Level of insufficient physical activity among adults in a rural area of South India: A population-based cross-sectional study

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**Abstract**

**Introduction:** Insufficient physical activity is the fourth leading cause of death globally. Increased physical activity improves the physical and psychological well-being and decreases the incidence of type 2 diabetes mellitus, cardiovascular diseases, stroke, and cancer.

**Methods:** This is a cross-sectional study conducted among 267 adults from a rural area of Kancheepuram District in Tamil Nadu, South India. Cluster sampling method was used. Clusters were selected randomly. Within each clusters, the simple random sampling method was used to select the individual participants. Data were collected using the World Health Organization’s standard Global Physical Activity Questionnaire.

**Results:** Overall prevalence of insufficient physical activity among adults in a rural area of South India was 22.5% (17.88–27.85) \(n = 60\), and the prevalence of sufficient physical activity was 77.5 (72.2–82.08) \(n = 207\).

Among overall physical activity, major contribution was from work (75%) followed by transport time activity (18%) and the least by leisure-time physical activity, which was only 7%. With increase in age, level of adequate physical activity was decreasing (adjusted odds ratio (0.95 [0.92–0.98], \(P < 0.001\)). Insufficient physical activity was not associated with any other studied factors (gender, employment, education, occupation, and marital status).

**Conclusion:** In a rural area of South India, the physical activity was contributed majorly by work domain and least by other domains. Leisure-time physical activity in rural community was poor and to be encouraged in future by community interventions.

**Keywords:** Global Physical Activity Questionnaire, insufficient physical activity, physical activity, physical inactivity

INTRODUCTION

Insufficient physical activity is the fourth leading cause of mortality worldwide.\(^1\) Globally, it has been estimated that insufficient physical activity causes 7% of type 2 diabetes, 6% of coronary heart disease, and 10% of colon cancer and breast cancer each.\(^2\) This is also responsible for 9% premature mortality worldwide in 2008.\(^3\) Insufficient...
Physical activity is the key risk factor for diabetes, cardiovascular diseases, cancer, and stroke. In addition to this, physical activity has a positive effect on mental health and delays the dementia and maintains the healthy weight of the individual. In 2013, during the World Health Assembly, the World Health Organization (WHO) member states agreed to reduce insufficient physical activity by 10% by 2025. Refocusing and renewing efforts at promoting physical activity are stressed in the Sustainable Development Goal by 2030. Unfortunately, there is a worldwide variation in the level of physical activity. In Lancet physical activity trends by Sallis noted that consistent data on physical activity are scarce at globally and regionally. All these created a need to report the level of physical activity in every geographical region to promote and prevent the noncommunicable diseases (NCDs) at various levels. Our present study was conducted with an aim to evaluate the level of physical activity among adult rural population in South India. We have also published a similar study on urban population of Pondicherry Union Territory in 2017.

METHODS

Study setting
This study was conducted in the surrounding villages of Rural Health Training Centre (RHTC) belonging to Pondicherry Institute of Medical Sciences, Puducherry, India. Our RHTC is situated in Chunampet, Kancheepuram District of Tamil Nadu, 30 km away from Pondicherry Institute of Medical Sciences. This center covers about twenty villages with a population of approximately 15,000 which is called as “service area of RHTC.” All the individuals belonging to this service area were enrolled in the routine annual survey conducted by the team from RHTC, and an electronic database was maintained in this center using EpiData Version 3.1. This database is called as Community Health Information Management System (CHIMS).

Sampling technique
Adults between the age group of 18–70 years were included. Multistage sampling method was used where villages were selected using cluster sampling technique. Each village was treated as a single cluster, and five clusters (villages) were selected randomly in the first step. Required samples were selected randomly from these five clusters (villages) from the line list of CHIMS. When a participant was not available during the first visit, two more visits were done. Thereafter, if the participant is still not available or exclude in the study, then the random selection was repeated for that participant. Pregnant, acutely ill, and physically challenged individuals were excluded from the study. The data were collected by medical social workers and interns. Data were collected using standard WHO steps survey Global Physical Activity Questionnaire (GPAQ). Details about the physical activities were collected after showing the pictorial show card published by the WHO. Two days of training were given to the data collectors, and quality monitoring was looked after by a faculty from the department of community medicine with a qualification of MD in community medicine. Ten percent of the data was checked by the faculty and statistician for quality assurance.

