

Gender Differences in Incidence of Type 2 Diabetes and Related Psychosocial Factors

Azam Alizadeh ^{*1} , Parvaneh Danesh ¹, Amir Maleki ¹, Fatemeh Javaheri

1. Department of Sociology, Faculty of Social Sciences, Payame Noor University, Tehran, Iran
2. Department of Sociology, Faculty of Social Sciences, Kharazmi University, Tehran, Iran

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Corresponding Author:

Azam Alizadeh

a-alizadeh@pnu.ac.ir

ABSTRACT

Introduction: Diabetes is one of the chronic diseases which causes other chronic diseases. The incidence of it is increasing in different societies, including Iran. This study aimed to investigate Gender differences in incidence of type 2 diabetes and related psychosocial factors.

Methods: This was a cross-sectional study conducted in 2019 among people with the age group of 20 to 60. All the 600 participants were married and lived in Kerman. Using multi-stage sampling, 300 men and 300 women were selected. Data were collected through a questionnaire which included 3 sections as follows: Social demographic variables, healthy lifestyle variable and perceived stress variable. Statistical analysis was done through descriptive statistics, Lambda test, Independent sample T -test and Binary Logistic regression. The SPSS 23 was used to perform the data analysis. The significance level was considered to be 5%

Results: The mean (SD) score of physical activity for women was significantly lower than men: (7.6 (2.3) vs. 8.2 (2.7) ($P=0.006$)). In the same vein, the mean (SD) score of healthy diet among women was significantly higher than men: (18.6 (3) vs. 18 (2.4), ($P<0.001$)). The rate of avoidance of tobacco and alcohol consumption among women was significantly higher than men: (19.4 (1.3) vs. 17.9 (2.6), ($P<0.001$)). Results of multiple logistic regression showed that in the group of women, the chance of developing diabetes was significantly related to perceived stress level ($OR=1.21$), level of sports activities ($OR=0.48$) (and education. Education level and health diet also had a significant effect on men's odds of developing diabetes ($OR=0.63$, 1.35, respectively).

Conclusion: Among the indicators of healthy lifestyle, doing exercise in women and having a healthy diet in men were effective in predicting the risk of diabetes. In addition, the amount of perceived social stress was one of the most important psychological factors in the development of diabetes just in women. Therefore, it is crucial to recognize the factors affecting diabetes in both men and women separately and This can be an appropriate analytical instrument for sociologists and health researchers to recognize and focus on this problem as well as for health policy makers to reduce and control harmful factors.

Keywords: Gender difference, Type 2 Diabetes, Social factors, Perceived Stress

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Introduction

Diabetes is one of the chronic diseases with no definitive treatment (1). On the other hand, in 2019 edition of *the IDF Diabetes Atlas*, the prevalence of diabetes was estimated to be 463.0 million adults aged 20–79 worldwide. Based on the 2019 estimates, by 2045, 700.2 million adults have diabetes (2). In Iran, the prevalence of diabetes in adults was 11 %, in the age range of approximately 25 to 70 in 2019 (3).

This shows a 35% increase compared to 2005. It is estimated that by 2030, approximately 9.2 million Iranians will develop diabetes (4). Type 2 diabetes epidemic is associated with rapid cultural change, aging populations, increasing urbanization, mechanization, and industrialization, leading to changing lifestyles in communities. They include changes in eating habits and a tendency toward eating ready-to-eat food and fast food, reduced physical activity, exercise, sedentary lifestyle, and consequently, obesity and weight gain, increased stress, and in general, unhealthy lifestyle and behavioral patterns (5). In fact, one of the main mechanisms by which health is socially constructed or destroyed is a health-related lifestyle (6). Therefore, studying these risk factors in the context of any society is important and can be helpful regarding prevention and treatment of the disease (7). Healthy lifestyle seeks to form such behaviors that help maintain people's health and prevent high-risk behaviors (8). Another risk factor is psychological stress. Regarding the relationship between stress and diabetes, the authors suggest that increased stress can lead to increase of type 2 diabetes (9). By secreting the hormones such as cortisol and adrenaline, which are anti-insulin, stress can cause type 2 diabetes (10). On the other hand, stress can indirectly affect the risk of developing diabetes through specific behaviors associated with health just as it can affect the risk of developing diabetes by reducing exercise (11). Stress, physically and mentally, affects people. As shown in some studies, psychological stress has doubled diabetes (12) and research in Sweden has

