Predicting Women's Marital Adjustment based on Attitudes toward Infidelity, Health Literacy and Self-Care in their Diabetic Spouses in Ahvaz

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Abstract

Objective: The aim of this study is to employ an artificial neural network to predict the marital adjustment of women by investigating their attitudes toward infidelity, health literacy, and self-care concerning their diabetic spouses.

Materials and Methods: The present study employed a descriptive-correlational research design. The study's statistical population comprised all couples residing in Ahvaz City, in which their male spouse was diagnosed with either type 1 or type 2 diabetes and who had been registered with the Diabetes Association of Khuzestan province until the end of December in the year 2022. Out of a total population of 2,200 individuals, a sample of 205 individuals was chosen using convenience sampling. In order to gather data, the researchers utilized several questionnaires, including the Marital Adjustment Questionnaire (MAQ), Attitude towards infidelity Scale, Health Literacy for Iranian Adults (HELIA), and The Diabetes Self-Care Activities Questionnaire (DSCAQ. The data analysis involved the application of descriptive statistics and inferential statistics to examine Pearson's correlation coefficient, regression, and the artificial neural network.

Results: The results indicated a statistically significant negative association between men's attitude towards infidelity and women's marital adjustment as well as statistically significant positive associations between men's health literacy and women's marital adjustment, and between men's self-care and women's marital adjustment ($P < 0.01$).

Conclusion: Health literacy plays a crucial role in enhancing the ability of men with diabetes to self-regulate and manage their condition through proper diet. It also increases their awareness of how diabetes can impact their marital life and sexual relationships.

Keywords: Diabetes, Marital adjustment, Attitude toward Infidelity, Health literacy, Self-care

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Introduction

Diabetes is a highly costly disease that is as a prominent etiological factor for blindness, progressive renal dysfunction, and amputation within the adult population of numerous nations. Cardiovascular illnesses are the prevailing cause of mortality in numerous nations and are frequently observed as a prominent consequence of diabetes. In contrast, it is essential to note that diabetes currently lacks a transparent cure, and prospects for a definitive treatment soon appear limited. Like numerous other diseases, the most effective approach to managing this condition is its prevention (1). Diabetes is a persistent medical condition characterized by the body's inability to utilize or retain glucose effectively. Glucose, a monosaccharide, can potentially elevate blood glucose levels when it becomes concentrated within the bloodstream. This condition can be classified into two primary categories: Type 1 and Type 2 diabetes. Type 1 diabetes is characterized by a total cessation of endogenous insulin production within the body (2). Diabetes has a significant impact on multiple dimensions of individuals' lives, encompassing employment, overall well-being, interpersonal and psychological functioning, and, notably, sexual functioning (3). Additionally, it can also disrupt the marital adjustment of individuals with diabetes and their spouses. Marital adjustment can be conceptualized as a psychological phenomenon that necessitates the joint efforts of both spouses, particularly during the initial years of marriage when satisfaction levels are exceedingly unstable, and relationships are most susceptible to instability (4).

Several elements can influence the marital adjustment of women. One potential aspect that may influence individuals' behavior is their attitude toward infidelity in their spouses. Crossover relationships can be characterized as a form of intimate involvement, encompassing either sexual, emotional, or both dimensions, with an individual other than one's spouse while maintaining secrecy from the spouse (5). Mphaphuli & Smuts (2021) conducted a study to investigate the correlation between marital satisfaction and attitudes pertaining to infidelity. The statistical sample comprised 98 women from South Africa. The findings indicated a lack of marital satisfaction impacted women's attitudes toward marital relations (6). Granado-Casas et al. (2019) conducted a study that demonstrated the impact of diabetes on the quality of life and sexual functioning of patients and how these factors influence the overall life satisfaction of couples. The study also highlighted the potential consequences of persistent sexual dysfunction, such as marital infidelity in the non-diabetic spouse (7). The study findings indicate that there is a positive relationship between self-efficacy and self-management in the context of controlling type 2 diabetes and improvements in sexual functioning, as well as a reduction in attitudes towards infidelity (8). It was demonstrated that the presence of type 2 diabetes among male and female patients from Brazil and Venezuela has a detrimental impact on their sexual functioning and poses a potential threat to their marital satisfaction (9).

