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Structural Relationship between Family Functioning and Health Literacy with Quality of Life in Diabetic Patients: The Mediating Role of Emotion Regulation

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ABSTRACT

Background: Quality of life is as important as its quantity, this issue is more important in sick people. In this study, the structural relationship between family functioning and health literacy with the quality of life of diabetic patients was investigated with the mediating role of emotion regulation.

Method: The research design was correlational. The statistical population was all male and female patients with type 2 diabetes in the first half of 1403. The sample consisted of 620 people who were sampled using purposive sampling. The data collection tools included the World Health Organization Quality of Life questionnaires, Epstein et al. Family Assessment (1983), Wahl et al. Health Literacy (2021), and Garnevsky et al. Emotion Regulation (2001). The data of this study were analyzed with SPSS23 and Lisrel8.8 software and using the structural equation modeling method.

Results: All indicator variables were significantly loaded on the latent variables (in all four variables of quality of life, emotion regulation, family functioning, and health literacy) (t>1.96). Emotion regulation had a direct and significant effect on quality of life (β= 0.186), family functioning had a significant effect on quality of life (γ= 0.223), health literacy had a significant effect on quality of life (γ= 0.511), family functioning had a significant effect on emotion regulation (γ= 0.415), health literacy had no significant effect on emotion regulation (1.96t>0, γ= 0.023), the indirect effect of family functioning on quality of life was significant (1.96t>0, IE= 0.077), the indirect effect of health literacy on quality of life was not significant (1.96t>0, IE= 0.077).

Conclusion: Improving family functioning and enhancing health literacy can effectively promote the quality of life of individuals with diabetes. Strengthening emotion regulation skills, together with appropriate family support, helps patients adapt more successfully to their condition and experience daily life with a greater sense of control and well-being.

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Extended Abstract

Introduction

Diabetes mellitus is one of the most common chronic metabolic diseases, classified into type 1 and type 2. In type 1 diabetes, the pancreas fails to produce insulin, whereas in type 2, insulin secretion remains, but its effectiveness is impaired, resulting in elevated blood glucose levels (Rachna & Satish, 2022). Diabetes represents a major global health challenge and a leading cause of disability-adjusted life years (Abbafati et al., 2020). Despite advances in preventive medicine, the prevalence of diabetes continues to rise, with projections estimating a 54% global increase by 2045 (Cho et al., 2018). In Iran, its prevalence has grown by nearly 30% in the past decade, exceeding international averages (Khamseh et al., 2021). The disease contributes to several complications—such as cardiovascular disease, kidney and liver dysfunction, visual impairment, and cancer—that significantly reduce quality of life (QoL) and increase health expenditures (Bommer et al., 2017; Williams et al., 2020).

Beyond its physical burden, diabetes profoundly affects psychological and social well-being. Contemporary healthcare emphasizes enhancing life quality rather than merely extending lifespan (Blood et al., 2021). QoL is a multidimensional construct encompassing physical, psychological, social, and environmental domains (Felce & Perry, 1995; Eurostat, 2017). Among psychosocial variables, family functioning is considered a critical determinant of QoL. According to Olson's Circumplex Model, family cohesion, adaptability, and communication are essential for emotional support and effective disease management (Dai & Wang, 2015). Research has shown that positive family interactions and supportive communication are associated with better glycemic control and higher QoL among individuals with diabetes (Fatusin et al., 2016; Bennich et al., 2019; Firat & Tuncay, 2020).

Another key factor is health literacy (HL), defined as the ability to access, understand, and apply health information to make appropriate health decisions (Zheng et al., 2018; Wahl et al., 2021). Low HL is linked to poor self-care, medication nonadherence, and lower perceived health (Baker et al., 1997; Berkman et al., 2011). Studies confirm a positive relationship between HL and QoL among diabetic patients (Couture et al., 2017; Ghaffari-Fam et al., 2020; Hu et al., 2019).

Moreover, emotion regulation (ER) the ability to manage and modify emotional responses plays a central role in adaptation to chronic illness (Gross & Thompson, 2007; Garnefski & Kraaij, 2018). Adaptive ER strategies are associated with improved mental health and QoL in patients with diabetes (Mocan et al., 2018; Tarabay et al., 2023).

In summary, empirical evidence suggests that family functioning and health literacy influence QoL directly and indirectly through emotion regulation (Boyes et al., 2023; Hsu et al., 2023). Therefore, the present study aims to investigate the structural relationships among family functioning, health literacy, and quality of life in patients with diabetes, focusing on the mediating role of emotion regulation.

