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Sedentary Behavior and Metabolic Dysregulation: A Cross-Sectional Correlational Analysis of Body Mass Index and Random Blood Glucose Levels in Relation to Daily Sedentary Hours

Dr. Soniya S[1], Dr. Sriraghunath S[2], Dr. Srishti Hegde[3], Dr. Pooja N[4], Dr. Ashna Patel[5], Dr Chaitrali Kulkarni[6], Dr. Sasanka Sekhar Pradhan[7]

[1]Assistant Professor, School of Allied and Healthcare, S-VYASA Deemed to be University
[2]Dean, School of Allied and Healthcare, S-VYASA Deemed to be University
[3,4,5,7]Assistant Professor, School of Allied and Healthcare, S-VYASA Deemed to be University
[6]Associate Professor, School of Allied and Healthcare, S-VYASA Deemed to be University

Abstract

Sedentary behaviour is increasingly recognized as an independent risk factor for metabolic dysregulation, particularly among university employees engaged in prolonged desk-based work. This cross-sectional correlational study examined the relationships between daily sedentary hours, Body Mass Index (BMI), and Random Blood Glucose (RBG) levels among 66 university workers at S-VYASA University, Bengaluru. Anthropometric measurements and biochemical testing were conducted, and data were analysed using SPSS version 26.0. Participants reported a mean sedentary time of 6.7 ± 2.5 hours/day, with a mean BMI of 27.2 ± 4.5 kg/m² (69% overweight or obese) and mean RBG of 103.7 ± 25.4 mg/dL. No statistically significant correlation was found between sedentary hours and BMI ($r \approx 0.00$, $p = 0.996$) or between sedentary hours and RBG ($r \approx 0.01$, $p = 0.961$). However, BMI showed a significant moderate positive correlation with RBG across the sample ($r = 0.350$, $p = 0.006$), independent of sedentary classification. These findings suggest that adiposity, rather than self-reported sedentary time, may be a stronger determinant of glycaemic risk in this population. The results support the need for occupational therapy-led, weight-focused workplace health interventions and highlight the value of objective sedentary-behaviour measurement and more robust glycaemic markers in future research.

Keywords: Sedentary behaviour, Body Mass Index, Random Blood Glucose, Metabolic dysregulation, Occupational therapy

Need for the study

Sedentary behavior has become increasingly common in modern workplaces, particularly among university workers who spend prolonged hours sitting while performing computer-based and desk-related tasks. World Health Organization mentions physical inactivity and prolonged sedentary behaviour are among the leading risk factors contributing to non-communicable diseases, including obesity, diabetes mellitus, and cardiovascular disorders (WHO, 2020). Recent studies have reported that extended sedentary time is significantly related to unfavourable metabolic indicators such as increased Body Mass Index (BMI), elevated blood glucose levels, and other cardiometabolic risk factors (Wu et al., 2022; Naik et al., 2024). These findings highlight the growing concern regarding sedentary occupational patterns and their impact on metabolic health.

Sedentary work habits are an important area of intervention because occupational therapists aim to promote healthy participation in daily activities and prevent lifestyle-related disorders. Workplace-based activity programs and strategies to reduce sitting time have shown potential benefits in improving metabolic health outcomes among employees (Cabrera et al., 2021).

However, limited research has simultaneously examined the relationship between sedentary hours, BMI, and random blood sugar levels among university workers. Therefore, this study aims to investigate the correlation between a sedentary lifestyle and metabolic risk factors. The findings may help in early identification of individuals at risk and support the development of occupational therapy-based workplace health promotion and lifestyle modification programs.

