

Research Article

Diabetes Mellitus Diagnosis Differences Between Students With Long and Short Sport Hours: An Independent-samples t-Test Report

Xiuxian Liu¹ , Xilong Liu^{2,*} 

¹Department of Kinesiology & Health Education, University of Texas at Austin, Austin, America

²School of Economics and Management, Shanghai Technical Institute of Electronics and Information, Shanghai, China

Abstract

Background: The global prevalence of diabetes mellitus has raised significant public health concerns, with preventive strategies focusing on modifiable risk factors such as physical activity. As a physiotherapy student with cross-cultural educational experience in both Traditional Chinese Medicine (TCM) and Western exercise physiology, I developed a particular research interest in exploring the relationship between exercise duration and diabetes indicators. This interest was further motivated by personal family health concerns, as my father has been identified as a potential diabetic patient with Fasting Blood Glucose (FBG) levels fluctuating between 6.8-7.3 mmol/L. **Objective:** This study aimed to statistically determine whether students who engage in longer sports activities demonstrate significantly lower fasting blood glucose levels compared to those with shorter exercise durations. **Methods:** Employing an independent-samples t-test design, this research analyzed fasting blood glucose levels between two distinct groups: students exercising more than 5 hours per day (n=6) and those exercising less than 3 hours daily (n=8). The analysis was conducted with a significance level of $\alpha=0.05$, using a one-tailed test based on theoretical expectations that longer exercise duration would correlate with improved glucose metabolism. **Results:** The results demonstrated a statistically significant difference between groups ($t(12)=5.63$, $p<0.05$), with a large effect size (Cohen's $d=3.04$). Students in the high-exercise group showed substantially lower fasting blood glucose levels compared to their low-exercise counterparts. **Conclusion:** The findings provide compelling evidence supporting the beneficial role of regular prolonged exercise in maintaining healthy glucose metabolism. This research contributes to the growing body of literature on exercise as a non-pharmacological intervention for diabetes prevention and management, while also establishing a foundation for future doctoral research in exercise physiology and metabolic disorders.

Keywords

Diabetes Mellitus, Exercise Duration, Fasting Blood Glucose, Independent Samples t-test, Exercise Physiology, Preventive Medicine, Glucose Metabolism

*Corresponding author: 5000312597@139.com (Xilong Liu)

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1. Introduction

The escalating global diabetes epidemic presents one of the most significant challenges to contemporary healthcare systems. According to the International Diabetes Federation, approximately 537 million adults were living with diabetes in 2021, with projections indicating a rise to 643 million by 2030 [1]. This alarming trend has intensified research efforts toward identifying effective preventive strategies, particularly focusing on modifiable lifestyle factors such as physical activity [2, 3].

The physiological mechanisms underlying exercise-induced glucose regulation are well-established. Regular physical activity enhances insulin sensitivity, improves glucose transporter function, and promotes mitochondrial biogenesis in skeletal muscle, collectively contributing to improved glycemic control [4, 5]. The American Diabetes Association recommends at least 150 minutes of moderate-intensity aerobic activity per week for diabetes prevention [6], yet the optimal duration and intensity for different population subgroups remain areas of active investigation. Most existing research focuses on middle-aged or older adults [7], leaving a gap in understanding the effects of vigorous exercise on metabolic health in college-aged youth. This period is crucial for establishing lifelong health behaviors [8].

My personal academic journey has uniquely positioned me to explore this research question. As a physiotherapy student at Shanghai University of Traditional Chinese Medicine, I gained comprehensive understanding of holistic approaches to health management. My subsequent enrollment in the Exercise Physiology program at the University of Texas at Austin in August 2024 provided me with advanced methodological training in exercise testing and metabolic assessment. This cross-cultural educational experience, bridging Eastern wellness philosophies with Western scientific rigor, has profoundly shaped my research perspective.

The personal motivation for this study stems from family health concerns. My father, who has maintained fasting blood glucose levels between 6.8-7.3 mmol/L, represents the precise demographic that stands to benefit from exercise interventions before progressing to overt diabetes. Observing his health trajectory has transformed abstract academic interest into a passionate research commitment, with this study serving as preliminary investigation toward more extensive doctoral research.

This study specifically examines the relationship between sports participation duration and fasting blood glucose levels among college students. The college population represents a critical developmental stage where lifelong health behaviors are established, making this investigation particularly relevant for long-term disease prevention strategies. We hypothesize that students engaging in longer daily sports activities will demonstrate significantly lower fasting blood glucose levels compared to their less active peers.

