



Original Article

Association between socio-demographic factors and diabetes mellitus in the north of Iran: A population-based study

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ABSTRACT

Objective: This study considers the prevalence of DM and some related factors among adults in the Golestan province (north of Iran) in 2006.

Methods: This is a Crosssectional–Descriptive and population-based study, carried out among 1999 cases (1000 men and 999 women) between 25 and 65 years old. Participants were chosen by cluster and stratified sampling in urban and rural areas. Data on socio-demographic factors were collected using questionnaire, and anthropometric and biochemical indexes were measured. Fasting Blood Sugar (FBS) equal to or over 126 mg/dl was classified as type 2 DM.

Results: Mean of age was 39.2 years and mean \pm SD of FBS among men and women was 94.51 ± 32.91 and 98.2 ± 40.1 mg/dl, respectively. Prevalence of DM was 8.3% [(men = 6.8% and women = 9.7%), (urban = 10.5% and villages = 6.4%)]. Twenty-five percent of patients were undiagnosed as whole, 43% of patients were unaware of their problem, in men more than women (48.5% versus 39.2%) and in rural area more than in urban area (35.1% versus 54.4%). We showed a positive and significant correlation between FBS and age, waist circumference and BMI ($P = 0.01$).

Conclusion: DM was the one of the biggest health problems in the north of Iran, and half of them were unaware of their morbidity. DM was influenced by socio-demographic factors.

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1. Introduction

The number of people suffering from DM is increasing due to population growth, aging, urbanization, low physical activity and the high prevalence of obesity [1,2]. Quantifying the prevalence of DM and the number of people affected by diabetes, now and in the future, is important in permitting national planning and allocation of resources.

DM and its complications are a major cause of morbidity and mortality in developing countries. Successful management of DM requires that we understand the beliefs, lifestyles, attitudes, family and social networks of the patients being treated [3].

Veghari [4] announced that diabetes is one of the health problem in north of Iran and that patients do not have an effective knowledge about their diet and blood glucose controlling methods. Hadaegh [5] in Iran [5] reported that DM is a health problem, and most of patients were unaware of their problem.

The studies of Azimi-Nezhad [6] and Maddah [7] in Iran showed that DM was related to socioeconomic factors. Janghorbani [8]

reported that metabolic syndrome was common among 65% of DM in Iran.

Of the 1,600,000 population in the north of Iran, 66.39% are 15–64 years old, whereas 43.9% and 56.1% are living in urban and rural areas, respectively [9]. Agriculture is the main job in rural areas. Different ethnic groups, such as Fars(native), Turkman and Sistani, are living in this region.

Due to the restriction in executing epidemiological projects, there has been no study of the DM in this area up till now; therefore it was necessary to design a research project to address this. The aims of this study are to determine the prevalence of DM and some socio-demographic factors such as sex, age, BMI, central obesity, residential area, physical activity, economic status and level of education in the north of Iran in 2006.

2. Material and methods

This population based cross sectional descriptive study was carried out in 1999 adults (1000 males and 999 females) between 25 and 65 years old. Participants were chosen by cluster and stratified sampling in urban and rural areas.

According to American Diabetes Association (ADA) criteria, Fasting Blood Sugar (FBS) equal to or more than 126 mg/dl was diagnosed as type 2 DM [10].

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FBS were determined using laboratory kits (enzymatic methods) and spectrophotometry technique. Data on socio-demographic factors and physical activity were collected using questionnaires. Anthropometric and biochemical indexes were examined. Body Mass Index (BMI) was calculated by dividing weight (kg) to height (m²). Those with a BMI of 25.0–29.9 kg/m² were classified as overweight, while those with a BMI \geq 30.0 kg/m² were classified as obese and BMI \geq 40 classified as pathologically obese [11]. Central obesity was defined based on waist circumference (men \geq 102 and women \geq 88 cm) [12].

Weight measurement without shoes and clothing was carried out using a balance, and recorded to the nearest 0.5 kg. Height and waist were measured to the nearest 0.5 cm, while the participants were standing on their feet. Waist circumference was measured using a tape measure over the iliac and lower border of the ribs.