According to study, the possession of health literacy among male individuals with diabetes appears to be associated with improved diabetes management and recovery and enhanced marital adjustment among female spouses. Following health literacy promotion among individuals with diabetes, the cultivation of self-care behaviors will also be observed (10). Self-care behaviors among individuals with diabetes include adhering to a well-balanced dietary regimen, engaging in regular physical exercise, monitoring blood glucose levels, complying with prescribed drug regimens, and attending to foot care (11). In a separate investigation, findings demonstrated that raising awareness regarding self-care among diabetic patients improves marital satisfaction and overall quality of life

(12,13). The relationship between health literacy, self-care behaviors, and marriage satisfaction is such that an increase in health literacy and engagement in self-care behaviors is associated with a corresponding improvement in marital satisfaction (10-13). In their study titled "The Relationship between Health Literacy and Self-Care Behaviors in Individuals with Diabetes Aged 60 and Above: The Mediating Role of Empowerment," Shin and Lee (2018) found that individuals with higher health literacy and awareness of diabetes are more likely to engage in self-care behaviors and experience increased empowerment, leading to better disease control (14).

The existence of health literacy among individuals diagnosed with diabetes is associated with the
Adoption of self-care activities. Self-care is a procedural undertaking wherein the individual utilizes their acquired knowledge and abilities to engage in the prescribed behaviors. Hence, it is imperative for individuals to not only acquire adequate knowledge regarding their ailment and the requisite caregiving procedures but also to effectively apply their acquired knowledge in diverse circumstances and contexts (15). The purpose of this research is to predict the level of marital satisfaction of women living in Ahvaz City by investigating their opinions on adultery, knowledge about health, and personal care in relation to their diabetic partners.

Material and methods

This study is fundamental, also descriptive and correlational. The criterion variable in this study is women's marital adjustment, whereas the predictor variables include attitudes toward infidelity, health literacy, and self-care. The statistical population of this study comprises all couples in Ahvaz city who have male spouses diagnosed with type 1 and type 2 diabetes. These couples were registered in the Khuzestan Diabetes Association till the end of December in the year 2022, and the total population of this group amounts to 2200

individuals. Criteria for inclusion consisted of demonstrating a minimum level of reading and writing proficiency, being married, as well as being male with either type 1 or type 2 diabetes. Criteria for exclusion included incomplete or unreliable questionnaire responses, as well as a lack of interest in participating in the study. The current study employed convenience sampling to choose the sample of 205 male patients with type 1 and type 2 diabetes who were sent to endocrinologists in Ahvaz city, together with their wives. Concerning the determination of the sample size to evaluate the proposed model and research hypotheses, it has been suggested by Chen & Liu (2019) that a sufficient number of subjects for each route would be 15, resulting in a total of 175 individuals being deemed enough for the present study(16). However, considering potential attrition, the initial sample size of 220 individuals was considered. Ultimately, after excluding questionnaires with distorted responses, 205 participants were included in the research study.

The research adhered to ethical standards, such as obtaining written agreement from participants before commencing the study and ensuring that participation did not impose any financial burden on the individuals. The present work obtained ethical approval under the number IR.IAU.AHVAZ.REC.1402.112 from the Institutional Review Board of the Islamic Azad University, Ahvaz branch. The data analysis involved the utilization of descriptive statistics, specifically the mean and standard deviation, and inferential statistics, such as Pearson's correlation coefficient, stepwise regression, and artificial neural networks. Before the analysis, the data was thoroughly scrutinized to verify that it adhered to the fundamental assumptions of the regression analysis model employed in this research. The data were analyzed using the SPSS-27 program and MATLAB software, specifically version 2019.

Instrumentation

The Marital Adjustment Questionnaire (MAQ) was developed by Spanier, Spanir (17) conducted a study to assess the validity of the "Husband and Wife Compromise Scale." The study used a sample group of married individuals (n= 218) and divorced individuals (n= 94). The average duration of marriage for the married sample group was found to be 13.2 years. The mean duration of marriage among individuals who have undergone divorce, as observed within the sample population, was found to be 8.5 years. The mean score on the "Husband and Wife Compromise Scale" for married individuals was 114.8, with a standard deviation of 17.8.

