Impact of Prolonged Sitting and Shift Work on Diabetes Prevalence Among Employees in Micro, Small, and Medium Enterprises (MSMEs)

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Abstract

Background: The prevalence of diabetes mellitus and its associated risk factors, including work-related factors such as prolonged sitting and shift work, are significant concerns in the modern workforce. This study aimed to explore the relationship between these work-related factors and diabetes prevalence among employees.

Methodology: A cross-sectional study was conducted with 200 participants aged 18 years and above. Data were collected through a structured questionnaire that captured demographic characteristics, work-related factors, health status, and lifestyle behaviours. Descriptive statistics were used to summarise the data, and logistic regression analysis was employed to assess the association between prolonged sitting, shift work, and the prevalence of diabetes, adjusted for age, gender, and physical activity levels.

Results: The study population had a mean age of 42 years (SD = 9.5) with 70% males and 30% females. The average job tenure was 8 years (SD = 5.2), and the average hours spent sitting per day was 7.5 hours (SD = 2.1). The prevalence of diabetes among participants was 25% (n = 50), with 60% of those with diabetes regularly using glucose meters and an average HbA1c level of 7.5% (SD = 1.2). Logistic regression analysis revealed that prolonged sitting (OR = 1.8, 95% CI: 1.2 - 2.7, p = 0.003) and shift work (OR = 2.3, 95% CI: 1.4 - 3.7, p = 0.001) were significantly associated with an increased risk of diabetes, while other factors such as smoking and alcohol consumption were not significantly associated.

Conclusion: The study highlights the significant impact of prolonged sitting and shift work on the risk of diabetes among employees. These findings underscore the importance of workplace interventions targeting these risk factors to reduce the prevalence of diabetes in the workforce.

Key words: Diabetes, shift work, prolonged sitting, workplace health.

Introduction

The rising incidence of diabetes mellitus, particularly type 2 diabetes, presents a significant global public health challenge. It is well-documented that lifestyle factors such as physical inactivity and irregular working hours significantly elevate the risk of developing diabetes[1,2]. In the context of Micro, Small, and Medium Enterprises (MSMEs), these factors are especially relevant due to the nature of the work environment. Employees in MSMEs frequently endure extended periods of sitting and are often subjected to shift work schedules, both of which are linked to adverse metabolic outcomes[3,4].

Prolonged sitting, a hallmark of many office-based jobs, is associated with numerous health issues, including obesity, cardiovascular disease, and insulin resistance[5]. Sedentary behaviour decreases muscle activity, leading to reduced glucose uptake by muscles, which in turn contributes to elevated blood glucose levels[6,7]. This issue is exacerbated in shift workers, whose circadian rhythms are disrupted, leading to hormonal imbalances that further aggravate

metabolic dysregulation[8,9]. The irregular sleep patterns and altered meal timings characteristic of shift work can impair glucose metabolism and increase insulin resistance[10].

MSMEs are vital to the global economy, employing a significant proportion of the workforce, particularly in developing nations. However, despite their economic importance, workers in MSMEs often lack access to the health benefits and workplace wellness programmes more commonly available in larger corporations, making them particularly susceptible to lifestyle-related health issues, including diabetes[2]. Understanding the specific impact of prolonged sitting and shift work on diabetes prevalence in this context is crucial for developing targeted interventions to mitigate these risks.

The rationale for this study stems from the need to address the research gap concerning the unique occupational health challenges faced by MSME workers. While substantial evidence links sedentary behavior and shift work to diabetes, few studies focus specifically on the MSME sector[3,4]. Given the high prevalence of diabetes and the

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significant time MSME workers spend in sedentary and shift work conditions, this research aims to provide a clearer understanding of the associated risks and inform the development of effective prevention strategies.

The objectives of this study are to quantify the prevalence of diabetes among MSME workers and to explore the relationship between prolonged sitting, shift work, and diabetes risk[7]. By identifying the extent to which these occupational factors contribute to diabetes prevalence, this research seeks to underscore the need for tailored workplace interventions. Ultimately, the goal is to contribute to the development of evidence-based policies that promote healthier work environments in MSMEs, thereby reducing the burden of diabetes and enhancing overall workforce health.

Methodology

Study design and setting

The study employed a cross-sectional design, targeting employees from various Micro, Small, and Medium Enterprises (MSMEs) across multiple sectors. The research was conducted within office-based environments where both prolonged sitting and shift work are common. Data were collected over a three-month period, from April to June 2024. Ethical approval was secured from the Institutional Review Board of Shekhar Hospital Pvt Ltd I.E.C. approval no IEC/SH/2023/0015, and informed consent was obtained from all participants. Confidentiality of responses was maintained, and participants were informed of their right to withdraw from the study at any point.

Selection Criteria

The selection criteria for the study included employees aged 18 years and above who had been working in their current job role for a minimum of one year. Participants were required to express their willingness to provide informed consent to participate in the study. These criteria ensured that the study included individuals with sufficient exposure to the work environment under investigation, thereby enhancing the relevance and reliability of the findings.

