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THE WORLDWIDE PREVALENCE OF INSUFFICIENT PHYSICAL ACTIVITY IN ADOLESCENTS; A SYSTEMATIC REVIEW

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Revisión

The worldwide prevalence of insufficient physical activity in adolescents; a systematic review

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Abstract

Objective: **To perform a systematic review of cross-sectional studies on the prevalence of insufficient physical activity (IPA) based on a WHO-defined cutoff point (< 60 min/d of moderate and vigorous physical activity).**

Methods: **The search was carried out using online databases (BioMed Central, CINAHL, EMBASE, ERIC, PsycInfo, PubMed MEDLINE, SCOPUS, SPORTDiscus), and included articles published from the beginning of the databases until February18th, 2012, as well as references cited by the retrieved articles and information provided by the authors. Only original articles using questionnaires in the diagnosis were considered.**

Results: **Of 2,384 papers initially retrieved, fifteen studies met the inclusion criteria, of which seven were conducted in Brazil. The prevalence of IPA varied from 18.7% to 90.6%, with a median of 79.7%. In all surveys, the prevalence was higher among girls than boys and the developing countries have higher prevalence.**

Conclusions: **We concluded that the prevalence of IPA is high among adolescents and that the definition adopted in this study is rarely used in the literature. These results suggesting that is necessary the development of interventions for increasing physical activity levels among adolescents.**

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Key words: *Exercise. Sedentary lifestyle. Cross-sectional studies. Prevalence. Review.*

LA PREVALENCIA MUNDIAL DE FALTA DE ACTIVIDAD FÍSICA EN ADOLESCENTES; UNA REVISIÓN SISTEMÁTICA

Resumen

Objetivo: **Realizar una revisión sistemática de los estudios transversales sobre la prevalencia de actividad física insuficiente (IPA) sobre la de base a un punto de corte definido por la OMS (< 60 min/d de actividad física moderada y vigorosa).**

Métodos: **La búsqueda se llevó a cabo utilizando bases de datos en línea (BioMed Central, CINAHL, EMBASE, ERIC, PsycInfo, Medline PubMed, SCOPUS, SPORTDiscus), e incluyó artículos publicados desde el inicio de las bases de datos hasta 18 de febrero de 2012, así como las referencias citadas por los artículos recuperados y la información proporcionada por los autores. Sólo artículos originales que evaluaban el nivel de actividad física mediante cuestionarios fueron considerados.**

Resultados: **De los 2.384 artículos recuperados inicialmente, quince estudios cumplieron los criterios de inclusión, de los cuales siete fueron llevados a cabo en Brasil. La prevalencia de la IPA varió de 18,7% a 90,6%, con una mediana de 79,7%. En todas las encuestas, la prevalencia fue mayor en las niñas que en los niños y y los países en desarrollo presentaron una mayor prevalencia.**

Conclusiones: **Se concluye que la prevalencia de la IPA es alta entre los adolescentes y que la definición adoptada en este estudio se utiliza raramente en la literatura. Estos resultados sugieren que es necesario el desarrollo de intervenciones para aumentar los niveles de actividad física entre los adolescentes.**

(*Nutr Hosp.* 2013;28:575-584)

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Palabras clave: *Ejercicio. Estilo de vida sedentario. Estudios transversales. Prevalencia. Review.*

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Introduction

The benefits of a physically active lifestyle are well known and include a lower risk of cardiovascular disease, obesity and insulin resistance[1] and colon and breast cancer.[2] It has been shown that physical activity during childhood and adolescence reduces the risk of both childhood and adult obesity and high blood pressure[3] and is associated with emotional well-being.[4]

A recent review study emphasized important methodological differences in the literature, such as divergent instruments and cutoff points, which frequently prevent comparisons among studies.[5] Aiming to develop evidence-based recommendations for physical activity in adolescents, Strong et al.[6] performed a Delphi consensus review of 850 articles. According to the evidence they found, i.e., better control of blood glucose levels, normal HDL cholesterol levels, low LDL-cholesterol and triglyceride levels, increased bone mineral density and fewer muscular problems, they proposed a cutoff of < 60 min/d as an insufficient level of physical activity (IPA). Based on this evidence, the World Health Organization (WHO)[7] adopted this cutoff point for classification of IPA in adolescents in 2008.