Background of the study

Body Mass Index (BMI) remains the most widely applied anthropometric measure for estimating obesity in both epidemiological and clinical research. The WHO's internationally accepted classification categorizes individuals as underweight (<18.5 kg/m²), normal weight (18.5–24.9 kg/m²), overweight (25.0–29.9 kg/m²), or obese (≥30.0 kg/m²) (WHO, 2024). As an important marker of metabolic risk in population studies, higher BMI has been closely associated with insulin resistance, dyslipidemia, hypertension, fatty liver disease, and type 2 diabetes (Kopelman, 2000). Random Blood Glucose (RBG) testing, by contrast, can be conducted at any point during the day without regard to when the individual last ate, making it a practical and accessible tool for preliminary glucose screening in community and workplace settings (Olarinoye et al., 2004). Although fasting plasma glucose (FPG) and the oral glucose tolerance test (OGTT) remain the reference standards for diagnosing diabetes and prediabetes, both require fasting and controlled testing conditions that are often difficult to implement in occupational surveys. RBG, on the other hand, can be obtained quickly with portable glucometers and without meal restrictions, making it well-suited for large-scale occupational health assessments (American Diabetes Association, 2023).

Sedentary behavior contributes to metabolic dysregulation through several distinct physiological pathways. Sitting for a long period, in the absence of regular muscular contraction, also limits the translocation of glucose transporter type 4 (GLUT-4) to cell membranes, thereby reducing glucose uptake by tissues and leading to elevated post-meal blood glucose levels (Borghouts & Keizer, 2000). A Prolonged sitting is also linked to endothelial dysfunction driven by reduced nitric oxide availability and heightened oxidative stress which in turn elevates cardiovascular disease risk. Together, these physiological changes culminate in metabolic syndrome, characterized by central obesity, dyslipidemia, hypertension, and insulin resistance (Alberti et al., 2009). Supporting this, epidemiological research consistently identifies sedentary behavior as an independent metabolic risk factor: prolonged sitting has been shown to raise the risk of cardiovascular disease, type 2 diabetes, cancer, and all-cause mortality, even in individuals who are otherwise physically active (Biswas et al., 2015). A meta-analysis by Wilmot et al. (2012) similarly found substantially elevated risks of diabetes and cardiovascular disease among those with high sedentary time, while more recent work by Wu et al. (2022) reinforced positive links between sedentary behavior and increased BMI, dysglycemia, and other cardiometabolic risk factors across diverse populations. The scale of metabolic disease in India is particularly concerning: the country currently has over 101 million people living with diabetes and roughly 136 million with prediabetes, placing it second globally in absolute diabetes burden (Saeedi et al., 2019). Alongside this, rates of overweight and obesity among urban Indian adults based on Asian-specific BMI thresholds have risen sharply, driven by shifting dietary habits, increasingly sedentary occupations, and declining physical activity (Misra et al., 2019).

Within this broader epidemiological context, university employees represent a particularly vulnerable group. The demands of academic and administrative work including extensive computer use, manuscript writing, data analysis, correspondence, and meetings expose this cohort to some of the highest levels of occupational sedentarism among professional groups. Compounding this, academic environments often treat prolonged sitting as a marker of productivity and intellectual focus, creating cultural and institutional barriers to adopting more active work habits (Biswas et al., 2015). Consistent with this, Naik et al. (2024), in a study of Indian university employees, identified a significant positive relationship between daily sedentary hours and BMI, along with a tendency toward higher random blood glucose levels among those in the most sedentary tertile findings that highlight the pressing need for proactive metabolic health screening in this population (Cabrera et al., 2021).

Occupational therapy is in a distinct platform to address the metabolic effects of workplace sedentarism since it is a health profession dedicated to promoting meaningful and health-sustaining engagement in daily activities. According to the occupational therapy framework, sedentary work behavior is a changeable occupational pattern that can be changed through behavioral counseling, environmental restructuring, and activity modification (AOTA,2020). Workplace-based occupational therapy interventions have shown encouraging results in lowering daily sedentary time and enhancing metabolic and cardiovascular outcomes among employees. These interventions include the prescription of standing desks, structured movement breaks, ergonomic workspace reconfiguration, and individualized activity coaching (Cabrera et al., 2021). Therefore, the planning and rationale of occupational therapy-led workplace health programs depend on producing solid, population-specific correlational evidence on the association between sedentary hours and metabolic risk indicators like BMI and RBG.