Method

This study employed a correlational research design using the structural equation modeling (SEM) approach. In terms of data collection, it was a survey-based and applied study. The statistical population comprised all male and female patients with type 2 diabetes during the first half of 2024 in Iran. The sample size was determined according to Bentler's (1993, cited in Mueller, 1996) rule for SEM studies, which recommends a minimum ratio of 10 participants per estimated parameter. Given that 50 parameters were estimated, a target sample of 500 participants was set. To ensure full coverage, 700 questionnaires were distributed, 643 were returned, and after

screening and removing outliers, 620 valid responses were analyzed. A purposive sampling method was used. Inclusion criteria were: (1) confirmed diagnosis of type 2 diabetes by a physician; (2) minimum education level of a high school diploma (to ensure sufficient health literacy); (3) age range of 30–50 years; and (4) absence of other acute or chronic diseases or substance dependence. The instruments included: The World Health Organization Quality of Life Questionnaire (WHOQOL-BREF) – 24 items across four domains (physical, psychological, social, and environmental health) rated on a 5-point Likert scale; Cronbach's α ranged from 0.66 to 0.80. Family Assessment Device (FAD; Epstein et al., 1983) – 60 items across seven subscales; Cronbach's α values ranged from 0.60 to 0.79, with α= 0.94 for the total scale. Health Literacy Questionnaire (HLQ; Wahl et al., 2021) – 43 items in nine dimensions; Cronbach's α ranged between 0.71–0.87 and composite reliability between 0.88–0.96. Cognitive Emotion Regulation Questionnaire (CERQ; Garnefski et al., 2001) – 18 items measuring nine strategies; α coefficients above 0.62 were reported. All ethical principles were observed, including voluntary participation, confidentiality, and informed consent. Data were analyzed using SPSS 23 and LISREL 8.8, employing SEM for hypothesis testing.

Results

The final sample of this study consisted of 620 male and female participants. The mean age of the participants was 43.23 years with a standard deviation of 7.60. Among them, 259 individuals (41.8%) were women and 354 individuals (57.1%) were men, while 7 participants (1.1%) did not report their gender. Regarding marital status, 197 participants (31.8%) were single, 346 (55.8%) were married, 62 (10%) were divorced or widowed, and 15 participants (2.4%) did not report their marital status. In terms of educational level, 108 participants (17.4%) held a diploma or below, 130 (21%) had an associate degree, 260 (41.9%) held a bachelor's degree, 130 (21%) had a master's degree, and 45 (7.3%) possessed a doctoral degree. Additionally, 12 participants (1.9%) did not report their educational status.

The participants reported a moderate to relatively high level of quality of life, with the highest mean observed in the environmental health dimension (M= 25.55, SD= 5.51) and the lowest in psychological health (M= 17.96, SD= 3.97). Regarding emotion regulation, adaptive strategies (M= 34.88, SD= 7.04) were used more frequently than maladaptive ones (M= 28.29, SD= 5.03). In terms of family functioning, the total mean score (M= 174.44, SD= 24.27) indicated a generally favorable level of family performance, with the highest subscale mean in roles (M= 29.25, SD= 5.08). Finally, the overall health literacy score (M= 134.14, SD= 20.21) reflected a moderate to good level, with the highest mean in "social support for health" (M= 15.92, SD= 3.36).

Table 1. Effects among the research variables

Effects	Unstandardized coefficient	Standard error	t	Standardized coefficient
Direct effect of emotion regulation on quality of life	.122	.030	4.11	.186
Direct effect of family functioning on quality of life	.252	.059	4.24	.223
Direct effect of health literacy on quality of life	.638	.067	9.58	.511
Direct effect of family functioning on emotion regulation	.716	.118	6.09	.415
Direct effect of health literacy on emotion regulation	.034	.097	.450	.023
Indirect effect of family functioning on quality of life	.078	.025	3.45	0.77
Indirect effect of health literacy on quality of life	.005	.012	.450	.004

The findings indicate that emotion regulation has a significant positive effect on the quality of life of individuals with diabetes (t> 1.96). Family functioning also exerts a significant direct positive effect on quality of life, and its indirect effect on

quality of life through emotion regulation is similarly significant (t> 1.96). Health literacy has a significant direct positive effect on quality of life (t> 1.96), whereas its indirect effect on quality of life via emotion regulation is not significant (t< 1.96). The direct effect of family functioning on emotion regulation is significant and positive (t> 1.96), but the direct effect of health literacy on emotion regulation is not significant (t< 1.96). Furthermore, the results show that 51.6% of the variance in quality of life and 18.2% of the variance in emotion regulation are explained by the corresponding exogenous variables.

