147 - A SOMATORYPE STUDY OF ADOLESCENTS FROM TECHNICAL COURSES INTEGRATED TO HIGH SCHOOL IN A CITY OF RONDÔNIA (BRAZIL)

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INTRODUCTION

Literature stresses the description and interpretation of human somatotyping variability as one of the center themes of investigation in many areas of Anthropology, Medicine and Science of Sports. “The variability is an exact fact in size and homo sapiens sapiens' body shape”. In this sense, the somatotyping is an adequate form of describe, interpret and classify the alteration that occur in human body in a morphological level (MAIA, 2004:37).

The somatotype represents bodily types. Those types relates to proportions of each body component (bone, muscles and fat). The somatology uses 13 classification categories (CARTER, 2002; FONTOURA, FORMENTIN & ABECH, 2008):

1. Central: all components are the same or do not differ in more than half unit.
2. Balanced ectomorph: endomorphy is dominant and mesomorphy and ectomorphy are equal or do not differ by more than one-half unit.
3. Endomorphic ectomorph: ectomorphy component is dominant and endomorphy is greater than mesomorphy.
4. Mesomorphic ectomorph: ectomorphy component is dominant and mesomorphy is greater than endomorphy.
5. Endomorph-ectomorph: endomorphy and ectomorphy components are equal and greater than mesomorphy or do not differ by more than onehalf unit.
6. Balanced endomorph: endomorphy component is dominant and mesomorphy and ectomorphy are equal or do not differ by more than one-half unit.
7. Ectomorphic endomorph: endomorphy component is dominant and ectomorphy is greater than mesomorphy.
8. Mesomorphic endomorph: endomorphy component is dominant and mesomorphy is greater than ectomorphy.
9. Balanced mesomorph: mesomorphy component is dominant and endomorphy and ectomorphy are equal or do not differ by more than one-half unit.
10. Endomorphic mesomorph: mesomorphy component is dominant and endomorphy is greater than ectomorphy.
11. Mesomorph-endomorph: endomorphy and mesomorphy components are equal or greater, not differing by more than onehalf unit.
12. Ectomorphic mesomorph: mesomorphy component is dominant and ectomorphy is greater than endomorphy.
13. Mesomorph-ectomorph: mesomorphy and ectomorphy compoents are equal or greater than endomorphy, not differing by more than onehalf unit.

Nevertheless, those categories may be simplified in four larger categories:

1. Central: it occurs when there is no predominance of one characteristic over another.
2. Endomorph: it is characterized by the harmony, roundness and regularity of the body and there is the predominance of the abdomen and a tendency to obesity (softness).
3. Mesomorph: it indicates greater fatless muscle.
4. Ectomorph: it refers to thinness, linear shapes, fragility and slimness of the body (PITANGA, 2000; CARTER, 2002; BARBANTI, 2003; FONTOURA, FORMENTIN & ABECH, 2008; FERNANDES FILHO, 2010).

According to Ribeiro et alii (2007) somatotyping is an instrument used to classify body composition and allows an accurate study about the ideal physical type relating to each sport modality.

In this sense, besides providing guidelines to children, teenagers and adults to appropriate sports according to their present and potential somatotype, literature also points three important facts concerning to the somatotypology use: describing and compare populations, monitoring growth and changes related to age, and monitoring modifications due to physical training and/or diet (FERNANDES FILHO, 2010).

Nevertheless, Guedes and Guedes (1999) emphasize that the intend to provide subsidies which can contribute to the awareness of the growth and maturation process of the somatotyping components have been limited to athletes, with a few studies being developed with non-athlete populations.

Therefore, in the yearly physical education plan, teachers from the Instituto Federal de Rondônia (IFRO) - Ji-Paraná Campus – have decided to monitor the anthropometric and functional development of the students, carrying out a test in the beginning of the school year. In the end of 2011, a second evaluation shall be carried out in order to verify possible alterations in those students along the year.

The present study presents the somatotyping characteristics identified in the first test. It is important to point out that the data collected through the tests and measurements carried out with students were organized in banner by the group and displayed during a week, so that students could question and be aware of it. This action aimed to make students attentive to the importance of health care. They also took part of lectures with physical education professionals and nutritionist, which brought up themes on the importance of maintaining healthy practices to prevent diseases, mainly active habits and balanced eating habits.

