

Research

*Corresponding author
Nilupher Feroz, MPhil

Department of Anthropology
University of Delhi
Delhi 110007, India

E-mail: nilupher12@gmail.com

Volume 2 : Issue 1

Article Ref. #: 1000DROJ2124

Article History

Received: April 27th, 2016

Accepted: June 23rd, 2016

Published: June 24th, 2016

Citation

Feroz N, Dhall M, Kapoor S. Behavioural indicators as risk of diabetes mellitus: A community based study in Manipur. *Diabetes Res Open J.* 2016; 2(1): 8-13. doi: [10.17140/DROJ-2-124](https://doi.org/10.17140/DROJ-2-124)

Copyright

©2016 Feroz N. This is an open access article distributed under the Creative Commons Attribution 4.0 International License (CC BY 4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Behavioural Indicators as Risk of Diabetes Mellitus: A Community based Study in Manipur

Nilupher Feroz, MPhil^{*}; Meenal Dhall, PhD; Satwanti Kapoor, PhD

Department of Anthropology, University of Delhi, Delhi 110007, India

ABSTRACT

Background: Diabetes Mellitus (DM) has become a major health issue all over the world. Lifestyle factors may affect the health of the patients with diabetes directly or indirectly. Family history of diabetes was given importance in various studies of this aspect of metabolic syndrome.

Aim: The present study was conducted to find out the effect of lifestyle indicators and family history of diabetes among the diabetic Muslim population of Manipur.

Materials and Methods: Cross-sectional method was used for the study in which individuals of both sexes in the age group from 20-45 years. The respondents were taken from two districts in Manipur. Information was gathered by using a structured proforma.

Results: Chi-square test showed significant *p*-values for stress level, family history, physical activity and Quality of Life (QoL) of the participants. All these lifestyle indicators including breakfast habit and family history of diabetes were found to be significant except quality of life on multinomial logistic regression analysis.

Conclusion: Lifestyle had greatly influenced on the life of the diabetic Muslim people of Manipur in which it needed to give more awareness to them.

KEYWORDS: Diabetes mellitus; Family history; Lifestyle; Manipur.

ABBREVIATIONS: QoL: Quality of life; DM: Diabetes Mellitus; CMHA: Canadian Mental Health Association; WHO: World Health Organization; BMI: Body Mass Index; CDC: Centre for Disease Control and Prevention; HRQL: Health Related Quality of Life.

INTRODUCTION

Diabetes mellitus, a metabolic disease is increasing rapidly in almost all regions of the world. India stands at the topmost position in the world with the highest number of people with diabetes mellitus of about 31.7 million in the year 2000 followed by China with 20.8 million in second and the United States 17.7 million in the third place.¹ The maximum increase of the prevalence of diabetes in India will contribute largely to the global increase from 171 million in 2000 to 366 million in 2030.¹ India is experiencing an alarming increase in the incidence and prevalence of type 2 diabetes mellitus (T2DM)² both in rural³ and urban areas⁴ with higher prevalence in South than in North India.⁵ A higher risk of diabetes has been reported from few Southern and North-eastern states while several northern and central states were at lower risk after adjusting for individual characteristics and place of residence.⁶

Family history of diabetes is considered as a positive factor if either or both the parents have diabetes.⁷ Two to three times higher risk of developing glucose intolerance is associated with those individuals who have family history of diabetes. It has been recognized that family history of type 2 diabetes is one of the important risk factor of the disease.^{8,9} Individuals who have a family history of diabetes can have two to six times the risk of type 2 diabetes compared with individuals with no family history of the disease.^{8,10} The causes of type 2 diabetes are quite complex, family medical history provides valuable genomic information. Hence, this informa-

tion represents the combination of inherited genetic susceptibilities and shared environmental and behavioural factors.¹¹

Physical inactivity is also another major behavioural risk factor of type 2 diabetes. Sedentary habits of the individuals developed higher prevalence of the disease.¹² Quality of life of people with diabetes is seriously threatened.¹³ The present study was therefore conducted to examine whether these lifestyle indicators affected the diabetic Muslim population of Manipur.

