

PHYSICAL GROWTH AND BODY FAT FOR BOYS FROM DIFFERENT ECONOMIC LEVELS

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Abstract

In this study, we aimed at comparing physical growth and body fat (BF %) among different economic-level (EL) boys and assessing results obtained from reference data. The sample consisted of 90 students, aged 11. Physical growth was assessed by means and percentiles (P5 – P95) of stature (ST) and body mass (BM). The BF % was obtained by Lohman's equation (triceps + subscapular). The BM and ST for medium and high EL boys were higher ($p < 0.05$). For the high EL boys, the BF % was higher ($p < 0.05$) than for the low EL boys. ST and BM were similar concerning the reference data (P5 – P95). Concerning the boys, (a) only 50 % reached a great BF % for health, (b) roughly 34 % presented BF % higher than the recommended and (c) 16 % showed low BF %.

Keywords: Stature - Socioeconomic Factors - Adiposity

Introduction

The physical growth can be understood as a growth of body or its parts as a whole. It can be measured, e.g., by using centimetres (stature – ST) or kilogrammes (body mass – BM). The ST and BM of children and adolescents are sensible indicators internationally accepted to detect the social, economic and political quality concerning the environment they live (OMS, 1985; MARCONDES, 1994).

To ease and become more practical measuring the ST and BM, the BMI is recommended by the WHO (OMS, 1985) to assess the physical growth. The BF measure, however, is most indicated, since it is a variable which shows both physical growth and sundry risk factors. Such factors, in addition, are linked to its excess and very low quantity.

Studies evinced that the quantity of children and adolescents with

overweight and obesity have gradually risen (WANG; MONTEIRO; POPKIN, 2002; GLANER, 2005; FERNANDES et al., 2007). Such obvious facts cause worry, since the metabolic syndrome prevails over 42.4 % of obese boys (BUFF et al., 2007). Children and adolescents, in general, with a high BF accumulation become obese adults, and they usually continue in such state until adult age (FREEDMAN et al., 2005). In such age, the overweight and obesity are connected with sundry non-transmissible chronic disease.

Men with relative BF over 19 % are riskier to develop non-transmissible chronic disease, e.g. cardiopathy, CVA (HU et al., 2000), hypertension (CERCATO et al., 2004), dyslipidaemia, Diabetes Mellitus (HIRANI; ZANINOTTO; PRIMATESTA, 2008), atherosclerosis (BACHA et al., 2004), etc. The predominance of cardiovascular risk factors is also within the socioeconomy (KRISTENEN et al., 2006). The economic levels are established to access the basic education, provided in the three school education systems, namely, municipal, state and private, which both lower classes and higher classes frequent.

By contrast, extremely low fat levels can be linked to bulimia (JACKSON; GRILO; MASHEB, 2002), anorexia (KERRUISH et al., 2002), and protein-calorie malnutrition (MARCONDES, 1982). Besides, Malina (1990) stresses that men are more susceptible to environmental influences than women. According to such fact, both excess and BF minimum values are particularly relevant. Based on the obvious facts presented in this study, we aimed at (a) comparing physical growth and BF among different EL boys, (b) assessing physical growth concerning the rules mentioned and BF regarding the criteria mentioned.

Methodology

Sample

The ELs are established to access the basic education, provided in the three school education systems, i.e. municipal, state and private, which both lower classes and higher classes frequent, in this order. To achieve such aim, thus, we had to search for the sample in those three school education systems.

The school selection was performed stratifiedly, considering the th-

ree school education systems of Chapecó, a major city in the western area of the state of Santa Catarina, Brazil. One school was at random chosen from each school education system. In each school, 30 boys (aged 11) were chosen. All chosen people volunteered to collect data. In this study, thus, 90 boys aged 11 took part in it.

