ISSN - Print: 2277 – 1522; Online: 2277 – 3517

ORIGINAL RESEARCH ARTICLE

DOI: 10.26727/NJRCM.2018.7.3.223-228 Year: 2018 Vol: 7 Issue: 3. Jul.-Sep. Page: 223-228

Pattern Of, And Risk Factors For Physical Activity Among Medical Students In A Private Institution

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Date of Submission	**: 06-07-2018**	**Date of online Publication**	**: 21-07-2018**
Date of Acceptance	**: 20-07-2018**	**Date of Print Publication**	**: 31-07-2018**

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Abstract

Background: Physical activity refers to bodily movement generated by skeletal muscles, and involving expenditure of energy. The lack of adequate physical activity is an established behavioural risk factor for the development of several non-communicable diseases. The global prevalence of physical inactivity among adults is around 23%. **Objectives:** 1) To determine the prevalence and pattern of physical activity among medical students; 2) To investigate the relationship between physical activity and selected physical measures associated with risk of developing non-communicable diseases; and 3) To ascertain the factors associated with performance of adequate physical activity among medical students. **Methodology:** This cross-sectional study was performed among medical students and interns of a private medical college in Kerala using the Global Physical Activity Questionnaire. Waist circumference, waist-hip ratio, Body Mass Index and resting pulse rate were measured using standard procedures. **Results:** 57 (24.1%) of subjects had inadequate physical activity (<600 MET/ week). 210 (88.9%) of subjects had suboptimum resting pulse rate (≥65 beats per minute). 201 (85.2%) of subjects had an abnormal waist-hip ratio. 167 (70.7%) of subjects had a waist circumference at or above Action Level 2. 56(23.73%) of the subjects reported a daily sitting time of more than 480 minutes. Performance of adequate physical activity was significantly associated with male sex, year of study, and less than 480 minutes of daily sitting time (p<0.05). Females were significantly more likely to have a daily sitting time of >480 minutes (p<0.0001); and not to mention physical activity as a means of improving physical fitness (p: 0.002). **Conclusions:** Physical activity is significantly associated with sex, year of study, and daily duration of sitting.

Key-words: Physical activity, GPAQ, medical students

Introduction

Physical activity (PA) refers to any bodily movement produced by skeletal muscles that uses energy.[1] Inadequate PA is an established independent causal risk factor for ischaemic stroke, type 2 diabetes, ischaemic heart disease, breast cancer and colon cancer.[2,3] Globally, around 23% of adults lack adequate PA.[4] Apart from being the fourth leading risk factor for death globally, physical inactivity cost health-care systems INT$67.5 billion, with low and middle-income countries (LMICs) bearing 75% of the disease burden.[5,6]

Physical activity has been identified as an important factor in the progress and achievement of Sustainable Development Goals (SDGs).[7] An increase in PA will directly contribute to the achievement of good health and well-being (SDG3); ending all forms of malnutrition (SDG2.2); quality education (SDG4.1 and 4.2); gender equality (SDG5.1); decent work and economic growth (SDG8); industry, innovation and infrastructure (SDG9.1); reduced inequalities (SDG10.2 and 10.3); sustainable cities and communities (SDGs 11.2, 11.3, 11.6 and 11.7); responsible production and consumption (SDGs 12.8 and 12c); peace, justice and strong institutions (SDGs 16.1 and 16b); climate action (SDGs 13.1 and 13.2); life on land (SDGs 15.1 and 15.5); and partnerships (SDG17).[1]

In addition to providing protective benefits- such as maintenance of physical, social and mental health (including the prevention or delay of dementia); prevention of falls; and healthy ageing, physical activity is also associated with academic performance.[1,2,8]

Health-care professionals are at substantial risk for physical inactivity, and inactive behavior may commence during training.[9-13] Considering that health-care professionals are a valuable resource, and are expected to model healthy behaviours, investigation of their physical activity patterns would enable identification of areas for targeted intervention(s), as well as institution of remedial measures at an early stage. This is required to protect the health of the health-care professionals, and ensure their availability to address the health needs of the community at large.

