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Brief Report

Urban-Rural Differences in the Prevalence of Self-Reported Diabetes and its Risk Factors: The WHO STEPS Iranian Noncommunicable Disease Risk Factor Surveillance in 2011

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What's Known

- For all the studies examining the prevalence of diabetes in the urban and rural areas of Iran, there is a lack of a comprehensive study in the whole country.
- Several studies on risk factors for diabetes have been conducted utilizing different measurement units.

What's New

- This study boasts the largest nationally representative study sample, allowing comparisons between urban and rural settings and lifestyle patterns of self-reported diabetes risk factors.
- Prevalence of self-reported diabetes was higher in the urban areas than in rural areas in the adult population in Iran.
- Major risk factors for self-reported diabetes were studied using a modified WHO STEPS approach in the whole country.

Abstract

The high prevalence of diabetes in Iran and other developing countries is chiefly attributed to urbanization. The objectives of the present study were to assess the prevalence of self-reported diabetes and to determine its associated risk factors. This study is a part of the national noncommunicable disease risk factor surveillance, conducted in 31 provinces of Iran in 2011. First, 10069 individuals, between 20 and 70 years old (3036 individuals from rural and 7033 from urban areas), were recruited. The major risk factors were studied using a modified WHO STEPS approach. Diabetes was considered based on self-reported diabetes. The prevalence of self-reported diabetes was 10% overall. The prevalence in the rural and urban settings was 7.4% and 11.1%, respectively. Moderate physical activity (OR=0.45, 95% CI=0.29–0.71) and family history of diabetes)OR=6.53, 95% CI=4.29–9.93) were the most important risk factors among the rural residents and systolic blood pressure (OR=1.01, 95% CI=1–1.02), waist circumference (OR=1.02, 95% CI=1.01–1.03), and overweight (OR=1.36, 95% CI= 1–1.84) were significantly associated with self-reported diabetes in the urban residents. The prevalence of self-reported diabetes in the urban setting was higher than that in the rural setting. Physical inactivity, abdominal obesity, and high blood pressure were the most important risk factors associated with self-reported diabetes in Iran.

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Keywords ● Self report ● Prevalence ● Risk factors ● Non-communicable disease ● Iran

Introduction

Diabetes is one of the most prevalent noncommunicable diseases affecting people globally, and its prevalence is on the rise in every country of the world, particularly in developing countries.[1]

The World Health Organization (WHO) and the International Diabetes Federation (IDF) consider this disease a serious challenge in primary health care in the 21st century, with the threat deemed graver in the Middle East.[2] In 2030, 5 out of the world's 10 highest rates of national prevalence will occur in the Middle East countries. It is estimated that the adjusted prevalence of

diabetes to the world population will increase from 8% in 2010 to 9.8% in 2030 in Iran.[3] More than 60% of diabetic cases in Asian countries happen following socioeconomic development and increasing urbanization and lifestyle changes.[4] Other studies have demonstrated that migration and urbanization are increased by unhealthy lifestyles and noncommunicable diseases and that modifiable risk factors such as hypertension, type 2 diabetes, and obesity are more common in urban than in rural areas.[5] The increase in the prevalence of diabetes is the result of lifestyle changes, begotten by modernization. Accordingly, the risk factors of diabetes should be controlled with a view to allocating social and health resources. Given its high prevalence, costs, and side-effects in terms of personal life and its economic costs affecting any given country's health system, diabetes is regarded as one of the most pressing issues. Self-reported diabetes has been found to be a valid method to evaluate people's diabetes status in the populations of several countries such as Britain,[6] Japan,[7] and the USA.[8] Self-reported diagnosis of diabetes is the major method for determining diabetes in large-scale epidemiological studies, so self-reported diabetes can be used to identify and recruit diabetic subjects.[9]

The present study is a part of an investigation on the surveillance of noncommunicable disease risk factors (STEPS) in the urban and rural areas of all Iranian provinces with the objectives of describing geographical variations in the prevalence of self-reported diabetes and determining the modifiable risk factors among a representative national sample of the Iranian population.

