Original Article

RBAFS Revista Brasileira de Atividade Física & Saúde
SOCIEDADE BRASILEIRA DE ATIVIDADE FÍSICA & SAÚDE

rbafs.org.br

Commute to school, level of physical activity, and physical fitness of young adolescents in the Municipality of Florestal, Minas Gerais

Diferentes formas de deslocamento para a escola, nível de atividade física e desempenho físico de jovens adolescentes do Município de Florestal - MG

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DOI

10.12820/rbafs.v.22n6p554-60

ABSTRACT

This study aimed to evaluate performance in physical fitness tests and physical activity level when comparing the level of physical activity and performance in physical fitness tests among adolescents who moved in three different ways to school. The sample was 60 students (50% female), divided equally into three groups: walk, bike and motorized transport, aged between 15 and 18 years (16,38 ±0,86 years). The physical fitness was evaluated by means of the six-minute run/walk tests, horizontal jump test and 20m maximal speed run. The physical activity score was estimated by the brief IPAQ version. The time and distance displaced by each school was estimated through the Global Positioning System by the Google Maps application. The main findings were that in the physical fitness evaluation, in neither test and for both sexes were found significant differences in physical performance of the three groups. But we found differences in physical activity levels between the walking and motorized transport groups. And the distance traveled by the motorized group was higher than that of the other groups, in both sexes, and the mean total time spent to perform the displacement in the bicycle group in both sexes was smaller. The differences in time or distance between the groups were not able to produce an effect on the physical fitness. We concluded that the walking group presents a higher level of physical activity to the other groups, pedaling and motorized, suggesting that walking improves physical fitness due to time spent on the course.

Keywords: Adolescents; Physical fitness; Physical activity.

RESUMO

Este estudo objetivou avaliar o desempenho em testes de aptidão física e o nível de atividade física ao comparou o nível de atividade física e o desempenho em testes de aptidão física entre adolescentes que de deslocavam de três formas distintas até a escola. A amostra compreendeu 60 escolares (50% do sexo feminino), divididos igualmente em três grupos: caminhada, bicicleta e transporte motorizado, com idades entre 15 e 18 anos (16,38 ±0,86 anos). A aptidão física foi avaliada mediante os testes de corrida/caminhada de seis minutos, salto horizontal e corrida de 20 metros. O escore de atividade física foi estimado pela versão curta do IPAQ. O tempo e distância de deslocamento foi estimado por meio do Global Positioning System pelo aplicativo Google Maps. Os principais achados foram que, na avaliação da aptidão física, em nenhum dos testes e para ambos os sexos foram encontradas diferenças significativas em relação ao desempenho físico dos três grupos. Foram indentidicadas diferenças nos níveis de atividade física entre os grupos caminhada e transporte motorizado: a distância percorrida pelo grupo motorizado foi maior do que a dos demais grupos, em ambos os sexos, e que o tempo total médio gasto para realizar o deslocamento no grupo bicicleta com relação aos outros grupos em ambos os sexos foi menor. As diferenças no tempo ou na distância entre os grupos não foram capazes de produzirem efeito nas aptidões físicas, mas pode-se concluir que o grupo que se desloca caminhando apresenta um maior nível de atividade física em relação aos outros grupos, pedalando e de carro, sugerindo que o deslocamento está associado as maiores níveis de condicionamento física.

Palavras-chave: *Adolescentes; Aptidão física; Atividade física.*

Introduction

Obesity is increasing worldwide, affecting about 641 millions of people[1]. Preventive measures, such as regular physical activities through transport, can be adopted for commuting to school helping stagger the elevated growth in obesity and its morbidities caused low level of physical activity[2,3].

Satisfactory levels of physical fitness related to health can favor prevention, maintenance, and improvement of functional capacity, lowering the likelihood of developing a number of chronical-degenerative dysfunctions such as obesity, type II diabetes, cardiovascular disease,

hypertension, among others, allowing for better health conditions and quality of life for the population[4,5]. However, it is important to know the population levels of physical fitness, physical activity, and to increase use of bicycles and walking for transport[3].

In low- and middle-income countries, little is known about active transport as physical activity[6]. Level of physical activity is a difficult measure as it may include occupational, leisure, domestic, and transport activities, as well as frequency, duration, and intensity of such activities[7,8]. Nonetheless, active transport is being studies in high-income countries[2,9]. Active transport to school can be an important source of daily physical activity[2,3,10]. Consistent evidence suggest that physical activity in transport is closely related to many health related outcomes such as increase in global physical activity[11], cardiovascular fitness[12], maintenance of body mass[12,13] and decrease in risk for cardiovascular events[14].

