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Original Research Article

ASSOCIATION BETWEEN THE LEVELS OF PHYSICAL ACTIVITY AND CARDIORESPIRATORY FITNESS AMONG SECURITY GUARDS

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ABSTRACT

Background: Physical fitness is important in most high physically demanding jobs especially in the security services. It has to be ensured that the security guards are both physically fit for work, by matching their capabilities with the physical requirement for their job, and physically fit for life. Cardiorespiratory fitness has a strong relationship with physical activity. This study aims to explore the correlation that exists between physical activity and cardiorespiratory fitness among the security guards.

Method: A total of 50 healthy security guards aged 20-40 years (mean 31) participated in the study. Global Physical Activity Questionnaire (GPAQ) was used to assess the physical activity level among the security guards. Metabolic Equivalent (MET) was used to express the intensity of physical activity. The data collected related to the perception of guards on physical activity at work, transport, recreation and sedentary. Cardiorespiratory fitness was determined by a submaximal progressive protocol performed by the Chester step test. The Chester step test evaluated the aerobic capacity of the security guards.

Results: Spearman correlation test revealed a significant strong positive correlation ($r= 0.847$, $p<0.01$) between physical activity and cardiorespiratory fitness. Work domain and transport domain showed positive correlations with aerobic capacity (i.e. $r= 0.811$, $p<0.01$ and $r= 0.383$, $p=0.006$ respectively). On average, 3469.60 (2141.63) MET minutes per week were spent in physical activity. Average $VO_{2\ max}$ was 60.6 (11.8) ml/kg/min.

Conclusion: The results of the present study suggest that physical activity is strongly associated with cardiorespiratory fitness in security guards.

KEY WORDS: Cardiorespiratory fitness, physical activity, security guards.

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INTRODUCTION

Physical activity is a fundamental means of development and maintenance of individual and population health and well-being [1,2]. It is defined as "any force exerted by skeletal muscles that results in energy expenditure above resting level" [3]. Physical activity is typically characterised by mode or type of activity (e.g. walking, running, sweeping), frequency (how often), duration (minutes), and intensity (light, moderate, vigorous). The energy necessary to conduct these physical activities is described and measured as the energy cost of physical activity or energy expenditure [4].

According to a report from World Health Organisation (WHO), globally 23% of the adults aged 18 and above are insufficiently physically active. In developed countries, 26% of the men and 35% of the women whereas in underdeveloped countries 12% of the men and 24% of the women were not physically active [5]. As per the directions of WHO, it is recommended that adults aged between 18-64 years should do at least 150 minutes of moderate-intensity aerobic physical activities throughout the week or do at least 75 minutes of vigorous-intense physical activity throughout the week or an equivalent combination of moderate and vigorous intensity activity [6].

Monitoring of population levels of physical activity using a standardised protocol is a core part of a public health response to current concerns regarding levels of physical inactivity [7]. The Global Physical Activity Questionnaire (GPAQ) was developed by WHO for physical surveillance in countries. It collects information on the amount of physical activity and sedentary behaviour in 3 setting (or domains) - activity at work, travel to and from places, and recreational activities- with 16 questions [8].

One factor related to physical activity is cardiorespiratory fitness. Physical activity and cardiorespiratory fitness are closely related in that fitness is partially determined by physical activity patterns over recent weeks or months. Cardiorespiratory fitness reflects the overall capacity of the cardiovascular and respiratory systems and the ability to carry out prolonged exercise [9]. Hence, cardiorespiratory fitness has been considered as a direct measure of the physiological status of the individual.

The gold standard for the measurement of cardiorespiratory fitness is the maximal rate of oxygen uptake ($VO_{2\,max}$). One such test to determine the $VO_{2\,max}$ is the Chester step test. The Chester step test was originally developed by Sykes et al. [10] to evaluate the aerobic capacity of healthy adults and to prescribe physical activity [11]. It consists of a submaximal test for healthy subjects, which is easy to perform, does not require a large space, is inexpensive and has a pace that is determined by a sound signal [10]. In this study, we aimed to address the security guards, which represent a professional category that is still understudied in the occupational health field. Security guards are professionals responsible for guaranteeing the security and the physical integrity of employees, workers and visitors, in public institutions, like universities. Furthermore, the security guards are required to be constantly alert and react rapidly at any circumstance that threatens or violates the security.

MATERIALS AND METHODS

This study was a cross-sectional correlation study design. The study was carried out in and around Ahmedabad city. A sample 50 security guards were selected through convenience sampling. Guards suffering from any physical or medical abnormalities like respiratory, or thopaedic or neurological conditions were excluded from the study. Those who were in the age group of 25- 40 years healthy male and given an informed consent were included in the study.

GPAQ was used to assess physical activity. It consists of 16 questions that capture physical activity undertaken in different behavioural domains: at work, in transport, and recreational. To assess physical activity, metabolic equivalents (MET) scores were calculated separately for each domains and sub domains. MET is used to express the intensity of physical activity.