MATERIALS AND METHODS

All the participants studied were from Muslim community of Imphal-East district and Thoubal district and were under medical supervision. A cross-sectional research method was used. Among a total of 400 participants, 200 were diabetics and 200 were non-diabetics of both sexes. The purpose of the study and techniques to be used were explained to each participant. Only those participants who gave written consent were included for the study. Ethical permission was taken from Institutional Ethical Committee (IEC) prior to the fieldwork. Direct interview method was used. Detailed information of the participants was collected using standardized proforma. Stress level of the participants was assessed by using standardized questionnaires given by Canadian Mental Health Association (CMHA).¹⁴ Total stress level was calculated and classified according to its cut-off points (14-22=considerably above average, 10-13=above average, 9-0=average). QoL was assessed by using the World Health Organization (WHO) Quality of life-BREF (WHOQL-BREF) questionnaire.¹⁵ Statistical analysis of all the data collected were

analysed by using 17.0 version of SPSS. Cross tabulations were carried out to find out the frequencies, percentages and chi-square values. Risk factors of the variables were determined by using multinomial logistic regression.

RESULTS

The basic characteristics of the population under study are displayed in Table 1. The numbers of subjects were 200 each for both males and females. Mean values of age, height and weight were more for the patients with type 2 diabetes. Table 2 shows cross tabulation of different stress levels among patients with type 2 diabetes and non-diabetic participants. All the stress level percentages were higher among patients with type 2 diabetes as compared to non-diabetic participants. Chi-square value was found to be statistically significant at $p < 0.001$. Distribution of patients with type 2 diabetes according to family history of diabetes has been displayed in Table 3. Maximum number of diabetic subjects (60%) was found to have a family history of type 2 diabetes mellitus and 4.5% subjects had type 1 family history of this disease. But the corresponding values were comparatively less among non-diabetic participants. Statistical significance was found for this factor at $p < 0.001$.

Table 4 displays the cross tabulation of physical activity status. It was found from the study that more number of patients with type 2 diabetes were physically inactive as compared to non-diabetics. Most of the non-diabetics were found to be physically more active (98%). However, 77% patients with type 2 diabetes were active for physical activity. Marked differ-

Characteristics	Mean±SD			
	Male (N=200)		Female (N=200)	
	Diabetic	Non-diabetic	Diabetic	Non-diabetic
Sex				
Age (years)	41.2±4.16	32.8±6.97	40.6±4.79	31.8±6.90
Height (centimetre)	160.1±5.10	158.6±5.53	151.8±4.64	149.7±5.24
Weight (kilogram)	63.3±8.78	60.1±9.52	61.6±9.84	52.8±10.04

N: Number of participants.
Table 1: Distribution of participants under different characteristics.

Stress level	Diabetic N(%)	Non-diabetic N(%)	Total no.(%)	χ^2
Considerably above average	80(40.0%)	24(12.0%)	104(26.0%)	
Above average	49(24.5%)	29(14.5%)	78(19.5%)	61.7***
Average	71(35.5%)	147(73.5%)	218(54.5%)	
Total	200(100.0%)	200(100.0%)	400(100.0%)	

N: Number of participants.
*** $p < 0.001$.
Table 2: Cross tabulation of different stress levels.

Family history of diabetes	Diabetic N(%)	Non-diabetic N(%)	Total no.(%)	χ^2
Type 1	9(4.5%)	1(0.5%)	10(2.5%)	
Type 2	120(60.0%)	41(20.5%)	161(40.3%)	78.2***
Not applicable	71(35.5%)	158(79.0%)	229(57.3%)	
Total	200(100.0%)	200(100.0%)	400(100.0%)	

N=Number of participants.
*** $p < 0.001$.
Table 3: Cross tabulation of family history of diabetes.

ence with statistically significance ($p < 0.001$) was also observed for physical activity status among patients with type 2 diabetes and non-diabetic participants. In the present study, maximum subjects had their breakfast regularly (93% diabetic and 98% non-diabetic). Five percent diabetic and 1% non-diabetic took breakfast irregularly. Two percent diabetic and 1% non-diabetic were not taking breakfast at all. The differences in the various categories were found statistically non-significant (Table 5).

The median of the total score of QoL was calculated and it was found to be 77. It was categorized as < 77 as low quality of life and ≥ 77 as good quality of life. It was found from the scores of quality of life of the participants (Table 6) that 54.5%

of them had low QoL out of which proportionately larger number were diabetic (66.5%). Only 42.5% non-diabetics had low quality of life. Good quality of life was comparatively more in number among non-diabetics (33.5% diabetic and 57.5% non-diabetic). The difference in distribution of participants in the quality of life categories was statistically significant ($p < 0.001$).