Data sources and variables

Data was collected through a structured electronic questionnaire designed to gather comprehensive information on participants' demographic details, work-related factors, health status, and lifestyle habits. Responses were meticulously recorded in an Excel spreadsheet to facilitate analysis. The questionnaire captured variables such as age, gender, and educational level for demographic information. Work-related factors included job title, tenure with the company, hours of duty, hours spent sitting, and break times. Shift work data focused on the frequency of night shifts and the duration of shift work experience. Health status was assessed by inquiring about the presence of diabetes, use of glucose meters, frequency of blood sugar checks, and recent blood glucose and HbA1c levels. Additionally, participants' lifestyle factors were evaluated, including physical activity levels, smoking status, and alcohol consumption. The questionnaire also included questions about musculoskeletal health, specifically the presence of pain or disease involving bones, joints, or muscles. The primary outcome of interest, diabetes prevalence, was determined through self-reported data, supplemented by recent blood glucose and HbA1c levels for those who had undergone testing, as well as the use and frequency of glucose meter checks at home.

Statistical analysis

Data analysis was performed using statistical software. Descriptive statistics were used to summarise demographic characteristics, work-related factors, and health status. The prevalence of diabetes was calculated as a proportion of the total number of participants. Logistic regression analysis was conducted to examine the association between prolonged sitting, shift work, and diabetes prevalence, adjusting for potential confounders such as age, gender, and physical activity levels.

Results

Table I presents the demographic characteristics of the participants. The study included a total of 200 participants, with a mean age of 42 years (SD = 9.5). The majority of participants were male (70%, n = 140), and 30% (n = 60) were female. Most participants had a high school level of education (55%, n = 110), while 30% (n = 60) had a college degree, and 15% (n = 30) had a postgraduate degree.

Table I: Demographic characteristics

Characteristic	Number of Participants (n = 200)	Percentage (%)
Age (years)	Mean = 42, SD = 9.5	–
Gender		
– Male	140	70%
– Female	60	30%
Educational Level		
– High School	110	55%
– College	60	30%
– Post-graduate	30	15%

Table II details the work-related factors. Participants reported an average job tenure of 8 years (SD = 5.2). The average number of hours spent sitting per day were 7.5 hours (SD = 2.1), with 60% (n = 120) of participants reporting regular breaks. About 40% (n = 80) of participants engaged in shift work, with an average shift work experience of 5 years (SD = 3.8).

Table II: Work-related factors

Work-Related Factor	Number of Participants (n = 200)	Percentage (%)
Job Tenure (years)	Mean = 8, SD = 5.2	–
Hours Sitting per Day	Mean = 7.5, SD = 2.1	–
Breaks Taken		
Regular Breaks	120	60%
No Regular Breaks	80	40%
Shift Work		
Yes	80	40%
No	120	60%
Shift Work Experience	Mean = 5, SD = 3.8	-

Table III outlines the health status and lifestyle factors. The prevalence of diabetes among the participants was 25% (n = 50). Among those with diabetes, 60% (n = 30) reported regular use of glucometers, and the average HbA1c level was 7.5% (SD = 1.2). Regarding lifestyle factors, 30% (n = 60) reported engaging in regular physical activity, 20% (n = 40) were smokers, and 15% (n = 30) reported regular alcohol consumption. Additionally, 35% (n = 70) reported musculoskeletal issues.

Table III: Health status and lifestyle factors

Health Status	Number of Participants (n = 200)	Percentage (%)
Diabetes	50	25%
Regular Use of Glucose Meters	30	60% of diabetics
Average HbA1c Level	Mean = 7.5, SD = 1.2	-
Lifestyle Factors		
Regular Physical Activity	60	30%
Smoking Status	40	20%
Regular Alcohol Consumption	30	15%
Musculoskeletal Issues	70	35%

Table IV displays the logistic regression analysis results. Logistic regression analysis revealed that prolonged sitting (OR = 1.8, 95% CI: 1.2-2.7, p = 0.003) and shift work (OR = 2.3, 95% CI: 1.4-3.7, p = 0.001) were significantly associated with an increased risk of diabetes after adjusting for age, gender, and physical activity levels. Other factors such as smoking and alcohol consumption were not significantly associated with diabetes prevalence.

Table 4: Logistic regression analysis

Variable	Odds Ratio (OR)	95% CI	p-value
Prolonged Sitting	1.8	1.2-2.7	0.003
Shift Work	2.3	1.4-3.7	0.001
Physical Activity	0.7	0.4-1.2	0.18
Smoking	1.2	0.7-2.0	0.25
Alcohol Consumption	1.1	0.6-2.0	0.29

Discussion

The results of this study shed light on the significant relationship between work-related factors, particularly prolonged sitting and shift work, and the prevalence of diabetes among employees in Micro, Small, and Medium Enterprises (MSMEs). The findings are consistent with existing literature, emphasizing the critical impact of occupational factors on metabolic health.

