; 11, nº 4: 63-66.
26. Nieman DC. *Exercício e saúde: como se prevenir de doenças usando o exercício como seu medicamento*. São Paulo: Manole, 1999.
27. Costa COM, Sarni RA, Fisberg M. Obesidade na infância e adolescência. *JBM (Jornal Brasileiro de Medicina)* – V, 1992; 62: 6.
28. American College of Medicine. *ACSM's guidelines for exercice testing and prescripion*. Philadelphia: Williamas and Wilkins, 1995.
29. Lopes AA. Influência da pressão arterial na incidência de doenças renais terminais em negros e mulatos portadores de glomerulonefrite. São Paulo, SP. *Revista da Associação Médica Brasileira*, 2001.