demonstrated that chronic stress (stress at home and at work) increased the risk of type 2 diabetes by about 45% (13). Because chronic stress and the stress caused by people's social roles in life are increasing every day and human beings are now facing a set of stressors, many people are indirectly affected (14). Due to the chronic, non-communicable and costly nature of diabetes for public health, it puts a lot of burden on the individual, family, the community and country and. It threatens the life quality of patients leading to complications. Most of the data on the population of Western Europe or Asia reveals that the prevalence of type 2 diabetes is higher in men than women (15,16). However, the situation is different in each region. For example in was no gender difference regarding the disease (17). However, contrary to global statistics, the prevalence of type 2 diabetes in Iran is higher in women than men (18). The results of research (18, 19) also confirmed that type 2 diabetes is more common in women than men in Iran. Therefore, due to the growing rate of diabetes in Iran and the consequent rise in financial and social costs, it is crucial to identify the social and psychological predictors of type 2 diabetes for both men and women as separate cases. Understanding gender differences can help create fairer health systems and policies to prevent the disease. The aim of this study is to evaluate the rate of type 2 diabetes in men and women and identify the social and psychological factors affecting the incidence of type 2 diabetes in women compared to men.

Methods

According to the World Health Organization, the prevalence of diabetes in Iran in 2021 was about 9% (<https://worldpopulationreview.com/country-rankings/diabetes-rates-by-country>). Based on this, using the formula for calculating the sample size in terms of proportion (Cochran's formula) and considering the level of significance of 5 percent, accuracy of 3 percent ($d=0.03$) and placement in the formula below

sample size of 350 people is obtained.

$$n \geq \frac{z_{1-\frac{\alpha}{2}}^2 P(1-P)}{d^2}, \alpha = 0.05, d = 0.03, P = 0.09$$

In the next step, due to the use of cluster structure in sampling, the sample size is multiplied by 1.5 (design effect) and reaches the sample size of 525 people. Then, by considering the 10% probability of non-response, the sample size was obtained at least 583 people. However, In order to make the test more reliable and to increase accuracy, the number of participants increased to 600 (20). According to the purpose of the present research, the sample of 600 people was divided into two groups of 300 women and 300 men.

Sampling: Sampling was in two stages. First, through cluster random sampling, 4 areas of Kerman urban areas were selected. Then, in each area, non-probability sampling (quota sampling) was performed to obtain the results of 300 female and 300 male samples.

Inclusion criteria: Inclusion criteria included willingness to participate in research and married and age range of 20 to 60 years. Exclusion criteria included people who refused to cooperate during the research or answered the questionnaires incompletely. The ethical considerations of the research were that the objectives of the research and how to do it were explained to the individuals and they were assured that their information would be confidential. Their first and last names were not recorded in the questionnaires and individuals participated in the research with their willingness and informed consent. Of course, people who were not literate in filling out the questionnaire asked the interviewer for information.

Questionnaire: The instrument used in this research was a questionnaire.

The questionnaire had three sections with Section1: socio-demographic variables were like age, gender, education, job status.

Section 2: Perceived stress questionnaire designed by Cohen et al. Section 3: Healthy lifestyle questionnaire: for Assessment of healthy lifestyle Some parts of Ghaderi et al.'s questionnaire (21) were used. The components

used in most studies were diet, alcohol and smoking, exercise and physical activity, so two dimensions of Ghaderi et al.'s Healthy Lifestyle Questionnaire, namely responsibility and shopping hygiene, were omitted because they did not meet the objectives of this study.

