



## **Risk Factors for Non-communicable Disease: A Population Based Study in Mashhad (Iran)**

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### **Authors' contributions**

*This work was carried out in collaboration between all authors. Author MD managed the literature searches, analyses of the study and wrote the first draft of the manuscript. Author MK performed part of analysis and authors MKR and SN helped in writing the first draft of the manuscript and interpretation of results. Authors MA, MJ and GK collected the data. All authors read and approved the final manuscript.*

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### **ABSTRACT**

**Aims:** Non-communicable disease currently accounts for 55% of the global disease burden, and is predicted to make up 73% of all causes of death by 2020. There have been few studies into chronic diseases in developing countries. Considering the priorities for health care systems (prevention and control of non-communicable diseases), this study aimed to compare the risk

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factors for chronic disease for males and females in a metropolitan area of Iran.

**Study Design:** A cross-sectional study.

**Location and Duration of Study:** This cross-sectional study was carried out in 2007 in Mashhad (Iran) as a part of a national survey to assess the risk factors for non-communicable diseases.

**Methodology:** One thousand participants aged between 17 and 67 years were included and a standardized national questionnaire about each participant was completed. Height, weight, waist circumference, blood pressure and blood biochemical factors were measured. Informed consent was obtained from all participants. Chi-square tests, T-tests and Mann–Whitney U-tests were used for statistical analysis;  $p < 0.05$  was considered as statistically significant. SPSS version 11.5 was used for statistical analysis.

**Results:** Half of the participants were male; 46.4% lived in rural areas; 36% were housewives; and 0.04% were unemployed. BMI, smoking, waist circumference and physical activity were statistically different between the two genders (in all cases  $p < 0.001$ ). HDL was the only difference between men and women in terms of their lipid profiles ( $p < 0.001$ ). The most important risk factors for chronic diseases were high BMI, waist circumference and low levels of HDL-cholesterol in women; in men, smoking was the most significant risk factor. Systolic and diastolic hypertension and hypercholesterolemia were important risk factors for both genders.

**Conclusion:** The risk factors for chronic diseases were different for the two genders and each will need different approaches to control these risk factors.

*Keywords: Risk factor; chronic disease; prevention.*

## 1. INTRODUCTION

As we know, over the decades, disease patterns have changed due to epidemiologic and demographic transitions. Many infectious agents have been controlled, removed or eradicated, but non-communicable disease risk factors have increased due to westernized life styles and industrialization of communities. More recently, non-communicable diseases such as cardiovascular disease, cancer, chronic respiratory disease and diabetes have become the main causes of death and illness. Today, 55% of the global burden of diseases is due to those non-communicable. The chronic disorders account for 60% of the total morbidity and will be responsible for 73% of all causes of death by 2020 [1]. The most important risk factors for non-communicable diseases in developed countries are hyperglycaemia, hypertension, alcohol consumption, hypercholesterolemia, increased BMI, low intake of fruit and vegetables, physical inactivity, illegal drugs, obesity and iron deficiency; on the other hand in developing countries these risk factors include being underweight, unprotected sex, unsanitary water, air pollution in enclosed environments, deficiency in zinc, iron and vitamin A, hypertension, tobacco, hypercholesterolemia, alcohol consumption, increased BMI and low intake of fruit and vegetables [2].

Several studies have assessed the risk factors for non-communicable diseases [3-7]. A study

done in 2000 in Iran showed that 11.1% of men and 11.9% of the women had high blood pressure (defined as more than 160/95mmHg) and the prevalence of cholesterol levels over 240mg/dL in men and women was 9.4% and 12.4%, respectively. The prevalence of obesity (Body Mass Index (BMI)  $>30$ ) was 14.2% in women and 5.6% in men. Smoking prevalence was about 23.9% in men and 1.7% in women [8]. The Diabetes Prevention and Control Program, which began in 2000 in rural areas of 17 provinces, covering 730,000 people above the age of 30, demonstrated that 25% of the individuals had at least one risk factor such as obesity, hypertension or a positive family history of diabetes [9].

Various review articles have been conducted in the context of chronic disease risk factors [10,11] but studies which compare these risk factors between the two genders are very rare. In a review article covering the numbers and types of studies that were performed in different parts of the world, the researchers showed that few studies are done in low income and developing countries and that most of the studies about chronic diseases were done in developed countries. They have therefore suggested that more studies need to be done in this field in developing countries [12].

