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Original Article

Relation of pedometer steps count & self reported physical activity with health indices in middle aged adults

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ABSTRACT

Objective: To describe the relationship between daily physical activity (steps/day and self report method) and health indices. Also to observe relationship between daily physical activity and existence of any prior sign of metabolic syndrome in middle aged adults of 40–60 years. A secondary objective was to observe relation between objective (steps/day) and subjective (IPAQ) measure of physical activity.
Method: 145 subjects were recruited from residential colony of New Delhi, India and their health indices (waist circumference, hip circumference, waist hip ratio, blood pressure, resting heart rate), and presence of any sign of metabolic syndrome were noted down. Their daily physical activity was determined by pedometer (steps/day) and IPAQ (self report). Steps/day was compared with self reported physical activity, presence of any prior sign of metabolic syndrome, and health indices.
Result: The average steps/day was 3226 ± 1558 for females ($n = 76$) and 4273 ± 2530 for males ($n = 69$). IPAQ results were inversely related with WHR ($p = 0.046$, $r = -0.166$), RHR ($p = 0.020$, $r = -0.193$) and signs of metabolic syndrome ($p = 0.017$, $r = -0.198$). Pedometer determined physical activity was inversely related with prior signs of metabolic syndrome present ($p = 0.041$, $r = -0.170$). Pedometer determined steps/day were positively correlated with self-reported physical activity ($p < 0.001$, $r = 0.56$).
Conclusion: Main findings suggested that fewer steps/day and METS are associated with more components of the metabolic syndrome. Prior signs of metabolic syndrome were mainly present in females. Majority of participants were sedentary, showed high resting heart rate, high waist hip ratio and more number of sign of metabolic syndrome.

1. Introduction

The prevalence of physical inactivity and related diseases like obesity and metabolic disease including hypertension, type 2 diabetes is rising dramatically worldwide [1]. A recent, large scale study done in India using subjective measure for physical activity (PA) by ICMR- INDIAAB found a staggering 392 million people who were inactive in India and thus putting a high percentage of population at risk of lifestyle disease including metabolic syndrome (MeS) and cardiovascular disease (CVD) [2]. Inactivity is not only associated with body weight but also with other elements of metabolic syndrome [3]. Physical inactivity is directly linked with obesity which is another important health problem in most of countries. Obesity is associated with CVD, and MeS including type 2 diabetes mellitus, hypertension, dyslipidemia, and high cholesterol [4]. Studies support that adequate amount of PA leads to major and wide ranging health benefits and may reduce negative consequences of physical inactivity [5]. Recent PA recommendations states that, in addition to strength and flexibility exercises, adults should participate in moderate PA for a minimum of 30 min for 5 days each week or vigorous-intensity aerobic PA for a minimum of 20 min, 3 days each week to achieve health benefits [6,7]. Apart from all types of PA, walking stands out as the most popular form of leisure time exercise [8], which can be easily performed at moderate intensity [9], and is also a functional part of activities of daily living. This includes “brisk walking” as a primary example of an appropriate activity [10]. According to National Health Interview Survey (2008), decreased PA and alteration in lifestyle pattern in middle aged adults have significant adverse effect on their overall cardiovascular health [11]. This is the main

Abbreviations: PA, physical activity; CVD, cardiovascular diseases; MeS, metabolic syndrome; WHO WPRO, World Health Organization Western Pacific Regional Office; ICMR-INDIAB, Indian Council of Medical Research-India Diabetes; WC, waist circumference; HC, hip circumference; WHR, waist hip ratio; BP, blood pressure; BMI, Body mass index; RHR, resting heart rate; IPAQ, international physical activity questionnaire; METS, metabolic equivalents.

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reason for promotion of PA in middle-aged adults to avoid the health risk formerly mentioned.

The necessity for precise measurement of PA is well recognized in the health literature [12]. The two most practicable measures of PA are subjective method like self-report, questionnaires, surveys and objective methods like motion sensors, pedometers and accelerometers. Every method has its own advantages and limitations. Researchers often rely on questionnaires and surveys to assess PA because of their low cost and ease of administration but they have some inherent limitation like subject to recall bias and inability of adults to accurately recall relevant PA details retrospectively leads to overestimations [13]. Pedometer having an advantage in being an objective measure followed by its low cost, simple to use and easy availability to everyone. It is simple and inexpensive body-worn motion sensor which measures vertical hip displacement during ambulatory movements and express activity in terms of steps taken [14].