This complex and dynamic epidemiological environment is the setting for the current cross-sectional correlational analysis. This study aims to produce integrative, clinically actionable evidence on the triangular metabolic risk nexus of sedentary behavior, adiposity, and glycaemic dysregulation by concurrently examining the relationships among daily sedentary hours, BMI, and Random Blood Glucose levels within a defined population of university workers. It is hoped that the results will offer a contextually grounded empirical basis for the creation and execution of evidence-based, occupational therapy-led lifestyle modification programs aimed at reducing sedentary behavior in university work environments.

Aim of the Study: To investigate the relationship between daily sedentary behavior and metabolic dysregulation by examining the correlation between sedentary hours, Body Mass Index (BMI), and Random Blood Glucose (RBG) levels among university workers, with the intent to identify sedentary behavior as a modifiable risk factor for early metabolic disturbances.

Objectives of the Study:

- To determine the daily sedentary hours, Body Mass Index (BMI), and Random Blood Glucose (RBG)

among the University workers.
- To examine the correlation between daily sedentary hours and BMI among the University workers.
- To examine the correlation between daily sedentary hours and Random Blood Glucose levels among the University workers.
- To determine the association between BMI and Random Blood Glucose levels in relation to sedentary behaviour patterns.

Hypothesis:

Null Hypothesis (H_0): There is no statistically significant association between BMI and Random Blood Glucose levels in relation to sedentary behavior.

Alternate Hypothesis (H_1): There is a statistically significant association between BMI and Random Blood Glucose levels in relation to ssedentary behavior.

Methodology

The study population consisted of employees working at the university, with enrolment restricted to individuals between 20 and 60 years of age who were actively employed and prepared to complete the full set of anthropometric and biochemical assessments. Participants were excluded if they fell outside this age range, were pregnant or breastfeeding, had a diagnosed chronic illness such as kidney disease, thyroid dysfunction, liver disorders, or cardiovascular conditions likely to independently influence body composition or metabolic readings, or had a physical impairment that would compromise measurement accuracy. Using an observational cross-sectional design, the research was carried out at SVYASA University in Bangalore, enrolling 66 participants selected through a purposive sampling approach. Data gathered included height and weight for BMI calculation, together with a biochemical assessment of random blood sugar (RBS). Recruitment took place at SVYASA University, Bengaluru, where eligible individuals meeting the inclusion criteria were enrolled, and a record was kept for each participant capturing basic demographic details name, age, gender, occupation, department, and contact number to support later follow-up and documentation. In addition, detailed background information was collected from every participant, including presenting complaints, prior medical history, any family history of diabetes, and lifestyle-related factors such as physical activity, eating habits, smoking status, and alcohol use, each considered relevant to the aims of the investigation.

Height, weight, and waist circumference were assessed using properly calibrated equipment and consistent measurement protocols, and BMI was subsequently derived from the recorded height and weight data. Biochemical assessment involved collecting random blood samples under aseptic technique by a trained nurse, with Random Blood Glucose (RBG) serving as the sole biochemical marker examined. All data were first recorded on a standardized proforma before being entered into Microsoft Excel for organization and management, and subsequent statistical analysis was performed using SPSS (version 26.0). To safeguard participant privacy, each individual was assigned a unique identification code in place of personal identifying information throughout the study. The instruments used for data collection comprised a measuring tape, a weighing scale, and a glucometer.

General Statistics and Analysis

Table 1: Demographic distribution of variables

Demographic variables	Category / Statistic	Value
Age (years)	Mean ± SD	34.8 ± 9.1
	Range	23 – 61
Gender	Female	46 (69.7%)
	Male	20 (30.3%)
Movement breaks	Regularly	54 (83.1%)
	Rarely	6 (9.2%)
	Occasionally	5 (7.7%)
Activity level	Sedentary	26 (40.0%)
	Low Active	21 (32.3%)
	Active	13 (20.0%)
	Highly Active	5 (7.7%)

