



# COMPARISON OF PHYSICAL ACTIVITY LEVEL BETWEEN COLOMBIAN AND BRAZILIAN PHYSICAL EDUCATION STUDENTS

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## ABSTRACT

**Introduction:** Evidence suggests that populations of developing countries present high levels of sedentarism. In contrast, it is also shown that educational level and access to information regarding the health benefits of exercise can raise a population's level of physical activity (LPA). Thus, the present study aimed to evaluate the morphological profile (MP), level of physical activity (LPA) and cardiovascular risk among Brazilian (BPES) and Colombian physical education students (CPES) in an effort to determine if these specific subjects presented different results among themselves and in relation to normative data for each country. **Method:** The subjects, 59 BPES and 65 CPES, were evaluated through IPAQ in its short form, and had their MP determined through a bioelectric scale and waist measurement to determine the cardiovascular risk. **Results:** As result we verified that between BPES and CPES only waist circumference (WC) had significant difference ( $p = 0.016$ ), being higher for CPES males. Comparing the results of the subjects with normative data, with the exception of CPES males, we observed higher LPA, better MP, and lower WC values. Female CPES were more active than their male peers, the opposite being true for the Brazilian subjects. **Conclusion:** We conclude that the repetitive exposition to information regarding the benefits of physical activity and the access to installations that allows for its practice not only raises LPA of physical education students, but also improves, in general, their MP and cardiovascular risk.

**Keywords:** Physical Activity; Anthropometry, Motor activity, Questionnaires.

## INTRODUCTION

According to the World Health Organization, 23% of the world's adult population are insufficiently active <sup>(1)</sup>. Physical inactivity is a primary factor for the development of chronic non-communicable diseases (CNCD) such as cancer and diabetes <sup>(1)</sup>. In 2012, CNCDs accounted for 68% of the world's causes of death, with cardiovascular diseases killing 17.5 million people, representing three out of every 10 deaths recorded <sup>(2)</sup>. These numbers resulted in alarming expenses, accounting for up to 10% of the world's gross domestic product <sup>(3)</sup>.

Sedentary lifestyles and physical inactivity relates to other important mortality risk factors such as overweightness and obesity, evaluated by increasing measures of Body Mass Index (BMI), waist circumference (WC) and body fat percentage <sup>(4,5)</sup>. In this sense, studies have shown that higher levels of physical activity (LPA) are accompanied by the reduction of body fat, therefore, resulting in risk reduction in the development of CNCDs <sup>(6)</sup>.

Shuval *et al.* <sup>(4)</sup> demonstrated the positive association between a sedentary lifestyle and the increase in body

markers related to the occurrence of CNCDs. The study evaluated circulating triglyceride values, BMI, cardiovascular risk through WC, and body fat percentage of more than 2000 volunteers ( $n = 1304$  first analysis;  $n = 1269$  second analysis). It demonstrated that individuals with higher LPA have the best circulating triglyceride profile, BMI, WC and body fat percentage, evidencing the positive effect of physical activity as a CNCD marker regulator <sup>(4)</sup>. For reasons such as these, the American College of Sports Medicine (ACSM) recommends the practice of at least 150 minutes of moderate physical activity per week or 75 minutes of vigorous physical activity for the maintenance and improvement of health-related parameters <sup>(6,7)</sup>.

Several factors may influence a population's LPA. In a cross-sectional study that evaluated 19,298 university students from 23 different countries, Haase and colleagues <sup>(8)</sup> researched the influence of the following factors on leisure time LPA: a country's economic status, its population's recognition of the importance of physical activity for health, and its population's knowledge about the influence of physical activity on heart

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disease. As a result, they found that the population of developing countries have lower LPA when compared to those of developed countries, as well as less recognition about the importance of physical activity for health. It concludes that economic, cultural factors and beliefs about the influence of physical activity on health are important factors related to the population’s LPA.

Considering the cultural aspects, knowledge and belief in the benefits that physical activity can bring to health, we highlight that individuals enrolled in health-related university majors present higher LPA than individuals from other majors <sup>(9)</sup>. Among these, physical education students present the highest LPA, a fact attributed to their high participation in corporal practices during childhood and adolescence, determining factors for LPA in adulthood <sup>(10)</sup>.

