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Metabolic Syndrome and 10-Year Cardiovascular Diseases Risk among Male Taxi drivers in 2016: A Cross-Sectional Study in Yazd, Iran

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ABSTRACT

Introduction: The evidence indicates that drivers -- including taxi drivers – are involved have high rates of metabolic syndrome and also have a higher risk of cardiovascular events than other occupations. Only few studies have been conducted to assess the prevalence of metabolic syndrome among urban taxi drivers. The aim of this research was to estimate prevalence of metabolic syndrome and risk of cardiovascular disease in the next 10 years among a group of Iranian male taxi drivers in Yazd.

Methods: In this cross-sectional survey, 120 male taxi drivers in Yazd, Iran in 2016 were selected using simple random sampling and studied to evaluate the prevalence of metabolic syndrome using Adult Treatment panel III criteria and 10-year risk of cardiovascular events by Framingham risk score. Statistical analysis was performed by SPSS software using the chi-squared test and Student's t-test.

Results: The prevalence of metabolic syndrome was 37.5%. Mean and standard deviation of number of MetS components was 2.09±1.30 among drivers. Hypertriglyceridemia was the most prevalent component of MetS. This study showed that 40% of drivers with MetS had an intermediate 10-year risk of cardiovascular events, and 4.4% of them had a high 10-year risk. The results of this study indicated that drivers with metabolic syndrome had a higher risk of cardiovascular events than drivers without MetS.

Conclusion: Based on the findings, the prevalence of metabolic syndrome and risk of cardiovascular events were high among Iranian taxi drivers in Yazd. In this regard, proper preventive programs should be conducted for early diagnosis and appropriate interventions are recommended.

Keywords: Metabolic Syndrome, Risk, Cardiovascular Disease, Iran

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Introduction

Metabolic syndrome (MetS), also known as syndrome X, is a combination of disorders including abdominal obesity, elevated level of fasting blood sugar and insulin resistance, increased level of serum triglyceride, hypertension, and low HDL-C level [1, 2]. Several definitions have been proposed by the World Health Organization (WHO), the International Disease Federation (IDF), and National Cholesterol Education Program (NCEP) for MetS. However, the third report of NCEP, called Adult Treatment panel III (ATP III) has been used widely as the current definition in the literatures [1, 3].

Age-adjusted prevalence of MetS among adults in the United States has been estimated from 24 to 25% [4] and the prevalence of this syndrome was reported 20 – 25% among populations of South Asia [5, 6]. In addition, the results of two recent systematic reviews showed that the overall prevalence of MetS in Iranian adults was 36.9% (95% CI: 32.7-41.2%) according to ATP III criteria and 34.6% (95% CI: 31.7-37.6%) based on IDF [7, 8].

This syndrome can increase the risk of morbidity of diseases such cardiovascular diseases, Type II diabetes, and dyslipidemia, stroke, and thus is a factor in early death [2, 9]. Thus, early diagnosis of MetS in high risk groups can prevent from its consequences.

Evidence indicated that prevalence of MetS among Iranian occupational drivers varied in the range of 26.1 - 35.9% [10-12]. However, the rates of MetS were estimated as 49.9% among Korean drivers [9] and 43.1% among Taiwanese drivers [13]. Moreover, the results of a study from Hong Kong reported that 26.8% of occupational drivers suffered from MetS according to IDF criteria [14]. In addition, Chen et al. found that 46.9% of Taiwanese professional drivers had a risk of higher than 10% for cardiovascular events based on the Framingham Risk Score (FRS) [13]. The FRS assesses the risk of cardiovascular events using risk factors including age, gender, systolic blood pressure (SBP), treatment of hypertension, total cholesterol, high-density lipoprotein cholesterol (HDL-C), and cigarette smoking [15]. Although the MetS [16, 17] or risk of cardiovascular events [18, 19] have been examined among occupational drivers, few studies were conducted on the risk of cardiovascular events especially among the taxi drivers [20-22]. To the best of our knowledge, few studies have been carried out to assess the prevalence of MetS especially among urban taxi drivers. Therefore, the aim of this study was to evaluate the MetS status and risk of cardiovascular events among a group of Iranian male urban taxi drivers in Yazd. Their unhealthy life style and their working conditions is characterized by numerous stress factors such as lack of physical activity due to working in a fixed position and long hours of work, irregular sleep habits and work shifts, stressful conditions and exposure to air pollution. Because of these factors, they are at high risk for catch cardiovascular disease.