Materials and Methods

Population and Sampling

We performed a community-based cross-sectional survey in Iran. The data utilized in this study were taken from the survey on noncommunicable diseases by the Ministry of Health in the urban and rural areas of 31 provinces of Iran during 2011. We randomly took a number of households proportional to the population size of each province. A stratified random sampling method was used, and sampling in the urban and rural areas was conducted in a random sampling. Data were collected on site during house-to-house visits, conducted based on the figures given as zip codes. Totally, 10069 individuals, at an age range of 20 to 70 years old, were selected (7033 from urban and 3036 from rural areas) from all the provinces, except Khuzestan and Kohgiluyeh and Boyer-Ahmad provinces, where rural sampling was not available. Areas with a population <5000 people as rural and with a population >5000 people as urban areas according to the 2011 census divisions were identified. The individual had to have been a resident for at least 1 year in the region of residence for the purposes of area identification.

Risk Factor Definition

In the present study, data gathering was conducted via interviews and anthropometric measurements in accordance with the STEPS guideline, retrieved from the WHO. A modified version of the WHO Stepwise questionnaire was pretested and suitably modified to fit Iranian conditions after pilot testing on a sub-population in each province in 2011 before its use for data collection. The data encompassed information on demographics (region of residence, age, gender, education, and occupation), fruit and vegetable consumption, behavioral factors (smoking and physical activity), and anthropometric and blood pressure measurements. Anthropometric measurements comprised height (measured in cm), weight (measured in kg), and body mass index (BMI), calculated by dividing weight by height squared as an indicator of the general condition of obesity measured using standard techniques. BMI<24.9 kg/m^2 indicated "normal" and BMI=25–29.9 kg/m^2 and BMI>30 kg/m^2 showed overweight and obesity, respectively) high BMI was defined as ≤25 kg/m^2).Waist circumference was measured in "cm", and the waist/hip ratio was obtained by dividing waist-to-hip circumferences, which indicated the status of abdominal obesity. Blood pressure was measured 3 times every 3 minutes in a sitting position using an Omron electronic sphygmomanometer with the accuracy of 1 mm Hg. High blood pressure was a systolic blood pressure >140 mm Hg and/or a diastolic blood pressure >90 mm Hg. According to the relevant guidelines, height, weight, waist circumference, and blood pressure were measured by trained medical personnel. Smoking was defined as daily cigarette and/or water-pipe consumption, low fruit and vegetable consumption as <5 units per day, and low physical activity as <150 minutes of moderate-intensity physical activity per week.[10] The physical activity questionnaire (Global Physical Activity Questionnaire, GPAQ, available on the website (http://www.who.int/chp/steps/en/) used in this survey was developed by the WHO for physical activity surveillance in countries and it collects information on physical activity participation in the 3 settings of activity at work, travel to and from places, and recreational activities. Overall,

physical activity was then graded as sedentary, moderate, and vigorous. In the current study, diagnosed diabetes was identified by a positive response to the question: "Have you ever been diagnosed with diabetes by a doctor during the past year?" irrespective of diabetes control status.

Statistical Analysis

Descriptive analysis was presented for the urban and rural residential areas. The normality of the variables was checked using the Kolmogorov–Smirnov test. For the continuous exposure variables with a non-normal distribution, the Mann–Whitney test and the χ^2 test were applied to compare the variables (dichotomy) between the urban and rural settings. The assumptions related to regression and nonparametric analyses were reviewed. The relationships between each of the risk factors as independent variables in the univariate logistic regression model were examined separately. The level of significance was a P≤0.05, and all the statistical analyses were calculated using SPSS 21 software.