In contrast, the divorced group had an average score of 70.7, with a standard deviation 23.8. The dependability of this tool's total scores has been judged to be 0.96 (17). The internal consistency of the scale's total score is statistically significant, as indicated by a Cronbach's alpha coefficient of 0.96. The tool's reliability was assessed by conducting a study over 37 days with a sample of 92 individuals. The reliability coefficient, as measured by Cronbach's alpha, was 0.86(18). In the current study, the tool's reliability through Cronbach's alpha achieved 0.88.

Attitude towards infidelity Scale

The scale utilized in this study was developed by Whatley (19) to examine individuals' attitudes about infidelity. The scale consists of 12 items assessed using a 7-point rating system, ranging from a score of 7, indicating substantial agreement, to a score of 1 indicating significant disagreement. According to Habibi et al. (2015), the retest coefficient for this exam was 80 (20). The current study employed Cronbach's alpha to assess the reliability of the scale, and the resulting coefficient was 0.84.

Health Literacy for Iranian Adults (HELIA)

Montazeri et al. (21) developed and standardized the scale utilized in this study, considering the cultural and socioeconomic attributes specific to Iran. The questionnaire comprises 33 inquiries, with the scoring scale ranging from 1, indicating a response of utmost ease, to 5, indicating a response of utmost difficulty. The results of the exploratory factor analysis indicate that the questionnaire, as mentioned earlier, consisting of 33 items across five domains, demonstrates strong construct validity. The Cronbach's alpha coefficients for the items in the linked structures show acceptable levels of reliability, ranging from 0.72 to 0.89(21). The present study used Cronbach's alpha to assess the reliability. The reported coefficient equaled 0.82.

The Diabetes Self-Care Activities Questionnaire (DSCAQ)

Is a reliable and valid self-report measure developed by Toobert, et al (22). This questionnaire comprises 15 items that assess many dimensions of diabetes self-care, such as dietary habits, physical activity, blood glucose monitoring, foot care, and smoking behavior. The term "measures" refers to actions or strategies implemented to achieve a specific goal. There are a total of 14 initial questions that are evaluated on a scale ranging from 0 to 7, while the last question is a binary choice with options of "yes" and "no." The range of scores spans from 0 to 98, encompassing both the minimum and highest values. The study in Iran reported a Cronbach's alpha coefficient of 0.92 for the questionnaire utilized in their research (23). The study at hand took the advantage of Cronbach's alpha coefficient to assess the reliability. The resulting value was 0.85.

Ethical considerations

The present work obtained ethical approval under the number IR.IAU.AHVAZ.REC.1402.112 from the Institutional Review Board of the Islamic Azad University, Ahvaz branch.

Results

The study consisted of 205 male and female volunteers, with 57 individuals ranging between 32-37. Additionally, among the male participants, 57 were between the ages of 34-39. In Table 1, it can be shown that doctoral education exhibited the least frequent occurrence, while education demonstrated the highest frequency when comparing the two groups.

As indicated in Table 2, the mean (±SD) of the marital adjustment variable for women are 89.20 (±32.74). Similarly, the mean (±SD) of the attitude variable towards infidelity are 43.56 (±16.47). The mean (±SD) of the health literacy variable are 82.47 (±27.01).

According to the regression results, the variables of attitudes towards infidelity, health literacy and self-care were included in the analysis. In the initial stage, the analysis solely incorporates the self-care variable, corresponding (F= 62.723; P= 0.01), respectively. In the second phase of the analysis, the examination of attitudes toward infidelity yielded (F= 53.528; P= 0.01), respectively. The third step of the analysis, including the health literacy variable, yielded (F= 43.595; P= 0.01), respectively (Table 3). In this model, the initial stage exhibits a multiple correlation coefficient of MR= 0.489 for the variable of attitude toward infidelity. Moving to the second stage, the multiple correlation coefficient for attitude towards infidelity and health literacy is MR= 0.591. Finally, in the third stage, the multiple correlation coefficient for attitude towards

Table 1. Demographic variables of the subjects

Variables	Male		Female	
	Frequency	Age (in years)	Frequency	Age (in years)
Age	39	46-51	24	44-49
	53	40-45	45	38-43
	57	34-39	57	32-37
	43	28-33	47	26-31
	13	22-27	32	20-25
	Frequency	Education	Frequency	Education
Education	58	High school	36	High school
	30	Diploma	48	Diploma
	70	Bachelor	80	Bachelor
	34	Master	26	Master
	13	Ph. D	15	Ph. D

