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**Original Research Article**

# A cross-sectional study on the level of physical activity and perceived barriers to adherence of physical activity among individuals with type 2 diabetes mellitus aged 30-60 years in Chennai

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## ABSTRACT

**Background:** The prevalence of type 2 diabetes mellitus (T2DM) is increasing rapidly in India, driven by sedentary lifestyles and environmental constraints that limit physical activity. Regular physical activity is essential for glycemic control and the prevention of complications. This study assessed the level of physical activity and perceived barriers among individuals with T2DM aged 30-60 years who were residing in urban field practice area of Madras Medical College in Chennai.
**Methods:** A cross-sectional study was conducted among 155 individuals aged 30-60 years with T2DM who were residing in urban field practice area of the Madras Medical College in Chennai. Participants were selected using consecutive sampling methods. After obtaining informed consent, data were collected using a semi-structured, pre-validated questionnaire based on the WHO 's global physical activity questionnaire (GPAQ). Physical activity was quantified in MET-minute/week. Data analysis was performed using Epi Info, with Chi-square tests for associations ($p<0.05$).
**Results:** Among the 155 participants, 38.7%, 30.3%, and 31.0% had low, moderate, and high physical activity levels, respectively. Older age (>50 years), female sex, lower education, and unemployment were significantly associated with low activity, whereas employment and primary education were related to higher activity ($p<0.05$). The key barriers included physical discomfort (85.8%), unfavorable climate (82.6%), stray animals (78.1%), belief that exercise is unnecessary (73.5%), and lack of motivation (65.2%).
**Conclusions:** A substantial proportion of urban T2DM patients exhibit low physical activity influenced by sociodemographic factors and barriers. Future studies should examine the causal links, barriers, and effectiveness of interventions for physical activity, especially in high-risk groups.

**Keywords:** Barriers, Chennai, Metabolic equivalent of task, Physical activity, Type 2 diabetes mellitus

## INTRODUCTION

According to recent estimates, approximately 829 million adults worldwide were living with diabetes in 2025, with projections indicating a steep rise by 2050, largely driven by population ageing, urbanization, and lifestyle transitions in low- and middle-income countries.[1,2] The global prevalence of diabetes mellitus is 11.1%.[3] Diabetes is responsible for millions of deaths annually and significantly increases the risk of cardiovascular disease, renal failure, blindness, and premature disability, making effective long-term management a global priority.[1]

India is the epicenter of the diabetes epidemic, accounting for up to 107 million (1 in 7 of all adults living with diabetes worldwide). The number of adults living with diabetes is predicted to increase by 73% to 185 million by 2050.[2] Southern states, particularly Tamil Nadu, exhibit some of the highest diabetes prevalence rates in the country, highlighting the critical need for tailored preventive and management interventions.

Evidence shows that individuals with T2DM who engage in regular moderate-intensity physical activity experience better glycemic control, lower HbA1c levels, and a reduced risk of both microvascular and macrovascular complications, including cardiovascular mortality.[4] Therefore, the WHO guidelines recommend at least 150 minutes of moderate-intensity physical activity per week as a cornerstone of diabetes management.[5]

Regular physical activity improves insulin sensitivity, enhances glucose uptake by skeletal muscles, reduces adiposity, and favorably influences blood pressure and lipid profiles.[6] Studies from India have revealed a high prevalence of physical inactivity among the diabetic population, with a considerable proportion failing to meet the minimum activity thresholds.

Despite these well-established benefits, adherence to the recommended physical activity levels among individuals with T2DM remains suboptimal. Understanding the level of physical activity and perceived barriers to adherence is essential for designing effective intervention strategies that will improve the outcome of diabetes. While several studies have examined physical inactivity among diabetic populations, there remains a relative paucity of data focusing simultaneously on activity levels and perceived barriers in urban tertiary care settings, such as Chennai.

In this context, the present study aimed to assess the level of physical activity and identify the perceived barriers to adherence among individuals aged 30-60 years with type 2 diabetes mellitus in Chennai.

