ASSOCIATION OF PHYSICAL ACTIVITY OF ADOLESCENTS, FAMILIES AND PEERS: A SYSTEMATIC REVIEW

Associação da atividade física de adolescentes, familiares e pares: uma revisão sistemática

Asociación de la actividad física de adolescentes, familiares y sus pares: una revisión sistemática

Review Article

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ABSTRACT

Objective: To analyze the association between physical activity (PA) of parents, siblings and peers with the PA of Brazilian adolescents through a systematic review. **Methods:** We conducted a systematic review in two stages, in June 2013 and February 2014 in the PubMed/MEDLINE, Web of Science, EBSCO and LILACS databases using four sets of descriptors, those being the influence of parents and siblings, physical activity, type of sample, and nationality, in English and Portuguese, which should meet the following criteria: (i) healthy subjects; (ii) Brazilian adolescents; (iii) studies addressing PA; and (iv) studies published between January 2008 and February 2014. **Results:** The search in databases resulted in 2,094 titles of potentially relevant articles, but only seven met all the inclusion criteria. There is a positive association between parents' and children's PA; however, when stratified by sex, this association is found only in women, both for inactivity and for being physically active. Social support has great influence on the PA of children and adolescents; however, such association has not been found in longitudinal studies. **Conclusion:** There is a positive association between the PA of father and mother with that of their daughters, both for inactivity and for being active, but no association was found between parents and sons, a fact that has also been observed as to inactive siblings. Social support proved to be effective to increase the level of physical activity in adolescents.

Descriptors: Motor Activity; Family Relationships; Friends.

RESUMO

Objetivo: *Analisar a associação entre a atividade física (AF) de pais, irmãos e pares à AF de adolescentes brasileiros por meio de uma revisão sistemática da literatura.* **Métodos:** *Realizou-se revisão sistemática em duas etapas, em junho de 2013 e fevereiro de 2014, nas bases de dados PubMed/MEDLINE, Web of Science, EBSCO e LILACS, utilizando-se quatro grupos de descritores, sendo estes "influência de pais e irmãos", "atividade física", "tipo de amostra" e "nacionalidade", nos idiomas inglês e português, que atendesse aos seguintes critérios: (i) indivíduos saudáveis; (ii) adolescentes brasileiros; (iii) estudos abordando a AF; e (iv) estudos publicados entre janeiro de 2008 e fevereiro de 2014.* **Resultados***: A busca nas bases de dados resultou em 2.094 títulos de artigos potencialmente relevantes, mas apenas 7 atenderam a todos os critérios de inclusão. Há uma associação positiva entre a AF de pais e filhos, porém, ao estratificar por sexo, esta é encontrada apenas no feminino, tanto para a inatividade quanto para estar fisicamente ativo. O apoio social possui grande influência na AF de crianças e adolescentes, no entanto, tal associação não foi encontrada em estudos longitudinais.* **Conclusão***: Existe uma associação positiva entre a atividade física do pai e da mãe com suas filhas, tanto para a inatividade quanto para serem ativos, mas não foram encontradas associações entre os pais e os filhos, fato também observado para com irmãos inativos. O apoio social mostrou-se eficaz para aumentar o nível de atividade física de adolescentes.*

Descritores*: Atividade Motora; Relações Familiares; Amigos.*

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RESUMEN

Objetivo: *Analizar la asociación entre la actividad física (AF) de los padres, los hermanos y sus pares con la AF de adolescentes brasileños a través de una revisión sistemática de la literatura.* **Métodos:** *Se realizó una revisión sistemática en dos etapas distintas (junio de 2013 y otra en febrero de 2014) en las bases de datos PubMed/MEDLINE, Web of Science, EBSCO y LILACS utilizándose cuatro grupos de descriptores "influencia de los padres y hermanos", "actividad física", "tipo de muestra" y "nacionalidad" en los idiomas inglés y portugués que atendiera a los siguientes criterios: (i) individuos saludables; (ii) adolescentes brasileños; (iii) estudios sobre la AF; y (iv) estudios publicados entre enero de 2008 y febrero de 2014.* **Resultados***: La búsqueda en las bases de datos resultó en 2.094 títulos de artículos relevantes en potencial, pero solamente 7 cumplieron todos los criterios de inclusión. Hay una asociación positiva entre la AF de padres e hijos, pero al estratificarlos por el sexo, la asociación se da solamente para el femenino tanto para la inactividad como para estar físicamente activo. El apoyo social tiene gran influencia en la AF de niños y adolescentes, sin embargo, esta asociación no ha sido encontrada en estudios longitudinales.* **Conclusión***: Existe una asociación positiva entre la actividad física del padre y de la madre con sus hijas para la inactividad y para el hecho de ser físicamente activo pero no fueron encontradas asociaciones entre los padres e hijos, hecho observado también con los hermanos inactivos. El apoyo social se mostró eficaz para el aumento del nivel de la actividad física de los adolescentes.*