The response range of the Likert Healthy Lifestyle Questionnaire was 4 options and a score of 1 to 4 was considered for the four options. A total of 21 questions were used for assessment. The highest score was 84 and the lowest was 21. A higher score meant a healthier lifestyle.

Reliability and validity of this tool was confirmed and Cronbach's alpha value for internal consistency was equal 0.81.

Statistical analysis

Frequency (percentage) and mean (standard deviation) were used to describe the data. For inferential statistics, binary logistic regression model, two independent sample t-test were used. All analyzes were performed in SPSS software version 23 with a significance level of 5%.

Results

Demographic indicators of this study included gender, age, education and job status. 50% (300 people) of the sample population were female 49 percent of women had a low job status and only 3.7 percent had a high job status. Among men, 29.3 percent had a low job status and 19 percent had a high job status. In terms of education, 5.3 percent of women had primary education, while 2.3 percent had secondary education, 24.3 percent had a diploma, 36 percent had a bachelor's degree and 10.3 percent had a master's degree. 12.7 percent of men had primary education, 13.3 percent had secondary education, 27.7 percent had a diploma, 31.7 percent had a bachelor's degree and 23.7 percent had a master's degree.

The results show that 41(6.8%) of men, 65(10.8%) of women, and a total of 106(17.7%) of the statistical population were diabetic.

The results of Independent Sample t-Test in Table showed The mean (SD) score of physical activity among women was significantly lower than men (7.6 (2.3) vs. 8.2 (2.7), $p=0.006$).The

mean (SD) score of healthy diet among women was significantly higher than men: 18.6 (3) vs. 18 (2.4), ($p < 0.001$). This demonstrates that women had a healthier diet compared to men. The rate of avoidance of tobacco and alcohol consumption among women was significantly higher than men: (19.4 (1.3) vs. 17.9 (2.6) $p < 0.001$). This means that women avoid smoking and alcohol comparatively

more than men. The results of Independent Sample t-Test also showed that the difference between the mean scores of the variable "perceived stress" between the two sex groups was statistically significant ($p = 0.002$). The mean (SD) score of women's Perceived Stress was 2.4(1) significantly higher compared to men with the mean score of 2.1 (0.9) ($p < 0.001$).

Table 1. Results of Independent Samples t –Test in comparing means base gender

Variables	Gender	M±SD	P
Perceived Stress	Man	2.1± (0.9)	0.002
	Woman	2.4± (1)	
Exercise and physical activity	Man	8.2± (2.7)	0.006
	Woman	7.6± (2.3)	
Avoidance of smoking and alcohol	Man	17.9± (2.6)	0.001
	Woman	19.4± (1.3)	

According to the results of independent samples t -Test in Table 1, healthy women have less perceived stress than women with diabetes. Furthermore, healthy women exercise more than women with diabetes. "Avoiding tobacco and alcohol" and "healthy diet" are not significantly different in women without

diabetes and women with diabetes. According to the results of Table 2, healthy and sick men are not significantly different in terms of perceived stress, exercise and physical activity, and smoking and alcohol abstinence. But healthy men have a healthier diet than those with diabetes.

Table 2. The mean in the dimensions of a healthy life and perceived stress by Health/ Disease in women and men)

Variables- women	Group	M±SD	P
Perceived Stress	Health	2.3± (0.95)	<0.001
	Disease	2.8± (1.00)	
Exercise and physical activity	Health	7.9± (2.97)	<0.001
	Disease	6.2± (2.53)	
Healthy diet	Health	18.2± (2.9)	0.202
	Disease	20.1± (2.5)	
Avoidance of smoking and alcohol	Health	19.2(1.4)	0.009
	Disease	19.8± (0.7)	
Variables-men			
Perceived stress	Health	2.1± (.96)	0.76
	Disease	2.3± (.98)	
Exercise and physical activity	Health	8.2± (2.7)	0.1
	Disease	7.9± (2.4)	
Healthy diet	Health	17.9± (2.4)	0.03
	Disease	18.4± (2.5)	
Avoidance of smoking and alcohol	Health	17.9± (2.6)	0.81
	Disease	18.1± (2.5)	