In recent review Jansen et al.[8] analyzed the evidence of this cutoff point and found evidence *Level 2, Grade A* for protective benefits for the developing cardiovascular risk factors and *Level 1, Grade B* for protective benefits for bone and muscle problems. Among there are many factors that influence physical activity: intrauterine development, socioeconomic status, environment, parental physical activity.[8]

So far, no systematic review has been conducted to verify either the prevalence of IPA among adolescents or the current criteria established for identifying this unhealthy lifestyle. Thus, the objective of this study was to systematically review the literature regarding (i) the prevalence of IPA in male and female adolescents (10-19 years old, according criteria WHO) and (ii) to analyze the associated factors of IPA by sex.

Methods

Identification of studies

This study followed the systematic review methodology proposed in the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) statement.[9] Searches were carried out using nine electronic databases: BioMed Central, Cinahl, Embase, ERIC, Medline/PubMed, PsyINFO, Scielo, Scopus, SportDiscus and Web of Science, with searches until February18th, 2012. An expanded number of databases were used in an attempt to minimize selection bias. Moreover, the references from the articles found in the databases were reviewed and contact was made with the corresponding authors when there was no report of complete data in studies. Moreover, cross-references were sought in reference lists of two other systematic reviews.[10,11]

Four command groups according to key word were used for the database search. Within each group, we used the Boolean operator "OR" and between the groups we used the Boolean operator "AND". In the first group we included terms related to physical activity: physical fitness, physical activity, physical exercise, motor activity, sedentary, and sedentarism. In the second group we included terms related to age: adolescent, adolescence, young, youth, teenager, and teenage. In the third group we added a term to restrict the instrument used for assessing physical activity: questionnaire. Given that the aim of the present review was to verify the prevalence of IPA, we added a fourth set of commands, which were terms for restricting the study design so that only cross-sectional studies were included: "prevalence studies", "cross-sectional studies" and "survey".

Inclusion criteria

For inclusion, studies were required to: 1) have a representative population-based sample that included adolescents (10-19 years old) by randomly selected; 2) have a cross-sectional design; 3) be an original study presenting the prevalence of insufficient physical activity (IPA) for both sexes; 4) define physical inactivity as less than 60 minutes per week of moderate and vigorous-intensity physical activity; 5) measured physical inactivity by questionnaire, because in developing countries this methods is more using; and 6) studies published in English, Portuguese or Spanish. In cases of duplicate data, studies presenting outcomes related to our systematic review were maintained.

Potentially relevant articles were selected by (i) screening the titles; (ii) screening the abstracts; and (iii) if abstracts were not available or did not provide sufficient data, the entire article was retrieved and screened to determine whether it met the inclusion criteria. The STROBE checklist for cross-sectional studies was applied by two researchers to assess the percentage of items correctly related to the individual papers[12,13] and in case of disagreement between the reviewers, the paper was evaluated by a third researcher (fig. 1).

Assessment, data extraction and analysis

The reading, evaluation and data extraction from the retrieved original articles were performed independently by two reviewers. Disagreements were discussed by the reviewers until consensus was reached. Due to the great variability in the cross-sectional studies and the high probability of spurious meta-analysis results, it was established at the beginning that there would be no meta-analysis of the data.

The data extracted from each study were: lead author, country, year published, year of survey, journal