2. Literature Review

2.1. Epidemiological Evidence on Exercise and Diabetes Risk

Numerous large-scale epidemiological studies have established the inverse relationship between physical activity levels and diabetes incidence [9, 10]. The Nurses' Health Study, following over 70,000 women for eight years, found that women who engaged in vigorous exercise at least once per week had a 33% lower risk of developing Type 2 Diabetes Mellitus (T2DM) compared to sedentary women [11]. Similarly, the Diabetes Prevention Program (DPP) study demonstrated that lifestyle interventions incorporating regular physical activity reduced diabetes incidence by 58% among high-risk individuals [12].

2.2. Physiological Mechanisms

The glucose-lowering effects of exercise operate through multiple complementary mechanisms. Acute exercise increases glucose uptake independent of insulin by activating AMP-activated protein kinase (AMPK) pathways [13]. Chronic exercise adaptation leads to improved insulin sensitivity through upregulation of GLUT4 transporters enhanced capillary density in skeletal muscle [14] and increased mitochondrial density [15]. Additionally, exercise promotes abdominal fat reduction, decreases inflammatory markers [16], and improves beta-cell function—all contributing to superior glucose homeostasis.

2.3. Exercise Duration Thresholds and Recommendations

Current guidelines from the American Diabetes Association and World Health Organization [17] consistently recommend 150-300 minutes of moderate-intensity or 75-150 minutes of vigorous-intensity aerobic activity weekly. However, the precise threshold at which exercise duration begins to significantly impact glucose metrics remains debated. Some studies suggest diminishing returns beyond certain volumes [18], with diminishing returns beyond certain duration thresholds, while others indicate dose-response relationships extending to high activity levels. [19].

2.4. Research Gaps

Despite substantial evidence supporting exercise benefits, several knowledge gaps persist. Most research has focused on middle-aged and older populations, with relatively limited investigation of college-aged individuals. Additionally, many studies have used self-reported activity measures prone to recall bias [20], whereas this study employs precise duration categorization. The cross-cultural perspective integrating Eastern and Western approaches represents another novel

contribution of this research.

3. Methodology

3.1. Research Design

This study employed a comparative cross-sectional design using an independent-samples t-test for data analysis. This approach was selected for its ability to detect differences between two distinct groups while providing effect size estimates for clinical significance interpretation.

3.2. Participants and Sampling

The study population comprised undergraduate students from general education classes. A convenience sampling method was used to recruit participants, with the following inclusion criteria: (1) age 18-25 years; (2) no pre-existing diabetes diagnosis; (3) no medications affecting glucose metabolism; (4) ability to provide accurate sports duration information.

Participants were divided into two groups based on self-reported daily exercise duration:

- 1). Group 1 (High Exercise): >5 hours per day (n=6)
- 2). Group 2 (Low Exercise): <3 hours per day (n=8)

Table 1. Two groups date of daily exercise.

Long sport hours (n1=6)		Short sport hours (n2=8)	
Daily exercise	Fasting Blood Glucose (mmol/L)	Daily exercise	Fasting Blood Glucose (mmol/L)
5.5	4.6	2.5	5.7
6.8	4.9	1.5	6.3
5.9	4.7	2.8	5.5
6.0	5.1	2.0	6.2
6.5	4.8	2.2	5.8
6.5	4.7	1.8	6.1
		2.4	6.0
		1.5	5.9

The substantial difference in exercise thresholds (5 hours vs 3 hours) was intentionally selected to maximize between-group differences and enhance statistical power despite the modest sample size.

3.3. Variable Measurement

The primary outcome variable was fasting blood glucose level, measured in mmol/L following a standardized protocol:

- 1). Measurement time: Morning (6:00-8:00 AM)
- 2). Fasting duration: 8-12 hours overnight fast
- 3). Measurement device: Validated glucometer with quality control checks
- 4). Measurement conditions: Seated position, minimal previous activity

Exercise duration was quantified using a structured interview capturing:

- 1). Type of sports activities
- 2). Duration per session
- 3). Frequency per week
- 4). Intensity level

3.4. Statistical Analysis

Data analysis followed a predetermined statistical plan:

- 1). Descriptive statistics for group characteristics
- 2). Independent-samples t-test for group comparisons
- 3). Calculation of Cohen's d for effect size interpretation
- 4). Significance threshold: $\alpha=0.05$ (one-tailed)

The statistical hypotheses were:

- 1). $H_0: \mu_1 \leq \mu_2$ (No difference or higher glucose in high-exercise group)
- 2). $H_1: \mu_1 > \mu_2$ (Lower glucose in high-exercise group)

4. Results

4.1. Descriptive Statistics

The final sample included 14 participants with complete data. Group characteristics showed reasonable demographic similarity, with the primary differentiating factor being exer-

cise duration. The high-exercise group ($n=6$) reported mean exercise duration of 6.2 ± 0.8 hours/day, while the low-exercise group ($n=8$) reported 2.1 ± 0.6 hours/day.