Although some studies have examined the practice of physical activity among medical students, they have often been conducted outside India, limiting their utility in the Indian context.[12,14,15]

Objectives

This study was conducted to 1) determine the prevalence and pattern of PA among medical students; 2) investigate the relationship between PA and selected physical measures associated with risk of developing non-communicable diseases (NCDs); and 3) ascertain the factors associated with performance of adequate PA in the study population.

METHODOLOGY

Participants

This cross-sectional study was conducted between September to October 2016 in a private medical college in south Kerala. Permission to conduct the study was obtained from the head of the department. The study population consisted of consenting medical students and interns between the ages of 18 and 30 years. Since first year MBBS students were unavailable on account of examinations, the study was restricted to the remaining students. Stratified random sampling was employed (with each year of study taken as a stratum), and systematic random sampling was performed within each stratum.

Sample size

The prevalence of physical activity in urban areas of Tamil Nadu is reported to be 29%.[16] This was assumed to be comparable with the physical activity level in south Kerala, hence was taken for sample size calculation.

Sample size was calculated using the formula $4Pq/l^2$

where p is prevalence

q is (100-p)

l is 20% of p

Sample size = 4 x 29 x (100-29)/ (20/100) x 29

= 244

Measures

Sociodemographic and physical attributes

A self-administered, semi structured questionnaire was used to collect details regarding age, sex, year of study, marital status, and perceived fitness level. Subjects were asked if they were satisfied with their level of fitness, and how to improve the same. In addition, questions pertaining to weight gain in the preceding six months, and reasons for the change were asked. Physical measurements were obtained immediately after administration of the questionnaire.

Physical measurements such as waist circumference (WC), hip circumference (HC), waist-hip ratio (WHR), weight (Kg), height (cm), resting heart rate (RPR), and body mass index (BMI) were obtained by the authors using standard procedures.[17,18] Weight and height were measured to the nearest 0.1 kg and 0.1 cm respectively, using a free standing stadiometer with digital weighing scale (Model WS703, Narang Medical Limited, Delhi). Both weight and height were measured twice, and the average was used to compute BMI. The weighing scale and stadiometer were calibrated with standard weight and height on each day of data collection. Waist and hip circumference were measured using an inelastic measuring tape. RPR is an independent indicator of cardiovascular fitness, with lower values usually indicating greater cardiovascular efficiency.[19,20]

Studies have shown that there are important differences in adiposity between south Asians and other races. Therefore, lower cut-offs for WC have been suggested for them.[18,21] Specifically, south Asians demonstrate greater adiposity at the same BMI level; have a tendency for greater visceral adiposity; and manifest overt disease (like type 2 diabetes) at lower levels of WC and BMI than established as global thresholds for intervention.[21] This has resulted in the development of separate (lower) cut-off levels for south Asians (including Indians). The Association of Physicians in India has suggested two Action Levels to facilitate risk screening and inform management. Action Level 2 corresponds to the threshold for definite action/ intervention to reduce WC.[21]

The following cutoff points were employed for the physical measurements:

Waist circumference- Men: 90 cm Women: 80 cm (corresponds to Action Level 2)[21]

Waist-Hip Ratio- Men: 0.9 Women: 0.8 (appropriate for South Asians)[18]

BMI- Underweight: <18.5 Normal: 18.5-24.9 Overweight: 25.0-29.9 Obese: ≥30.0[18]

Resting Pulse Rate- Abnormal: ≥65 beats/ minute[20]

Physical Activity

Physical activity was assessed using the Global Physical Activity Questionnaire (GPAQ) (version 2.0), a validated tool that has been developed by the World Health Organization (WHO) for epidemiological surveillance.[22] The tool captures PA across three domains- work, transportation, and leisure time- and intensity levels (vigorous, moderate, and low) over a typical week. In addition, it collects details regarding frequency of PA; and time spent sitting daily.[14,22] The GPAQ was administered through face-to-face interview by the authors. Sitting for more than 3 hours a day is associated with an increased risk of mortality in all but the most active.[23] However, sedentary behavior involves sitting for more than 8 hours per day, therefore 480 minutes was taken as the threshold for categorization.[23,24]

