Shift Work and Type 2 Diabetic Patients' Health

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Objective: *To compare the health between type 2 diabetic patients doing day work and shift work.*
Material and Method: *Two hundred and forty workers (120 day workers, 120 shift workers) aged 30-60 years were selected from the Social Security Clinic in five hospitals in Bangkok and its vicinity. All participants in the present study filled out the questionnaires that included questions for detecting hypoglycemic symptoms, Thai GHQ -12 questionnaires, and Suanprung Stress Test -20 questionnaires. Fasting blood glucose during the last six months, blood pressure during the last six months, and body mass index (BMI) were collected from the patient's medical records. All results were collected and compared between day workers and shift workers.*
Results: *Good glycemic control was significantly higher in day workers versus shift workers (28.3% vs. 15.8%). A higher proportion of shift workers had hypoglycemic symptoms and abnormal mental health compared to day workers.*
Conclusion: *Shift work may have a negative effect on type 2 diabetic patients' health. Consequently, type 2 diabetic shift-worker needs more attention from physicians and employers at their work place.*

Keywords: *Shift work, Type 2 diabetes, Health*

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At present, about one in five workers worldwide are employed on shift work[1].There are a lot of health effects that are caused by shift work such as sleep disorder[2], increased risk of coronary heart disease[3,4], gastrointestinal disorders[5], and adverse effect on mental health[6]. In addition, shift work may influence worker behavior such as change workers' dietary habit with a higher caloric content and increased coffee, alcohol, and tobacco consumption[7]. Many biological parameters follow a circadian rhythm, and shift work can interfere with disorders involving these parameters. The dose–response patterns of many drugs also follow a circadian pattern. Even if the shift worker takes a drug at the same time every day, the resulting biological effect can differ[5].

Type 2 diabetic patients can improve glycemic control by oral hypoglycemic drugs, insulin injection, regular exercise, and diet control, whereas shift work may effect their diabetic control. No data exist on type 2 diabetic patient's health working shifts.

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The objective of this cross-sectional analytic study was to compare the health of type 2 diabetic patients who did day work and health of type 2 diabetic patients who did shift work.

Health of type 2 diabetic patients included glycemic control, hypoglycemic symptoms, blood pressure control, body weight control, mental health testing by Thai GHQ -12 questionnaires, and level of stress measured by Suanprung Stress Test -20 questionnaires.

Material and Method

Two hundred and forty workers (120 day workers and 120 shift workers) aged 30-60 years treated as type 2 diabetic patients and attending the diabetes clinic for over 1 year were enrolled in the present study without randomization. Diabetes clinics were randomly selected from the Social Security Clinic in five hospitals in Bangkok and its vicinity.

All participants in the present study filled out the questionnaire about their demographic data, working conditions, previous medical history, detected hypoglycemic symptoms according to questions

adapted from Jennings[8], Thai GHQ-12 questionnaires for detecting abnormal mental health, and Suanprung Stress Test -20 questionnaires (divided into four stress levels: mild, moderate, high, and severe.)

A research assistant retrieved relevant information from the patient's medical records. These included information on fasting blood glucose during the last six months, blood pressure during the last six months, and body mass index (BMI).

Average fasting blood glucose during the last six months $\leq$ 130 mg/dl was defined as good glycemic control[9] and average blood pressure during the last six months < 130/80 mmHg was defined as good blood pressure control[9]. Body mass index (BMI) was calculated as weight in kilograms (kg) divided by height in meter square (m^2) and normal BMI was defined as BMI $\leq$ 25 kg/m^2[10].

Statistical method

The groups of day workers and shift workers were compared using the appropriate two sample technique by SPSS version 11.5 Software. Student t-test was used to compare means of continuous variables. In case of considerable skewness of data, the Mann-Whitney U test was used as appropriate. The Chi-square test of association was used to analyze binary variables. Individual tests were considered to be significant when $p < 0.05$.

The present study was approved by the medical ethics review board of the Faculty of Medicine, Chulalongkorn University.

Results

Table 1 shows the main characteristics of day and shift workers. There were no significant differences in age, duration of diabetes, number of patients treated with oral hypoglycemic agent, and years of work between the two worker groups. Shift workers had much more hours of work per day and days of work per week than day workers. Shift workers had less sleep time than day workers. Day workers could have their meals on time at work more often than shift workers.