Economic status, with regard to Iranian social-economic was categorized as based on home ownership, number of the rooms in the house, owning of a private car, structure of the house and the number of the family members. According to this list, the scoring of economic status of the sample population in this study was as follows: low \geq 1, moderate = 2–3, and good \geq 4. Physical activity was categorized as based on activity during daily work, in five categories: (1) no physical activities (without moving from one place to another place); (2) low activity (physical activity involving the extension of muscular-skeletal and moving from one place to another place); (3) moderate activity (physical activity sometimes involving an increase in respiratory rate like cleanliness, gardening, building painter, . . .); (4) high activity (physical activity involving a highly increased reparatory rate such as manual labor, building labor, porter, . . .) and (5) all of the above activities during the day.

Educational level categories were based on three levels: illiterate, 0–12 years schooling and college.

Data were analyzed using SPSS version 16.0 and statistical significance was defined as a *p*-value of <0.05. Analysis of variance (ANOVA) and chi-2 tests were used to compare group means and frequencies, respectively.

3. Results

Mean and standard deviation of FBS are present in Table 1, and prevalence of DM was shown in Table 2.

Mean and standard deviation of FBS was 96.40 \pm 36.38 mg/dl and the prevalence of DM was 8.3%. Nearly 25% of total cases of diabetes were undiagnosed. The portion of type 2 DM is 95.4%. There was a positive and significant correlation between age and blood glucose (*P* < 0.05). The mean of blood glucose was shown to be more significant in women more than men (*P* < 0.05). The prevalence of DM in women was 3.1% more than in men, and in 55–65 years olds, was five times more than the 25–35 years old group.

Statistically significant differences were shown among four age groups, based on the mean of FBS (*P* < 0.001).

The mean of blood glucose among central obese people was 10.1 mg/dl more than in normal people, and the prevalence of DM was also 7.3% more. The prevalence of DM in urban areas was more than rural (10.4% versus 6.4%), and statistical differences were significant (*P* = 0.003). Meanwhile, there was a direct relationship between FBS level and economic status, but statistical differences were not significant between the three economic groups.

Physical activity has a marked effect on FBS level, and the prevalence of DM in the low physical activity group was two times as much as in the high physical activity group, and the statistical differences were significant (*P* = 0.04). There was a positive correlation between BMI and FBS level, and it was elevated to 1.77 mg/

Table 1

FBS and socio-demographic factors among adult people in the north of Iran.

Characteristics	N	Mean(SD) mg/dl	ANOVA test <i>P</i> -value
<i>Sex</i>			
Male	1000	94.56(32.2)	0.023
Female	999	98.25(40.10)	
<i>Age group(y)</i> [*]			0.001
25–35	548	87.74(27.01)	
35–45	538	94.36(33.59)	
45–55	489	103.33(44.18)	
55–65	419	102.39(38.04)	
<i>Central obesity</i>			0.001
No	1113	92.05(29.67)	
Yes	850	102.65(44.84)	
<i>Residential area</i>			0.001
Urban	931	99.79(40.18)	
Village	1067	93.45(32.45)	
<i>Economic status</i> ^{**}			0.549
Low	211	93.83(38.30)	
Moderate	1717	96.68(36.29)	
Good	70	97.30(32.70)	
<i>Physical activity</i> ^{***}			0.004
Low	508	99.34(40.67)	
Moderate	883	93.34(30.90)	
High	83	88.39(18.17)	
Whole	96	96.75(36.48)	
<i>BMI</i> [†]			0.001
<18.5	58	87.69(16.62)	
18.5–24.9	665	91.12(31.67)	
25–29.9	663	95.94(33.72)	
30–34.9	538	103.35(44.53)	
35–39.9	42	113.67(52.19)	
<i>Educated level</i>			0.04
Illiterate	731	98.90(39.21)	
0–12 year schooling	1147	95.34(35.41)	
College	120	91.41(25.24)	
Overall	1999	94.40(36.38)	

SD: standard deviation.

FBS equal to or more than 126 mg/dL defines hyperglycemia and diabetes mellitus.