Based on the above mentioned data, at present, risk factors relating to the prevention and control of non-communicable diseases in both men and

women are the most important priority for Iran's health system. If the Public Health System were able to collect accurate data on chronic disease risk factors this would be a big step towards better health planning. This study aimed to compare chronic disease risk factors in both genders in 2007 in Mashhad, a large city in Iran.

## 2. MATERIALS AND METHODS

This cross-sectional study was performed as part of a national survey for the assessment of risk factors for non-communicable diseases in Mashhad (the second most populous city in Iran and capital of Razavi Khorasan Province, located in the northeast of the country. In the 2011 census, its population was recorded as 3,131,586. The sample size for this study was estimated at the national level by considering the prevalence of risk factors, with  $\alpha = 0.05$  and  $\beta = 0.2$ .

It was calculated that one thousand participants from this province with an age range of 17-67 years who were referred to different urban health centers in the Razavi Khorasan Province should be included in this study. Random sampling was used to select participants from a list of patients at health centers. A national standardized questionnaire was filled in for them by trained interviewers. This questionnaire was designed at a national level and it included demographic data and questions about lifestyle that would enable calculation of the anthropometric index. Height, weight, waist circumference and blood pressure were measured by standard protocols using the same devices. All the instruments were calibrated daily. Blood pressure (BP) was defined as the mean of measurements taken 5 and 10 minutes after a rest with electronic sphygmomanometers (OMRON-M7). If the difference between the two blood pressure readings was more than 10 mmHg, this variable was measured for a third time and the mean of three measurements was recorded as the final blood pressure. Blood samples for biochemical tests were obtained after 10 to 12 hours of fasting. These tests were performed using standardized automatic devices in the laboratory of Razavi Khorasan Province Health Centre, under the supervision of the central national laboratory. BMI was calculated by using the formula: weight (kg) divided by the square of height (m<sup>2</sup>). Body weight was measured by using an analogue scale with participants only wearing one layer of clothing and height was measured by using a stadiometer with subject not wearing shoes or headgear. Waist circumference was

measured using a non-flexible tape in the standing position, midway between the lowest rib and the superior iliac border along the mid-axillary line.

We have used the following definitions in this study:

- Any form of smoking was considered as a risk factor.
- Participants who consumed fruits or vegetables less than 5 times a week were considered as a high risk group.
- Body Mass Index (BMI)  $\geq 25$  kg/m<sup>2</sup> and BMI  $\geq 30$  kg/m<sup>2</sup> were considered overweight and obese, respectively.
- A waist circumference greater than 90 cm in men and greater than 85 cm in women was considered to indicate abdominal obesity.
- Hypertension (HTN) was considered to be high systolic blood pressure above 140 mmHg or diastolic blood pressure above 90 mmHg or being under treatment for hypertension.
- Those with cholesterol levels  $\geq 200$  mg/dl, high density lipoprotein (HDL)  $\leq 40$  mg/dl in men or  $\leq 50$  mg/dl in women, and triglycerides (TG)  $\geq 150$  mg/dl were considered as high risk groups regarding lipid profile.
- Fasting blood sugar (FBS) of more than 125 mg/dl was considered as elevated blood sugar.
- Physical activity was categorized into three groups:
  - o Not active: subjects who were inactive in the workplace, during traveling and recreational times.
  - o Very active: subjects who were rigorously active in the workplace, and during commuting and recreational times.
  - o Moderately active: other subjects were categorized in this group.

It was explained to the subjects that high physical activities were defined as those that required extreme body movements and increased the respiratory rate and heart rate. Moderate activities meant activities that required moderate body movements, causing low elevation of respiratory and heart rates. Informed consent was obtained from all the participants. This study was approved by the National Ethics Committee. Data analysis was performed using Statistical Package for the Social

Sciences(SPSS)version 11.5;  $P < 0.05$  was considered as statistically significant. Frequency and percentage were used for description of qualitative variables. If quantitative data had a normal distribution, mean±standard deviation were used and if data did not have this prerequisite, the median and interquartile range were reported. Chi-square tests, T-tests and Mann–Whitney U-tests were used for comparison of variables between the two genders.

### 3. RESULTS

Demographic characteristics of the study population are shown in Table 1.

The differences between the two genders are shown in Figs. 1(A-E) and Figs. 2(A-F).

BMI, as one of the most important risk factors for chronic diseases, was significantly different between the two genders ( $P < 0.001$ ) This is shown in Fig. 1A.

The differences in smoking status between men and women are shown in Fig. 1B; statistical analysis showed a significant difference between the two genders ( $P < 0.001$ ).

Fig. 1C shows the average waist circumferences of the two genders. A statistically significant difference was found between men and women ( $P < 0.001$ ).