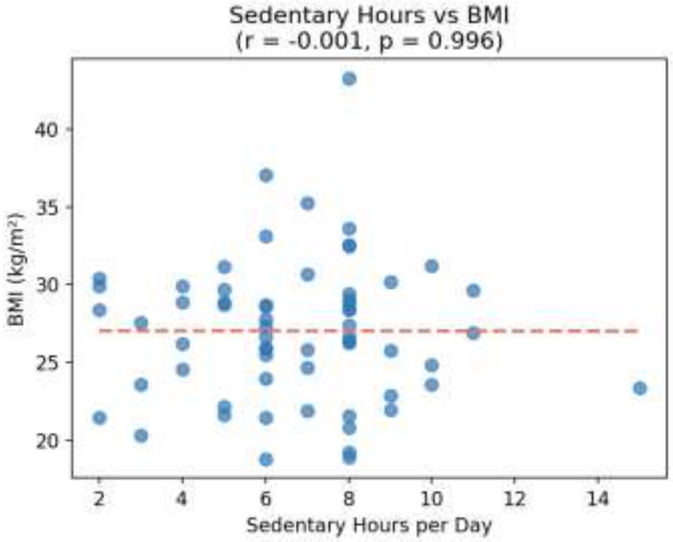
Table 2: Sedentary Hours, BMI, and Random Blood Glucose

Variable	N	Mean ± SD	Median	Min – Max
Sedentary hours / day	63	6.69 ± 2.47	7.0	2.0 – 15.0
BMI (kg/m^2)	65	27.21 ± 4.53	26.4	18.8 – 43.3
Random Blood Glucose (mg/dL)	61	103.65 ± 25.40	98.0	63 – 184

Table 3: Correlation between daily sedentary hours and BMI

Test	n	Coefficient	p-value	Interpretation
Pearson correlation (r)	62	-0.001	0.996	No linear relationship
Spearman correlation (ρ)	62	-0.011	0.930	No monotonic relationship

Figure 1: Scatterplot of daily sedentary hours against BMI, with linear fit.

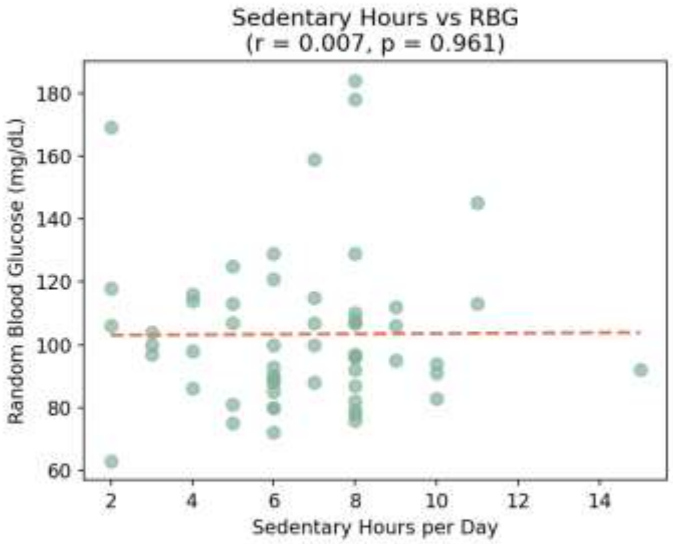


There is no statistically significant correlation between daily sedentary hours and BMI in this sample (r ≈ 0.00, p = 0.996). The scatterplot confirms a flat trend line with wide vertical spread — BMI varies considerably at every level of sedentary time, indicating sedentary hours alone do not predict BMI here.

Table 4: Correlation between daily sedentary hours and Random Blood Glucose levels

Test	n	Coefficient	p-value	Interpretation
Pearson correlation (r)	58	0.007	0.961	No linear relationship
Spearman correlation (ρ)	58	-0.004	0.974	No monotonic relationship

Figure 2: Scatterplot of daily sedentary hours against Random Blood Glucose, with linear fit.

