ANALYSIS OF THE INFLUENCE OF ANTHROPOMETRIC PARAMETERS IN EXERCISE AND NON-EXERCISE DIABETIC PATIENTS

Sourabh Sarjerao Jadhav[1], Dr.Pragati Patil[2*]

[1]Department of Neurosciences, Krishna College of Physiotherapy, Krishna Vishwa Vidyapeeth, Deemed to Be University, Karad, Email.id – sourabhjadhav4579@gmail.com, Orcid.id – 0009-0006-1661-624X

[2]Assistant Professor, Department of Neurosciences, Krishna College of Physiotherapy, Krishna Vishwa Vidyapeeth, Deemed to Be University, Karad, Email.id – drpragatisalunkhe94@gmail.com, Orcid.id – 0000-0001-7038-7229

***Corresponding Author**

Email: drpragatisalunkhe94@gmail.com

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ABSTRACT

Introduction: Diabetes mellitus has become a major global public health concern, with sedentary behaviour and unfavourable body composition contributing substantially to its development and complications. This study sought to examine the impact of habitual physical activity on important anthropometric indicators among diabetic patients in Karad. By analysing differences between exercise and non-exercise groups, the research aims to highlight the role of exercise in managing body fat distribution and related health risks in people with diabetes.

Methodology: This observational research involved individuals with diabetes aged 18–65 years and classified them into two groups based on exercise behaviour**.** Standardized measurement procedures were employed to record body size and composition parameters, including height, weight, BMI, circumferential measures, and blood glucose values. Simple random sampling was used, followed by statistical analysis to evaluate group differences and correlations.

Results: The study found that diabetic patients who exercised regularly had significantly lower body weight, BMI, waist and hip circumferences, and waist-to-hip ratios compared to non-exercisers, indicating reduced central obesity. Slightly higher arm and calf circumferences in the exercise group reflected better muscle mass. Correlation analysis showed weak to very weak links between anthropometric measures and blood glucose levels, but stronger associations were noted in non-exercisers, suggesting that lack of physical activity may worsen the impact of unhealthy fat distribution on glucose control.

Conclusion: The study demonstrates that regular exercise positively influences body composition among diabetic individuals, helping to control weight and abdominal fat while preserving muscle mass. The findings reinforce the need to promote consistent physical activity as a practical, cost-effective strategy to support better glycaemic control and overall health in people living with diabetes.

Keywords: Type 2 Diabetes Mellitus, Anthropometric Parameters, Physical Activity, Exercise vs Non-Exercise, Body Mass Index (BMI), Waist-to-Hip Ratio (WHR), Central Obesity, Glycaemic Control, Body Composition, Lifestyle Intervention

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INTRODUCTION

Diabetes mellitus is a chronic metabolic condition marked by progressive deterioration in glucose regulation and long-term systemic complications. It has emerged as one of the most common non-communicable diseases worldwide and contributes significantly to global morbidity and mortality. Recent estimates indicate that diabetes accounted for more than 6.7 million deaths globally in 2021. According to the International Diabetes Federation, approximately 537 million individuals were living with diabetes in 2021, and this number is expected to increase to nearly 643 million by 2030 in the absence of effective preventive measures. In addition, more than 541 million people are currently considered at high risk of developing diabetes. The global burden of diabetes, measured in Disability-Adjusted Life Years (DALYs), has more than doubled since 1990, with nearly three-quarters of affected individuals residing in low- and middle-income countries.[1,8]

Type 2 Diabetes Mellitus (T2DM) constitutes the majority of diabetes cases and is largely influenced by modifiable lifestyle factors. Inadequate physical activity, unhealthy dietary habits, excess body weight, and prolonged psychological stress are key contributors to its development. Among these factors,

physical inactivity and poor nutrition represent the most accessible targets for prevention and disease control. These behaviours not only increase the risk of T2DM but also contribute to associated comorbidities such as cardiovascular disease, hypertension, dyslipidaemia, and certain cancers. Although extensive research from Western populations has explored the relationship between physical activity and diabetes-related outcomes, limited evidence is available from developing countries like India, where lifestyle patterns are shaped by cultural, socioeconomic, and environmental factors.[2]

