ORIGINAL RESEARCH

Physical Activity Pattern among Adolescents in a Rural Area

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Abstract
Background: Physical activity is defined as any bodily movement produced by skeletal muscles which results in energy expenditure above the resting level. For children and young people, physical activity includes play, games, sports, physical education, or planned exercise, in the context of family, school or the community. Lack of physical activity is already a global health hazard and is a rapidly increasing problem among adolescents due to changes in lifestyle, the availability and constant use of newer technologies and devices. Preventive interventions addressing physical inactivity should begin early in life for lifelong benefits and these should target the adolescents at the right time to change the age of inactivity to an age of opportunity.
Materials and methods: A cross sectional study was conducted among adolescents in higher secondary schools in a block panchayat area in Kerala using a self-administered semi structured questionnaire. The Global Physical Activity Questionnaire (GPAQ) was used to assess the pattern of physical activity among adolescents. The statistical significance of association was tested using Pearson Chi square test for qualitative variables and binary logistic regression analysis was used to find out the independent predictors of physical inactivity.
Results: The prevalence of inadequate physical activity which is one of the risk factors for lifestyle diseases was 42.4% and the prevalence was higher in girls. Significant association was found between female gender, mother being employed, studying in government aided schools and inadequate physical activity.
Conclusion: Physical activity needs to be emphasised as a protective behaviour during adolescence to halt the progression of chronic diseases. Adolescence provides a key opportunity where risk and protective factors can be modified altering the health trajectory into adulthood.
Key words: Adolescents, Physical activity, Non Communicable diseases.

Introduction
Non Communicable Diseases(NCDs) constitute one of the major public health challenges of the present century in terms of human sufferings and the harm they inflict on the socio economic progress of countries.[1] The escalating increase in the proportion of NCDs has

been attributed to changes in lifestyle, the increased ageing population, improvements in medical care and the availability of newer health care interventions. These diseases are strongly associated and causally linked to four particular behaviours, namely physical inactivity, tobacco use, unhealthy diet and the harmful use of alcohol.[2]These behaviours appear in childhood or adolescence or are reinforced during this period and often persist throughout life and are difficult to change.

Physical activity is defined as any bodily movement produced by skeletal muscles which results in energy expenditure above the resting level.[1]Physical activity has many dimensions like the types of activity, the frequency and the different levels of physical activity or the intensity. Physical activity includes exercise as well as other activities which involve bodily movement. For children and young people, physical activity includes play, games, sports, transportation, chores, recreation, physical education, or planned exercise, in the context of family, school, and community activities.

Lack of physical activity is already a global health hazard and is a rapidly increasing problem in both developed and developing countries. Physical inactivity has been identified as the fourth leading risk factor for global mortality; accounting for 6% of deaths globally.[3]Approximately 3.2 million deaths and 32.1 million DALYs (representing about 2.1% of global DALYs) each year are attributable to insufficient physical activity.[1]

Adolescence is the period in life when attitudes and behaviours are formed and future patterns of adult health are established. Foundations laid during adolescence in terms of health, education and skills will have profound implications for social and economic development of the country. It is well known that the behavioural risk factors can be made less damaging if addressed early in life, when habits are not yet well established.[4]Hence evidence points to adolescence as a crucial period in the development of adult non communicable diseases

Adolescence is crucial age of opportunity where public health interventions can be made to protect them against the risky behaviours and help them navigate on the path to fulfilling their potential. The results of the study could be utilised for public health planning and implementation of appropriate interventions for the promotion of healthy behaviour and lifestyle modifications among adolescents.

Aims & objectives

1. To estimate the prevalence of inadequate physical activity and determine the factors associated with inadequate physical activity among adolescents in a rural area in Alappuzha.
2. To study the pattern of physical activity among adolescents in a rural area in Alappuzha.