Multinomial logistic regression of lifestyle indicators and family history of diabetes was found out to the risk factors for each category as given in Table 7. The patients under the categories of considerably above average level of stress and above average level of stress were 6.9 times and 3.8 times more risk of having diabetes respectively. Patients with family history of

Physical activity status	Diabetic N(%)	Non-diabetic N(%)	Total no.(%)	χ^2
Inactive	46(23.0%)	4(2.0%)	50(12.5%)	
Active	154(77.0%)	196(98.0%)	350(87.5%)	40.3***
Total	200(100.0%)	200(100.0%)	400(100.0%)	

N: Number of participants.
*** $p < 0.001$.

Table 4: Cross tabulation of physical activity status.

Breakfast consuming pattern	Diabetic N(%)	Non-diabetic N(%)	Total no.(%)	χ^2
Irregular	10(5.0%)	2(1.0%)	12(3.0%)	
Absent	4(2.0%)	2(1.0%)	6(1.5%)	6.3
Regular	186(93.0%)	196(98.0%)	382(95.5%)	
Total	200(100.0%)	200(100.0%)	400(100.0%)	

N: Number of participants.

Table 5: Cross tabulation of breakfast consumption pattern.

Quality of life categories	Diabetic N(%)	Non-diabetic N(%)	Total no.(%)	χ^2
Low quality of life	133(66.5%)	85(42.5%)	218(54.5%)	
Good quality of life	67(33.5%)	115(57.5%)	182(45.5%)	23.2***
Total	200(100.0%)	200(100.0%)	400(100.0%)	

N: Number of participants.
*** $p < 0.001$.

Table 6: Cross tabulation of quality of life categories.

Lifestyle indicators	Categories	Exp(B)	CI(95%)
Stress level	Considerably above average	6.9	(3.6, 13.3)
	Above average	3.8	(2.0, 7.4)
	Average	0 ^a	
Family history of diabetes	Type 1 diabetes mellitus	20.5	(2.2, 186.7)
	Type 2 diabetes mellitus	7.1	(4.2, 12.1)
	Not applicable	0 ^a	
Physical activity	Inactive	13.2	(4.2, 41.6)
	Active	0 ^a	
Breakfast	Irregular	6.5	(0.9, 43.9)
	Absent	8.1	(1.4, 45.5)
	Regular	0 ^a	
Quality of life	Low quality of life	1.5	(0.9, 2.5)
	Good quality of life	0 ^a	

Note
CI: Confidence Interval.
0^a: Reference (normal).
Diabetic: Dependent category.
Non-diabetic: Reference category.

Table 7: Multinomial logistic regression of various lifestyle indicators.

type 1 and type 2 diabetes mellitus were 20.5 times and 7.1 times more likely to have risk of diabetes respectively. Those patients who were less active in physical activity were 13.2 times more at risk to develop diabetes compared to the active group. Irregular breakfast consumers and none breakfast consumers were 6.5 times and 8.1 times more at risk of developing diabetes respectively. Patients with low quality of life had 1.5 times more risk to suffer from diabetes.

DISCUSSION

Stress level, physical inactivity, breakfast consumption pattern, quality of life, etc. do indicate the health status of an individual. The present study was conducted to determine whether these indicators affected the health of the diabetic and non-diabetic Muslim population of Manipur. It was observed from the present study that most of the patients with diabetes were found to have stress and it was identified as one of the risk factor of diabetes. This was consistent with the results of earlier studies¹⁶ and was suggestive of direct or indirect negative impact of stress on blood glucose level through the release of stress hormones or by disrupting self-care practices.

Indian population were commonly seen to have familial aggregation of diabetes with a high prevalence among very close relatives and was transmitted vertically through more than two generations.¹⁷ A study conducted among the South Indian population showed the development of diabetes to be earlier among the subjects with family history of diabetes as compared to subjects without family history. Further, it was demonstrated by which study that glucose intolerant subjects with family history were 7 years younger than subjects without a family history of diabetes.¹⁸

In a self-reported study among US adults, family history of diabetes was shown to be a significant predictor of diabetes. The study estimated that those adults with a family history of diabetes on their parents or siblings had four times more risk of having diabetes than adults without a family history of the disease, after adjusting for gender, age, race, and body mass index (BMI).¹⁹

The risk of type 2 diabetes was six times higher among the women with family history of diabetes as compared with individuals without a family history of the disease.¹⁰ Furthermore, the study conducted by Centre for Disease Control and Prevention (CDC)²⁰ demonstrated that the risk of having diabetes among adults with two diabetic parents was more than twice.

