

# Relation of type 2 diabetes mellitus with gender, education, and marital status in an Iranian urban population

Karamatollah Rahmanian<sup>1</sup>, Mohammad Shojaei\*<sup>2</sup>, Abdolreza Sotoodeh Jahromi<sup>3</sup>

## Abstract

**Background:** Type 2 diabetes mellitus is one of the most important cardiovascular risk factors. Objectives: This study was performed to assess the relationship of diabetes with gender, education, and marital status in an Iranian urban population.

**Methods:** A total of 892 men and women aged 30-85 were recruited using a cluster-stratified sampling method from an urban population. Using a questionnaire, demographical data including gender, education, and marital status were collected. A blood sample after fasting for at least eight hours was collected from each subject. Associations of type 2 diabetes mellitus and studied variables were tested for significance.

**Results:** The prevalence of diabetes mellitus was 11.6%; 11.1% in men and 12.1% in women with no significant difference between them. Diabetes mellitus was most prevalent in the oldest age (age more than 60 years, 22.9%) and low education groups (17.9%,  $P < 0.001$ ). Marital status was not significantly related to diabetes mellitus ( $P = 0.37$ ).

**Conclusion:** The prevalence of diabetes mellitus is related to education within the Iranian population. Thus preventive strategies should be based on the affective factors.

**Keywords:** Diabetes mellitus, Education, Marital status, Gender

## Introduction

Type 2 diabetes mellitus (DM) is one of the most common chronic diseases in the world. The prevalence of DM is growing due to life style changes and health status improvements (1). It is estimated that about 300 million subjects will have this condition by 2025 (2). In 2007, 240 million people in the world suffered from DM (3). It is estimated that more than 70% of all diabetic patients in the world live in developing countries (4). The prevalence of DM was 15.6% in Syria in 2006 (5), 13.14% in Pakistan in 2008 (6), and 6.1% in the Asian Indian population (7). The prevalence of type 2 DM ranges from 2.6% to 15.1% in the Asia-Pacific region (8) and 3.5% to 13.1% in subjects aged 30 or

older in Iran (9). In the national survey of risk factors for non-communicable diseases of Iran, the prevalence of DM in the population aged 25-64 was 7.7% (10).

The relationship between socioeconomic status (SES) and disease was obvious, with SES inversely related to the prevalence of DM (11-13). One important factor of SES is education. A marked difference in the risk of DM was associated with education (14-16), although in some studies, and association between DM and education was not identified (17-18). Presently, the relationship between the prevalence of DM and marital status is controversial (17). However, few studies have examined the relationship of previously diagnosed

1: Department of Community Medicine, Jahrom University of Medical Sciences, Jahrom, Iran

2: Department of Internal Medicine, Jahrom University of Medical Sciences, Jahrom, Iran

3: Department of Immunology, Jahrom University of Medical Sciences, Jahrom, Iran

\*Corresponding author: Mohammad Shojaei; Tel: +98 9171913446; Fax: +98 791- 3341509; E-mail: Shojaei1300@yahoo.com

Received: Dec 28, 2012; Accepted: Feb 25, 2013

DM (PDM) and newly diagnosed DM (NDM) with education and marital status. A significant inverse correlation between educational level and NDM has been reported in Korean women (18); however, no significant association was observed between DM and gender, marital status, or education in Iranian women (17). The aim of this study was to assess the association of DM (newly and previously diagnosed) with gender, education, and marital status in south Iran.

### Materials and Methods

As a part of a survey of ischemic heart disease, using a multistage sampling method, 1000 subjects (538 women and 462 men, aged 30–85) were recruited in Jahrom, Fars province, south Iran. Jahrom includes 10 urban health centers. Subjects were selected randomly from each center.

Informed consent was obtained from all participants before they enrolled in the study.

Data on demographical and biochemical measures were completed for 892 subjects. One hundred forty subjects (15.7%) were prediabetic, thus 752 persons used for the analyses are presented in this report.