Table 2. Descriptive statistics of research variables of the subjects

Variables	Statistics Mean	Standard deviation
Women's marital adjustment	89.20	**32.74**
Attitude toward infidelity	43.56	**16.47**
Health literacy	82.47	**27.01**
Self-care	39.02	**8.68**

Table 3. Statistics of step-wise multiple regression analysis for predicting women's marital adjustment

Predictor variables	MR	RS	F P-value	(B & β) 1	2	3	Constant (a)
Self-care	0.489	0.239	62.723 0.001	β = 0.489 B= 0.423 t=7.920 P=0.001	-	-	**12.524.**
Self-care attitude toward infidelity	0.591	0.350	53.528 0.001	β = 0.377 B= 0.326 t=6.249 P=0.001	β = 0.352 B= 0.201 t=-5.830 P=0.001	-	**28.123**
Self-care attitude toward infidelity health literacy	0.631	0.389	43.595 0.001	β = 0.377 B= 0.327 t=6.489 P=0.001	β = -0.201 B= -0.115 t=-2.901 P=0.004	β = -0.266 B= -0.085 t=-3.972 P=0.001	**29.199**

infidelity, health literacy, and self-care is calculated to be MR= 0.631. These results suggest that the three stages have respective increments of RS= 0.239, 0.350, and 0.350. The findings indicate that the variable of marital adjustment in women is explained by RS= 0.398. Consequently, the fourth hypothesis is supported.

Neural network question

To what extent women's marital adjustment is predicted by attitudes toward infidelity, health literacy, and self-care in their diabetic spouses? The researcher designed a neural network and built it using MATLAB software to answer this question. First, the data to enter the network was divided as follows:

- 70% as a training set
- 15% as a test set
- 15% as a validation set.

In this context, the network was provided with two input values and one output value, which were presented as an Excel file in a matrix format. Based on the findings, it was seen that the optimal outcome was achieved by utilizing a neural network comprising two hidden layers. Specifically, the first hidden layer consisted of nine neurons, while the second hidden layer contained a single neuron. The provided diagram illustrates the structure of the artificial neural network that possesses the most accurate estimation.

Uncertainty regarding the optimal number of training repetitions necessitates utilizing the early stopping method. This method involves presenting the validation set data and optimizing the network weights while simultaneously presenting the validation set data solely to obtain predictions. The process continues until there is no further improvement in the error. The desired threshold has yet to be attained; hence, training repetitions will persist. The optimal repetition rate is determined by selecting the value corresponding to the lowest total data value inside the training set. Diagram 1 illustrates the sequential progression of the neural network training set, commencing from the input data. Based on the specified parameters, the network ceased operation when encountering a sequence of 5 consecutive instances where the error in the validation set was repeated.
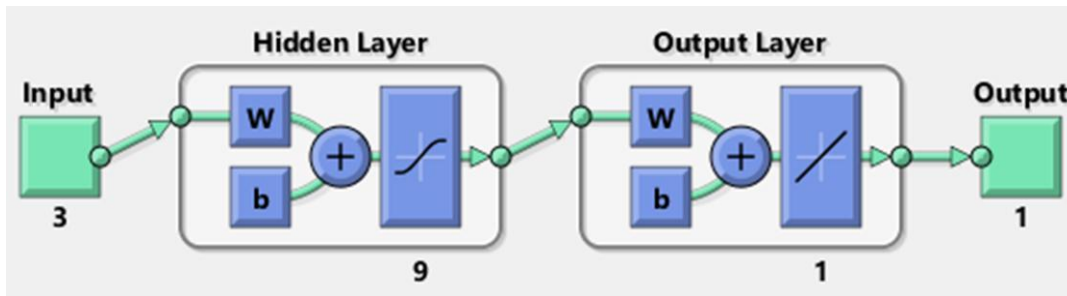