Table 3. Results of multiple logistic regression

Gender	Variables- women	Levels	OR _{adj}	95%CI	P
Female	Perceived Stress	---	1.21	1.29-2.51	0.001
	Exercise and physical activity	----	0.48	0.76-0.98	0.027
	Educational level	Illiterate	1.28	1.08-1.74	0.034
		Under diploma	1.13	1.10-1.56	0.014
		Diploma	1.07	0.94-1.22	0.18
		Bachelor	1.18	0.89-1.35	0.49
		Higher than Bachelor	1	-----	-----
	Educational level	Illiterate	1.35	1.12-1.76	0.042
		Under diploma	1.29	1.11-1.44	0.029
		Diploma	1.59	0.91-1.37	0.42
Bachelor		1.34	0.95-1.63	0.88	
Higher than Bachelor		1	----	---	
Male	Healthy diet	Yes	0.63	1.04-1.41	0.012
		NO	1	---	

According to table 3, results of multiple logistic regression showed that in the group of women, the chance of developing diabetes was significantly related to perceived stress level, level of sports activities and education, so that with a single increase in perceived stress level, 21 chances initially increased (OR=1.21). It also reduces the chances of developing diabetes by 52 per unit increase in exercise (OR=0.48). Regarding the level of education, illiterate people and of people with undergraduate education were more likely to be infected than people with educational level (OR=1.28, OR=1.13, respectively).

Table 3 also showed Education level and health diet had a significant effect on men's odds of developing diabetes. On the other hand, people on a healthy diet were 37% less likely to develop diabetes (OR=0.63, p=0.012). Also, in the group of men with illiterate and undergraduate education, they had a 35% and 29% higher chance of developing diabetes, respectively, compared to higher education levels (OR=1.35, OR=1.29, respectively).

Discussion

Considering the importance of diabetes and the high rate of its prevalence in different societies, it is very important to predict the factors affecting this disease and selecting an appropriate statistical model that can accurately handle diagnosis of diabetes in men and women. Predicting whether or

not people have a chance of developing diabetes in future is of great importance.

The results of present study illustrated that women had a higher chance of developing diabetes than men, which was consistent with the results of Mirzaei et al.'s (18) and Moghimi et al.'s studies (19), and the results of the National Health Survey in Iran in 2016 (22). The predictor and significant variable that affected both men and women in this study was age. With increasing age, the probability of developing diabetes for both men and women increased which was in line with Navipour and et al.'s research (23).

In this study, the effect of two types of factors on type 2 diabetes was measured. They included social factors such as education, job status, gender and indicators of healthy lifestyle (healthy nutrition, exercise and physical activity, avoidance of smoking and alcohol) as well as psychological factors such as perceived stress. Increased perceived stress had a significant effect on increasing the risk of diabetes among women and was which in line with the research by Zareipour et al. (24), and Riazi et al. (25). One of the most important psychological factors regarding the occurrence of medical diseases such as diabetes is stress (26). The results of Elstad's (27) research also demonstrated that blood sugar levels rise with increase of environmental, cultural, family and personal stresses. In the present study, perceived stress only affected the risk of developing diabetes

in women and did not significantly increase the risk of developing diabetes in men. This was consistent with studies of Harris et al. (28) and Williams et al. (9). In explaining this result, the authors realized that because the average perceived stress of women was higher than men, perceived stress factor played an important role regarding diabetes in women. Therefore, recognizing the sources of stress in women by conducting interventions based on creating policies and trainings can be a step toward reducing stress and improving their health(29). Another indicator of a healthy lifestyle, namely exercise and physical activity, was significantly related to the chance of developing diabetes. In a way that the more females work out, the lower the risk of diabetes they face. The average rate of doing exercises for women was less than men. Moreover, the average rate of doing exercises by women with diabetes was comparatively less than healthy women. Therefore, according to the results of this study, the effect of doing exercise or physical activity on reducing the incidence of diabetes in women is undeniable.

