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Brief Report

Modifiable Lifestyle Risk Factors and Metabolic Syndrome: Opportunities for a Web-Based Preventive Program

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ABSTRACT

Background: Lifestyle is recognized as a key factor as the cause and management of the metabolic syndrome. The aim of this study was to identify individuals at increased cardiovascular diseases risk and determine main features of lifestyle of participants with metabolic syndrome via internet.

Methods: The study was conducted from Jun 22 to August 22, 2012 in Tehran, Iran. Recruitment was carried out through the study website. Participants with metabolic syndrome who were interested and met the study criteria were invited for free clinic visits and clinical assessments. Baseline measurements were metabolic syndrome risk factors. Physical activity and dietary intake were measured by international physical activity questionnaire (IPAQ- short form) and the frequency food questionnaire (FFQ) respectively. Metabolic syndrome was defined according to Adult Treatment Panel III diagnostic criteria.

Results: Mean (SD) age for men and women were 41.9 (10.4) and 48.1 (7.8) yr respectively. Men were well educated and more likely to participate in the study than women. Men with metabolic syndrome had larger waist circumference (105.5) and lower BMI (29.1) than women with metabolic syndrome (P<0.001). Approximately 73% of the sample was inactive and 3% of participants had health enhancing physical activity. There were significant differences in the intakes of total fat and cholesterol between men and women (P<0.001).

Conclusions: Because of the high prevalence of metabolic syndrome, national lifestyle modification policies must be developed for population. Web-based healthy lifestyle programs may contribute to the reduction of the metabolic syndrome components.

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Introduction

Metabolic syndrome is a cluster of cardiovascular risk factor associated with increased risk of cardiovascular disease and diabetes mellitus[1]. Metabolic syndrome has been identified by central obesity, increased triglycerides, reduced high-density lipoprotein cholesterol (HDL), hypertension, and elevated fasting blood glucose concentration[2]. According to the Tehran Lipid and Glucose study (TLGS) in 2003, 42% of women and 24% of men were suffering from metabolic syndrome[3]. However, the current prevalence of metabolic syndrome may be higher than the previous estimate[4]. Therefore, the importance of managing the metabolic syndrome and the identification of its components should be emphasized on the prevention of cardiovascular disease[5].

Lifestyle is recognized as a key factor as the cause and management of the metabolic syndrome. Lifestyle modification programs including improvement of the quality of diet and promotion of physical activity are main approach of preventing and treatment of metabolic syndrome[6,7].

A means to promote healthy lifestyle is e-health communication[8]. Several studies have explored the efficacy of web-based lifestyle programs[9,10]. The internet with World Wide Web and e-mail applications, news group, instant messaging and file exchange has the potential to improve the effectiveness of health education and capable of reaching large numbers of people at a very low costs[11]. The internet is an effective and popular medium for delivery healthy lifestyle programs[12]. It seems that the internet as powerful tool for delivering health information provides unique opportunity to identify, management and prevention of diseases, besides it increases knowledge about diseases, risk factors and strategies to deal with health problem.

The aim of this study was to identify individuals at increased cardiovascular diseases risk and determine main

features of lifestyle of participants with metabolic syndrome via internet.

Methods

This study was conducted from Jun 22 to August 22, 2012 in Tehran, Iran. This paper is reporting the main features of lifestyle of participants with metabolic syndrome in a web-based study. Participants were individuals with metabolic syndrome that met the study criteria.

Recruitment of participants was carried out through a website namely Healthy Heart Education (http://www.Heartresearch.ir). This public website provides general prevention recommendations regarding cardiovascular disease risk factors such as hypertension, metabolic syndrome, diabetes, obesity and central obesity, nutrition for healthy heart and cardiovascular diseases (types, symptoms, prevention). Page visitors were invited to participate in a research study for free prevention of cardiovascular diseases through a registration page and record their information if they wish. Registration form contained information about name, gender, age, waist circumference, weight, e-mail and address. There was a tip on homepage that was shown how to measure waist circumference size correctly. The study also was announced in virtual and non-virtual environments including Tehran Heart Center, Tehran University of Medical Sciences', Iranian Students' News Agency.

The recorded website database was reviewed by trained research assistant and registrants with waist circumference cut-off points 90 cm and above for both men and women aged 20 years and above living in Tehran was determine. Individuals were screened for eligibility through the telephone contact. Besides, participants were asked if they would be interested in participating in the study and to schedule for free clinic visit and clinical measurements by the trained research assistant at Tehran Heart Center (local hospital).