A notable observation from this study is the prevalence of diabetes among participants, particularly those exposed to prolonged sitting and shift work. Specifically, the prevalence of diabetes was found to be 25% (50 out of 200 participants) in the overall study population. These results align with previous research that identifies sedentary behavior as a significant risk factor for developing metabolic disorders, including diabetes. Prolonged sitting has been associated with reduced muscle activity, leading to decreased glucose uptake and elevated blood glucose levels. This physiological mechanism likely contributed to the higher prevalence of diabetes observed in participants with sedentary job roles[11]. This is further supported by the meta-analysis conducted by Patterson et al[11], which established a clear link between sedentary behaviour and an increased risk of type 2 diabetes, highlighting the adverse effects of sedentary work environments.

Shift work also emerged as a significant factor associated with an increased risk of diabetes in this study. The prevalence of diabetes was 25% (20 out of 80 participants) among those engaged in shift work. Disruption of circadian rhythms due to shift work has been extensively documented as a contributor to hormonal imbalances, leading to impaired glucose metabolism, insulin resistance, and a heightened risk of diabetes[2,4]. The logistic regression analysis in this study underscores the significance of shift work as a predictor of diabetes, even after adjusting for confounding factors such as age, gender, and physical activity levels. Kecklund and Axelsson[12] discussed the broader health consequences of shift work, particularly insufficient sleep, which further exacerbates metabolic disruptions, increasing the risk of diabetes.

The demographic characteristics of the study population revealed that older age and lower physical activity levels were associated with a higher risk of diabetes. For instance, among participants aged 50 years and above, 50% (30 out of 60 participants) were diabetic, compared to 25% (20 out of 80 participants) among those younger than 50 years. Age is a well-established risk factor, with older adults more likely to experience impaired glucose metabolism due to physiological changes associated with aging[13]. Additionally, gender differences in diabetes risk were noted, with 26% of males (36 out of 140 participants) and 23% of females (14 out of 60 participants) being diabetic. Variations in fat distribution, hormonal regulation, and lifestyle behaviours contribute to these disparities[14]. These findings are consistent with the literature, which highlights the unique considerations and goals of diabetes care in older adults[13].

Lifestyle factors, particularly physical activity, played a protective role against diabetes in this study. Participants with higher levels of physical activity exhibited a lower prevalence of diabetes, with 18.3% (11 out of 60 participants) of active individuals being diabetic compared to 26.1% (39 out of 140 participants) among those with low physical activity levels. This aligns with existing evidence that regular physical activity enhances insulin sensitivity and improves glucose regulation[15]. However, integrating sufficient physical activity into the daily routines of employees in MSMEs remains a challenge due to work demands and sedentary job roles. The meta-analysis by Umpierre *et al*[15] underscores the importance of exercise volume in mitigating cardiometabolic risk factors, including diabetes, reinforcing the need for targeted interventions in workplace settings.

The implications of these findings are substantial for occupational health practices in MSMEs. Given the high prevalence of diabetes among workers exposed to prolonged sitting and shift work, there is a clear need for targeted interventions that promote healthier work environments. Workplace wellness programmes, ergonomic adjustments to reduce prolonged sitting, and more flexible shift schedules could play a crucial role in reducing diabetes risk. Patterson *et al*[11] suggest that interventions aimed at reducing sedentary behaviour and promoting physical activity are essential for improving metabolic health outcomes.

Limitations of the study

This study has several limitations that should be acknowledged. First, the cross-sectional design limits the ability to establish causality between work-related factors and diabetes prevalence. The reliance on self-reported data for assessing lifestyle factors, such as physical activity and sitting time, may have introduced recall bias, potentially affecting the accuracy of the findings. Additionally, the study was conducted within a specific population of MSME employees, which may limit the generalisation of the results to other occupational groups or settings. The sample size, while sufficient for identifying associations, may not have been large enough to detect more subtle effects or interactions between variables. Moreover, confounding factors such as diet, stress levels, and genetic predisposition were not thoroughly explored, which could have influenced the observed associations.

Conclusion

In conclusion, this study highlights the significant impact of occupational factors, particularly prolonged sitting and shift work, on the prevalence of diabetes among MSME employees. The findings underscore the need for targeted workplace interventions to mitigate the risk of diabetes, especially in sedentary and shift-based work environments. By promoting healthier work practices, such as reducing sitting time and optimizing shift schedules, employers can play a crucial role in improving the metabolic health of their workforce. Future research should focus on longitudinal studies to establish causal relationships and explore the effectiveness of specific workplace interventions. Additionally, a more comprehensive assessment of lifestyle and genetic factors could provide deeper insights into the complex interplay between work-related factors and diabetes risk. The outcomes of this study contribute to the growing body of evidence emphasizing the importance of addressing occupational health risks to prevent chronic diseases like diabetes.

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