Data collected included age, sex, education, and marital status. Subjects were classified into subgroups according to the level of formal education received; low (primary school or lower), medium (secondary to diploma), and high (college) education. Marital status was classified into two groups; married, and other (singled, divorced, or widowed).

Blood samples were obtained in the morning after an 8-10 hour overnight fast at the Paymaniah hospital, and assayed for serum glucose using standard techniques.

According to the criteria of the American Diabetes Association (19), a fasting blood sugar (FBS) < 100 mg/dl was considered as normal; values between 100 and 126 mg/dl, and those  $\geq$  126 mg/dl were considered as impaired fasting glucose (IFG) and DM, respectively. DM was divided to two groups, NDM (subjects with no histories of DM or no use of hypoglycemic agents) and PDM (subjects with histories of diabetes mellitus or use of hypoglycemic agents).

Statistics were analyzed using the Statistical Package for Social Sciences version 11.5. Qualitative data was analyzed using the chi-square method. Associations between DM and variables (age, sex,

education and marital status) were analyzed using binary logistic regression. Differences were considered significant at  $P < 0.05$ .

### Results

The overall prevalence of DM was 11.6% (Table 1); 11.1% in men and 12.1% in women, with no significant difference between the sexes ( $p > 0.05$ ). The prevalence of NDM was 2% in men and 2.3% in women.

There was association between age group and prevalence of DM (Table 1). The prevalence of DM increased with advancing age from 4% in subjects 30-39 to 22.9% in subjects  $\geq$  60 ( $p < 0.001$ ). Also, the prevalence of PDM increased from 3.1% in subjects 30-39 to 20.9% in the  $\geq$  60 age groups ( $p < 0.001$ ), but there was no statistical difference between age groups and prevalence of NDM.

The association of education with DM was inverse and statistically significant (Table 1). The prevalence of DM was highest in the low educational group at 17.9% ( $p < 0.001$ ), followed by the medium (6.8%) and high educational groups (6.5%). The prevalence of PDM was high in the low education group ( $p < 0.001$ ), but not significant for NDM.

Although there are no significant differences in the prevalence of DM among married and other subjects, the differences are slightly more noticeable in other subjects (15.9% vs. 11.1%;  $p = 0.373$ ).

The prevalence of PDM and NDM was not associated with marital status.

By binary logistic regression, the oldest age groups had the highest odds-ratio (OR= 7.78, 95% CI: 3.17–19.09,  $p < 0.001$ ) in subjects with PDM compared to subjects with normal FBS (Table 2). Moreover, a significantly increased risk of PDM was found with lower educational level, with OR of 2.87 (95% CI: 1.08–7.63,  $p = 0.034$ ). There is no significant association of NDM with studied variables in subjects with normal FBS. Compared to subjects in the high education group, subjects in the low education group had a 6.23-fold greater (CI 95%: 1.21-31.92,  $p = 0.028$ ) risk of PDM than NDM.

### Discussion

In our study, although the prevalence of DM was higher in females than males, the difference was not significant. This may be because of less physical activities in women than men. Some studies found a

relationship between DM and gender (20-21), however, data from other studies agree with our finding (17, 22).

Regarding age, a significant difference was observed in the prevalence of DM between the oldest age group and other related categories. Other studies have also indicated that the prevalence DM increases with age (17, 23).

Low educational level correlated with PDM and DM in this study, which is consistent with other studies (24-25). In the Women's Health Study, low education was associated with an increased risk for type 2 DM (16). Fisher-Hoch et al. reported that the prevalence of undiagnosed DM was inversely related to socioeconomic status (26); however, other researchers found no association between education and DM (17, 27). Rathman et al. reported no difference in the prevalence of NDM in either men or women of any educational level (18).

In this study, no significant difference was observed in the prevalence of DM, PDM, and DM between the married and other subgroups. Another study reported a similar result (17); however, some

findings suggested that single, divorced, and widowed statuses are significantly associated with DM (28-29).

The multivariate analysis indicates that the prevalence of PDM is related to age. This finding is consistent with previous studies (29-31).