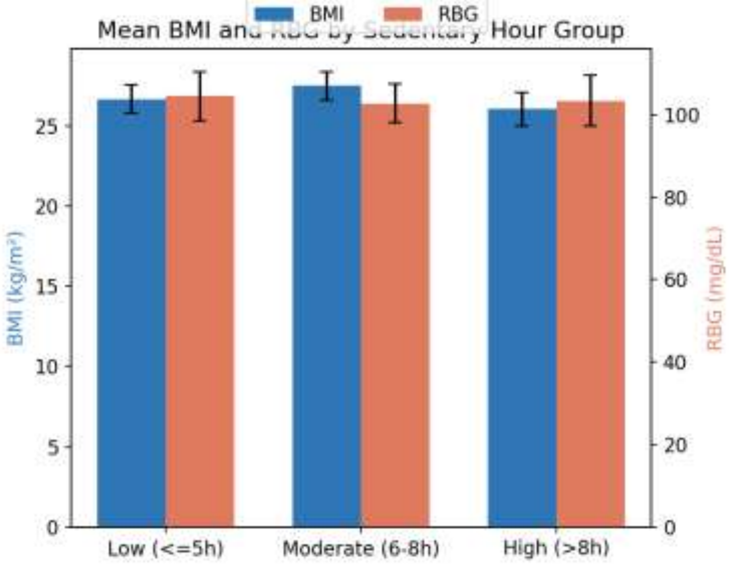


Similarly, no statistically significant correlation was found between sedentary hours and Random Blood Glucose ($r \approx 0.01$, $p = 0.961$). RBG levels are essentially independent of how many hours a worker reports sitting per day in this sample

Table 5: Association between BMI and Random Blood Glucose levels in relation to sedentary behaviour patterns.

Sedentary Group	n (BMI)	BMI Mean ± SD	n (RBG)	RBG Mean ± SD
Low (≤5 h/day)	16	26.68 ± 3.61	16	104.50 ± 24.04
Moderate (6–8 h/day)	33	27.51 ± 5.26	33	102.76 ± 27.17
High (>8 h/day)	9	26.04 ± 3.32	9	103.44 ± 18.58

Figure 3: Mean BMI and RBG (± SEM) across Low / Moderate / High sedentary-hour groups.



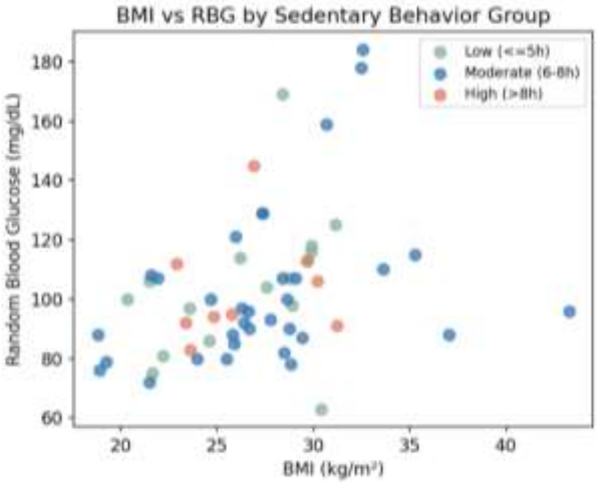
Neither BMI nor RBG differ significantly across Low, Moderate, and High sedentary-hour groups (both $p > 0.6$). This reinforces the correlation findings above: in this sample, sedentary behaviour alone is not a distinguishing factor for either BMI or RBG.

Table 6: Relationship Between BMI and RBG

Comparison	n	Pearson r	p-value	Interpretation
BMI vs RBG overall sample	60	0.350	0.006	Significant, moderate positive
BMI vs RBG Low sedentary group	16	0.360	0.171	Not significant
BMI vs RBG Moderate sedentary group	33	0.361	0.039	Significant, moderate positive

BMI vs RBG High sedentary group	9	0.176	0.650	Not significant

Figure 4: BMI vs Random Blood Glucose, colored by sedentary-hour group.