Having discussed above some of the dangers and harms of a sedentary lifestyle <sup>(4)</sup> and evidence that a country’s economic landscape and its population’s beliefs in the health benefits caused by physical activity <sup>(8)</sup>, the present work is primarily aimed at evaluating LPA, Morphological Profile (MP) and cardiovascular risk through WC among physical education students from two developing countries: Brazil (BPES) and Colombia (CPES). We assume that specific groups, such as physical education students, among populations with lower levels of physical activity (underdeveloped countries) may present better LPA, MP and cardiovascular risk when compared to the general population of the same age range.

**METHODS**

**Subjects**

The present study is a cross-sectional analysis. The subjects were, respectively, students from Universidade Estadual de Campinas (UNICAMP), Brazil and the Universidad Tecnológica de Pereira (UTP), Colombia. All subjects ranged between 18 and 20 years of age, and were students of physical education (Brazil) or of sports and leisure sciences (Colombia). We conducted data collection between 2014 and 2016. The sample, n = 124, was determined by convenience. Among Brazilian subjects, 39 were men and 20 women; among Colombian subjects, 45 were men and 20 women. The study complied with ethical standards requirements from both countries and was approved by protocols CBE-SYR-192015 (UTP, in compliance with Resolution 8430 of 1993 of the Ministry of Health of Republic of Colombia) <sup>(11)</sup> and 938,574 (UNICAMP Research Ethics Committee). We informed all subjects of research objectives and all signed consent terms.

**Tests**

We evaluated LPA through the International Physical Activity Questionnaire (IPAQ) - Short Version, validated for the Spanish and Portuguese languages <sup>(12,13)</sup>, which quantifies physical activities in hours and different intensity levels.

Body composition and weight was evaluated by a bioelectric scale, a procedure validated for this kind of study <sup>(16, 17)</sup>. Researches assessed height by stadiometer and calculated Body Mass Index (BMI) by dividing body mass by height (cm) squared.

WC was determined with a tape following the AHA protocol <sup>(18)</sup>. WC is a measure established in the literature to evaluate cardiovascular risk, atherogenic factors and metabolic disorders <sup>(19)</sup>, even in populations with low BMI (<25 kg / M2) <sup>(20)</sup>. Studies have shown that the cutoff ratio for WC changes with respect to different ethnic groups and populations, for which the acceptable range recommendation used in this study was 88 to 90 centimeters for males and 83 to 84 for females <sup>(21)</sup>.

**Statistical analysis**

We used the Kolmogorov-Smirnov test to verify data normality. For the comparison between groups, the Mann-Whitney and Student’s T-Test were both used for the independent data. Data with non - parametric distribution were presented as median and quartiles (25% - 75%), and data with parametric distribution were presented as mean ± standard deviation. In addition, the data were also presented in absolute and relative frequency. Software SPSS 17.0 was used and p <0.05 was adopted as significance criteria.

**RESULTS**

A total of 124 individuals (n = 59 Brazilians and n = 65 Colombians) participated in the study. Age, WC, BMI, fat mass, total METs and total Kcals were identified as non-parametric measures, while body fat percentage and lean mass presented normal distribution.

We found no statistical difference between the variables for the BFES and CFES group, aside from WC (table 1).

With the results analyzed by gender, we found significant differences for the following variables: WC between BFES and CFES males; Weekly energy expenditure in METs and Kcal between BFES and CFES males and females (table 2).

**Table 1.** Characterization and comparison between countries.

Variables	Colombia (n=65)	Brazil (n=59)	P
Age (years)	23 [20-24]	21 [19-23]	0.11
Waist circumference (cm)	79,8 [65-108]	75,6 [61-103]	0.016*
BMI (kg/cm <sup>2</sup> )	23,1 [17,2-33]	23,3 [18-35,2]	0.24
Fat Mass (Kg)	11,8 [2,2-36,5]	14 [4,2-37]	0.69
Total METS	4067 [330-18690]	3419 [452-16692]	0.697
Total Kcal	2274,8 [385-23576]	3988 [558-20681]	0.842
% Fat	17,6 ± 7,9	19,8 ± 8,1	0.88
% Fat	54,1 ± 8,84	54,8 ± 13	0.14

(\* ) p <0,05. Data with nonparametric distribution were presented as median and quartiles (25% - 75%), parametric data were presented as mean ± standard deviation.

