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Commentary

Comentário

Assessment of physical activity: an important epidemiological issue

Quantificação de atividade física: uma importante questão epidemiológica

Lilian Cristina X. Martins¹ PhD; Paulo de Tarso Farinatti² PhD

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Abstract

Introduction: The body of evidence about the benefits of physical activity (PA) on health is massive. There are several distinct subjective and objective methods to evaluate PA levels, which can be a source of bias in self-reported outcomes.

Objective: The purpose of the present essay was to review findings from recent research with particular focus on PA assessment, and point out some issues for future research.

Conclusion: The variability among evaluation methods compromises comparability between studies. Special attention should be given to self-report instruments that can lead to some sort of bias. Therefore, it is important for proper theoretical basis with respect to the objectives and types of PA, which should be considered before selecting the instrument to be applied in a given population. Views of several review studies were discussed and recommendations were presented.

Keywords: physical activity, health, objective measures, self-reported instruments.

Resumo

Introdução: O corpo de evidências científicas a respeito dos benefícios da atividade física (AF) para a saúde é massivo. Existem vários métodos, subjetivos e objetivos, distintos para avaliar os níveis de AF e desfechos autorrelatados pode ser fonte de viés.

Objetivo: O objetivo do presente ensaio foi revisar os achados de pesquisa recente com foco particular na avaliação de PA e apontar algumas questões para pesquisa futura.

Conclusão: A variabilidade entre os métodos de avaliação prejudica a comparabilidade entre os estudos. Deve-se dar atenção especial aos instrumentos de autorrelato que podem levar a algum tipo de viés. Por isso, é importante, inicialmente, estabelecer a base teórica adequada com relação aos objetivos e aos tipos de AF. Tais considerações devem ter lugar antes de se selecionar o instrumento a ser aplicado em uma determinada população. Neste trabalho,

Keypoints

- Variability among evaluation methods compromises comparability
- The theoretical background is fundamental for the constructs developed to measure physical activity
- Development of a new PA questionnaire requires justification about how and why it is superior to questionnaires that already exist

Pontos-Chave Destaque

- A variabilidade entre os métodos de avaliação compromete a comparabilidade
- A fundamentação teórica é fundamental para as construções desenvolvidas para medir a atividade física
- O desenvolvimento de um novo questionário sobre nível de AF requer justificativa sobre como e por que seria superior aos questionários existentes

[§] Corresponding Author: Lilian Cristina X. Martins – e-mail: lilitina@gmail.com.

Affiliations: ¹Instituto de Pesquisa da Capacitação Física do Exército (IPCFEx); ²Laboratório de Atividade Física e Promoção da Saúde, Instituto de Educação Física e Esporte / Universidade Estadual do Rio de Janeiro.

foram examinados vários estudos de revisão e foram apresentadas recomendações.

Palavras-chave: atividade física, saúde, métodos objetivos, instrumentos autorrelatados.

Assessment of physical activity: an important epidemiological issue

Physical activity definition and health benefits

One of the major concerns on public health is the sedentary lifestyle because of its association with several diseases and health problems. Health benefits of physical activity (PA) are well documented (1,2). Literature exhibits massive body evidence showing that increased PA in leisure time decreases cardiovascular and all-cause mortality rates among men and women (3,4). Higher levels of PA are related to better health, greater degree of independence (5), improving satisfaction and enhancing well-being (6). According to the literature, practically all individuals may benefit from regular PA (1). Therefore, PA assessment is one of the most important public health issues. This evaluation is a vital health measure that should be performed regularly together with assessment of other modifiable cardiovascular risk factors (diabetes mellitus, hypertension, hypercholesterolemia, obesity, and smoking) that are normally assessed (7,8) and that physicians should more frequently promote PA in their daily practice (9).

