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Type 2 Diabetes in Non-Sedentary Workers with Long Working Hours "An Evidence-Based Case Report"

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Abstract

Background: Type 2 diabetes mellitus is a serious threat to public health and the economy. Several reviews suggested that working long hours has a negative effect on health, especially metabolic disorders.
Objective: To determine whether long working hours increase the incidence of diabetes mellitus in non-sedentary workers.
Methods: A literature search using PubMed, Scopus, and Proquest was conducted based on the clinical question. Selected studies were critically reviewed for their validity using Oxford University's Center for Evidence-Based Medicine's etiological study criteria.
Result: Three relevant studies were found. A cohort study found that non-clerical workers and shift workers with long working hours had a significantly higher risk of developing diabetes with a Hazard Ratio (HR) of 2.28 (95% Confidence Interval [CI] 1.13-4.82). However, the dominant risk factor that may have influenced the outcomes could not be clearly identified. In contrast, a cross-sectional study found no significant association (p>0.05) between working overtime and diabetes prevalence among field workers. Another cross-sectional study showed that blue-collar workers with long working hours had a higher likelihood of prediabetes with an adjusted Odds Ratio (aOR) of 1.54 (95% CI 1.15-2.06). However, since this is a cross-sectional study, the causal relationship is uncertain.
Conclusion: Studies regarding the relationship between long working hours and an increased risk of type 2 diabetes mellitus in non-sedentary workers showed inconsistent and unclear results. Further evaluation is still needed to find more evidence on the health effects of long working hours on workers.
Keywords: diabetes mellitus, long working hours, non-sedentary workers

Abstrak

***Latar Belakang**: Diabetes melitus tipe 2 merupakan ancaman serius bagi kesehatan masyarakat dan perekonomian. Beberapa literatur menunjukkan bahwa bekerja dalam jangka waktu panjang berdampak negatif pada kesehatan, terutama risiko terjadinya gangguan metabolisme.*
***Tujuan**: Untuk menentukan apakah jam kerja panjang meningkatkan risiko kejadian diabetes melitus pada pekerja non-sedentari.*
***Metode**: Pencarian literatur menggunakan PubMed, Scopus, dan Proquest dilakukan berdasarkan pertanyaan klinis. Studi yang dipilih kemudian ditinjau keabsahannya secara kritis dengan menggunakan kriteria studi etiologi dari Oxford University's Center for Evidence-Based Medicine.*
***Hasil**: Ditemukan tiga studi yang relevan. Sebuah studi kohort menemukan bahwa pekerja non- sedentari dan pekerja shift dengan jam kerja yang panjang memiliki risiko lebih tinggi untuk menyandang diabetes dengan HR sebesar 2,28 (95% Interval Kepercayaan 1,13-4,82). Namun, penelitian ini tidak dapat mengidentifikasi dengan jelas faktor risiko dominan yang mempengaruhi hasil. Sebaliknya, penelitian lain yang merupakan studi potong lintang menemukan bahwa tidak ada hubungan signifikan (p>0,05) antara kerja lembur dan prevalensi diabetes di antara pekerja lapangan. Studi lainnya menunjukkan bahwa pekerja dengan jam kerja yang panjang memiliki kemungkinan lebih tinggi untuk menyandang prediabetes dengan aOR sebesar 1,54 (95% Interval Kepercayaan 1,15-2,06). Namun, hubungan sebab-akibat dalam penelitian belum dapat dipastikan karena jenis studi ini adalah potong lintang.*
***Kesimpulan**: Studi mengenai hubungan antara jam kerja yang panjang dan peningkatan risiko diabetes melitus tipe 2 pada pekerja non-sedentari menunjukkan hasil yang tidak konsisten dan kurang jelas. Telaah lebih lanjut masih diperlukan untuk mendapatkan lebih banyak bukti mengenai dampak kesehatan jam kerja yang panjang pada pekerja.*
***Kata kunci**: diabetes melitus, jam kerja yang panjang, pekerja non-sedentari*

Background

Type 2 diabetes mellitus is a serious threat to public health and the economy. Several reviews suggested that working long hours has a negative effect on health, especially metabolic disorders. It is estimated that 537 million people suffer from diabetes and will increase to 643 million in 2030 and to 783 million in 2045.[1] In Indonesia, data showed that the national prevalence of diabetes in 2021 is 8.5 percent or around 20.4 million people.[2]