Figure 1. Artificial neural network structure with the best possible estimate
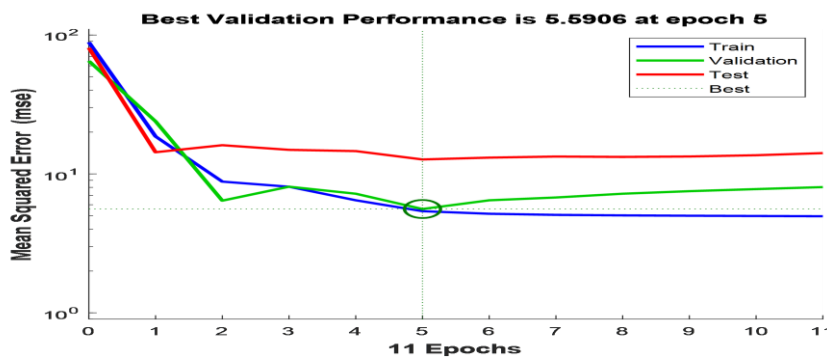

Diagram 1. Network efficiency chart

The stop mentioned above took place during the eleventh iteration. Based on the information presented in diagram 1, it is evident that:

1- The value of the final mean square error is small.

2- The error of the test set has almost the same behavior and characteristics as the error of the validation set.

3- Until iteration 5 (which is the best performance of the validation set), no over fitting has occurred.

Regression mean diagram

Chart 2 shows the accuracy of the network in predicting women's marital adjustment, which is displayed in 4 parts: training, validation, test, and all. This graph shows how close the network outputs are to the actual values. The closer the points are to the diagonal axis of the graph and accumulate, the closer the output values are to the actual values. Below are the graphs related to the prediction equations in each phase of training, validation, test, and all.

According to the above graphs, in the training phase, the neural network was able to

predict the marital adjustment of women with an accuracy of 0.77. At this phase, the prediction equation was as follows:

Output = 0.54 * Target + 14

Also, in the validation phase, the neural network was able to predict the marital adjustment of women with an accuracy of 0.85. At this phase, the prediction equation was as follows:

Output = 0.73 * Target + 8.1

In the test phase, the neural network was able to predict the marital adjustment of women with an accuracy of 0.55. At this phase, the prediction equation was as follows:

Output = 0.63 * Target + 12

And in general, the neural network was able to predict the marital adjustment of women with an accuracy of 0.74. At this phase, the prediction equation was as follows:

Output = 0.59 * Target + 12

Error value

It is possible to evaluate the functioning of different models with the help of RMSE and MRE factors.
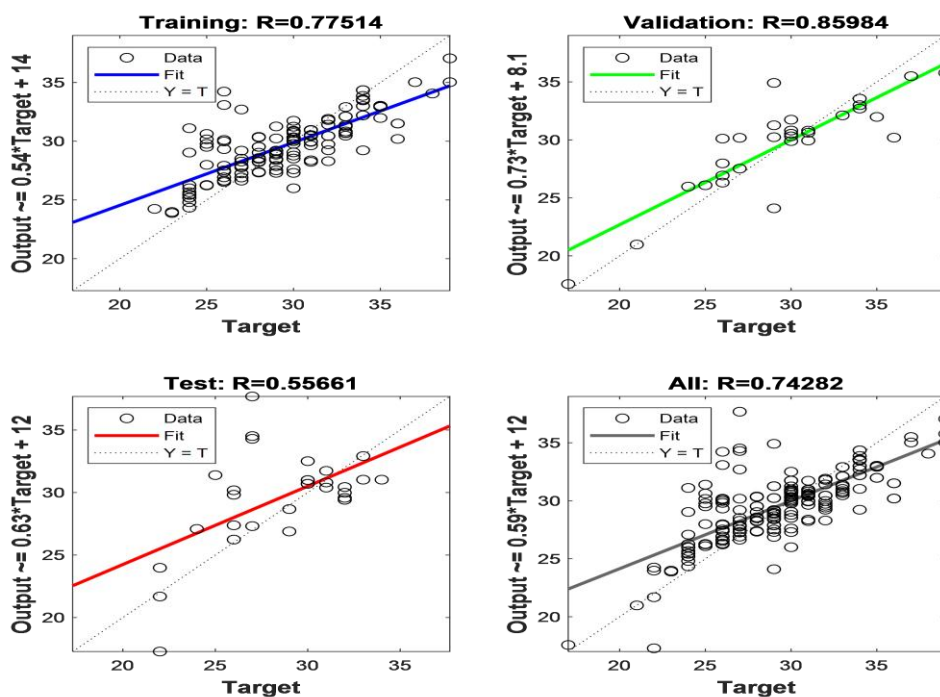