The sample size was calculated as 287, using OpenEpi V3.01 software (Atlanta USA), with \( P = 50\% \) (the prevalence of insufficient physical activity) was assumed from a previous Indian Council of Medical Research INDIA DIABetes (ICMR INDIAB) study, with a relative precision of 20%, design effect of 2 (for cluster sampling), confidence limit of 95% and attrition of 20%. In our study, 267 participants were included, and 20 participants refused to take part in the study. The study was conducted between November 15, 2016, and December 30, 2016. Ethical committee approval was obtained from the Ethical Committee of Pondicherry Institute of Medical Sciences, Puducherry (IEC ref No: RC138/16). Informed consent was obtained from the study participants after providing participant information sheet. Ethical principles were followed as per Helsinki Declaration and UNESCO Bioethics principles.

Operational definitions were described in detail elsewhere in a similar publication by the same authors in an urban setting of Puducherry, India. Total number of minutes spent by a person on moderate and vigorous physical activity in a typical week were captured under three domains (during work, transport, and leisure activities), respectively, using the WHO GPAQ questionnaire. Activities such as paid or unpaid work, study/training, household chores, harvesting food/crops, fishing or hunting for food, seeking employment were classified under work physical activities, mode of travel around getting from place to place by walk or by bicycle were classified under transport physical activities, sports, and exercises were classified under leisure-time physical activities. To classify the type of work and intensity of work, the WHO show card was used during data collection. The intensity of physical activities was expressed in metabolic equivalents (METs). Four METs were assigned for moderate-intensity physical activity per minute and eight METs for vigorous-intensity physical activity per minute. This is based on the finding that an individual’s caloric consumption is four times higher when doing moderate activity, and eight times...
higher when doing vigorously active, when compared to a person sitting quietly or taking rest. As per the WHO recommendation to consider a person as physically active, an adult should perform at least 75 min (600 METs) of vigorous or 150 min (600 METs) of moderate physical activity or an equivalent combination of moderate and vigorous physical activity achieving at least 600 METs in a week, provided the individual should perform physical activity minimum of 5 days in a week. If an individual either not performing physical activity at least 5 days in a week or if the individual not meeting the total of 600 METs, then he/she will be classified as physically inactive or insufficient physical activity. The detailed definitions and analysis plan have been described in WHO – GPAQ analysis guide.\[11\] Data analysis was done using SPSS version 22 (IBM Corp., Armonk, NY, USA). Associations were identified using Chi-square and adjusted odds ratio was calculated using binary logistic regression.

RESULTS

A total of 267 participants were included in our study. The overall prevalence of insufficient physical activity among the rural adult population was 22.5% (17.88–27.85) \(n = 60\), and the prevalence of adequate physical activity was 77.5 (72.2–82.08) \(n = 207\). In total activity, the major contribution was from work (75%) followed by transport time activity (18%) and the least by leisure-time physical activity which is only 7%. The association of insufficient physical activity with other factors shown in Table 1, METs score was shown in Table 2, and the strength of associations with different variables was shown in Table 3.

| Variables                  | Total \(n\) | Physically active, \(n\) (%) | Physically inactive, \(n\) (%) | \(P^*\) |
|---------------------------|------------|-----------------------------|-------------------------------|--------|
| Age (years)               |            |                             |                               |        |
| 18-25                     | 35         | 22 (63)                     | 13 (37)                       | <0.01  |
| 26-35                     | 72         | 61 (85)                     | 11 (15)                       |        |
| 36-45                     | 69         | 62 (90)                     | 7 (10)                        |        |
| 46-55                     | 45         | 40 (89)                     | 5 (11)                        |        |
| 56-65                     | 31         | 17 (55)                     | 14 (45)                       |        |
| >65                       | 15         | 5 (33)                      | 10 (67)                       |        |
| Sex                       |            |                             |                               |        |
| Male                      | 98         | 77 (79)                     | 21 (21)                       | 0.8    |
| Female                    | 169        | 130 (77)                    | 39 (23)                       |        |
| Marital status            |            |                             |                               |        |
| Single                    | 26         | 17 (65)                     | 9 (35)                        | <0.05  |
| Married                   | 214        | 176 (82)                    | 38 (18)                       |        |
| Widowed                   | 27         | 14 (52)                     | 13 (48)                       |        |
| Education                 |            |                             |                               |        |
| Graduate and above        | 24         | 17 (71)                     | 7 (29)                        | 0.84   |
| Secondary school          | 69         | 53 (77)                     | 16 (23)                       |        |
| High school               | 27         | 22 (82)                     | 5 (18)                        |        |
| Primary school            | 15         | 13 (87)                     | 2 (13)                        |        |
| Illiterate                | 132        | 102 (77)                    | 30 (33)                       |        |
| Employment                |            |                             |                               |        |
| Unemployed                | 45         | 18 (40)                     | 27 (60)                       | <0.01  |
| Unskilled                 | 12         | 10 (83)                     | 2 (17)                        |        |
| Semiskilled               | 17         | 10 (59)                     | 7 (41)                        |        |
| Skilled                   | 12         | 10 (83)                     | 2 (17)                        |        |
| Clerical or farmer        | 173        | 153 (88)                    | 20 (12)                       |        |
| Semi-professional and professional | 8     | 6 (75)                      | 2 (25)                        |        |
| Per capita income in rupees/month |     |                             |                               |        |
| <3000                     | 153        | 125 (82)                    | 28 (18)                       | 0.06   |
| 3000-10,000               | 110        | 107 (97)                    | 13 (12)                       |        |
| 10,001-20,000             | 4          | 4 (100)                     | 0 (0)                         |        |