The benefits of riding a bike or walking for transport have been neglected since about half of the trips taken by citizens are short and promote an excellent opportunity for physical activity that is free and accessible for all[15]. Promoting the use of bikes has been one of the goals for the World Health Organization (WHO)[16] due to the need for a decrease in pollutants in cities resulting from motor vehicles, but also the promotion of health (reducing the amount spent in treatments for chronic-degenerative disease) that its use may represent at medium and long term[15]. Therefore, this study aims to compare the physical activity levels of three modes of transport to school, through walking, bicycling, or motor vehicle and physical fitness of adolescents in Florestal, Minas Gerais, Brazil.

Methods

A cross-sectional, descriptive, quantitative study was conducted aiming to collect information in physical activity level of participants, using the Brief IPAQ questionnaire[8,17] and three tests from the Projeto Esporte Brasil (PROESP-BR)[18]. On an exploratory perspective, evidence was searched where there was no knowledge of regarding physical activity and fitness levels of high schoolers in the municipality of Florestal, MG, in physical fitness tests, comparing three modes of commute to school – walking, cycling, and motorized.

Given the population that comprise the interest group for this study (adolescents), non-probabilistic intentional sampling was conducted for volunteers within the three groups: walking, cycling, and motorized. The sample was composed by 60 students of both genders, in high school within the public education system of the Federal University of Viçosa, Campus Florestal, Minas Gerais (UFV-CAF), divided into three groups; walking, cycling, and motorized. Each group had 20 participants, 10 boys and 10 girls, aged between 15 and 18 years old. Since there were interferences in the analysis, exclusion criterion was considered for those who carpooled, which could represent an interference in the results of the study.

The study was approved by the Ethics Committee in Research with Human Subjects of the UFV, under registered number 1.460.934, which is compliant with Brazilian legislation (466/12) of the National Council for Health in Research with Human Subjects. All adolescents were informed of the methodological procedures and their aims. Those who accepted to participate in the study were asked to sign an informed consent. Participants who were under the age of 18 had their parents sign the consent form.

For data collection, the Brief IPAQ questionnaire[7] and three tests were performed from the PROESP-BR manual[18]. The application of the questionnaire for physical activity levels and motor tests were conducted in the same day, during physical education classes in march of 2017 by the researches. These were performed during physical education classes, in a quiet environment, without the interference of researchers.

The Brief IPAQ consists in responding to eight questions aiming at verification of physical activity levels of the participant. To classify participants, answers were examined according to recommendations by Marsahl and Baumann[8]. The individuals who reported physical activity but did not meet the proposed recommendations were considered as insufficiently active. Classifications were substituted by values in a Likert scale in a quantitative format, aiming at comparing the following: 0= insufficiently active; 1= irregularly active B; 2= irregularly active A; 3= active; 4= very active, to make the quantitative comparison.

The Google Maps app was installed in adolescents' cellphones, where Global Positioning System (*GPS*) was used to monitor commute and individual analysis of each volunteer within the three groups to measure the distance and the time. The application is a search and visualization system, totally free and available online, and provided by the North American Google for smartphone with Android operational system. The version used in this study allows maps to multiple countries

in the world, including Brazil, and allows off-line navigation, being the 2015 version exclusively for Android.

Horizontal jump test, which measures lower limb strength. Twenty-meter run, which measures speed and six-minute running/walking test, which measures cardiorespiratory fitness, in this order.

The physical tests were conducted according to recommendations proposed by PROESP-BR. All previous explanations on the procedures were presented prior to the beginning of the questionnaire and tests. For all tests, students had two tries according to recommendations from the protocol, the highest value being noted, except for the six-minute running/walking. All tests were conducted by experienced researchers, where one was responsible for data collection of one measure/test while others controlled execution, aiming to avoid variability and guarantee reliability of data.

Residential addresses were collected from participants (street name, number, neighborhood, and city), to calculate commute distance and time spent between residence and campus and vice-versa, for data on mean time and distance of daily commute from home to school and back.