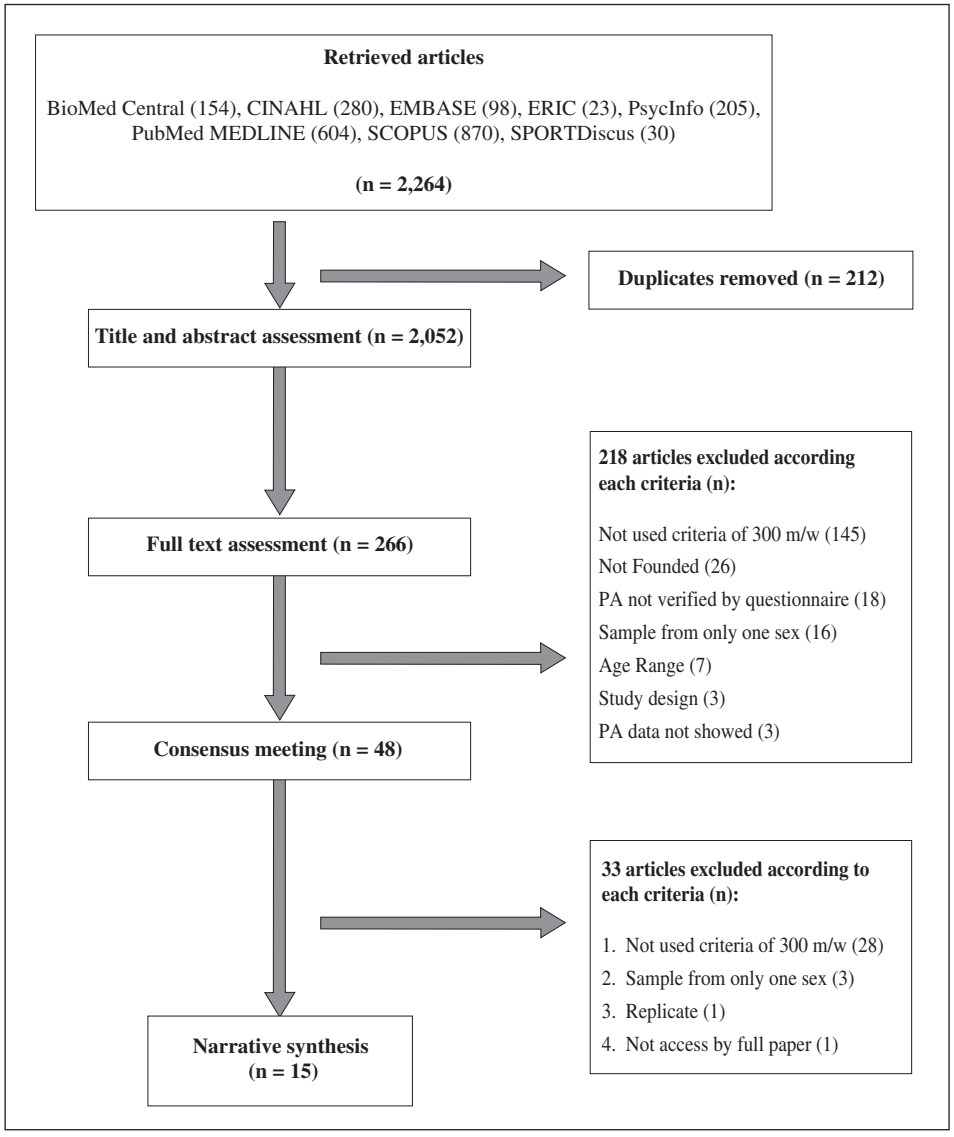

Fig. 1.—Flowchart of Systematic Review.

in which the article was published, total study sample size, sample size of adolescents, age of subjects in years, proportion of girls, type of questionnaire used, outcome and risk factors associated with the outcome. Outcome prevalence and respective 95% confidence intervals (CI 95%) are presented. The CI 95% was directly extracted from the articles[14-18] or was calculated in the statistics program Stata 10.0 using the "cii" command (95% CI exact for binomial distribution).[19-26]

Results

Literature search

The figure 1 shows that literature search yielded 2,264 titles of potentially relevant articles (fig. 1), the full texts of 266 were evaluated, and an initial consensus of 48 articles was reached between the two reviewers. After reanalyzing the full texts, 15 studies were eligible according to the inclusion criteria established for this review.[14-28] To compose the descriptive synthesis, twenty-six of the thirty-three exclusions were because they did not define sufficient physical activity as ≥ 60 min/d.