Methods

This cross-sectional study was conducted among 120 male taxi drivers in Yazd, Iran in 2016. This research was approved by the Ethics Committee of Yazd University of Medical Sciences. All participants were selected by simple random sampling method using a sampling frame (based on a list of driver names provided by the taxi union). The sample size required for the study was calculated by considering confidence level equal to 95% and p= 0.26 from similar studies and d= 0.08, using the sample size formula for estimating the proportion. All participants signed informed consents form. The inclusion criteria were being male and having been employed for at least one year of employment as a taxi driver. Exclusion criteria, on the other hand, included lack of consent to participate in the study, and having a second job. Nine people were not included in the study because they had a second job or less than one year of work experience, so the sample selection was repeated randomly. Information including age, smoking status, and work experience (number of years) were collected.

Anthropometric and clinical examination

The age of participants was determined through self-reporting and the sample was grouped by age in ten-year intervals.

The participants' weights were measured using a portable digital scale (Omron Inc. Osaka, Japan). Height was also measured in a standing position using a stadiometer fixed on a straight wall to the nearest centimeter. Body mass index (BMI) was also calculated using the following formula: Weight (kg)/ height (m)^2.

Waist circumference (WC) was later measured using a non-elastic tape at midway between the lowest ribs and the iliac crest [(23)].

Then, blood pressure (BP) was examined on the right arm using a digital barometer (Omron Inc. Japan) after five minutes of rest in a sitting position. The measurements were repeated two times with at least two minutes of interval and the average of the two measurements was considered for analysis. Hypertension was defined as BP ≥ 140/90 mmHg and/or using medications for hypertension [(24)].

After 8 – 12 hours of fasting, blood samples of participants were collected for assessment of low-density lipoprotein cholesterol (LDL-C), high-density lipoprotein cholesterol (HDL-C), total cholesterol [(25)], triglyceride (TG), and fasting blood sugar (FBS). Blood glucose and lipids were analyzed using an AutoAnalyzer (Alpha classic, Iran).

The FBS ≥ 126 mg/dL and/or using medications for treating hyperglycemia were considered as diabetes type 2 [(26)].

Definition of the Metabolic Syndrome

All individuals were screened for MetS using the ATP III guidelines as the presence of three or more of the following components: WC > 102 cm; HDL-C level <40 mg/dL; TG level ≥150 mg/dL and/or medication use for treating hypertriglyceridemia; FBS ≥ 110 mg/dL and/or drug use for treating hyperglycemia; BP ≥130/85 mmHg and/or antihypertensive drugs [(15)].

Estimation of 10-year risk for cardiovascular events

For estimation of the 10-year risk for cardiovascular events, the Framingham risk score was used. Scoring algorithms included gender, age, total cholesterol, smoking status, HDL level, SBP, and treatment status. Then, three levels of 10-year risk were obtained as follow: low risk; < 10%, intermediate risk; 10-20 % and high risk; > 20% [(27)].

Statistical analysis

In order to analyze data, SPSS $_{16}$ software was applied. In this study, there was no missing data. The categorical variables were expressed as frequency or percentage, while continuous variables were presented as mean ± standard deviation (SD). The differences between continuous variables were analyzed by using independent t-test and chi-square test to compare the categorical variables. The significant statistical level was considered as $p < 0.05$. The prevalence of MetS and its components were later evaluated by ATP III criteria among all drivers and different age groups.

Results

The mean values of age and driving experience were respectively 46.73 ± 12.04 and 11.31 ± 8.07 years among all drivers. Table 1 shows the general characteristics of MetS versus non-MetS individuals.

Table 1. The general characteristics of Metabolic Syndrome (MetS) versus non-MetS participants

items	Individuals with MetS N= 45 Mean (SD) or n (%)	Individuals without MetS N= 75 Mean (SD) or n (%)	P-value
Age (year)	49.82 (12.39)	44.85 (11.44)	0.027*
Driving experience (year)	12.42 (8.84)	10.64 (7.55)	0.244
Smoking			
Yes	11 (24.4%)	4 (5.3%)	0.002*
No	34 (75.6%)	71 (94.7%)	
Diabetes type 2			
Yes	10 (22.2%)	4 (5.3%)	0.005*
No	35 (77.8%)	71 (94.7%)	
Hypertension			
Yes	14 (31.1%)	12 (16%)	0.052
No	31 (68.91%)	63 (84%)	
WC (cm)	106.00 (10.42)	94.71 (12.65)	< 0.001*
BMI (kg/m^2)	29.91 (3.70)	26.22 (3.50)	< 0.001*
SBP (mmHg)	131.78 (13.10)	122.65 (13.55)	0.001*
DBP (mmHg)	87.36 (10.33)	79.35 (12.74)	0.001*
FBS (mg/dl)	113.37 (39.60)	94.53 (24.80)	0.006*
TC (mg/dl)	203.48 (39.6)	183.67 (36.73)	0.006*
TG (mg/dl)	237.33 (102.47)	156.58 (81.94)	< 0.001*
HDL-C (mg/dl)	36.44 (4.69)	41.90 (7.06)	< 0.001*
LDL-C (mg/dl)	120.88 (36.54)	110.65 (35.28)	0.132