Anthropometric measurements play a vital role in assessing obesity and related metabolic risks. Commonly used indicators include body weight, height, Body Mass Index (BMI), waist circumference, hip circumference, and waist-to-hip ratio. These measures offer valuable insight into body fat distribution and are widely used due to their simplicity, low cost, and feasibility in both clinical and community settings. BMI remains the most frequently used index for categorizing weight status; however, it does not differentiate between fat mass and lean body mass, which may lead to misclassification in some individuals. Consequently, measures of central obesity—such as waist circumference and waist-to-hip ratio—are increasingly emphasized, as abdominal fat accumulation is strongly associated with insulin resistance and cardiovascular risk. Emerging research suggests that the waist-to-height ratio may serve as a more sensitive predictor of diabetes risk than BMI alone. Several population-based studies have demonstrated a strong association between increased abdominal adiposity and elevated blood glucose levels, thereby increasing the likelihood of T2DM.[4,5]

Physical inactivity is a major contributor to the global diabetes burden and is estimated to account for approximately 7% of diabetes-related disease burden and nearly 9% of premature mortality. Sedentary behaviour promotes weight gain, accumulation of central fat, reduced insulin sensitivity, and chronic low-grade inflammation, all of which adversely affect glycaemic control. In contrast, regular participation in physical exercise provides multiple benefits, including improved glucose uptake by skeletal muscles, reduction in adiposity, better blood pressure regulation, and enhanced weight management. Exercise also plays a protective role in preventing diabetes-related complications such as neuropathy, nephropathy, and retinopathy, while simultaneously improving cardiovascular fitness, mental well-being, and overall quality of life. [3]

Previous studies have demonstrated that consistent physical activity leads to significant reductions in BMI, waist circumference, waist-to-hip ratio, and total body fat percentage among individuals with diabetes. These improvements are often accompanied by better glycaemic control, lower HbA1c levels, and improved lipid and inflammatory profiles. Conversely, sedentary individuals with diabetes are more likely to experience weight gain and poor metabolic outcomes. Despite this evidence, limited research has directly compared anthropometric parameters between physically active and inactive diabetic individuals within the Indian population. Moreover, variations in these parameters across age, sex, and other demographic factors remain insufficiently explored. Addressing these gaps is essential for developing culturally relevant and population-specific intervention strategies.[11]

In 2019, elevated BMI was linked to nearly five million deaths from non-communicable diseases, including cardiovascular disorders, diabetes, cancer, neurological, respiratory, and gastrointestinal conditions. [6] in light of this substantial impact, the present study aims to examine differences in body composition between individuals with T2DM who engage in regular physical activity and those who lead sedentary lifestyles. Key anthropometric indices such as BMI, waist circumference, waist-to-hip ratio, and waist-to-height ratio will be assessed to determine the influence of regular exercise on body composition and overall health status.

The findings of this study are expected to support healthcare professionals in providing effective lifestyle counselling and promoting physical activity among individuals with diabetes. Additionally, the results may contribute to the development of cost-effective, community-based health programs, particularly in resource-constrained settings. The increasing economic burden of diabetes management, along with its negative impact on productivity and quality of life, underscores the need for preventive strategies. Encouraging regular physical activity has the potential to reduce healthcare costs and improve long-term health outcomes. Therefore, understanding the relationship between physical activity and anthropometric parameters in individuals with diabetes is critical for addressing this growing public health concern.[9]

Maintaining optimal body weight is a cornerstone of diabetes management, as central obesity significantly increases the risk of developing T2DM. Evidence suggests that individuals with diabetes are more likely to be overweight compared to the general population. Measures of abdominal obesity, such as waist circumference and waist-to-hip ratio, demonstrate a stronger association with diabetes risk than BMI alone. This is particularly relevant in the Indian population—often referred to as the “diabetes capital of the world”—where individuals tend to exhibit higher levels of abdominal fat despite relatively lower BMI values. This phenotype contributes to increased insulin resistance and heightened susceptibility to diabetes.[5] Accurate assessment of body fat distribution is therefore essential for effective risk evaluation.