Results

Characteristics in the Studied Population

Table 1 depicts the characteristics of the studied population in terms of the region of residence. The level of education in the urban areas was higher than that in the rural areas. The rural inhabitants exhibited statistically significantly higher physical activity than their urban counterparts. The means of weight, height, BMI, and waist in the urban subjects were higher than those in the rural subjects. Overweight,

Table 1: Demographic characteristics of the participants and self-reported diabetes risk factors by urban-rural comparison in the study of noncommunicable disease risk factors in Iran, 2011

Parameters	Total	Urban-Rural comparison		P value
		Urban	Rural	
Number of participants	10069	7033	3036	
Age (y)	43±15.34	43.15±15.25	42.66±15.53	NS
Educational status, no (%)				
Illiterate	2583 (25.7)	1334 (19)	1249 (41.1)	<0.001
Elementary school	2194 (21.8)	1432 (20.4)	762 (25.1)	
Secondary school	1516 (15.1)	1031 (14.7)	485 (16)	
High school diploma	2294 (22.8)	1898 (27)	396 (13)	
Higher education	1473 (14.6)	1331 (18.9)	142 (4.7)	
Work status, no. (%)				
Employee of the public sector	620 (6.2)	548 (7.8)	72 (2.4)	<0.001
Employee of the private sector	654 (6.5)	484 (6.9)	170 (5.6)	
Employed or self-employed	1919 (19.1)	1191 (16.9)	728 (24)	
Student, collegian, or soldier	658 (6.5)	521 (7.4)	137 (4.5)	
Housewife, retired, unpaid unemployed, or disabled	6218 (61.8)	4289 (61)	1929 (63.5)	
Height (cm)	162.40±11.38	163.08±1.11	160.80±1.18	<0.001
Weight (kg)	69.80±15.50	71.15±1.51	66.65±1.57	<0.001
Physical activity (occupational, %)				
Sedentary	4246 (42.2)	3102 (44.1)	1144 (37.7)	<0.001
Moderate	2851 (28.3)	1884 (26.8)	967 (31.9)	
Vigorous	529 (5.3)	337 (4.8)	192 (6.3)	
BMI, no (%)				
Normal (BMI≤24.9)	4219 (41.9)	2738 (38.9)	1481 (48.8)	<0.001
Overweight (25>BMI≤29.9)	3505 (34.8)	2565 (36.5)	940 (31)	
Obesity (BMI>30)	2288 (22.7)	1704 (24.2)	584 (19.2)	
Mean SBP	124.79±19.56	125.11±19.44	124.04±19.83	<0.001
Mean DBP	78.80±12.17	79.38±12.08	77.44±12.27	<0.001
Body mass index (kg/m^2)	26.98±15.06	27.23±14.04	26.38±17.19	<0.001
Waist circumference (cm)	88.92±14.88	89.72±14.83	87.07±14.82	<0.001
Waist/hip ratio	88.14±11.53	88.19±11.44	88.04±11.75	NS

Values are expressed as means±SDs for the normally distributed data and percentages for the non-normally distribute data, BMI: Body mass index; SBP: Systolic blood pressure; DBP: Diastolic blood pressure; NS: Not significant defined as a P>0.05; χ^2 tests for the normally distributed data and the Mann–Whitney tests for the non-normally distributed data

obesity, and mean systolic and diastolic blood pressure levels were significantly higher in the subjects living in the urban areas than in the rural inhabitants (P<0.001).

Prevalence of Self-Reported Diabetes and its Risk Factors

According to table 2, the prevalence of self-reported diabetes was detected to be significantly higher in the urban than in the rural areas (11.1% vs. 7.4% in the urban and rural areas, respectively). The prevalence of self-reported diabetes in most provinces was higher in the urban areas than in the rural areas (figure 1). The highest and lowest prevalence rates of self-reported diabetes in the urban regions were in Ilam and Kerman provinces, respectively (15.5% vs. 5%). The highest and lowest prevalence rates of self-reported diabetes in the rural regions were in Hamedan and Qazvin provinces, correspondingly (18.5% vs. 1.7%). The prevalence rates of most of the studied risk factors in the urban areas were higher than those in the rural areas.

Risk Factors and Self-Reported Diabetes

According to table 3, in both regions of residence, the chance of self-reported diabetes was increased up to 1.06 by increasing age from 20 years old. Overweight compared with normal weight increased the chance of self-reported diabetes among the residents of urban areas by 1.36 (OR=1.36, 95% CI=1–1.84). Waist size, in both regions, increased the chance of self-reported diabetes (OR=1.02 in the urban and OR=1.01 in the rural areas), which was significant in the urban areas. In both regions of residence, with increasing physical activity compared with low physical activity, the chance of self-reported diabetes was reduced; this relationship was statistically significant in the rural areas. Low intake of fruit and vegetables in the rural areas increased the prevalence of self-reported diabetes by 1.45-fold. Diabetic family history intensified the probability of self-reported diabetes in both areas.