After definition of the three groups had their routes determined by *GPS*, considering the start and end addresses. This commute was multiplied by two, considering a round trip. The students collected data on distance and time and informed the researchers. In case the participant reported the round trip more than once, the number of times the trip was taken was registered. A "commute" was considered by walking, cycling, and motor vehicle:

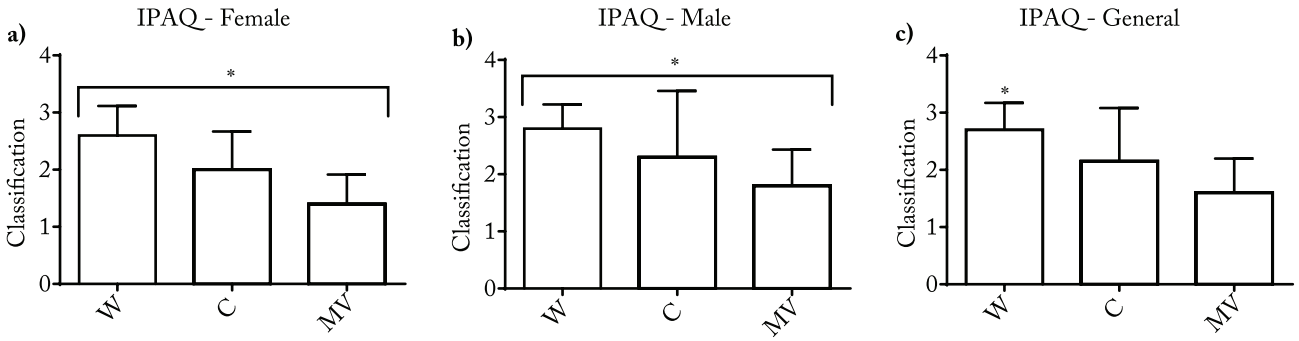

Figure 1 – Comparison of mean levels of physical activity among the groups Walking (W), Cycling (C) and Motorized (MV) for females (a), males (b) and total sample (c)
* Statistically significant at p≤ 0.05.

Table 1 –Results for horizontal jump, 20-meter run ad 6-minute run/walk for groups walking (W), cycling (C), and motorized (MV), (n= 60).

		Horizontal jump (m)		20m run (s)		6-minute run/walk (m)	
		Mean ± S.D	[Min;Max]	Mean ± S.D	[Min;Max]	Mean ± S.D	[Min;Max]
Female	W (n=10)	1,42 ± 0,17	[1,19;1,65]	4,37 ± 0,49	[3,88;5,39]	923 ± 210	[600;1200]
	C (n= 10)	1,47 ± 0,13	[1,27;1,66]	4,09 ± 0,34	[3,55;4,59]	902 ± 151	[690;1200]
	MV (n= 10)	1,37 ± 0,23	[0,94;1,64]	4,26 ± 0,40	[3,55;4,70]	843 ± 166	[600;1115]
		p= 0,640		p= 0,310		p= 0,650	
Male	W (n= 10)	2,05 ± 0,27	[1,85;2,62]	3,29 ± 0,44	[2,67;3,92]	1179 ± 249	[820;1600]
	C (n= 10)	1,93 ± 0,32	[1,47;2,30]	3,49 ± 0,51	[2,73;4,36]	1105 ± 214	[890;1430]
	MV (n= 10)	1,80 ± 0,33	[1,42;2,43]	3,62 ± 0,40	[3,12;4,38]	1039 ± 173	[660;1300]
		p= 0,182		p= 0,275		p= 0,621	
Total sample	W (n= 20)	1,74 ± 0,38	[1,19;2,62]	3,83 ± 0,70	[2,67;5,39]	1051 ± 253	[600;1600]
	C (n= 20)	1,70 ± 0,32	[1,27;2,30]	3,79 ± 0,51	[2,73;4,59]	983 ± 186	[690;1430]
	MV (n= 20)	1,58 ± 0,34	[0,94;2,43]	3,94 ± 0,50	[3,12;4,70]	941 ± 188	[600;13000]
		p= 0,369		p= 0,711		p= 0,282	

route by *GPS* form home address to the main building on campus, as well as commute for each group and mean results. Individual analysis considering commute for each participant in each group, also considering associations between the variables, beyond mean results.

Descriptive statistics was used, presenting mean for each of the groups. Non-parametric Kruskal Wallis test was used for multiple comparison and Dunn's post hoc. Test to verify differences used level of significance ($p \leq 0.05$), through statistical software (GraphicPrism 6.0).

