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Original Article

Association between Metabolic Syndrome and Job Rank

Ramin Mehrdad, Gholamreza Pouryaghoub, Mahboubeh Moradi

Abstract

Background: The occupation of the people can influence the development of metabolic syndrome.

Objective: To determine the association between metabolic syndrome and its determinants with the job rank in workers of a large car factory in Iran.

Methods: 3989 male workers at a large car manufacturing company were invited to participate in this cross-sectional study. Demographic and anthropometric data of the participants, including age, height, weight, and abdominal circumference were measured. Blood samples were taken to measure lipid profile and blood glucose level. Metabolic syndrome was diagnosed in each participant based on ATPIII 2001 criteria. The workers were categorized based on their job rank into 3 groups of (1) office workers, (2) workers with physical exertion, and (3) workers with chemical exposure. The study characteristics, particularly the frequency of metabolic syndrome and its determinants were compared among the study groups.

Results: The prevalence of metabolic syndrome in our study was 7.7% (95% CI 6.9 to 8.5). HDL levels were significantly lower in those who had chemical exposure (p=0.045). Diastolic blood pressure was significantly higher in those who had mechanical exertion (p=0.026). The frequency of metabolic syndrome in the office workers, workers with physical exertion, and workers with chemical exposure was 7.3%, 7.9%, and 7.8%, respectively (p=0.836).

Conclusion: Seemingly, there is no association between metabolic syndrome and job rank.

Keywords: Metabolic syndrome; Insulin resistance; Hyperlipidemias; Risk factors; Exercise; Manpower; Prevalence

Department of Occupational Medicine, Faculty of Medicine, Tehran University of Medical Sciences, Tehran, Iran

Introduction

The global prevalence of metabolic syndrome has increased dramatically in the past decade due to the changes in the life style.[1,2] Metabolic syndrome, defined as high blood pressure, increased blood glucose and triglyceride levels, decreased high-density lipoproteins, and abdominal obesity, contributes to the development of cardiovascular disease, stroke, and diabetes mellitus.[3,4] Among the key factors for the metabolic syndrome, socioeconomic status and environmental factors are of great importance.[5-7]

Fast economic growth in developing countries has resulted in an increase in the rate of metabolic syndrome, and Iran is not an exception.[8] While the age-adjusted prevalence of metabolic syndrome in the USA is nearly 25%,[9] current studies show that the prevalence of metabolic syndrome in Iran ranges from 30% to 45%, based on the geographic location and the study

Correspondence to Mahboubeh Moradi, MD, Resident of Occupational Medicine, Faculty of Medicine, Tehran University of Medical Sciences, Keshavarz Blvd, Tehran, Iran
E-mail: mahboobehmoradi94@yahoo.com
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population.[10-13] This can impose a huge burden on the health care system of Iran that has limited resources. Therefore, it is important to understand the determinants of metabolic syndrome in the Iranian society, particularly the socio-environmental factors, as such studies are still lacking.

Evidence shows that the occupation of a person can influence the development of metabolic syndrome. A Korean study shows that shift work is significantly associated with metabolic syndrome in young women.[14] Physical activity and exertion, level of education, and the job rank can also have a significant influence on the rate of metabolic syndrome.[15,16] A large population-based study on Iranian long-distance drivers has shown that metabolic syndrome has a high prevalence in this group of people, although the study lacked a control group.[17]

Few studies have shown that chemicals and environmental toxicants can also contribute to the development of metabolic syndrome, particularly in the early-life period.[18,19] One study has shown that high level of heavy metals is also associated with the prevalence of metabolic syndrome.[20] However, the data regarding the association of chemical compounds and pollutants with metabolic syndrome is sparse.

We therefore conducted this study to determine the association between metabolic syndrome as well as its determinants and the job rank in workers of a large car factory in Iran. We hypothesized that metabolic syndrome has an inverse association with occupational physical activity but has a direct association with the exposure to chemical compounds and solvents in our study population.

Materials and Methods

All workers at a large car manufacturing company were invited to take part in a cross-sectional study conducted between October 2015 and September 2016. All the participants were invited to a university hospital for clinical work-up and laboratory measurements. A written informed consent was obtained at the beginning of the study from the participants. Those participants with incomplete data or working <5 years were excluded from the study. The protocol of this study was approved by the ethic committee of Tehran University of Medical Sciences.

Demographic, anthropometric and clinical data of the participants, including age, height, weight, and abdominal circumference were measured and recorded. Height was measured using an anthropometric scale with a maximum height of 2.2 m. Weight was measured using a Beurer mechanical scale (Beurer GMBH, Ulm, Germany) with a maximum capacity of 150 kg while the worker was wearing underwear and no shoes. The abdominal circumference was measured in the standing position while the participant was breathing normally without clothing in the abdominal region, using a 1.5-m flexible non-stretch tape measure. The abdominal circumference was measured midway between the costal margin and the iliac crest. Blood pressure was then measured after 5–10-min rest in a sitting position with a Riester mercury sphygmomanometer (Rudolf Riester GMBH, Jungingen, Germany) from the right arm. The clinical data collected included self-declaration of the presence of hypertension, diabetes mellitus, and dyslipidemia.

