Metabolic syndrome and intake of some dietary components in Iranian adult women

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ABSTRACT: Factors including insulin resistance, abdominal obesity, blood lipids disorders and hypertension constitute the metabolic syndrome that is affected by people's dietary intake. Although the relationship between different aspects of dietary components and metabolic syndrome has investigated, some dietary components that play roles in metabolic syndrome have been contradictory. So, the aim of present study is evaluating the relationship between intake of some dietary components (i.e., egg, garlic and hydrogenated oils) and metabolic syndrome in Iranian adult women. In this case-control study, 130 women (30-60 years) suffering from metabolic syndrome were selected as cases and 130 unaffected patients referred to clinics of Shiraz University of Medical Sciences as controls were selected. General characteristics and dietary intakes were assessed using the general and the semi-quantitative food frequency questionnaires, respectively. Chi-square, t-test and multivariate logistic regression were used for statistical analysis. Very low or lack of egg intake (OR 1.8 and CI 95% 1 to 3.1), lack of garlic intake (OR 1.9 and CI 95%: 1.1 to 3.5) and hydrogenated oil intake (OR 2.1 and CI 95%: 1.2 to 3.8) were found as the most important independent risk factors for metabolic syndrome (P <0.05). Given the importance of the intake of some food components in affecting or preventing from metabolic syndrome, the planners need to pay more attention to promoting the culture of healthy dietary intake in community, especially in women.

Keywords: Dietary components, metabolic syndrome, Women, Iran

INTRODUCTION

Insulin resistance, abdominal obesity, hypertension, blood lipids disorders and cardiovascular diseases among adults are risk factors that constitute the metabolic syndrome (Reaven, 1988). Metabolic syndrome increases the risk of cardiovascular diseases (Lakka et al. 2002) and diabetes (Hanson et al. 2002). In addition, people suffering from metabolic syndrome are at a higher risk of mortality induced from cardiovascular diseases and all the other causes of mortality (Ford, 2005; Sundstrom et al. 2006). Cross-sectional and prospective studies have reported different figures on the prevalence and incidence of this syndrome but they vary depending on the definition used (Lorenzo et al. 2006; Cameron et al. 2004). Using the ATP III criteria, the highest global incidence and prevalence of metabolic syndrome is reported in American Indians, with 60% in women and 45% in men 45 to 49 years (Fauci et al. 2008; Ford, 2004). In general, the prevalence of metabolic syndrome in Asian countries is higher than other countries especially those in Europe (Kim et al. 2004). Prevalence of metabolic syndrome is also high in women. According to the National Health and Nutrition Examination Survey (NHANES) in 2000, more than a quarter of American women (29%) are suffering from this syndrome (Sonnenberg et al. 2005). The rate of metabolic syndrome is also high in developing countries (Ghassemi et al. 2002). A high prevalence of metabolic syndrome among population of women in Iran was reported in 2003 (women: 42% and men: 24%; the overall prevalence: 33.7%) (Azizi et al. 2010). Metabolic syndrome is a multifactorial disorder (Vega, 2001) and most of its components are associated to lifestyle factors such as weight, diet and physical activity (Yoo et al. 2004). Although the relationship between many aspects of diet and components of metabolic syndrome has been studied (Azadbakht et al. 2005; Esmaillzadeh et al. 2008; Song et al. 2005 ), the effect of some of the dietary components in producing this syndrome has yielded contradictory results. Therefore, objective of this study is identifying the relationship between intake of some
dietary components including eggs, hydrogenated oils, and garlic and metabolic syndrome in Iranian adult women.

METHODS AND SUBJECTS

In this case-control study, 130 women between 30-60 years suffering from metabolic syndrome as cases and 130 unaffected patients referred to clinics of Shiraz University of Medical Sciences as controls were selected. Three clinics of Shiraz University of Medical Sciences randomly selected. First, women referring to these clinics lead to the study's questioner by the clinic's internist, with the test tabs of the same reference laboratory (Motahari Laboratory). Then, according to the test tabs and the ATP III criteria, women suffering from the metabolic syndrome were selected as the cases. These criteria included three or more of the following items: abdominal obesity ≥ 88 cm (based on waist circumference), triglycerides ≥ 150 mg/dL, HDL cholesterol < 50 mg/dL, blood pressure ≥ 130/85 mmHg, and fasting blood glucose ≥ 110 mg/dL. The same numbers of unaffected women from each clinic were selected as controls. Clinics were located in different places in Shiraz city and thus were representative of different socioeconomic levels. Criteria for entering the cases included the symptoms of metabolic syndrome and being 30 to 60 years old and not having a history of heart disease or myocardial infarctus and cancer, having a six month history of diabetes, high blood pressure or cholesterol, and taking medications of these diseases, following a special diet or changing a diet, and lack of consent for entering the study. The entry criteria for the controls included not having the symptoms of metabolic syndrome and the other criteria mentioned for the cases. Age, marital status, education level, employment status, and number of children were assessed using the general questionnaire.