^{*} The mean of FBS has a positive and significant correlation with age and BMI.

^{**} Although a positive correlation has shown between economic status and FBS, statistical differences is not significant.

^{***} There is a negative and significant correlation between FBS and physical activity.

dl per 1 kg/m² of BMI increasing, as whole. The prevalence of DM among pathologic obese people was five times more than in normal people. Statistical differences were significant (*P* = 0.001). There was a statistical significant difference among the three educational levels and DM was significantly observed in illiterate people, more so than in other educated groups (*P* = 0.004). The prevalence of DM among central obese people was significantly more than in normal people (*P* = 0.001).

4. Discussion

The results of this study were discussed from two aspects, prevalence and certain factors related to DM. In the present study, the prevalence of DM was 8.3%, and 25% of them were undiagnosed. The prevalence of diabetes was estimated to be 10% and 8.1% in women and men in Theran (center of Iran), respectively; based on this study, 40% of patients were undiagnosed [5]. Another study [6] reported that the prevalence of DM in Iran was 5.5%. The proportion of undiagnosed diabetes in China population was 70.5% and 58% in rural and urban areas, respectively [13]. In comparison with other studies, the undiagnosed DM rate in the north of Iran is appropriate.

King and et al. [2] were estimated the prevalence of DM in Iran up to 5.5% in 1995, 6.8% in 2000 and 6.8% in 2025. The prevalence

Table 2
Relationship between hyperglycemia and socio-demographic factors among adult people in the north of Iran.

Characteristics	N	Hyperglycemia N (%)	Chi 2 test P-value
Sex			
Male	1000	68(6.8)	0.029
Female	999	97(9.7)	
Age group(y)[*]			
25–35	548	14(2.8)	0.001
35–45	538	26(5.2)	
45–55	489	53(10.6)	
55–65	419	72(14.5)	
Central obesity[*]			
No	1113	58(5.2)	0.001
Yes	850	106(12.5)	
Residential area			
Urban	931	97(10.4)	0.003
Village	1067	68(6.4)	
Economic status			
Low	211	14(6.6)	0.665
Moderate	1717	146(8.5)	
Good	70	5(7.1)	
Physical activity[*]			
Low	508	51(10.0)	0.038
Moderate	883	55(6.2)	
High	83	4(4.8)	
Whole	96	7(7.3)	
BMI[*]			
<18.5	58	2(3.4)	0.001
18.5–24.9	665	32(4.8)	
25–29.9	663	51(7.7)	
30–34.9	538	69(12.8)	
35–39.9	42	8(19.0)	
Educated leve^{*1}			
Illiterate	731	72(9.8)	0.056
0–12 year schooling	1147	89(7.8)	
College	120	4(3.3)	
Overall	1999	16.5(8.3)	

^{*} Statistical differences are significant.

of DM in our study was approximately equal to other studies. We showed the prevalence of DM in women 3.1% more than men. Another study [2] have similar result. In religions countries like Iran, because of family priorities women can not exercise in public places. Like the other study [2], we have DM prevalence in urban more than rural residents.

The prevalence of DM increased with age, low physical activity, central obesity and BMI. Some studies [14–16] showed a higher DM rate in older people.

Patrick [17] and Wannamethee [18] showed that the prevalence of DM in low active people is more than in highly active people. Harris in US [15], Simmons [19] O'Rahilly [20], Regzedmaa [21], Brancati [22] and Thompson [23] announced that obesity and central obesity are two risk factors for the incidence of DM.

Like other studies [24,25] there was no positive correlation between economic status and educational level. Meanwhile, Weissman [26] showed that low economic status was associated with low access to health care. Limited access to health care not only influences the use of preventive services [27], but also elevates the risk of a decline in health [28].

In the present study, there was an association between illiteracy and DM which was consistent with other studies [29–31]. Moreover, limited literacy is associated with a decreased knowledge of medical conditions [32,33]. These persons have no access to knowledge about self care for the prevention or treatment of DM and other diseases [34,35].

We had no information about medical supervision status, and we did not determine all of the factors related to DM, such as

quantity and quality of diet, duration of diabetes morbidity and ethnic differences in this area. These are the limitations of this study.