After an average 10-hr overnight fasting, a venous blood sample was obtained from the antecubital vein to measure serum fasting blood sugar (FBS), high-density lipoprotein (HDL) cholesterol, and triglyceride.

Metabolic syndrome was defined according to ATPIII 2001 criteria[3] if the participant had three out of the five following criteria: (1) abdominal circumference

Table 1: Comparison of the elements of the metabolic syndrome among the study groups. Values are mean (SD).

Characteristics	Total (n=3949)	Office workers (n=1084)	Physical exposure (n=1969)	Chemical exposure (n=896)	p value
Age (yrs)	37.3 (4.9)	38.6 (5.1)	36.9 (5.0)	36.3 (4.2)	<0.001
Weight (kg)	82.7 (11.9)	82.3 (11.7)	82.9 (12.0)	82.7 (11.9)	0.455
Height (cm)	174.8 (6.2)	174.3 (6.4)	174.9 (6.1)	175.1 (6.3)	0.007
BMI (kg/m^2)	27.0 (3.4)	27.1 (3.3)	27.1 (3.5)	26.9 (3.4)	0.607
Abdominal circumference (cm)	93.4 (8.9)	93.8 (8.9)	93.2 (9.0)	93.1 (8.6)	0.116
FBS (mg/dL)	84.0 (17.1)	85.0 (20.5)	83.7 (16.1)	83.5 (14.5)	0.091
Triglyceride (mg/dL)	149.9 (85.0)	154.5 (83.5)	147.2 (80.6)	150.1 (95.5)	0.074
HDL (mg/dL)	42.9 (10.4)	43.1 (10.2)	43.2 (10.3)	42.2 (10.5)	0.045
SBP (mm Hg)	113.9 (10.0)	114.0 (10.3)	114.1 (10.0)	113.3 (9.7)	0.114
DBP (mm Hg)	74.8 (6.9)	74.9 (6.9)	75.0 (6.9)	74.3 (6.8)	0.026

BMI: Body mass index; DBP: Diastolic blood pressure; FBS: Fasting blood sugar; HDL: High-density lipoprotein

>102 cm, (2) blood pressure ≥130/85 mm Hg or being treated with antihypertensive drugs, (3) serum HDL cholesterol level <40 mg/dL or receiving treatment for low HDL, (4) serum triglyceride ≥150 mg/dL or being treated for hypertriglyceridemia, and (5) baseline fasting blood sugar (FBS) ≥110 mg/dL, being a known case of diabetes mellitus or being treated with antiglycemic drugs.

Based on the job rank, the workers were divided into three groups: (1) office workers—those who worked in the administrative buildings of the company with minimum physical activity and no exposure to chemicals, (2) workers with physical exposure—those who worked in the mechanical section of the company and had tasks with exertion, and (3) workers with chemical exposure—those who worked in the painting sections and had exposure with chemicals and solvents with a moderate physical activity during work.

Statistical Analysis

IBM SPSS Statistics for Windows®, ver 21.0 (Armonk, IBM Corp, NY, USA) was used for data analysis. Categorical variables were described by frequency and percentage and were compared among the study groups using χ^2 test. Continuous variables were expressed as mean (SD) and were compared among the study groups using one-way analysis of variance (ANOVA). A p value <0.05 was considered statistically significant.

Results

Data of 3949 of 3989 workers who were invited to participate in this study were analyzed. The participants aged between 23 and 73 years. The mean age of the administrative workers was significantly (p<0.001) higher than the other groups. The mean serum HDL level was significantly lower in those who had chemical exposure. The mean diastolic blood pressure was significantly higher in those who had mechanical exposure. Other study variables were not significantly different among the study groups (Table 1).

The frequency of those with low HDL level was significantly (p=0.011) higher in

Table 2: Prevalence of metabolic syndrome and its determinants among the study groups. Values are frequency (%).