To evaluate the dietary intake, the semi-quantitative food frequency questionnaire (FFQ) designed in the fourth stage dietary cohort in lipid and glucose study of Tehran was used by which the usual dietary intake of the individual during the last year was evaluated. FFQ is a list of 148 food items along with a standard size of each food item. Reliability and validity of this questionnaire has assessed in Tehran (Esmailizadeh et al. 2008). The participants were asked to report the frequency at which they consumed each item depending on its size during the last year. Although the frequency of food consumption during the last year was under consideration, depending on the type of the item, the frequency of consumption by day, week and month was also obtained. The size of each food was converted to grams using household measures. Food classification was done in Tehran, like to Tehran’s lipid and glucose study that was the first study in which food items were classified into 11 predefined food groups based on similarity of their nutrients and previous studies. The participants' weight was measured with minimal clothing without shoes using SECA floor analog scales (Seca) Model 760, made in Germany, and with accuracy of 100g. The height was measured by a wall-mounted tape measure with an accuracy of 0.5 cm following the standard instruction. Waist circumference was measured using a non-elastic tape with an accuracy of 0.1 cm without imposing any pressure to the body surface. The slimmest waist area was determined when the individuals were at the end of the normal expiration. To measure blood pressure, the participants were asked to rest for 15 minutes. Then, the blood pressure was measured twice in a sitting position from the right arm of the participants with a 5-minute interval using a standard Mercury thermometer which had different measures of cuff depending on the size of the arm circumference. Blood lipids (triglycerides, HDL cholesterol) and fasting blood glucose were assessed via the individual’s test papers and the ATP III criteria. After data collection, the statistical software Statat11SE and Tehran’s lipid and glucose study computer software program (Nutritionist3) were used for data entry and analysis. To assess the relationship between dietary components and metabolic syndrome, the mean and standard deviation of dietary intake was calculated and analyzed by one-way ANOVA. Finally, the significant dietary components intake in metabolic syndrome and some potentially confounding factors entered a multiple logistic regression model and the final independent factors were determined using the backward method. The significance level was α = 0.05.

RESULTS

It was found that the abdominal obesity (97.7%), low HDL cholesterol (73.8%), and high systolic blood pressure (73.1%) were the most common disorders observed in women suffering from the metabolic syndrome (Table 1). According to the results obtained, employment status (P = 0.013), educational level (P = 0.030), overweight (P = 0.020), number of children (P <0.0001), whole-grain intake (P = 0.038), fruit and natural juices (P = 0.021), green leafy vegetables (P = 0.035), yellow (P = 0.001) and other vegetables (P = 0.063), legumes (P = 0.005), low-fat dairy products (P = 0.033), fish (P = 0.016), hydrogenated oils (P <0.0001), egg (P = 0.021), garlic (P = 0.001) and Salt (P < 0.0001) were significantly associated with metabolic syndrome. Then, other potential confounding factors were entered the multiple logistic regression model. As it is common in case-control studies, in performing the multiple regression analysis, the mean of the control group was split to appropriate and inappropriate groups for division purposes. The regression analysis showed that very low or lack of egg intake, lack of garlic intake and hydrogenated oil intake were the most important independent risk factors for metabolic syndrome that the proportion of the chance of metabolic syndrome in women without
intake of egg and garlic was 1.8 and 1.9 times higher than those receiving these components, respectively, and 2.1 times higher in women with intake of hydrogenated oils compared to those with lack of intake (Table 2). Due to the fact that the mean of egg intake in the control group was 7.62 gram, the intake lower than this amount or lack of intake were considered as a risk factor.

<table>
<thead>
<tr>
<th>Components of the metabolic syndrome</th>
<th>Cases</th>
<th>Controls</th>
</tr>
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<tbody>
<tr>
<td>Waist Circumference ≥88 cm</td>
<td>127 (97.7%)</td>
<td>91 (70%)</td>
</tr>
<tr>
<td>Fasting Blood Glucose ≥ 110 mg/dL</td>
<td>61 (46.9%)</td>
<td>35 (26%)</td>
</tr>
<tr>
<td>Systolic Blood Pressure ≥ 130 mmHg,</td>
<td>95 (73.1%)</td>
<td>38 (29%)</td>
</tr>
<tr>
<td>Diastolic Blood Pressure ≥ 85 mmHg,</td>
<td>52 (40%)</td>
<td>19 (14%)</td>
</tr>
<tr>
<td>Triglycerides ≥ 150 mg/dL</td>
<td>93 (71.5%)</td>
<td>30 (23%)</td>
</tr>
<tr>
<td>HDL Cholesterol &lt; 50 mg/dL</td>
<td>96 (73.8%)</td>
<td>32 (24%)</td>
</tr>
</tbody>
</table>

Table 2: Final regression model of relationship between some dietary components and metabolic syndrome