Discussion

Diabetes epidemic is directly allied to increased urbanization, changing eating patterns followed by increasing inactive lifestyle and obesity around the world.[11] Among the important findings of the current study was the crude prevalence of self-reported diabetes, which was larger in the urban than in the rural settings.

The accuracy of self-reported diabetes has been evaluated in previous studies.[3,9] The accuracy of self-reported information can be affected by respondents' age, gender, education, medical knowledge, and frequency of contact with a physician.[9] Worldwide diabetes estimates

Table 2: Rural-urban differences in the prevalence of self-reported diabetes and its main risk factors in the study of noncommunicable disease risk factors in Iran, 2011

Parameters	Total	Urban-Rural comparison		P value
		Urban	Rural	
Self-reported diabetes	1006 (10)	780 (11.1)	226 (7.4)	<0.001
Daily tobacco	1328 (13.2)	935 (13.3)	393 (12.9)	NS
Low physical activity[a]	4246 (42.2)	3102 (44.1)	1144 (37.7)	<0.001
Low fruit and vegetable intake[b]	8448 (83.9)	5956 (84.7)	2492 (82.1)	0.020
High BMI[c]	5793 (57.5)	4269 (60.7)	1524 (50.2)	<0.001
High blood pressure[d]	1706 (16.9)	1204 (17.1)	502 (16.5)	NS
Family history of diabetes	2603 (25.09)	1948 (27.7)	655 (21.6)	<0.001

BMI: Body mass index; Data are in numbers and percentages unless otherwise indicated. NS: defined as a P>0.05; χ^2 tests; [a]Defined as<150 minutes of moderate or intense physical activity per week. [b]Defined as <5 servings of fruit and vegetables per day. [c]Defined as BMI≥25 kg/m^2, high BMI defined as overweight and obesity. [d]Defined as a systolic blood pressure≥140 mm Hg and/or a diastolic blood pressure ≥90 mm Hg

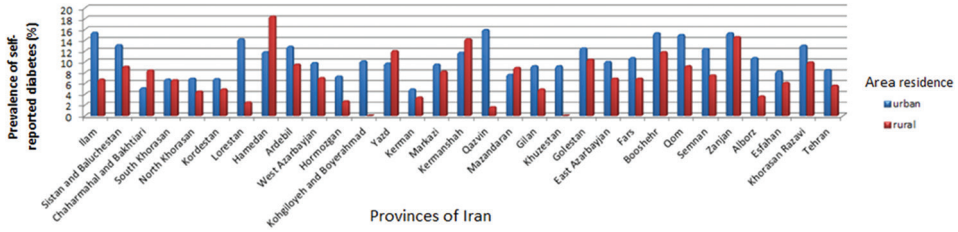

Figure 1: Prevalence of self-reported diabetes by region of residence (urban-rural) in 31 provinces of Iran. In most provinces, the prevalence of self-reported diabetes in the urban areas was higher than that in the rural areas.

Table 3: Logistic regression analysis using self-reported diabetes as the dependent variable in the study of noncommunicable disease risk factors in Iran, 2011

Parameters	Region of Residence			
	Rural		Urban	
	Adjusted		Adjusted	
	OR	95% CI	OR	95% CI
Age	1.06*	(1.04-1.07)	1.06*	(1.05-1.07)
Low fruit and vegetable intake	1.54	(0.51-4.57)	0.745	(0.35-1.57)
Physical activity				
Sedentary	Reference	Reference	Reference	Reference
Moderate	0.458*	(0.29-0.71)	0.961	(0.76-1.21)
Vigorous	0.497	(0.18-1.33)	0.658	(0.35-1.22)
Daily consumption of tobacco	0.569	(0.27-1.15)	0.713	(0.50-1.00)
Family history of diabetes	6.53*	(4.29-9.93)	4.67*	(3.74-5.83)
SBP	1.01	(0.99-1.02)	1.01*	(1.00-1.02)
DBP	1	(0.97-1.02)	0.983*	(0.97-0.99)
BMI				
Normal	Reference	Reference	Reference	Reference
Overweight	1.55	(0.91-2.66)	1.36*	(1.00-1.84)
Obesity	1.37	(0.68-2.73)	1.08	(0.75-1.57)
Waist circumference) cm)	1.01	(0.99-1.03)	1.02*	(1.01-1.03)