Results

The levels of physical activity of adolescents in Florestal, Minas Gerais were statistically higher in male adolescents ($p< 0.001$) (Figure 1a) and female ($p< 0.05$) (Figure 1b) who moved walking, the way compared by motorized. The same results are showed when are male and female together (Figure 1c), but are statically different between cycling too.

When comparing female groups for lower limb strength (horizontal jump), speed (20-meter run), and cardiorespiratory fitness (6-minute run/walk), no significant differences were found (Table 1). The same was replicated for male and no significant differences were found (Table 1).

When comparing mean distances in commute, significant differences were found for females between motor vehicles group and the others (Figure 2a). For comparison in commute time, significant differences were found between the cycling group walking and motor vehicle groups (Figure 2b).

Similar results were found for comparison of means in commute distance for males, where there were significant differences between motor vehicle group and the other groups (Figure 2c). In the same way, when comparing groups for males in mean time in commute, there were statistically significant differences between cycling group and walking and motor vehicle group (Figure 2d).

Discussion

The aim aims to compare the physical activity levels of three modes of transport to school, through walking, bicycling, or motor vehicle and physical fitness of adolescents in Florestal, Minas Gerais, Brazil. . The levels of physical activity of adolescents were statistically higher in male adolescents ($p< 0.001$) and female ($p< 0.05$) who moved walking, the way compared by cycling and motorized. Individuals males commuting by walking showed higher physical activity levels than those using motor vehicles. The same was seen for females, where significant differences were found, that is, female individuals who commute by walking presented a higher level of physical activity when compared to those commuting by motor vehicles. In the same

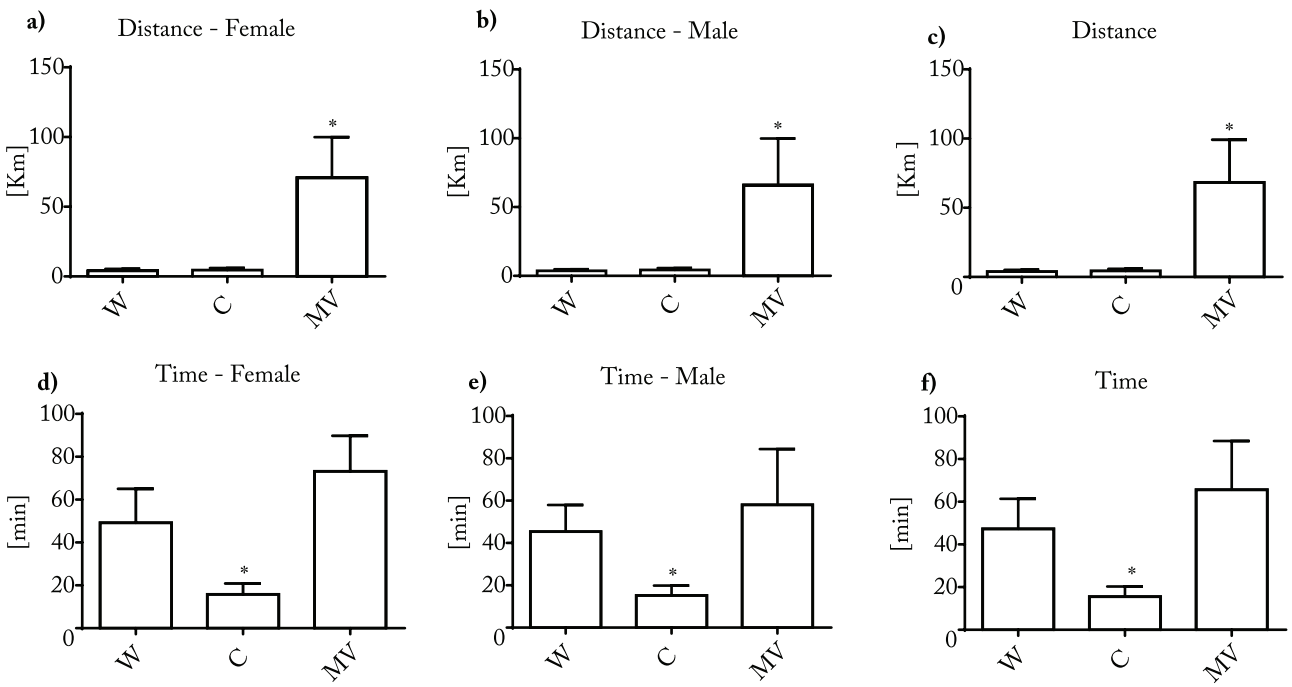

Figure 2 – Comparison between means for walking (W), cycling (C), and motor vehicle (MV) of female (a), male (b), total sample (c) commute distance and commute time for female (d), male (c), and total sample (f).
* Statistically significant at $p\leq 0.05$