## METHODS

### *Study design and setting*

A community-based cross-sectional study was conducted in the urban field practice area attached to a tertiary care teaching hospital, Chennai, Tamil Nadu, for a period of 2 months from November 2025 to December 2025.

### *Study population*

The study population comprised known cases of type 2 Diabetes Mellitus aged 30-60 years residing in the area. Among them, known cases of type 2 diabetes mellitus on treatment for at least one month, with age between 30-60 years who provided informed consent were included as study participants. Participants who could not respond or did not consent were excluded from the study.

### *Sample size*

The sample size was calculated based on the previously reported prevalence of 36.9% physical inactivity among adults with type 2 diabetes mellitus.[7] Using formula for cross-sectional studies with 95% CI and 8% margin of error, the sample size was calculated:

$n=Z_{\alpha}^{2}pq/d^{2}$,

p=63.1%, q =36.9 %, absolute precision (8%) d=8%

The approximate sample size calculated was 140, with a non-response rate of 10%; thus, the final sample size was 155.

### *Sampling technique*

A house-to-house survey was conducted in Pulianthope to identify individuals with diabetes in the area. The participants were selected according to the inclusion criteria using the consecutive sampling method until the desired sample size was obtained.

### *Study tool*

Data were collected using a validated semi-structured questionnaire for socio-demographic details, including comorbidities and treatment details. The level of physical activity was assessed using the WHO global physical activity questionnaire (GPAQ).[8,9] The assessment is done in three components: work-related activity, mode of transportation, and recreational activity, and each component will be assessed for the presence of moderate or vigorous intensity activity. It also includes the amount of time spent sitting or reclined. Barriers to adherence to physical activity were assessed using a semi-structured questionnaire based on EBAS questionnaire [environmental barriers to adherence scale (EBAS)].[10]

### *Data collection and analysis*

Data were collected from November 2025 to December 2025. Participants were given an information sheet, and after obtaining informed consent, data were collected using face-to-face interviews in their house ensuring privacy. Responses were recorded using Google forms and extracted into a spreadsheet.

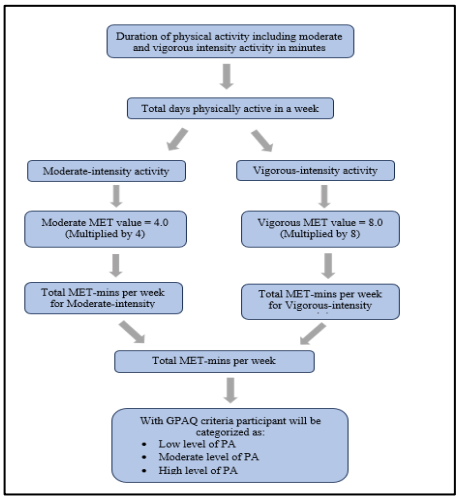


**Figure 1: Calculation of METS and categorization of physical activity.**

After data cleaning, analysis was performed using Epi Info software. The calculation of METS and categorization of physical activity are shown in Figure 1.[9] Descriptive statistics were expressed as frequencies and percentages. Continuous variables will be described as mean with standard deviation, and categorical variables as frequency with percentage. Chi-square test was used to assess associations and $p<0.05$ was considered statistically significant.

### *Ethical considerations*

Ethical approval was obtained from the institutional ethics committee (29112025). A participant information sheet was given, study procedure and purpose were explained, and written informed consent was obtained from all participants.

## RESULTS

Among the 155 study participants, the mean age of the study participants was 50.5±7.8. Females (74.2%) constituted a larger proportion of the sample. Regarding educational status, 36.8% were illiterate. Only a small proportion had a higher level of education (2.5%). In terms of occupation, majority (31%) were self-employed and homemakers (31%). Most participants belonged to the upper-middle socioeconomic class (43.2%). Regarding marital status, 67.1% were married. The majority of participants (89.7%) had diabetes for more than one year. Regarding the treatment status of the participants, 96.1% were on regular treatment. Nearly all the participants (98.1%) received oral hypoglycemic agents. Among the study participants, 42% had one or more comorbidities, with hypertension being the most prevalent, affecting 36.1% of the participants (Table 1).

