Master en Condicionantes Genéticos, Nutricionales y Ambientales del Crecimiento y Desarrollo 2012/13

TRABAJO FIN DE MASTER

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Associations between pedometer-determined physical activity and adiposity in children and adolescents: Systematic review

Abstract.

The present review sought to examine the recent evidence on associations between objectively physical activity determined by pedometer and adiposity.

A search for observational studies was carried out using database Pubmed in May 2013. Of 278 potentially eligible papers, 34 papers were included. Most studies (28/34; 82%) were crosssectional and all used proxies for adiposity, such as body mass index (BMI) or BMI z-score as the outcome measure. Few studies (9%; 3/34) focused on pre-school children.There was consistent evidence of negative associations between pedometer-determined physical activity and adiposity: significant negative associations were observed in 24/34 (71%) of studies overall.The present review supports the hypothesis that higher levels of habitual physical activity are protective against child and adolescent obesity. However, prospective longitudinal studies are warranted; there is a need for more research on younger children, and for more 'dose-response' evidence.

Resumen

El presente estudio de reviosion pretende examinar la evidencia sobre las asociaciones entre actividad física medida con podómetros y la adiposidad.

Una búsqueda de los estudios observacionales se realizó utilizando la base de datos Pubmed en mayo de 2013. De 278 estudios potencialmente elegibles, se incluyeron 34 artículos. La mayoría de los estudios (28/34; 82%) eran de corte transversal y proporcionaban datos como el índice de masa corporal (IMC) o IMC z-score como medida de resultado. Son pocos los estudios (9%, 3/34) que se centraron en los niños pre-escolares. Hubo sólida asociación negativa deribada de los podómetros y la adiposidad: asociaciones negativas significativas se observaron en 24/34 (71%) de los estudios generales. Esta revisión apoya la hipótesis de que los niveles más altos de actividad física habitual tienen un efecto protector contra la obesidad infantil y juvenil. Sin embargo, se necesitan estudios longitudinales prospectivos sobre los niños más pequeños, y más pruebas "dosis-respuesta".

Introduction.

High proportions of youth in Europe and the United States do not meet current physical activity (PA) guidelines highlighting the importance of promoting a physically active lifestyle among youth, despite the increasing recognition of the health benefits associated with PA participation (1). Diet and physical activity both play a significant role in the onset and development of obesity and in the maintenance of health of young people (2).

There is a wide range of evidence linking physical activity and weight status. For example, physically active adolescents have been shown to have lower levels of adiposity than youth who are less active (1). Regrettably, research has reported that adolescents show a decrease in physical activity as they age, specifically, begins in children as young as first to third grade (2).

In the last years, there has been an increased interest in objective monitoring of daily physical activity using simple and inexpensive pedometers (5) and is that step counts are highly correlated with physical activity and have been validated agains accelerometers, heart rate monitors, and direct observation for children aged 7 years and older (6). An It has been stated as objection that pedometers do not provide a suitably accurate estimate of PA to enable the detection of a significant association with body size. An alternative explanation is that BMI, as a weight-based index, is a simplistic indicator of adiposity, (3) that cannot account for variations in the distribution of body fat, body somatotype or differences in fat free mass (bone, muscle) and fat (4).

Recently used body mass index (BMI) as a criterion for developing pedometer-determined activity recommendations in children.

Optimal age- and gender-specific standards for steps per day related to international BMI cut points for body mass status were used to determine whether children were sufficiently physically active(5). The pedometer is increasing in popularity as a research tool for measuring physical activity as well as a stimulus for promoting physical activity (6). Daily step count targets of 15,000 (boys) and 12,000 (girls) were proposed as the optimal cut-off points for predicting normal and overweight BMI (7).

The main objective of this review was to systematically review the original studies that assess the relationship between the physical activity measured objectively with pedometers and adiposity of children and adolescents.

Methods

Search strategy

The search was conducted in Pubmed database in May 2013. The period time was open as the pedometer usage is not a very old device and we wanted to include all the literature available. Keywords used were: “pedometer” and “pedometers and physical activity”. The searches by these terms resulted in 268 and 172 papers articles identified, from which after to fusion and eliminate duplicates, checking titles and abstracts and applying the inclusion and exclusion cirteria remaining 117 relevant papers (figure 1.