Descriptores*: Actividad Motora; Relaciones Familiares; Amigos.*

INTRODUCTION

The benefits of regular physical activity (PA) are fully clarified by the scientific literature, which points out numerous benefits related to the adoption of an active lifestyle, including the improved strength and flexibility, prevention of metabolic diseases, psychological well-being and weight control[1-6]. However, in order to obtain such benefits, the PA should be present in at least 60 minutes a day[7], as suggested by the literature[8-10]. Currently, it is estimated that 31% of the population does not follow the minimum recommendations for PA, and 80.3% of young people aged 13-15 years fail to comply with the relevant recommendations for their age group[11]. Additionally, there is the alarming fact that children and adolescents tend to decrease their PA levels over the years[12-14], which constitutes a significant risk factor for metabolic disorders, which tend to remain in adulthood[15,16]. Concerning this aspect, the problem of low physical activity levels (PAL) is even more worrying, considering that even within the recommended standards for PA, there is evidence on the fact that sedentary time, when in excess, may increase the risk of mortality and cardiovascular disease[5,17].

Opting for a sedentary lifestyle in childhood and adolescence is partly influenced by parents[1,18]; however, the opposite is also described in the literature, i.e., the adoption of healthy habits can be influenced by parents[1,19]. In family relationships, siblings also present a correlation in their PAL regarding both active and sedentary individuals, indicating that subjects of the same generation, genetic, or who are closely related, tend to be similar in their PA habits[20]. Additionally, there is an association between PA and friends, which appears to be consistent[21].

Understanding the causes of a physically active behavior is essential for the development and improvement of public health interventions. Among these causes, social relations are identified as factors that can affect the PA[22].

Thus, the aim of this study was to analyze the association between physical activity (PA) of parents, siblings and peers with the PA of Brazilian adolescents through a systematic literature review.

METHODS

A systematic review was conducted in PubMed/MEDLINE, Web of Science, EBSCO and LILACS databases. The strategy for searching the studies was based on four groups of descriptors, which are: influence of parents and siblings, physical activity, sample type, and nationality, performed with descriptors in Portuguese and English languages previously consulted on the websites *Descritores em Ciências da Saúde – DeCS* (Health Sciences Descriptors) and Medical Subject Headings (MeSH), respectively.

The descriptors used for searching potentially relevant studies were: for the influence of parents and siblings (*influência* OR *pais* OR *parental* OR *relações familiares* OR *pares* OR *irmão*), (*influence* OR *parents* OR *parental* OR *family relations* OR *peer* OR *sibling*); for its combination with physical activity (*atividade motora* OR *atividade física* OR *exercício*), (*motor activity* OR *physical activity* OR *exercise*); for the combination with sample type (*criança* OR *juventude* OR *jovem* OR adolesc*), (*child* OR *youth* OR *teen** OR *adolesc**) and, finally, the nationality (*Brasil**, *Brazil**). Boolean operator "*AND*" was used for the combination between the groups of descriptors.

The present systematic review was carried out in two stages: the first was held in June 2013 and the second in February 2014 due to a possible updating of publications.

The inclusion criteria adopted in this review were: (i) healthy subjects; (ii) samples including Brazilian

adolescents aged 10-19 years being compared to their respective families; (iii) studies addressing the PA, whether as an exposure or outcome variable; and (iv) studies published in the time interval between January 2008 and February 2014 in an attempt to use the latest literature.