Also, PDM was higher in the lower education groups than in the highest education group. The inverse correlation of DM with education was observed in previous studies (32-34), but other studies reported opposite results (17-18). Also in an ELSA study, education was not significantly related to DM after adjustment for all covariates (35).

This study is limited by the cross-sectional nature of the data, which provides no indication of the direction of effect or causality. Also, only some variables were analyzed. Longitudinal studies would complement the present study to determine causality and directional effect of the factors.

#### Acknowledgements

Authors thanks to all subjects enrolled to this study. This research has been financed by Jahrom University of Medical Sciences.

Total	No: 752	Normal FBS		PDM		NDM	
		Number	%	Number	%	Number	%
		648	72.7	85	9.5	19	2.1
Age groups (years)	30-39	207	90.3	7	3.1	2	0.9
	40-49	195	75.6	10	3.9	7	2.7
	50-60	140	67	27	12.9	6	2.9
	≥60	106	54.1	41	20.9	4	2
Sex	Male	289	71.4	37	9.1	8	2
	Female	359	73.7	48	9.8	11	2.3
Education	Low	256	64.5	62	15.6	9	2.3
	Medium	274	77.2	18	5.1	6	1.7
	High	118	84.2	5	3.6	4	2.9
Marital status	Married	584	73.2	72	9	17	2.1
	Other	64	68.1	13	13.8	2	2.1

**Table 1:** Prevalence of previously and newly diagnosed diabetes mellitus (PDM and NDM) according to age, education, and marital status by sex. (FBS: Fasting Blood Sugar, No: Number, NDM: Newly diagnosed Diabetes Mellitus, PDM: Previously diagnosed Diabetes Mellitus).

		Normal FBS * PDM			Normal FBS * NDM			NDM * PDM		
		OR	CI 95%	p	OR	CI 95%	p	OR	CI 95%	p
Age group (year)	30-39	1			1			1		
	40-49	1.44	0.53-3.86	0.471	3.71	0.76-18.1	0.104	0.49	0.07-3.23	0.464
	50-59	4.59	1.90-11.08	0.001	4.43	0.88-22.29	0.071	1.44	0.23-9.01	0.696
	≥60	7.78	3.17-19.09	<0.001	3.9	0.7-21.67	0.119	3.73	0.5-27.7	0.198
Education	High	1			1			1		
	Medium	1.71	0.61-4.81	0.305	0.61	0.16-2.23	0.455	4.53	0.71-28.67	0.108
	Low	2.87	1.08-7.63	0.034	0.76	0.2-2.82	0.684	6.23	1.21-31.92	0.028

**Table 2:** ORs (95% CI) for prevalence of newly and previously diagnosed diabetes by binary logistic regression. (Variables entered on step 1: Age, sex, education, and marital status. CI: Confidence Interval, FBS: Fasting Blood Sugar, NDM: Newly diagnosed Diabetes Mellitus, OR: Odds Ratio, PDM: Previously diagnosed Diabetes Mellitus)

