

**Original Article**

**Cardiorespiratory and nutritional status through anthropometric patterns of health in 12-14-year-old schoolchildren in urban and rural areas of the Araucanía Region, Chile**

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Published online: March 31, 2017

(Accepted for publication February 22, 2017)

DOI:10.7752/jpes.2017.01051

**Abstract:**

In Chile, the increase in childhood obesity in school populations is a concern and has become an important public health problem, both in urban and rural sectors, it has experienced an accelerated increase in the number of overweight or obese individuals. The objective of the research was to describe and relate nutritional status through anthropometric assessments and the state of cardiorespiratory condition among students from rural and urban sectors of the Araucanía region of Chile. A total of 103 students (males, n = 60, females, n = 43) between 12 and 14 years of age ( $M \pm DT$ : age =  $12.9 \pm 0.7$  years), belonging to rural and urban sectors of the municipality of Angol, Araucanía region, Chile took part in the research. To evaluate the anthropometric variables weight, height and waist circumference were measured, to then calculate BMI and waist / height index; Navette and Ruffier tests were applied to evaluate cardiorespiratory capacity and VO<sub>2</sub>max after which a statistical analysis was performed using the SPSS v20.0 software. The results obtained indicated that in general there are not too many significant differences between urban and rural students in the variables evaluated, VO<sub>2</sub>max variable had a significant difference ( $p < 0.05$ ) though, the population of urban students obtained better results in the evaluated variables over rural students, correlations were found between the variables, the most prominent, a negative correlation between VO<sub>2</sub>max and BMI, it is proposed to carry out new research in the related school population in rural and urban sectors throughout Chile.

**Key words:** School children, oxygen consumption, anthropometry, overweight.

**Introduction**

In the last three decades, there has been a progressive increase in overweight and obesity indicators worldwide, in the developed world as in developing countries (Wang & Lim, 2012), both in urban and rural areas, showing an accelerated increase in the number of obese individuals (Popckin, 2006). Obesity is the first metabolic disorder and a worldwide health problem. It is estimated that the obese population in the world represents one-sixth of the world's total population, and overweight individuals account for more than 50% of the population (Medialdea, & Medina, 2012). In Chile, the prevalence of overweight is 64.5%, which is comprised of 39.32% of overweight and 25.13% of obesity (Ministry of Health, 2011) and in the last decades not only in the adults, but also in the school-age population (Silva, Collipal, Martínez, & Torres, 2008). Evidenced in the national study of 8th grade schoolchildren aged 13-15 years found that 40.2% of them were either overweight or obese (Ministry of Education, 2010). Obesity in the adolescence increases the risk of developing diabetes (Li C, Ford et al, 2009), leading to other health complications, including hypercholesterolemia and hypertension (Brophy, Cooksey et al 2009) and metabolic syndrome, where visceral obesity and insulin resistance are considered as main characteristics that determine a negative cardiovascular profile (Faloia, Michetti et al 2012).

A 13% of Chilean population lives in rural areas (Moreno, 2007) and which corresponds to approximately 290,000 families settled in rural areas with a number of 2,185,831 people (Vera, Osses, & Schiefelbein, 2012). There are few studies related to physical education and rural schoolchildren that characterize their nutritional status, physical condition and cardiorespiratory recovery as cardiovascular risk factors. National reports indicate that most research has been carried out in urban sectors (Silva et al, 2008). Among the detection techniques for characterization we have the anthropometric techniques, these are used to evaluate the nutritional status of individuals and the risks associated with an inappropriate body fat (Fernandes, Souza, & Moreira, 2007), being the body composition and the distribution of adiposity useful indicators for the early diagnosis of risk factors for cardiovascular diseases (Pérez, Landaeta-Jiménez, Arroyo, & Marrodán, 2012). There is a consensus in the use of the Body Mass Index (BMI kg / m<sup>2</sup>) as a tool to classify obesity

(Wang, 2004), although it may be limited by the inability to differentiate between fat mass and lean mass (Weber, Leonard, Shults, & Zemel, 2014). Waist circumference (WC) provides a measure of central adiposity which has been specifically associated to cardiovascular risk factors (Sung, Yu, Choi, McManus, Li, Xu et al., 2007). In order to solve these difficulties, the waist-to-height ratio (WHtR) was developed as a product of dividing waist circumference in centimeters by the height in centimeters, which accounts for intraabdominal fat (Balas, Villanueva, Tawi, Schiffman, Suverza, & Vadillo, 2008).