Fruit and vegetable consumption was primarily categorized as being less than 5 units per week (high risk) and more than 5 units per week (low risk). As can be seen in Fig. 1D, no significant difference was found between the two genders ( $P = 0.66$ ).

Physical activity was statistically different between men and women ( $P < 0.001$ , Fig. 1E).

Systolic and diastolic blood pressures were primarily categorized as being normal or elevated, as shown in Figs. 2A and B, there were no significant differences between the two genders for either systolic or diastolic pressure ( $P = 0.58$  and  $P = 0.31$ , respectively).

Triglyceride levels were primarily categorized into normal and elevated groups, as shown in Fig. 2C. No statistical difference was found between the two genders ( $P = 0.32$ ). HDL levels were primarily categorized into normal and elevated groups, as shown in Fig. 2D. There was a significant difference between the two genders ( $P < 0.001$ ). Fig. 2E shows the cholesterol levels of the two genders, based on high and low risk categories. No statistically significant difference was found between men and women ( $P = 0.24$ ).

FBS levels are shown in Fig. 2F; no statistically significant difference was observed between men and women ( $P = 0.53$ ).

### 4. DISCUSSION

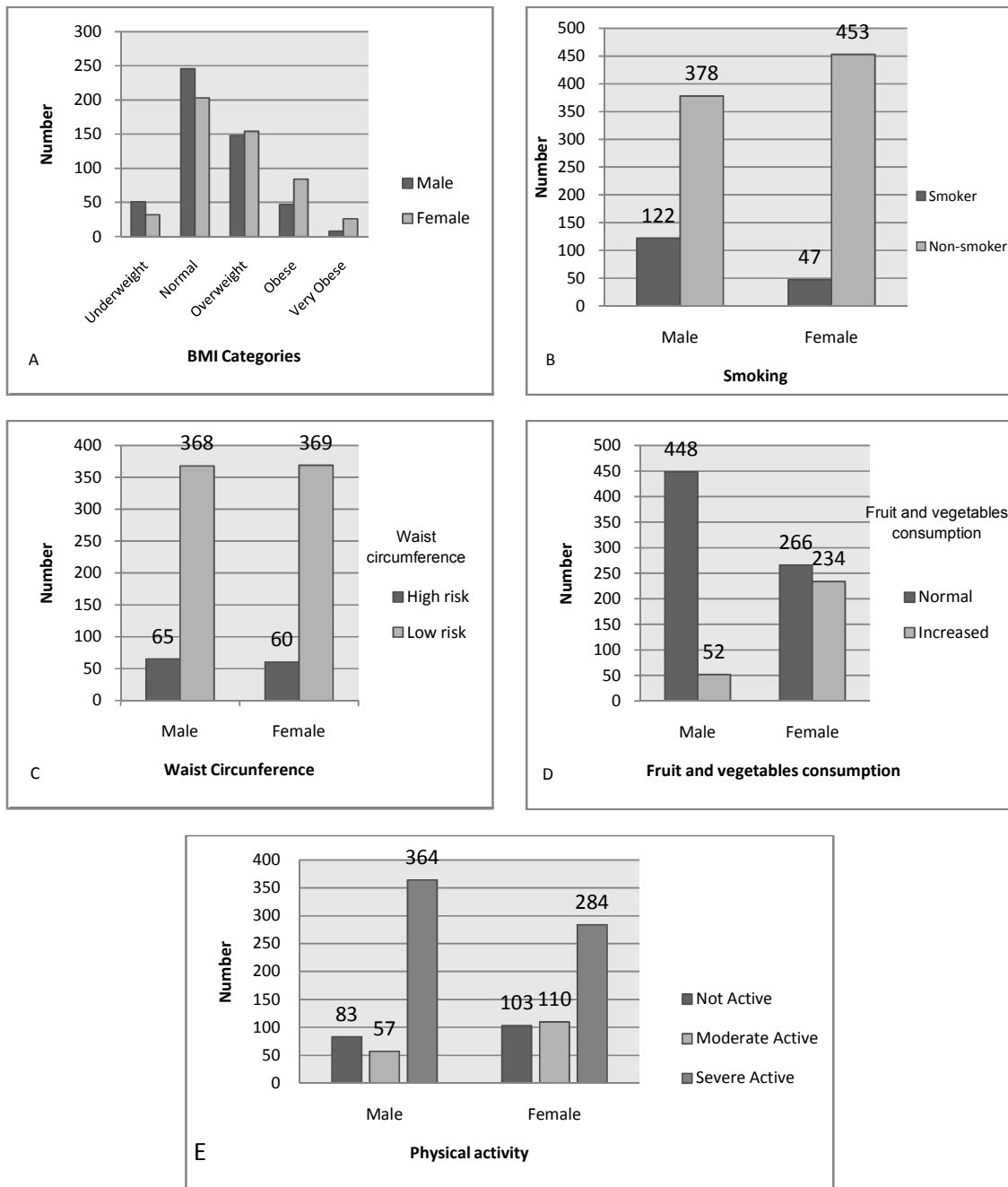
The most important risk factors for chronic diseases were: higher BMI and waist circumferences and low levels of HDL-cholesterol in women; smoking in men; and systolic and diastolic hypertension and hypercholesterolemia in both genders.

