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Original Article

Risk Factors of Non-Communicable Diseases and Metabolic Syndrome

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Abstract

Background: Metabolic syndrome is a common metabolic disorder, which leads to early Cardio Vascular Disease and diabetes type II. The goal of this study was to determine the prevalence of metabolic syndrome and its risk factors in Kurdistan, Iran.

Method: The data was extracted from provincial section of Iranian national non-communicable surveillance survey conducted in 2005. The study was a population-based survey with multi-stage cluster sampling method. Adult Treatment Panel-III measures were used for assessing the prevalence of metabolic syndrome among residents of Kurdistan Province aged 25 to 64 yr. EPI-Info 6 was used to enter the data and the data was analyzed using SPSS 11.5.

Results: Totally, 1194 participants were recruited in our survey. The prevalence of metabolic syndrome was 29.1%. The prevalence was 41.3% among women and 17.1% among men (P= 0.001). As we go higher among age groups, the prevalence increases.

Conclusion: This is the first study to investigate the metabolic syndrome in Kurdistan and Kurd ethnicity. The high level of metabolic syndromes prevalence especially among women shows the need and importance of suitable and effective preventive programs. These preventive programs must promote changes in lifestyle, especially with respect to nutrition, physical activities, and control of blood pressure.

Keywords: Metabolic Syndrome, Prevalence, Non-communicable diseases, Kurdistan, Iran

Introduction

About 67% of all disease loads is caused by non communicable diseases globally. Metabolic and behavioral risk factors are the most common causes of noncommunicable diseases. The most important risk factors include smoking, blood pressure, unhealthy food diet, inactivity, overweight and obesity, hypercholestrolemia, diabetes and blood sugar and alcohol (1).

Although all these risk factors play a great role in generating noncommunicable diseases, a group of them called metabolic syndrome has been extremely concerned during recent past years. Metabolic syndrome is the most common metabolic disorder, which leads to cardio vascular diseases and diabetes. A more precise definition of metabolic syndrome defines it as a cluster of abnormalities that includes abdominal obesity and hyperglycemia or glucose metabolic disorder, hypertension, and heterogenic dyslipidemia. A great amount of noncommunicable disease load is caused by cardiovascular diseases and diabetes metabolic syndrome increases the risk of these two kinds of problems (2-5).

It is especially more important when we know that most of people are not aware of the presence of these risk factors and metabolic syndrome

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within their bodies and they do not know that they are potentially endangered by these problems (6).

Metabolic syndrome is also called: Syndrome X, cardiometabolic syndrome, insulin resistance syndrome, Reaven's syndrome, CHAOS (an abbreviation for coronary artery disease, hypertension, atherosclerosis, obesity, and stroke), and the Deadly Quartet (6-7).

Metabolic syndrome is very common among adult population of the world and it is widely prevalent. In most parts of the world, the syndrome is more common in men than women are. According to several studies, its prevalence is between 8 to 24.2 % in men. In addition, 7 to 46.5 % of adult women are diagnosed with metabolic syndrome. (8-9). Differences in genetic background, nutritional status, physical activity status, age and sex composition of the populations, malnutrition, obesity, and using different definitions have resulted in a wide range prevalence rates of metabolic syndrome in the world (10).

The prevalence of metabolic syndrome in the US which is a developed country is about 20 to 30 % (11), while in some Asian countries like India and Iran higher prevalence rates have been reported (12, 13).

Some studies in Iran show the importance of these risk factors. Like other developing countries, metabolic risk factors including overweight, hypertension, and blood sugar are among the main causes of chronic diseases and mortality (14).

According to some studies, metabolic syndrome has been introduced as one of the fundamental determinants of ischemic heart disease in middle-aged Iranian population and especially in smokers (15).

Metabolic syndrome is a proper and exact way of detecting and diagnosing people endangered by noncommunicable diseases. Therefore, finding the syndrome among the population is critical for the public health. If the syndrome prevalence is determined, it will help to clarify the status of the risk factors; in addition, if its trend is measured with the passage of time, it can be used as a criterion for evaluation and assessment of interventional policies, which are designed to reduce noncommunicable risk factors.