BMI: Body mass index; SBP: Systolic blood pressure; DBP: Diastolic blood pressure; Dependent variable was self-reported diabetes. Independent variables in all the models were age, family history, BMI, waist circumference, physical activity, fruit and vegetable intake, daily consumption of tobacco, SBP, and DBP. *P<0.05 was considered statistically significant

for the adult population (aged 20–79 y) range from 2.2 in Uganda to 16.8 in Saudi Arabia.[12] A study performed in Tehran by Asadi-Lari and colleagues[3] showed that the prevalence of self-reported type 2 diabetes was higher in the more deprived areas. The results of a study by Yuan X et al.[9] showed that the highest prevalence of self-reported diabetes was in urban areas, which chimes in with our findings. This finding, however, is inconsistent with the results of studies in developed countries such as Russia in which the prevalence is higher in rural than in urban areas.[13]

In the present study, self-reported diabetes prevalence was higher among the females than among the males, in both regions of residence, which could be attributed to women's higher susceptibility, large population of housewives, and inactive and low physical activity in their lifestyle.[14] In these works, the urban population significantly suffers more from obesity, has less physical activity, and more frequently has a diabetic family history than the rural population. Obesity and overweight is a strong modifiable risk factor for type 2 diabetes.[3] There is some evidence that the rate of obesity in Iran has increased.[15] Physical activity has been shown to have a beneficial effect in protecting from diabetes.[1] Narayanamurthy M.[16] conducted a study in India and revealed that diabetes prevalence was higher among people with less physical activity than those with high physical activity; further, inactive life style, diabetic family history, hypertension, and BMI were significantly related to diabetes. The results of a multinomial logistic analysis in Vietnam demonstrated that age, BMI, family history, hypertension, and physical activity were significantly related to diabetes.[17] Office work in cities leads to reduced physical activity such that the urban population moves toward an inactive lifestyle. A study by Govindu[18] showed that increased smoking led to increased self-reported diabetes in both sexes. Therefore, it is seriously recommended for diabetics to quit smoking. Elsewhere, Bazzano[19] showed that the intake of fruit and vegetables was associated with a decrease in self-reported diabetes risk. Different studies have also demonstrated the increased prevalence of high blood pressure in diabetics, which is consistent with the results of the present research.[20,21] A national study in Oman also revealed a positive slope between systolic blood pressure values in diabetics.[5] Other studies have also maintained that urban-rural differences with respect to diabetic risk factors may be resulted from environmental pollution and environmental conditions in urban areas.[22]

The present work was a cross-sectional study that could be followed by longitudinal studies to determine causative effects. The information on diabetes was collected through self-report, which is subject to recall bias, especially in rural areas. However, in developed societies or provinces,

self-reported data can be a reliable source for the prevalence of self-reported diabetes and can be strengthened by using simple finger-prick blood glucose measurements in addition to self-reports. Also, we were unable to distinguish between type 1 and 2 diabetes diagnoses. Nonetheless, previous analyses based on age at diagnosis suggest that the vast majority of the cases are of type 2 diabetes.[23] The results of the present study may be used as the foundation for further investigations. Our study was approved by the Ethics Committee of Shahid Beheshti University of Medical Sciences, Tehran, Iran.

Conclusion

The self-reported prevalence of diabetes and its risk factors overweight, low physical activity, and hypertension is on the rise among the Iranian urban population. As a result, the need to improve care for noncommunicable disease risk factors such as diabetes is more than ever before.

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Conflict of Interest: None declared.

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