way, when all participants are analyzed in one general groups, similar results were found; moreover, the walking group was more active than the cycling group. In agreement with this study, Saksvig et al.[19] found higher levels of physical activity (increase in 13.7 minutes in total physical activity) in North American school girls who walked to school when compared to those who did not. In national literature, there are few studies involving different active commute modes to school and level of physical activity[20].

In this study, there were no significant differences for those commuting by cycling when compared to the motor vehicle and walking groups for any of the gender categories for physical activity levels, nonetheless, commute by cycling was the fastest mode of transport even though it did not present the expected benefits such as the increase in activity levels. When grouping by gender, similar results were found by Mendonza et al.[21], where active commute to school by cycling was associated to higher levels of moderate to vigorous physical activity in 12 to 19 year olds and lower scores in adiposity among youth in the United States, before and after school.

Nonetheless, even though there were significant differences in levels of physical activity between the walking and motor vehicle groups, no differences were found in physical fitness: speed, strength, cardiorespiratory fitness when compared for both males and females and all. Even though physical activity levels can increase in adolescents, those are not enough to increase results in physical fitness tests. Though there were no significant differences, studies have shown that school children who commute to school by walking or cycling improve their cardiovascular fitness when compared to those who do not actively commute to school[22,23]. No significant differences were found in levels of physical activity in this study, likely due to the fact that cycling commute and/or walking were not enough to detect these differences. However, it would be interesting in new studies the use of accelerometers to reaffirm these results.

Two contexts of domains in which adolescents are physically active are during commute by walking and by cycling. Therefore, they may be considered active or inactive when comply or not with the groups in analyses in methodology. This classification considers low active those classified as inactive by choosing to commute by motor vehicle[24,25]. In comparison of mean distance, significant differences were found in mean total distance (round trip) of female commute routes from 4,400m for walking group, 4,600m for cycling group and 63,700m for motor vehicle group. For males, mean total distance in commute was 3,740m for walking, 4,330m for cycling and 65,800m for motor vehicle, that is, both girls and boys in each of the groups – walking and cycling, commuted a much smaller distance than those in motor vehicle group. No studies were found using *GPS* for measuring distance in meters used by adolescents to school. Only studies using physical activity monitors, such as accelerometers[3]. IPAQ is a simple questionnaire to be used, with adequate reliability even in small groups[26] and is considered valid for physical activity analysis and verified in studies with accelerometry[23,27]. Similarly, the use of GPS according to Souza et al.[28], which affirms the use of Google Maps is advantageous because it allows users to create and incorporate a number of robust functionalities to their own websites and applications, such as reference points and even add information to the map with the help of points, lines, polygons, images, and icons, and supports up to 25,000 map uploads per day, available in any website, which is used to help users locate themselves in the moment they insert a new geographic reference.

When comparing means in commute time totals, significant differences were found in total mean time (round trip) spent to commute in female groups of 49min walking, 15min cycling and 73min for motor vehicle. For males, total mean time spent was 45min walking, 15min cycling and 58min for motor vehicle. It is possible to infer that the time spent in motorized commute generated a waste of time that could be better used to add quality of life benefits to adolescents. However, this study did not evaluate quality of life of participants, even though this variable should be considered in future studies. The route and the short distance between the university and downtown contributes to the active commute of these adolescents, once the environment also favors this practice, due to lack of traffic and mostly leveled streets. The access environment to the university includes bicycle paths, walking paths, pedestrian crossings, signs, which are great stimuli for the use of active commute by bicycle or walking[29]. Environmental and physical factors may positively influence in the choice of students in active commuting by walking or cycling to their study place. When the route to school is direct and the terrain has plane characteristics, it is favorable to active commute by adolescents[30], nonetheless, those who commute to school in motor vehicles do it due to the distance, a mean of 68km. Though urban design to the university may contribute to the use of bicycle, we can stress that measures for promotion of daily use of bicycles must be

done to reach the goals proposed by the World Health Organization (WHO)[14].