**Table 2.** Characterization and comparison between genders.

Variables	Man			Women		
	Colombia (n=45)	Brazil (n=39)	p	Colombia (n=20)	Brazil (n=20)	p
Age (years)	23 [ 20-24]	21 [ 19-23]	0,24	22 [ 20-26]	21 [ 18-24,2]	0.10
Waist circumference (cm)	79 [71,5-81,5]	75 [69,5-78]	0,02*	81 [75-87]	73,5 [69,4-84,1]	0.08
BMI (kg/cm <sup>2</sup> )	22,5 [20,7-24]	22,8 [20,4-24,7]	0,57	22 [21-23,8]	22,3 [20,6-27]	0.64
Fat Mass (Kg)	11,6 [6,91-14,5]	12,7 [9,62-17,9]	0,14	11 [6 -15]	12,3 [8-11,2]	6.19
Total METs	2245,5 [1212-3492]	3476 [2316-4216]	0,00*	5313 [3262-9353]	1905 [1370-3692]	0.00*
Total Kcals	2274,8 [1336-3953]	3824 [2790-5169]	0,00*	5879 [4256-12280]	2502 [1376-4480]	0.00*
% Fat	18,2 ± 8,25	20,7 ± 8,51	0,18	16,3 ± 7,18	17,6 ± 7,69	0.57
% Fat	52,5 ± 8,29	52,4 ± 12,4	0,97	57,8 ± 9,15	57,3 ± 13,3	0.89

(\*) p <0,05. BMI (Body Mass Index).

## DISCUSSION

The main finding of this study is that BFES and CFES of the same gender displayed significant differences in LPA, male BFES having a higher energy expenditure than male CFES, and the opposite being true for female BFES and CFES.

Several factors correlate with LP: social and cultural factors (governmental incentives for sports and leisure and a country's sport identity), environmental factors (access to sport and leisure facilities) <sup>(22)</sup>. In addition, Trots *et al.* <sup>(22)</sup> emphasize age and gender as the two main factors that influence LPA, men being more active than women and age being inversely correlated with it. In this study, we found that Colombian women have higher levels of physical activity than Colombian men do ( $p = 0.009$ ), it is possible to find similar results in the literature <sup>(24)</sup>. Several reasons may relate to this finding, such as cultural factors and the facilitated access that CFES have to sports facilities when they start university. There were no significant gender differences ( $p = .12$ ) among the BFES. We attribute this fact to the great incentives that students receive in their universities about the importance and benefits of practicing physical activity. However, we cannot rule out the hypothesis that, perhaps, physical education students have an inclination to practice physical activity, and thus, of course, have higher values for it.

A study by Bauman *et al.* <sup>(23)</sup> that used a similar methodology to ours, allows us to compare the values found for LPA to normative values for the general population of the same age group. In general, we can observe that BFES of both genders present a greater number of people classified as highly active than the average of the population for the same age group (variation of 27.7% more for men and 17% more for women). The same applies for CFES (46% higher for female). However, male CFES have a lower percentage of people classified as highly active when compared to the average values of the same age group (-17.9%). We speculate that this result comes from the fact that male students face great pressure to become successful professionals, thus prioritizing professional

and academic practices over physical activity at high levels. Certainly, this finding deserves attention by researchers.

We observed from the data that female physical education students are the most distant from the population mean for LPA. It is well known that in developing countries there is a patriarchal culture that restricts the practice of physical activity by women, as states Ramírez-Vélez *et al.* <sup>(25)</sup>. Perhaps the phenomenon observed in this work relates to the paradigm shift experienced by women, who are starting a physical education major in college, where they are expected to be active, together with facilitated access to structures that promote physical activity.

When we compared CFES MP through BMI with the normative data, we observed that there were no large differences between men (university mean 22.7; CFES mean 22.5) and women (university mean 22.6; CFES mean 22). In Brazil, normative male BMI scores for university students (25.2) is different from BFES scores, 22.7. The same is true for the women, with scores of 22.8 and 22.3 respectively. We observed in this case that male BFES presents lower BMI than the university average <sup>(26)</sup> by a variation of approximately 10%. Investigating the work of Carvalho *et al.* <sup>(26)</sup>, we observe that the higher percentage of visceral fat and BMI found in the male university student population is attributed to the more frequent habit, when compared to women, of alcohol consumption. In the present study, we did not investigate dietary habits, but we can speculate that the BFES, because they are inserted in a health area major, should have lower intake of alcoholic beverages when compared with university students of the same age group.