Another point to consider is that exercise and physical activity, according to the results of some studies, had a decreasing effect on stress, and consequently, on the disease (30, 31).

Many studies emphasized the role of education as one of the social indicators affecting type 2 diabetes (31, 32). This is because education is an essential factor enabling people to change their behavior and lifestyle, access health systems, and promote their health. On the other hand, the results of studies by McClear (2011) showed that people with higher education level had higher level of health (33). Therefore, people with higher education had better health literacy and better understanding regarding the use of health information and instructions. In addition, according to the results of Rahimi et al.'s study (2015) with increasing the level of education, the level of awareness and taking actions in the field of health increases (34). Thus, higher education level by increasing health literacy, greater awareness of proper health-related behaviors and increased self-

care can be an effective factor in reducing the risk of diseases such as diabetes. Some studies found that people with the lowest levels of education (illiterate and elementary) were more likely to develop diabetes. Consistent with the study by Lareng (2004), authors acknowledged that the prevalence of type 2 diabetes in people with an education level of less than 4 years, compared with 4 years or more, can be at a higher risk. Rayapa's study discussed that education level had major effects on the prognosis of diabetes, but it was not clear that these effects were associated with greater understanding of the disease and ultimately "participation in self-care or with improved socio-economic conditions, and consequently, having High education levels led to better and more care services because faster diagnosis and subsequent follow-up treatment reduced the severity and consequences of the disease (31).

However, the results indicated that increasing the level of education had an effect on reducing the risk of diabetes in both women and men. But unlike Rapaya's research, job status and income were not significantly associated with the risk of developing diabetes in the present study. Therefore, increasing education level was more effective with respect to understanding the disease, and ultimately, participating in self-care. This was not related to improving economic conditions.

Another important factor was a healthy diet, the increase of which reduced the incidence of diabetes in men. According to official statistics and the results of the current research, since men ate unhealthier foods, including fast food and convenience foods, sweets, etc. more than women, they were more likely to get diabetes due to an unhealthy diet (22).

In many papers social factors in predicting type 2 diabetes, for both women and men have been studied. However, one of the strengths of the present study was examining the social factors affecting type 2 diabetes. Then, it was disaggregated by gender and compared. This be investigated separately for macro-planning and future policies to prevent diabetes in men and

women, depending on the factors affecting each group. One of the limitations of the present study was that the research sample was limited to the community of married people aged 20 to 60 in Kerman. It did not include single people, and caution should be taken in generalizing these results to other studies with different people in different communities and other geographical areas who may have different lifestyles. Another limitation was related to people's self-reporting of some sensitive variables, such as smoking and alcohol consumption, that may not have been reported in all honesty by the respondent. Therefore, in future research, other methods such as in-depth interviews can present more reliable information in this regard.

Conclusion

Cultural differences and different healthy lifestyles between men and women cause differences regarding the prevalence of type 2 diabetes among them. In fact, differences in disease can be due to gender differences according to behavioral and social norms. Therefore, adopting policies and plans to develop healthy lifestyle, culture and norms in this field and provide facilities such as sports for everyone; especially women can be a step towards preventing the possibility of infection. This can be accompanied by increasing the level of education

to raise awareness with regard to the consequences of diabetes as a result of unhealthy food consumption, particularly for men.

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Author contribution

AA, P.D, and A.M conceived of the paper's idea and A.A collected the data, and performed computations. A.A, P.D, A.M and Fj developed the theoretical framework necessary for the work; all authors discussed the results and contributed to the final manuscript.

