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Address: 1 Kraljice Natalije Street, 11000 Belgrade, Serbia
☎ +381 11 4092 776, Fax: +381 11 3348 653
E-mail: srparhiv@bvcom.net, Web address: www.srpskiarhiv.rs

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Yahya Pasdar[1], Mitra Darbandi[2], Parisa Niazi[3], Behrooz Hamzeh[4], Seyed Mostafa Nachvak[1], Akbar Barzegar[5,†]

Risk Factors of Metabolic Syndrome Among Food Suppliers

Фактори ризика метаболичког синдрома код снабдевача храном

[1]Department of Nutritional Sciences, Research center for environmental determinacies of health, School of Public Health, Kermanshah University of Medical Sciences, Kermanshah, Iran
[2]Research center for environmental determinacies of health, School of Public Health, Kermanshah University of Medical Sciences, Kermanshah, Iran
[3]Department of Nutritional Sciences, School of Public Health, Kermanshah University of Medical Sciences, Kermanshah, Iran
[4]Department of Public Health, School of Public Health, Kermanshah University of Medical Sciences, Kermanshah, Iran
[5]Department of Occupational Health Engineering, School of Public Health, Kermanshah University of Medical Sciences, Kermanshah, Iran

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† **Correspondence to:**
Akbar BARZEGAR
Kermanshah University of Medical Sciences, School of Public Health
Dolat Abad, Isar Square, Kermanshah, Iran
E-mail: **barzegarakbar@gmail.com**

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SUMMARY

Introduction/Objective As a risk factor for chronic diseases, metabolic syndrome is increasing at an alarming rate. The prevalence of metabolic syndrome varies according to lifestyle and occupation in different populations.
The present study aimed to determine the prevalence of metabolic syndrome and its components in food suppliers.
Methods A total of 112 food suppliers were randomly selected from all around the city. Data collection tools included demographic, physical activity, and food frequency questionnaires. Body Composition was measured using Bio-Electrical Body Analyzer. 5ml fasting blood sample was taken from participants to assess lipid profile, blood sugar, insulin, and liver enzymes. Data were analyzed using Chi-Squared, Kolmogorov-Smirnov and ANOVA tests.
Results Participants' mean BMI was 27.1±3.9 kg/m^2, 43.6% were overweight, and 26.4% were obese. Consumption of vegetables was less and meats more than recommended amounts. The prevalence of metabolic syndrome was 45.5% (51 people), which increased with aging (p=0.02). Among factors causing metabolic syndrome, the most common was Waist–Hip Ratio (WHR)>0.09 (72.7%), followed by high triglyceride and low HDL.
Conclusions In this study, the prevalence of metabolic syndrome among food suppliers was higher than the world average and other countries. WHR (or obesity) was found the most important risk factor for metabolic syndrome. To reduce risk of metabolic syndrome, changing dietary consumption habits and increased physical activity are recommended to whom whit high risk and sedentary occupations.
Keywords: Metabolic syndrome, food Suppliers, Body Mass Index, risk factors

САЖЕТАК

Увод/Циљ Метаболички синдром (МС) као фактор ризика хроничних болести је у алармантном порасту. Учесталост МС варира зависно од начина живота и врсте занимања.
Циљ овог рада је био да се одреди учесталост МС и његових компоненти код снабдевача храном.
Методе Од свих снабдевача храном у граду рандомизовано је издвојено 112. Прикупљени су подаци: демографски, о физичкој активности и врсти исхране. Грађа тела је одређена *Bio-Electrical Body Analyzer*-ом. Од испитаника је узето по 5 мл крви ради одређивања липодног профила, шећера, инсулина и ензима јетре у крви. Подаци су анализирани χ^2, Колмогоров-Смирновљевим и Фишеровим тестом.
Резултати Индекс телесне масе испитаника био је 27.1±3.9 kg/m^2. Било је 43,6% са повећаном телесном масом, а 26,4% гојазних. У исхрани је поврће коришћено мање, а месо више од препоручених количина. Учесталост метаболичког синдрома је била 45,5% (51 испитаник) и расте са старењем (p=0,02). Најчешћи узроци метаболичког синдрома су: Однос струк-кукови (ОСК), потом висока триглицеридемија и ниска HDL-холестеролемија.
Закључак Учесталост МС код снабдевача храном је већа од светског просека. ОСК (или гојазност) је најважнији фактор ризика за МС. За све са високим ризиком и седантерним послом ради умањивања ризика МС препоручује се промена начина исхране и повећање физичке активности.
Кључне речи: метаболички синдром; индекс телесне масе; фактори ризика, снабдевачи храном