Diagram 2. Regression equation between the means of women's marital adjustment and the estimated value

In the following, neural network functioning evaluations are presented in the training, validation, and test phases.In the training phase, RMSE = 1.99 and MRE = 0.054 were obtained.In the validation phase, RMSE = 2.57 and MRE = 0.069 were obtained, and in the test phase, RMSE = 2.03 and MRE = 0.054 were obtained.The subsequent diagrams depict the hierarchical order of the relationship between the variables. The findings indicated that the variable of attitude towards infidelity exhibited the strongest correlation with the marital adjustment of women in relationships with diabetes spouses. Subsequently, the variables of self-care and health literacy were found in the subsequent categories (diagram 3). The neural network demonstrated a remarkable capability to accurately predict the level of marital adjustment among women who were in relationships with diabetic spouses.

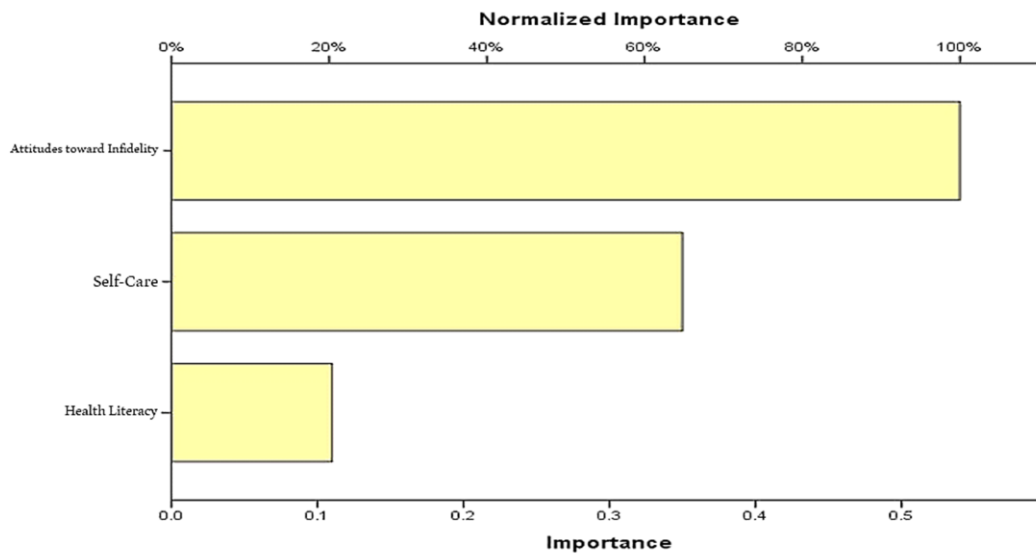According to diagram 4, four hidden variables are in the hidden layer of the above model.

Diagram 3. Evaluation of women's marital adjustments regarding research variables

Hidden layer activation function: Hyperbolic tangent
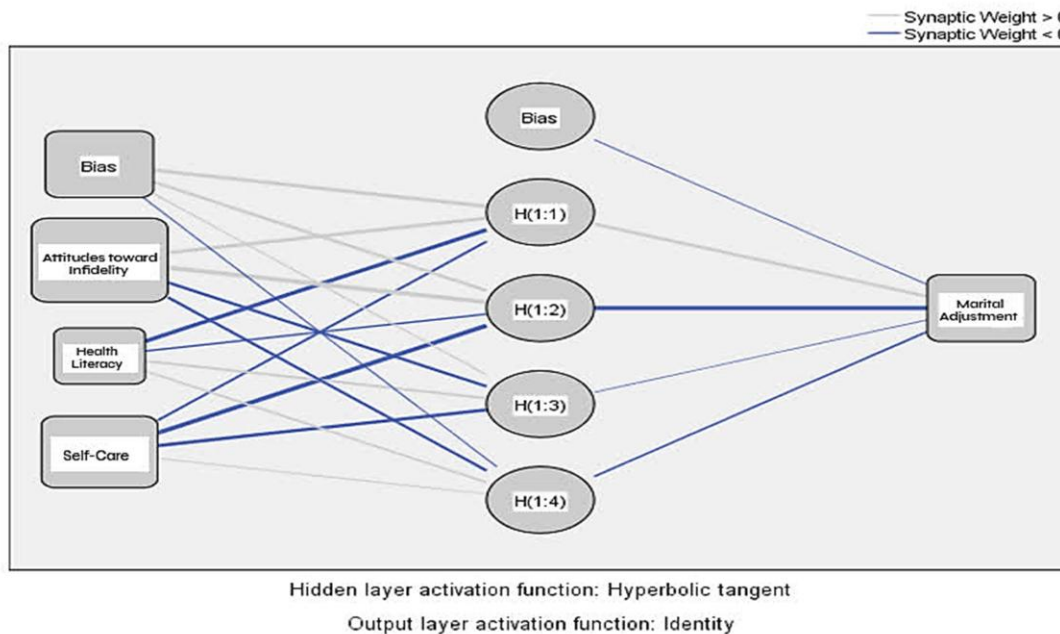
Output layer activation function: Identity