Based on the results, was found in the physical fitness evaluation, in neither test and for both sexes no significant differences in physical performance of the three groups. But, was found differences in physical activity levels between the walking and motorized transport groups. The other find is that the distance traveled by the motorized group was higher than that of the other groups, in both sexes, and the mean total time spent to perform the displacement in the bicycle group in both sexes was smaller. The differences in time or distance between the groups were not able to produce an effect on the physical fitness. We concluded that the walking group presents a higher level of physical activity to the other groups, pedaling and motorized, suggesting that walking improves physical fitness due to time spent on the course.

Moreover, if regular physical activity and active commute are incorporated to the routine of adolescents, they may generate prevention of chronic disease and well-being to health at long term, but future studies should analyze these variables. It is important to stress that the use of *GPS* for commute, though results are limited, is useful in the description of routes and time in normal traffic conditions, but is less precise than if accelerometers were used for data collection. New studies with a design that allows to associate and/or investigate the interference of commute modes on levels of physical activities may present more information on the subject.

Conflict of interest

The authors declared no conflict of interest.

Funding

PIBID – Institutional Program for Scholarships for Initiation in Teaching – CAPES.

Author´s contribuition

Oliveira JC participated in the planning, data collection, data analysis and writing of the manuscript. Pussieldi GA participated in the planning, review of manuscript, orientation during data collection, and data analysis. Simplício AT participated in the planning, review of the manuscript, and orientation during data collection. Leite DMM participated in the review of the manuscript and writing of the manuscript.

Acknowledgments

We thank the Federal University of Viçosa – Campus Florestal.

References

1. Trends in adult body-mass index in 200 countries from 1975 to 2014: a pooled analysis of 1698 population-based measurement studies with 19·2 million participants. Lancet.2016;387(10026):1377-96
2. Stevenson M, Thompson J, de Sá TH, Ewing R, Mohan D, McClure R, et al. Land use, transport, and population health: estimating the health benefits of compact cities. Lancet. 2016;388(10062):2925-35.
3. Carlson JA, Saelens BE, Kerr J, Schipperijn J, Conway TL, Frank LD, et al. Association between neighborhood walkability and GPS-measured walking, bicycling and vehicle time in adolescents. Health Place. 2015;32:1-7.
4. Boreham C, Riddoch C. The physical activity, fitness and health of children. J Sports Sci. 2001;19:915-29.
5. TammelinT, Nayha S, LaitinenJ, Rintamaki H, JarvelinMR. Physical activity and social status in adolescence as predictors of physical inactivity in adulthood. Prev Med. 2003;37:375-81.
6. Rech RR, da Rosa CO, Avrela PR, Halpern R, Costanzi CB, Bergmann MLA, et al. Associated factors to active commute in school children. Rev Bras Ativ Fis Saúde. 2013;18(3):332-8.
7. Matsudo S, Araujo T, Matsudo V, Andrade D, Andrade E, Oliveira LC, et al. International Physical Activity Questionnaire: validity and reliability in Brazil. Rev Bras Ativ Fís Saúde. 2001;6(2):5-18.
8. Marshall A, Bauman A. The international physical activity questionnaire: summary report of the Reliability & Validity Studies. Produzido pelo Comitê Executivo do IPAQ. IPAQ - Summary, Mar. 2001.
9. Smith L, Norgate SH, Cherrett T, Davies N, Winstanley C, Harding M. Walking school buses as a form of active transportation for children-a review of the evidence. J Sch Health. 2015;85(3):197-210.
10. Tudor-locke C, Ainsworth BE, Popkin BM. Active commuting to school: an overlooked source ofchildrens' physical activity? Sports Med. 2001;31:309-13.
11. Faulkner GE, Buliung RN, Flora PK., Fusco C. Active school transport, physical activity levels and body weight of children and youth: a systematic review. Prev Med. 2009;48(1):3-8.
12. Cooper AR, Wedderkopp N, Wang H, Andersen LB, Froberg K, Page AS. Active travel to school and cardiovascular fitness in Danish children and adolescents. Med Sci Sports Exerc. 2006;38:1724-31.
13. Heelan KA, Donnelly JE, Jacobsen DJ, Mayo MS, Washburn R, Greene L. Active commuting to and from school and BMI in elementary school children preliminary data. Child Care Health Dev. 2005;31:341-9.
14. Hu G, Sarti C, Jousilahti P, Silventoinen K, Barengo NC, Tuomilehto J. Leisure time, occupational, and commuting physical activity and the risk of stroke. Stroke. 2005;36:1994-9.
15. Dora C. A different route to health: implications of transport policies. Br Med J (Clin Res Ed). 1999;318:16869
16. World Health Organization - WHO (2004). Global Strategy on diet, physical activity and health - Fifty-seventh World Health Assembly. Disponível em: url:http://www.who.int/dietphysicalactivity/strategy/eb11344/strategy_english_web.pdf
17. Pardini R, Matsudo SMM, Matsudo VKR, Araújo T, Andrade E, Braggion E. Validation of international physical activity questionnaire (IPAQ): pilot study in Brazilian young adults. Med Sci Sports Exerc. 1997;29(6):S5-9.
18. PROJETO ESPORTE BRASIL: manual. Disponível em: url: https://www.proesp.ufrgs.br.