<table>
<thead>
<tr>
<th>Independent Risk Factors</th>
<th>OR (CI 95%)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very low or lack of egg intake</td>
<td>1.8 (1-3.1)</td>
<td>0.049</td>
</tr>
<tr>
<td>Lack of garlic intake</td>
<td>1.9 (1.1-3.5)</td>
<td>0.021</td>
</tr>
<tr>
<td>Intake of hydrogenated oils</td>
<td>2.1 (1.2-3.8)</td>
<td>0.010</td>
</tr>
</tbody>
</table>

OR=odds ratio; CI=confidence interval

DISCUSSION

Multiple logistic regression analysis showed that very low or lack of egg intake, lack of garlic intake, and intake of hydrogenated oils were the most important independent risk factors for metabolic syndrome. Results showed that hydrogenated oil is another independent risk factor for metabolic syndrome, that proportion of chance of metabolic syndrome in women with hydrogenated oil intake was 2.1 times higher than those with lack of hydrogenated oil intake (P= 0.010). In line with the present study, Esmailzadeh and colleagues found that high intake of hydrogenated oils increases the risk of metabolic syndrome and insulin resistance (Esmailzadeh & Azadabakht, 2008). Hydrogenated oils are the sources of Trans and saturated fatty acids. According to the studies, these fatty acids increase the blood LDL cholesterol and are among the risk factors of cardiovascular diseases (Willett al. 1993; Mensink et al. 1990). High intake of hydrogenated oils is associated to increased risk of cardiovascular diseases (Hu et al. 1997), diabetes (Salmerón et al. 2001), and elevation of inflammatory factors (Mozaffarian et al. 2004).

Results showed that lack of egg intake is another independent risk factor of the metabolic syndrome, so that the proportion of the chance of metabolic syndrome in women with lack of egg intake was 1.8 times more than those with egg intake (P=0.049). Kelishadi et al’s study showed that egg consumption is significantly associated to a reduced risk of metabolic syndrome (Klishadi et al. 2010). Previous studies of cholesterol of egg have always been controversial. In Dawber et al’s study in 1982, the serum cholesterol distribution curve of the participants was similar based on the share of egg intake and wasn’t observed any relationship between cardiovascular diseases and egg intake (Dawber et al. 1982). Results of a prospective study by Hu et al showed that daily doses of eggs (up to 1) did not have a significant effect on the risk of heart diseases (CHD) and stroke (CVA) in healthy men and women (Hu et al. 1999). Apart from having cholesterol, eggs contain many other nutrients such as unsaturated fats, essential amino acids, folate and other B vitamins. In addition, according to the previous studies, egg consumption, unlike foods rich in carbohydrates increases the HDL cholesterol (Schnohr et al. 1994; Packard et al. 1983) and reduces the postprandial glucose and insulin responses (Pelletier et al. 1996). Scientific evidences also suggest the impact of egg on weight management. Eating egg at breakfast gives people a feeling of satiety during the day and reduces the caloric intake during the day and improves the weight loss in a long term (Ratliff et al. 2010; Vander Wal et al. 2008). Thus, according to the above studies, the inverse relationship between egg and metabolic syndrome can be justified.

Also results showed that lack of garlic intake is another independent risk factor for metabolic syndrome, so that the proportion of the chance of metabolic syndrome in women with lack of garlic intake was 1.9 times more than those who intake it (P=0.021). Most studies suggest a relationship between garlic intake and components of the metabolic syndrome (disorders in blood lipids and hypertension). Durak et al’s study showed that garlic improves the blood lipids profile (decreased LDL and VLDL, and increased HDL), increases the antioxidant capacity of blood, and causes a significant reduction in systolic and diastolic blood pressure. It also leads to reduction in the level of oxidation product (Malonyldialdehyde) in the blood which suggests a decrease in oxidation reactions in the body (Durak et al. 2004). Meta-analysis of the trial data suggests that garlic is an effective lipid lowering agent (Neil and Silagy, 1994). Garlic probably causes vasodilation of the peripheral vessels by direct effect on the smooth muscle of the arterial wall. Furthermore, by activating the endothelial nitric oxide synthase, it increases the nitric oxide production, thus lowers the blood pressure (Sendel et al. 1992;
Kim-Park et al. 2000). Effect of garlic on reducing cholesterol and triglyceride synthesis probably appears by inhibiting the key enzymes of cholesterol and fatty acids such as hydroxymethyl glutaryl coenzyme A (HMG-CoA) and acetyl-CoA carboxylase (Gupta et al. 2001; Gebhardt et al. 1992; Augusti et al. 2005). Hence, garlic consumption has a vital role in reducing risk factors of cardiovascular diseases. This study was administered only among women referred to the clinics of Shiraz University of Medical Sciences, therefore it is suggested that future studies be administered in men. Future studies can be performed only on premenopausal or postmenopausal women and the effects of various factors on metabolic syndrome can be studied with the design of cohort studies.

CONCLUSION

Given the importance of the intake of some dietary components in promoting or preventing from metabolic syndrome, it is possible to promote the households dietary patterns by healthy choices and therefore reduce the prevalence of metabolic syndrome and cardiovascular diseases in households.

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