**Table 1: Socio-demographic characteristics (n=155).**

| Characteristics (n=155) | | N | % |
|---|---|---|---|
| **Age (years)** | ≤50 | 87 | 56.13 |
| | >50 | 68 | 43.87 |
| **Gender** | Male | 40 | 25.81 |
| | Female | 115 | 74.19 |
| **Educational Status** | Illiterate | 57 | 36.8 |
| | Primary school | 20 | 12.9 |
| | Middle school | 37 | 23.9 |
| | High school | 37 | 23.9 |
| | Diploma | 3 | 1.9 |
| | Graduate and above | 1 | 0.6 |
| **Occupation** | Government employee | 1 | 0.6 |
| | Non-government employee | 16 | 10.3 |
| | Self employed | 48 | 31 |
| | Homemaker | 48 | 31 |
| | Retired | 4 | 2.6 |
| | Unemployed (able to work) | 26 | 16.8 |
| | Unemployed (unable to work) | 12 | 7.7 |
| **Socioeconomic status (BG Prasad scale 2026)** | Upper (I) | 13 | 8.4 |
| | Upper middle (II) | 67 | 43.2 |
| | Middle (III) | 52 | 33.5 |
| | Lower middle (IV) | 17 | 11 |
| | Lower (V) | 6 | 3.9 |
| **Marital status** | Married | 104 | 67.1 |
| | Others | 51 | 32.9 |
| **Duration of diabetes (years)** | ≤1 | 16 | 10.3 |
| | >1 | 139 | 89.7 |
| **Regular treatment** | yes | 149 | 96.1 |
| | no | 6 | 3.9 |
| **Mode of treatment** | Oral hypoglycemic agents | 152 | 98.1 |
| | Insulin | 2 | 1.3 |
| | others | 1 | 0.6 |
| **Co-morbidities** | Hypertension | 56 | 36.1 |
| | Dyslipidaemia | 24 | 15.5 |
| | Coronary artery disease | 5 | 3.1 |
| | No known comorbidities | 90 | 58 |

Among the 155 study participants, 38.7%, 30.3%, and 31% reported low, moderate, and high levels of physical activity, respectively. These findings indicate that more than one-third of individuals with type 2 diabetes had insufficient physical activity (Table 2).

**Table 2: Distribution of level of physical activity (n=155).**

| Level of physical activity (n=155) | N | % |
|---|---|---|
| **Low physical activity (<600 METs)** | 60 | 38.7 |
| **Moderate physical activity (600-2999 METs)** | 47 | 30.3 |
| **High physical activity (>3000 METs)** | 48 | 31 |

The most commonly reported barriers were physical discomfort or pain (85.8%), unfavorable climate conditions (82.6%), and presence of stray animals (78.1%). Fear of hypoglycemia (21.9%) and lack of encouragement from healthcare providers (24.5%) were the least reported barriers. 73.5% of participants believed that exercise was not necessary, indicating a substantial gap in awareness and health education about the importance of physical activity (Figure 2).