In the present study, it was clearly found that patients with type 2 diabetes had 60% type 1 and 4.5% type 2 family histories of diabetes respectively. However, the risk of developing diabetes was more among those who had type 1 diabetes family history. Similarly, in a recent clinic based study among patient with diabetes of Western Indian population, it was reported that 57.7% had positive family history out of which 37.0% had single

parent with diabetes, 10.5% had both parents with diabetes and 26.7% had near relatives suffering with diabetes which showed high familial aggregation of T2DM in the Western Indian population.²¹

Sedentary lifestyle adversely affected the health of the people that might contribute to the increase in body weight, a major risk factor of diabetes. Maintaining exercise regularly and active physical work could contribute in improving the health of the diabetic patient. Regular physical exercise whether aerobic or resistance was proved to be effective in the reduction of degree of obesity and the incidence of metabolic results such as type 2 diabetic individuals.²² Wing et al.²³ suggested walking as a form of exercise and prescribed an increment of exercise. In the present study, it was found that the percentage of physically inactive individuals was more among diabetics as compared to non-diabetics and the difference between the two was also statistically significant. Moreover, it was marked that the physically inactive persons were 13 times more likely to be at risk of diabetes. This finding was consistent with the study by Dowse et al.²⁴ that there was an association between physical inactivity and risk of non-insulin dependent diabetes mellitus and impaired glucose tolerance.

The present study among the Muslims of Manipur showed relative risk between irregular or absence of breakfast consumption and diabetes. Maximum percentage of patients with diabetes had regular breakfast and very few them did not consume breakfast at all. The risk of diabetes was found 8.1% on patients not taking breakfast and 6.5% among regular consumers. This result was consistent with a large prospective study by Mekary et al.²⁵ that the risk of type 2 diabetes might be decreased among men by breakfast consumption. Breakfast omission was associated with an increased risk of type 2 diabetes mellitus in men even after adjustment for BMI which needed further studies to elucidate this association in women and in other ethnic and racial groups and to conduct an in-depth analysis of specific breakfast foods.

Marked significant difference in the QoL between patients with diabetes and non-diabetic participants was revealed in the present study. However, in multinomial logistic regression analysis, it showed less difference and statistically non-significant. It could be due to social conditions and lifestyle of the people which adversely affected their physical and psychological domains. Similarly, this type of difference was found in Health Related Quality of Life (HRQoL) of both genders in a study conducted in Iran.²⁶ Eljedi et al.²⁷ in their study on the diabetic patient living in refugee camps in the Gaza strip analyzed HRQoL in comparison with gender and age matched non-diabetic controls from the same camps. They reported that all the domains of the WHOQL-BREF was negatively affected by diabetes and its complications that had greatest effects on the physical health and psychological domains but the effects was weaker for the social relationships and environmental domains. Further, interactions between gender and disease status between diabetic patients and

non-diabetic were also strong. However, this finding could not be explained fully because the situation of the female patient was worse which showed the evidence for gender inequalities.²⁸

Another study²⁹ found the deterioration of the QoL of patients with type 2 DM by the presence of depression. This finding resulted on the conclusion that the QoL of the subject could be made better by treating depression.

CONCLUSION

The family history of diabetes as well as lifestyle indicators such as stress level, physical activity, breakfast consuming pattern and quality of life among Muslim males and females of Manipur played crucial role in the life of patients with diabetes. The present study demonstrated these parameters as risk factors of this metabolic disease. Thus, there is a need to make efforts for improving the lifestyle which might help in the reduction of this disease.

ACKNOWLEDGEMENTS

The authors are thankful to all the participants of the Muslim community of Imphal-East district and Thoubal district for their full cooperation in the present study. Nilupher Feroz is grateful to the University Grants Commission for financial assistance during the study under the Non-NET fellowship scheme.

CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

CONSENT

The participants have been properly, made aware about the objectives, relevance and purpose of the research study. The participants have been told that the anthropological information collected from them will be utilized for the real purpose of research and academic activities. They are also made to understand that no money will be charged from them for any of the tests, and they can withdraw from the study at any time, but will keep getting counselling benefits till the duration of the project.

All the participants consciously gave their consent to participate in the above research study.