Materials & methods

This was a cross sectional study done among adolescents in the age group 15 -17 years in 2017 in Alappuzha district of Kerala. The study was initiated after obtaining Institutional Review board and Ethics Committee approval. The sample size was calculated taking the prevalence of inadequate physical activity among adolescents which showed a varying prevalence of 20% to 41%, [5] of which the lower prevalence of 20% which was taken for the calculation of the sample size with 5% significance and 20% allowable error and was estimated using the statistical formula $n = z\alpha^2 pq/d^2$ The calculated sample size was 384 with the alpha error at 5% and precision of 80%. Taking into account the design effect (multiplied by a factor of 2) and a non respondent rate of 10%, the sample size was estimated to be 845. The sample size was fixed as 850. The final sample size was divided proportionately into government (32%), government aided (63%) and private (4.9%) sectors as per the proportion of students enrolled in the three subdivisions of schools. Stratified and

cluster sampling method was used and the number of students to be selected from each strata was computed proportionate to the population of students in each strata.

A semi structured questionnaire was used to collect data regarding the socio demographic variables, the family details and academic details. The Global Physical Activity Questionnaire (GPAQ) was used to assess physical activity among adolescents. The Global Physical Activity Questionnaire (GPAQ) is a standardised questionnaire developed by the World Health Organization.[6]It consists of 16 items. It is a globally accepted and validated instrument for measuring physical activity. The questionnaire contains four domains, namely activity at work, travel to and from places, recreational activities and sedentary behaviour. Metabolic equivalents per week (METs/week) are used to assess the levels of physical activity. MET is the ratio of a person's working metabolic rate relative to the resting metabolic rate. One MET is defined as the energy cost of sitting quietly and is equivalent to a caloric consumption of 1 kcal/kg/hour. The intensity, frequency and duration of physical activity was assessed.

Intensity of physical activity was categorised into moderate and vigorous physical activity. Moderate physical activity includes activities that require a moderate amount of effort and noticeably affects the heart rate. Vigorous physical activity includes activities that require a large amount of effort and causes rapid breathing and a substantial increase in heart rate. Activities that were carried out for a minimum of 10 minutes only were counted. Frequency of physical activity was obtained as the number of days in a week involving the mentioned physical activity. Duration of physical activity was obtained for each of the activities in a typical day. Duration was captured in minutes per day.

Metabolic equivalent scores were computed by multiplying the MET constant for each activity with the total duration of activities across each domain in a week. The total duration in a week was obtained by the product of duration of activity per day and the frequency of activity per week. One MET is defined as the energy cost of sitting quietly and is equivalent to a caloric consumption of 1 kcal/kg/hour. Therefore, when calculating a person's overall energy expenditure using GPAQ data, 4 METs get assigned to the time spent in moderate activities, and 8 METs to the time spent in vigorous activities.[7]WHO recommendations on physical activity for children aged 5 to 17 years was followed and adolescents with less than 60 minutes of moderate to vigorous intensity physical activity daily was considered to be inadequate physical activity.[3]

Height and weight of all the study participants were measured. BMI was calculated as weight in kg/height in metre square. ELIZ Health Pathway for Adolescents (EPHA) was used for categorising the study participants.[8]The ELIZ health pathway for adolescents was designed and validated as a simple tool to assess the nutritional status of adolescents applicable for both sexes whether under nourished or overnourished.[9] The nature of the study was explained and consent was obtained from the parents of the students. Privacy and confidentiality of all information collected was maintained throughout the conduct of the study.

Statistical analysis

All data were entered into Microsoft excel sheet and analysed using Statistical Package for Social Sciences (SPSS) version 27 (SPSS Inc, Chicago, USA). The categorical variables have been summarized using percentages and proportions. The quantitative variables have been summarized as mean with standard deviation for normally distributed data. The statistical significance of association was tested using Pearson Chi square test for qualitative variables. Binary logistic regression analysis was used to find out the independent predictors of the behavioural risk factors. The adjusted odds ratios with their 95% CI were given as final

predictors in the model. All hypotheses were tested at a significance level of 95% and power of 80%.

Results

The mean age (SD) of the study participants was 16.24 (0.621) years. The highest number of study participants (55.5%) were of 16 years of age. Gender based analysis showed that majority of boys (53.6%) and girls (57.7%) were of 16 years of age. More than half of the study participants 489(52.9%) were males. Majority 665 (72 %) of the study participants belonged to Hindu religion. The proportion of students from government, government aided and private schools were 304 (32.9%), 576 (62.3%) and 44 (4.8%) respectively. Gender based analysis showed that majority 311 (63.6%) of boys and 265 (60.9%) of girls were from government aided schools. 603 (65.3%) of the study participants were studying in the 11th standard and 321(34.7%) were studying in the 12th standard. Majority of the parents (father 55.3% and mother 54.8%) had education upto secondary level.   Majority 634 (68.6%) of the fathers were employed in daily wages job and majority of the mothers 576 (62.3%) were housewives. Alappuzha being a coastal area, the main occupation of the area is related to the fishing industry.