Studies conducted with subjects who were unhealthy or had some form of disability, whether momentary or permanent; samples that were not Brazilian; studies that did not address the PA, both as an independent or dependent variable; studies published in the period different from the pre-established one and published in languages other than Portuguese, English or Spanish were excluded.

RESULTS

The bibliographic research identified 2,094 titles of potentially relevant articles for the present review, with 1,995 in the first search and 99 in the second. After reading all the titles, 109 studies were selected – according to the inclusion and exclusion criteria – for abstract analysis. After this stage, 26 studies were selected for the reading of full articles. At the end of this process, six articles met all inclusion criteria, as well as 1 article selected from the list of references of the selected studies, making up a total of 7 articles used (Figure 1).

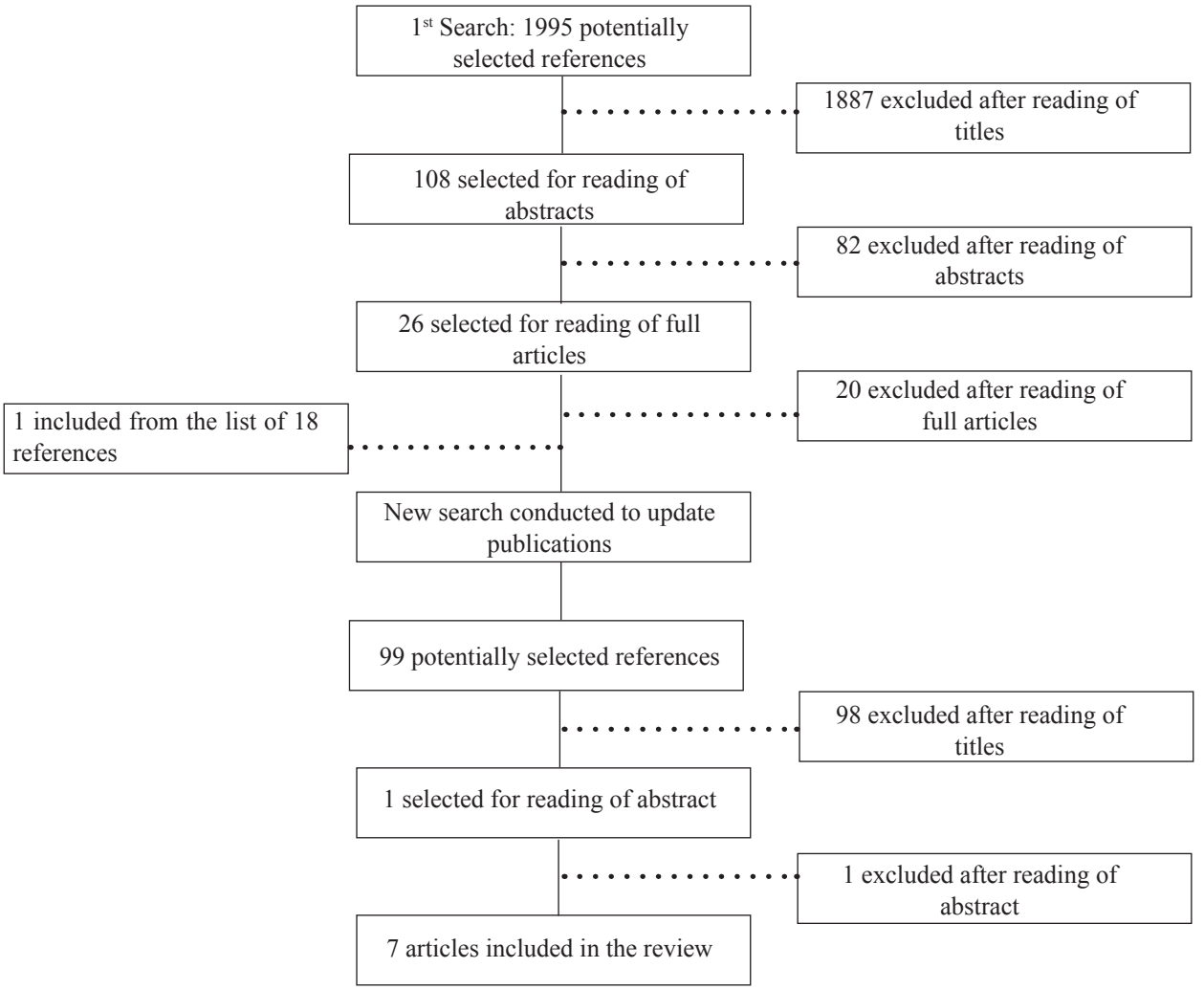

Figure 1 – Article selection flowchart. Curitiba, PR, 2013-2014.

Chart 1 shows general information on the methodologies employed, and Chart 2 presents the main results found by the 7 articles included in the systematic review. Of the selected articles, six are cross-sectional studies[1,18,23-26] and one is a prospective longitudinal study[14].

Age groups were similar among the studies; however, the youngest sample was of 7-year-olds[24] and the oldest was of 19-year-olds[23]. However, there was a coincidence regarding the states where the research took place. Rio Grande do Sul was present in four studies, represented by the municipalities Barão do Triunfo[1] and Pelotas[14,23,26]. In addition to these, Curitiba, PR[25] and São Paulo, SP[24] are present in the studies, and only one did not report the location where data were collected[18].

Regarding the study populations, two articles presented representative samples[23, 25] describing the procedures for the respective calculations. Two studies used a cohort of individuals born in 1993[14, 26] and one evaluated all school students within the age group of interest[1]; however, the latter obtained a low power for certain analyses. Finally, two other studies used intentional samples[18,24].