The 15 articles included in this review, as indicated in table I, led to the identification of a further 14 surveys that showed to all 49 different prevalence's, of which have 27 nationally representative samples and the others were regional or sub-national samples. In two separate cases, articles were found that had used the same sample to verify different outcomes.[14,15,17,18] The decision to incorporate these duplicate items was based both on their outcomes, which were consistent with our research questions, and the fact that no meta-analysis would be performed. Two studies[29,30] provided data on the prevalence of IPA in 69 countries, which was obtained through the Global School-based Student Health Survey. These

Table I
Descriptive analysis of the studies reviewed

First author	*Country*	*Coverage*	*Year published*	*Year survey*	*Questionnaire used*	*n of adolescents*	*Age (years)*	*Proportion of girls*
Feldman DE[19]	Canada	Local (Montreal)	2003	?	developed for the study	743	15.1*	48.3%
Hallal PC[14]	Brazil	Local (Pelotas)	2006	2004/2005	developed for the study	4,452	10-12	50.7%
Zaborskis A	Lithuania	National	2006	2001/2002	HBSC-WHO	5,645	11-15	?
Al Sabbah A[20]	Palestinian	National	2007	2003/2004	HBSC-WHO	8,885	12-18	51%
Li M[21]	China	Local (Xi'an City)	2007	2004	APARQ	1,760	11-17	50%
Tammelin T[22]	Finland	Subnational (Oulu and Lapland)	2007	2001/2002	developed for the study	6,928	15-16	51.8%
Bastos J[16]	Brazil	Local (Pelotas)	2008	2007	developed for the study	857	10-19	52%
da Silva KS[18]	Brazil	Regional (Santa Cararina State)	2008	2002	Adapted HBSC-WHO	5,028	15-19	59.3%
Gonçalves H[15]	Brazil	Local (Pelotas)	2008	2004/2005	developed for the study	4,452	10-12	50.7%
Ceschini FL[23]	Brazil	Local (São Paulo)	2009	2006	IPAQ	3,845	14-19	52.6%
da Silva KS[19]	Brazil	Local (Florianópolis)	2009	2001-2002	Adapted HBSC-WHO	5,028	15-19	59.3%
de Moraes AC[26]	Brazil	Local (Maringá)	2009	2007	IPAQ-A	991	14-18	54.5%
Hoelscher DM[24]	EUA	Local (Texas)	2009	2000-2002	Self-Reported Physical Activity Measures	8,929	13.1*	46.2%
Guthold R[25]	34-countries	National Subnational	2010	2003-2007	HBSC-WHO	72,845	13-15	52.4%
Serrano-Sanchez JA[28]	Spain	Local (Gran Canaria)	2011	2004	MLTPAQ	3,503	12-18	51.6%

APARQ = Adolescents Physical Activity Recall Questionnaire.
IPAQ = International Physical Activity Questionnaire.
IPAQ-A = International Physical Activity Questionnaire for Adolescents.
HBSC-WHO = Health Behavior School-aged Children – World Health Organization.
CAPANS = Western Australian Child and Adolescent Physical Activity and Nutrition Survey Questionnaire.
MLTPAQ = Minnesota Leisure Time Physical Activity Questionnaire.
? = Date not available.
*Average.

studies were conducted across five WHO Regions using a standardized two-stage design and included objectives for assessing health behaviors among schoolchildren. However, one these studies [30] was excluded because it did not show the prevalence data by gender or the prevalence of IPA in the total sample (11-15 y). Therefore, discarding the duplicate data, the synthesis includes descriptive information obtained from 131,276 individuals between 10-18 years of age.

The earliest publication found using the current cutoff criterion of < 60 min/d[6] is dated 2003. Of the 15 articles included, 11 were conducted in developing countries (76.9%), including seven from Brazil (53.8%)[14-18,23,26] and one was conducted in 34 countries simultaneously.[25]

Prevalence of the IPA

Table II describes the prevalence of IPA with the respective confidence intervals according to sex and total sample size of each survey included in this review. In one article[27] it was not possible to calculate the CI 95% by sex and total sample size because the authors did not indicate the proportion of each sex in the sample. Girls showed a higher prevalence than boys in all of the studies.