Participants completed health assessments consisting demographic, anthropometrics and clinical assessments. Metabolic syndrome was defined according to Adult Treatment Panel III diagnostic criteria. Metabolic syndrome components including waist circumference were measured in horizontal plane, midway between the lowest rib and the iliac crest with a measuring tape in centimeter. The weight of individual dressed in light clothing without shoes were measured using a calibrated scale (Seca model 8811021658). Blood pressure was measured with mercury sphygmomanometer twice in the same arm after the individual seated at rest 10-15 min. The systolic and diastolic measurement represented the mean of two readings. Blood sampling was collected for measurements of total cholesterol, triglycerides, LDL-cholesterol, HDL-cholesterol, and fasting blood glucose for all participants. Overnight fasting for 12-14 h was needed before blood sampling. Venous blood samples (5 ml) were collected. Body Mass Index (BMI) was calculated by individual's weight divided by the square of the height.

Food frequency questionnaire were used for estimating dietary intake[13] and the International Physical Activity Questionnaire (IPAQ) by the last 7 days, short form were used to estimate the total amount of time spent in physical activity per week. IPAQ instrument provide separate scores on walking; moderate-intensity; and vigorous-intensity activity as well as a combined total score to describe overall level of activity. Physical activity was categorized into inactive, minimal activity, and HEPA activity (health enhancing physical activity) levels according to Guidelines for Data Processing and Analysis of the IPAQ.

Inclusion criteria were: (a) waist circumference ≥ 90 (cut-off for metabolic syndrome in Iran for both gender[14,15]); (b) blood pressure ≥ 130/85. Exclusion criteria were: (a) having history of cardiovascular diseases; (b) diabetics; (c) having cancer; (d) patients with renal diseases; (e) being pregnant; (f) taking medication for hypertension; (g) taking medication for dyslipidemia; and (i) having incomplete registration form.

The sample size calculated for the main study (randomized clinical trial) was used. To have a 95% power to detect a difference of 0.7 standard deviation in decrease of waist circumference as one of the most important components of metabolic syndrome[16] when the type I error assumed to be 0.05 and the attrition of 35% a sample with a total size of 160 in was needed.

Statistical analysis was performed by SPSS software (Version 21.0, IBM Co. Chicago, IL). *P*-value less than 0.05 was considered as statistically significant. To explore the data we used descriptive statistics including reporting on mean, standard deviation, frequency, and percentage. To evaluate the differences between groups we used chi-square and *t*-test.

The Ethics Committee of the Tehran University of Medical Sciences approved the study protocol. Written informed consent was obtained from all participants.

Results

Overall, 1437 people registered on the study website. Of those, 815 records were excluded for the reasons such as living outside the study setting (356), having waist circumference less than 90 cm (n=392) and having incomplete response (without telephone number n=67). The remaining 622 registered participants were screened for eligibility and 305 were excluded due to morbid conditions as Figure 1. Then, 317 participants were invited. Of these, 229 were able to attend for clinical assessments and were scheduled for a baseline visit. However, only 171 met the criteria for inclusion. Of these 160 participants agreed to complete the baseline measures and questionnaires and were randomly assigned to intervention and control groups (Figure 1).

Demographic characteristics of participants were associated with metabolic syndrome are presented in Table 1. Mean (SD) age for men and women were 41.9 (10.4) and 48.1 (7.8) years respectively. Women in the sample were significantly older than men ($P<0.001$). Men were well educated and more likely to participate in the study than women. Men with metabolic syndrome had larger waist circumference (105.5) and lower BMI (29.1) than women with metabolic syndrome ($P<0.001$). In sub-analyses, demographic differences between included participants with waist circumference over than 90 (694 men and 210 women) were analyzed. Age, BMI, weight and waist circumference variables were lower among excluded participants than those included mean (SD) age: 39.2 (22.3) vs 44.2 (10.1), BMI: 26.2 (4.6) vs 30.1 (4.6), weight: 77.3 (16.4) and waist

circumference: 94.03(13.8). Evaluation of metabolic syndrome components have shown that 44.3% (male: 24.4 and female: 46.2) had three components of metabolic syndrome, 51.8 (male: 53.7 and female: 48.1) and 3.7% (male: 3.7 and female: 3.7) had four and five components of metabolic syndrome respectively.