The data on VO<sub>2</sub>max and cardiorespiratory capacity in Chile from SIMCE (National System for Evaluation of Learning Outcomes of the Ministry of Education of Chile) in Physical Education showed that of the total number of students in Chile, only 8% is at the leading level, while 27% is at an acceptable level and 65% need improvement (Education Quality Agency, 2013). Cardiorespiratory fitness is a measure of body function and its assessment should play an important role in physical activity promotion (Jankowski, Niedzielska, Brzezinski, & Drabik, 2015), when cardiorespiratory capacity is high it is associated with lower cardiovascular risk, especially when accompanied by weight reductions (Diez, Sánchez, Mora, Notario, Torrijos et al, 2014). Since it is a prognostic parameter for cardiovascular disease (Herdy & Uhlendorf, 2011), the variable VO<sub>2</sub>max is generally considered to be the best measure of cardiorespiratory capacity (Freedson and Goodman, 1993; cited in Meléndez-Ortega, Lucy, Barbeau, & Ann, 2010), given this and its importance, the determination of VO<sub>2</sub>max has become a routine procedure in research projects to evaluate the cardiovascular capacity of subjects (Meléndez-Ortega et al., 2010). It is of the utmost importance to collect evidence from adolescent schoolchildren in both rural and urban sectors to contribute to future public health policies in Chile.

The present research aims to compare and relate anthropometric variables and cardiorespiratory capacities, as cardiovascular protective factors among schoolchildren from rural and urban sectors of the municipality of Angol, Araucanía Region, Chile.

## Methodology

### *Design*

Sampling is non-probabilistic, subjects were chosen non-randomly by convenience and, it is of a quantitative cross-sectional type, whose common element lies in the property of objectifying the phenomenon under study through measurement or other operations such as classification and counting (Bar, 2010). It is of a descriptive comparative type, since it involves comparing groups through their most basic statistics, such as means; And correlational, they try to discover or clarify the relationships between the most significant variables of a phenomenon through the use of correlation coefficients (Mateo, 2009).

### *Participants*

The evaluated students belonged to urban and rural educational establishments from the municipality of Angol, Araucanía Region, Chile. We evaluated 103 students, 60 males and 43 females, between 12 and 14 years of age ( $M \pm SD$ : age =  $12.9 \pm 0.7$  years, height =  $1.61 \pm 0.07$  m, weight =  $60, 16 \pm 10.5$  kg, BMI =  $22.94 \pm 3.18$  kg · m<sup>-2</sup>). Participants were divided into two groups: students from urban establishments ( $n = 61$ ) and students from rural establishments ( $n = 42$ ).

### *Instruments and measures*

Data was collected on anthropometric variables such as Body Mass Index (BMI), Waist Circumference (WC), Waist Size Index (WCI), and data on cardiorespiratory capacity such as maximum oxygen volume (VO<sub>2</sub>max) and the Ruffier Index (RI). Size was determined using a SECA® brand measuring rod graduated in mm. The BMI was used to estimate the degree of obesity (kg / m<sup>2</sup>) and determining the participants' body weight status (low weight, normal weight, overweight and obesity) using BMI limits according to international standards (Cole, & Lobstein, 2012).

Waist circumference was measured using a tape measure applying internationally validated techniques (Marfell-Jones, Olds, Stewart, & Carte, 2006). Measurement of waist circumference has presented difficulties for its standardization, however, it is accepted that values <80 cm in women and <90 in men is a strict cutoff limit. Even though it has been a regular use that it is desirable <88 cm in women and < 102 cm in men (Balas et al, 2008), higher values are predictive of cardiovascular and metabolic risk (Moreno, 2010). In addition, the waist measurement was used along with height to determine the waist-to-height ratio (WHtR), whose desirable cut-off point was <0.5 (Muñoz, Pérez, Córdova, & Boldo, 2010). In order to determine the VO<sub>2</sub>max of the students, the Navette Course test was used, which consists of running between 2 lines separated by 20 m in both directions, round trip as long as possible (García & Secchi, 2014). At the end of the fatigue test, the time the subject was able to keep running is recorded and its VO<sub>2</sub>max is calculated using the following proposed formula for children from 6 to 17.9 years:  $31.025 + (3.288 \times VFA) - (3.248 \times E) + (0.1536 \times VFA \times E)$ , where VFA = Speed in km / h (speed =  $8 + 0.5 \times \text{stage number}$ ) and E = age. (Leger et al., 1988, cited in Garcia, & Secchi, 2014).