To our knowledge, no research has been conducted to determine the relationship between objectively measured PA with indices of health and presence of MeS signs in middle aged adults in Indian population. The purpose of this study is to describe the relationship between daily PA (steps/day and self report method) and health indices. Secondary objectives are to observe relationship between daily PA and existence of any prior sign of MeS and also to observe relation between objective (steps/day) and subjective (IPAQ) measure of PA in middle aged adults.

2. Materials and methods

2.1. Recruitment

145 Males and females were recruited from residential colony of New Delhi, India based on inclusion and exclusion criteria and informed about the study. All participants were middle aged (40–60 years) with a good health condition and participant were excluded if they were not able to perform daily PA due to any existing reason. Participants were recruited via word of mouth and through fly leaf poster in the selected residential colony. All subjects were given informed consent to participate in the study and the information of each participant was kept confidential by assigning a number to each subject. All the participants were volunteers and were not remunerated for taking part in the study.

2.2. Data collection

Participants were instructed not to eat or drink caffeinated beverages within 2 h of data collection. Each participant completed a questionnaire to provide data regarding occupational activity, education, and health status. Participants were evaluated for height, weight, resting heart rate (RHR), and blood pressure (BP). In addition waist circumference (WC), hip circumference (HC), and their PA was taken by IPAQ. All the participants were provided with a pedometer and were asked to wear it, also note down their steps count at the end of each day for 3 consecutive days. Each participant was asked to complete Kuppuswami socioeconomic scale based on which they were classified into different socioeconomic status [15].

2.3. Anthropometric measurements

Height of each subject was measured by a stadiometer with the subject standing against the wall and feet close together without shoes, to the nearest 0.1 cm. Weight was measured in minimal clothing by a weighing machine to the nearest 0.1 kg.

2.4. Clinical history and examination

BP & RHR was measured by digital sphygmomanometer (Omron HEM-7120). Body mass index (BMI) was calculated by dividing weight (kilograms) by height squared (meters square). Classification of normal weight (18.5–22.9 kg/m^2), overweight (23.0–24.9 kg/m^2), and obese I (25.0–29.9 kg/m^2), obese II (>30 kg/m^2) was made according to the World Health Organization (WHO) WPRO criteria, 2000 [16]. WC was measured using inch tape at the narrowest portion of the torso below the xiphoid process and above the umbilicus, after a normal exhalation [17]. HC noted at the maximum circumference of the buttocks while participants stood with their feet together [17]. Waist hip ratio (WHR) was calculated by dividing WC with HC and classified for CVD risk, according to Asian population for males and females [18].

2.5. International physical activity questionnaire (IPAQ)

IPAQ is standardized method used to measure level of PA in subjective manner. Short version of IPAQ was used to assess PA which consists of seven questions according to type of activity performed [19]. IPAQ was given to each subject after taking baseline measurements, to give detail about their daily activity including walking, sitting, and any vigorous or moderate activity in a week. IPAQ scores were calculated by evaluating METS (metabolic equivalents) by using standard formula [20] and further PA level classified into three categories (sedentary, moderate, active) according to METS [20].

2.6. Pedometer measurement

All participants were issued with an OMRON (HJ-325) pedometer and daily step log. Pedometer has shown to accurately detect steps taken in both free-living conditions and under controlled laboratory conditions [21]. A single familiarization session was given, so that all the participants get to know how to operate and take readings with pedometer. The appropriate position to wear the pedometer, on the waist band in-line with the midline of the thigh was demonstrated to participants before their actual use for study. Participants were instructed to wear the pedometer throughout walking hours for three consecutive days and to remove only when bathing, showering or swimming [22]. Participants were explained to record the number of steps displayed in their log before going to bed each night and they were also asked to reset the pedometer ready for the following day (Table 1).

2.7. Statistical analysis

Data was analyzed using SPSS software version 21. Statistical significance was taken $p < 0.05$. Descriptive data are presented as means, standard deviation and percentage value for continuous data. Data was assessed by a Shapiro-Wilk test for normality of the distribution scores. Descriptives were calculated of all the variables taken in the study. PA was divided into five groups according to steps/day, given by Tudor-Locke [23]. These five groups were compared by applying one way ANOVA test and further post hoc analysis was done by bonferroni test. Correlation of health indices and presence of any existing MeS sign with PA (steps/day and IPAQ) was analyzed by Spearman rank test as all the studied variables were not normally distributed.

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