Table 2 shows lifestyle characteristics of participants. Approximately 73% of the sample was inactive, and 25% had a minimal level of activity. However, only 3% of participants had health enhancing physical activity (HEPA). There was a significant difference in time spent siting (min/ week-1) between women and men (P<0.001). Despite the fact that women were eight years older than men, they spend less time siting during a typical working day. Analysis of dietary intake showed that there were significant differences in the intakes of total fat and cholesterol between men and women (P<0.001). There was a significant difference on smoking between genders (P<0.001).

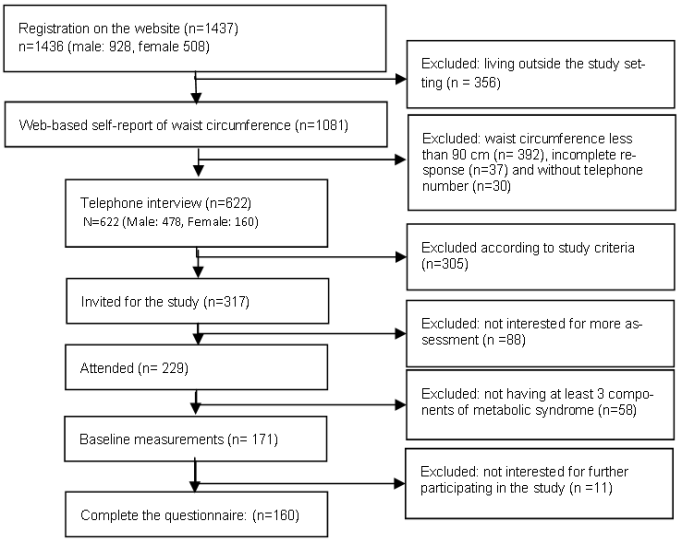

Figure 1: The study flow chart

Table 1: Demographic characteristics and metabolic parameters of participants

Variables	Men, n=106	Women, n=54	Total, n=160	*P* value
Dichotomous	**N (%)**	**N (%)**	**N (%)**	
Education				0.001
≤12	39 (36.8)	32 (59.3)	71 (44.4)	0.007
>12	67 (63.2)	22 (40.7)	89 (55.6)	
Marital status				0.628
Single	14 (13.3)	7 (13.0)	21 (13.1)	
Married	90 (84.9)	44 (81.5)	134 (83.8)	
Divorced/ widowed	2 (1.8)	3 (5.5)	5 (3.1)	
Employment status				0.001
Employed	87 (82.1)	27 (50.0)	114 (71.2)	
Unemployed	19 (17.9)	27 (50.0)	46 (28.8)	
Drug addiction				0.310
No	104 (98.1)	54 (100.0)	158 (98.7)	
Yes	2 (1.9)	0 (0.0)	2 (1.3)	
Continuous	**Mean (SD)**	**Mean (SD)**	**Mean (SD)**	
Age (yr)	41.9 (10.4)	48.1 (7.8)	44.2 (10.1)	0.001
Weight (Kg)	90.7 (12.5)	81 (16.9)	87.4 (14.8)	0.001
Body mass index (Kg/m2)	29.1 (3.8)	31 (5.8)	30.1 (4.6)	0.050
Waist circumference (cm)	105.5 (7.8)	102.1 (9.7)	104.3 (8.7)	0.016
Systolic blood pressure (mmHg)	132.1 (12.4)	131.1 (7.4)	131.7 (11.1)	0.585
Diastolic blood pressure (mmHg)	88.1 (7.1)	88.5 (5.1)	88.3 (6.5)	0.660
Total cholesterol (mg/dL)	194.3 (36.9)	196 (44.8)	194.9 (39.5)	0.772
LDL cholesterol (mg/dL)	128.3 (28.6)	128.9 (38.5)	128.5 (32.2)	0.916
HDL cholesterol (mg/dL)	39.1 (8.4)	45.7 (11.2)	41.3 (9.9)	0.001
Triglycerides (mg/dL)	198.1 (119.0)	179 (96.2)	191.8 (112.5)	0.261
Fast blood glucose (mg/dL)	88.5 (13.1)	92.5 (14.6)	89.9 (13.7)	0.077