Energy balance, defined by the relationship between energy intake and energy expenditure, is another crucial determinant of diabetes prevention and management. Total energy expenditure comprises basal energy expenditure (BEE), diet-induced

thermogenesis (DIT), and physical activity. BEE is influenced by factors such as age, sex, body size, and muscle mass, with age-related muscle loss leading to a decline in metabolic rate. DIT varies according to dietary composition, with protein producing the highest thermogenic effect. Understanding these components is important for designing effective weight management and diabetes care strategies.[7]

This study also seeks to explore the effects of different exercise modalities on body composition and functional outcomes in individuals with diabetes. The intervention incorporates both aerobic and resistance training, with supervised exercise sessions aimed at evaluating changes in anthropometric parameters and physical performance. The study further aims to identify the most effective exercise modality for reducing fat mass, enhancing lean muscle mass, and improving functional mobility. The findings are expected to aid in developing individualized exercise prescriptions and highlight the value of simple, low-cost anthropometric measures—such as BMI and waist circumference—for monitoring health improvements. Given the rapidly rising prevalence of diabetes in India, this research holds significant relevance for informing future clinical practice and public health initiatives.

MATERIALS AND METHODS

Prior to the initiation of the study, ethical approval was obtained from the Institutional Ethics and Protocol Review Committee. A cross-sectional observational study design was employed, using a survey-based approach to investigate the influence of regular physical activity on selected anthropometric parameters among individuals with diabetes mellitus residing in Karad.

A total of 175 participants were recruited for the study. The sample size was calculated using the standard formula $n = Z^2pq/L^2$. Adult male and female participants aged between 18 and 65 years were selected through simple random sampling. Individuals were considered eligible if they had a confirmed diagnosis of diabetes mellitus for at least one year and were attending regular outpatient follow-up visits. Participants with severe systemic conditions, marked physical limitations affecting mobility, or pregnancy were excluded to avoid confounding influences.

Participants were categorized into two groups based on their physical activity status. The exercise group included individuals who reported engaging in regular physical exercise, while the non-exercise group comprised individuals who did not participate in structured or routine physical activity. Prior to data collection, the purpose and procedures of the study were clearly explained to all participants, and written informed consent was obtained.

Anthropometric evaluation involved the measurement of body height, body weight, Body Mass Index (BMI), waist circumference (WC), hip circumference (HC), waist-to-hip ratio (WHR), arm circumference (AC), and calf circumference (CC). Height and circumferential measurements were recorded using a standard, non-elastic measuring tape, whereas body weight was measured using a calibrated Beat XP digital body analyzer. All measurements were taken following standardized protocols to ensure consistency and minimize measurement error.

Blood glucose levels were assessed using a portable glucometer to examine their association with anthropometric variables. In addition, participants completed a structured questionnaire that collected information on demographic details, physical activity patterns, and sedentary behaviour.

The collected data were systematically organized and analysed using appropriate statistical methods. Mean differences in anthropometric variables between physically active and inactive groups were evaluated using independent *t*-tests. Pearson's correlation coefficient was applied to assess the relationship between anthropometric measures and blood glucose levels. Statistical significance was determined using appropriate confidence intervals, with results interpreted accordingly.

RESULT:

The present study analysed data obtained from 175 individuals diagnosed with diabetes mellitus, who were categorized into two groups based on their physical activity status: those who reported engaging in regular exercise and those who did not participate in structured physical activity.

Demographic Characteristics

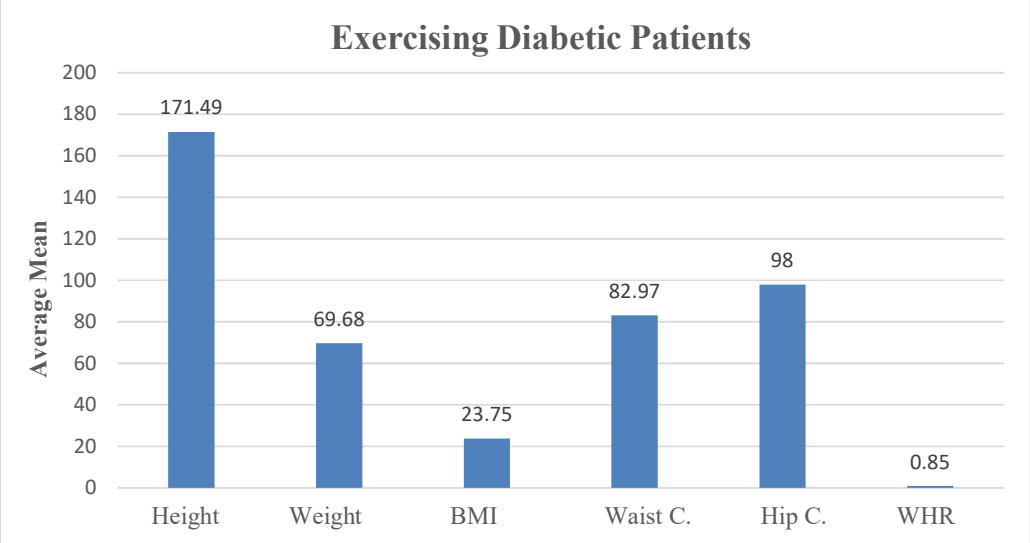
Analysis of age distribution revealed that the majority of participants belonged to the 46–60 years age group, accounting for 56.32% of the study population. Individuals aged between 31–45 years constituted 42.53%, while younger adults aged 18–30 years represented only 1.72% of the total sample. This distribution indicates that most participants were middle-aged to older adults, reflecting the higher prevalence of diabetes within these age groups.