Diagram 4. Functioning of the hidden layer and the priority of predictors

It has also been shown that the attitude variable towards infidelity is the most important predictor of women's marital adjustment.

Discussion

The purpose of this research was to predict women's marital adjustment based on attitudes towards infidelity, health literacy, and self-care in their diabetic spouses. According to the results, the hypothesis that women's marital adjustment can be predicted based on their attitudes towards infidelity with their diabetic spouses was confirmed. This finding is consistent with the results of Mehdipour-Rabori et al. (24), Keyhani et al. (25), Mphaphuli & Smuts (6) and Cooper et al. (26) are consistent.

Mehdipour-Rabori et al. (24) showed that women with diabetes often face sexual problems due to their unique health condition, impacting their overall happiness and relationship with their partner. Moreover, Keyhani et al. (25) demonstrated that the discrepancy in marital adjustment between diabetic and healthy women is due to the perception of chronic illnesses as significant life events that can impact family dynamics.

To explain the findings, we resort to a previous study, which suggested that marital adjustment depends on how spouses interact and their respective coping strategies in stressful life circumstances. This is because ineffective communication patterns contribute to the persistence of unresolved issues within the shared life of couples, thereby serving as a recurring source of conflict (27). Given the significant impact of marital compatibility and relationship quality on couples' physical and psychological well-being, it is evident that couples invest a substantial amount of their emotional and psychological resources into improving their marital bond. Consequently, the presence of mutual agreement between spouses serves as a deterrent to engaging in marital infidelity (28). Conversely, the impact of diabetes on males encompasses multiple dimensions of their marital relations, with

sexual pleasure emerging as a pivotal factor that may diminish couples' commitment and affection. The lack of awareness among men regarding the potential repercussions of untreated sexual disorders resulting from diabetes can have adverse effects on marital adjustment. It may lead to crossover relationships among their wives. Hence, it can be inferred that the attitude of men with diabetes towards crossover relationships has a significant impact on women's marital adjustment (29).

Furthermore, the research findings verified another hypothesis, namely that the marital adjustment of women can be predicted by the health literacy levels of their spouses who have diabetes. This finding aligns with the results reported by Hoogendoorn et al. (30), Wang et al (31), and Wallner et al. (32).

Hoogendoorn, Shapira, Roy, Kane, and Gonzalez (2020) conducted a study examining how diabetes distress impacts the marital quality of life in adults with diabetes. Their findings suggest that the distress associated with diabetes significantly influences the quality of married life among these individuals, and that demographic factors also play a role in exacerbating distress (30). Wang, Hung, and Lo (2019) found in their research that having health literacy among diabetic patients is crucial for constantly monitoring blood sugar levels, enhancing the quality of life, and boosting sexual and marital contentment (31). Additionally, Wallner et al (2019) discovered that low sexual functioning in female diabetic patients can negatively impact their sexual satisfaction and marital relationship happiness (32).

In explaining the results, it can be said that health literacy is defined as people's access to health services, understanding and using health information systems, interpreting health-related problems, and making correct decisions. Inadequate health literacy of patients with diabetes causes marital dissatisfaction, and this lack of satisfaction is effective in couples' relationships and causes problems in the foundation of the family (30).