Conflict of Interest

The authors declared no conflict of interest. The present paper did not have financial resources and support, but, it received support from the professors of the Faculty of Social Sciences, Payame Noor University.

References

1. World Health Organization. 2021. Available from: <https://www.who.int/news-room/fact-sheets/detail/diabetes>. 2021 (WHO, 2021).
2. IDF DIABETES ATLAS Ninth edition. 2019. Available from: https://www.diabetes-atlas.org/upload/resources/material/20200302_133351_IDFATLAS9e-final-web.pdf.
3. <https://behdasht.gov.ir>
4. Esteghamati A, Larijani B, Aghajani MH, Ghaemi F, Kermanchi J, Shahrami A, et al. Diabetes in Iran: prospective analysis from first Nationwide diabetes report of National Program for prevention and control of diabetes (NPPCD-2016). *Sci Rep*. 2017;7(1): 34-61. [Persian]
5. Alizadeh, Mahasti, Ghanbari. Study of the relationship between lifestyle and social factors in diabetic patients, health image. 2018; 9 (2): 115-108. [Persian]
6. Cockerham, W.C. Bourdieu and an Update of Health Lifestyle Theory, In Cockerham, W.C. (ed) *Medical Sociology on the Move*. London: Springer. 2013.
7. Roglic G, Unwin N, Bennett PH, Mathers C, Tuomilehto J, Nag S, et al. The burden of mortality attributable to diabetes: realistic estimates for the year 2000. *Diabetes Care*. 2005; 28(9):2130-5.
8. Ahmadi, Yaghoob, Hossein Mohammadzadeh, Simin Ali Zamani. The relationship between capital types and health-

