Original Article

Estimating the Incidence of Prediabetes and Type 2 Diabetes among Taxi Drivers in Indonesia

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Abstract

Objective: Health problems among taxi drivers can affect their performance and increase the risk of accidents. The aim of this study was to determine the prevalence of dysglycemia and metabolic risk factors affecting taxi drivers in Jakarta to provide baseline information for programs to prevent type 2 diabetes mellitus (T2DM) in this specific population. **Methods:** This cross-sectional study involved 106 male taxi drivers from 1006 total taxi drivers in Jakarta, Indonesia. All drivers underwent a general medical interview, physical examination, and oral glucose tolerance test. **Results:** The prevalence of dysglycemia in the taxi driver population was 54.7% (29.2% prediabetes and 25.5% diabetes). Central obesity was identified in 74.1% of dysglycemic individuals ($P = 0.032$). In the final multivariate analysis, waist circumference was the dominant factor that predicted dysglycemia (odds ratio 0.8; 95% confidence interval 1.01–5.26; $P = 0.048$). **Conclusions:** There is a high prevalence of dysglycemia in taxi drivers in Jakarta compared with the prevalence of dysglycemia in Indonesia (29.9% prediabetes and 6.9% diabetes), of which waist circumference is the strongest predictor. Programs must be implemented to prevent T2DM in this population.

Keywords: Dysglycaemia, taxi driver, waist circumference

Introduction

Type 2 diabetes mellitus (T2DM) is a metabolic disorder characterized by an increase in blood glucose levels because of impaired insulin secretion and insulin resistance.[1] The global prevalence of T2DM in 2017 was 425 million people, which is estimated to increase to approximately 629 million by 2045.[2] Around 6.9% of the Indonesian population has T2DM, and this is likely to increase because of sedentary lifestyles combined with a high-calorie diet, smoking, and lack of exercise.[3,4] Cardiovascular diseases and metabolic disorders can affect anyone, including taxi drivers, in whom they could increase the risk of accidents, thereby compromising the safety of the public. A study in Ireland found that 75% of taxi drivers have an unfavorable lifestyle, as assessed by the number of steps they took per day.[5] Gany *et al*.[6] found that taxi drivers in South Asia took only an average of 3731 steps/day, compared with the World Health Organization recommendation of >8000 steps/day; this increased their risk of dysglycemia. A study by Siu *et al*.[7] including 3376 Hong Kong drivers reported that 272 (8.1%) and 337 (10%) new drivers were diagnosed with T2DM and prediabetes, respectively. In Iran, Izadi *et al*.[8] showed that 705 of 1903 drivers were hyperglycemic and overweight. The present study was required because of the lack of data related to T2DM prevalence and its risk factors in Indonesian taxi drivers. The study aimed to determine the prevalence of T2DM, prediabetes, and risk factors that affect this specific population to provide baseline information to alert health-care workers and taxi companies to institute programs to prevent T2DM.

Access this article online

Quick Response Code:

Website: www.jnsbm.org

DOI: 10.4103/jnsbm.JNSBM_109_19

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How to cite this article: Edi Tarigan TJ, Purwaningsih EH, Yusra, Abdullah M, Nafrialdi, Prihartono J, *et al*. Estimating the incidence of prediabetes and type 2 diabetes among taxi drivers in Indonesia. J Nat Sc Biol Med 2019;10:S150-3.

Methods

This cross-sectional study involved 106 male taxi drivers from 1006 total taxi drivers in Jakarta, Indonesia. The study was approved by the Ethics Committee of the Faculty of Medicine Universitas Indonesia. All individuals who participated in the study provided written informed consent. The inclusion criteria for this study were age 20–60 years and not having been diagnosed previously with prediabetes or T2DM. Exclusion criteria were a history of chronic diseases such as a chronic liver disease identified by history taking or previous laboratory examinations.

Personal data including name, age, family history of T2DM, and smoking history were collected for all drivers. In addition, a physical examination was carried out to determine their body weight, height, waist circumference, and blood pressure. All drivers had fasted for 8–12 h before blood was collected for laboratory tests including fasting blood glucose, 2-h postload 75-g glucose, alanine aminotransferase, creatinine, and estimated glomerular filtration rate (eGFR). Body mass index (BMI) was classified based on the Asia-Pacific criteria,[9] i.e., 18.5–22.9 kg/m^2 was classified as normal, 23–24.9 kg/m^2 as overweight, and >25 kg/m^2 as obese. Central obesity was defined as a waist circumference >90 cm.[9] Blood pressure was measured by sphygmomanometer (produced by Riester), and the criteria for hypertension were determined based on the criteria of the Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC 7).[10] Prehypertension was included as hypertension because it indicates early signs of blood pressure disturbance. The diagnosis of blood glucose disturbance in this study was made using the Indonesian Society of Endocrinology (PERKENI) 2015 criteria, i.e., T2DM was defined as a postload blood glucose level ≥200 mg/dL and prediabetes as a postload blood glucose level between 140 and <200 mg/dL or a postload blood glucose level <140 mg/dL and a fasting blood glucose level between 100 and <126 mg/dL. The results were analyzed using Statistic Package for the Social Sciences (SPSS) version 20 (IBM Corp, Armonk, NY, USA). Categorial data are presented as percentages. Testing of the significance of differences between two variables was performed using the Chi-squared test, and logistic regression analysis was performed to analyze the influence of the existing independent variables (age and waist circumference variable) on the dependent variables (incident of prediabetes and diabetes variable).