Inadequate physical activity

The proportion of students not satisfying the WHO recommended levels of 60 minutes of moderate to vigorous physical activity per day was taken as the prevalence of inadequate physical activity.[10]

Out of the 924 study participants, 392(42.4%) were found to have inadequate physical activity. Gender based analysis showed that the prevalence of inadequate physical activity in boys was 23.3% (114) and in girls was 63.9% (278)

Pattern of physical activity

Out of the 924 study participants, 140 (15.2%) had vigorous work related physical activity, and 299 (32.4%) had participated in moderate work related physical activity including 159 of the 489 boys and 140 of the 435 girls.

797 (86.3%) had travel related physical activity which includes walking or cycling. About 381 (41.2%) of them took part in vigorous recreation related physical activities like football including 333 of the 489 boys and 48 out of the 435 girls and 635 (68.7%) participated in moderate recreation related activities.

The duration of physical activity was captured in minutes per day. 42.4% (392) of the study participants had less than 60 minutes of physical activity per day.

Frequency of physical activity was captured in number of days per week. Majority of the study participants 784 (84.8%) were not involved in work related vigorous physical activity and 625 (67.6%) were not involved in work related moderate physical activity. Of the 924 study participants, 432 (46.7%) had travel related physical activity on 6 to 7 days a week. Gender based analysis showed that majority of boys and girls had travel related physical activity on 6-7 days a week.. Recreation related activities consists of sports and games. Majority of the study participants 543(58.8%) were not involved in vigorous recreation related activity.

201 (21.8%) of the study participants belonged to low level of physical activity category according to the MET scores. Gender based analysis showed that 46.6% (228) of the boys had high levels of physical activity compared to 9% (39) in girls.

The ELIZ health pathway for adolescents was used to categorize the adolescents based on anthropometry. 692 (74.9%) of the study participants had BMI of 15 to 22 and are normal, whereas 103 (11.1%) were overweight and 52 (5.6%) were obese. Gender based analysis of

BMI showed that majority of boys 370 (75.7%) and 322 (74%) of the girls were normal, 53(10.8%) boys and 50 (11.5%) girls were overweight and 22 (4.5%) boys and 30 (6.9%) girls were obese.

Bivariable analysis was done to find the factors associated with inadequate physical activity(Table 9). The outcome variable was the physical activity done by the adolescents, whether inadequate or adequate. Female gender, occupation of mother and studying in government aided schools were found to be significantly associated with inadequate physical activity.

Binary logistic regression was performed to analyse the factors predicting inadequate physical activity(Table 10). Female gender and government aided school type were found to have adjusted OR significant and emerged as positive predictors of inadequate physical activity.

Table 1: Prevalence of inadequate physical activity among adolescents(n=924).

Physical activity	Boys		Girls		Total	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Inadequate	114	23.3	278	63.9	392	42.4
Adequate	375	76.7	157	36.1	532	57.6
Total	489	100	435	100	924	100

Table 2: Participation in various domains of physical activity (n=924)

Activities		Boys n(%)	Girls n(%)	Total n(%)
Work related	Vigorous	72 (14.7)	68 (15.6)	140 (15.2)
	Moderate	159 (32.5)	140 (32.2)	299 (32.4)
Travel related		432 (88.3)	365 (83.9)	797 (86.3)
Recreation related	Vigorous	333 (68.1)	48 (11)	381 (41.2)
	Moderate	407 (83.2)	228 (52.4)	635 (68.7)

Table 3: Duration of physical activity among the study participants (n=924)

Duration	Frequency	Percentage
< 30 min	205	22.2
31- 60 min	187	20.2
61 -120 min	243	26.3
121-300 min	264	28.6
>300 min	25	2.7
Total	924	100

Table 4: Frequency of work related physical activity (n=924)