Scientists have structured PA definition as any bodily movement produced by the contraction of skeletal muscle that increases energy expenditure above the basal level (10) and measuring PA involves the energy expenditure assessment. The components of the daily expenditure are the basal metabolic rate (~60-75%), the thermic effect of food (~10%) and the caloric cost of PA (~15-30%). In order to study the phenomenon scientists classified PA in different dimensions grouped in structured (sports and exercises) and non-structured activities (occupational, leisure-time, and household activities). All together compounds the day-life physical activities (10). PA may vary considerably between individuals of a given community and even within individuals

from day to day. Consequently, to correctly assess the energy cost of PA, measurements should be performed in free-living conditions and during week and weekend days (11). In brief, PA studies involve a complex design, and results can present bias related to assessment strategies and techniques. There are innumerable different methods to measure PA, and this diversity can be source of bias in reported outcomes. The purpose of the present essay was to gather recent findings on research of PA assessment, and point out some issues for future research.

Comparability among studies

One of the key problems on PA research is the lack of comparability between studies. Warren et al. (12) highlighted that one of the main problems to compare studies on PA and health is how PA is understood – its various domains are often mixed and incorrectly applied. Inappropriate or crude measures of PA may have serious implications on the observed outcomes, leading to misinterpretation of results and underestimation of effect sizes. Therefore, it is important for researchers to pay careful attention to the specific characteristics of the object of investigation using appropriate conceptual basis, which needs to be considered to define which PA domain is being investigated.

To cope with this problem, scientists proposed conceptualizations, terms and definitions (1,7) that should be used in reports and recommendations regarding PA and public health. Furthermore, researchers should consult before to start a design study aiming to avoid lack of comparability between studies, and to better understanding the phenomenon of PA and the complexity of its evaluation. The American Heart Association (AHA) Guide (7) states that the evaluation of PA refers to its dimensions: mode (aerobic versus anaerobic activity,

resistance or strength training, balance and stability training), frequency (number of sessions per day or per week), duration (time: minutes or hours per session), and intensity (rate of energy expenditure: an indicator of the metabolic demand of an activity). Standard patterns to define the intensity of an activity can be found in the Compendium of Physical Activities of Ainsworth et al. (13) which includes almost all activities.

On PA assessment, it is also necessary to consider the domain which researcher wants to focus. The AHA's established four main domains: occupational, domestic, commuting, and leisure time (7).

If researchers observe the concepts and terms definitions, they could contribute to reduce several problems related to comparability between studies and would increase the quality of the data.

Methods to quantify physical activity

Objective methods

Objective methods are those that directly measure the amount of PA such as direct calorimetry, accelerometry, heart rate, combination of accelerometry and heart rate, pedometry, and doubly labeled water (12,14). Those are the most accurate methods to assess PA. However, they are often too expensive to be applied in large populations (12,15) and therefore subjective methods are perhaps more feasible to be used in epidemiological studies.

Subjective methods

Subjective methods are a kind of approach that frequently relies on self-reported PA regardless of the fact that they can be expressed in kilocalories (kcal) or units of metabolic equivalents (METs). Self-reported instruments to measure PA may add information not provided by direct assessment, such as the types of PA, which is useful for several different analyses. Many questionnaires have acceptable accuracy and reliability and can be adequately used to rank PA in large population sets (12,15). Hence, epidemiologic evidence related to PA and health is in a great extent derived from studies using indirect PA assessment.

There are evident advantages in using indirect assessment techniques to quantify PA (12,15). In addition to providing information about several PA domains, including modality and sites at which it is performed; questionnaires provide immediate scoring and preserve confidentiality. Moreover, this kind of instrument can be administered electronically or by mail, which allows efficient use of time and resources and increases the potential of assessing PA in large samples. According to Westerterp (15), despite their limitations, questionnaires can be used to appropriately to classify PA.

On the other hand, it must be acknowledged that variability among instruments makes comparisons across studies difficult. For instance, Poppel et al. (16) identified a remarkable number of 85 questionnaires (or versions of questionnaires) to estimate PA levels. Although no comparison data are available to establish the superiority of a given instrument over others, it is evident that more attention should be paid to the psychometric properties of most questionnaires and scales.