Regarding the questionnaires, the authors developed their own questionnaire in five studies, three used a questionnaire developed by WHO and two used the International Physical Activity Questionnaire (IPAQ). We found that the prevalence was over 50% in all of the surveys conducted in six of the 14 included studies, with the girls having a higher prevalence than boys. The smallest difference in prevalence between the sexes was observed in da Silva et al. (0.9%),[17] and the greatest in Ceschini et al. 24.4%.[23] The data presented in figure 2 show that the median IPA for girls was 83.1 (inter-quartile range = 75.4 to 80.9) and 76.3 (inter-quartile range = 57.5 to 80.9) in boys, while the total was 80.0 (inter-quartile range = 62.5 to 83.6), revealing a high prevalence of inactivity among the included studies. The highest prevalence was observed in Africa and Latin America; on the other hand the lowest in the Europe and North America.

Associated factors with IPA

We found a variety of factors associated with the IPA: demographic (location of residence), socioeconomics (socioeconomic level and parental education), behavioral (screen time and dietary patterns) and biological (nutritional status). Of these the most commonly reported positive factor associated with the IPA (four times) were TV time, but the cutoff points used varied among studies, as seen in table III. IPA was strongly associated with sociodemographic and economic status regardless of the country in which the research was conducted, yet the characteristics of these variables differed among studies.

The studies that reported an association stratified by sex showed no association for the total sample and vice versa, except for the study conducted by Feldman et al.[19] The study developed in Gran Canaria[28] found access appeal of physical education classes and sports competitions last year decrease of probability of the IPA.

Discussion

An important aspect of this review was that it analyzed data from different parts of the world, thus providing a realistic estimate of IPA prevalence by country and by continent. This study systematically reviewed the literature on IPA in adolescents according to the current WHO guidelines[6] and 15 studies met the inclusion criteria. Among the included studies, six were published after 2009.[17,23-26,28]

The growing interest about IPA in the scientific community can be attributed, at least in part, to three factors: 1) the publication of Strong et al.,[6] which definitively established the cutoff point of < 60 min/d; 2) the fact sufficient physical activity has been associated with numerous health benefits in adolescents;[8] 3) the WHO has made physical activity a priority for health promotion policies. However, we emphasize that there are few studies using the current cutoff point and that information on outcome prevalence is indispensable for developing interventions.

Although varying widely, the prevalence of IPA of adolescents with this unhealthy lifestyle were high, with a prevalence above 25% observed in 45 of the 49 analyzed countries[14-18,20-23,25,28] and a prevalence over 50% in forty countries.[14-16,20,23,25,26] The differences in results can be partly explained by such methodological aspects. Another factor that may influence the recorded prevalence is the questionnaire of measurement accuracy, because different questionnaire were used in the studies and the psychometric properties of these tools vary[31] and can be introduce the differential or non-differential misclassification effects (error due to disease status or exposure) of IPA prevalence are unpredictable, and may have caused the underestimation or overestimation of the true prevalence. In the context of this study, it is likely to believe that the validity of diagnostic criteria and used tools used varied for each characteristic of the adolescents studied.[32]

The highest prevalence was observed in developing countries, where urbanization may be associated with the lack of physical activity, since physical activity levels have been linked with environmental factors.[33,34] In low- and middle-income countries across the epidemiological transition,[35,36] physical activity has taken a prominent place in public health, since higher physical activity levels are associated with a lower risk of major chronic diseases. This fact may help explain another result of our review, which was that most of the studies were undertaken in countries in this income range, including seven in Brazil. The large volume of

Table II

Description of insufficient physical activity (IPA) prevalence (%) and the respective confidence intervals 95% (CI 95%) along with total data by sex from each study that was included in the review