Unlike sedentary hours, BMI itself shows a statistically significant, moderate positive association with Random Blood Glucose across the whole sample (r = 0.350, p = 0.006) — higher BMI tends to go with higher RBG, independent of sitting time. This relationship holds most clearly within the Moderate sedentary-hour group (r = 0.361, p = 0.039), but does not reach significance in the smaller Low and High sedentary subgroups, likely due to limited sample size in those strata rather than a true absence of effect.

Discussion

A workforce with observable occupational metabolic risk is described by the descriptive findings. With a mean BMI of 27.2 ± 4.5 kg/m², a mean sedentary exposure of 6.7 ± 2.5 hours per day, and nearly 70% of personnel in the overweight or obese category, this cohort is superior to other similar institutional samples reported in the literature. The prevalence of overweight/obesity was 32.9% among sedentary workers and 18.0% among non-sedentary workers in a cross-sectional study conducted in Bangladesh (Hasan & Rahman, 2024). Sedentary workers had significantly higher adjusted odds of both diabetes and overweight/obesity, which is significantly lower than the absolute rates found here, indicating that this university population is at the higher end of occupational metabolic risk even by regional standards.

Comparably, a study of university employees in Ghana revealed that 44% of all employees were overweight or obese; this number increased to 70% among senior academic staff, (Atinga et al., 2017) which is closer to but still less than the 69% observed in the current group. On a population level, the mean RBG of 103.7 ± 25.4 mg/dL falls within the prediabetic-adjacent range; but, as a single random reading, it cannot replace HbA1c or fasting glucose in determining an individual's glycaemic status. In a relatively young (mean age 34.8 years), female-majority cohort, the co-occurrence of high prevalence overweight/obesity with borderline-elevated random glucose is clinically consistent with an occupational sedentary risk phenotype that is increasingly described among desk-based and academic staff populations, where sedentary occupations are associated with higher obesity risk due to low physical activity and poor dietary pattern (Alshahrani et al., 2025).

There was a lack of correlation between self-reported daily sedentary hours and BMI (Pearson r = -0.001, p = 0.996; Spearman ρ = -0.011, p = 0.930). This null result probably illustrates the difficulties of using a single-item self-reported sedentary time as an exposure measure in a modest sample, not that sitting time is metabolically insignificant. Even among well-resourced cohort studies, there is still conflicting systematic evidence in this area. For example, a review of sedentary behavior and adiposity in young people found that cross-sectional studies using self-reported screen time showed small associations with adiposity, but studies using objective accelerometer measurement produced null associations (Carson et al., 2016). This suggests that measurement modality significantly influences whether a sedentary–adiposity signal is detected at all. As the present study relied on self-reported measures of sedentary behavior rather than objective device-based assessments, the absence of a significant correlation is generally consistent with findings reported in previous literature and should not be considered contradictory. Furthermore, Body Mass Index (BMI) is influenced by multiple factors beyond sedentary behavior, including dietary habits, overall energy expenditure, sleep patterns, genetic predisposition, and other lifestyle-related variables. Therefore, the relationship between occupational sedentary behavior and BMI is likely multifactorial, and a simple bivariate analysis using self-reported sitting time may not adequately capture the complex pathways linking sedentary behavior to metabolic risk.

Similarly, there was No significant correlation observed between sedentary hours and Random Blood Glucose (RBG) levels ($r = 0.007$, $p = 0.961$; $\rho = -0.004$, $p = 0.974$). This finding differs from previous studies (Pesola et al., 2024) that have demonstrated adverse effects of prolonged sedentary behavior on glucose metabolism and glycaemic control (Stephens et al., 2011). The lack of association in the present study may be attributed to methodological factors, particularly the use of a single random, non-fasting blood glucose measurement and self-reported sedentary time. Random blood glucose levels are subject to short-term fluctuations influenced by factors such as recent food intake, stress, and time of assessment, which may obscure associations with chronic sedentary behavior. Therefore, fasting blood glucose, HbA1c, or continuous glucose monitoring may provide more reliable indicators of the relationship between sedentary behavior and glycaemic status in future studies.