Ruffier test was used in order to evaluate cardiorespiratory capacity and physical state of the students; it's carried out as follows: the student must remain at rest for five minutes and then measure their heart rate (P1), then they must do 30 complete squats in 45 seconds, and finish by measuring the heart rate (P2) again; then after one minute of finishing the squats, the pulse (P3) is measured again. With these three heart rate measurements, the Ruffier Index (IR) is obtained by applying the following formula:  $(P0 + P1 + P2) - 200 / 10$ , then with the IR,

the cardiorespiratory capacity According to the following scale: 0 = Excellent; 1-5 = Very good; 6-10 = Good; 11-15 = Insufficient; 16-20 = Weak. (Rodríguez, García, A., García, T., Salinero, & Pérez, 2015).

#### *Procedure*

Contact was made with educational establishments in both urban and rural areas, and authorization was requested to access schoolchildren. The protocols were in accordance with the Declaration of Helsinki (2000), and approved by the Ethics Committee of the Catholic University of Temuco, Chile. Each parent or guardian must have signed an informed consent form for their child to participate in the study. Those who presented health problems, some disabilities that could affect the investigation, and those who did not present informed consent were excluded.

#### *Statistical analysis*

The first analysis was exploratory to debug the information, we proceeded to determine prevalence of the main study variables in along with a descriptive analysis. The variables were then normalized through the Kolmogorov-Smirnov test. For the comparison of quantitative parametric variables between two groups, Student's t-test was used, and when there were more than two, ANOVA was performed. The Pearson correlation test was used for the association of variables. All analyzes were performed using the SPSS program, version 19.0. The confidence level was 95%, ( $p < 0.05$ ).

### **Results**

*Table 1. Characteristics of the total population studied and comparison by type of population*

|                       | <i>N= 103</i> | <i>Urban N= 61</i> | <i>Rural N= 42</i> | <i>P value</i> |
|-----------------------|---------------|--------------------|--------------------|----------------|
| Age                   | 12,9 ± 0,7    | 12,59 ± 0,52       | 13,55 ± 0,50       | 0,000          |
| Weight                | 60,16 ± 10,5  | 58,74 ± 9,39       | 62,2 ± 11,7        | 0,099          |
| Height                | 1,61 ± 0,07   | 1,60 ± 0,07        | 1,63 ± 0,07        | 0,084          |
| BMI                   | 22,94 ± 3,18  | 22,69 ± 2,78       | 23,32 ± 3,68       | 0,326          |
| Waist C.              | 76,24 ± 8,17  | 75,39 ± 7,7        | 77,48 ± 8,6        | 0,206          |
| VO2max (ml)           | 44,68 ± 6,0   | 43,33 ± 5,44       | 46,65 ± 6,30       | 0,005          |
| Waist-to-height ratio | 0,47 ± 0,04   | 0,46 ± 0,04        | 0,47 ± 0,04        | 0,653          |
| Ruffier index         | 5,19 ± 2,15   | 5,05 ± 1,91        | 5,40 ± 2,47        | 0,425          |

Values are shown as mean ± SD. Values of  $p < 0.05$  are considered statistically significant. BMI = Body Mass Index.

In the comparison by type of population, the age variable presented a significant difference ( $p = 0.000$ ), the mean age of students in the urban sector is lower than that of students in the rural sector; the variables weight and height did not present significant differences ( $p > 0.05$ ), waist circumference was higher in rural students, although they did not present significant differences ( $p = 0.206$ ). The BMI was higher in rural students, but did not present significant differences ( $p = 0.326$ ); In the Waist Size Index, there were no significant differences ( $p = 0.653$ ). The variable VO2max shows significant differences ( $p = 0.005$ ), students in rural sectors have higher VO2max in relation to students in urban sectors. Regarding the Ruffier Index, students in rural areas had higher rates than the urban sector, although there were no statistically significant differences ( $p = 0.425$ ) (Table I).