Various factors can cause diabetes, including genetic factors, medical conditions such as hypertension, cardiovascular disorders, lifestyle including diet, obesity, smoking, and psychosocial stress factors.[3,4] Factors in workplace conditions are also considered to have an influence on the incidence of diabetes, either directly or indirectly. Several studies have shown that sedentary lifestyle, work stress, and shift work can increase the risk of diabetes.[5–7]

Several reviews show that working long hours (long working hours) has a negative effect on health, especially cardiovascular.[8,9] Workers with long working hours show that they are at work for a longer time (> 55 hours per week) and will be more exposed to psychosocial hazards, noise, chemicals, lack of lighting, and various other hazards.[8,10] According to regulation in Indonesia, it is stated that working time cannot exceed 8 hours a day and 40 hours for 5 working days. If it exceeds that amount, it is known as overtime with the rules that it can only be done for a maximum of 4 hours in 1 day and 18 hours in 1 week.[11,12]

In addition to psychological and cardiovascular impacts, long working hours are also considered to play a role in causing metabolic disorders. Related to this, this evidence-based case report aims to obtain evidence whether long working hour is a risk factor that increases the incidence of diabetes mellitus in non-sedentary workers.

Case Description

A 54-year-old man came to the clinic with chief complaints of weakness and had lost 3 kg in 1 month. The patient's drinking frequency is felt to increase and has made the patient also urinate frequently. The patient did not smoke and had no history of hypertension or heart disease. No one in the family has diabetes. Previously, the patient had not taken any type of diabetes medication. The results of fasting blood sugar examination was180 mg/dl.

The patient has been working as a security officer in the hospital since 5 years ago. Security working hours are divided into 2 shifts a day. In a week, the patient's working hour is 60 hours of work. In 1 shift, it consists of 3-5 workers who take turns supervising the entire work area and are on standby at certain posts. Prior to working at this location, the patient also worked as a security officer at another location with fewer hours. In the pre-work medical examination at the new place, there was no indication of metabolic disease in the patient's condition. The doctor tries to determine whether the condition experienced by the patient is an occupational disease.

For this reason, it is necessary to know the risk of diabetes in non-sedentary workers, and the clinical question for finding relevant literature is "Is non-sedentary workers with long working hours have a higher risk of developing type 2 diabetes mellitus than workers with standard/regular working hours?"

PICO in finding literature, namely:
P (*Population*) : Non sedentary Workers
I (*Intervention*) : Long working hours
C (*Comparison*) : Standard working hours
O (*Outcome*) : Type 2 Diabetes Mellitus

Methods

Literature search was conducted through PubMed, Scopus, and Proquest, carried out based on inclusion and exclusion criteria with keywords "diabetes mellitus OR type 2 diabetes mellitus OR diabetes OR blood glucose OR prediabetes OR glucose intolerance" AND "working hours OR overtime" AND "workers OR employees". The search strategy is presented in table 1.

For the population based on the type of work, adjustments are made according to the case or non-sedentary workers. The study must include the types of job categories and their analysis. The search strategy, results, inclusion and exclusion criteria are depicted in figure 1 below.

These studies that we found were critically reviewed using the criteria for evaluating validity, importance, and applicability using guiding questions for etiological studies from the Center for Evidence-Based Medicine, University of Oxford.

Table 1. Database Searching Strategy Finding

Database	Searching Strategy	Finding
Pubmed	(((((diabetes mellitus[MeSH Terms]) OR (diabetes[Title/Abstract])) OR (prediabetes[MeSH Terms])) OR (blood glucose[MeSH Terms]) (glucose intolerance[MeSH Terms])) AND (((working hours[Title/Abstract]) OR (overtime[Title/Abstract]))) AND ((workers[Title/Abstract]) OR (employees[Title/Abstract]))	61
Proquest	(Diabetes Mellitus) OR (Glucose Intolerance) OR (Blood Glucose) OR (Prediabetes)) AND (Workers OR Employee) AND (Working hours OR Overtime)	242
Scopus	((diabetes) OR (blood glucose) OR (Prediabetes) OR (Glucose intolerance)) AND ((working hours) OR (overtime)) AND ((Workers) OR (Employee))	437