Briefly, our study has shown that DM was a health problem in the north of Iran, and one to four of diabetic patients remained undiagnosed. Socio-economic status, obesity and low physical activity are predisposing factors for DM morbidity. A screening and intervention program for preventing of DM in the north of Iran is necessary.

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References

- [1] Wild S, Roglic G, Green A, Sicree R, King H. Global prevalence of diabetes: estimates for the year 2000 and projections for 2030. *Diabetes Care* 2004;27:1047–53.
- [2] King H, Aubert RE, Herman WH. Global burden of diabetes, 1995–2025. Prevalence, numerical estimates, and projections. *Diabetes Care* 1998;21:1414–31.
- [3] Bradley C, Gamsu DS. For the Psychological Well-being Working Group of the WHO/IDF St Vincent Declaration Action Programme for Diabetes. Measures of psychological well-being and treatment satisfaction developed from the responses of people with tablet-treated diabetes. *Diabet Med* 1994;7:510–6.
- [4] Veghari G, Marjani A, Joshaghani H. The study of diabetes mellitus in Gorgan, Iran. *Saudi Med J* 2007;28(8):1300–1.
- [5] Hadaegh F, Bozorgmanesh M, Harati H, Saadat N, Azizi F. High prevalence of diabetes and abnormal glucose tolerance in urban Iranians aged over 20 years: determining an effective screening strategy for un-diagnosed diabetes. *Iranian J Endocrinol Metab* 2008;9(4):384–91.
- [6] Azimi-Nezhad M, Ghayour-Mobarhan M, Parizadeh MR, Safarian M, Esmaeili H, Parizadeh SM, et al. Prevalence of type 2 diabetes mellitus in Iran and its relationship with gender, urbanization, education, marital status and occupation. *Singapore Med J* 2008;49(7):571–6.
- [7] Maddah M. Association of diabetes with living area in Iranian women. *Int J Cardiol* 2008; 20 [Epub ahead of print].
- [8] Janghorbani M, Amini M. Metabolic syndrome in type 2 diabetes mellitus in Isfahan, Iran: prevalence and risk factors. *Metab Syndr Relat Disord* 2007;5(3):243–54.
- [9] Statistical Center of Iran. Population and Housing Census. Available from: <http://www.sci.org.ir>; 2006.
- [10] American Diabetes Association. Diagnosis and classification of diabetes mellitus. *Diabetes Care* 2004;27:55–10.
- [11] WHO. Obesity: Preventing and managing the global epidemic. WHO/NUT/98. Geneva, Switzerland: World Health Organization; 1998.
- [12] Molarius A, Seidell JC, Visscher TL, Hofman A. Misclassification of high-risk older subjects using waist action levels established for young and middle-aged adults – results from the Rotterdam Study. *J Am Geriatr Soc* 2000;48(12):1638–45.
- [13] Dong Y, Gao W, Nan H, Yu H, Li F, Duan W, et al. Prevalence of type 2 diabetes in urban and rural Chinese populations in Qingdao, China. *Diabet Med* 2005;22(10):1427–33.
- [14] Harris MI, Hadden WC, Knowler WC, Bennett PH. Prevalence of diabetes and impaired glucose tolerance and plasma glucose levels in US population aged 20–74 year. *Diabetes* 1987;36(4):523–34.
- [15] Porapakkhom Y, Pattaraarchachai J, Aekplakorn W. Prevalence, awareness, treatment and control of hypertension and diabetes mellitus among the elderly: the 2004 National Health Examination Survey III, Thailand. *Singapore Med J* 2008;49(11):868–73.
- [16] Bruce A, Reeder, Aubie Angel T, Marielle Ledoux, Simon W, Rabkin, Kue Young T, et al. Obesity and its relation to cardiovascular disease risk factors in Canadian adults. *Can Med Assoc J* 1992;146(11):2009–19.
- [17] Patrick W, Sullivan, Elaine H, Morrato, Vahram Ghushchyan, Holly R, Wyatt, James O. Hill. Obesity, inactivity, and the prevalence of diabetes and diabetes-related cardiovascular comorbidities in the US, 2000–2002. *Diabetes Care* 2005;28(7):1599–603.
- [18] Wannamethee SG, Shaper AG. Weight change and duration of overweight and obesity in the incidence of type 2 diabetes. *Diabetes Care* 1999;22(8):1266–72.
- [19] Simmons D, Rush E, Crook N. Prevalence of undiagnosed diabetes, impaired glucose tolerance, and impaired fasting glucose among Maori in Te Wai o Rona: diabetes prevention strategy. *NZ Med J* 2009;122(1288):30–8.
- [20] O'Rahilly S. Non-insulin dependent diabetes mellitus: the gathering storm. *BMJ* 1997;314:955–9.