In this context, it is aimed to describe the somatotype of adolescents from the Instituto Federal de Educação, Ciência e Tecnologia de Rondônia (IFRO) Ji-Paraná Campus.

METHODOLOGY

The sample is composed by 264 students, among those 160 female and 104 male, from 13 to 17 years old (15.25±0.90 female, 15.51±0.98 male). These students are enrolled in one of the three Technical Courses integrated to High School (Jungles, Computer Science and Chemistry) of IFRO – Ji-Paraná Campus.

In order to collect data it was used: a) a mechanical scale with capacity of up to 150 kg and accuracy of 100 grams, in order to weight body mass; b) a stadiometer with a measurement scale of 0.1cm, to measure the height, c) a scientific adipometer with precision measurement of 0,1 mm, to measure the skinfold thicknesses, d) an adjustable sliding caliper, with markings in every 0.1 cm, to measure bone diameters, e) an inelastic and flexible anthropometric tape, with accuracy of one decimal place, to perform the circumferences measurements; f) a black demographic skin pencil, 4 mm thick for tracing the anatomical region to be

measured, g) forms to keep records of measurements.

Data were collected throughout the students' anthropometric evaluation and carried out during the physical education classes in February and March, 2011. Students who missed the anthropometric evaluation, the ones who were older than 17 and the ones with only part of the required measurements (incomplete data) were excluded from this study.

Data were collected by two Physical Education professionals from the Instituto Federal de Rondônia, who performed the same procedures during the measurement process, from the standardization by Fontoura, Fornentim and Abech (2008). The required measurements from the students, required to calculate the three somatotype components, included a) Height and weight; b) subscapular skin fold (SE), suprailiac (SI), triceps (TR) and leg (L); humerus and femur diameters; and c) leg and arm girth.

To determine the somatotype, Heath-Carter equations were used, as described below (FONTOURA, FORMENTIM & ABECH, 2008):

1st Component – endomorphy obtained from the equation:
Endomorphy = - 0.7182 + 0.1451 (X) - 0.00068 (X 2) + 0.0000014 (X 3)

Where X = (sum of triceps, subscapular and supraspinale skinfolds)

2nd Component – mesomorphy, obtained from the equation:
MESO = 0,858 (H) + 0,601 (F) + 0,188 (A) + 0,161 (L) – 0,131 (S) + 4,50

Read as:
H = Humerus diameter in centimeters (cm); F = Femur diameter in cm;
A = corrected arm girth in cm; L = corrected leg girth in cm.
S = Students' stature in cm;

To calculate the corrected arm girth it is necessary to subtract the value of triceps skinfold (corrected arm girth = corrected arm girth – triceps skinfold. To calculate the corrected leg girth it is necessary to subtract the value of leg skinfold (corrected leg girth = leg girth – L skin). In both cases, it is necessary to transform the value of leg and triceps skinfold thickness from millimeter to centimeters.

3rd component – ectomorphy, obtained from the equations:

$$HWP = \frac{STATURE}{\sqrt[3]{weight}}$$

If the HWP (height-weight ratio) is ranging from 38,25 to 40,75 ? ECTO = 0,463 (HWP) - 17,63
If HWP > 40,75 ? ECTO = 0,732 (HWP) – 28,58
If HWP 38,25 ? ECTO = 1

Body mass index (BMI) was calculated from the formula: BMI = Weight (kg)/ Stature $(m)^2$

The percentage of body fat (%BF) was determined by the described equations according to Pitanga (2000):

Male adolescentes:
13 to 14 years old
%BF = 1,21 (Σ_2) 0,008 $(\Sigma_2)^2$ - 4,4
15 to 17 years old
%BF = 1,21 (Σ_2) - 0,008 $(\Sigma_2)^2$ - 5,5
For those with Σ_2 higher than 35 mm
%BF = 0,783 (Σ_2) + 1,6

Female adolescents:
%BF = 1,33 (Σ_2) - 0,013 $(\Sigma_2)^2$ - 2,5
For those with Σ_2 higher than 35 mm
%BF = 0,546 (Σ_2) + 9,7

Σ_2 = sum of triceps and subscapular skinfolds

Data were tabulated and the calculations were carried out through Excel 2007 software and the statistical analysis in Excel XL Stat 2011 supplement.