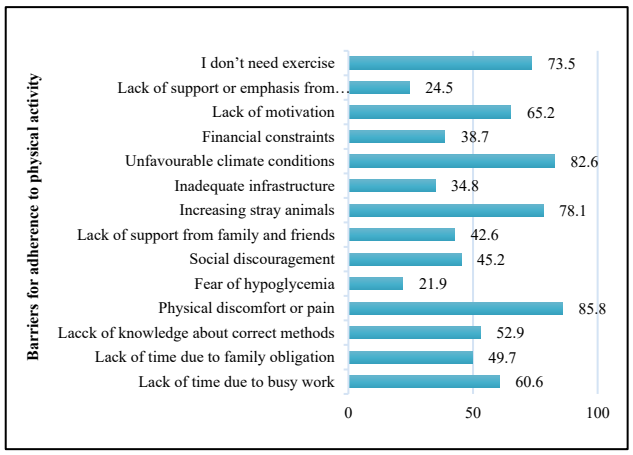


**Figure 2: Barriers to adherence of physical activity (n=155).**

**Table 3: Association of level of physical activity (PA)* with socio-demographic determinants (n=155).**

| Characteristics (n=155) | | High and moderate PA* | | Low PA* | | Odds Ratio | 95% CI | P value |
|---|---|---|---|---|---|---|---|---|
| | | n | % | n | % | | | |
| **Age** | ≤50 years (n=87) | 36 | 41.4 | 51 | 58.6 | 0.1 | 0.04-0.24 | <0.001* |
| | >50 years (n=68) | 59 | 86.8 | 9 | 13.2 | | | |
| **Gender** | Male (n=40) | 33 | 82.5 | 7 | 17.5 | 4.03 | 1.64-9.85 | 0.001* |
| | Female (n=115) | 62 | 53.9 | 53 | 48.09 | | | |
| **Education** | ≤primary (n=77) | 35 | 45.45 | 42 | 54.55 | 4.0 | 2.00- 7.98 | <0.001* |
| | >primary (n=78) | 60 | 76.92 | 18 | 23.08 | | | |
| **Occupation** | Employed (n=65) | 59 | 90.77 | 6 | 9.23 | 14.75 | 5.76-37.75 | <0.001* |
| | Unemployed (n=90) | 36 | 40 | 54 | 60 | | | |
| **Marital status** | Married (n=104) | 76 | 73.08 | 28 | 26.92 | 4.57 | 2.22- 9.33 | <0.001* |
| | Others (n=51) | 19 | 37.25 | 32 | 62.75 | | | |
| **Duration of diabetes** | ≤1 year (n=16) | 8 | 50 | 8 | 50 | 0.59 | 0.21- 1.68 | 0.327 |
| | >1 year (n=139) | 87 | 62.59 | 52 | 37.14 | | | |
| **Co-morbidities** | Yes (n=65) | 41 | 63.1 | 24 | 36.9 | 1.13 | 0.59-2.19 | 0.82 |
| | No (n=90) | 54 | 60 | 36 | 40 | | | |
| **Socioeconomic status** | ≤Middle (n=75) | 45 | 60 | 30 | 40 | 0.9 | 0.47-1.71 | 0.749 |
| | >Middle (n=80) | 50 | 62.5 | 30 | 37.5 | | | |

*PA- Physical activity

Males had four times higher odds of engaging in moderate to high levels of physical activity compared to females (OR=4.03, 95% CI=1.64-9.85, p<0.001). Participants with education beyond the primary level had fourfold higher odds of engaging in moderate-to-high levels of physical activity compared to those with primary or lower education (OR=4, 95% CI=2.00-7.98, p<0.001). Employed individuals had 14 times higher odds of engaging in moderate to high level of physical activity compared to those who were unemployed (OR=14.75, 95% CI=5.76-37.75, p<0.001). Married individuals had four times higher odds of engaging in moderate-to-high levels of physical activity compared to unmarried individuals (OR=4.57, 95% CI=2.22-9.33, p<0.001). Older individuals, females, unemployed individuals, and those with lower education were more likely to have low physical activity (Table 3).

## DISCUSSION

The present study assessed the level of physical activity and perceived barriers to adherence to physical activity among individuals with type 2 diabetes mellitus (T2DM) in an urban area of Chennai. The findings revealed that

38.7% of participants had low level of physical activity, indicating a considerable gap in adherence to recommended physical activity guidelines. This observation is consistent with recent evidence from a study by Shah et al conducted in Chennai, which showed that 39.7% of the participants had low levels of physical activity.[7] A study conducted by Carolina et al in Argentina, stated that around 30.5% of the participants had moderate level of physical activity, which aligns with the results of this study (30.3%).[11]

In contrast, a study conducted by Devamani et al in Vellore reported that a majority of participants (63.3%) had inadequate levels of physical activity, which differs from the findings of the present study, in which a lower proportion (39.7%) exhibited inadequate physical activity.[12]

A study conducted by Samraj et al in South India reported that a substantial proportion (52.9%) of individuals with T2DM did not meet the recommended physical activity levels, with women (35.4%) demonstrating significantly lower activity compared to men (53.9%).[13] Similar gender differences were observed in the present study (male 82.5% and female 53.9%), which may be attributed to sociocultural norms, household responsibilities, and limited opportunities for leisure-time exercise among women.