Table No. 1: Comparison of Anthropometric Parameters Between Exercise and Non-Exercise Groups

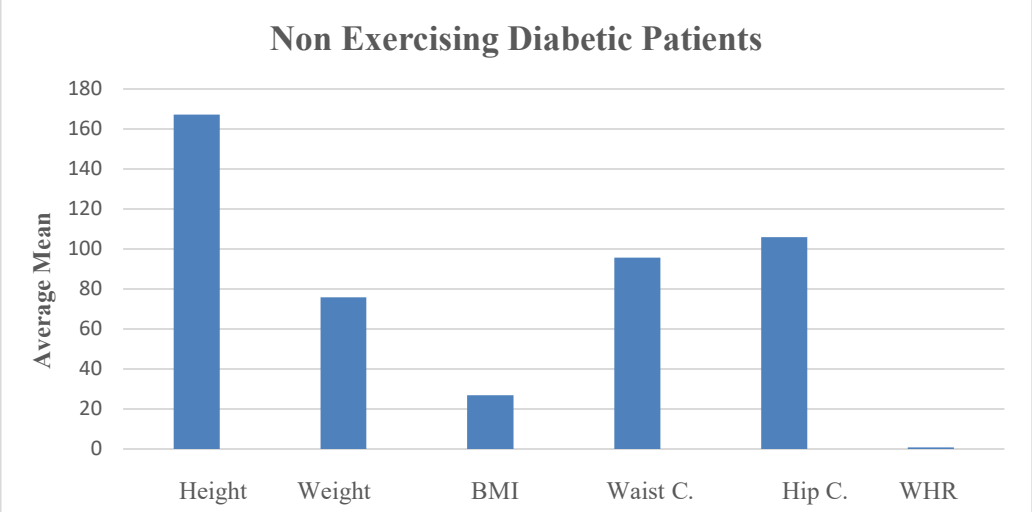
Parameter	Exercise Group	Non-Exercise Group	t-value	p-value
Height (cm)	171.49	167.32	3.48391	0.000626
Weight (kg)	69.68	75.99	-4.43063	0.000017
BMI (kg/m²)	23.75	26.99	-6.64	< 0.00001
Waist Circumference (cm)	82.97	95.60	-9.4363	< 0.00001

Hip Circumference (cm)	98.00	106.00	-9.52957	< 0.00001
Waist-Hip Ratio (WHR)	0.85	0.90	-3.61	0.000406
Arm Circumference (cm)	30.44	29.75	2.59	0.009997
Calf Circumference (cm)	36.79	35.84	3.19	0.001522

Graph No. 1: A Comparative Study of Anthropometric parameters in Exercising Diabetic Individuals.



Graph No. 2: A Comparative Study of Anthropometric parameters in Non-Exercising Diabetic Individuals.



Comparison of Anthropometric Parameters

A comparative analysis of anthropometric variables between the exercise and non-exercise groups is presented in Table 1. Mean height was significantly greater in participants who exercised regularly (171.49 cm) compared to those who were physically inactive (167.32 cm). The difference was statistically significant ($t = 3.48$, $p = 0.000626$).

Participants in the exercise group demonstrated a significantly lower mean body weight (69.68 kg) than those in the non-exercise group (75.99 kg). This difference was statistically significant ($t = -4.43$, $p = 0.000017$), indicating a clear association between regular physical activity and reduced body weight among individuals with diabetes.