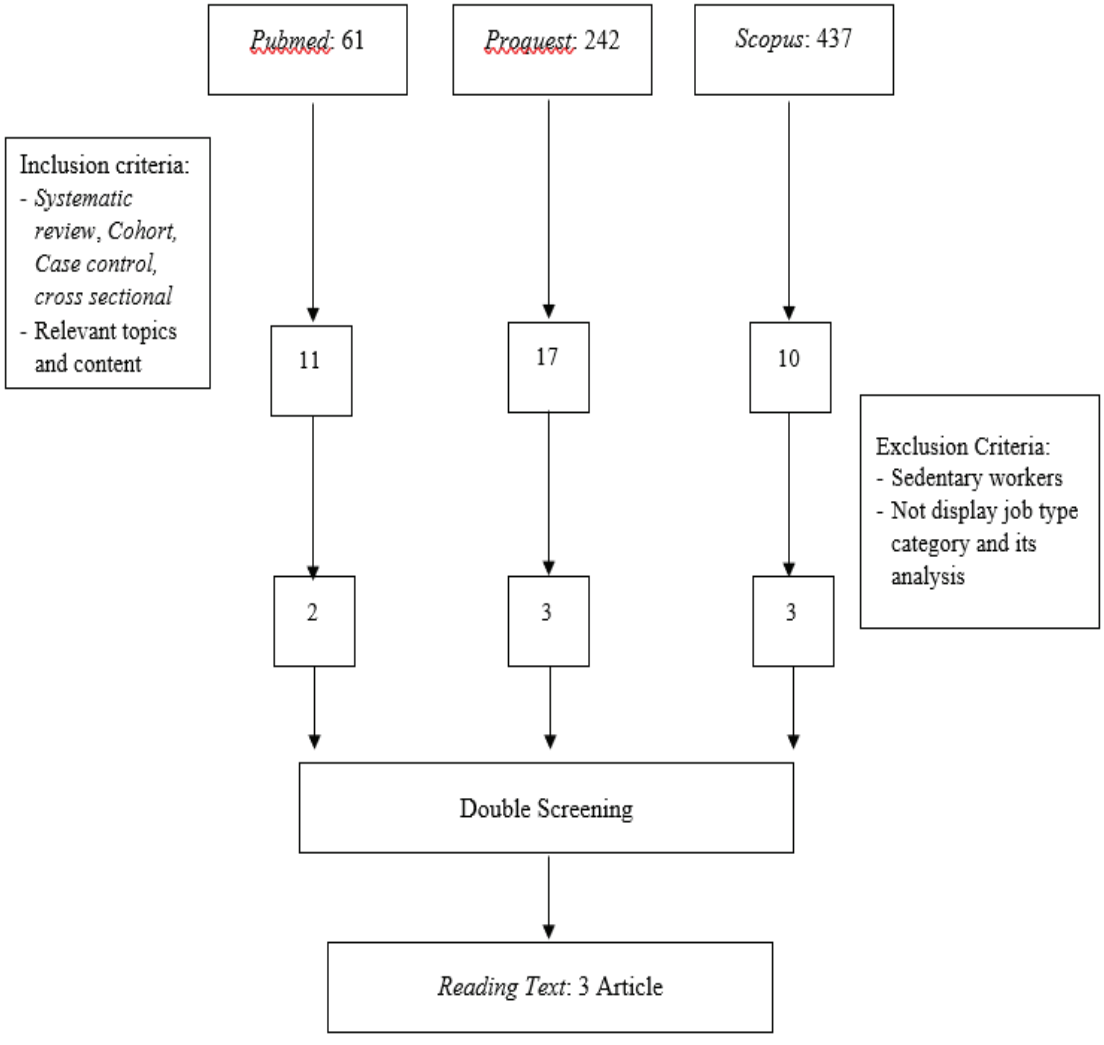

Figure 1. Literature searching chart

Result

Based on the results of the search, only 3 studies were found to address clinical questions, one of which was a cohort study, and the other 2 were cross-sectional studies. In the first study, Bannai et al[13] aims to assess the relationship between long working hours and the incidence of diabetes based on shift working hours. The authors conducted a prospective cohort study for 6 years in the employee population, with age criteria of ≥35 years. There is an outcome assessment for non-clerical work types. For the relationship between long working hours and diabetes, several analyzes were carried out by assessing other risk factors. From several analysis models, results were found that were not significant regarding the relationship between long working hours and diabetes in non-clerical and non-shift workers, with a Hazard Ratio (HR) value 0.90; 95% CI, 0.52–1.52. As for the relationship between long working hours and diabetes in non-clerical and shift workers, significant results were obtained from all analysis models, with an HR value of 2.28; 95% CI, 1.13–4.82. After carrying out the analysis, the results were obtained for NNH 12, which means that out of 12 non-clerical and shift workers who worked long hours, 1 worker was found to be suffering from diabetes.

Another study from Kuwahara et al[14] aims to assess the relationship between long working hours and the incidence of diabetes in the working population by considering other factors that influence it. This cross-sectional study involved 40,861 respondents, aged 15-84 years, with no history of cardiovascular disease, CVD, or psychiatric disorders. There is an outcome assessment for field work and non-field work types of work. There was an insignificant relationship between workers with long working hours (> 45 hours) and standard working hours, with p value = 0.07 after controlling for the factors age, smoking and BMI. The relationship between long working hours and diabetes based on other factors, including shift work, sleep duration, job category, alcohol consumption, leisure time, and history of diabetes, also showed that the respective results were not significant with p value > 0.05.