Estimation of Energy Expenditure

Energy expenditure was estimated using metabolic equivalent of task (MET) per week, as indicated by the PA reported in GPAQ. One MET is equal to the energy cost of sitting quietly (1 kcal/kg/min). Moderate-intensity activities are assigned a value of 4 METs; while vigorous activities are assigned a value of 8 METs. The total MET/week is determined by adding the METs for all PA in the week. The GPAQ framework classifies PA variously as

a. Adequate (≥600 MET/week) / Inadequate (<600 MET/week); and

b. High (≥ 3000 MET/week) / Moderate (≥600 MET/week) / Low (<600 MET/week)[14,25]

Statistical analysis

Data entry was performed using Microsoft Office Excel 2013, and analyses were performed using EZR (version 1.36) [R Commander version 2.4-0; R version 3.4.1].[26] Data were analysed in accordance with the GPAQ analysis guide.[25] In addition, descriptive statistics, chi-square tests, independent samples t-test, and logistic regression were performed.[27,28] Statistical significance was set at the 5% level.

The data were cleaned to exclude improbable responses (16 hours or more of physical activity in a day, etc.). This resulted in the exclusion of eight respondents from analysis, reducing the available sample to 236 subjects (95% of the original estimated sample size).

RESULTS

Of the respondents, 79 (33.5%) were male, while 157 (66.5%) were female. Year-wise details of study subjects is provided in Table 1. 57 (24.1%) of subjects had inadequate physical activity (<600 MET/ week). 210 (88.9%) of subjects had suboptimum resting pulse rate (≥65 beats per minute). 201 (85.2%) of subjects had an abnormal waist-hip ratio. 167 (70.7%) of subjects had a waist circumference at or above Action Level 2. Overall, the proportion of subjects classified as underweight (18(7.63%)); normal BMI (151(63.9%)); overweight (61(25.8%)); and obese (6(2.5%)) were comparable across strata. The mean time spent sitting by subjects was 348.8 minutes per day. Only 56(23.73%) of the subjects reported a daily sitting time of more than 480 minutes. Female subjects were 4.6 times more likely to report a daily sitting time of more than 8 hours (95%CI: 1.9-12.8; p<0.0001).

Table 1. Details of stratified sampling

Year of study	Number of students		Sample characteristics		
	Male	Female	Male	Female	Total
2nd MBBS	33	61	21	32	53
3rd MBBS	35	67	21	42	63
Final year	34	52	20	38	58
Internship	27	86	17	53	70
Total	129	266	79	165	244

The baseline characteristics of the study sample disaggregated by sex are provided in Table 2.

Although there was a predominance of female subjects, there was no statistically significant difference in the proportion of male to female subjects across the years of study. Similarly, there was no significant difference in age, resting pulse rate, or mean hip circumference between male and female subjects.

There was a statistically significant difference between male and female subjects in terms of their BMI- both mean BMI (p: 0.001); and BMI classification (p: 0.003). Statistically significant differences were also present in waist circumference (p <0.001); waist-hip ratio (p <0.001); and MET per week (p <0.001).

Table 2. Sex disaggregated characteristics of study subjects*

Variable	Level	Male (79)	Female (157)	P value
Year of study	2nd MBBS	21 (26.6%)	32 (20.4%)	0.2
	3rd MBBS	21 (26.6%)	37 (23.6%)	
	Final year	20 (25.3%)	35 (22.2%)	
	Internship	17 (21.5%)	53 (33.8%)	
BMI	Underweight	0 (0.0%)	18 (11.5%)	**0.003**
	Normal	52 (65.8%)	99 (63.1%)	
	Overweight	24 (30.4%)	37 (23.6%)	
	Obese	3 (3.8%)	3 (1.9%)	
Age		22.47±1.77	22.37±1.57	0.6
BMI		24.24±3.22	22.71±3.25	**0.001**
Hip circumference		93.84±7.78	92.21±9.93	0.2
Waist circumference		92.43±7.04	82.60±9.22	**<0.001**
Waist-Hip Ratio		0.98±0.08	0.89±0.06	**<0.001**
MET per week		2123.04 ± 1285.85	1291.72 ± 1058.62	**<0.001**
Resting Pulse Rate		76.49±8.66	75.46±8.89	0.4
Sitting time per day		279.93±127.06	383.43±185.99	**<0.001**

*Results are presented as Mean±Standard Deviation or n(%)