First author	*IPA in girls% (CI 95%)*	*IPA in boys % (CI 95%)*	*IPA no total % (CI 95%)*
Feldman DE	37.0 (32.1-42.0)	28.0 (23.5-33.1)	23.4 (20.4-26.6)
Hallal PC	67.0 (65.1-69.0)	49.0 (46.8-51.1)	58.2 (56.7-59.7)
Zaborskis A	64.4	50.4	?
Al Sabbah A	82.3 (81.1-83.4)	77.9 (76.6-79.1)	80.0 (79.2-80.8)
Li M	53.0 (49.6-56.2)	37.0 (33.8-40.3)	44.0 (41.6-46.3)
Tammelin T	49.0 (47.3-50.7)	41.0 (39.3-42.7)	44.9 (43.7-46.1)
Bastos J	82.1 (78.5-85.6)	56.5 (51.6-61.3)	69.8 (66.7-72.9)
da Silva KS	37.0 (34.9-39.1)	21.1 (19.2-23.2)	30.5
Gonçalves H	67.5 (65.6-69.5)	48.7 (46.5-50.8)	58.2 (56.7-59.7)
Ceschini FL	74.1 (72.1-75.9)	49.7 (47.3-52.0)	62.5 (60.5-64.1)
da Silva KS	28.8 (27.0-30.7)	27.9 (25.6-30.2)	28.5 (27.0-29.9)
de Moraes AC	57.9 (53.7-62.1)	55.7 (50.9-60.3)	55.9 (52.7-59.0)
Hoescher DM	23.9 (22.6-25.2)	13.9 (12.9-14.9)	18.7 (17.9-19.5)
	84.6 (84.2-85.0)	76.2 (75.7-76.6)	80.6 (80.4-80.9)
	87.2 (84.8-89.6)	73.9 (70.5-77.3)	81.1 (79.1-83.1)
	87.8 (85.3-90.2)	83.1 (80.0-86.1)	85.6 (83.7-87.5)
	80.4 (76.4-84.3)	68.2 (63.7-72.8)	74.2 (71.2-77.2)
	89.5 (87.5-91.6)	76.3 (73.5-79.2)	82.9 (81.1-84.7)
	76.7 (74.0-79.4)	68.9 (65.9-71.9)	72.9 (70.9-74.9)
	84.4 (81.7-87.1)	76.7 (73.2-80.3)	81.1 (78.9-83.3)
	89.1 (85.9-92.3)	79.8 (76.3-83.2)	83.6 (81.2-86.0)
	88.2 (85.7-90.7)	77.0 (73.7-80.2)	82.6 (80.5-84.7)
	96.3 (95.4-97.2)	85.7 (84.2-87.3)	90.6 (89.7-91.5)
	86.2 (84.6-87.9)	82.2 (80.4-84.0)	84.1 (82.9-85.3)
	82.4 (79.2-85.7)	79.5 (75.7-83.2)	81.1 (78.6-83.6)
	63.2 (61.3-65.0)	62.1 (60.5-63.7)	62.5 (61.3-63.7)
	80.4 (78.4-82.5)	77.2 (75.0-79.4)	78.8 (77.3-80.3)
	84.8 (82.5-87.2)	80.2 (77.5-82.9)	82.6 (80.8-84.4)
	86.8 (84.9-88.7)	82.2 (79.9-84.6)	84.7 (83.2-86.2)
Guthold R	88.8 (86.5-91.2)	77.0 (73.8-80.1)	82.9 (80.9-84.9)
	88.4 (86.3-90.5)	74.8 (71.8-77.9)	81.9 (80.1-83.7)
(by country)	88.0 (85.7-90.2)	80.3 (77.8-82.9)	83.9 (82.2-85.6)
	83.1 (80.8-85.5)	77.5 (74.9-80.1)	80.3 (78.5-82.1)
	89.9 (88.6-91.2)	88.9 (87.3-90.5)	89.5 (88.5-90.5)
	84.1 (81.9-86.4)	66.5 (63.7-69.2)	74.9 (73.1-76.7)
	91.8 (90.7-92.9)	90.4 (88.9-91.9)	91.2 (90.3-92.1)
	95.4 (94.1-96.8)	85.2 (83.3-87.1)	89.3 (88.0-90.6)
	82.4 (78.8-86.0)	67.4 (62.7-72.0)	75.1 (72.1-78.1)
	81.8 (78.2-85.5)	76.9 (72.6-81.3)	79.7 (76.9-82.5)
	88.9 (86.1-91.8)	82.5 (78.8-86.2)	86.0 (83.7-88.3)
	81.7 (79.2-84.1)	67.2 (64.2-70.3)	74.5 (72.5-76.5)
	81.7 (80.7-82.8)	72.4 (71.1-73.6)	22,8 (76.4-78.0)
	83.5 (81.0-86.0)	81.8 (79.0-84.5)	82.7 (80.9-84.5)
	78.1 (74.6-81.5)	67.4 (63.6-71.3)	72.6 (70.0-75.2)
	83.0 (80.9-85.1)	58.5 (55.4-61.5)	72.0 (70.2-73.8)
	91.9 (89.9-93.9)	81.4 (78.4-84.3)	86.8 (85.0-88.6)
	90.7 (88.1-93.4)	91.6 (89.1-94.1)	91.1 (89.3-92.9)
	87.1 (84.6-89.6)	83.0 (80.0-86.0)	85.3 (83.4-87.2)
Serrano-Sánchez JA	46.0 (43.9-48.1)	26.2 (24.1-28.3)	36.4 (34.8-38.0)