INTRODUCTION

Metabolic syndrome (MS) is a series of metabolic disorders and cardiovascular diseases (CVD) and diabetes type II risk factors, including central obesity, insulin resistance, lipid disorders, and hypertension . MS increases the risk of cardiovascular diseases and diabetes type II twice and five times, respectively [1]. Several factors can affect the incidence of MS, including genetic and environmental factors such as lifestyle, regular exercise, diet, and smoking [2]. The prevalence of MS is increasing at an alarming rate.

Other studies have shown that job can also affect the incidence of MS [3]. A number of recent studies have shown that the prevalence of obesity and MS is different in different occupation groups. The prevalence of MS was reported 15% among administration employees of oil industry, 17.5% in bank clerks, and 56.6% among firefighters [3-5]. In the Unites States, the prevalence of MS among

food serving or food Suppliers workers and those in transportation has been reported higher compared to other occupations [3].

An interesting point recently addressed in some studies was easy access to prepared food outside home, which further increases their consumption [6]. To taste and look better, more fat is added to the food in restaurants and fast food outlets. Thus, their consumption is associated with adverse health risks, including increased risk of overweight, obesity, diabetes, insulin resistance, low quality diet, and MS [7]. In recent years, consumption of high TFA-content foods has adversely affected people's health. Adverse effects of this fat in plasma lipoproteins increase Low-Density Lipoproteins (LDL), and decrease Lipoprotein (LP) and High-Density Lipoproteins (HDL) [6].

Therefore, studying people that routinely deal with industrial and ready-made foods can produce important and interesting results. Considering varying prevalence according to jobs, and also since no study has yet been conducted in the country to assess the prevalence of MS and diet among people working in food supply, this study aims to determine the prevalence of MS and its components among such workers.

METHODS

This cross-sectional study was conducted in 2015 on 112 all-male workers in 30–65 years age range working in patisseries, sandwich shops, restaurants, pizza and doughnut outlets, lamb liver kebab shops, and lamb head and offal cookeries. Participants were randomly selected from among those with more than 3 years' experience in their current jobs.

Study questionnaires included demographic, physical activity and Food Frequency Questionnaire (FFQ). Demographic questionnaire contained questions on age, education, work history, smoking, and daily, weekly, and monthly frequency of consumption of fried and barbequed foods.

Participants' normal food intake was assessed using FFQ, whose validity and reliability had been confirmed in some local studies [8]. FFQ contains a list of 168 food items and standard portion size. Amounts of foods, as recommended portion size, were converted into daily units. According to Food Guide Pyramid recommended by the Ministry of Health, recommended number of units per day for each food group was as follows: bread and cereals 6–11 units, fruits 2–4, vegetables 3–5, meats and pulses 2–3, milk and dairy products 2–3, and miscellaneous little.

To assess participants' level of physical activity, International Physical Activity Questionnaire (IPAQ) whose validity and reliability had been confirmed in Iran was used [9]., and participants were classified according to Total Met scores found based on instructions provided by this questionnaire, so that over the past 7 days, Met-min/week less than 600 meant low physical activity, Met-min/week equal to 600 moderate physical activity, and Met-min/week reaching 3000 meant intense physical activity.

Participants' body composition was measured using Avis 333 Body Analyzer system in terms of weight, height, Body Fat Mass (MBF), Percentage Body Fat (PBF), Soft Lean Mass (SLM), Total Body Water (TBW), and Body Mass Index (BMI), Body Impedance, Body Protein, Minerals, Lean Body Mass, and Waist Hip Ratio (WHR). Height was measured using tape measure in standing position by the wall, without shoes, and with shoulders heels and buttocks touching the wall at 1 cm precision. WHR for normal and obese upper body are defined by WHO (WHR>0.9 for men). According to WHO criteria, BMI≥30 is considered obese, and 25<BMI<29.9 overweight . Systolic (SBP) and diastolic blood pressures (DBP) were measured using a calibrated OMRON digital brachial sphygmomanometer.