Results

Subject characteristics

The characteristics of the participants are shown in Table 1. All were men, with an average age of 46 years. Most participants were smokers (83.96%) and had central obesity (65%) with high BMI (overweight 12.3% and obese 87.7%). These data of central obesity are high compared to the Indonesian Basic Health Profile (RISKESDAS) 2013 (26.6%).[3] A high percentage of the participants (51.2%) suffered from renal impairment as assessed by eGFR (<90 mL/min/1.73 m^2). The majority of the participants (92.4%) also had high blood pressure.

Prevalence of dysglycemia in taxi drivers

In total, 106 participants were examined for fasting blood glucose and 2-h postload 75-g blood glucose; 54.7% of the taxi drivers were dysglycemic, of whom 29.2% had prediabetes and 25.5% had T2DM [Figure 1]. Impaired glucose tolerance (IGT) was more prevalent than impaired fasting glucose (IFG) in participants with prediabetes [Table 2].

Risk factors for prediabetes and type 2 diabetes mellitus

A bivariate analysis showed that waist circumference was significantly associated with prediabetes and undiagnosed T2DM ($P = 0.032$). For the multivariate analysis, all variables where $P < 0.25$ were entered in the final model and then were adjusted and tested by backward elimination. Prediabetes and undiagnosed T2DM were influenced by age and waist circumference, but waist circumference was more meaningful than age as a risk factor for developing prediabetes and undiagnosed T2DM (odds ratio [OR] 2.3; 95% confidence interval [CI]: 1.0–5.3; $P = 0.048$) [Table 3].

Discussion

This study revealed that there is a very high prevalence of undiagnosed dysglycemia in taxi drivers (>50%). The prevalence of dysglycemia in Hong Kong taxi drivers was reported to be 8.1% T2DM and 10% prediabetes,[7] and the prevalence of T2DM in drivers in Kashmir and Iran was around 7%.[11] Compared with these data, the prevalence of dysglycemia identified in this study of Jakarta taxi drivers was very high.

Most of the participants in this study had a waist circumference >90 cm, which was strongly associated with dysglycemia ($P = 0.032$). In Iran, it was found that 16.4% of taxi drivers had a waist circumference above the prevailing cutoff of 102 cm. That study also reported that taxi drivers who had >5 years of working experience had the greatest

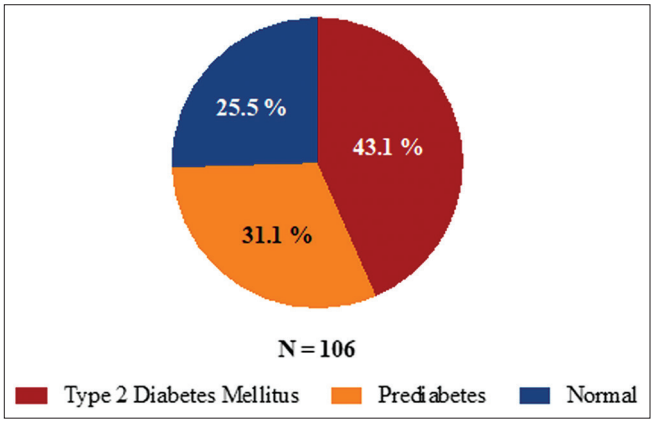

Figure 1: Proportion of dysglycemia in taxi drivers

Table 1: Participant characteristics

	Normal, *n* (%)	Prediabetes and diabetes, *n* (%)	Total, *n* (%)	*P*
Sex				
Male	48 (45.3)	58 (54.7)	106 (100)	
Age (years old)				
<46	25 (52.1)	21 (36.2)	46 (43.4)	0.101
≥46	23 (47.9)	37 (63.2)	60 (56.6)	
Smoking				
Yes	43 (89.6)	46 (79.3)	89 (83.9)	0.151
No	5 (10.4)	12 (20.7)	17 (16.1)	
Waist circumference (cm)				
>90	26 (54.2)	43 (74.1)	69 (65.1)	0.032*
≤90	22 (45.8)	15 (25.9)	37 (34.9)	
BMI				
18.5-22.9 (normal)	0	0	0	0.064
23-24.9 (overweight)	9 (18.8)	4 (6.9)	13 (12.3)	
≥25 (obese)	39 (81.2)	54 (93.1)	93 (87.7)	
eGFR				
≥90	20 (41.7)	31 (53)	51 (48.2)	0.210
89-60	25 (52.1)	20 (34.5)	45 (42.5)	
59-45	3 (6.2)	5 (8.6)	8 (7.5)	
44-35	0	2 (3.4)	2 (1.8)	
High blood pressure				
Yes	42 (87.5)	56 (96.6)	98 (92.5)	0.079
No	6 (12.5)	2 (3.4)	8 (7.5)	

