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Original Article

Prevalence of metabolic syndrome and the association with socio-demographic characteristics and physical activity in urban population of Iranian adults: A population-based study

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ABSTRACT

Background: The metabolic syndrome (MetS) is the main concern of health problem in transition population. The objective was to determine the prevalence of MetS and its association with socio-demographic and physical activity in Iranian adults.

Methods: A population-based cross-sectional study of 1000 representative samples aged 20–70 years was conducted in urban area in northern Iran. The socio-demographic data were collected by interview and the physical activity was assessed by standard International Physical Activity Questionnaire (IPAQ). Weight, height, waist circumference and the systolic and diastolic blood pressures were measured by standard methods. Fasting plasma glucose, triglycerides, total cholesterol, high density lipoprotein-cholesterol level and low density lipoprotein cholesterol level were measured using enzymatic method. The ATP III criteria were used for diagnosis of MetS.

Results: The prevalence rate of MetS was 42.3% (36.5% men and 47.1% women, $p = 0.001$). The higher education at university level was appeared inversely associated with MetS (age adjusted OR = 0.34, $p = 0.001$) compared with illiterate. The prevalence rates of MetS were 49.0%, 42.5% and 22.6% in low, moderate and vigorous physical activity level respectively ($p = 0.001$). After adjusting for potential confounding factors, the vigorous physical activity was inversely associated with MetS compared with low level (adjusted OR = 0.46, $p = 0.001$).

Conclusion: These results highlight an immediate action of preventive measures programs for modification of cardio metabolic risk factors.

1. Introduction

Metabolic syndrome (MetS) is a clustering of multiple risk factors of cardiovascular diseases (CVD) and type 2 diabetes mellitus [1]. It is the growing problem and the main public health concern in both developed and developing counties [2–4]. Although there are several definitions for MetS, the most popular criteria for clinical diagnosis is using Adult Treatment Panel (ATP III). The third report of the National Cholesterol Education Program's ATP III identified the components of MetS that is of interesting for public health intervention program and clinical purposes [1]. These components include abdominal obesity, athrogenic dyslipedemia (manifested by raised triglycerides and low concentration of high density lipoprotein cholesterol (HDL)), elevated blood pressure, insulin resistance, proinfalematory state indicating high level of C-reactive protein (CRP) and prothrombolic state (characterized by increased plasma plasminogen activator inhibitor (PAI-1) and fibrinogen [1]). It is well established that an increase in prevalence of MetS as clustering of these risk factors contribute to the development of serious complications such as CVD and increased risk of mortality [2–4]. For example, abdominal obesity accelerates insulin resistance and thus provides further susceptibility to the development of type 2 diabetes and therefore has a contributive role for cardiovascular disease [5].

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A large variation in prevalence of metabolic syndrome has been observed in the world particularly in the Asian populations because of difference in lifestyles and ethnic groups [6]. In the adult population of the United States the unadjusted and age-adjusted prevalence of MetS ranged from 21.8% to 23.7% [5]. In Asian populations, the rate is lower at 10–15% in Korea [6,7] and Taiwan [8] and. at higher rate of 30–35% in Turkey [9,10], Iran [11,12], Pakistan [13] and countries around the Persian Gulf [14]. Asians are more prone to abdominal obesity with low BMI than Caucasians [7,15]. Increasing rate of abdominal obesity in Asian population resulted in high incidence of type 2 diabetes mellitus and CVD during the two recent decades [7,15]. Nevertheless, BMI may be used as a significant predictor of metabolic syndrome [16].

In recent decades, significant socio-economic and lifestyle transitions were associated with increased rate MetS and CVD events. As a result the prevalence of some components of MetS such as obesity and abdominal obesity has been also increased in the general population [17]. However, the contribution of other factors like intake of calorie-dense and high fat foods, diminished physical and sedentary life styles should not be ignored. Modernization and sedentary life in the geographic region of northern Iran was associated with increased rate of CVD in this geographic area [18,19].

High prevalence of MetS and obesity as well as abdominal obesity has been reported in several geographic areas of Iran including northern Iran [11,12,17]. Nevertheless, obesity and abdominal obesity in general population of northern Iran particularly in women and even in adolescence periods is higher than other regions of Iran [17,20]. Hence, in this geographic region the prevalence of diabetes, hypertension, cardiovascular death and early onset myocardial infarction reached as high as Western countries [19,21–23]. These conditions are linked with MetS or its components [15,16,19,24]. Because MetS is a significant predictor of diabetes and it is a simple tool for predicting subsequent CVD [3,24,25]. Nevertheless data regarding to prevalence of MetS in this area is scarce and the present study aimed to investigate the prevalence of MetS and its association with socio-demographic characteristics and physical activity in northern Iran in a population-based study.