When comparing body fat percentage, lean mass and fat mass values between countries (table 1) and genders (table 2), we observed that there are no significant differences between them, and according to the classification of Foss and Keteyian, students in both countries fall into the optimal health category <sup>(26)</sup>. We observed in this case that, even though there was a significant difference in the weekly energy expenditure between the students of both countries, this difference did



not influence the MP regarding body fat percentage, lean mass and BMI.

According to the Colombian National Institute of Health, cardiovascular diseases are the main cause of death in the country. In 2011, 25.4% of Colombian deaths were caused by cardiovascular diseases<sup>(22)</sup>. In Brazil, according to the Ministry of Health, a large part of society (30%) is at high risk of developing cardiovascular diseases<sup>(28)</sup>. In the present study cardiovascular risk was assessed by waist circumference (WC). Carvalho *et al.*<sup>(26)</sup> states that the average WC for young Brazilian women and young Brazilian men was 75 cm and 87 cm, respectively. In the present study, we found that females had a mean of 73 cm, while men had a mean of 75 cm. We note that that there is a 13.7% variation for WC values between male BFES and university students evaluated by Carvalho *et al.*<sup>(26)</sup>, which is in agreement with the already verified variation of around 10% in BMI values among university students and male BFES. Colombian women and men aged 18-30 years WC normative values are, respectively, 72.2cm and 77.7cm<sup>(25)</sup>. In our study, the values were 81cm and 79cm, respectively, for females and males, demonstrating higher WC values for CFES (variation of approximately 10%). Although the values found were above the normative data, they are within the normal range for cardiovascular health<sup>(21)</sup>.

Regarding differences between the countries, we found that the Brazilian students presented lower WC than the Colombian students. To our knowledge, this is the first work to highlight this morphological difference between BFES and CFES. We hypothesize that the ethnic distribution among these countries account for this difference; the Brazilian population is composed of 47.7% whites followed by 43.1% mulattoes, while the Colombian population is composed of 84% mestizos and whites and only 10.4% mulattos. In addition to this fact, we also have evidence that the Colombian population is exposed to high altitude environments (average of 593 m)<sup>(28)</sup> while the average altitude in Brazil is 320 m. It is already consolidated in the literature that high altitudes can influence morphological aspects<sup>(29)</sup>, having as a main mechanism the anorectic effect of low atmospheric pressure and increased metabolic rate.

As our initial hypothesis, we assumed that physical education students would present higher LPA when compared to normative data, since they are constantly exposed to information about the benefits of physical activity and have privileged access to spaces that allow sports practice, even if residing in developing countries. The hypothesis was partially confirmed, since BFES of both sexes presented positive variations of up to 27% more than the normative data for the practice of physical activity in the highly active category. Also, female CFES presented LPA almost 50% higher than that found in the normative data. However, male CFES had a lower LPA in the highly active category when compared to the values for the country's young population<sup>(23)</sup>.

To our knowledge, this is the first study to show that there are significant differences regarding weekly energy expenditure and WC between BFES and CFES. However, these values did not significantly influence MP, body fat percentage, lean mass and BMI. Moreover, when we analyzed men and women as a group, only WC maintained a significant difference between the two populations, demonstrating the subject's similarities, even if belonging to two different South American countries. Regarding morphological comparisons, the BFES presented the greatest differences for BMI and WC when compared to the normative data, whereas the CFES presented higher values for WC, but still inside healthy parameters<sup>(21)</sup>.

## CONCLUSION

We conclude that Brazilian and Colombian physical education students have similar values for LPA variables, having MP and WC as their distinguishing parameters. When compared to normative data, the students presented, in general, higher LPA and better MP than the general population. The exception for this finding are the CFES, with men showing lower LPA scores and women showing higher WC scores, respectively. Studies should be done to evaluate the reasons and factors that led to this scenario.

## AUTHOR'S CONTRIBUTIONS

All authors made substantial contributions to the conception or design of the work; or the acquisition, analysis, or interpretation of data for the work. LAAC, MCU, CENG, HMG, conceived and designed the experiments; JFB, RACS, PYSS: collected data and drafted the manuscript; RFC, RACS, analyzed and interpreted data; LAAC, JFB, PYSS: Reviewed the scientific literature and wrote the final draft of the paper; CENG, MCU: Gave project orientation and approved the final version to be published.

## CONFLICT OF INTEREST

Nothing to declare

## AUTHOR DETAILS

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