RESULTS AND DISCUSSIONS

Adolescents' kinanthropometric morphological characteristics are presented in table 1. Body weight was the measurement which presented the highest data dispersion. The skinfold which has presented the highest rate was the subscapular and the one which has presented the largest girth was the leg's. When considering the average values, BMI and BF% are according to the standards recommended as healthy. However, it is observed in the highest indexes that there are girls and boys with high BMI. Similarly, when considering minimum indexes, BMI is indicative of malnutrition.

Regarding to the somatotype results, adolescents present greater endomorphy rates, followed by mesomorphy and the boys in mesomorphy, followed by endomorphy; and then ectomorphy. Taking these values and the ones presented in table 3, it can be stated that most part of the girls are endomorphy and most part of boys are mesomorphy.

Studies carried out by Guedes and Guedes (1999), with children and adolescents from 7 to 17 years old, showed some increase in endomorphy values, what can be resulted in an increase in students' body fat disposition.

The body fat excess can cause a set of problems in the cardiorespiratory system. Carramiñana and Pérez (1992) mentions some symptoms and illness resulted from overweight such as: infections (lung, bronchial), chronic bronchitis, bronchial asthma, emphysema, hypertension, arteriosclerosis, varicose veins, phlebitis, hemorrhoids, flatulence, dyspepsia, gastric problems, constipation, fatty liver, high cholesterol, and also psychological problems such as depression and low self-esteem. On the other hand, malnutrition may cause chronic tiredness, short stature, underweight, poor muscle strength, decayed teeth, inclination to irritability, flaccidity, slimness, facial tiredness and decreased psychomotor and cognitive skills.

Table 1: Average, standard deviation, minimum and maximum values in each collected variable from the 264 students evaluated.

GENDER	FEMALE				MALE			
VARIÁVEIS	X	S	MÍN	MÁX	X	S	MÍN	MÁX
Age	15.25	0.90	13	17	15.51	0.98	13	17
Weight	53.50	9,78	33	83	63.25	13.13	37	115.70
Stature	160.32	6.68	136	175	171.55	6.98	157	193
BMI	20.75	3.13	13.38	30.12	21.42	3.89	15.01	34.77
%BF	25.45	6.12	12.44	42.41	17.88	9.97	6.73	53.05
Endomorphy	4.72	1.36	1.95	7.89	3.34	1.85	1.42	9.57
Mesomorphy	3.55	1.23	0.25	7.74	4.22	1.42	1.86	8.84
Ectomorphy	2.79	1.48	-0.40	7.26	3.23	1.59	-0.70	6.67
Humerus	6.18	0.33	4.50	7.40	7.02	0.41	6.10	8.10
Femur	9.04	0.66	5.43	10.90	9.93	0.67	9	12.90
Corrected arm girth	22.57	2.47	16.07	30.64	25.11	3.15	12.71	33.53
Corrected leg girth	31.25	2.39	25.43	38.07	33.77	3.65	26.75	47.05
Subscapular	14.89	6.45	6.30	48.25	12.23	7.32	5.55	41.20
Suprailliac	14.85	5.85	5.75	34	11.26	8.44	4	46.50
Triceps	15.59	4.97	4.40	28.10	11.51	7.10	4.60	45.75

X = Average S = Standard deviation MÍN = minimum MÁX = maximum

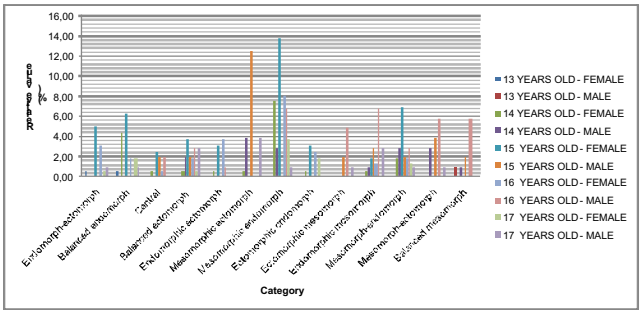
Regarding to the 13 somatotyping categories, it is observed that there is a greater concentration of mesomorph-endomorph female adolescents, followed by balanced endomorphy. While in boys', the mesomorphic ectomorph category prevailed, followed by endomorphic mesomorph and mesomorph-ectomorph.