## References

- Shamseddeen H, Getty JZ, Hamdallah IN, Ali MR. Epidemiology and economic impact of obesity and type 2 diabetes. *Surg Clin North Am.* 2011 Dec;91(6):1163-72, vii.
- Ebrahim S, Smith GD. Exporting failure? Coronary heart disease and stroke in developing countries. *Int J Epidemiol.* 2001 Apr;30(2):201-5.
- Albache N, Al Ali R, Rastam S, Fouad FM, Mzayek F, Maziak W. Epidemiology of Type 2 diabetes mellitus in Aleppo, Syria. *J Diabetes.* 2010 Jun;2(2):85-91.
- Ebrahim S, Davey SG. Exporting failure coronary heart disease and stroke in developing countries. *Int J Epidemiol.* 2001;30:201-5.
- Albache N, Al Ali R, Rastam S, Fouad FM, Mzayek F, Maziak W. Epidemiology of Type 2 diabetes mellitus in Aleppo, Syria. *J Diabetes.* 2010;2(2):85-91.
- Zafar J, Bhatti F, Akhtar N, Rasheed U, Bashir R, Humayun S, et al. Prevalence and risk factors for diabetes mellitus in a selected urban population of a city in Punjab. *J Pak Med Assoc.* 2011;61(1):40-7.
- Nazir A, Papita R, Anbalagan VP, Anjana RM, Deepa M, Mohan V. Prevalence of Diabetes in Asian Indians Based on Glycated Hemoglobin and Fasting and 2-H Post-Load (75-g) Plasma Glucose (CURES-120). *Diabetes Technol Ther.* 2012;23:23.
- Lee CM, Huxley RR, Lam TH, Martiniuk AL, Ueshema H, Pan WH, et al. Prevalence of diabetes mellitus and population attributable fractions for coronary heart disease and stroke mortality in the WHO South-East Asia and Western Pacific regions. *Asia Pac J Clin Nutr.* 2007;16(1):187-92.
- Haghdoust AA, Rezagadeh-Kermani M, Sadghirad B, Baradaran HR. Prevalence of type 2 diabetes in the Islamic Republic of Iran: systematic review and meta-analysis. *Eastern Mediterranean Health Journal.* 2009;15(3):591-9.
- Esteghamati A, Gouya MM, Abbasi M, Delavari A, Alikhani S, Alaedini F, et al. Prevalence of Diabetes and Impaired Fasting Glucose in the Adult Population of Iran: National Survey of Risk Factors for Non-Communicable Diseases of Iran. *Diabetes Care.* 2008;31(1):96-8.
- Tang M, Chen Y, Krewski D. Gender-related differences in the association between socioeconomic status and self-reported diabetes. *Int J Epidemiol.* 2003;32:381-5.
- Green C, Hoppa RD, Young TK, Blanchard JF. Geographic analysis of diabetes prevalence in an urban area. *Soc Sci Med.* 2003;57:551-60.
- Whitford DL, Griffin SJ, Prevost AT. Influences on the variation in prevalence of type 2 diabetes between practices: practice, patient or socioeconomic factors? *Br J Gen Pract.* 2003;53:9-14.
- Ko GTC, Chan CN, Yeung VTF, Chow CC, Tsang LWW, Cockram CS. A low socio-economic status is an additional risk factor for glucose intolerance in high risk Hong Kong Chinese. *Eur J Epidemiol.* 2001;17:289-95.
- Chiu CJ, Wray LA. Physical disability trajectories in older Americans with and without diabetes: the role of age, gender, race or ethnicity, and education. *Gerontologist.* 2011;51(1):51-63. Epub 2010 Aug 16.
- Krishnan S, Cozier YC, Rosenberg L, Palmer JR. Socioeconomic status and incidence of type 2 diabetes: results from the Black Women's Health Study. *Am J Epidemiol.* 2010;171(5):564-70.
- Azimi-Nezhad M, Ghayour-Mobarhan M, M.R P, Safarian M, Esmaeili H, Parizadeh SMJ, et al. Prevalence of type 2 diabetes mellitus in Iran and its relationship with gender, urbanisation, education, marital status and occupation. *Singapore Med J.* 2008;49(7):571-6.
- Rathmann W, Haastert B, Icks A, Giani G, Holle R, Meisinger C, et al. Sex differences in the associations of socioeconomic status with undiagnosed diabetes mellitus and impaired glucose tolerance in the elderly population: the KORA