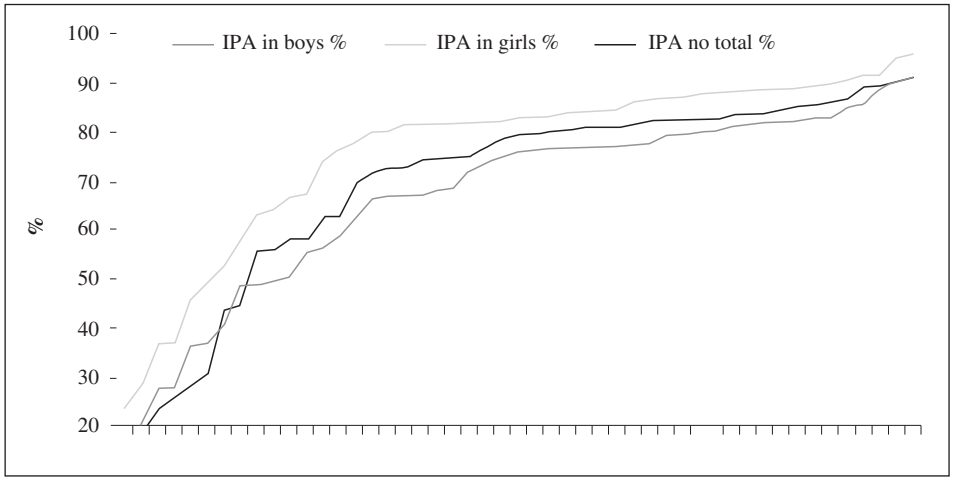

Fig. 2.—The distribution of increasing prevalence's of insufficient physical activity according to sex and for total.

Brazilian research in this area may be attributed partially to the Brazilian Society of Physical Activity and Health (*Sociedade Brasileira de Atividade Física e Saúde)*,[37] which is a network of researchers from a number of universities and research centers.

Overall, the prevalence of IPA was lower in boys than in girls, which could be at least partially explained by previously published data that cultural and social variables are more likely to explain this difference than biological factors,[38,39] i.e., that boys have more social and family encouragement to engage in physical activity.[15] Future interventions aiming to increase physical activity levels must be different for boys and girls, not only due to these socio-cultural variables, but because the types of activity performed also vary between the sexes.[14,16]

Regarding associated factors, we found that excessive time watching TV and/or using the computer (screen time) increases the likelihood that adolescents did not achieve the recommended physical activity levels.[14,18,22,23] A principal cause for this association would be that teens watch TV, use the computer or play video games during the times in which they could be involved in physical activity.[40]

On the other hand, we found association of IPA with sociodemographic and economic variables. In a recent review, Edwardson & Gorely[41] observed that parents are influential in promoting both physical activity and the level of activity in adolescents. There is no consensus in the literature regarding socioeconomic variables as determinants of prevalence since such differences may be attributed to the demographic context and characteristics of the populations studied rather than the individual.[42,43]