Data collection

The legal persons in charge, before data collection, were informed on the study proposal. They agreed with a term which allowed the boys participating in this study. In such term was ensured that any volunteer could give it up at any stage of the collection, without any type of damage. They were also ensured of thorough anonymity and secrecy concerning the individual results, in compliance with the ethical standards in the resolution No 196/out. , 1996 and 251/97 (NATIONAL HEALTH COUNCIL). An Institutional Ethics Committee (IEC 174/07) approved the study. The collection was performed in the second half of 2008.

The BM and ST were measured as described by Petroski (2007). The relative BF was obtained by using the Lohman's equation (1986) ($BF \% = 1.35(TR + SE) - 0.012(TR + SE)^2 - CONSTANT$), which requires the total of tricipital and subscapular skinfolds. To measure it, we used a protocol described by Lohman (1986). A CESCORF compass was used. The technical error of measurement for skinfold measurement was lower than 5 % for each of them. All measurements were performed by the same person.

For the stratification in different ELs, Critério de Classificação Econômica Brasil [Brazil Economic Classification Criterion] (ANEP, 1996), which was adapted to three EL. The adolescents from families with monthly income roughly until R\$ 424.00 were considered low EL. The medium EL adolescents (classified as B1, B2 and C) came from families with monthly income between R\$ 425.00 and R\$ 2,804.00. For the high EL adolescents (Class A1 and A2), finally, families with monthly income over R\$ 2,805.00 were considered. Parents or legal persons in charge with whom boys lived answered the questionnaire at home. After the stratification, we observed that all school boys — from municipal, state and private schools — composed the low, medium and high EL, in this order.

Assessing the data based on rules and criteria

The BF % classification was performed as proposed by Lohman (1987). You can verify it in the box 1.

| | | | | | |
|----------|-----------|------------|-----------------|------------|-----------|
| very low | low | great | moderately high | high | very high |
| " 6% | 6.1 – 10% | 10,1 – 20% | 20.1 – 25% | 25,1 – 31% | > 31% |

Table 1 – Relative BF classification

The physical growth (BM and ST) was assessed according to the reference rules proposed by Marcondes (1982), INAN (1990) and Glaner (2003). The physical growth was considered normal from percentiles 5 to 95 (P5 – P95).

Dealing with statistics

All variables showed normal distribution, verified by performing an exploratory analysis and observing histogram and skewness. To verify the potential differences ($p \leq 0.05$) from the variables investigated between the three ELs, one-way and post-hoc ANOVA was used. To verify the students' percentage who respect the rules and criteria for the physical growth and FB % we used descriptive statistics, in this order. For all analysis Statistical Package for the Social Sciences, version 14.0, was used.

Results and discussions

In the table 1, you can verify the comparison among the three EL boys for the variables studied. There was statistical difference for all of them. The BM and ST were similar among medium and high EL boys and significantly ($p \leq 0.05$) greater than the low EL boys were. The BF % was significantly different ($p \leq 0.05$) for the low and high EL boys; thus, the value of low EL boys was smaller.

Table 1: Mean, standard deviation, and ANOVA (F) for the variables of boys pertaining to the three ELs

| variables | low EL (n=30) | medium EL (n=30) | high EL (n=30) | F |
|------------------|--------------------------|--------------------------|--------------------------|--------|
| BM _{kg} | 33.8 ± 4.5 ^a | 40.9 ± 10.0 ^b | 40.8 ± 7.9 ^b | 8.21* |
| ST _{cm} | 140.2 ± 4.6 ^a | 149.3 ± 7.4 ^b | 148.9 ± 5.6 ^b | 22.37* |
| fat % | 13.4 ± 4.8 ^a | 17.4 ± 8.1 ^{ab} | 21.0 ± 8.0 ^b | 8.49* |

Means with the same letter do not differ ($p > 0.05$); * $p \leq 0.001$.