*Significant if $P<0.05$. Comparative analysis using Chi-squared test. eGFR: Estimated glomerular filtration rate, BMI: Body mass index

Table 2: Distribution of blood glucose levels

	n (%)
Normal	46 (43.4)
IFG	14 (13.2)
IGT	19 (17.9)
Undiagnosed T2DM	27 (25.5)

T2DM: Type 2 diabetes mellitus, IGT: Impaired glucose tolerance, IFG: Impaired fasting glucose

Table 3: Final model of multivariate analysis of the relationship between waist circumference and age with prediabetes and undiagnosed diabetes mellitus

	OR	95% CI	*P*
Waist circumference (cm)			
≤90	Reference		
>90	2.3	1.006-5.256	0.048*
Age (years old)			
<46	Reference		
≥46	1.9	0.804-3.954	0.154

*Significant if $P<0.005$. OR: Odds ratio, CI: Confidence interval

waist circumference.[12] The prevalence of prehypertension and hypertension observed in the present study was very high (92%). This high prevalence is closely related to the poor lifestyle habits of taxi drivers, such as lack of physical activity, smoking, irregular working and sleeping hours, and high-calorie food intake.[5] In Japan, Nakamura *et al*.[13] reported a significant relationship between overtime work and increased BMI and abdominal circumference, and Nakanishi-Minami *et al*. found that irregularities in the sleep–wake cycle play a role in metabolic abnormalities in T2DM.[14] Our multivariate analysis also found that waist circumference was the strongest risk factor for the incidence of dysglycemia (OR 2.3; 95% CI: 1.0–5.3; $P = 0.048$). In a study of Oman adults, it was found that an abdominal circumference >94 cm doubled the risk of dysglycemia.[15] A study conducted in Japan also explained that central obesity has a closely related to be T2DM (relative risk [RR]: 2.8; 95% CI: 1.5–5.35).[16]

In the present study, the percentage of participants with IGT (17.9%) was higher than that with IFG (13.2%). This result differs from the data within the Indonesian Basic Health Profile (RISKESDAS) 2013, which reported 36.6% IFG and 29.9% IGT.[3] IFG and IGT represent the intermediate state of abnormal glucose regulation that exists between normal glucose tolerance and diabetes. Carnevale Schianca *et al*.[17] showed that fasting blood glucose had a sensitivity level of 19% and a specificity of 93% for the incidence of dysglycemia. Nathan *et al*.[18] noted that the outcomes for patients with IFG and IGT vary because 25% may develop diabetes, 50% may remain prediabetic, and 25% will return to normal within 3–5 years. Based on 2-year follow-up IGT data from RISKESDAS 2007, Mihardja *et al*.[19] reported that 7.2% developed T2DM, 47.8% retained IGT, 4.3% developed IFG, and 40.7% returned to normal. Carnevale Schianca *et al*.[17] noted that although both IFG and IGT are conditions of insulin resistance, IFG is dominated by hepatic insulin resistance and normal muscle insulin sensitivity while individuals with IGT

have normal to slightly reduced hepatic insulin sensitivity and moderate-to-severe muscle insulin resistance. It should be noted that the present study has some limitations, namely nutritional factors and physical activity were not strictly controlled, and the study population was smaller than those in the previous studies. Our suggestion is to continue the existing study to obtain cohort data and include the physical activity and nutritional status variables into one of the variables assessed.

Conclusion

The prevalence of undiagnosed dysglycaemia was high in taxi drivers in Jakarta, Indonesia. Healthy lifestyle and prevention programmes targeted to this specific population are needed to prevent T2DM. Taxi companies should develop specific exercises for their drivers during working hours and encourage their general physical activity.

Acknowledgments

This study was supported by Kementerian Riset Teknologi Dan Pendidikan Tinggi Republik Indonesia Grant 2018 (323/UN2.R3.1/HKP05.00/2018). The authors would like to thank the Integrated Laboratorium Team for their support in collecting blood samples and laboratory examinations. Our sincere thanks to all the taxi drivers who participated in this study.

Financial support and sponsorship

The 3rd ICE on IMERI committee supported the peer review and manuscript preparation of this article.

Conflicts of interest

There are no conflicts of interest.

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