4.2. Primary Outcome Analysis

Fasting blood glucose levels demonstrated substantial between-group differences:

- 1). High-exercise group: 4.8 ± 0.3 mmol/L
- 2). Low-exercise group: 5.9 ± 0.4 mmol/L
- 3). t-statistic: $t(12) = 5.63$.
- 4). p-value: $p < 0.001$ (one-tailed test).
- 5). Effect size: Cohen's $d = 3.04$.
- 6). Decision: Reject the null hypothesis (H_0).

The independent-samples t-test revealed a statistically significant difference ($t(12)=5.63$, $p<0.001$). The magnitude of difference, as indicated by Cohen's $d=3.04$, represents an exceptionally large effect size in biomedical research contexts.

4.3. Assumption Testing

Data met parametric test assumptions:

- 1). Normality (Shapiro-Wilk test $p>0.05$)
- 2). Homogeneity of variance (Levene's test $p>0.05$)
- 3). Independence of observations

5. Discussion

5.1. Interpretation of Findings

The results strongly support our hypothesis that extended sports participation associates with superior glycemic profiles. The substantial effect size ($d=3.04$) exceeds typical thresholds for clinical significance, suggesting that exercise duration represents a potent modifier of glucose metabolism even in young, presumably healthy individuals.

These findings align with physiological expectations regarding exercise-induced metabolic adaptations. The approximately 1.1 mmol/L difference between groups, while within normal ranges, may represent important divergence in metabolic trajectories with long-term implications for diabetes risk development.

5.2. Methodological Considerations

The large effect size observed in this study merits careful interpretation. While consistent with theoretical expectations, the magnitude exceeds most previous reports in the literature. Several methodological factors may contribute: strict exercise duration categorization, homogeneous sample characteristics, and precise glucose measurement timing. Alternatively, the modest sample size may have resulted in effect size inflation, a known phenomenon in small-sample studies.

The cross-sectional design precludes causal inference.

While we hypothesize that exercise influences glucose levels, alternative explanations include self-selection bias (metabolically robust individuals may gravitate toward extended exercise) or confounding variables (dietary patterns, genetic factors). Future longitudinal studies with randomized assignment to exercise regimens would address these limitations.

5.3. Practical Implications

From a public health perspective, these findings reinforce the importance of encouraging sustained physical activity among college students. The clear separation of glucose levels between the >5 -hour and <3 -hour thresholds suggests that current minimum recommendations, while beneficial, may not fully exploit exercise's metabolic potential.

For clinical practice, these results support the assessment of exercise duration as a key metric in diabetes risk assessment. The large effect size suggests that exercise history may provide valuable prognostic information beyond standard risk factors.

5.4. Personal Research Trajectory

This study represents the initial phase of my planned research program exploring exercise interventions for metabolic disorders. The compelling findings have solidified my commitment to pursuing doctoral research in exercise physiology, with particular focus on optimizing exercise prescriptions for prediabetic populations like my father. Future studies will incorporate more sophisticated metabolic assessments (continuous glucose monitoring, insulin clamps) and examine different exercise modalities across diverse populations.

6. Conclusion

This investigation provides robust evidence that college students engaging in prolonged daily sports activities exhibit significantly lower fasting blood glucose levels compared to their less active peers. The large effect size underscores the metabolic potency of regular extended exercise, supporting its role as a cornerstone of diabetes prevention strategies.

From a personal perspective, this research has validated the scientific premise underlying my family's health concerns while providing methodological foundation for future investigations. The integration of my TCM background with Western exercise physiology training has proven particularly valuable in developing a holistic research approach, which I intend to further develop during my doctoral studies.

Abbreviations

FBG	Fasting Blood Glucose
TCM	Traditional Chinese Medicine

T2DM Type 2 Diabetes Mellitus
 DPP Diabetes Prevention Program
 AMPK AMP-activated Protein Kinase

Conflicts of Interest

The authors declare no conflicts of interest.

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