According to Fernandes Filho (2010), women are usually more endomorphy and less mesomorphy than men, and they are similar in ectomorphy, having the somatotyping average 4,5-3,5-2,5 for women and 3-4,5-3 for men. By analyzing table 1 data under this perspective, it can be stated that the author's observation for men and women is also true for adolescents. Still, according to the same author, during adolescence mesomorphy increases and ectomorphy decreases in boys. Females tend to be classified in mesomorphic-endomorph and mesomorph-endomorph categories, beginning in adolescence. This behavior could be observed in the students who were evaluated, as shown in graph 1.

Table 2: Students' somatotype by category.

CATEGORY	FEMALE		MALE	
	Number of subjects	Relative value (%)	Number of subjects	Relative value (%)
Central	6	3.75	4	3.85
Balanced ectomorph	11	6.88	10	9.62
Endomorphic ectomorph	14	8.75	1	0.96
Mesomorphic ectomorph	1	0.63	21	20.19
Endomorph-ectomorph	12	7.50	1	0.96
Balanced endomorph	23	14.38	1	0.96
Ectomorphic endomorph	13	8.13	-	-
Mesomorphic endomorph	53	33.13	11	10.58
Balanced mesomorph	3	1.88	10	9.62
Endomorphic mesomorph	5	3.13	14	13.46
Mesomorph-endomorph	19	11.88	9	8.65
Ectomorphic mesomorph	-	-	8	7.69
Mesomorph-ectomorph	-	-	14	13.46
TOTAL	160	100	104	100

Graph 1: Somatotype by age and gender.



When analyzing the students' summarized somatotype it is observed that more than 63% of the adolescents have an endomorph biotype and more than 52% of the boys are mesomorphy. In the first one the digest system characteristics and tendency to obesity predominate and, in the second group muscularity aspects prevail. In both cases, health care is necessary, since it is known that eating habits, growth and physical exercises may alter the somatotype. Thus, those who have hyper caloric eating habits and reduced physical activities may develop endomorphic characteristics in the future, even though he/she can present a different somatotype in present-day.

In this study, as in Guedes and Guedes' (1999:16), considering the inverse existing relation between greater quantity of body fat associated to poor musculo-skeletal development with better health condition, it is evident the necessity of action implementation towards healthy eating habits and regular physical exercises. Therefore, positive morphological adaptation may occur, resulting in a major impact in students' health.

Then, the somatotyping use can be a tool for teachers to track children and adolescents' growth and develop body awareness activities through the use of strategies to make them aware of healthy practices, promoting health and preventing some modern illnesses.

That is so because in health/education relation, children and adolescents are a big concern in our time. When they are not guided and monitored appropriately they may run the risk of becoming adults full of serious complications resulted from overweight or underweight (GUEDES & GUEDES, 1997; KREBS & POBL, 2000; SANTOS et alii, 1992).

Therefore, active habits are imperative, mainly regular physical exercises, due to their importance, they constitute a central component in the weight-control programs, body fat reduction, muscular mass gain, bone strengthening, among other aspects related to health.

Table 3: Adolescents's somatotype profile.

	FEMALE		MALE	
CATEGORY	Number of subjects	Relative values (%)	Number of subjects	Relative values (%)
Endomorphy	101	63,13	13	12,50
Mesomorphy	27	16,88	55	52,88
Ectomorphy	26	16,25	32	30,77
Central	6	3,75	4	3,85
Total	160	100	104	100

CONCLUSION

In this study, it was shown that somatotyping may constitute a very important tool to identify and track children and adolescents' somatotype. The use of somatotyping in school environments may help in healthy action promotion and illness preventions such as obesity, diabities, cardiovascular diseases and problems related to overweightness.

Considering that, endomorphic somatotype can indicate a tendency to obesity and that that is the main characteristic in female students (63,13%), also present in male students, it is important to develop an attentiveness to healthy practices in order to reduce fat in those students who are already overweight/obese and to prevent in those who have the ideal weight.

Regarding to athletic potential and based on somatotyping diversity it can be understood that the existing athletic possibilities in this technical-high school institution is varied.