Subjects were asked if they were satisfied with their fitness level, and how it could be improved. 129 (54.66%) were satisfied with their fitness level. Of the remaining 107, 63(58.8%) mentioned exercise; 39(36.4%) mentioned diet; 3(2.8%) mentioned diet and exercise; and 2 (1.8%) mentioned yoga as means of improving fitness. Among those unsatisfied with their fitness, male subjects were 4.2 times more likely to mention exercise as a means of improving fitness as compared to female subjects (95% CI: 1.48-14.05; p: 0.002). While 96 (40.7%) subjects indicated that they had maintained their weight over the preceding six months, 72 (30.5%) had gained weight, and 68 (28.8%) had lost weight during the same time period. Among those who had gained weight, the commonest explanations offered were that they were too lazy to work out (43(69.3%)); and stress/ illness (14(22.6%)). There was no statistically significant difference between male and female subjects regarding reason for weight gain (p: 1). Analysis of Variance (ANOVA) revealed that there was a statistically significant difference in MET/week between interns and other students (p<0.001). Post-hoc test (Tukey) revealed that there was a statistically significant difference in physical activity level between interns and second year students (p<0.001); interns and third year students (p<0.001); and interns and final year students (p<0.001). There was no significant difference between second, third and final year students in terms of physical activity level.

The relationship between adequate physical activity and selected factors is presented in Table 3.

Table 2. Relationship between adequate/ inadequate physical activity and selected factors*

Variable	Level	≥600 MET/ week (n=179) (n(%))	<600 MET/ week (n=57) (n(%))	P value
Resting Pulse Rate	≤65 beats/ min	19(10.6%)	7(12.3%)	0.8
	>65 beats/ min	160(89.4%)	50(87.7%)	
BMI	Overweight/ Obese	44(24.6%)	23(40.4%)	**0.028**
	Others	135(75.4%)	34(59.6%)	
Time sitting/ day	<480 minutes	145(81.0%)	35(61.4%)	**<0.0001**
	≥480 minutes	34(19.0%)	22(38.6%)	
Satisfied with fitness?	Yes	104(58.1%)	25(43.9%)	0.06
	No	75(41.9%)	32(56.1%)	
How to improve fitness	Exercise	51(68.0%)	15(46.9%)	0.051
	Others	24(32.0%)	17(53.1%)	
Weight status in last 6 months	Gained	48(26.8%)	24(42.1%)	**0.033**
	Others	131(73.2%)	33(57.9%)	
Reason for weight gain	Too lazy to work out	26(63.4%)	17(81.0%)	0.24
	Others	15(36.6%)	4(19.0%)	
Waist Circumference	Normal	17(9.5%)	2(3.5%)	0.17
	Abnormal	162(90.5%)	55(96.5%)	
Waist Hip Ratio	Normal	26(14.5%)	9(15.8%)	0.83
	Abnormal	153(85.5%)	48(84.2%)	
Waist circumference Action Level	Action Level 2	122(68.2%)	45(78.9%)	0.13
	Others	57(31.8%)	12(21.1%)	

*Results are presented as n(%)

Logistic regression analysis was performed with MET/week as the dependent variable, and factors that had achieved statistical significance as independent variables. For the purpose of this analysis, year of study was transformed to a binary variable with two levels- interns; and others. The results of logistic regression analysis revealed that sex, year of study, and daily sitting time were significantly associated with adequate physical activity. Male students were 5.8 times more likely to have adequate physical activity than their female counterparts (95% CI: 2.1-16.0; p: 0.0006). Similarly, year of study was significantly associated with adequate physical activity- students were 5.2 times more likely to have adequate physical activity than interns (95% CI: 2.6-10.4; p<0.0001). Daily sitting time of less than 480 minutes was 2.3 times likely to be associated with MET/week of ≥600 (95% CI: 1.1-4.8; p: 0.02).

DISCUSSION

Overall, the prevalence of physical activity among medical students was 75.85%, with males significantly more physically active than females. This is consistent with the findings reported by WHO, and several investigators.[2,4,6,9,12-16,29-31] Although the overall figure is respectable, it conceals considerable inactivity on the part of both females and interns. According WHO, globally around 23% of adults aged 18 and above were not active enough in 2010, which is comparable to that in our study (24.15%).[4]

46.5% of the interns were physically inactive, and students were more physically active compared to interns. The observation that year of study influences physical activity levels is consistent with that reported by Wattanapisit et al, who reported greater physical activity in preclinical students.[12] The possible explanation for the reduced physical activity could be erratic work and sleep timings during internship. Under such circumstances, it would be difficult to maintain a physical activity regimen.