With regard to the instruments used to evaluate PA, there was a prevalence of self-reported evaluations, which are used by four articles[1,18,24,25], one of which used the "Fantastic Lifestyle" questionnaire[18] and another used the long version of the International Physical Activity Questionnaire (IPAQ)[1] to evaluate the PAL of parents. Three other studies used the structured interview as an instrument to measure PA[14,23,26]. There is no consensus on the type of PA analyzed by the articles selected in the present systematic review. The instruments used evaluated the PA of their samples by different ways, as shown in Chart 1.

Studies using the common activities within the age group as a measure of PAL found a prevalence of low PA in percentiles of 52.3 and 72.8[14], 56.5 and 82.1[23] and 37.4 and 65.5[26], for males and females, respectively – the latter two studies also used active commuting to reach these results. Among parents, three studies selected in this review categorized the PA into active or inactive, with the results of inactivity in percentiles 76.9 and 78.5[23] for father and mother, respectively. Two other studies did not stratify parents by sex and found a prevalence of inactivity in 84.7%[26] and 48.5%[1], and in another study two-thirds of mothers of adolescents were not involved in PA in their leisure time[14].

In two articles[23,26], the PA of daughters was positively associated with parental PA, with prevalence ratio values of 1.21 (1.01 to 1.46), 1.14 (1.02-1.28)[23] and 1.50 (1.31-1.72)[26], and one study found a positive association for the adolescent and the father, with a prevalence ratio of 1.40 (1, 10-180)[1].

Chart 1 - Methodologies employed in the systematic review of the association of physical activity of adolescents, family and peers. Curitiba, PR, 2013-2014.

PA Domain	Child / Adolescent	Parents	Siblings	Peers
Common activities in the age group	Dumith et al. (2012)[14]; Bastos, Araújo, Hallal (2008)[23]; Dumith et al. (2010)[26]	-	-	-
Active commuting	Bastos, Araújo, Hallal (2008)[23]; Duncan et al. (2011)[24]; Dumith et al. (2010)[26]	-	-	-
Sports practice	Duncan et al. (2011)[24]	-	-	-
MVPA	Fermino et al. (2010)[25]	-	-	-
Active / Inactive	Raphaelli, Azevedo, Hallal (2011)[1]	Petroski, Pelegrini (2009)[18]	Duncan et al. (2011)[24]	-
Lifestyle	-	Raphaelli, Azevedo, Hallal (2011)[1]; Dumith et al. (2012)[14]; Bastos, Araújo, Hallal (2008)[23]; Dumith et al. (2010)[26]	-	-

MVPA: Moderate to Vigorous Physical Activity

Chart 2 - Studies on the association of physical activity (PA) of adolescents, parents, siblings and friends and their main results. Curitiba, PR, 2013-2014.