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(3): 1047-1053. doi: [10.2337/diacare.27.5.1047](https://doi.org/10.2337/diacare.27.5.1047)
2. Ramachandran A, Snehalatha C, Vijay V. Low risk threshold for acquired diabetogenic factors in Asian Indians. *Diabetes Res Clin Pract*. 2004; 65: 189-195. doi: [10.1016/j.diabetes.2004.03.012](https://doi.org/10.1016/j.diabetes.2004.03.012)
3. Tonstad S, Butler T, Yan R, Fraser GE. Type of vegetarian diet, body weight, and prevalence of type 2 diabetes. *Diabetes Care*. 2009; 32: 791-796. doi: [10.2337/dc08-1886](https://doi.org/10.2337/dc08-1886)
4. Misra A, Pandey RM, Devi JR, et al. High prevalence of diabetes, obesity and dyslipidaemia in urban slum population in Northern India. *Int J Obes Relat Metab Disord*. 2001; 25: 1722-1729. Web site. <http://www.ncbi.nlm.nih.gov/pubmed/11753596>. Accessed April 26, 2016
5. Bai PV, Krishnaswami CV, Chellamariappan M. Prevalence and incidence of type-2 diabetes and impaired glucose tolerance in a selected Indian urban population. *J Assoc Physicians India*. 1999; 47: 1060-1064. Web site. <http://www.ncbi.nlm.nih.gov/pubmed/10862313>. Accessed April 26, 2016
6. Corsi DJ, Subramanian SV. Diet and health: Implications for reducing chronic disease risk between socio-economic status and self-reported diabetes in India: A cross-sectional multilevel analysis. *BMJ Open*. 2012; 2: e000895.
7. Mohan V, Shanthirani S, Deepa R, Premalatha G, Sastry NG, Saroja R. Intra-urban differences in the prevalence of the metabolic syndrome in southern India-the Chennai Urban Population Study (CUPS No. 4). *Diabet Med*. 2001; 18: 280-287. doi: [10.1046/j.1464-5491.2001.00421.x](https://doi.org/10.1046/j.1464-5491.2001.00421.x)
8. Bishop DB, Zimmerman BR, Roesler JS. Diabetes. 2nd ed. In: Brownson RC, Remington PL, Davis JR, eds. *Chronic Disease Epidemiology and Control*. Washington, DC, USA: American Public Health Association; 1998: 421-464.
9. ECDCDM. Report of the expert committee on the diagnosis and classification of diabetes mellitus. *Diabetes Care*. 2003; 26(Suppl 1): S5-S20.
10. Harrison TA, Hindorff LA, Kim H, et al. Family history of diabetes as a potential public health tool. *Am J Prev Med*. 2003; 24(2): 152-159. doi: [10.1016/S0749-3797\(02\)00588-3](https://doi.org/10.1016/S0749-3797(02)00588-3)
11. Yoon PW, Scheuner MT, Khoury MJ. Research priorities for evaluating family history in the prevention of common chronic diseases. *Am J Prev Med*. 2003; 24(2):128-135. doi: [10.1016/S0749-3797\(02\)00585-8](https://doi.org/10.1016/S0749-3797(02)00585-8)
12. Bamji. Textbook of Human Nutrition. In: Raghuram TC, ed. *Diet and Diabetes Mellitus*. 3rd ed. Delhi, India: Oxford & IBH Publishing Company Pvt. Limited; 2009: 356-369.
13. Kamel NM, Badawy YA, El-Zeiny NA, Merdan IA. Sociodemographic determinants of management behaviour of diabetic patients. Part I. Behaviour of patients in relation to management of their disease. *Eastern Mediterr Health J*. 1999; 5: 967-973. Web site. <http://www.ncbi.nlm.nih.gov/pubmed/10983537>. Accessed April 26, 2016

cessed April 26, 2016

14. Bickford M. Stress in workplace: A general overview of the causes, the effects, and the solutions. *Canadian Mental Health Association*. 2005. Web site. <http://changeforthegood.ca/wp-content/uploads/2014/09/workplace-stress.pdf>. Accessed April 26, 2016

15. WHOQOL-BREF. *Introduction, Administration, Scoring and Generic Version of the Assessment*. Programme on Mental Health. Geneva, Switzerland: WHO; 1996.