With prior knowledge of participants, and to assess blood factors such as fasting blood sugar (FBS) and lipid profile including TG, LDL, HDL, and T.Chol, and insulin and liver enzymes (ALP, ALT, AST), 5 ml of fasting blood was drawn from each participant, and after serum separation, kept frozen at -40 °C, which were then sent to the laboratory under same conditions. Auto-analyzer RA1000-RAXT was used to measure fasting blood sugar, Technicon (Ireland) RA-XT and standard kits from Pars Company, to measure lipid profiles using photometric method and Monobind kit. Insulin level measured using ELISA reader, and a Biosystems Company kit. RA-1000 Auto-analyzer was used to measure liver enzymes.

Insulin resistance (HOMA-IR) and beta cell function (HOMA-% β) calculated by applying following formulas [10]. For the conversion of fasting glucose units from mg/dl to mmol/l, the number was multiplied by 18.

HOMA-IR = [FPI (mIU/L) × FPG (mmol/L)]/22.5

HOMA-%β = [20×FPI (mU/L))/(FPG (mmol/L) – 3.5]

MS was defined according to the criteria of the third report of National Cholesterol Education Program/Adult Training Program (NCEP/ATP III) in 2005 [11].

According to the current ATPIII criteria, the presence of 3 of the following 5 criteria is necessary to be considered as metabolic syndrome:

1. TG ≥ 150 mg/dl or receiving medication for high triglyceride,
2. HDL cholesterol < 40 mg/dl in men and less than 50 in women,
3. Blood pressure ≥ 130/85 mm/hg or receiving medicinal treatment for hypertension,
4. Fasting Plasma Glucose [FPG] ≥ 100 mg/dl or receiving medication for high FPG,
5. Waist Hip Ratio: Waist Hip Ratio more than 0.9cm in men and more than 0.85cm in women.

Data were analyzed using Chi-square test to determine the relationship between the prevalence of MS and age groups, Kolmogorov-Smirnov test to verify normal distribution of data, ANOVA to compare mean values in three age groups, and Tukey post hoc for comparison of pairs in SPSS-16 software. P<0.05 was considered significant.

RESULTS

This study was conducted on 112 all-male food Suppliers with a mean age of 43.4±9.1 years, of whom only 18 (16.1%) had university education and the rest had high school diploma or below, and 69 (61.6%) had more than 10 years of work experience. 80 (71.4%) had low to moderate physical activity and the rest were highly active. Thirty (26.9%) reported daily smoking or hookah use.

Among participants, mean weight and BMI were 80.8±13.5 kg and 27.1±3.9 kg/m2, respectively. Mean WHR , PBF and SLM were 0.9±0.06, 26.1±4.9 percent and 54.6±7.6 kg.

Mean protein and minerals were found 11.9±1.6 kg and 4.6±0.7 kg, respectively. Mean systolic and diastolic blood pressures were 125±17.2 mmHg and 81.5±10.8 mmHg, respectively. Mean TG and total cholesterol were 177±6.2 mg/dl and 196.1±35.9 mg/dl, respectively, and fasting blood sugar was 81.2 ±15.7 mg/dl (table 1).

Table 1. Study variables in participating food Suppliers.