Reference	Study design	PA Measure	Association with	Statistical treatment	Association of PA of adolescents with parents, siblings and/or peers
Bastos, Araújo and Hallal, 2008[23]	Cross-sectional	Semi-structured interview	Father and mother	Poisson Regression	Girls whose mothers and fathers are inactive are at greater chance of being inactive (1.21 and 1.14, respectively). No association among boys.
Dumith et al., 2012[14]	Prospective longitudinal	Self-reported	Mother	Multiple regression	No significant association.
Duncan et al., 2011[24]	Cross-sectional	Self-reported	Father, mother and siblings	Logistic regression	Children and adolescents whose one parent does physical activity has 1.25 more chances of being overweight/obese compared to those whose none of the parents does physical activity. Those who were encouraged by one or both parents have 1.67 and 1.63 more chances of being overweight/obese, respectively, compared to those who were not encouraged. No association regarding inactive siblings was found.
Dumith et al., 2010[26]	Cross-sectional	Self-reported	Father and mother	Poisson Regression	Girls whose fathers and/or mothers are active have 1.50 more chances of being active compared to daughters of inactive parents. No association among boys.
Fermino et al., 2010[25]	Cross-sectional	Self-reported	Family and friends	Poisson Regression	Adolescents who receive social support from family have 1.32 and 1.14 more chances of being physically active compared to those who do not so, in the bivariate and multivariate analyses, respectively. Adolescents who receive social support from friends have 1.97 and 1.52 more chances of being physically active compared to those who do not so, in the bivariate and multivariate analyses, respectively. Adolescents who receive social support from Family have 1.49 more chances of following the recommendations for PA (≥60 min/day) compared to those who do not so. Adolescents who receive social support from friends have 2.44 more chances of following the recommendations for PA (≥60 min/day) compared to those who do not so.
Petroski, Pelegrini, 2009[18]	Cross-sectional	Self-reported (Fantastic lifestyle)	Father and mother	Fischer's Exact	Children with low body fat percentage have parents whose lifestyle is more favorable to health.
Raphaelli, Azevedo, Hallal, 2011[1]	Cross-sectional	Self-reported (Bastos et al, 2008[23] and IPAQ long version)	Father and mother	Chi-squared test and Poisson Regression	Association between the physical activity of the father and that of the adolescent in the raw analysis. In the adjusted analysis, the probability of the adolescent being active was 1.40. When stratifying the analysis by sex of the school student, having an active father was associated with greater chance of female adolescents engaging in physical activity.

PA: Physical Activity

DISCUSSION

The fact of finding few Brazilian studies indexed in international databases clearly shows the need for research on the PA of adolescents and their relationships with family and peers, corroborating with authors who reported the need for studies on social aspects and PA[22].

It is known that PA below the recommended levels is one of the most common risk behaviors among adolescents, with prevalence rates above 50%[27], which are similar to the results presented by the articles of this review; however, they are below the global average, which is 80.3% of adolescents who fail to follow the recommendations for PA[11]. Regarding parental PAL, the studies in the present review present values which are far above the global average values, which is 31.1% of physically inactive adults[11]. These differences may be related to different types of instruments used to estimate PA, in addition, of course, to the socio-cultural differences and regional distinctions that influence, among other things, the PA practice.

Positive association between the PA of female adolescents and that of their parents was found for both inactive parents and inactive daughters[23] and for active parents and active daughters[26], which may be explained by the fact that parental PA could have a greater effect on females than on males[28]. Corroborating other studies[1,26], which showed that female adolescents with active fathers and/or mothers are 50% more likely to develop an active lifestyle compared to daughters of inactive parents, and the chance of the adolescent being active when the father is so ranked 40%[1,26].

Still with regard to the associations, a previous review showed a correlation between parental and children PAL; it also showed that a high paternal and maternal PAL is associated with a high PAL among adolescents[29], which clearly shows the family model by associating the PA of parents with that of their children[1,29].