Table 2: lifestyle characteristics of participants

Variables	Men, n=106	Women, n=54	Total, n=160	*P* value
Dichotomous	**N (%)**	**N (%)**	**N (%)**	
Physical activity				0.420
Inactive	75 (70.5)	41(75.9)	116 (72.7)	
Minimal activity	28 (26.4)	13 (24. 8)	41 (25.6)	
Health enhancing physical activity	3 (2.8)	0 (0.0)	3 (1.8)	
Smoking				0.005
No	86 (81.1)	52 (96.3)	138 (86.2)	
Yes	20 (18.9)	2 (3.7)	22 (13.8)	
Alcohol drinking				0.467
No	99 (93.4)	52 (96.3)	151 (94.3)	
Yes	7 (6.6)	2 (3.7)	9 (5.7)	
Continuous	**Mean (SD)**	**Mean (SD)**	**Mean (SD)**	
Walking (MET-min/ week^{-1})	400.66 (684.4)	268.3 (388.3)	355.9 (602.9)	0.190
Time spent siting (min/ week^{-1})	1340 (130.2)	1259.6 (171.4)	2539.6 (1340.3)	0.007
Energy intake (kcal/day)	3084 (1231.9)	2805.9 (852.5)	2987.9 (1120.4)	0.144
Protein intake (gr/day)	105.7 (42.9)	95.8 (33.8)	102.3 (40.2)	0.143
Carbohydrate intake (gr/day)	475.5 (188.7)	451.5 (147.9)	467.2 (175.6)	0.424
Fat intake (gr/day)	95.7 (50.6)	81.8 (43.7)	90.9 (45.6)	0.043
Cholesterol intake (gr/day)	282.3 (157.7)	234 (114.5)	265.6 (145.7)	0.041

Discussion

The results of the study indicated that it is possible to identify especially unknown people with metabolic syndrome from general population. This is probably the first web-based study as a method of targeted screening for metabolic syndrome to identify people with metabolic syndrome and measure their cardiometabolic risks factors. As the number of male participants detected with metabolic syndrome was younger and more than female, one might argued that web-based health communication is affordable and suitable for the men in Iran. The metabolic syndrome seems to be a serious new aspect to the epidemic and an emerging public health problem[17]. It is a lifestyle depended a high risk conditions with a cluster of metabolic disturbances associated with a 2-fold increase in cardiovascular outcomes and 3.5-5 fold in type 2 diabetes[18]. Metabolic syndrome is not a disease, but it was introduced as a diagnostic category to identify individuals with three of five relatively arbitrarily chosen criteria to initiate lifestyle changes with the goal of decreasing risk of cardiovascular disease. It is important to be aware of typical components of metabolic syndrome as waist circumference and consider the earlier recognition to obtain better clinical outcomes[19].

Unhealthy lifestyles including physical inactivity and unhealthy diets have a major impact on metabolic syndrome[20]. A main finding of this study was that most of participants in the web-based study were physically inactive and the least of them were most likely to meet recommendations. Moreover, considering lifestyle health enhancing physical activity (HEPA), only 1.8% of participants had a high physical activity. Our results are generally consistent with Bankoski et al. that people with metabolic syndrome spent more hours and a longer average sedentary time. They revealed strongly that sedentary time was associated with a significantly greater likelihood of metabolic syndrome[21]. Another study represented higher level of time spent in moderate to vigorous physical activity by adolescents were associated with better cardio-metabolic risk factors regardless of the amount of time spent sedentary[22].

HEPA activity is a total volume of being active that reflects a healthy lifestyle. However, the recommended physical activity for reducing health risks for chronic diseases including coronary heart disease and diabetes is for adults 30 min of moderate intensity activity daily, preferably all days of the week[23]. It seems that a good approach for many individuals with metabolic syndrome to obtain the recommended level of physical activity is to reduce sedentary behavior by incorporating more incidentals and leisure-time activity into the daily routine. Besides, political action is commanding to effect physical and social environmental changes to enable and encourage to physical activity.

There were significant differences in total fat and cholesterol consumption between men and women. In other words, women had been reported lower fat and cholesterol consumption than men. There was no significant difference on any of the other dietary variables among men and women. It seems that risk of metabolic syndrome was highest in men with a higher nutrition risk that consumed high dietary lipid[24].

There is growing evidence that internet technology can be used to reach at-risk populations with web-based disease prevention and behavior change programs[25]. People often go to the internet for health information; in particular internet could play an important role in life decisions[26] through clearly communicating risk factors to users, identifying appropriate interventions to address specific risks, and assisting patients in identifying barriers to behavior change[27].

Conclusions

Increasing physical activity and decreasing caloric intake by reducing portion sizes could improve metabolic syndrome abnormalities. Because of the high prevalence of cardiovascular disease and metabolic syndrome, national nutrition and physical activity policies must be developed accordingly for the modification of lifestyle between Iranian populations. Web-based healthy lifestyle programs may contribute to the reduction of the metabolic syndrome components.

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Conflict of interest statement

The author declares that they have no competing interests.

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