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A SOMATORYPE STUDY OF ADOLESCENTS FROM TECHNICAL COURSES INTEGRATED TO HIGH SCHOOL IN A CITY OF RONDÔNIA (BRAZIL)

Somatotype represents body types. These types are related to the proportion of each body component (bones, muscles and fat). In order to describe each person's somatotype the following expressions are used: a) endomorphy – characterized by the harmony (roundness) and regularity (softness) of the body, and digest system and tendency to obesity prevail; b) mesomorphy – it indicates greater musculo-skeletal mass; c) ectomorphy – it refers to thinness, linear shapes, fragility and body sliminess prevail; and d) central – when there is no predominance of one characteristic over another. This study has aimed to describe the somatotype of the adolescents from Instituto Federal de Educação, Ciência e Tecnologia (IFRO) – Ji Paraná Campus. The sample was constituted by 264 students, from 13 to 17 years old (average values 15,25±0,90 for female and 15,51±98 for male), studying in the morning or afternoon. From those, 160 were female and 104 male. The somatotype was calculated from the anthropometric measurements carried out according to specific protocols and based on Heath-Carter procedures, described by Fontoura, Formentin and Abech (2008), the calculations were done through Excel 2007 Software and

the statistical analysis in the Excel: XL Stat 2011. The following results were found out: a) female – endomorphy 63,13%, mesomorphy 16,88%, ectomorphy 16,25% and central 3,75%; b) male – mesomorphy 52,88%, ectomorphy 30,77%, endomorphy 12,50% and central 3,85%. It is necessary to develop preventive actions in school environments in order to avoid obesity, diabetes, cardiovascular diseases and problems related to body fat excess, thus the endomorphic somatotype has this feature and this characteristic predominates in 43,56% of the students analyzed. By the somatotyping diversity it can be stated that those students have various athletic possibilities.

KEY-WORDS: Somatotype. Students. School Health.

ÉTUDE DU SOMATYPE DES ADOLESCENTS DES COURS TECHNIQUES INTEGRÉE AU ENSEIGNEMENT MOYEN DANS UNE VILLE À RONDÔNIA (BRÉSIL)

Le somatotype représente les types des corps. Ces types ont des relations avec les proportions de chaque composant corporel (os, muscles et graisse). Pour décrire le somatotype d'une personne on utilise les expressions: un endomorphe) - caractérisé par l'harmonie (arrondi) et la régularité (douceur) de l'organisme, et a une prédominance du système digestif et de la tendance à l'obésité; b) mésomorphe - indique musculature (supérieur masse musculaire squelettique), c) ectomorphe - on réfère à la douceur, principalement des formes linéaires, la fragilité et la minceur du corps, et d) central - quand il n'y a pas de prédominance d'une caractéristique sur une autre. Cette étude a eu comme objectif décrire le somatotype des adolescents du Instituto Federal de Educação, Ciência e Tecnologia de Rondônia (IFRO) du Campus Ji-Paraná Rondônia (IFRO). L'échantillon a compris 264 élèves de 13 à 17 ans (valeur moyenne 15,25 ± 0,90 pour les femmes et 15,51 ± 98 pour les hommes), du matin et après-midi. Sur ces 160 a été de sexe féminin et 104 de sexe masculin. Le somatotype a été calculé à partir des mesures anthropométriques réalisées selon des protocoles et des procédures spécifiques sur la base de Heath-Carter, décrit par Fontoura Formentin et Abéché (2008), les calculs ont été effectués en utilisant le Excel 2007 et l'analyse statistique le Excel add-in: XL Stat 2011.Les résultats ont été: une femme) – 63,13% endomorphe, 16,88% mésomorphe, ectomorphe 16,25% et 3,75% centraux b) mâle –52,88% mésomorphe, ectomorphe 30,77% endomorphe12,50% et 3,85% central. On est conclu que le développement nécessaire de l'environnement scolaire, des actions préventives pour se protéger contre l'obésité, le diabète, les maladies cardiovasculaires et les troubles liés à l'excès de graisse corporelle, afin que le endomorphique somatotype ont cette prédisposition et est caractéristique prédominant dans 43,56% des élèves évalués. Par le diversité des somatotypes peut être dit que sont variées les possibilités athlétiques de ces étudiants.

MOTS-CLÉ: somatotype. Etudiants. Santé scolaire.