WC: waist circumference; BMI: body mass index; SBP: systolic blood pressure; DBP: diastolic blood pressure; FBS: fasting blood sugar; TC: total cholesterol; TG: triglyceride; HDL-C: high-density lipoprotein cholesterol; LDL-C: low-density lipoprotein cholesterol; SD: standard deviation.
* The P-values were calculated by Independent sample t-test or chi-square test.

The mean of age was significantly higher among drivers with MetS than individuals without ($p= 0.027$). Moreover, the mean values of WC, BMI, SBP, DBP (Diastolic Blood Pressure), FBS, TC, and TG were higher among MetS group in comparison with none-MetS group ($p< 0.05$). However, the mean HDL-C levels were lower among MetS group than non-MetS group ($p< 0.001$). In addition, there was no significant difference between the two groups for LDL-C levels and the rate of hypertension ($p> 0.05$). Meanwhile, the prevalence of smoking and diabetes were significantly higher among MetS than the non-MetS participants ($p= 0.002$ and 0.005, respectively).

The prevalence of MetS and its components based on the ATP III criteria among all drivers and different age groups are presented in Table 2 and Table 3, respectively.

Table 2. The prevalence of metabolic syndrome (MetS) and its components based on the ATP III

Criteria	Prevalence (%)
MetS	37.5
High WC	40.0
Low HDL-C	57.5
High TG	60.0
High FBS	15.8
High BP	35.8

WC: waist circumference; BP: blood pressure; FBS: fasting blood sugar
TG: Triglyceride; HDL-C: high-density lipoprotein cholesterol.

Table 3. The Prevalence of MetS and its components based on the ATP III criteria among different age groups

criteria	26-35 years old N=22	36-45 years old N=38	46-55 years old N=33	56-65 years old N=19	66-75 years old N=8	p-value
MetS	6 (27.3)	12 (31.6)	13 (39.4)	9 (47.4)	5 (62.5)	0.340
High WC	7 (31.8)	13 (34.2)	14 (42.4)	9 (47.4)	5 (62.5)	0.502
Low HDL-C	12 (54.5)	25 (65.8)	18 (54.5)	9 (47.4)	5 (62.5)	0.709
High TG	13 (59.1)	23 (60.5)	20 (60.6)	11 (57.9)	5 (62.5)	.999
High FBS	1 (4.5)	3 (7.9)	7 (21.2)	5 (26.3)	3 (37.5)	0.061
High BP	4 (18.2)	9 (23.7)	16 (48.5)	10 (52.6)	4 (50)	0.030*

Data expressed as n(%). WC: waist circumference; BP: blood pressure; FBS: fasting blood sugar; TG: triglyceride; HDL-C: high-density lipoprotein cholesterol.
*The p-values were calculated with the chi-squared test.

The most prevalent component of MetS was high TG and the least was high FBS. Although the results demonstrated no significant difference between different age groups for prevalence of MetS and its components including high WC, low HDL-C, high TG, and FBS levels, there was a significant difference for prevalence of high BP (p= 0.03) (Table 3).

Figure 1 shows the number of MetS components based on ATP III criteria in participants. The mean and standard deviation of number of MetS components was 2.09 ± 1.30 in the drivers.