## Type 2 diabetes mellitus in Iran

- Survey 2000. *Eur J Public Health*. 2005;15(6):627-33.
19. American Diabetes Association. Position Statement: Diagnosis and Classification of Diabetes Mellitus. *Diabetes Care*. 2008;31:S55-S60.
  20. Lidfeldt J, Li TY, Hu FB, Manson JE, Kawachi I. A prospective study of childhood and adult socioeconomic status and incidence of type 2 diabetes in women. *Am J Epidemiol*. 2007 Apr 15;165(8):882-9.
  21. Robbins JM, Vaccarino V, Zhang H, Kasl SV. Socioeconomic status and type 2 diabetes in African American and non-Hispanic white women and men: evidence from the Third National Health and Nutrition Examination Survey. *Am J Public Health*. 2001 Jan;91(1):76-83.
  22. Bosi PL, Carvalho AM, Contrera D, Casale G, Pereira MA, Gronner MF, et al. Prevalence of diabetes and impaired glucose tolerance in the urban population of 30 to 79 years of the city of São Carlos, São Paulo. *Arq Bras Endocrinol Metabol*. 2009;53(6):726-32.
  23. Dray-Spira R, Gary TL, Brancati FL. Socioeconomic position and cardiovascular disease in adults with and without diabetes: United States trends, 1997-2005. *J Gen Intern Med*. 2008;23(10):1634-41. Epub 2008 Jul 31.
  24. Robbins JM, Vaccarino V, Zhang H. Socioeconomic status and type 2 diabetes in African American and non-Hispanic white women and men: evidence from the Third National Health and Nutrition Examination Survey. *Am J Public Health*. 2001;91(1):76-83.
  25. Lidfeldt J, Li TY, Hu FB, et al. A prospective study of childhood and adult socioeconomic status and incidence of type 2 diabetes in women. *Am J Epidemiol*. 2007;165(8):882-9.
  26. Fisher-Hoch SP, Rentfro AR, Salinas JJ, Perez A, Brown HS, Reininger BM, et al. Socioeconomic status and prevalence of obesity and diabetes in a Mexican American community, Cameron County, Texas, 2004-2007. *Prev Chronic Dis*. 2010;7(3):1-10.
  27. Hayashino Y, Yamazaki S, Nakayama T, Sokejima S, Fukuhara S. The association between socioeconomic status and prevalence of diabetes mellitus in rural Japan. *Arch Environ Occup Health*. 2010;65(4):224-9.
  28. Bréchon F, Czernichow P, Leroy M, Blum-Boisgard C. Chronic diseases in self-employed French workers. *J Occup Environ Med*. 2005;47:909-15.
  29. Poljicanin T, Sekerija M, Boras J, Kolaric B, Vuletic S, Metelko Z. Cumulative incidence of self-reported diabetes in Croatian adult population in relation to socioeconomic status and lifestyle habits. *Coll Antropol*. 2012;1:41-6.
  30. Anjana RM, Pradeepa R, Deepa M, Datta M, Sudha V, Unnikrishnan R, et al. Prevalence of diabetes and prediabetes (impaired fasting glucose and/or impaired glucose tolerance) in urban and rural India: Phase I results of the Indian Council of Medical Research-India DIABetes (ICMR-INDIAB) study. *Diabetologia*. 2011;30:30.
  31. Cao Y, Xue YM, Li CZ, Zhang ML, Gao F, Xie CH, et al. Epidemiological investigation of diabetes and prediabetes in community residents in the suburbs of Guangzhou. *Nan Fang Yi Ke Da Xue Xue Bao*. 2010;30(9):2122-4.
  32. Lee TC, Glynn RJ, Pena JM, Paynter NP, Conen D, Ridker PM, et al. Socioeconomic status and incident type 2 diabetes mellitus: data from the Women's Health Study. *PLoS One*. 2011;6(12):e27670.
  33. Le C, Jun D, Zhankun S, Yichun L, Jie T. Socioeconomic differences in diabetes prevalence, awareness, and treatment in rural southwest China. *Trop Med Int Health*. 2011;16(9):1070-6.
  34. Kavanagh A, Bentley RJ, Turrell G, Shaw J, Dunstan D, Subramanian SV. Socioeconomic position, gender, health behaviours and biomarkers of cardiovascular disease and diabetes. *Soc Sci Med*. 2010;71(6):1150-60.
  35. Demakakos P, Marmot M, Steptoe A. Socioeconomic position and the incidence of type 2 diabetes: the ELSA study. *Eur J Epidemiol*. 2012;27(5):367-78.