A longitudinal study linked its baseline to three factors related to PA: perception of parental attitudes, body shape and fitness by male adolescents and parental attitudes regarding PA, as well as the PA of mothers[30]. However, the longitudinal analysis included in this review showed no significant association between the PA of mothers and that of their children[14], showing that the results may indicate an influence of parents found in cross-sectional studies; or, as in the case of the study included in this review, the influence may be on the baseline, but not on changes in PA patterns over the years[30].

Regarding body composition, the two studies that addressed this issue presented conflicting results. Children and adolescents with one of the parents involved in sports practices were 1.25 (1.02 to 1.53) times more likely to be overweight/obese than those who had no parents involved in sports; and in that same study, adolescents who were encouraged to engage in PA by one or both parents have, respectively, 1.67 (1.26 to 2.32) and 1.63 (1.27 to 2.08) more chances of being overweight/obese[24]. However, the literature provides evidence that the risk behavior of parents is associated with the risk behavior of children[31], and also that children of active parents are more likely to be active[1,23,26,32].

The present review found a study that associated PA with social support received by the adolescent[25] and whose results indicated that adolescents who received social support from family had 1.32 (1.18 to 1.47) and 1.14 (1.05 to 1.23) more chances of being physically active than those who did not receive social support from family, in the bivariate and multivariate analyses, respectively. With regard to the compliance with the recommendations for PA (≥60min/day), the prevalence ratio analyses showed that social support from family increases the odds by 1.49 (1.10-2.02)[25].

These results are consistent with the evidence found in the literature, which suggests that families play an important role in the development of healthy behaviors by their children[33], either due to the direct involvement or the fact that they serve as a model for an active behavior[19]. It is noteworthy that parents have the ability to provide access to equipment and implications that facilitate PA, thus reducing some barriers, like the lack of someone to take the adolescents to places, for example[34]. Added to this, there is a positive association between the behavior of parents and that of their children, whether sedentary or physically active[25].

It was also observed that adolescents who receive social support from friends have 1.97 (1.67 to 2.33) and 1.52 (1.31 to 1.78) more chances of being physically active compared to those who do not receive so, in the bivariate and multivariate analyses, respectively. With respect to compliance with the recommendations for PA, the odds increased by 2.44 (1.67 to 3.57) with the social support from friends[25]. This can be explained by the fact that active adolescents tend to have similarly active friends[32], with an association between their PAL[35], as it is known that adolescents influence one another to start an activity and continue with it[36]; therefore, a greater contact with friends, especially outside the school environment, seems to contribute to an active behavior[25]. Complementing this clarification, in addition to the association with the influence indicators, there is a positive association between PA, the PAL of friends and their presence during activities[21]. Thus, it is evident the importance of active friends, after all,

adolescence is a period of life characterized by increased family independence and expansion of external social networks[37].

Social support comes then as a consistent and important determinant for PA, especially parental support and that from friends, given their positive association with PAL of adolescents[38].

Regarding the limitations observed in the seven studies included in this systematic review, one of the studies did not stratify its sample by sex[23], and another did not use a validated questionnaire[24]. The fact that the samples included students from the public school system in most studies limits the understanding of the phenomena studied in different sociocultural levels[25]; having one study in which only one parent agreed to participate [1], another that evaluated only mothers[14], and another study that used an intentional sample[18] is also limiting. Another major limitation common to all studies is that none of them controlled sexual maturity in their analysis. Importantly, it is difficult to compare studies because they use different instruments to measure the PA. Thus, there are gaps to be filled by future research, and there is a need for new studies on the issue.

CONCLUSION

Based on the findings of the present review, it was found that there is a positive association between the physical activity of father and mother and that of their daughters, both for inactivity and for being active. However, there were no associations between both parents and children, a fact that is also observed for inactive brothers. As to body composition, the results are contradictory, with one study pointing to the children of parents involved in sports activities as being more likely to be overweight and/or obese and another study showing that parents with a lifestyle more favorable to health have their children with low body fat percentiles. In addition, social support was effective to increase the level of physical activity in adolescents.