Conclusion

The findings of the study indicated that family functioning has a significant direct positive effect on the quality of life of individuals with diabetes. This result is consistent with previous research (Wang & Zhao, 2016; Fatusin et al., 2016; Benich et al., 2019; Firat & Tonkai, 2020), highlighting the important role of the family as part of the healthcare system (Zan et al., 2024). According to Bowen's family systems theory (1966), the family should be considered as an interconnected system in which members influence and are influenced by each other. Diabetic patients are often cared for at home and, due to the complexity of diabetes management, rely on their caregivers for daily support. Positive family functioning can therefore substantially improve patients' experiences by supporting both their physical and psychological health (Allenaim et al., 2021; Bomer et al., 2017; Khamseh et al., 2021). Families can facilitate lifestyle adjustments necessary for managing the disease, including promoting regular physical activity, maintaining dietary routines, monitoring medication, and supporting healthcare behaviors. In addition, optimal family functioning can reduce the levels of depression and anxiety commonly experienced by diabetic individuals (Swiele et al., 2014). From a psychological perspective, a supportive family structure enhances a sense of coherence, a concept from Antonovsky's salutogenic theory, which allows individuals to perceive their lives as understandable, manageable, and meaningful, thereby improving their capacity to cope with stress and chronic illness (Ando & Kawano, 2018). Overall, these factors provide a clear explanation for the positive impact of family functioning on the quality of life of individuals living with diabetes.

Ethical Considerations

Ethics Code: This study was approved by Semnan University of Medical Sciences, Semnan, Iran. To address social desirability concerns, participants were assured of the confidentiality of the collected data, and written informed consent was obtained from all participants.

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Second author:Arezoo alijani: Project supervision, final manuscript editing.

Third author:Nemat Sotodeh asl: Methodology, data collection.

Fourth author:Daryoush mehrafzoon: Statistical analyses, software, validation.

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Introduction

Diabetes[1] is one of the most prevalent metabolic[2] disorders and is classified into two main types: type 1 and type 2. Type 1 diabetes is characterized by impaired pancreatic[3] function (**the body's insulin-producing organ[4])** in the production and secretion of insulin[5] (1). In contrast, type 2 diabetes is more prevalent and is associated with insulin secretion; however, due to insulin resistance, it results in elevated blood glucose levels (2). This disease represents one of the most significant global public health concerns and leads to approximately 916 disability[6]-adjusted life years (DALYs) lost per 100,000 population worldwide (3). Despite extensive efforts, diabetes remains the second leading cause of reduced healthy life expectancy worldwide. The International Diabetes Federation[7] has estimated that, in the absence of effective preventive strategies, the global prevalence of diabetes will increase by 54% by the year 2045 (4). The prevalence of diabetes in Iran has increased by approximately 30% over the past decade, markedly exceeding global estimates (5). Diabetes is associated with increased mortality due to infections, cardiovascular diseases, stroke, chronic kidney disease, chronic liver disease, lower-limb amputation, visual impairment, and various types of cancer (6). Uncontrolled diabetes can impose substantial direct and indirect costs on patients and healthcare systems. It is projected that diabetes-related expenditures will rise significantly in the coming years, disproportionately affecting low- and middle-income countries, where nearly 80% of individuals with diabetes reside (7). Evidence from empirical and systematic studies Reviews indicate that diabetes significantly affects the quality of life[8] of affected individuals. In recent years, it has increasingly been recognized that "improving quality of life[9]" is, for many individuals, as important as "adding years to life[10]," that is, merely extending longevity. Accordingly, strategies aimed at improving quality of life have shifted from a peripheral concern to a central focus in diabetes clinical care (8). There is a broad consensus that quality of life is a multidimensional construct commonly categorized into five domains: physical well-being, material well-being, social well-being, emotional well-being, and growth and development or active engagement (9). Quality of life is defined as the quality of the social and physical environment, including both human and natural dimensions, within which individuals pursue and fulfill their needs and aspirations. Key dimensions of quality of life include material living conditions and productive activities; health; education; leisure and social interactions; economic and personal security; environmental and natural[11] quality; and, ultimately, the individual's overall evaluation of their life experience (10). The family structure of individuals with diabetes can significantly influence their quality of life. According to Olson's[12] Family Functioning Theory, family functioning can be classified into three primary dimensions: family cohesion, family adaptability, and family communication. The degree of family cohesion reflects the quality of emotional bonding and relationships among family members. In contrast, family adaptability refers to the family's ability to modify its power structure, reassign roles, and adjust internal rules in response to environmental pressures or life transitions, including stages of marriage. Family communication pertains to the quality of interactions among family members and plays a crucial role in shaping