\*P value is calculated using Chi-square test, significant results (<0.05) are shown in bold

DISCUSSION

Chunampet is a remote rural area situated between Puducherry Union Territory and Chennai. Important finding in our study was nearly one-fourth of the rural population (22.5% [17.88–27.85]) were physically inactive even though they have better opportunities to be physically active when compared to the urban population. This level is almost similar to the global prevalence of 27.5%.[16] However, our finding is much lower when comparing to the ICMR-INDBIAB Study, where the insufficient physical activity in the rural population in Tamil Nadu was 55%, and overall India was 50%.[13]

Another finding in our study was a poor contribution from leisure-time physical activity. This could be due to people's...
poor awareness about the importance of the physical activity. There is a lot of scope for encouraging the rural population on leisure-time physical activity. Insufficient physical activity among men and women was 21.4% (15–31) and 23% (17–30), respectively. There was no significant gender difference in insufficient physical activity. This could be due to the fact that village women are equally active in the field works like men. According to a large sample sized study from North India, there was no difference in physical activity between rural and urban area, but the rural women were more active than urban women. [17]

This study has the following limitations. This study did not have explored the other associated risk factors to insufficient physical activity in detail. This study setting was also confined to a limited geographical area. This study has the following strengths. This study was conducted in a remote rural area of South India. We have used a robust sampling method to enroll the participants (cluster sampling in general and random sampling within the clusters). In this study, we have used standard WHO questionnaire for data collection.

A similar study was also conducted in 2013, in an urban area of Puducherry which is closely situated to this rural study site and a comparison as follows: [8] based on that study findings and comparing with our study, rural population has better physical activity level (about three fourth of the adult population are physically active) than the urban population (only about a half are physically active). Age is associated with insufficient physical activity in both the studies. In both the studies the insufficient physical activity was equal among men and women. In our study, we did not find any relationship with insufficient physical activity and occupation or education like other studies. [8,13] Both studies have found that most of the physical activity happened during the work hours. Both the studies have shown poor physical activity during the transport time and very poor during leisure time. Studies have shown that poor leisure-time physical activity associated with depression. [18] Physical activity improves self-esteem, and those who are physically active are less likely to suffer from mental health problems and have enhanced cognitive functioning. [19] Poor awareness about the physical activity was common in both urban area and rural area and needs to be studied in detail regarding the reasons and the ways to improve leisure time activities in future.

On August 29, 2019, India has launched “Fit India Movement” with an aim “to encourage the people to include physical activity and sports in their daily lives.” National Programme for Prevention and Control of Cancer Diabetes Cardiovascular Diseases and Stroke advocated promotion of physical activity, healthy diet, “stop alcohol” and “stop smoking” through subcenters at the rural level to prevent the NCDs. [20] The promotion of physical activity should start from school going period itself with the help of education departments. [21] Important barriers identified in the recent times are poor infrastructure at the school levels to promote physical activity. [21,22]

Our study adds strength to the existing data on the physical activity levels in rural India, which is sparse and variable from place to place. It is recommended to conduct community-based interventional studies in rural area to promote physical activity, especially on the leisure time activity domain, in near future.

**CONCLUSION**

In a rural area of South India, the physical activity was contributed majorly by work domain and least by other domains. Leisure-time physical activity in rural community
was poor and to be encouraged in future by community interventions.

Financial support and sponsorship
Nil.

Conflicts of interest
There are no conflicts of interest.

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