The reference data for the percentage of boys which are below, normal and over the recommended to BF %, concerning the criteria of Lohman (1986), can be verified in the table 2. Only one boy (1.1 %) from the sample total presents very low FB %. In the low and medium EL there is the higher quantity (16.7 % in this order) of boys with low fat quantity, followed by the high EL (10 %). Concerning the great quantity of FB percentage, most portions of boys is at low EL, followed by the medium and high EL, totalising only 50 % of the total sample. In the case of percentage of boys having quantity of FB % moderately high and very high, occurs the opposite. Half of the high EL boys (50 %), 33.3 % for medium EL, and 20 % for low are all classified in this category.

Table 2: Absolute number and percentage of boys classified according to relative fat based on EL

| FB % | low EL | medium EL | high EL | Total |
|-----------------|------------|------------|------------|------------|
| very low | - | 1 (3.3%) | - | 1 (1.1%) |
| low | 5 (16.7%) | 5 (16.7%) | 3 (10%) | 13 (14.4%) |
| great | 19 (63.3%) | 14 (46.7%) | 12 (40 %) | 45 (50%) |
| moderately high | 6 (20%) | 3 (10%) | 6 (20 %) | 15 (16.7%) |
| high | - | 6 (20%) | 4 (13.3 %) | 10 (11.1%) |
| very high | - | 1 (3.3%) | 5 (16.7%) | 6 (6.7%) |
| Total | 30 (100%) | 30 (100%) | 30 (100 %) | 90 (100%) |

For the physical growth, five (16.7 %) low EL boys showed BM below for P5, and for the ST three (10 %). For the medium EL a boy (3.3 %) showed BM below P5, and for ST zero. For the high EL, any variable presented boy below P5, when it is compared to national (MARCONDES, 1982), regional (INAN, 1990), and local (GLANER, 2003) references.

Besides the genetic inheritance, the physical growth is related to three environmental factors: food, biopsychosocial stimulation and physical activity ((MALINA; BOUCHARD, 2002). The findings show that the low EL boys have lower values for BM and ST. It potentially occurred due to protein-calorie problems (MARCONDES, 1982), from purchasing power according to its partners. A similar result was obtained for BM when it is compared to fifteen-year-old boys, being different between the high EL and low EL (SILVA; PACCINI; GLANER, 2007). In this study, there were not differences for the ST variable among high EL, medium EL and low EL.

When assessing growth trends for other studies, considering the median value, or the percentile 50 (P50) as reference point, we realized that is also important to assess the growth for a certain range of variation. According to Marcondes (1982), such fact occurs due to P50 value variations having clinic meanings much smaller than the variations based on the external percentiles, e.g. P10 and P90. This same researcher define the normal ST, that in between P2.5 and P97.5. The author also considers watch situations it is between P2.5 and P97.5 for low ST and P90 and P97.5 for high ST.

Based on what Marcondes (1982) exposed, the results obtained in this study agree with other studies (GUEDES, 2002; PIRES; LOPES, 2004), which show problems in physical growth for a small portion of children from lower social classes.

The percentiles reported by the INAN (1990) and used here for comparison regards to southern region of Brazil. We used the data regarding such region since the need in building and using regional standards for growth are clear in the literature (MARCONDES, 1994; TANNER, 1986). In addition, the adolescents who compose the INAN sample (1990) would have developed in better conditions if the nutritional aspect and life general condition would be considered. It occurs because they came from a population with per capita income over or equal to 2.2 minimum salary, and this is the higher income range considered in this study.

As this study sample presents the same tendency to the cited study growth, one can say that most boys from low and medium EL do not suffer damage during growth due to the potential economic restrictions. Such behaviour perhaps came from the positive secular trend, found one decade ago in southern Brazil (BIANCHETTI; DUARTE, 1998; GLANER, 1998). The results we obtained here reveal that the secular trend perhaps also had a positive effect for the sample within nearly one decade for the medium and high EL boys. The mean values in this study are superior to state school education system students (MC = 37.6 ± 7.9 kg; ES = 144.9 ± 5.9 cm), obtained in the same city (GLANER, 2003).