19. Saksvig BI, Catellier DJ, Pfeiffer K, Schmitz KH, Conway T, Going S, et al. Travel by Walking Before and After School and Physical Activity Among Adolescent Girls. Arch Pediatr Adolesc Med. 2007;161(2):153-8.

20. Silva KS, Lopes AS, Silva FM. Physical activity in commute to school and free time in children and adolescentes in the city of Joao Pessoa, PB, Brazil. Rev Bras Ciênc Mov. 2007;15:61-70.

21. Mendoza JA, Watson K, Nguyen N, Cerin E, Baranowski T, Nicklas TA. Active Commuting to School and Association with Physical Activity and Adiposity Among US Youth. J Phys Act Health. 2011;8(4):488-95.

22. Blair SN, Cheng Y, Holder JS. Is physical activity or physical fitness more important in defining health benefits? Med Sci Sports Exerc.2001;33(6 Suppl):S379-99.

23. Davison KK, Werder JL, Lawson CT. Children's Active Commuting to School: Current Knowledge and Future Directions. Prev Chronic Dis. 2008;5(3):A100.

24. Pardini R, Matsudo S, Araújo T, Matsudo V, Andrade E, Braggion G, et al. Validation of the International Physical Activity Questionnaire (IPAQ - version 6): pilot study in Brazilian Young adults. RBCM. 2001;9(3):45-51.

25. Garcia LMT, Nahas MV. A bit of history, recente developments, and perspectives for research in physical activity and health in Brazil. Rev Bras Educ Fís Esporte. 2010;24(1):135-48.

26. Benedetti TRB, Antunes PC, Rodriguez-Añez CR, Mazo GZ, Petroski EL. Reliability and validity of the International Physical Activity Questionnaire (IPAQ) in older males. Rev Bras Med Esporte, 2007;13(1):11-6.

27. Garcia LMT, Osti RFI, Ribeiro EHC, Florindo AA. Validation of two questionnaires for evaluation of physical activity in adults. Rev Bras Ativ Fis Saúde. 2013;18(3):317-31.

28. Souza WD, Vidal Filho JN, Ribeiro CAAS, Lisboa Filho J, Franklin D. Voluntary Geographic Information in Pantanal: a web system collaborative using API Google Maps. Anais 4º Simpósio de Geotecnologias no Pantanal, Bonito, MS, 20-24 de outubro 2012. Embrapa Informática Agropecuária/INPE, p. 763 -72. Disponível em: url www.dpi.ufv.br/~jugurta/papers/geopantanal-p131.pdf.

29. Saelens BE, Sallis JF, Frank LD. Environmental correlates of walking and cycling: Findings from the transportation, urban design, and planning literatures. Ann Behav Med. 2003;25(2):80-91.

30. Timperio A, Ball K, Salmon J, Roberts R, Giles-Corti B, Simmons D, et al. Personal, family, social, and environmental correlates of active commuting to school. Am J Prev Med. 2006;30(1):45–51.

Recebido: 31/03/2017
Aprovado: 11/12/2017

Quote this article as:

Oliveira JC, Simplício AT, Leite DMM, Pussieldi GA. Commute to school, level of physical activity, and physical fitness of young adolescents in the Municipality of Florestal, Minas Gerais. Rev Bras Ati Fis Saúde. 2017;22(6):554-60. DOI: 10.12820/rbafs.v.22n6p554-60.