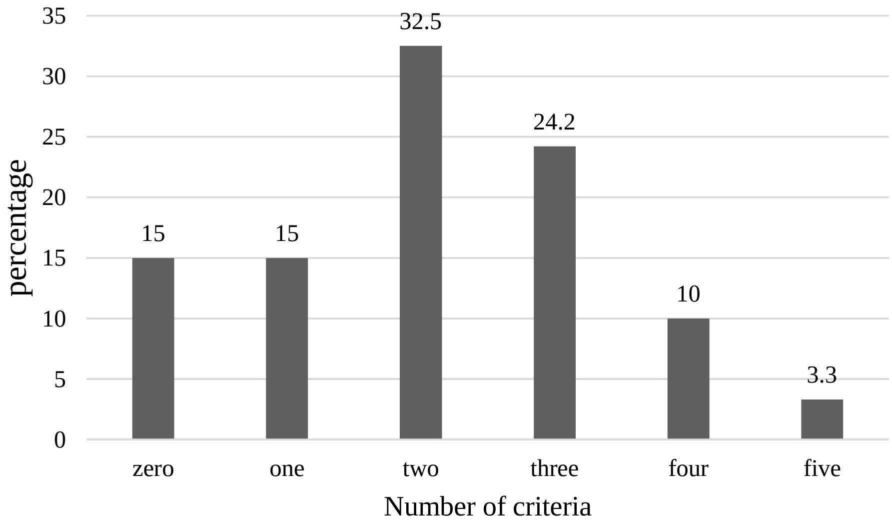

Figure 1. The number of MetS criteria based on the ATP III among all drivers.

According to Table 4, 40 % of drivers with MetS had intermediate and 4.4% of them had high 10-year risk for cardiovascular events. The low risk was also observed among other members of this group. On the other hand, the intermediate risk and low risk were found in 13.3% and 86.7% of none-MetS individuals, respectively. There was no participant with high risk in none-MetS group.

Table 4. The prevalence of 10-Year Risk of CVD in the subjects with and without MetS

	Individuals with MS N=45	Individuals without MS N=75	Total n(%) N=120	P*
Low risk	25(55.6)	65(86.7)	90(75)	
Intermediate risk	18(40)	10(13.3)	28(33.3)	p< 0.001
High risk	2(4.4)	0(0)	2(1.7)	

Data expressed as n(%). *The p-values were calculated by the chi-squared test.

Discussion

The findings of this study indicated that 37.5% of drivers suffered from MetS according to the ATP III criteria. This prevalence was higher than that of the general population in Iran and Yazd city [7, 8, 28]. Various studies have been conducted about assessment of MetS [10, 11] or risk of cardiovascular events [16, 18] among professional drivers. However, few researches have examined the risk of cardiovascular events among urban taxi drivers [20-22]. In addition, to the best of our knowledge, there has been no study on the prevalence of MetS among the urban taxi drivers, especially in Iran.

The results of some studies from Iran demonstrated that the rates of MetS based on ATP III criteria were 32.4% among the bus drivers in West Azerbaijan [17], 35.9% among bus and truck drivers in Kashan (12), and 26.1% among professional drivers in Shahrod [10]. Moreover, Mohebbi I et al. found that 30.5% of Iranian long-distance drivers had MetS according to IDF criteria in West Azerbaijan [11]. But, the rates of MetS based on ATP III criteria were reported as 49.9% among Korean bus drivers [19]. Siu S.C et al. also calculated the prevalence of MetS based on IDF criteria as 26.8% among the professional drivers in Hong Kong [14]. So far, some studies have identified several important reasons for high prevalence of MetS among drivers than general population. Lifestyle risk factors (such as smoking, lack of physical activity and unhealthy diet) and psychological reasons (such as high stress related to working conditions and irregular sleep habits) are some of these reasons [13].

Differences among reported prevalence of our study and other studies may be due to the use of different criteria for the diagnosis of MetS. Also, the studies mentioned above have examined bus or truck drivers, while our study focused on taxi drivers. Therefore, differences in work related conditions such as work hours and shift working, can justify differences in prevalence of MetS.

Based on the findings achieved from the present study, hypertriglyceridemia was the most common component of MetS among taxi drivers. Similarly, the high level of TG was the most prevalent component of MetS among Iranian bus and truck drivers in Kashan [12]. Conversely, central obesity and low level of HDL-C were the most common MetS components among Iranian occupational drivers in West Azerbaijan [11] and Shahrod [10]. respectively. In a recent review, abdominal obesity was reported as the most common component of MetS among commercial truck drivers [29].

The high prevalence of hypertriglyceridemia in our study may be due to high rate of cigarette smoking, diabetes and obesity.

While abdominal obesity was observed in 40% of drivers in the current study, the prevalence of central obesity was estimated as 19–74% among commercial truck drivers based on ATP III criteria in a recent review [29]. The results of some studies from Iran indicated that the rates of abdominal obesity according to ATP III criteria were 31.7% among bus and truck drivers in Kashan [12] and 25.2% among professional drivers in Shahrod [10]. Mohebbi et al. also reported that 50.5% of Iranian professional drivers suffered from central obesity according to IDF criteria in West Azerbaijan [11]. Another study from Korea indicated that the prevalence of abdominal obesity was 40.9% in bus drivers based on the cut-off values among Koreans [19]. Meanwhile, Siu S.C et al. found that 48.2 % of occupational drivers had central obesity in Hong

Kong according to Asian cut-off points [14]. As in the results of the above studies, we saw high prevalence of central obesity. This may be attributed to lack of physical activity and unhealthy eating habits.