The results presented in this review are worrisome, because in recent systematic review and pooled analysis Dumith et al. showed that physical activity levels decrease by ~7% per year in the adolescents, which would equate to an overall decline of ~60-70% during adolescence.[44] Moreover, the high prevalence of IPA demonstrates the need for public policy programs promoting physical activity for this age group, since physically active adolescents are more likely to be active in adulthood[45,46] and adolescents whose physical activity levels are ≥ 60 min/d are less likely to develop cardiovascular risk factors (metabolic syndrome, obesity and type II diabetes mellitus).[8,47]

In the context of promoting physical activity for children and adolescents, it may be noted that many school-based interventions show positive effects when combined with printed educational materials and other changes in the school.[48] Van Sluijs et al.[49] observed that, especially for teenagers, school interventions are more successful when they include various activities and disclosed to parents and/or the community. Therefore, in light of the high prevalence of physical inactivity reported in this review, we reiterate that such interventions should be increasingly developed in order to reduce levels of physical inactivity, preferably in conjunction with schools, where children and adolescents spend a large amount of their time.

Conclusion

The results of the review of the articles present in the descriptive synthesis allow the following conclusions: (i) according to the WHO criteria are high prevalence's of IPA in adolescents, (ii) by sex, the girls are less physically active; (iii) the highest prevalence of IPA was observed in developing countries; (iv) the principal factors associated with IPA are screen time and sociodemographic variables; and (iv) even with the consolidation of the cutoff, there are few studies that use cutoff point of 60 min/d to evaluate IPA.

Practical implications

1. Effective strategies for health, aiming to promote physical activity are necessary.
2. For this, we emphasize the importance of actions in the school environment where adolescents spend much of the day, with emphasis on

Table III
Risk (+) and/or protection (-) factors for insufficient physical activity according to total data by sex from each study

First author	*Risk/protection factors for girls*	*Risk/protection factors for boys*	*Risk/protection factors for total*
Feldman DE	(+) working computers; (+) work	(+) working computers; (+) work	(+) working computers; (+) work; (+) musculoskeletal pain; (+) male sex
Hallal PC	–	–	(+) female sex; (+) AF da mãe; (+) TV; (+) > 1 h/d
Zaborskis A	–	–	–
Al Sabbah A	–	–	(+) Mother's education
Li M	–	–	(-) Rural residance; (+) male sex
Tammelin T	(+) > 4 h/d TV; (+) > 2 h/d computer or videogames	(+) > 4 h/d TV	–
Bastos J	(+) Parent physically inactive; (+) adolescents 17-19 years	(+) Low socioeconomic level, (-) maternal smoking; (-) mother physically inactive	–
da Silva KS	no association	(+) overweight; (+) ≥ 2 h/d TV	–
Gonçalves H	(+) Rich, (+) insecurity in the neighborhood; (+) does not help with household chores, (-) gets together with friends; (+)	Maternal age ≥ 50 years; (+) rich, (+) mother does not work, (+) adolescent has employment; (+) does not help with household chores, (-) gets together with friends;	–
Ceschini FL	–	–	(+) female sex, (+) 17-19 years old, (+) wealthiest socioeconomic level, (+) geographic area of the city, (+) awareness of the "Agita São Paulo" program, (+) non-participation in physical education classes, (+) smoking, (+) alcohol intake and (+) time spent per day watching television
da Silva KS	–	–	(+) low consumption of fruits and vegetables; (+) absence from physical education; (+) enrollment in night classes
Moraes AC	–	–	(+) lower socioeconomic level; (+) attendance to public schools and (+) obesity
Hoelscher DM	–	–	(+) female sex; (+) African American children
Guthold R	–	–	(+) female sex
Serrano-Sanchez JÁ	(-) Mother physically inactive; (-) Sports organized participation; (-) Appeal of PE classes; (-) Access to PA Outdoor and Indoor spaces	(+) Total of screen-time; (-) Father physically inactive; (-) Sports organized participation; (-) Sports competitions last year; (-) Appeal of PE classes	–

Data not available.

physical activity in leisure-time, to decrease the levels of sedentary behavior.

3. Prevalence data in IPA are alarming, especially in girls, a fact that enhances the risk of the emergence of chronic non-communicable diseases among adolescents.
4. The definition of the WHO should be used in epidemiological research.

Competing interest

The authors declare that there are no conflicts of interest.

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