So one of the most effective intervention strategies to prevent and control noncommunicable diseases is to screen the metabolic syndrome and to make interventions to prevent insulin resistance and oxidative stress and cardiovascular disease in all the social levels. Therefore, the prevalence of metabolic syndrome and other risk factors in society can be used as one of the most important indicators for evaluation of these interventions (11, 16-17).

Previously, one of the problems in assessing metabolic syndrome was the variety of definitions. Metabolic syndrome can be diagnosed through measuring different indicators. These include WHO, European Group for the study of insulin resistance, and National Cholesterol Education Program-Third Adult Treatment Panel-III (NCEP-ATPIII) (11). The NCEP-ATPIII diagnostic criteria for metabolic syndrome are considered as major references for many researchers in this field. According to NCEP-ATPIII criteria the presence of three out of five risk factors including increased waist circumference (WC), low level of high-density lipoprotein (HDL), high triglycerides (TG), elevated blood pressure (BP), and impaired fasting glucose fulfils the criteria for the diagnosis of Metabolic syndrome (18).

Recently it is has been presented that metabolic risk factors for non-communicable diseases have different prevalence rates among various ethnic and cultural groups (1, 19-20).

This study assesses non-communicable diseases risk factor and metabolic syndrome among Kurd people living in Kurdistan aged 25-64 years based on ATP-III measure.

Materials and Methods

This study was conducted as a provincial module of 2005 surveys of Iran's national NCD risk factors surveillance program. The methodology of the survey was based on WHO's STEP wise approach to NCD surveillance (STEPS). It was adapted to collect the data that is provincially and

nationally interpretable using a validated STEPS instrument (21). The methodology has been already described in other sources (22-25), and here we just point out its major steps. Iranian National non-communicable Disease has set risk factor surveillance targets for four age groups: 25-34, 35-44, 45-54, and 55-64. Target groups are defined according to STEPS protocol.

The multi-stage random cluster sampling method was used to choose the participants a two-stage cluster sampling method was used to select the samples. A national data bank of postcodes was used to identify the clusters at random. Each 10-digit postcode represented an individual household in the country. In each cluster, 8 male and 8 female participants were approached to fulfill four eligible respondents from each age group. Trained male and female staff from medical universities/schools served as interviewers in pairs and a trained supervisor monitored the process in each district.

Interviewers were supposed to complete demographic and behavioral risks sections of the questionnaire through face-to-face interview. Waist circumference (WC) was measured midway between the lower rib margin and the iliac crest using a standard measuring tape.

Blood pressure was measured two times with a five-minute interval from right arm of the participant using Richter aneroid sphygmomanometer. Different cuffs were available for different arm sizes. Ten mmHg or more difference between measured systolic or diastolic blood pressure was led to a third measurement. Richter mercury sphygmomanometer was used to calibrate the aneroid equipment based on a clear guideline.

To measure the biochemical factors of the participants, they were instructed to fast for 10 hours before taking blood samples. The samples were taken after making an appointment with eligible persons by trained laboratory technicians at laboratories close to the selected households. The blood samples were centrifuged for ten minutes at 1500 rpm to provide a serum sample and were kept cool in a refrigerator at the temperature of 4 to 8 C° for a maximum of 48 hours. Serums were transferred to a provincial reference laboratory approved by Iran's National Reference Laboratory, a WHO-collaborating centre in Tehran, which was responsible for biochemical standardization of the process. Samples would have been kept frozen at -20 C° if there was long distance between centrifuging site and the referral provincial laboratory or if the transfer time was supposed to take longer than 48 hours. Uniform testing kits from the same batch number produced by an Iranian company, Pars Azmoun, were used to test the samples. From the whole samples, 10% were re-checked by the national reference laboratory as a quality assurance measure. The coefficient of variation was less than 5% for all provincial laboratory measurements.

We used the ATP-III indicators for diagnosing and determination of prevalence level of Metabolic Syndrome. Concerning this, the presence of metabolic syndrome would have been proved if three or more of the following measures were fulfilled (11, 18).

a)-Waist circumference more than 102 cm in men and more than 88 cm for women ,b)- Triglyceride more than 150 mg c)-DHL lower than 40 mg/dl for men and lower than 50 mg/dl for women d)-Blood pressure above 130/85 e)-FBS higher than 110mg/dl.