These findings are in agreement with previous studies that assessed chronic disease risk factors [13-17]. Results of the Diabetes Prevention and Control Program, which began in 2000 in rural areas of 17 provinces of Iran, showed that of more than 730,000 people aged older than 30 who were covered by the program; 25% had at least one risk factor, such as obesity, hypertension or a positive family history of diabetes [9]. These findings have been used to plan the prevention and screening programs.

**Table 1. Demographic characteristics of 1000 patients evaluated for risk factors of chronic diseases**

Gender		Male N (%)	Female N(%)
Age (year)*		500(50)	500(50)
		42(30-54)	41(30-54)
Habitat	Rural	234(23.4)	230(23)
	Urban	266(26.6)	270(27)
Job	Unemployed	24(2.4)	20(2)
	Employee	379(38.5)	53(5.4)
	Worker	2(0.2)	13(1.3)
	Self-employment	43(4.3)	14(1.4)
	Student	43(4.3)	31(3.1)
	Housewife	0(0)	362(36.8)

*Median (Interquartile Range)*



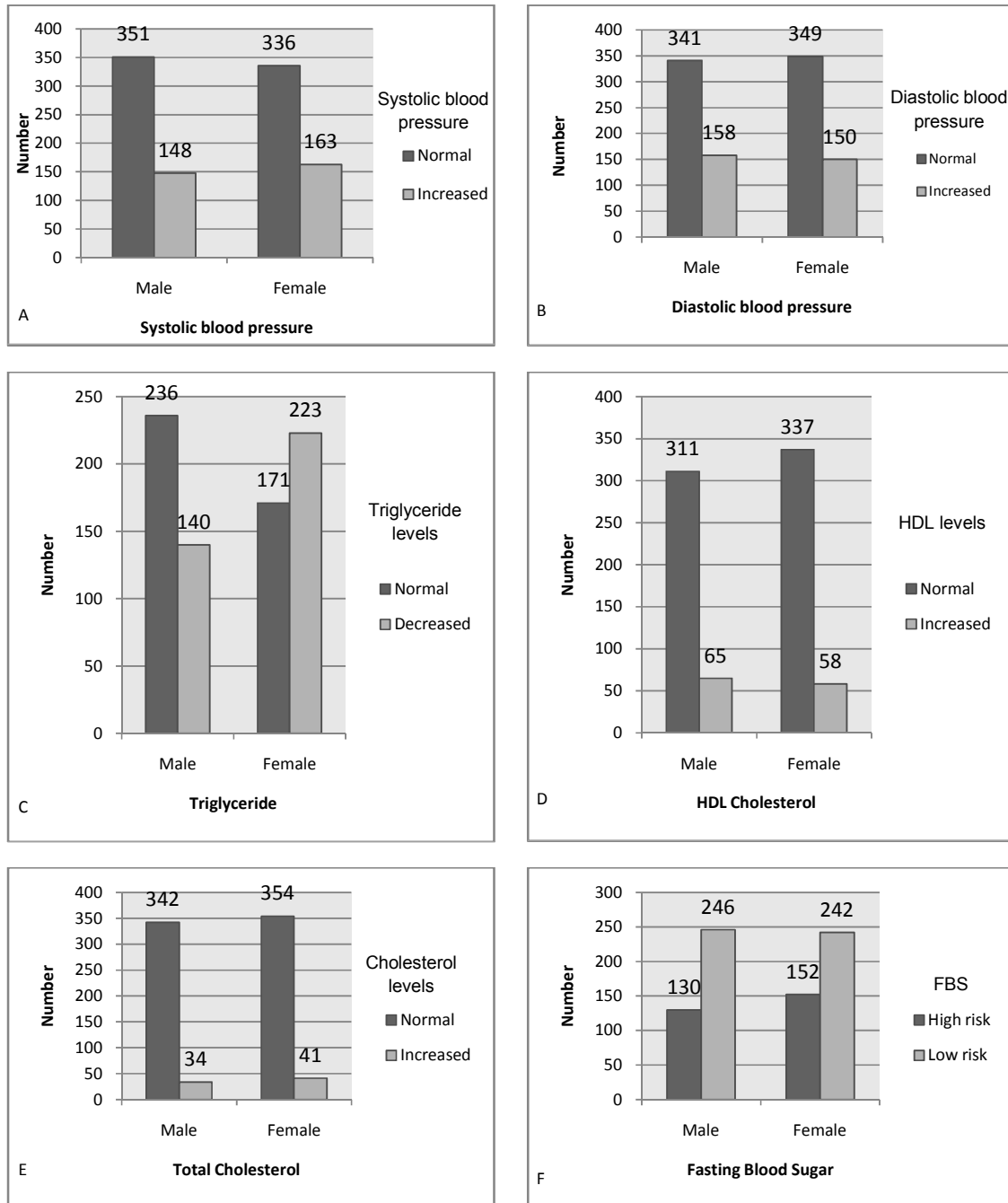
**Fig. 1. A- BMI in two genders, B- Smoking in two genders, C- Waist circumference in two genders, D- Fruit and vegetables consumption in two genders, E- Activity level in two genders**