Table 2 shows comparison of type 2 diabetic patient's health between day and shift workers. Good glycemic control was significantly different between day workers and shift workers (28.3% vs. 15.8%). A higher proportion of shift workers had hypoglycemic symptoms compared to day workers (42.5% vs. 26.7%). Workers who had abnormalities upon mental health test (Thai GHQ-12) were 14.2% and 37.5% for day workers and shift workers respectively, and the difference was statistically significant.

There were no significant differences in blood pressure control, body weight control and stress assessed by Suanprung Stress Test -20 questionnaires between the two groups.

Discussion

The results of the present study show that shift work may have an effect on type 2 diabetic patients' health such as blood sugar control, hypoglycemic symptoms, and mental health problems. The difference was found in the control of diabetes between the two worker groups. This may be caused by shift workers having less sleep time than day workers so circadian rhythm of shift workers was interfered. Disruption of circadian rhythm may influence cortisol secretion[11] and dose-response patterns of oral hypoglycemic agents[5].

Table 1. Characteristics of day and shift workers

	Day workers (n = 120)	Shift workers (n = 120)	p-value
Age (year), (mean $\pm$ SD)	46.65 $\pm$ 8.46	45.57 $\pm$ 8.48	0.28[a]
Duration of diabetes (year), (mean $\pm$ SD)	4.35 $\pm$ 3.60	4.51 $\pm$ 4.04	0.99[b]
Number of patients treated with oral hypoglycemic agent (%)	104 (86.7)	103 (85.8)	0.85[c]
Years of work, (mean $\pm$ SD)	12.77 $\pm$ 9.33	11.87 $\pm$ 8.82	0.50[b]
Hours of work per day, (mean $\pm$ SD)	8.16 $\pm$ 0.76	9.94 $\pm$ 2.40	<0.001[b]
Days of work per week, (mean $\pm$ SD)	5.86 $\pm$ 0.47	6.16 $\pm$ 0.62	<0.001[b]
Sleep time (hour), (mean $\pm$ SD)	7.38 $\pm$ 1.02	6.66 $\pm$ 1.37	<0.001[a]
Number of patients who had their meal on time at work (%)	87 (72.5)	59 (49.2)	<0.001[c]

a = Unpaired t-test, b = Mann-Whitney U test, c = Chi-square test

Table 2. Comparison of type 2 diabetic patient's health in day and shift workers

	Day workers (n = 120)	Shift workers (n = 120)	p-value
Average fasting blood glucose during last six months			
Number of patients who had good glycemic control (%)	34 (28.3)	19 (15.8)	0.02[c]
Symptomatic hypoglycemia			
Number of patients who had hypoglycemic symptom (%)	32 (26.7)	51 (42.5)	0.01[c]
Average blood pressure during last six months			
Number of patients who had good blood pressure control (%)	58 (48.3)	45 (37.5)	0.09[c]
Body weight control			
Number of patients who had normal BMI (%)	60 (50.0)	53 (44.2)	0.365[c]
Mental health assessed by Thai GHQ-12 questionnaires			
Number of patients who had abnormal mental health (%)	17 (14.2)	45 (37.5)	<0.001[c]
Level of stress assessed by Suanprung Stress Test -20 questionnaires			
Mild stress (%)	95 (79.2)	86 (71.7)	0.109[c]
Moderate stress (%)	18 (15.0)	30 (25.0)	
High stress (%)	7 (5.8)	3 (2.5)	
Severe stress (%)	0	1 (0.8)	

c = Chi-square test

Hypoglycemic symptoms were experienced by a higher proportion of shift workers than day workers. This may be caused by shift workers having more hours of work than day workers and shift workers could have their meals on time at work less frequently than day workers.

The results from the present study showed that shift work might be associated with an increased risk of abnormal mental health. This finding was consistent with Harrington et al[6] who documented that anxiety and depression may be an adverse effect on mental health from shift work.

In the present study, Suanprung Stress Test -20 questionnaires did not show an association with shift work. The most probable explanation is that Suanprung Stress Test -20 questionnaires is not a questionnaire designed to detect stress from work.

A recent study by Karlsson et al[12] demonstrated a significant increase in BMI among shift workers compared with day workers, but the present study found no difference. A possible explanation for this could be insufficient adjustment for possible confounding variables - for example, age and socioeconomic status.