- centered lifestyle in women in Sanandaj. *Social Welfare Quarterly*.2016;16 (61): 23-42. [Persian]
9. Williams ED, Magliano DJ, Tapp RJ, Oldenburg BF, Shaw JE. Psychosocial Stress Predicts Abnormal Glucose Metabolism: The Australian Diabetes, Obesity and Lifestyle (AusDiab) Study. *Ann. Behav. Med.* 2013;46: 62–72.
 10. Joshua J. J , Golden S H. Cortisol dysregulation: the bidirectional link between stress, depression, and type 2 diabetes mellitus. *Ann N Y Acad Sci.* 2017; 4(1): 20–34.
 11. Stults-Kolehmainen, M.A., Sinha, R. The Effects of Stress on Physical Activity and Exercise.Sports Medicine . 2014; 44(2): 81–121.
 12. Bergmann N, Gynzelberg F, Faber J. The appraisal of chronic stress and the development of the metabolic syndrome: a systematic review of prospective cohort studies. *Endocr Connect*.2014; 3(2): 55-80.
 13. Novak M, Bjorck L, Giang KW, Heden-Stahl C, Wilhelmsen L, Rosengren A. Perceived stress and incidence of type 2 diabetes: a 35-year follow-up study of middle-aged Swedish men. *Diabet Med.* 2013; 30(2) :8-16.
 14. Walsh R.lifestyle and Mental Health. *American Psychologist.* 2011; 66(7): 392-579.
 15. Tracey ML, McHugh SM, Buckley CM, Canavan RJ, Fitzgerald AP, Kearney PM. The prevalence of type 2 diabetes and related complications in a nationally representative sample of adults aged 50 and over in the Republic of Ireland. *Diabet Med.* 2016; 33(4):441–445.
 16. Nordstrom A, Hadrevi J, Olsson T, Franks PW, Nordstrom P. Higher prevalence of type 2 diabetes in men than in women is associated with differences in visceral fat mass. *J Clin Endocrinol Metab .* 2016 ; 101(10):3740–3746.
 - 17.Centers for Disease Control and Prevention National Diabetes Statistics Report.2019. Available from: www.cdc.gov/diabetes/pdfs/data/statistics/national-diabetes-statistics-report.pdf.
 - 18.Mirzaei M, Rahmaninan M, Ali Dehghani tafti A,. Nadjarzadeh A, *BMC Public Health.* 2020; 20:166. <https://doi.org/10.1186/s12889-020-8267-y> [Persian]
 19. Moghimi-Dehkordi B, Safaei A, Vahedi M, Pourhoseingholi A, Pourhoseingholi M, Ashtari S, et al. Overweight and obesity and related factors in urban Iranian population aged between 20 to 84 years. *Ann MedHealth Sci Res.*2013;3(2):171–6. <https://doi.org/10.4103/2141-9248.113656>. [Persian]
 20. Basti M, Madadzadeh F. A beginner's Guide to Sampling Methods in Medical Research. *Critical Comments in Biomedicine.* 2021 Sep 30;2(2).
 21. Ghaderi M, Maleki A, Haghjoo M. The Role of Social Capital in Promoting Healthy Lifestyle among People with Vascular Disease. *Journal of Cardiovascular Nursing.* 2015; 4(2): 24-35. [Persian]
 22. Atlas of Diseases, Ministry of Health Publications.2019. [Persian]
 23. Navipour, E and et al. Prediction of factors associated with type 2 diabetes using logistic regression. *Journal of Knowledge and Health.*2017; 12(2). [Persian]
 24. Zareipour, Morad Ali, Khair Mohammad Jadgal .Evaluation of the relationship between perceived stress and blood sugar levels in patients with type 2 diabetes. *Journal of Health Rahavard.* 2015; 2(4):130-138. [Persian]
 - 25.Riazi A, Pickup J, Bradley C. Dailystress and glycaemic control in Type 1diabetes: individual differences in magnitude, direction, and timing of stressreactivity.*Diabetes research and clinicalpractice.*2004 ;66(3):237-44.
 - 26.Davazdah Emami, Mohammad .Hassan et al. The effectiveness of cognitive-behavioral stress management training on blood sugar control and depression in type 2 diabetic patients." *Iranian Journal of Endocrinology and Metabolism, Shahid Beheshti University of Medical Sciences and Health Services,* 2011; 11(4): 392-385. [Persian]
 - 27.Elstad E. Living with Ma'i Suka. individual, familial, cultural, and environmental stress among patients with type 2 diabetes mellitus and their caregivers in American Samoa. *J Prev Chronic Dis.* 2008; 5(3) : 79-84.
 28. Harris ML, Oldmeadow C, Hure A, Luu J, Loxton D, Attia J . Stress increases the risk of type 2 diabetes onset in women: A 12-year longitudinal study using causal modelling. *PLoS ONE.* 2017; 12(2). doi:10.1371/journal.pone.0172126.
 29. Zare F, Ameri H, Madadzadeh F, Aghaei MR. Health-related quality of life and its associated factors in patients with type 2 diabetes mellitus. *SAGE Open Medicine.* 2020;8:25-29. Doi:10.1177/2050312120965314.
 30. Edenfield, T. M., & Blumenthal, J. A. Exercise and stress reduction. In R. J. Contrada & A. Baum (Eds.), *The handbook of stress science: Biology, psychology, and health .*Springer Publishing Company. 2011;301–319.
 - 31.Tale, Azar,et al. Evaluation of socio-economic factors in type 2 diabetic patients and disease-related outcomes in affiliated hospitals. 2010;10(2). [Persian]
 - 32.Mahmoudi, H, et al.Study of health literacy and its relationship with the consequences of diabetes in patients with

- type 2 diabetes. Journal of Urmia School of Nursing and Midwifery, 2013;12(1). [Persian]
- 33-McCleary-Jones V. Health literacy and its association with diabetes knowledge, self-efficacy and disease self-management among African Americans with diabetes mellitus. ABNF J. 2011; 22(2):25-
34. Rahimi et al. The level of knowledge and practice about self-care in diabetic patients in Kermanshah, Journal of Rafsanjan University of Medical Sciences. 2015;14(2). [Persian]