The proportion of metabolic syndrome was calculated for all the population, for both sexes and for all age groups. Using odd ratio (OR), the proportion was tested for both sexes and for various age groups. The mean and standard deviation for every risk factor involved in metabolic syndrome were calculated for both sexes; the means were tested by t-test. In addition to mentioned tests, the OR and Confidence Interval (CI) of each of risk factors was calculated for all the population based on their gender.

EPI-Info 6 was used to enter the data and the data was analyzed using SPSS 11.5.

Results

We recruited 1194 eligible people in our study whose measurement data were valid and analyzable. 463 (38.87%), 324 (27.14%), 262 (21.94%)

and 145(12.4%) participants were in 25-34, 35-44, 45-54 and 55-64 age groups, respectively. From all participants 603(50.5%) were men and 591(49.5%) were women. In addition, 729 participants (61.1%) were residents of urban areas and 465 (38.9%) were residents of rural areas. As table 1 demonstrates, 29.1% of the sample is diagnosed with metabolic syndrome; this is 17.1% in men and 41.3% in women ($P < 0.001$).

Table1: Prevalence of metabolic syndrome by sex and age groups in Kurdistan-2005

		n	Metabolic syndrome	*P*
Sex	Male	603	103(17.1%)	
	Female	591	244(41.3%)	<0.001
Age group (yr)	25-34	463	90(19.4%)	
	35-44	324	98(30.2%)	<0.0001
	45-54	262	100(38.2%)	
	55-64	145	59(40.7%)	
	25-64	1194	347(29.1%)	

The prevalence of the syndrome is 19.4% for the first age group; this is increased to 40.6% for the oldest age group. There is a statistically significant relationship between the age group and prevalence of the syndrome ($P \leq 0.0001$). In other words, the prevalence increases with the increase of age.

Table 2 contains the summary of our estimations for the measures of the metabolic syndrome risk factors. Using this information, we can conclude that the mean of WC for men is 87.27 cm and it is 91.65 cm for women. In addition, the mean of HDL is 43.09 mg/dl for men while this is 45.71 mg/dl for women. For two risk factors there was statistically significant difference between the means based on sex ($P< 0.001$) while for the other indicators there was no significant difference. 69.4% of men and 65.9% of women with undesirable WC size had metabolic syndrome (OR=17.3, $CI_{95\%}$ = 12.7-23.7).

Table 2: Metabolic Risk factors distribution by sex

	sex	n	mean	SD	*P*-Value
Age (years)	Male	603	41.25	10.52	*P*=0.964
	Female	591	41.28	10.28	
WC(cm)	Male	601	87.27	11.90	*P*<0.001
	Female	574	91.65	13.49	
Systolic BP (mmHg)	Male	602	122.25	17.22	*P*=0.178
	Female	590	123.73	20.55	
Diastolic BP (mmHg)	Male	597	77.27	11.21	*P*=0.928
	Female	583	77.20	12.52	
TG (mg/dl)	Male	539	184.72	114.93	*P*=0.205
	Female	547	176.53	97.19	
HDL (mg/dl)	Male	540	43.9	14.39	*P*=0.001
	Female	546	45.71	10.19	
FBS (mg/dl)	Male	545	93.78	20.50	*P*=0.096
	Female	552	95.98	23.19	

30.1% of men and 67% of women who had high systolic blood pressure had metabolic syndrome (OR=4.6, $CI_{95\%}$ = 3.5-6.9). 43.3% of men and 35.4% of women who had high diastolic blood pressure had metabolic syndrome (OR=3.2, $CI_{95\%}$ = 2.3-3.4).

31.5% of men and 66.8% of women who had high TG level, had metabolic syndrome (OR=4.6, $CI_{95\%}$ = 3.5-6.9). 31.7% of men and 65.7% of women who had low HDL level had metabolic syndrome (OR=6.43, $CI_{95\%}$ = 8.6-8.8). Finally, 65% of men and 73.4% of women who had high FBS level had metabolic syndrome (OR=6.4, $CI_{95\%}$ = 4.6-8.8). Table 3 shows the OR for the metabolic syndrome indicators for men and women.