The present study demonstrated that 35.8% of participants had high BP. Similarly, the studies of Saberi [12], and Mohebbi [11] estimated the rates of high BP among professional drivers as 42.9% and 39.8%, respectively. The findings of a recent review also indicated that 5–48% of commercial truck drivers suffered from hypertension [29]. Furthermore, the prevalence of hypertension was 57% among professional drivers in Hong Kong [14].

Nasri and Moazenzadeh found that Iranian taxi drivers had an increased hypertension risk in comparison with the control group (OR= 9.09, P< 0001) [30]. Isfahan Cardiovascular Research Centre also found that 19% of Iranian adults suffered from high BP [31]. So, the risk of high BP among Iranian taxi drivers is higher than the general population. The high prevalence of elevated blood pressure in taxi drivers, regardless of positive familial history of hypertension, may be related to their sedentary lifestyle, smoking, nutrition and stress in the working environment.

The difference between our study and other studies, may be attributable to the differences in the study population, hypertension diagnostic criteria, environmental impacts, and dietary habits.

It was further observed from the current study that 22.2% of participants with MetS had diabetes, whereas Saberi HR et al. indicated that 93.3% of Iranian occupational drivers with MetS suffered from diabetes in Kashan [12]. In addition, MetS has been known as an important predictive factor for risk of type 2 diabetes mellitus [32].

Prevalence of diabetes in our study was more than the prevalence reported by Saberi HR et al. The difference in results may be explained by genetic factors, level of physical activity, dietary habits, daily work hours, or other factors.

Findings of the present research showed that drivers with MetS had greater risk of cardiovascular events than the non-MetS group. In other words, 40% of participants in the MetS group had intermediate risk, 4.4 % had high risk, and the rest of drivers had low risk. On the other hand, 13.3% of drivers in non-MetS group had intermediate risk, while 86.7% of them had low risk. High risk was not observed in this group. Previous surveys reported that the risk of cardiovascular events is higher among professional drivers than people with other occupations [21, 33]. Similarly, in a study from Taiwan 46.9% of professional drivers had the risk≥ 10% for cardiovascular events [13].

MetS may have an effect on cardiovascular risk. People with MetS had a higher probability of developing cardiovascular disease, because each component of MetS is a known factor for the development of cardiovascular disease. The reason for the positive association between drivers and cardiovascular risk may be related to high BP, obesity, high blood glucose, dyslipidemia (high total cholesterol, low HDL-C and high TG) and factors related to MetS in taxi drivers (such as, unhealthy lifestyle, improper working environment and psychological reasons) [13]. In our study, for the reasons mentioned above, high risk of developing cardiovascular disease in people with MetS is justifiable.

In general, the higher prevalence of MetS and risk of cardiovascular events among taxi drivers may be associated with improper diet, sedentary lifestyles, job stress, sleep disorders, and long working hours [10, 12, 34]. The professional drivers have inactive life style, limited access to healthy foods, more work hours throughout the day and daily poor quality sleep. Such conditions can result in increased risk of general and abdominal obesity, diabetes mellitus, hypertension, hypertriglyceridemia, and lower level of HDL-C [34, 35]. Also, it was represented in literature that stressors can lead to more secretion of catecholamines and glucocorticoids and this in turn increases the levels of blood glucose, free fatty acids, TG, cholesterol, and decreased level of HDL-C [36].

The present survey was faced with several limitations. Initially, the sample size was small. The dietary habits, physical activity, and job stress were not evaluated. There was no control group of general population in this study to examine the accurate role of driving in risk of MetS or cardiovascular events. This research was finally a cross-sectional study which could not provide a casual association for MetS or cardiovascular events. Because of the fact that female drivers have not participated in this study, the results may not be generalized to this group of drivers.

Conclusion

The results showed a high prevalence of MetS and risk of cardiovascular events among taxi drivers in Yazd, Iran. Taxi drivers may need intensive medical risk reduction. In this regard, suitable programs and proper interventions are suggested for early detection of MetS and risk factors for cardiovascular disease and improvement of healthy lifestyle. In addition, more studies with larger sample size, especially cohort studies should be carried out for assessment of MetS status and risk of cardiovascular events among taxi drivers. Related factors including dietary habits, physical activity, and job stress should also be investigated.

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Conflict of interest

The authors declare that they have no conflict of interest.

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