The main reason for physical inactivity in this study was laziness (69%). This is consistent with the findings of Gadhvi et al, who reported that 57% of the subjects in their study cited laziness as the reason for inadequate physical activity.[9] This finding is important as it suggests that mere knowledge of the importance of physical activity is insufficient to effect behavioural change, or generate sufficient motivation to result in regular physical activity.

Sitting for at least eight hours on a daily basis was identified as a significant risk factor for inadequate PA. This is consistent with literature, and highlights the need to reduce sitting time as a proportion of one's daily routine. Since a reduction in sitting time alone does not lower the risk for developing non-communicable diseases or premature mortality, a reduction in sitting time should be accompanied with a corresponding increase in moderate-vigorous physical activity.[23,32]

Male subjects had significantly higher waist circumference and waist-hip ratios compared to their female counterparts. However, there was no such relationship between PA and either measure. This may be on account of variations in perceived effort of PA- those who are obese would perceive less intensive activities to be strenuous, thus reporting greater intensity of PA. It is suggested that adiposity may influence PA, as opposed to physical inactivity leading to overweight and obesity.[33] Perhaps, the relationship between obesity and physical inactivity is similar to a closed feedback loop, where the presence of one results in the other, and so on. Simultaneously, the findings may reflect the tendency of the GPAQ to significantly underestimate sedentary behavior.[34] It is also possible that the PA guidance is misinterpreted, and thus individuals fail to acquire cardiovascular benefits, since the greatest magnitude of benefit is available at considerably higher METs than the 600 MET/week recommendation by WHO.[3,35] Interestingly, female subjects indicated a preference for improving fitness by engaging in non-exercise activities (like dieting). This aversion to PA possibly stems from the mistaken belief that weight and BMI are more important than WC, WHR or RPR. It could also be reflective of greater importance being placed on physical appearance than physical fitness. This prioritization is flawed, as engaging in regular physical activity will usually have positive effects on one's physical appearance, but the reverse is not necessarily true. These factors may also explain the lack of association between RPR and PA levels in this study, since regular aerobic activity generally results in an improvement in heart rate variability; and lower resting heart rate.[20] With less regular and/or less intense physical activities, it is possible that the modulation of cardiac rhythm occurs much less perceptibly and slowly.

Limitations

It is difficult to establish a causal relationship between physical activity and the factors under consideration due to the cross-sectional nature of the study. Similarly, we were unable to verify PA levels using an independent measure (like an accelerometer or sensors).

Conclusions

Adequate physical activity was more among males students, and those sitting for less than eight hours a day. Subjects cited laziness as the main reason for inadequate physical activity. Sedentary behavior was significantly higher among females. Female subjects were more likely not to mention exercise as a means to improve physical activity.

Efforts to increase PA levels should be population-wide, and preferably commence during adolescence.[1] In India, this could be achieved through effective implementation of programs like the Rashtriya Kishor Swasthya Karyakram (RKSK).[36-38] These interventions should continue through adulthood, and into old age. This would ensure a culture of physical activity across various life stages, and possibly offset the impacts of sedentary behavior.

Recommendations

The practice of physical activity among medical students should be incentivized, and dedicated time made available for the same throughout their period of training.

Interventions to increase physical activity should focus on female subjects, and emphasize PA over maintenance of body weight.

ACKNOWLEDGEMENT

We would like to thank all the students and interns who participated in this study.

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Conflict of Interest: **None**
Source of funding support: Nil

How to cite this article: Liaquat Roopesh Johnson, Chithra Chandran Prabha, Deepa Prakash, Drisya Gopinath Vasantha, Geethanjali Mohandas, Karthika Reghunath, Muhsina Peediakal Padinjarai, Rabina Rasheed, Vishnu Satheeshan. Pattern of, and risk factors for physical activity among medical students in a private institution.Nat J Res Community Med 2018;7(3):223-228.

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