Choosing the appropriate method to measure physical activity

Scientists must select the method of evaluation very carefully, since numerous tools available do not assess important components that are part energy expenditure. Several review studies have pointed out main problems. On the one hand, several questionnaires did not consistently assess PA type, frequency, intensity, and duration (17). On the other hand, validity studies on the two widely used instruments, the International Physical Activity Questionnaire (IPAQ) (18) and Baecke's Questionnaire (19) that have addressed the correlation with doubly labeled water – the gold standard for measuring energy expenditure in free-living individuals, are scarce. Westerterp (15) discussed comprehensively the difficulty of realizing this kind of study. There were identified only two studies for Baecke's Questionnaire (20,21) and one for IPAQ (22) and results showed low to moderate correlation and they

are considered appropriate for estimating PA level in the population under observation.

Strategies for selecting the adequate questionnaire for a given purpose are useful and should be applied prior to defining the assessment approach. With this purpose, Terwee et al. (23) proposed a checklist called Quality Assessment of Physical Activity Questionnaire (QAPAQ) to help selecting adequate instruments for specific research and clinical settings. The checklist is a comprehensive questionnaire that covers several qualitative attributes of a PA instrument and gathered formulas to validity analyses. By choosing an instrument, the authors recommend consideration about what is being measured and suggested that the development of a new PA questionnaire requires justification about how and why it is superior to questionnaires that already exist.

Warren et al. (12) also elaborated a table depicting advantages and disadvantages of direct and indirect methods to assess PA. The authors claim that the study design has great importance with respect to selecting the PA measuring method and aiming to help researchers, they developed a guide framework to select the most suitable tool for use in a specific study. This was a good contribution because such kind of comparative analysis is important, enabling researchers to consider the pros and cons of each instrument when designing their studies.

Issues for future research

Types of PA, health benefits and outcomes

There are two types of PA: structured and non-structured. The first refers to sports and exercise, and the latter to occupational and leisure time PA (LTPA) as well other non-planned or supervised daily life activities. Accumulated evidence suggests that increased LTPA is strongly related to reduced mortality and morbidity due to cardiovascular causes (24–26), although the effects of occupational PA (OPA) and LTPA on cardiovascular disease risk are opposite (3,27–29). Furthermore, it is possible that PA assessment period vary from hours to several years (30). Nevertheless, this kind of comparative research is limited. Hence, future research is

warranted to better define the specific impact OPA and LTPA on risk factors associated with the development of cardiovascular disease as well as the effects on mental health and quality of life in the working population.

Validity studies

Further validity studies should be conducted to confirm the theoretical and psychometric properties of most indirect PA assessment instruments. It is important to improve the quality of PA data reported in epidemiological studies; therefore, the use of precise techniques such as doubly labeled water or new generation triaxial accelerometers would be desirable to validate indirect assessment instruments, since these kinds of studies are lacking.

Conclusion

The quantification of PA in population-based studies is a complex task, and available research. One of the more common sources of bias is the lack of theoretical background to define which type of PA is being assessed and with what purposes. Occupational, leisure time, or structured/supervised PA, as well regular versus episodic PA have completely different meanings and should be appraised accordingly.

More attention should be given to bias that arises due to strategies used to assess PA. Self-reported instruments are valuable and widely used in epidemiological research, but critical limitations often preclude the accuracy and generalization of their outcomes. In this context, additional research is necessary to evaluate their psychometric properties and confirm their validity against direct measurements (as doubly labeled water), in order to improve studies on relationship between PA and health.

To select the most appropriate method to evaluate PA, it is important to define an adequate theoretical background with regard to the purposes and type of PA to be assessed prior to choose the instrument to quantify it in a given population. Here, we highlighted useful tools that help researchers to choose the most adequate instrument for their investigation.

Finally, the effect of OPA differs from LTPA in terms of physical and mental health benefits. In this context, it is interesting that more studies investigate the effect of OPA on LTPA levels.

Conflict of interest statement

The authors declared that there are no conflicts of interests.

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