*Table 2. Characteristics and comparison according to gender*

|                       | <i>Female N = 43</i> | <i>Male N = 60</i> | <i>P value</i> |
|-----------------------|----------------------|--------------------|----------------|
| Age                   | 12,95 ± 0,68         | 13,0 ± 0,71        | 0,741          |
| Weight                | 58,59 ± 8,98         | 61,28 ± 11,41      | 0,202          |
| Height                | 1,58 ± 0,06          | 1,63 ± 0,06        | 0,000          |
| BMI                   | 23,24 ± 3,06         | 22,73 ± 3,26       | 0,428          |
| Waist C.              | 74,47 ± 7,4          | 77,52 ± 8,5        | 0,061          |
| VO2max (ml)           | 41,24 ± 4,17         | 47,15 ± 5,92       | 0,000          |
| Waist-to-height ratio | 0,46 ± 0,04          | 0,47 ± 0,04        | 0,679          |
| Ruffier index         | 5,15 ± 2,26          | 5,22 ± 2,10        | 0,872          |

Values are shown as mean ± SD. Values of  $p < 0.05$  are considered statistically significant. BMI = Body Mass Index.

In the comparison by gender, the variables Age and Weight did not present significant differences ( $p > 0.05$ ), the height variable presented a significant difference ( $p = 0.000$ ), with males having a greater height than females. Regarding the anthropometric variables, women had higher BMI values than men, but without significant differences ( $p > 0.05$ ). In the variables Waist Circumference and Waist-to-height ratio, men presented higher results than women, but there were no significant differences ( $p > 0.05$ ). Regarding the variables of cardiorespiratory capacity, in the Vo2max, males had higher levels than females having significant differences ( $p = 0.000$ ); there were no significant differences for the Ruffier Index ( $p > 0.05$ ) (Table II).

Table 3. *Characteristics according to nutritional status*

| Characteristics       | Normal weight<br>(n= 47) 45,6% | overweight<br>(n= 44) 42,7% | obesity<br>(n= 12) 11,6% | P value |
|-----------------------|--------------------------------|-----------------------------|--------------------------|---------|
| Waist C.              | 71,17 ± 5,55                   | 77,84 ± 4,86                | 90,25 ± 8,02             | 0,000   |
| VO2max (ml)           | 44,80 ± 6,31                   | 45,86 ± 5,12                | 39,91 ± 5,87             | 0,008   |
| Waist-to-height ratio | 0,44 ± 0,03                    | 0,47 ± 0,02                 | 0,55 ± 0,03              | 0,000   |
| Ruffier index         | 4,92 ± 2,05                    | 4,97 ± 1,87                 | 7,05 ± 2,73              | 0,005   |

Values are shown as mean ± SD. Values of  $p < 0.05$  are considered statistically significant.

There were 47 students with normal weight (45.6%), 44 with overweight (42.7%) and 12 with obesity (11.6%), there were no students with malnutrition. Regarding the nutritional status evaluation in cardiorespiratory performance, there were significant differences ( $p < 0.05$ ) in the variables; VO2max ( $p = 0.008$ ) and Ruffier's index ( $p = 0.005$ ), higher VO2max results in students with normal weight, then overweight and finally obesity in descending order respectively, in relation to the Ruffier Index the highest indices were for students with obesity, then overweight and finally normal weight with lower rates. Regarding the anthropometric variables, students with obesity presented higher Waist Circumference and a Waist-to-height ratio, both variables with significant differences ( $P < 0.05$ ) (Table III).

Table 4. *Correlations between study variables and their association by population type*

|                       | a) BMI                 |        |               |        |               |        |
|-----------------------|------------------------|--------|---------------|--------|---------------|--------|
|                       | Total (n= 103)         |        | Urban (n= 61) |        | Rural (n= 42) |        |
|                       | Valor p                | R      | Valor p       | R      | Valor p       | r      |
| Waist-to-height ratio | 0,000                  | 0,715  | 0,000         | 0,629  | 0,000         | 0,822  |
| VO2max (ml)           | 0,005                  | -0,275 | 0,033         | -0,274 | 0,021         | -0,356 |
| Ruffier index         | 0,003                  | 0,294  | 0,066         | 0,612  | 0,001         | 0,478  |
| Waist C.              | 0,000                  | 0,712  | 0,000         | 0,661  | 0,000         | 0,762  |
|                       | b) Waist circumference |        |               |        |               |        |
|                       | Total (n= 103)         |        | Urban (n= 61) |        | Rural (n= 42) |        |
|                       | Valor p                | R      | Valor p       | R      | Valor p       | r      |
| Waist-to-height ratio | 0,000                  | 0,907  | 0,000         | 0,905  | 0,000         | 0,917  |
| VO2max (ml)           | 0,535                  | 0,062  | 0,513         | 0,085  | 0,824         | -0,035 |
| Ruffier index         | 0,000                  | 0,340  | 0,225         | 0,158  | 0,000         | 0,516  |

The values shown refer to the Pearson correlation coefficient. Values of  $p < 0.05$  are considered statistically significant.