Work related activity	Category	Boys n(%)	Girls n(%)	Total n(%)
Vigorous activity	Not done	417 (85.3)	367 (84.4)	784 (84.8)
	On 3 days or less	30 (6.1)	34 (7.8)	64 (6.9)
	More than 3 days	42 (8.6)	34 (7.8)	76 (8.2)
	Total	489 (100)	435 (100)	924 (100)
Moderate	Not done	330 (67.5)	295 (67.8)	625 (67.6)
	On 4 days or less	74 (15.1)	45 (10.3)	119 (12.8)
	More than 4 days	85 (17.4)	95 (21.8)	180 (19.4)
	Total	489 (100)	435(100)	924 (100)

Table 5: Frequency of travel related physical activity (n=924)

Travel related physical activity	Boys n(%)	Girls n(%)	Total n(%)
Not done	57 (11.7)	70 (16.1)	127 (13.7)
On 5 days or less	184 (37.6)	181 (41.6)	365 (39.4)
6-7 days	248 (50.7)	184 (42.3)	432 (46.7)
Total	489 (100)	435 (100)	924 (100)

Table 6: Frequency of recreation related physical activity (n=924)

Recreation related physical activity	Category	Boys n(%)	Girls n(%)	Total n(%)
Vigorous	Not done	156 (31.9)	387 (89)	543 (58.8)
	On 5 days or less	200 (40.9)	37 (8.5)	237 (25.7)
	6- 7 days	133 (27.2)	11 (2.5)	144 (15.6)
	Total	489 (100)	435 (100)	924 (100)
Moderate	Not done	82 (16.8)	207 (47.6)	289 (31.3)
	On 5 days or less	241 (49.3)	138 (31.7)	379 (41)
	6 -7 days	166 (33.9)	90 (20.7)	256 (27.7)
	Total	489 (100)	435 (100)	924 (100)

Table 7: Levels of physical activity according to MET score.(n =924)

Levels of physical activity	Boys n(%)	Girls n(%)	Total n(%)
Low (<600 METs/ week)	49 (10)	152 (34.9)	201 (21.8)
Moderate (600-3000 METs/week)	212 (43.4)	244 (56.1)	456 (49.4)
High (> 3000 METs/week)	228 (46.6)	39 (9)	267 (28.9)
Total	489 (100)	435 (100)	924 (100)

Table 8 Categorization of study participants according to BMI (n=924)

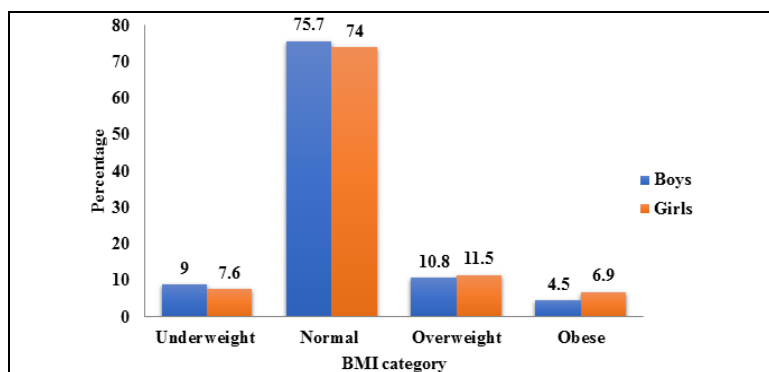| BMI	Category	Frequency	Percentage
< or=15	Underweight	77	8.3
15.01- 22.0	Normal	692	74.9
22.01-25.0	Overweight	103	11.1
>or =25.01	Obese	52	5.6
	Total	924	100

Figure 1: Categorization of adolescents across gender based on BMI (n=924)

Table 9: General characteristics associated with inadequate physical activity. (n=924)

Variable	Inadequate physical activity n=392 (%)	Adequate physical activity n=532 (%)	Chi square value	P value
Female gender	278 (70.9%)	157 (29.5%)	155.3	< 0.001
Occupation of mother	366 (93.4%)	474 (89.1%)	4.978	0.026
Government aided school	259 (66.1%)	317 (59.6%)	4.043	0.044

Test used was Pearson Chi square test, df=1, p value significant level < 0.05

Table 10: Predictors of inadequate physical activity, results of binary logistic regression(n=924)