Characteristic*	Total (n=3949)	Office workers (n=1084)	Physical exposure (n=1969)	Chemical exposure (n=896)	p value
High abdominal circumference	629 (15.9)	172 (15.9)	323 (16.4)	134 (15.0)	0.616
Diabetes mellitus	38 (1.0)	12 (1.1)	20 (1.0)	6 (0.7)	0.576
Low HDL	1296 (32.8)	329 (30.4)	639 (32.5)	328 (36.6)	0.011
Hypertriglyceridemia	1529 (38.7)	450 (41.5)	750 (38.1)	329 (36.7)	0.067
Hypertension	459 (11.6)	128 (11.8)	241 (12.2)	90 (10.0)	0.23
Metabolic syndrome	304 (7.7)	79 (7.3)	155 (7.9)	70 (7.8)	0.836

HDL: High-density lipoprotein

workers with chemical exposure. Although the frequency of workers with hypertriglyceridemia was higher in the administrative group, the difference was not significant (p=0.067). Metabolic syndrome was observed in 304 (7.7%, 95% CI 6.9% to 8.5%) of studied participants. The prevalence of metabolic syndrome in the office workers, workers with physical exertion, and workers with chemical exposure was 7.3%, 7.9%, and 7.8%, respectively (p=0.836; Table 2). Although the observed differences were statistically significant, most of them were not clinically important.

Discussion

In the present study, we investigated the association between metabolic syndrome and the job rank in a car manufacturing company. Based on our findings, there was no difference between the job rank groups regarding metabolic syndrome. However, the frequency of workers with low HDL levels was significantly higher in workers with chemical exposure.

The overall prevalence of metabolic syndrome in our study was 7.7%, which was actually much lower than that reported in other studies performed in general Iranian population. The prevalence of metabolic syndrome in Tehran Lipid and Glucose Study was 30.1%, almost four times that we found.[10] The reported prevalence of metabolic syndrome in Iran ranges from 10% to 60%.[13] The low prevalence of metabolic syndrome in our study might be due to the "healthy worker effect;" the workers were routinely selected from young and strong individuals, went under periodical medical examination, and sports facilities were provided for them in their workplace, regardless of their job rank. Furthermore, our study included only male participants and this can also influence our results.

Another reason for the observed low prevalence of metabolic syndrome in our study was probably the age of the participants. The prevalence of metabolic syndrome increases by age.[21-23] The mean age in our study was 37 years. Therefore, a comparison with an age-matched control group from general population could help to determine if occupational factors could influence the development of metabolic syndrome.

The prevalence of metabolic syndrome was not different among the studied groups, although we expected to see more cases of metabolic syndrome in those with less physical exertion. We could not find any reasons for this observation in the literature; however, there could be several reasons for this finding: first, all the work-

ers lived in a similar setting despite the difference in their task. Second, this might be due to the automatization in the industry; the tasks that had more physical exertion in the past, now have less exertion. As stated above, periodical medical examinations at the workplace can intervene in the development of metabolic syndrome in some of the workers. Finally, this might have happened due to chance.

The mean BMI in all groups was >25 kg/m^2. There were some individuals in the mechanical work group with a high BMI and metabolic syndrome. This might be due to their monotonous task as well as high-fat diet (as stated by some of these workers during the study interview).

None of the parameters of metabolic syndrome was different among the study groups except for low HDL, which was significantly more prevalent in the workers with chemical exposure. Some experimental evidence shows that chemical exposure can cause non-alcoholic fatty liver disease and disturbed lipid metabolism.[24,25] Level of exertion in the occupation is also an important factor for the development of metabolic syndrome among workers. In a German study comparing workers with a sedentary occupation and those with more exertion within their job, those with a sedentary work style had a significantly higher rate of metabolic syndrome.[16] On the other hand, one study showed that the risk of metabolic syndrome decreased in workers who met the physical activity recommendations.[26] In a Korean study showing a prevalence of metabolic syndrome of 13.5%, the risk factors for metabolic syndrome among office workers included previous health problem, less knowledge of metabolic syndrome, higher BMI, smoking, and physical inactivity.[27] Despite the above-mentioned studies, our findings did not show any difference among the groups regarding the prevalence of metabolic syndrome. On the other hand, the differences observed were not of clinical significance and the observed statistical significance came from the large sample size. Furthermore, these differences might be abolished after adjustment for covariates.

TAKE-HOME MESSAGE

- The prevalence of metabolic syndrome has increasing dramatically in the world.
- Evidence shows that the occupation of a person may influence the development of metabolic syndrome.
- Based on our findings, there was no difference between the job rank groups and metabolic syndrome.
- The prevalence of low HDL levels was significantly higher in workers with chemical exposure.

This current study had some limitations. As this study was performed on male workers working in a car company, the results of our findings cannot be generalized. Moreover, there are various occupational differences among workers that can influence their lifestyle and physical activity that are too difficult to be studied separately. We could only categorize the workers based on their main job rank, although we were aware of the differences within each job rank. We did also not categorize the workers based on their work shifts, a known parameter in the development of the metabolic syndrome.[14,28] Finally, we did not get a full history of smoking or alcohol use as many workers were reluctant to answer these questions.

In conclusion, the prevalence of metabolic syndrome in our study was 7.7%. We found no association between metabolic syndrome and the job rank. However, the prevalence of workers with low HDL levels was significantly higher in those with chemical exposure. Future studies can shed light over the probable association between occupational exposures and met-

abolic syndrome.

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