The ethnical factor could also explain the normal growth for the sample concerning national and regional references (MARCONDES, 1994). In the sample city, most population is descendent of Italians, Germans and Poles (IBGE, 1999). The population which brought INAN sample (1990), however, was not described in such characteristic, and Marcondes' sample (1982) is defined as '... relatively mixed for migration...' and data collection place, Santo André city (State of São Paulo), was described as '... a real genetic laboratory...' (MARCONDES et al., 1982). Even the ethnic group being alike, the socio-economic conditions affect 12 % in ST (MARCONDES, 1994). It explains the low EL boys presenting a growth lower than the others.

The obesity has gradually risen over all cities widely. The unfortunate result falls over the fat excess being associated to sundry non-transmissible chronic disease, e.g. metabolic syndrome and risk factor for cardiovascular diseases (BACHA et al., 2004; HIRANI; ZANINOTTO; PRIMATESTA, 2008). On one hand, the results (table 1) show that the medium and high EL boys are more susceptible to unfortunate results linked to BF excess than the ones linked to low EL. On the other hand, the low EL boys seem to be more exposed to damages from a lower purchasing power. A similar result was obtained in other study, nevertheless, the total of triceps and calf skinfolds (SILVA; PACCINI; GLANER, 2007).

As children and adolescents with overweight and obesity usually remain in such state during their adult life (FREEDMAN et al., 2005), the tendency is that 34.4 % of the sample total continue in such condition. It occurs because they present BF % quantity moderately high or very high. The unfortunate result is greater for the high EL boys (50 %) followed by the medium EL (33.3 %). Such situation is highly im-

portant, considering that the predominance of metabolic syndrome is 42.4 % for obese boys (BUFF et al., 2007) in the same age group in this study.

Sundry explanations for BF excess accumulation can be considered. The first is from metabolism; the second, linked to energy imbalance. The first contribute to a minimum proportion of caused by such genetic deficiency. Studies have confirmed that physical inactivity or caloric intake excess, or both, are linked to BF excess accumulation (PINHO; PETROSKI, 1999; BUFF et al., 2007).

As the BF excess is linked to non-transmissible chronic disease, a very low quantity is linked to a potential protein-calorie deficiency (MARCONDES, 1982), which have negative implications for the physical growth (MALINA; BOUCHARD, 2002). From the total sample, only 1.1 % presents such potential deficiency. In this wise, however, 14.4 % of the sample needs attention; it shows low quality of BF %. Major worry for such category is not necessary, especially for low EL boys (16.7 %) and for mean EL boys (16.7 %).

For physical growth studies, the sample should represent different age groups and both genders (male, female). As in this study we used only one age group of a gender, perhaps this is our main restriction. The obtained results, however, allow to conclude that the sample in question shows normal growth. The tool we used, in addition, does not represent a great EL standard; it appreciates the purchasing power. Other limit perhaps is the use of an equation not valid to estimate the BF % for the assessing population. Such equation, however, is indicated as an excellent option to be used with children and adolescents (PIRES NETO; PETROSKI; GLANER, 2010).

Conclusion

According to the established objective and obtained results, we conclude that the medium and high EL boys showed the same behaviour for growth. They also had advantage over the low EL boys. Nevertheless, all of them presented the same trend for growth concerning the national, regional and local references, despite a small part of mean and low EL boys had presented values below the used references. Despite the physical growth being coupled with purchasing power, the mean and low EL boys seem to have enjoyed the necessary conditions for their development.

The high EL boys presented a higher BF % than the lower EL boys. Concerning the sample, only 50 % had BF % considered great for health. The other part, i.e. 34.4 %, presented BF % values over the great reference, while only 1.1 % presented BF % very low, and 14.4 % showed BF % low. A significant part of the medium and high EL boys, thus, seems to have found a favourable environment for the BF excess accumulation.

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