In the present study, the authors found no association between shift work and blood pressure control. No previous study has compared blood pressure controlled between day and shift workers.

There are a few limitations in the present study. Firstly, in the present study the authors assessed glycemic control by average fasting blood glucose during the last six months because the Social Security Clinics in Thailand did not measure HbA_1c as a routine investigation in diabetes management. The second limitation is that the diagnosis of hypoglycemia was usually supported by laboratory blood glucose or by self-monitoring blood glucose (SMBG) but the authors diagnosed hypoglycemia by questionnaires. The authors used questionnaires because these groups of patients did not perform SMBG. The last limitation is that the present study was a cross-sectional design, in which the possibility of a healthy worker effect may exist and it is difficult to draw conclusions on causation. Therefore, there is a need to confirm the association between health of diabetic patient and shift work by means of a large-scale prospective cohort study.

In conclusion, shift work may have an effect on type 2 diabetic patients' health so shift workers should receive guidance from their physicians on how to adjust their oral hypoglycemic agents and insulin regimen. Shift workers should prepare themselves before going to work such as their medication and meals. Every work place where shift work is mandatory, health care personnel and employers need to pay more attention to shift workers.

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การทำงานเป็นกะกับสุขภาพของคนงานที่ป่วยเป็นเบาหวานชนิดที่ 2

ธนะวัฒน์ เจริญวนิชชากร, พรชัย สิทธิศรัณย์กุล, นรินทร์ หิรัญสุทธิกุล

วัตถุประสงค์*: เพื่อเปรียบเทียบสุขภาพของผู้ป่วยเบาหวานชนิดที่ 2 ที่ทำงานเฉพาะตอนเช้ากับทำงานเป็นกะ*

วิธีการศึกษา*: กลุ่มตัวอย่างประกอบด้วยผู้ป่วยเบาหวานที่ทำงานเฉพาะตอนเช้า และทำงานเป็นกะ กลุ่มละ 120 คน อายุ30-60 ปี จากผู้ป่วยที่มารับการรักษาที่คลินิกประกันสังคมของโรงพยาบาล 5 แห่ง ในเขตกรุงเทพมหานครและปริมณฑล ผู้เข้าร่วมการศึกษาทุกคนตอบแบบสอบถาม เพื่อประเมินการเกิดอาการน้ำตาลในเลือดต่ำ, แบบทดสอบ Thai GHQ -12เพื่อคัดกรองปัญหาทางสุขภาพจิต และแบบวัดความเครียดสวนปรุง 20 เพื่อวัดระดับความเครียด นอกจากนั้นยังมีการเก็บข้อมูลระดับกลูโคสในเลือดก่อนอาหารในช่วง 6 เดือนที่ผ่านมา, ระดับความดันโลหิตในช่วง 6 เดือนที่ผ่านมา และค่าดัชนีมวลกายจากเวชระเบียนของผู้ป่วย ข้อมูลที่รวบรวมได้ทั้งหมดได้นำมาเปรียบเทียบระหว่างผู้ป่วยเบาหวานที่ทำงานเฉพาะตอนเช้า และทำงานเป็นกะ*

ผลการศึกษา*: การควบคุมระดับน้ำตาลในเลือดของผู้ป่วยที่ทำงานเฉพาะตอนเช้าและทำงานเป็นกะมีความแตกต่างกันอย่างมีนัยสำคัญทางสถิติ ผู้ป่วยเบาหวานที่ทำงานเป็นกะมีอัตราส่วนของการเกิดอาการน้ำตาลต่ำและมีความผิดปกติทางสุขภาพจิตมากกว่าผู้ป่วยที่ทำงานเฉพาะตอนเช้าอย่างมีนัยสำคัญทางสถิติ*

สรุป*: จากการศึกษานี้ พบว่าการทำงานเป็นกะอาจจะมีผลต่อสุขภาพของผู้ป่วยเบาหวานชนิดที่ 2 ดังนั้นผู้ป่วยเบาหวานชนิดที่ 2 ที่ทำงานเป็นกะ ควรได้รับความสนใจมากขึ้นทั้งจากแพทย์ผู้ทำการรักษา และนายจ้างที่ที่ทำงาน*