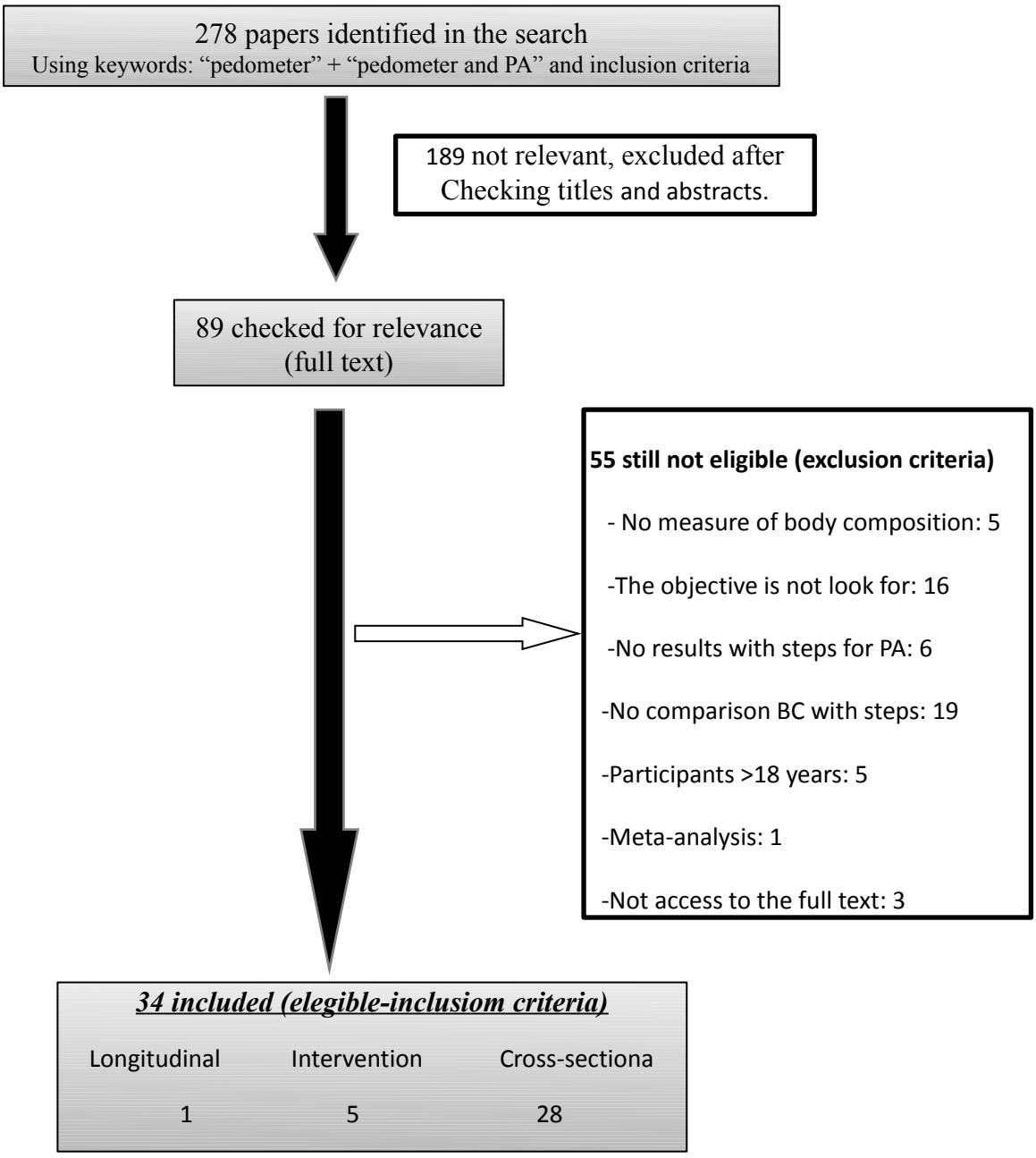

Figure 1. Flow diagram of the literature search and paper selection.

Eligibility criteria

Eligible studies were longitudinal and cross-sectional observational studies of healthy children and adolescents (0-18 years) that tested for the existence of associations between habitual physical activity using pedometers and adiposity. Studies were only included where they attempted to measure typical or 'habitual', freeliving, physical activity: studies that measured physical activity in confined conditions (e.g., within whole body calorimeters) were excluded. Community-based (non clinical) studies with a measure of pedometer-determined physical activity as the exposure variable and with at least one weight-based outcome indicative of adiposity were included. Studies that used subjectively measured physical activity as the exposure (e.g., using questionnaires) were excluded as these are more likely to be biased than studies using objectively measured physical activity. Studies in clinical populations, not in the English/Spanish languages, or proxy measures of habitual physical activity (e.g., physical education time) were also excluded.
Doubts over eligibility of individual papers/studies were resolved by discussion and consensus between the authors. Reasons for excluding papers were noted and are available from the corresponding author upon request.