ESTUDIO DEL SOMATOTIPO DE ADOLESCENTES DE CURSOS TÉCNICO INTEGRADO A LA ENSEÑANZA SECUNDARIA EN UN MUNICÍPIO DE RONDÔNIA (BRASIL)

El somatotipo representa los tipos corporales. Esos tipos se relacionan a las proporciones de cada componente corporal (huesos, músculos y grasa). Para describir el somatotipo de una persona se utiliza las expresiones: a) endomorfo – caracterizado por la armonía (redondeo) y regularidad (macieza o suavidad) del cuerpo, y tiene predominancia del sistema digestivo y tendencia a obesidad; b) mesomorfo – indica musculosidad (mayor masa músculo esqueléctico); c) ectomorfo – se refiere a la delgadez, predomina las formas lineales, fragilidad y delgadez del cuerpo; y d) central – cuando no hay predominio de ninguna característica sobre otra. Este estudio tuve como objetivo describir el somatótipo de adolescentes del Instituto Federal de Educación, Ciencia y Tecnología de Rondônia (IFRO) del Campus Ji-Paraná. La muestra fue compuesta por 264 estudiantes, en el intervalo de edad entre 13 a 17 años (valores medios 15,25±0,90 para el sexo femenino y 15,51±98 para el masculino), de los turnos matutino y vespertino. De estos 160 eran del sexo femenino y 104 del masculino. El somatótipo fue calculado a partir de medidas antropométricas realizadas segun protocolos específicos y con base en el procedimiento de Heath-Carter, descrito por Fontoura, Formentin y Abech (2008), los cálculos fueran realizados en el Software Excel 2007 y el análisis estadístico en el suplemento del Excel: XL Stat 2011. Los resultados fueron: a) sexo femenino - endomorfo 63,13%, mesomorfo 16,88%, ectomorfo 16,25% y central 3,75%; b) sexo masculino – mesomorfo 52,88%, ectomorfo 30,77%, endomorfo 12,50% y central 3,85%. Se conclui ser necesario el desarrollo, en el ambiente escolar, de acciones de prevención como protección contra la obesidad, el diabetes, las enfermedades cardiovasculares y disturbios relacionados al exceso de grasa corporal, teniendo en cuenta que el somatotipo endomórfico tiene esa predisposición y es característica predominante en 43,56% de los estudiantes evaluados. Por la diversidad somatotipologica se puede afirmar que son variadas las posibilidades atléticas de esos estudiantes.

PALABRAS-LLAVE: Somatótipo. Estudiantes. Salud escolar.

ESTUDO DO SOMATÓTIPO DE ADOLESCENTES DE CURSOS TÉCNICO INTEGRADO AO ENSINO MÉDIO EM UM MUNICÍPIO DE RONDÔNIA (BRASIL)

O somatótipo representa os tipos corporais. Esses tipos relacionam-se às proporções de cada componente corporal (ossos, músculos e gordura). Para descrever o somatótipo de uma pessoa usa-se as expressões: a) endomorfo – caracterizado pela harmonia (arredondamento) e regularidade (maciez) do corpo, e tem predominância do sistema digestivo e tendência a obesidade; b) mesomorfo – indica musculosidade (maior massa músculo esquelética); c) ectomorfo – refere-se a magreza, predomina as formas lineares, fragilidade e delgadeza do corpo; e d) central – quando não há predomínio de nenhuma característica sobre outra. Este estudo teve como objetivo descrever o somatótipo de adolescentes do Instituto Federal de Educação, Ciência e Tecnologia de Rondônia (IFRO) do Campus Ji-Paraná. A amostra foi composta por 264 estudantes, no intervalo etário de 13 a 17 anos (valores médios 15,25±0,90 para o sexo feminino e 15,51±98 para o masculino), dos turnos matutino e vespertino. Destes 160 eram do sexo feminino e 104 do masculino. O somatótipo foi calculado a partir de medidas antropométricas realizadas segundo protocolos específicos e com base no procedimento de Heath-Carter, descrito por Fontoura, Formentin e Abech (2008), os cálculos foram realizados através do Software Excel 2007 e a análise estatística no suplemento do Excel: XL Stat 2011. Os resultados foram: a) sexo feminino - endomorfo 63,13%, mesomorfo 16,88%, ectomorfo 16,25% e central 3,75%; b) sexo masculino – mesomorfo 52,88%, ectomorfo 30,77%, endomorfo 12,50% e central 3,85%. Conclui-se ser necessário o desenvolvimento, no ambiente escolar, de ações de prevenção como proteção contra a obesidade, o diabetes, as doenças cardiovasculares e distúrbios relacionados ao excesso de gordura corporal, tendo em vista que o somatótipo endomórfico têm essa predisposição e é característica predominante em 43,56% dos estudantes avaliados. Pela diversidade somatotipológica pode-se afirmar que são variadas as possibilidades atléticas desses estudantes.

PALAVRAS CHAVE: Somatótipo. Estudantes. Saúde escolar.