16. Cox DJ, Gonder-Frederick L. Major developments in diabetes research. *J Consult Clin Psychol*. 1992; 60(4): 628-638. doi: [10.1037/0022-006X.60.4.628](https://doi.org/10.1037/0022-006X.60.4.628)

17. Viswanathan M, McCarthy MI, Snehalatha C, et al. Familial aggregation of type 2 (non- insulin-dependent) diabetes mellitus in South India: Absence of excess maternal transmission. *Diabet Med*. 1996; 13: 232-237. doi: [10.1002/\(SICI\)1096-9136\(199603\)13:3<232::AID-DIA27>3.0.CO;2-7](https://doi.org/10.1002/(SICI)1096-9136(199603)13:3<232::AID-DIA27>3.0.CO;2-7)

18. Mohan V, Shanthirani CS, Deepa R. Glucose Intolerance (Diabetes and IGT) in a selected south indian population with special reference to family history, obesity and lifestyle factors - The Chennai Urban Population Study (CUPS 14). *JAPI*. 2003; 51: 771-777. Web site. <http://www.japi.org/august2003/O-771.pdf>. Accessed April 26, 2016

19. Annis AM, Caulder MS, Cook ML, Duquette D. Family history, diabetes, and other demographic and risk factors among participants of the National Health and Nutrition Examination Survey 1999-2002. *Prev Chronic Dis*. 2005; 2(2): 1-12. Web site. http://www.cdc.gov/pcd/issues/2005/apr/04_0131.htm. Accessed April 26, 2016

20. Centers for Disease Control and Prevention (CDC). Awareness of family health history as a risk factor for disease-United States. *MMWR Morb Mortal Wkly Rep*. 2004; 53(44): 1044-1047. Web site. <http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5344a5.htm>. Accessed April 26, 2016

21. Patel M. Health evaluation of diabetes mellitus and its burden on society in present Indian scenario. 2015. Web site. <http://ir.inflibnet.ac.in:8080/jspui/handle/10603/46411>. Accessed April 26, 2016

22. Sinha R, Kapoor S. *Obesity: A Multidimensional Approach to Contemporary Global Issue*. Delhi, India: Dhanraj Book House; 2008.

23. Wing RR, Venditti E, Jakicic JM, Polley BA, Lang W. Lifestyle Intervention in overweight individuals with a family history of diabetes. *Diabetes Care*. 1998; 21(3): 350-359. Web site. <http://www.ncbi.nlm.nih.gov/pubmed/9540015>. Accessed April 26, 2016

24. Dowse GK, Zimmet PZ, Gareebo H, et al. Abdominal obesity and physical inactivity as risk factors for NIDDM and impaired glucose tolerance in Indian, creole and Chinese mauritians. *Diabetes Care*. 1991; 14(4): 271-282. doi: [10.2337/diacare.14.4.271](https://doi.org/10.2337/diacare.14.4.271)

25. Mekary RA, Giovannucci E, Willett WC, Dam RMv, Hu FB. Eating patterns and type 2 diabetes risk in men: Breakfast omission, eating frequency, and snacking. *Am J Clin Nutr*. 2012; 95: 1182-1189. doi: [10.3945/ajcn.111.028209](https://doi.org/10.3945/ajcn.111.028209)

26. Aghamollaei T, Eftekhari H, Shojaeizadeh D, Mohammad K, Nakhjavani M, Ghofrani Pour F. Behavior, metabolic control and health-related quality of life in diabetic patients at Bandar Abbas Diabetic Clinic. *Iran J Public Health*. 2003; 32: 54-59. Web site. <http://ijph.tums.ac.ir/index.php/ijph/article/viewFile/1955/1936>. Accessed April 26, 2016

27. Eljedi A, Mikolajczyk RT, Kraemer A, Laaser U. Health-related quality of life in diabetic patients and controls without diabetes in refugee camps in the Gaza strip: A cross-sectional study. *BMC Public Health*. 2006; 6: 268. doi: [10.1186/1471-2458-6-268](https://doi.org/10.1186/1471-2458-6-268)

28. Redekop WK, Koopmanschap MA, Stolk RP, Rutten GE, Wolffenbuttel BH, Niessen LW. Health-related quality of life and treatment satisfaction in Dutch patients with type 2 diabetes. *Diabetes Care*. 2002; 25: 458-463. doi: [10.2337/diacare.25.3.458](https://doi.org/10.2337/diacare.25.3.458)

29. Das R, Singh O, Thakurta RG, et al. Prevalence of depression in patients with type ii diabetes mellitus and its impact on quality of life. *Indian J Psychol Med*. 2013; 35: 284-289. doi: [10.4103/0253-7176.119502](https://doi.org/10.4103/0253-7176.119502)