Variable	p value	Adjusted OR	95% CI
Female gender	< 0.001	6.168	4.595-8.279
Government aided school	0.002	1.628	1.189-2.228

$R^2 = 0.244$

Discussion

Physical inactivity is a global health hazard and is a rapidly increasing problem in all communities. Energy expenditure through physical activity is an important part of the energy balance equation that determines body weight. A decrease in energy expenditure through decreased physical activity is likely to be one of the major factors contributing to the global epidemic of overweight and obesity. Physical inactivity, now recognized as an increasingly important determinant of health, is the result of a progressive shift of lifestyle towards more sedentary patterns in all countries, more so in the wake of the COVID-19 pandemic. Therefore, the current analysis explored association among sociodemographic factors and inadequate physical activity among adolescents in rural area.

Globally the prevalence of inadequate physical activity in 11 -17 year old adolescents was 81%, with prevalence in South East Asian Region being 74%.[11] Studies from various parts of India showed prevalence of inadequate physical activity to be almost 50% in Udupi,[12] 60% in Tamil Nadu, 66.8% in Chandigarh [13]and 54.4% in New Delhi. [14] These are higher compared to the prevalence of physical inactivity obtained in this study.

The IDSP risk factor survey in Kerala among persons aged 15 to 64 years showed the prevalence of low physical activity to be 76%, which is also higher than the prevalence in this study.(15)

Study on the "Physical activity pattern among college students" in Kerala indicate that around 30 % of male and 36.5 % of female students were physically inactive with MET/week score below 600. Similar results have been obtained in this study also. Only 12 % (n=134) male and 14.83% females (n=273) were found belonging to HEPA (Health-enhancing physical activity) category with MET score above 1500/ week using the International physical activity questionnaire (IPAQ).[16]

Physical activity pattern assessed in other countries have shown that only 37% of the adolescents fulfilled the WHO criteria of 60 minutes of moderate to vigorous physical activity which is much less than the prevalence of adequate physical activity in this study. It was also found that boys were more physically active than girls to meet the recommendations (54.3%) at leisure time during active transportation and in total physical activity while girls reported significantly more school-based physical activity, home-based physical activity and light intensity physical activity.[17]

Female gender was found to have independent association with inadequate physical activity with Adjusted OR of 6.168 (95% CI 4.595- 8.279) Higher levels of inadequate physical activity among girls has been reported in previous studies the world over[18,19,14]; the reason being girls are confined indoors especially in the adolescent age group and do more of household chores and involve in lesser games and sports compared to boys. Studying in government aided schools was found to be an independent predictor of inadequate physical activity with Adjusted OR of 1.628 (95% CI 1.189-2.228) This reflects the influence of socio economic status on the pattern of physical activity, due to better facilities of transport and increased academic pressure from the school which discourages physical activity in children.

The prevalence of overweight and obesity in the present study was 11.1% and 5.6% according to EHPA based on BMI. Other studies have reported similar findings among adolescents.(20)Prevalence of overweight and obesity using the EHPA in a study in Meerut was found to be 19.7% and 5.3% in girls and 18.36% and 10.82% in boys. Obesity was found to be significantly associated with high intake of junk foods, binge eating, high calorie intake, lower physical activity , and prolonged TV watching.[21]

Although the adolescents are informed about the risk behaviours through science sessions on health and diseases, a behaviour change communication on life style modifications has to be considered to apply the knowledge into practice and protect the adolescents from reinforcing the behavioural risk factors into adulthood and to ensure a productive workforce in future.

A limitation of the present study is that the findings and their interpretations are restricted to adolescents attending educational institutions and hence may not be representative of the community. The pattern, intensity and frequency of physical activity were self-reports may likely have reporting bias. Qualitative research methods like focused group discussions can be utilized in further studies to have in-depth analysis of the reasons for inadequate physical activity among adolescents.

Conclusion

The findings in the study suggest that inadequate physical activity is an important risk behaviour among adolescents. The use of technological advances in education and modernised methods of transport and communication are forcing the youth to be more indoors. Schools play a major role in addressing this problem by promoting healthy behaviours like physical education and lifestyle changes from a very early age so that it becomes a way of their life in course of time.

Source of support

Nil

Conflict of interest

None declared.

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