The present study demonstrated a significant association between lower educational status and reduced physical activity levels. This finding aligns with recent research by Paulin et al, who reported that limited health literacy and inadequate awareness of lifestyle modification contribute to poor adherence to physical activity (32.6%) among individuals with diabetes mellitus.[14]

Additionally, unemployment and sedentary occupations were associated with lower activity levels (60.0%) in this study, which is consistent with the observations of a prospective study by Behera et al in Andhra Pradesh, which documented reduced physical activity among individuals engaged in less physically demanding occupations (77.3%).[15] Married individuals were also associated with high and moderate levels of physical activity (88.8%), which aligns with the findings of our study (73.08%).

In the present study, a significant association was observed between marital status and the level of physical activity. A higher proportion of married participants (73.08%) had adequate physical activity compared to unmarried participants (37.25%). However, this finding contrasts with the results reported by Sharma et al, who found that unmarried participants demonstrated higher levels of physical activity (51.0%) than married participants (46.7%).[16]

Regarding perceived barriers, physical discomfort or pain emerged as the most commonly reported barrier (85.8%). Comparable findings were reported in a study by Pati et al, which identified tiredness/discomfort, weakness, and illness, including joint pain and pregnancy, as major barriers (66.4%) to regular exercise among individuals at risk of or living with type 2 diabetes.[17] Unfavorable climate conditions were the second most common barrier (82.6%) identified in our study, which is in contrast with the above-mentioned study, where unfavorable climate conditions act as a barrier for only 15% of the study participants.

Another key barrier identified in the present study was lack of time, attributed to busy work schedules (60.6%) and family responsibilities (49.7%). This finding is consistent with the study by Paulin et al, who reported that lack of time was a significant barrier for 64.6% of participants.[14] Additionally, a significant proportion of participants in the present study (73.5%) perceived that they did not require any exercise. Similar observations were reported by Sari et al in an Australian study, where 74% of participants believed that exercise was unnecessary.[18]

Overall, the findings of this study align with the existing literature, demonstrating that physical inactivity among individuals with T2DM is driven by the complex interplay of demographic factors, health conditions, environmental challenges, and behavioral influences. These observations highlight the importance of implementing comprehensive strategies, including community-based interventions, patient-centered counselling, and improved urban infrastructure, to enhance physical activity levels and achieve better diabetes outcomes.

This cross-sectional study assessed physical activity and perceived barriers at a single point in time; therefore, causal relationships cannot be established. The study was conducted in an urban field practice area in Chennai, which may limit its generalizability to other populations. Physical activity levels were based on self-reported data, making the findings prone to recall and social desirability bias. Certain clinical parameters, such as glycemic control (HbA1c), severity of complications, and psychological determinants, such as depression or stress, were not assessed, which might provide complete information about adherence to physical activity.

## CONCLUSION

The present study highlights that one in three individuals with type 2 diabetes mellitus in urban Chennai have inadequate levels of physical activity (38.7%). Multiple barriers were identified, such as physical discomfort (85.8%), unfavorable climatic conditions (82.6%), presence of stray animals (78.1%), lack of motivation (65.2%), and the misconception that exercise is unnecessary (73.5%). This indicates that the cause is multifactorial, involving demographic, behavioral, and environmental factors.

***Recommendations***

Future exploration should focus on establishing causal links between physical activity and glycemic outcomes, combining quantitative analysis with qualitative exploration of behavioral and environmental barriers, especially among high-risk groups, and testing the effectiveness of community-based programs, counselling models, and environmental modifications in improving physical activity.

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