- [21] Regzedmaa Nyamdorj, Qing Qiao, Stefan Söderberg, Pitkaniemi Janne M, Zimmet Paul Z, Shaw Jonathan E, et al. BMI compared with central obesity indicators as a predictor of diabetes incidence in Mauritius. *Obesity* 2009;17(2):342–8.
- [22] Brancati FL, Wang NY, Mead LA, Liang KY, Klag MJ. Body weight patterns from 20 to 49 years of age and subsequent risk for diabetes mellitus: the Johns Hopkins Precursors Study. *Arch Int Med* 1999;159(9):957–63.
- [23] Thompson D, Edelsberg J, Colditz GA, Bird AP, Oster G. Lifetime health and economic consequences of obesity. *Arch Int Med* 1999;159(18):2177–83.
- [24] Bourdel-Marchasson I, Helmer C, Barberger-Gateau P, Peuchant E, Fevrier B, Ritchie K, et al. Characteristics of undiagnosed diabetes in community-dwelling French elderly: the 3C study. *Diabetes Res Clin Pract* 2006;76:257–64.
- [25] Wilder RP, Majumdar SR, Klarenbach SW, Jacobs P. Socio-economic status and undiagnosed diabetes. *Diabetes Res Clin Pract* 2005;70:26–30.
- [26] Weissman JS, Stern R, Fielding SL, Epstein AM. Delayed access to health care: risk factors, reasons, and consequences. *Ann Int Med* 1991;114:325–31.
- [27] DeVoe JE, Fryer GE, Phillips R, Green L. Receipt of preventive care among adults: insurance status and usual source of care. *Am J Public Health* 2003;93:786–91.
- [28] Baker DW, Sudano JJ, Albert JM, Borawski EA, Dor A. Lack of health insurance and decline in overall health in late middle age. *N Engl J Med* 2001;345:1106–12.
- [29] Al-Moosa S, Allin S, Jemai N, Al-Lawati J, Mossialos E. Diabetes and urbanization in the Omani population: an analysis of national survey data. *Popul Health Metr* 2006;4:5.
- [30] Gupta A, Gupta R, Sarna M, Rastogi S, Gupta VP, Kothari K. Prevalence of diabetes, impaired fasting glucose and insulin resistance syndrome in an urban Indian population. *Diabetes Res Clin Pract* 2003;61(1):69–76.
- [31] Laramee AS, Morris N, Littenberg B. Relationship of literacy and heart failure in adults with diabetes. *BMC Health Serv Res* 2007;7:98.
- [32] Lindau ST, Tomori C, Lyons T, Langseth L, Bennett CL, Garcia P. The association of health literacy with cervical cancer prevention knowledge and health behaviors in a multiethnic cohort of women. *Am J Obstet Gynecol* 2002;186(5):938–43.
- [33] Schillinger D, Grumbach K, Piette J, Wang F, Osmond D, Daher C, et al. Association of health literacy with diabetes outcomes. *JAMA* 2002;288(4):475–82.
- [34] Kalichman SC, Benotsch E, Suarez T, Catz S, Miller J, Rompa D. Health literacy and health-related knowledge among persons living with HIV/AIDS. *Am J Prev Med* 2000;18(4):325–31.
- [35] Scott TL, Gazmararian JA, Williams MV, Baker DW. Health literacy and preventive health care use among medicare enrollees in a managed care organization. *Med Care* 2002;40:395–404.