The most notable finding of the present study was the significant moderate positive correlation between BMI and Random Blood Glucose (RBG) levels ($r = 0.350$, $p = 0.006$), indicating that higher BMI was associated with higher blood glucose levels. Although this relationship remained significant within the moderate sedentary group, it was not observed in the low- and high-sedentary groups, likely due to smaller subgroup sample sizes. Furthermore, neither BMI nor RBG differed significantly across sedentary-hour categories, suggesting that sedentary behaviour did not influence the observed association between BMI and glycaemic status. (Sharma & Iyer, 2026)

These findings indicate that adiposity may be a more important determinant of glycaemic risk than self-reported sedentary time in this population. Previous research has similarly reported that body weight and adiposity contribute independently to metabolic risk, even when sedentary behaviour is considered. Therefore, the observed BMI–RBG association highlights the importance of weight management and obesity prevention strategies as key components of glycaemic risk reduction among university employees. Future studies employing objective measures of sedentary behaviour and larger sample sizes are recommended to further clarify these relationships.

Conclusion

The study comprised 66 university employees, whose mean body mass index (BMI) was 27.2 kg/m², their mean random blood glucose (RBG) level was 103.7 mg/dL, and their mean daily sedentary time was 6.7 hours. Furthermore, 69% of participants were considered fat or overweight. All of these results point to the existence of a borderline metabolic risk profile in a workforce that is primarily female and relatively young. There was no statistically significant correlation seen between daily sedentary time and RBG levels or BMI. Additionally, there was no significant difference in BMI or RBG numbers between the low, moderate, and high sedentary behavior categories. However, BMI and RBG were significantly and positively associated with one another across the sample as a whole ($r = 0.350$, $p = 0.006$), independent of sedentary classification.

The most significant conclusion of the study is the strong correlation between BMI and RBG, underscoring the significance of weight control as a possible tactic for lowering glycaemic risk in college staff. Future studies in this cohort should use more reliable indicators of glycaemic state, like fasting blood glucose or HbA1c, include objective measures of sedentary behavior, like accelerometry, and recruit larger samples to increase the statistical power of subgroup analyses.

Limitations

Sedentary behavior was assessed through self-report rather than objective monitoring devices, making the measurements vulnerable to recall bias, social desirability effects, and misclassification of light activity as sedentary time. Such errors are likely to reduce the observed strength of associations.

Additionally, RBG was measured using a single blood sample without controlling for meal timing, time of day, or recent exercise. Because random glucose levels fluctuate considerably and are less stable than fasting glucose or HbA1c, they may not reliably differentiate normal glucose regulation from early metabolic abnormalities in individual participants. All variables were measured at a single timepoint, so no causal or temporal inference can be drawn between sedentary behavior, BMI, and RBG. The total sample size was sufficient to identify moderate associations within the overall cohort, as evidenced by the significant correlation between BMI and RBG; however, it lacked adequate statistical power for comparisons among sedentary-hour subgroups. As the sample was obtained from a single university and consisted mainly of younger female employees, the results may not be representative of other populations.

Future Recommendations

Future research would benefit from several methodological improvements. First, sedentary behavior should be captured using accelerometers or other validated wearable devices worn continuously for 5–7 days, including weekends, rather than relying on self-report, as this would reduce measurement bias and enable clearer comparisons with existing accelerometer-based literature. Second, glycaemic status should be assessed using more reliable indicators, such as fasting plasma glucose, HbA1c, or oral glucose tolerance testing, either replacing or supplementing random blood glucose readings, since these provide more stable and clinically meaningful measures of glucose regulation and are better suited to detecting true associations with sedentary behavior. Third, sample sizes should be determined through a priori power calculations targeting the smallest planned subgroup comparisons, with at least 30–40 participants per sedentary-time category to strengthen the statistical reliability of subgroup analyses. Finally, further studies should move beyond a cross-sectional design toward longitudinal or experimental approaches, such as prospective cohort studies or sedentary-behavior-reduction interventions with repeated anthropometric and glycaemic measurements, which would allow temporal relationships to be examined and provide stronger evidence of causality than the current design permits.

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