Table 3: Odds Ratio of metabolic risk factors

Risk factor	Sex	OR	%95 CI
WC	Male	18.6	9.8-33
	Female	14.6	8.4-23.7
	Both	17.3	12.7-23.7
Systolic BP	Male	4.15	2.6-65
	Female	6.07	4.2-8.7
	Both	4.6	3.5-6
Diastolic BP	Male	3.2	2.02-5.35
	Female	3.36	2.19-5.17
	Both	3.2	14.3-23
TG	Male	10.9	5.5-21.5
	Female	8	5.4-11.8
	Both	6.7	4.9-9.2
HDL	Male	4.6	2.8-7.5
	Female	6.1	3.9-9.6
	Both	6.6	4.6-8.8
FBS	Male	20	11-35.6
	Female	4.9	2-7.7
	Both	8.2	5-11.4

We also computed the odds ratio of every risk factor for both sexes and for the overall sample by comparing these measures of the healthy members with the members that had metabolic syndrome.

Discussion

Our results showed that according to ATP-III definition the prevalence of metabolic syndrome among people aged 25 to 64 years in the province is 29.1%. This syndrome is more prevalent among women than men and the prevalence of the syndrome in all age groups in both sexes, increases as age increases. Based on our knowledge this is the first study in a community in which Kurds are the major ethnicity.

There are some other studies conducted in other parts of the country and their results can be compared with our results.

The first study on the prevalence of metabolic syndrome in an Iranian population in Tehran was published by Azizi et al. in Tehran, 2003. Metabolic syndrome prevalence among the people aged over 20 years in Tehran was 33.7 % and it was more prevalent in women (42%) than men (24%). The prevalence of this syndrome will increase as age increases in both sexes. Most findings in this study are consistent with our study. Except fasting blood sugar, and glucose level all the other risk factors are more prevalent in women than men are and this is not consistent with our results (13).

A study by Gharipour et al was published in 2006 in Isfahan. This study reports the prevalence of metabolic syndrome as 21.9% in the total population. The prevalence in urban population (25.4%) was higher than rural population (21.7 %). The prevalence of the syndrome increased with age. It was more prevalent in women than men were. All these results are consistent with our findings (26).

In Yazd, the prevalence of metabolic syndrome has been reported 32.1%. It is more prevalent in women (62.2%) than men (37.8%). The prevalence of the syndrome increased in both sexes with the increase of age. Although our findings are consistent with this study, the reported prevalence rates are larger than our results. In this study, having the triglycerides above 150 was the most common metabolic disorder (27).

Jalali et al. conducted a study in rural population of Akbarabad, Fars in 2008. The prevalence of metabolic syndrome among people aged 19 to 90 is reported as 25.6 %. This finding is consistent with our results. However, there is no significant relationship concerning the prevalence of metabolic syndrome among men compared with women and it is not consistent with our results (28).

In Isfahan, 2008 high prevalence of metabolic syndrome among Iranian women is introduced as an important and emergency public health issue. Based on the results of this study, the prevalence of metabolic syndrome among the total urban population, among the women and among men are reported as 23.3%, 35.1%, and 10.7%, respectively. The rural prevalence rate is reported as 19.5% (29).

In all age groups and in both urban and rural areas, the metabolic syndrome affected a significantly larger number of women than men. Among women, abdominal obesity (71.7%) was more prevalent followed by low HDL-C (60.9%) and hypertriglyceridemia (56.6%), whereas among men, the most frequent components were hypertriglyceridemia (49.1%) and low HDL-C (35.1%).

Therefore, the results of the national studies show that our results are consistent with most of other studies conducted within the country and the prevalence of metabolic syndrome in Kurd ethnicity is not different from the other ethnicities in the country.

We also compared our results with the results collected from other parts of the world. The results of our comparisons are presented as follows.

Our results are consistent with Arab and neighbor countries. In a retrospective study conducted among the countries around the Persian Gulf that was published in 2010 Prevalence of metabolic syndrome was 20.7% to 37.2% in men while it was from 32.1 to 42.7 % among women. The results of this study are consistent with our results (30).