Data management and extraction
Characteristics of each study were extracted and summarised: the exposure variable (s) used; methodology for measurement of the exposure variable; the outcome variable(s) used; methodology for measurement of the outcome variable(s) (adiposity measure, proxy, or index); sample size, location and characteristics; results and main conclusions relevant to the present review.

Outcome measure(s). A variety of different measures of adiposity or indices of adiposity were used in the studies reviewed: skinfolds, BMI and waist circumference. Exposure measure: The method used to measure physical activity was the pedometer, This has become a popular physical activity assessment tool (10). Pedometers capture objective physical activity data (8).
Sample size. The studies reviewed were characterized by a very wide range of sample sizes. Sample size is likely to determine the ability to detect associations between habitual physical activity and adiposity.

Results

Overall results

Of the 278 potentially eligible papers, 34 were included and are summarised in the present review (Figure 1 is a flow diagram describing the search and selection process).

Only 18% (6/34) of eligible studies were longitudinal [(9-14)] Table I, that 83% (5/6) were intervention study. Most studies (28/34; 71%) were cross-sectional [(1-5, 7, 8, 15-28)]; Table II.

Specific data were not provided by age group. Only 9% (3/34) of studies measured to children <6 years old. Most studies (19/34; 56%) measured to children with range of age 6-12 years and studies with data from children >12 years were 29% (10/34). One study didn´t show the average age of the sample.

In all studies was measured BMI as a criterion of choice, In total 12% of studies (4/34) measured waist circumference, 18% (6/34) skindfolds and only 9% (3/34) of studies used the BIA for measure %BF. The studies reviewed here consistently reported significant and negative associations between pedometer-determined physical activity and adiposity (24/34; 71%), indicating 'strong evidence' that such an association exists with higher levels of habitual physical activity being associated with lower measures or indices of adiposity. In the cross-sectional studies, 20/28 (71%) of studies found significant negative associations, and in the longitudinal studies, 4/6 (67%) of studies found significant negative associations while the other study found a nonsignificant trend in the 'expected' direction.

Results by outcome measure. Significant negative associations between pedometer-determined physical activity and adiposity were found in 25/31 (81%) of studies that used simple proxies for adiposity as the outcome measure, and 13/17 (76%) of studies that used more precise body composition methods as the outcome measure.

Results by sample size. 8/34 (23%) of studies were 'large' (n>1000 participants), 21/34 (62%) 'medium size' (n=100-1000 participants), and 5/34 (15%) 'small size' (n<100 participants). In all the large studies found significant negative associations, while the corresponding percentage was 62% (13/21 studies) in the medium sized studies, and 60% (3/5) in the small studies. 68% (23/34) of studies use this pedometer model for us measures, The Yamax Digiwalker SW series has consistently been found among the most accurate of pedometers, and the Yamax SW-200 is recommended as a reliable monitor for use in children (2).

Discussion

The studies summarized in the present review represent a large body of evidence that reported significant and negative associations between pedometer-determined physical activity and adiposity with a high degree of consistency, probably indicating 'strong evidence' that such an association exists. The present review therefore supports the view that variation in the level of habitual physical activity in youth is a contributor to variation in weight status.

Relatively few studies tested for associations between habitual physical activity using this growing device and adiposity in the preschool population. Many studies did not consider differences in associations between the sexes, but it may be noteworthy that the evidence summarised here contained a suggestion that significant negative associations may be found more commonly among boys than girls, and that associations may be stronger in boys than girls. Future research would be required to address the issue of gender differences more conclusively, but boys are usually more physically active than girls, as suggested by many reviews (1, 2, 6, 7, 9, 11, 12, 20, 21, 28, 29).

Numerous descriptive studies have implemented pedometers to assess weekday physical activity in children, yet comparatively few have obtained separate data representing weekend days. The number of steps taken by children on the weekends is of particular interest, given the current evidence that young people are less active when outside the school environment (3).

Further studies are necessary specialy inter studies, for measuring the relationship between pedometer-determined physical activity.

The fact of this review we find this strong association provides support to justify the use of pedometers always considering the limitations of measuring only with of steps.

Conclusions

The present review supports the hypothesis that higher levels of habitual physical activity are protective against higher levels of child and adolescent adiposity. However, prospective longitudinal studies using more precise methods of body composition are warranted; there is a need for more research on younger children, in a wider variety of settings and populations, and for more 'dose-response' evidence.

Acknowledgment.

Thanks to the group "Genud" for everything you taught me these six months, especially Luis Moreno and David Jimenez for their support in this work.

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