One MET is defined as the energy cost of sitting quietly and is equivalent to a caloric consumption of 1 kcal/kg/hour. For the analysis of GPAQ data, the existing guidelines have been adopted: It is estimated that, compared with sitting quietly, a person's caloric consumption is 4 times as high when being moderately active, and 8 times as high when being vigorously active. Therefore, when calculating a person's overall energy expenditure using GPAQ data, 4 METs are assigned to the time spent in moderate activities, and 8 METs to the time spent in vigorous activities [8].

The three levels of physical activity were classified as low, Moderate and high. The criteria for these levels are shown below.

High: An individual who does vigorous-intense activity for 1500 MET-minutes/work for 3 days (or) walking along with moderate or vigorous intense activity for 3,000 MET-minutes per week for more than 1 week.

Moderate: An individuals who doesn't meet the high category level but who does Vigorous intense activity for at least 20 minutes per day for 3 or more days (or) moderate intense activity for 30 minutes per day for 5 or more days (or) walking along with moderate or vigorous intense activity for 600 MET minutes per week for 5 days or more.

Low: An individual who doesn't comply with the above criteria.

To assess the cardiorespiratory fitness, aerobic capacity was estimated through the progressive Chester step test. The Chester step is a test validated for healthy subjects, which consists of going up and down a step that is up to 30 cm in height at a pace set by a signal sound, which progressively increases in speed up to five levels. In the first minute, patients go up and down the step 15 times, and this is increased by 5 every 60 seconds. The maximum test time is 10 minutes. The step height used depends on the study population. The minimum height is 15 cm, and the maximum is 30 cm. [11] For the present study, an 8 inch step was used.

The participants were instructed to report any limiting symptom as soon as it was perceived. The test was also stopped by the examiner if the subject reached 90% of the predicted maximum heart rate (HR_{max}) [11]. The number of completed levels and the number of steps were considered for the analyses.

HR, blood oxygen saturation (SpO2) and dyspnoea (modified Borg scale) were measured before, immediately after and at the end of each level of the test. HR_{max} was calculated using the equation HR_{max}=210–(0.65*age) [12]. Desaturation was considered when SpO2 decreased below 90% or when the baseline SpO2 decreased 4% or more and remained between 90 and 94% [13].

Mean and standard deviation were calculated for all the parameters. Mean MET scores of physical activity were calculated for individual domains and sub domains. Data collected was entered in Microsoft excel 2010. Spearman correlation test was used to find out the correlation between aerobic capacity and physical activity. A 'P' of less than 0.01 (P<0.01) was considered to be statistically significant.

RESULTS

Table 1 represents the demographic characteristics. The mean age of the participants was 31.02 (5.49). The mean (SD) of aerobic capacity was 60.60 (11.78) and that of total physical activity MET minutes per week was 3469.60 (2141.63).

Table 1: Demographic characteristics of variables.

Variables	Mean (SD)
Age (years)	31.02 (5.49)
Aerobic capacity (Vo_{2max}) (ml/kg/min)	60.60 (11.78)
Total physical activity MET minutes per week	3469.60 (2141.63)

Table 2 lists the mean values of various domains and sub domains of physical activity and its correlation with aerobic capacity. Information on physical activity participation was calculated in 3 settings (or domains): activity at work, transport and recreational activities. Intensity of physical activity was calculated in mean MET minutes/ week. Activity at work was further classified in 2 sub domains; moderate and vigorous. Total mean physical activity at work was 2726.40 (1896.32) MET minutes/ week. Mean MET minutes/ week for transport was 690.40 (630.23). Recreational activities were further classified into2 sub domains; moderate and vigorous. MET scores were calculated separately for individual sub domains. Total physical activity was calculated by sum of energy expenditures in the 3 domains. A strong positive correlation (0.847) was observed between aerobic capacity and total physical activity MET minutes per week. Correlation of aerobic capacity with work and transport was found to be significant 0.811 and 0.383 respectively whereas no association was observed with recreational activities.

Figure 1 illustrates the level of total physical activity. 25 (50%) security guards were found to have high level, 22 (44%) had moderate level whereas 3 (6%) has low level of total physical activity.

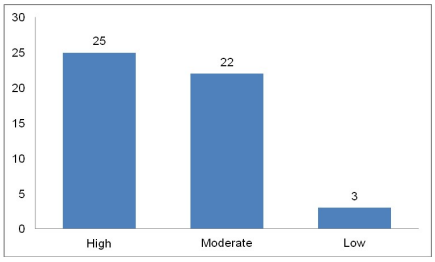

Fig. 1: Level of total physical activity.

Table 2: Mean values of various domains and sub domains and its correlation with aerobic capacity.