Similarly, Body Mass Index (BMI) values were considerably lower in the exercise group, with a mean BMI of 23.75 kg/m², compared to 26.99 kg/m² in the non-exercise group. The observed difference was highly significant ($t = -6.64$, $p < 0.00001$), suggesting improved weight status among physically active participants.

Measures of central obesity showed marked differences between the groups. Waist circumference was significantly lower in the exercise group (82.97 cm) compared to the non-exercise group (95.60 cm),

with statistical analysis confirming a highly significant difference ($t = -9.44$, $p < 0.00001$). Hip circumference also followed a similar pattern, with the exercise group demonstrating a lower mean value (98.00 cm) than the non-exercise group (106.00 cm), which was statistically significant ($t = -9.53$, $p < 0.00001$).

The waist-to-hip ratio (WHR), an indicator of fat distribution, was significantly lower among individuals who exercised (0.85) compared to inactive participants (0.90). This difference was statistically significant ($t = -3.61$, $p = 0.000406$), suggesting a more favourable body fat distribution and potentially lower cardiometabolic risk among physically active individuals.

Assessment of muscle mass using limb circumferences revealed beneficial effects of exercise. Arm circumference was significantly higher in the exercise group (30.44 cm) than in the non-exercise group (29.75 cm) ($t = 2.59$, $p = 0.009997$). Similarly, calf circumference was greater among participants who exercised regularly (36.79 cm) compared to inactive individuals (35.84 cm), with the difference reaching statistical significance ($t = 3.19$, $p = 0.001522$). These findings indicate better preservation or enhancement of muscle mass in physically active diabetic individuals.

Graphical representation of these anthropometric differences is illustrated in Graph 1 and Graph 2, depicting trends observed in exercising and non-exercising participants, respectively.

Table No. 2: Correlation between anthropometric parameters and blood glucose levels for exercise and non-exercise diabetic patients.

Anthropometric Parameter	Exercise Group (R)	Interpretation	Non-Exercise Group (R)	Interpretation
Height (cm)	0.0792	Very weak positive	0.0262	Very weak positive
Weight (kg)	0.1073	Very weak positive	0.1437	Weak positive
BMI (kg/m²)	0.0384	Very weak positive	0.1622	Weak positive
Waist Circumference (cm)	0.0298	Very weak positive	0.2083	Weak positive
Hip Circumference (cm)	0.1849	Weak positive	0.0288	Very weak positive
Waist-to-Hip Ratio	0.1464	Weak positive	0.1704	Weak positive

The correlation analysis between anthropometric variables and blood glucose levels for both groups is shown in **Table 2**. In general, anthropometric parameters exhibited very weak to weak positive correlations with blood glucose levels in both exercise and non-exercise groups.

Among non-exercising participants, waist circumference ($R = 0.2083$) and waist-to-hip ratio ($R = 0.1704$) demonstrated the strongest positive correlations with blood glucose levels, suggesting a potential association between central obesity and poorer glycaemic control in sedentary individuals.

In the exercise group, hip circumference ($R = 0.1849$) and waist-to-hip ratio ($R = 0.1464$) showed the highest correlations with blood glucose levels; however, these associations remained weak. This indicates that regular physical activity may reduce the strength of the relationship between body fat distribution and glycaemic status.

Interpretation of Physical Activity Patterns and Sedentary Behavior Among Diabetic Individuals

Physical Activity Patterns and Sedentary Behaviour

Evaluation of physical activity patterns revealed varied levels of engagement among participants. A large proportion reported participation in both vigorous and moderate forms of physical activity during the preceding week, indicating a generally positive trend toward active lifestyles.

Vigorous Physical Activity: Approximately 88% of participants reported engaging in vigorous physical activity for at least 10 minutes. Of these, 25.15% exercised five days per week. Session

durations commonly ranged between 30 and 40 minutes, suggesting consistent participation in higher-intensity activities, which are known to enhance insulin sensitivity and cardiovascular health.

Moderate Physical Activity: Engagement in moderate physical activity was reported by 82.29% of participants, with the highest frequency observed at five days per week (30.86%). The majority of sessions lasted between 20 and 50 minutes, aligning with recommended physical activity guidelines for individuals with diabetes.