REFERENCES

1. Raphaelli CO, Azevedo MR, Hallal PC. Association between health risk behaviors in parents and adolescents in a rural area in southern Brazil. Cad Saúde Pública. 2011;27(12):2429-40.
2. Babey SH, Wolstein J, Krumholz S, Robertson B, Diamant AL. Physical activity, park access and park use among California adolescents. UCLA Centre for Health Policy Research. 2013 Mar(PB2013-2):1-8.
3. Logstein B, Blekesaune A, Almas R. Physical activity among Norwegian adolescents--a multilevel analysis of how place of residence is associated with health behaviour: the Young-HUNT study. Int J Equity Health. 2013;12:56.
4. Carson V, Rosu A, Janssen I. A cross-sectional study of the environment, physical activity, and screen time among young children and their parents. BMC Public Health. 2014;14(1):61.
5. Young DR, Reynolds K, Sidell M, Brar S, Ghai NR, Sternfeld B, et al. Effects of physical activity and sedentary time on the risk of heart failure. Circ Heart Fail. 2014;7(1):21-7.
6. Swift DL, Johannsen NM, Lavie CJ, Earnest CP, Church TS. The role of exercise and physical activity in weight loss and maintenance. Prog Cardiovasc Dis. 2014;56(4):441-7.
7. Rasberry CN, Lee SM, Robin L, Laris BA, Russell LA, Coyle KK, et al. The association between school-based physical activity, including physical education, and academic performance: a systematic review of the literature. Prev Med. 2011;52 Suppl 1:S10-20.
8. Lima DF, Levy RB, Luiz OC. Recomendações para atividade física e saúde: consensos, controvérsias e ambiguidades. Rev Panam Salud Publica. 2014;36(3):164-70.
9. Haskell WL, Lee IM, Pate RR, Powell KE, Blair SN, Franklin BA, et al. Physical activity and public health: updated recommendation for adults from the American College of Sport Medicine and the American Heart Association. Med Sci Sport Exerc. 2007;3(2):1423-34.
10. International Physical Activity Questionnaire (IPAQ). Guidelines for data processing and analysis of the International Physical Activity Questionnaire (IPAQ) - short and long forms. 2005. [accessed on 2015 Jan 21]. Available at: https://www.academia.edu/5346814/Guidelines_for_Data_Processing_and_Analysis_of_the_International_Physical_Activity_Questionnaire_IPAQ_Short_and_Long_Forms_Contents
11. Hallal PC, Andersen LB, Bull FC, Guthold R, Haskell W, Ekelund U. Global physical activity levels: surveillance progress, pitfalls, and prospects. Lancet. 2012;21;380(9838):247-57.
12. Knowles AM, Niven A, Fawkner S. A qualitative examination of factors related to the decrease in physical activity behavior in adolescent girls during the transition from primary to secondary school. J Phys Act Health. 2011;8(8):1084-91.

13. Corder K, Atkin AJ, Ekelund U, van Sluijs EM. What do adolescents want in order to become more active? BMC Public Health. 2013;13(1):718.

14. Dumith SC, Gigante DP, Domingues MR, Hallal PC, Menezes AM, Kohl HW, 3rd. Predictors of physical activity change during adolescence: a 3.5-year follow-up. Public Health Nutr. 2012;15(12):2237-45.

15. Guedes DP, Souza MV, Ferreirinha JE, Silva AJ. Physical activity and determinants of sedentary behavior in Brazilian adolescents from an underdeveloped region. Percept Mot Skills. 2012;114(2):542-52.

16. Guimarães RF, Silva MP, Legnani E, Mazzardo O, Campos W. Reproducibility of adolescent sedentary activity questionnaire (ASAQ) in Brazilian adolescents. Rev Bras Cineantropom Desempenho Hum. 2013;15(3):276-85.

17. Maher C, Olds T, Mire E, Katzmarzyk PT. Reconsidering the sedentary behaviour paradigm. PLoS One. 2014;9(1):e86403.

18. Petroski EL, Pelegrini A. Associação entre o estilo de vida dos pais e a composição corporal dos filhos adolescentes. Rev Paul Pediatr. 2009;27(1):48-52.