In the whole sample when associating the variables Waist Size, VO2max and Ruffier Index with BMI, all variables showed significant differences, there being only negative correlation in the variable VO2max. When associated by population type, BMI has no correlation with Ruffier index in urban sector students ( $p > 0.05$ ), the other variables presented association in the urban sector, with VO2max having a negative correlation, whereas in rural students all variables presented association ( $p < 0.05$ ), with VO2max being the only one to present a negative correlation, the higher BMI, the lower the VO2max result. There was a positive correlation between BMI and Waist Circumference, both in the total sample and in the distribution of urban and rural schoolchildren ( $p < 0.05$ ) (a). When associating the variables with Waist circumference (b), in the total sample the variables Waist Size and Ruffier Index presented positive association in both cases and significant differences ( $p > 0.05$ ), the variable VO2max does not present association with Circumference Waist ( $P > 0.05$ ). In the association by population type, urban schoolchildren only present a positive association in the Waist-to-height ratio ( $p < 0.05$ ), the other variables do not present a correlation for this sector ( $p > 0.05$ ). In rural schoolchildren, the variables: Waist-to-height ratio and Ruffier Index, presented a positive association, the VO2max variable does not correlate with Waist Circumference in this sector ( $p > 0.05$ ) (Table IV).

## Discussion

In the studied population, lower prevalence values were found in normal weight (45.6%), overweight (42.7%) and obesity (11.6%) (Table III), compared to Chilean students' data in the SIMCE test (Ministry of Education, 2013). However, they presented higher values in overweight, and lower in obesity in relation to the total national population, who are 25.13% overweight and 39.32% obese (Ministry of Health, 2011). From the total number of students evaluated, 54.3% (Table III) were overweight (overweight and obese), which in the urban sector can find its explanation in the development of lifestyle and behaviors typical of urban and industrialized areas where an obesogenic environment is predominant, with the subsequent increase in health problems influenced by the increase of the obesity from early stages of development. In the present study, we found higher values in the rural population, similar to a research that showed that in 12-year-olds obesity rates were higher in rural sectors than in urban sectors in Finland (Vuorela, Saha, & Salo, 2009). This was also the case for students from Canada in which the highest percentages of overweight and obesity were found in rural subjects rather than in urban ones (Ismailov, & Leatherdale, 2010); and also in Spain, where it was reported a high prevalence of overweight and obesity in subjects from 6 to 14 years of rural sectors (Coronado, Otero, Canalejo, & Cidoncha, 2012). In relation to the IMC, a study of students from the city of Temuco, Araucanía Region, Chile, reported that 14-year-old students had a mean BMI of 27.0 (Silva, Collipal et al 2008) this is higher than the one found in the sample of this research with a BMI of 22,94; in the same manner, in the gender

distribution (Table II), the sample of the present study had lower BMI values in both men (22.73) and women (23.24) BMI. When comparing the results of BMI with foreign studies results, the students in the sample had higher values than Peruvian students (Cossio, Viveros, Hespanhol, Camargo, & Gómez, 2015), also when comparing to Portuguese students with a 19,82 BMI. A BMI (23.32) was found for rural schoolchildren, a higher result than the one found in rural American students (Jackson, Ellen, Manore, John, & Gunter, 2015). In the WC evaluation (Table I), the sample presented values of (76.24 cm), being these higher than those reported for Portuguese students (WC 73.11 cm) (Minghelli, Nunes, & Oliveira, 2013). In the distribution by gender (Table II), mean values in lower WC were found in females (74.47 cm) and in males (77.52 cm) as well as the total sample compared to students from Santiago, Chile (Arnaiz, Acevedo, Díaz, Bancalari, Barja et al, 2010).