Our study confirmed that gender is a specific effect modifier for common chronic disease risk factors. Results of a study conducted in 2000 in Iran showed that 11.1% of men and 11.9% of women had blood pressure over 160/95 mmHg; the prevalence of hypercholesterolemia (total

cholesterol levels > 240 mg/dl) was 9.4% in men and 12.4% in women; obesity prevalence (BMI≥30 kg/m<sup>2</sup>) was 2.14% in women and 6.5% in men. Smoking prevalence has been reported as about 9.2% in men and about 7.1% in women [8].

Another study was performed in Isfahan (Iran) in order to examine the modifiable risk factors for chronic diseases. The investigators defined eight risk factors as follows: sedentary lifestyle (47.2%), overweightness and obesity (BMI $\geq$ 25

kg/m<sup>2</sup>) (60.8%), hypertension(systolic or diastolic blood pressure) (22%), low levels of HDL(27.6%), high levels of total cholesterol (16.9%), high levels of triglycerides (22.1%) and high fasting blood sugar (7.6%) [18].



**Fig. 2. A- Systolic blood pressure in two genders, B- Diastolic blood pressure in two genders, C- Triglyceride levels in two genders, D- HDL levels in two genders, E- Cholesterol levels in two genders, F- Fasting blood Sugar (FBS) in two genders**

The CARMEN project was carried out in a city of Pelotas in southern Brazil to investigate chronic non-communicable disease risk factors. The results showed that the most common risk factors were physical inactivity (2.73%) and being overweight (1.48%). Women were less physically active than men and more than 50% of the cases had two or three risk factors [19]. It seems that changing lifestyles have affected the entire population and the risk factors for chronic diseases have increased [19]. In a study carried out in India in order to assess the risk factors for chronic diseases, the results similarly showed a high burden and prevalence of these risk factors [20].

In SURFNCD, a study performed on 89,000 people in 2009, Askari et al. assessed the risk factors for chronic diseases in Iran and concluded that smoking prevalence was 14.2%, and that 32.5% of participants aged 15-64 years did at least 10 minutes physical activity in their recreational time and 25.2% of participants had hypertension [21].

In another study aimed to determine the coronary disease risk factors in patients with hypertension compared with normotensive patients, Akbarzade et al. [22] demonstrated that strong predictors in hypertensive patients were male gender, diabetes mellitus, hyperlipidaemia and increased age, while in normotensive patients, these risk factors included male gender, smoking, family history and increased age. By considering these findings, different strategies should be planned for these patients.

A survey from Kenya showed that while the prevalence of hypertension was 22.8%, only 20% were aware of their hypertensive status. As we found in our study, the majority of males had normal BMI and waist circumference; however, nearly 40% of females had central obesity [23]. These and other similar results from different studies around the world point to the need for greater awareness and consideration of preventative approaches.

## 5. CONCLUSION

Risk factors for non-communicable diseases were found to differ between the two genders; it is therefore necessary to implement different approaches to deal with these risk factors in

males and females. A comprehensive and integrated approach is required to prevent and control the spread of chronic diseases and an inter-sectoral approach should be considered at all levels of policy making and implementation.

## ETHICAL APPROVAL

This study was a part of national survey and was approved in national ethical board; an informed consent was obtained from all participants.

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## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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