2. Methods and subjects

2.1. Study population and sampling techniques

This population-based cross sectional study was conducted in urban area of Babol, located in the south of Caspian Sea, northern Iran in 2012. A total number of representative samples of 1000 participants aged 20–70 years with respective mean age of 43 years were recruited in the study to capture a MetS prevalence rate of 30% (accepted marginal error of estimate at 3%) with 95% confidence level. A standard sampling procedure of two stage cluster sampling technique has been used. In the first step of sampling procedure, 25 clusters were selected randomly based on cumulative frequencies of population size under coverage of urban health centers. Then, around the center of each cluster, about 50 participants with roughly equal number of males and females who met our inclusion criteria for age and residence area were selected to satisfy the target sample size. Subjects who had major physical abnormality and suffering from severe CVA, and those less than10 h fasting, and those after 3 times phone call did not attend to the Lab center and also pregnant women at second and third trimesters were excluded from the study. The protocol of study was approved by Ethical Committee of Babol University of Medical Sciences. Each participant assented prior for his/her participation in the study. In addition, all participants signed an informed consent form prior participation as well and they were asked to attend in Lab center of Ayatollah Rohani hospital for taking blood samples the day after first interview with fasting 10–12 h overnight. The total participation rate was 80%.

2.2. Measurements and Instruments

2.2.1. Demographic data and clinical examination

All participants were interviewed by trained nurses at home using the designed questionnaires. The demographic data, such as age, gender, education level, occupation, marital status, age of marriage and self reported data of history of hypertension, diabetes and hyper lipidemia, parental obesity, family history of heart disease and smoking were collected. All anthropometric measurements were done by trained nurses at home visit as well. Weight and height were measured with standard methods. Weight was measured to the nearest 0.1 kg using a digital scale with light clothes without shoes. Height was measured to nearest 0.1 cm using a potable stadiometer. Then, the body mass index (BMI) was calculated by weight in kg to the square of height in meter ($kg/m^{2)}$. Waist circumference (WC) was determined by measuring of waist diameter to the nearest 0.1 cm at the level of midpoint between iliac crest and lower border of tenth rib. The systolic and diastolic blood pressures were taken consecutively two times with a digital sphygmomanometer using the right arm of subjects by trained nurses while the participant was in the sitting position after a 10-min rest period and the cuff was placed on the right arm at the head level. The average of two measurements, made in intervals of 10 min rest period, was used in analysis.

2.2.2. Physical activity assessment

The physical activity level was assessed by International Physical Activity Questionnaire (IPAQ) short form that is an instrument designed primarily for population surveillance activity among adults [26]. The validity and reliability of this questionnaire has been well established [27–29]. This questionnaire measures the specific types of activity that are waking, moderate-intensity and vigorous-intensity activity during the last 7 days. We assessed the duration per day (in minutes) and frequency (days) per week of waking, moderate-intensity and vigorous-intensity activity. In analysis data of physical activity, the volume of activity was computed by weighting each type of activity by its energy requirements defined in metabolic equivalents (MET) to yields a score in MET-minutes that is multiples of the resting metabolic rates. For example, MET-minute scores are equivalent to kilo calories for a 60 kg person. The selected MET value for each activity was derived from work under taken in IPAQ reliability study [29]: walking = 3.3 MET, moderate PA = 4.0 MET and vigorous PA = 8.0 MET. Then, total physical activity MET-minute/week score was calculated by sum of METS score × duration (min) × frequency (days) for each activity. Finally, the total physical activity in continuous scale was categorized into three levels. (1) Low: no activity is reported or some activity is reported but not enough to meet the criteria for categories 2 and 3. (2) Moderate: the pattern of activity were classified as moderate either the following criteria were met: (a) 3 or more days of vigorous activity of at least 20 min per day or (b) 5 or more days of moderate-intensity activity and/or walking of at least 30 min per day or (c) 5 or more days of any combination of walking, moderate-intensity or vigorous-intensity activities achieving a minimum of at least 600 MET-minutes/week. (3) High: The two criteria for classification as high were: (a) vigorous-intensity activity on at least 3 days and accumulating at least 1500 MET-minutes/week or (b) 7 or more days of any combination of waking, moderate- or vigorous-intensity activities accumulating at least 3000 MET-minutes/week of total PA score.