The strength and stability of the family depend on marriage and a stable and fundamental marital relation; that is, any wavering and weakness in marital satisfaction, in addition to disrupting the couple's mental peace, threatens the family's survival and durability. Therefore, by increasing the health literacy of men with diabetes and awareness of the effects of this disease on interpersonal relationships and men's sexual functioning, which leads to a decrease in women's marital satisfaction, it is possible to control diabetes to improve women's marital satisfaction.

On the other hand, sexual problems reduce the quality and satisfaction of life by reducing mood and the ability to maintain relationships. Therefore, it can be said that people who have sexual dysfunction have less marital satisfaction and marital adjustment. Health literacy increases the ability to self-regulate and manage diabetes through diet in men with diabetes, and their awareness of the effects of this disease on marital life and sexual relations increases (13).

Also, according to the findings, the hypothesis of marital adjustment of women can be predicted based on self-care in their spouses with diabetes that is consistent with the results reported by Montazami et al. (33); Soriano (34); Rastkar et al. (12); Wong et al. (13); Donoho et al. (35) and Wang & Yi (36). Soriano Laurenceau& demonstrated that with the increase in self-care behaviors in men with diabetes, marital satisfaction in their wives increases. If the patient has no financial problems, he regularly implements self-care programs, including timely visits to the doctor, preparation and adherence to medication and food regimen, contact with the treatment unit, and regular exercise (34). If the patient has a good relationship with his wife and children, he can take advantage of their help and participation in most self-care tasks and perform better self-care (35,36).

Donoho et al. (35) and Wang et al. (36) acknowledged in research that many studies were related to the critical and predictive role of the quality of married life on the mortality rate in married people. In this way, the death rate due to lack of self-care in people who had high marital satisfaction was significantly lower than in people who had low satisfaction in their married life. Marital satisfaction depends on how husband and wife interact and their coping methods in stressful situations because ineffective communication patterns cause essential issues of joint life to remain unresolved and become a source of repeated conflict between couples. Since the satisfaction and quality of marital relations lead to physical and psychological health in the couple's married life, couples spend most of their emotional and psychological funds on consolidating their married life. Because of the agreement between them, they tend to commit less marital infidelity (35,36). On the other hand, diabetes in men affects various aspects of their marital relations, the most crucial aspect of which is sexual satisfaction, which can reduce the commitment and love of couples (12). While these men are not aware of the consequences of not reducing their sexual disorders due to diabetes, they can reduce marital satisfaction and cause their wives to have crossover relationships. Therefore, on this basis, it is reasonable to say that women's marital satisfaction is affected by the attitude toward crossover relationships of men with diabetes.

In order to further generalize the results, it is suggested that in future research, the variables of the current research should be carried out on women with diabetes so that the results of both research can be compared. It is suggested that other influential variables such as age, duration of diabetes, and having or not having children should be controlled in future studies and their results compared with the results of the present study. It is also suggested that variables such as marital burnout and emotional divorce be investigated on the marital adjustment of women with a spouse with diabetes. Because self-care and health literacy are acquired issues and can be learned, planners and medical consultants should pay more attention to this matter and teach these

skills to patients with diabetes through mass media.

Considering that marriage and choosing a spouse is one of the most critical decisions in life, and considering the predictive role of sexual satisfaction and marital adjustment in people's attitudes towards infidelity, it is necessary to emphasize the need to examine these two variables in premarital counseling. According to the results of the present research, it is possible to provide sexual satisfaction to people with diabetes and their spouses through education in order to increase their sexual capabilities and also provide marital adjustment, which is the basic foundation of family strength. In this way, happiness in people increases.

Conclusion

In general, health literacy in this regard increases the ability to self-regulate and manage diabetes through diet in men with diabetes, and their awareness of the effects of this disease on marital life and sexual relations increases. In general, health literacy has been introduced as cognitive and social skills that determine the capacity and ability of people to acquire, process, understand, and apply health information in a way that leads to appropriate decision-making in the field of health and ultimately leads to health improvement.

Conflict of Interest

All authors interpret that they have no conflict of interest.

Authors' contributions

A.Sh.R. Investigation, data collection, data analysis, writing-original draft, methodology, conceptualization and supervision. P.E. writing, review and editing the manuscript.

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