Walking Behaviour: Walking was identified as the most commonly practiced form of physical activity. Approximately 81.72% of participants reported walking for at least 10 minutes during the previous week. Nearly one-third walked five days per week, with an average duration of around 50 minutes per session, reflecting the accessibility and sustainability of walking as a preferred exercise modality.

Occupational Activity and Sedentary Time: Despite these positive activity patterns, sedentary behaviour remained prevalent. More than half of the participants (51.43%) reported that their occupational activities primarily involved prolonged sitting or standing. Additionally, a substantial proportion spent three or more hours per day in a seated position, with 23.43% reporting sitting for five hours or longer. This prolonged sedentary time may diminish the benefits of physical activity and negatively influence glycaemic control and cardiovascular health.

Overall, while many participants demonstrated engagement in beneficial physical activity practices—particularly vigorous exercise, moderate activity, and walking—sedentary behaviour remains a significant concern. Strategies aimed at reducing prolonged sitting and encouraging regular movement throughout the day may further improve health outcomes, glycaemic control, and quality of life among individuals with diabetes.

DISCUSSION

The present study provides a detailed comparison of anthropometric characteristics and physical activity patterns among individuals with diabetes, distinguishing between those who engage in regular exercise and those who lead a predominantly inactive lifestyle. The findings highlight notable differences across age groups, body composition measures, and behavioural patterns, offering valuable insights into the role of physical activity in diabetes management.

The age distribution of participants revealed that the highest proportion of individuals with diabetes belonged to the 46–60 years age group, followed by those aged 31–45 years, with very few participants in the younger age category of 18–30 years. This pattern reflects the progressive nature of type 2 diabetes mellitus, which becomes more prevalent with advancing age due to cumulative exposure to risk factors such as physical inactivity, weight gain, and metabolic decline. The limited representation of younger adults emphasizes the importance of early preventive strategies aimed at lifestyle modification before the onset of metabolic dysfunction.

Clear and consistent differences were observed in anthropometric parameters between the exercise and non-exercise groups. Individuals who reported regular physical activity demonstrated significantly lower body weight, BMI, waist circumference, and hip circumference compared to their inactive counterparts. These findings suggest that habitual exercise is strongly associated with healthier body composition and reduced adiposity. In particular, the marked reduction in waist circumference among physically active participants highlights the role of exercise in limiting central fat accumulation, which is closely linked to insulin resistance, systemic inflammation, and cardiovascular risk.

The waist-to-hip ratio, a commonly used indicator of fat distribution, was also significantly lower in the exercise group. This finding further supports the protective effect of physical activity against abdominal obesity, which is considered a more critical predictor of metabolic risk than overall body weight alone. In contrast, higher values observed among non-exercising individuals suggest an unfavourable fat distribution pattern that may contribute to poorer glycaemic and cardiovascular outcomes.

Interestingly, arm and calf circumferences were slightly higher among participants who exercised regularly. This may reflect better preservation or development of skeletal muscle mass resulting from ongoing physical activity. Maintenance of muscle mass is particularly important in individuals with diabetes, as skeletal muscle plays a key role in glucose uptake and insulin sensitivity. These findings indicate that exercise not only reduces fat mass but may also contribute to improved muscle composition.

Correlation analysis between anthropometric variables and blood glucose levels revealed generally weak positive associations in both groups. However, stronger correlations were observed among non-exercising participants, particularly for waist circumference and waist-to-hip ratio. This suggests that in sedentary individuals, central obesity may have a more direct and measurable influence on glycaemic control. In contrast, the weaker associations observed in the exercise group indicate that regular physical activity may attenuate the impact of body fat distribution on blood glucose levels by improving insulin sensitivity and metabolic regulation.

Evaluation of physical activity patterns demonstrated that a large proportion of participants engaged in both vigorous and moderate forms of exercise during the preceding week. Many reported adequate frequency and duration of activity, aligning with recommended guidelines for diabetes management. Such activity levels are known to enhance glucose utilization, improve cardiovascular fitness, and support weight control, thereby contributing positively to overall metabolic health.

Walking emerged as the most commonly practiced form of physical activity, reflecting its accessibility, safety, and ease of integration into daily routines. The widespread adoption of walking among participants suggests that it represents a practical and sustainable intervention for promoting physical activity, particularly among individuals who may face barriers to structured exercise programs.