* Correlation is significant at the 0.01 level

Physical activity	Mean minutes/ week (SD)	Mean metabolic equivalents minutes/ week (SD)	Correlation with aerobic capacity
Domain			
Total physical activity MET minutes per week	862.80 (530.08)	3469.60 (2141.63)	0.847*
Setting specific physical activity			
Work	679.60 (473.22)	2726.40 (1896.32)	0.811*
Transport	172.60 (157.56)	690.40 (630.23)	0.383*
Recreational activities	10.60 (34.55)	52.80 (193.85)	-0.12
Work related physical activity			
Moderate	677.60 (472.58)	5420.80 (3780.67)	0.811*
Vigorous	2.00 (10.10)	16.00 (80.81)	0.023
Recreational physical activity			
Moderate	8.00 (24.83)	32.00 (99.30)	-0.029
Vigorous	2.60 (17.00)	20.80 (136.00)	0.049

Figure 2 illustrates the cariorespiratory fitness rating. Cariorespiratory fitness rating was classified into excellent, good and average. 39 (78%) participants had excellent level, 9 (18%) had good level and 2(4%) had average level of cardiorespiratory fitness rating.

Fig. 2: Cardiorespiratory fitness rating.

DISCUSSION

The present study was carried out to investigate the association between the physical activity levels using the global physical activity questionnaire and cardiorespiratory fitness using Chester step test among guards aged 25 to 40 years.

Among the study population, majority of the participants had high physical activity (50%) as compared to moderate (44%) and low (6%) physical activity level. The reason for high level of physical activity may be physical activity during the daily routine activities and travelling. In a similar study done in South India by Dutala et al about 22.2% belongs to low level, 73% belong to moderate and 4.8% belong to high level of physical activity [14]. In a ICMR-INDIAB study, the pattern of physical activity was assessed in four different areas of India (Tamil Nadu, Maharashtra, Jharkhand and Chandigarh) through a community based national survey and found that about 54.4% individuals were physically inactive and were more in the urban area (65% compared to rural area 50%) [15].

The perception of high level of physical activity (50%) was considered to be linked to an excellent rating of cardiorespiratory fitness. The reason for excellent level of cardiorespiratory fitness (78%) may be attributed to the more time spent at work during brisk walking and the active mode of transport that involved more walking and cycling to travel to places. This supports the finding of previous study by Dr. Jackson Wong, which indicates that cardiorespiratory fitness is significantly associated with fasting blood sugar and physical activity among security officers [16].

The duration of total physical activity per week was 862.80 minutes. It was found that there was a statistically strong correlation of total physical activity MET minutes/ week with aerobic capacity (r=0.847). In a study done by Singh et al, the total physical activity measured in mean MET minutes per week was 625.6, 786.3, 296.5 and 296.5 for third year, final year students, interns and faculty and statistical significance were noted between the various groups [17].

In setting specific physical activity, security guards spent most of their time at work (679.60 minutes), whereas less time was spent in transport and recreational activities i.e. 172.60 and 10.60 minutes respectively. In a study by Singh et al, the mean metabolic equivalents minutes per week in travel to and from places was

reported as 212.9, 185.2, 167.2, 69.4 of the various dental health care professional groups and statistical significance were noted for activity at work, travel to and from places, and recreational activity between various dental health professionals groups [17].

Among the sub domains we observed that the guards spent most of their time in moderate work related physical activity (677.60 minutes) while least time was for vigorous work related physical activity. This may be due to the less strenuous work required during duty hours, which mostly required sitting and more brisk walking hence a strong positive correlation was found between moderate work related physical activity and aerobic capacity. Whereas no correlation was found between recreational activities and aerobic capacity. The guards were less involved in any form of recreational activities as most of them had 12 hour shifts of work hence there they reported no time for leisure activities. As for transport, the guards reported that they had to either walk or cycle to travel to places.

It is observed that lower level of aerobic capacity among Physiotherapy graduate students is associated with low level of physical activity [18]. Physical fitness specifically cardio-respiratory is important consideration for security guards as they are involved in multiple activities during their duty hours. It is reported that cardio-respiratory fitness is needed for rhythmic use of the body's large muscle groups. A high level of Cardio-respiratory fitness permits continuous physical activity without a decline in performance and allows for rapid recovery following fatiguing physical activity [19].

The present study has some limitations related to the sample size which was small therefore conclusions can not be generalised. Another limitation was due to the use of self- reported questionnaire. This means that it is possible that some guards may have misreported, either intentionally or inadvertently, on any question asked. Other limitation was that the role of Body Mass Index (BMI) was not considered in the evaluation of aerobic capacity.

CONCLUSION

The results of the present study suggest that physical activity is strongly associated with cardiorespiratory fitness in security guards.

The guards reporting day-to-day habits such as walking and usage of bicycles may be considered as good practices and such simple and replicable behavioural modifications need to be brought about at a societal level to bring down the risk of future complications.

ABBREVIATIONS

GPAQ- Global Physical Activity Questionnaire
$VO2_{max}$- Maximum oxygen uptake
MET- Metabolic Equivalent
HR_{max}- Maximum heart rate
SPO2- Saturation of Peripheral Oxygen.

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Conflicts of interest: None

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