As for Vo2max, the sample of rural schoolchildren (table I) of the present study obtained an average VO2max (46.65 ml / kg / min) which is lower compared to a sample of rural students from Tanzania, who presented an average Of Vo2max (56.0 ml / kg / min) (Aandstad, Berntsen, Klasson-Heggebø, & Anderssen, 2006). According to the classification by population type (table I), in the urban school children, lower VO2max values were found in comparison to the rural school students of the present research, showing a significant difference ( $P = 0.005$ ), which results were different from those found in urban and rural students in the Chilean highlands, in which no significant differences were found regarding VO2max between these two groups (Espinoza-Navarro, Vega, Urrutia, Moreno, & Rodríguez, 2009). In the gender distribution (table II), men performed better than women in the Navette test, reflected in the statistically significant differences of VO2max ( $p < 0.05$ ), similar results were found in another sample of students from the Araucanía Region, Chile (Delgado, Caamaño, Cresp, Osorio, & Cofré, 2015), another research where men obtained a higher Pacer test score and cardio-respiratory capacity in the one-mile race compared to Women (Burns, Hannon, Brusseau, Shultz, & Eisenman, 2013). There was a negative correlation between VO2max and BMI in the total sample ( $P = 0.005$ ,  $r = -0.275$ ). By urban and rural sector, there was a negative correlation, with higher BMI values being lower than VO2max values in students from both populations (Table IV). This negative correlation between IMC and VO2max has been demonstrated in another research by means of the Urho Kaleva Kekonen test in a treadmill (Radovanović, Kocić, Gajović, Radević, & Milosavljević, 2014). A positive correlation ( $p < 0.05$ ,  $r > 0$ ) between the variables IMC and waist circumference was found in both types of school populations, which indicates that the higher the BMI score, the higher the waist circumference of the students (table IV). Literature also shows this correlation between BMI and waist contour (Cresp, Caamaño, Ojeda, Machuca, & Carrasco, 2014). In a sample of Serbian schoolchildren, a negative inverse correlation was found between waist circumference and VO2max (Ostojic, Stojanovic, Stojanovic, Maric, 2011) which is not consistent with the results of this investigation ( $p > 0.05$ ). Regarding the waist-to-height ratio (table I), the average value of this variable in the total sample (WHtR =  $0.47 \pm 0.04$ ) was similar in comparison to a sample of students from Santiago, Chile, in women (WHtR =  $0.47 \pm 0.04$ ) and men (WHtR =  $0.46 \pm 0.04$ ) (Arnaiz, Marín, Pino, Barja, Aglony et al, 2010). In addition, this variable showed positive correlation to waist circumference ( $p < 0.05$ ), meaning that the bigger the waist circumference the higher the WHtR will be (Table IV), this same correlation has been found in a research conducted on 2319 schoolchildren between the ages of 6 and 14 in Spain (Marrodán, Martínez, González-Montero, López-Ejeda, & Cabañas, 2011). In the Ruffier index variable (Tables I), mean values found in the total RI sample was (5.19). Gender analysis (table II) showed values in men (RI = 5.22) and in women (5.15) lower than in a sample of adolescents in Spain. Moreover, in the sample of the present research no significant differences were found in Ruffier index between men and women ( $p > 0.05$ ), whereas in the sample of Spanish adolescents, differences were significant between men and women ( $p = 0.000$ ) (Rodríguez, García, A., García, T., Salinero, & Pérez, 2015).

## Conclusions

This research reported negative trend values in anthropometric variables and variables of cardiorespiratory fitness as predictors of cardiovascular risk both in schoolchildren of urban and rural sectors. Unfavorable results were found in 6 out of 7 analyzed variables in rural school children, evidencing significantly positive results in the VO2max levels (46.65 ml / kg / min); urban schoolchildren obtained a VO2max (43.33 ml / kg / min.), which is contrary to what is commonly thought, that rural schoolchildren have a better nutritional status and physical condition than schoolchildren in urban settings due to the absence of city habits. Research should be focused on school populations, since values were found in the variables evaluated that suggest a predisposition for chronic Noncommunicable diseases (NCDs); metabolic syndrome and cardiovascular risk. The use and association of anthropometric variables as predictors of health in any type of study population and fundamentally in the physical education class is an economic tool. The nutritional aspect and the generalized physical activity in the school age are elements to consider to prevent childhood obesity and to design public articulated policies in Health and Education.

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