A study published in 2007, among Jordan people who were over 25 years of age prevalence of metabolic syndrome was reported as 36.3%. The prevalence rate in women (40.9%) was higher than men (28.7%). Metabolic syndrome prevalence increased in both sexes as age increased. The results of this part of study are almost consistent with our study. Low HDL was the most common cause of metabolic syndrome in men. However, abdominal obesity is the most important and most common cause in women. However, the mentioned prevalence rate is higher than the prevalence rate in Arab countries (31).

In America, the prevalence of metabolic syndrome has been reported as about 25 %. This is lower than prevalence rates reported in other studies and the prevalence rates reported in most of studies conducted in Iran (16).

Many studies are conducted in Latin America. Results of a retrospective study on the prevalence of metabolic syndrome in persons aged 18 to 65 in Latin American countries is as follows (32).

The prevalence of metabolic syndrome in Latin-American countries was 24.9% (range: 18.8%-43.3%). It was slightly more frequent in women (25·3 %) than in men (23·2 %), and the age group with the highest prevalence of metabolic syndrome consisted of those over 50 years of age. The most frequent risk factor of metabolic syndrome were low HDL cholesterol levels (62·9 %) and abdominal obesity (45·8 %).

Although the prevalence of this syndrome in people of Latin America is somewhat less than our study and other studies in Iran, there are still differences in the prevalence of this syndrome in men and women, but the differences are much smaller (32).

Because of interventional activities, the syndrome is less frequent in developed countries than developing countries. This syndrome has become increasingly prevalent in developing countries (33).

However, the sex-related reported prevalence of metabolic syndrome is different among Greeks; 24.2% in men vs. 22.8% in women. In addition, the rate for Mexican-American women is reported to be 23.4%, which is less than the 24% reported for Mexican-American men. This different rate of the syndrome between men and women depends on the ethnic background of the population studied (11).

In some countries such as the U.S., the research for determination of the metabolic syndrome's prevalence rate has started in the last decade and the trend analysis is possible. The analysis shows an increasing trend in prevalence of the metabolic syndrome in America. This trend is more prevalent for women; also, the increasing trend appears more in risk factors such as blood pressure, waistline, and triglyceride (11, 34).

As an overview, the mentioned facts and findings can be summarized in the following statements. The prevalence of metabolic syndrome in our study is more than many Western countries and some Arab countries. The prevalence of metabolic syndrome in our study is almost consistent with the prevalence of this syndrome in Tehran urban population (33.7%) (13), Turkish adult population (33.4%) (35), Hindi adult population (41%) (9), and with another study in India (31.6%) (36). In

Palestine (23%) the prevalence rate is somewhat lower than our country. (7). But the prevalence of metabolic syndrome is lower in some Asian countries. In China (13.2%) (37), in Taiwanese population (015.7%) (38), and in Korean population (6.7% to 13.1% based on different definitions) (39) the reported rates are smaller than values found in our study and other studies in the country.

An interesting finding that has been reported in other Iranian studies and was confirmed by our study is that the large WC and low HDL were more common in women than men were. The differences of the mean values for these two factors were statistically significant while the other risk factors did not make a significant different mean values for the two sexes. The risk factors based on value of OR for men in descending order are as follows: High FBS, high WC measure, high TG level, low HDL level, high systolic and diastolic blood pressures. For women these risk factors based on the value of odds ratio are ranked in descending order here: Large WC measure, high FBS, high TG, and low HDL, high systolic and diastolic blood pressures. The OR for the overall population follows the same order as for women.

The high level of prevalence of metabolic syndrome in the population indicates the need for an active public health program to reduce the factors influencing the prevalence. The preventive programs must be taken seriously and the suggested preventive moves such as reducing weight and healthy diet and suitable nutrition and activity that is more physical can be effective factors in reducing the level of prevalence for metabolic syndrome.

Moreover, there is a wide range of definitions for metabolic syndrome that has led to different suggestions and interventions. One of our recommendations is to use a unique criterion that is appropriate and suitable to the genetic and physical condition of our country. We suggest to measure, monitor the syndrome among different groups during regular intervals, and present the results to the health officials and policy makers. In addition, several studies are needed to assess the main causes of high prevalence of the syndrome within different groups in Iran and to find the reasons for the difference in prevalence of the disease among men and women.

Ethical considerations

Ethical issues (Including plagiarism, Informed Consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc) have been completely observed by the authors.

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