Variables		Min	Max	Normal Range	Mean±S.D
Lipid profile	TG (mg/dl)	70	490	200>	177±6.2
	T.C (mg/dl)	145	307	200>	196.1±35.9
	LDL (mg/dl)	70	149	130>	170.7±20.1
	HDL (mg/dl)	30	65	35<	40.1±7.5
Blood Sugar	FBS (mg/dl)	66	200	70–110	81.2±15.7
Insulin	(µIU/ml)	0.3	15	0.7–9	4.2±3.1
HOMA-IR	Unit	0.07	2.89	2.5 ≤	0.81±0.60
HOMA-β	Unit	-2.30	67.95	-	16.35± 15.23
Liver enzymes	AST (U/L)	4	48	< 45	24.9±9.8
	ALT (U/L)	6	47	< 45	25.2±9.8
	ALK-P (U/L)	82	317	40–306	180.6±57.5
Blood Pressure	Systolic (mmHg)	90	175	120	125±17.2
	Diastolic (mmHg)	58	113	80	81.5±10.8

Mean consumption of meats and protein products was found 4.97±1.4 units/day, which was higher than recommendation level, and mean vegetable consumption was 2.46±1.15 units/day, which was less than recommended amount (table 2).

Table 2. Daily consumption of food groups in food Suppliers.

Food groups (Serving/day)	Mean±SD	Daily recommendation
Bread and Cereals	7.47±3.61	6–11
Meats	4.97±1.4	2–3
Dairy products	4.07±2.93	2–3
Fruits	2.91±1.30	2–4
Vegetables	2.46±1.15	3–5

Table 3. Consumption of food according to type of cooking in subjects

Used frequency	Grilled or steamed n (%)	Fried n (%)
Every day	10 (8.9)	11 (9.8)
3 to 5 days per week	12 (10.7)	28 (25)
1 to 2 days per week	32 (28.6)	53 (47.3)
1 to 2 times a month	43 (38.4)	15 (13.4)
Never	15 (13.4)	5 (4.5)

2.7% of participant showed elevated level of HOMA-IR (2.5≥ HOMA-IR) and insulin resistance ($p<0.05$). Significant positive correlation observed between TG and HOMA-IR ($p<0.05$). However negative correlation found between BMI and WHR with HOMA-B ($p=0.04$ and $p=0.05$ respectively).

In this study, 25% of participants consumed fried foods 3-5 days per week, 10.7% used kebabs or steamed food, and 9.8% used fried foods every day (table 3).

According to BMI classification, 48 (43.6%) participants were overweight, and 29

(26.4%) were obese. The prevalence of MS was found 45.5% (51 participants). Among factors causing MS, the most common was WHR>0.9cm, found in 80 (72.7%) participants, followed by triglyceride>150mg/dl and HDL<40mg/dl (figure 1). In body composition components, WHR showed a significant relationship with MS (p=0.003). The prevalence of MS was 30.4% in age group <40 years, 51.4% in 40-49 age group, and 61.3% in age group ≥50years, and the difference between age groups was statistically significant (p=0.02).

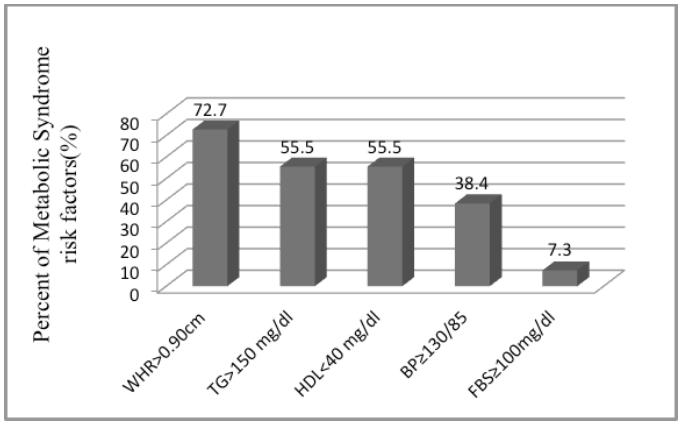

Figure 1. Frequency of MS risk factors in the food suppliers.

The prevalence of MS showed an increase with increasing consumption of fried foods (p=0.06), but showed no significant relationship with other cooking methods (p=0.16).

DISCUSSION

According to the literature very few studies have reported a high prevalence of MS in food Suppliers. In the present study, the prevalence of MS was found more than 40%, which was relatively high compared to other studies conducted in Iran. The various studies in Iran of the prevalence of MS from 22.5 to 55.6% have reported [4,12,13]. In a study conducted on firefighters in Tabriz, the prevalence of MS was higher compared to the present study, which was believed to be due to their stressful job. However, may have been due to the difference in study population, since occupation was not considered in these studies.