Study from Baek et al[15] aims to assess the relationship between long working hours and the incidence of prediabetes in the working population by considering other factors that influence it. After making adjustments based on age, educational status, economic status, lifestyle, history of diabetes, hypertension and hypercholesterolemia, in the male group there was a significant relationship between long working hours and the incidence of prediabetes (adjusted OR=1.22; 95% CI 1.03 to 1.46). Based on job category, the blue-collar worker group has a higher chance of developing prediabetes if they work more hours. In this group, a significant relationship was also found between long working hours and the incidence of prediabetes (adjusted OR=1.54 (95% CI 1.15 to 2.06). After analysis, the results were obtained for NNH 55, which means that from 55 blue-collar males who work long hours, found 1 worker is suffering from prediabetes. Summaries and critical assessments of each study are presented in Table 2 and Table 3.

Discussion

From the 3 studies obtained, 2 of them had a low level of evidence as they were cross-sectional studies. Meanwhile, another study, which was a cohort study, also could not elucidate the causal relationship between long working hours exposure in workers and the development of type 2 diabetes mellitus.

Experts suggest that prolonged working hours may influence health conditions by acting as a stressor or lead to chronic fatigue, leading to various consequences such as disturbances in circadian rhythms, including changes or insufficient sleep.[16] The causal relationship between long working hours and diabetes through stress can be explained by two factors: neuroendocrine dysregulation and accompanying lifestyle factors such as irregular eating patterns. Neuroendocrine dysregulation is a crucial mechanism where long working hours are considered a stress-inducing factor in individuals, subsequently inducing chronic activation of the hypothalamus-pituitary-adrenal axis and the sympathetic nervous system. This condition stimulates the release of sympathetic hormones and glucocorticoids like cortisol, leading to increased hepatic glucose production, decreased insulin secretion, insulin resistance, and visceral obesity.[3]

The definition of long working hours itself did not have a precise boundary from various sources, possibly due to differing regulations in each country. Bannai et al[13] and Kuwahara et al[14] studies mentioned that the threshold for long working hours was > 45 hours per week, while the Baek et al study suggested that the