19. O'Connor TM, Jago R, Baranowski T. Engaging Parents to Increase Youth Physical Activity: A Systematic Review. Am J Prev Med. 2009;37(2):141-9.

20. Horimoto AR, Giolo SR, Oliveira CM, Alvim RO, Soler JP, de Andrade M, et al. Heritability of physical activity traits in Brazilian families: the Baependi Heart Study. BMC Med Genet. 2011;12:155.

21. Maturo CC, Cunningham SA. Influence of friends on children's physical activity: a review. Am J Public Health. 2013;103(7):e23-38.

22. Bauman AE, Reis RS, Sallis JF, Wells JC, Loos RJ, Martin BW. Correlates of physical activity: why are some people physically active and others not? Lancet. 2012;380(9838):258-71.

23. Bastos JP, Araujo CL, Hallal PC. Prevalence of insufficient physical activity and associated factors in Brazilian adolescents. J Phys Act Health. 2008;5(6):777-94.

24. Duncan S, Duncan EK, Fernandes RA, Buonani C, Bastos KD, Segatto AF, et al. Modifiable risk factors for overweight and obesity in children and adolescents from Sao Paulo, Brazil. BMC Public Health. 2011;11:585.

25. Fermino RC, Rech CR, Hino AA, Rodriguez Anez CR, Reis RS. Physical activity and associated factors in high-school adolescents in Southern Brazil. Rev Saúde Pública. 2010;44(6):986-95.

26. Prevalence and correlates of physical activity among adolescents from Southern Brazil. Rev Saúde Pública. 2010;44(3):457-67.

27. Barbosa Filho VC, Campos W, Bozza R, Lopes AS. The prevalence and correlates of behavioral risk factors for cardiovascular health among Southern Brazil adolescents: a cross-sectional study. BMC Pediatr. 2012;12:130.

28. O'Loughlin J, Paradis G, Kishchuk N, Barnett T, Renaud L. Prevalence and correlates of physical activity behaviors among elementary schoolchildren in multiethnic, low income, inner-city neighborhoods in Montreal, Canada. Ann Epidemiol. 1999;9(7):397-407.

29. Gustafson SL, Rhodes RE. Parental correlates of physical activity in children and early adolescents. Sports Med. 2006;36(1):79-97.

30. Kahn JA, Huang B, Gillman MW, Field AE, Austin SB, Colditz GA, et al. Patterns and Determinants of Physical Activity in U.S. Adolescents. J Adolesc Health. 2008;42(4):369-77.

31. Wickrama KA, Conger RD, Wallace LE, Elder GH, Jr. The intergenerational transmission of health-risk behaviors: adolescent lifestyles and gender moderating effects. Journal of health and social behavior. 1999 Sep;40(3):258-72.

32. Seabra AF, Mendonca DM, Thomis MA, Anjos LA, Maia JA. Biological and socio-cultural determinants of physical activity in adolescents. Cad Saúde Pública. 2008;24(4):721-36.

33. Trost SG, Sallis JF, Pate RR, Freedson PS, Taylor WC, Dowda M. Evaluating a model of parental influence on youth physical activity. Am J Prev Med. 2003;25(4):277-82.

34. Santos MS, Hino AA, Reis RS, Rodriguez-Anez CR. Prevalence of barriers for physical activity in adolescents. Rev Bras Epidemiol. 2010;13(1):94-104.

35. Force CPST. Improving adolescent health through interventions targeted to parents and other caregivers: a recommendation. Am J Prev Med. 2012;42(3):327-8.

36. Pratt M, Sarmiento OL, Montes F, Ogilvie D, Marcus BH, Perez LG, et al. The implications of megatrends in information and communication technology and transportation for changes in global physical activity. Lancet. 2012;380(9838):282-93.

37. Parra DC, Hoehner CM, Hallal PC, Ribeiro IC, Reis R, Brownson RC, et al. Perceived environmental correlates of physical activity for leisure and transportation in Curitiba, Brazil. Prev Med. 2011;52(3-4):234-8.

38. Park H, Kim N. Predicting Factors of Physical Activity in Adolescents: A Systematic Review. Asian Nurs Res (Korean Soc Nurs Sci). 2008;2(2):113-28.

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