In other countries, different prevalence rates have been reported for MS in different occupations, including 7.5% in radiologists and 17.5% in bank clerks in Brazil. A low prevalence was reported in European countries including France, but a higher prevalence was reported in China compared to Iran, which may have been due to the older study population [3,14-16]. Compared to various countries in the world, Iran has a high prevalence of MS, which may be due to occupation of participants in the present study that were all shopkeepers with little daily physical activity. More importantly, because of their jobs, participants had easier access to ready-made and high-fat foods (or generally foods that do not comply with principles of healthy diet). In the United States, the prevalence of MS among food serving or food Suppliers workers and those in transportation has been reported higher compared to other occupations [7].

As well as the difference in the prevalence of MS reported in various studies, factors affecting MS have also been reported differently. In America, the most common risk factor was reported abdominal obesity and low HDL-C [17], and in China, the most common was found high blood pressure [18]. In a study, mean BP, BMI, WHR, and triglyceride were significantly higher in participants with MS compared to those without, but their HDL-C was lower [19]. In the present

study, the most common risk factor was WHR>0.9cm, followed by high triglyceride and low HDL-C, which may have been due to a lack of physical activity and greater accumulation of fat around the waistline. High starch consumption in the form of bread and rice can also increase triglyceride and abdominal obesity.

People with wrong food habits more frequently suffer obesity. Thus, perhaps one of the causes of obesity is improper dietary pattern. In this study, consumption of meats and miscellaneous groups was high, and consumption of vegetables and fruits was low. More extensive studies investigating the relationship between dietary pattern and MS, including a study on Korean adults, have shown that consumption of fruits and dairy products is associated with reduced risk of MS[20]. A study by NJ Bodor in New Orleans showed that easier access to ready-made foods in restaurants and food outlets (especially in workers), increased risk of obesity in these people [21].

Using healthy methods of cooking such as boiling, grilling and steam cooking was less common among the studied subjects. High consumption of fraying foods which may increase risk of overweight, obesity and may lead to cardiovascular diseases was very common. Trans fatty acids production during frying may increase risk of cancer and coronary heart diseases [21,22].

A study in U.S showed high consumption of restaurant and buffet foods increased risk of obesity in people . Indicated a relationship between easy access to local restaurant foods and diet and high BMI [23]. In a longitudinal study, Jayane et al. reported that once a week consumption of restaurant food significantly increased likelihood of overweight compared to those that did not use restaurant foods at all. Moreover, buying food for the family from restaurants once a week also increases mean percentage of body fat and incidence of CVD [24]. Frequent consumption of ready-made foods by adults is associated with increased BMI and body weight and increased body weight affects insulin resistance over time and metabolic outcomes [25,26]. Comparison of the present study results to other studies showed the undeniable effect of frequent consumption of ready-made and restaurant foods on increased BMI, body fat, and incidence of chronic diseases.

Obese people have significantly higher levels of triglyceride, glucose, and systolic and diastolic blood pressures compared to normal weight people, and obesity is significantly related to their food habits. Furthermore, the relationship of BMI and food habits with cardiovascular risk factors has been demonstrated [25]. Thus, given the effect of lifestyle (including physical activity) and especially food habits, special attention should be paid to people's diet, especially in people working in food outlets and have to have their meals at work. A healthy lifestyle with a balanced diet, consumption of more fruits and vegetables, adequate physical activity, regular aerobic exercise, keeping the right weight and weight loss is the best strategy for preventing obesity and MS, which should be observed by most people.

CONCLUSION

The present study showed a high prevalence of MS among workers in food Suppliers, and the prevalence increased with aging. In the study population, obesity was considered a risk factor for

incidence of MS, and WHR was found the most common risk factor. Another notable result was low consumption of fruits and vegetables and high consumption of meats in participants due to easier access to meat. A high prevalence of MS is an important predictor of cardiovascular diseases. Thus, workers in food outlets should receive appropriate dietary recommendations, and periodic medical examination and health check.

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