Table 2. General description and characteristics of studies

	Bannai et al (2014)[13]	Kuwahara et al (2016)[14]	Baek et al (2019)[15]
Purpose	Determine the relationship between long working hours and diabetes incidence regarding shift work	Determine the relationship between long working hours and diabetes incidence among the workers population	Determine the relationship between long working hours and pre-diabetes incidence
Study design	Prospective cohort	Cross sectional	Cross sectional
Number of samples	3195 respondents	40.861 respondents	10.325 respondents
Subject	Civil servants	Workers from several companies	Workers population
Country	Japan	Japan	South Korea
Study duration	6 years	-	-
Long working hours' criteria	Long working hours: working hour ≥ 45 hours/week	Long working hours: working hour ≥ 45 hours/week	- Standard working hour: 40 hours per week - Overtime: Add 12 hours/week - Long working hours: >52 hours/week
Working hour's category	1. 35–44 hours/week 2. ≥45 hours/week	1. <45 hours/week 2. 45-79 hours/week 3. 80–99 hours/ week 4. ≥ 100 hours/ week	1. 40 hours/week 2. 41-52 hours/week 3. >52 hours/week
Job Categories	Non clerical workers	Field work dan non-field work	- White-collar - Pink-collar - Green-collar - Blue-collar
Outcome	DM : Fasting blood glucose ≥126 mg/dL	DM : Fasting blood glucose ≥ 126 mg/dl or HbA1c ≥ 6.5%.	Prediabetes: HbA1c Level between 5.7% and 6.4%

limit for long working hours was > 52 hours per week. This condition also differed from the regulations in Indonesia, where standard working hours did not exceed 40 hours per week. Overtime was permitted, with a maximum of 4 hours per day and 18 hours per week, resulting in a maximum limit of 58 hours per week. This was taken into consideration when analyzing the obtained results.

The research results indicating a significant relationship between long working hours and diabetes were found in the study by Bannai et al[13] for the category of workers with long working hours and shift systems. Although it had a statistically significant relationship, there was confusion regarding the dominant factor influencing whether it was due to shift work or if both factors had equal influence. Additionally, a limitation of this study was that the assessment of working hours was only conducted at the beginning of the study. This condition might introduce bias in determining the impact because there was no data on how long the respondents worked long hours and whether there were changes in working hours data during the course of the study.

In the study by Baek et al,[15] a significant relationship was observed between long working hours and the occurrence of prediabetes. This study also presented job category data, allowing for an analysis based on relevant job types. However, it was a cross-sectional study, meaning the assessment was conducted at a single point in time. Therefore, we could not definitively ascertain whether the observed prediabetes cases were caused by long working hours in the patients.

To the extent of the research conducted by the author, no studies with the same job characteristics as the case or specifically addressing non-sedentary work have been found. However, the author assumed that the job categories in this study closely approximated the intended meaning. In the Bannai et al[13] study, the category of non-clerical work was identified. This type of work could have a broader meaning, generally not being routine administrative office work and allowing for more flexibility in activities. In the Kuwahara

Table 3. Summary of critical study reviews

Criteria	Validity								Importancy	Applicability	
STUDY	Clearly defined groups of patients	Measured the same ways in both groups	Follow up study complete and long enough	Clear the exposure preceede the onset	A dose respons gradient	"Dechalenge-rechalenge" study	Consistency	Sense biology	HR/RR Score	The study results be extrapolated to patient	The patient's risk of the adverse outcome
Bannai, et al (2014)[13]	+	+	+	Unclear	-	-	-	+	HR = 2.28 (1.13–4.82) For non-clerical and shift workers HR = 0.90 (0.52–1.52) For non-clerical and non-shift workers	+	NNH = 12 (shift workers) NNH = -128 (non-shift)
Kuwahara, et al (2016)[14]	+	+	-	-	-	-	-	+	OR = 1.02 (0.55-1.92)	+	NNH = N/A
Baek, et al (2019)[15]	+	+	-	-	-	-	-	+	OR = 1.54 (1.15-2.06) For blue collar workers	+	NNH = 55

et al[14] study, job categories were divided into field work and non-field work. The author assumed that field work also involved activity flexibility and was therefore more suitable for the case. In the Baek et al[15] study, job categories included white-collar, pink-collar, green-collar, and blue-collar. Among these categories, blue-collar jobs were most indicative of increased physical activity. Therefore, the author assumed that this category was suitable for the case (non-sedentary). Sedentary work itself is a risk factor associated with metabolic disorders in individuals, including diabetes, so the author only searched for studies that specified job categories for further analysis.[17,18]

Conclusion

Studies regarding the relationship between long working hours and an increased risk of type 2 diabetes mellitus in non-sedentary workers showed inconsistent and unclear results. Further evaluation is still needed to find more evidence on the health effects of long working hours on workers.

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