Despite these encouraging findings, sedentary behaviour remained prevalent. A considerable proportion of participants reported prolonged daily sitting time, and more than half described their occupational activities as largely sedentary. Prolonged sitting has been associated with impaired glucose metabolism, reduced energy expenditure, and increased cardiometabolic risk, even among individuals who meet physical activity recommendations. These observations highlight the need to address sedentary behaviour as an independent risk factor in diabetes management.

Overall, the findings of this study reinforce the critical role of regular physical activity in improving anthropometric profiles and reducing metabolic risk among individuals with diabetes. While many participants demonstrated engagement in beneficial physical activity practices, central obesity and sedentary behaviour remain significant concerns, particularly among non-exercisers. Public health initiatives should therefore focus not only on promoting regular exercise but also on reducing prolonged sitting and encouraging active lifestyles across different age groups. Tailored, culturally appropriate interventions that address both physical activity and sedentary behaviour are essential for improving long-term diabetes outcomes and quality of life.

STRENGTH OF THE STUDY:

- The study included a relatively adequate sample size (n = 175), enhancing the reliability and generalizability of the findings within the studied population.
- Use of standardized and simple anthropometric measurements (BMI, WC, HC, WHR, arm and calf circumferences) ensured practicality, cost-effectiveness, and clinical applicability.
- Comparison between exercise and non-exercise diabetic groups allowed clear identification of the influence of physical activity on body composition.
- The study addressed an important public health issue in the Indian context, where diabetes prevalence and central obesity are high.
- Inclusion of muscle mass indicators (arm and calf circumference) provided additional insight beyond conventional obesity indices.
- Ethical approval and standardized data collection protocols strengthened the methodological rigor of the research.

FUTURE RECOMMENDATIONS: -

- Future studies should adopt a longitudinal or interventional design to establish causal relationships between physical activity and changes in anthropometric and glycaemic parameters.
- Inclusion of biochemical markers such as HbA1c, lipid profile, and insulin resistance indices would provide a more comprehensive metabolic assessment.
- Objective assessment of physical activity using accelerometers or pedometers is recommended to reduce recall bias associated with self-reported activity.
- Further research should explore gender-specific and age-specific differences in anthropometric responses to exercise.
- Multicentric studies involving larger and more diverse populations are suggested to improve external validity.
- Integration of structured exercise interventions comparing aerobic, resistance, and combined training modalities may help identify the most effective approach for diabetic management.

LIMITATIONS OF THE STUDY:

- The cross-sectional observational design limits the ability to infer cause-and-effect relationships between exercise and anthropometric outcomes.
- Physical activity levels were self-reported, which may be subject to recall and reporting bias.
- Blood glucose was assessed using single-point measurements, rather than long-term indicators such as HbA1c.
- Dietary intake, medication adherence, and duration or intensity of exercise was not controlled, which could influence anthropometric and glycaemic outcomes.
- The study population was confined to a single geographic region, which may limit generalizability to other populations.
- Younger age groups were underrepresented, restricting age-wise comparisons.

CONCLUSION:

The purpose of this study was to examine the effect of physical exercise on selected anthropometric variables in individuals with diabetes by comparing physically active participants with those who did not engage in regular exercise. The results indicated that consistent physical activity is associated with more favourable anthropometric outcomes. A large proportion of the

study population belonged to the 46–60-year age group, suggesting a greater occurrence of diabetes among middle-aged and older adults. Significant differences were identified between the exercise and non-exercise groups across multiple measures, including body weight, BMI, waist and hip circumferences, waist-to-hip ratio, as well as arm and calf circumferences. Overall, individuals who participated in regular exercise demonstrated healthier body composition profiles.

Correlation analysis revealed weak to very weak relationships between anthropometric indicators and blood glucose levels. However, comparatively stronger associations observed in the non-exercise group indicate that physical inactivity may enhance the link between obesity-related measures and glycaemic status. Although many participants reported engagement in moderate to vigorous physical activity, including routine walking, a substantial number also reported extended periods of sitting and sedentary occupational activities. Such behaviour patterns may negatively affect metabolic control and increase the risk of poor glyceric outcomes.

ETHICS STATEMENT

The study received approval from the Institutional Ethical Committee of XXX, Karad (Protocol Number 368 /2024-2025).

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CONFLICT OF INTEREST

The authors declare that they have no conflicts of interest related to this article.

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