1. adding life to years
2. metabolic
3. pancreas
4. the body's insulin factory
5. insulin
6. disability-adjusted life-years
7. International Diabetes Federation (IDF)
8. quality of life
9. adding life to years
10. adding years to life
11. Natural and living environment
12. Olson

both family cohesion and adaptability.Olson's Circumplex Model categorizes family cohesion into four levels ranging from low to high: disengaged[1], separated[2], connected[3], and enmeshed[4]. According to Olson's theory, family adaptability can likewise be classified into four levels, progressing from low to high: rigid, structured, flexible, and chaotic (11). As a chronic disease, diabetes exerts substantial effects on both the physiological and psychological dimensions of an individual's life (6, 7). Controlling these effects without family support is challenging; therefore, comprehensive lifestyle modifications are essential for effective disease management, and family functioning plays a pivotal role in this context. The relationship between family dynamics and the quality of life in individuals with diabetes is also noteworthy from additional perspectives. Evidence indicates that diabetes is associated with psychological problems such as depression and anxiety (12). Family functioning and structure can play an important role in reducing these psychological disorders and, consequently, contribute to the improvement of patients' quality of life. Research evidence also supports the influence of family structure on the quality of life of individuals with diabetes. Wang and Zhao[5], in a study on Chinese patients with type 2 diabetes, found that these patients experienced significant family dysfunction in the emotional involvement dimension compared to a non-diabetic control group, and family structure was negatively associated with the quality of life of patients with type 2 diabetes (13).Fatusin[6] and colleagues, in a study on patients with type 2 diabetes, demonstrated that the level of family support was significantly associated with quality of life (14). Benich[7] and colleagues, in a study examining family functioning and quality of life in diabetic[8] patients, found that family functioning was related to diabetes burden and mental health (15). Firat and Tonkai[9], in a study investigating the relationship between diabetes-related factors, family structure, and health-related quality of life, showed that family structure was significantly associated with quality of life (16). Another important variable affecting the quality of life in individuals with diabetes is health literacy[10]. Health literacy is related to general literacy and refers to an individual's ability to access, understand, evaluate, and utilize health information. These skills help individuals make informed decisions regarding healthcare, disease prevention, and health promotion in their daily lives, and…maintain or improve their quality of life. The World Health Organization[11] defines health literacy as "cognitive and social skills that determine the motivation and ability of individuals to access, understand, and use information in ways that promote and maintain good health" (17, 18). Low health literacy is common in the general population (19), and this issue is even more pronounced among individuals with chronic diseases. Low health literacy can affect the quality of life, including by reducing adherence to treatment[12], decreasing the effective use of preventive services (20, 21), and increasing the frequency of hospitalizations (22). Health literacy can also impact quality of life indirectly through higher healthcare costs (22), poorer overall health (21, 24), and an increased risk of mortality (22, 25). Research evidence further indicates that health literacy plays a significant role in the quality of life of

1. disengaged
2. separated
3. connected
4. enmeshed
5. Zhao
6. Fatusin
7. Bennich
8. burden of diabetes
9. Firat & Tuncay
10. Health literacy
11. World Health Organization (WHO)
12. adherence to treatment

individuals with diabetes. Ohman[1] and colleagues demonstrated a moderate correlation between health literacy and quality of life, as well as between health literacy and mental health status (26). Hu[2] and colleagues found that individuals with higher diabetes-specific health literacy performed better than those with lower health literacy in components such as physical health, general health, vitality, social functioning, and mental health. They concluded that low diabetes-related health literacy was associated with reduced quality of life among older adults with prediabetes in rural areas of China (27). Ghaffarifam et al. also reported that health literacy predicted approximately 47.5% of the variance in quality of life (28). Zheng and colleagues, in a systematic review, similarly found a pooled correlation between health literacy and quality of life (16). However, Cotter and colleagues found that among frequent users of healthcare services, no significant relationship was observed between health literacy and the physical and psychological components of quality of life (18). Emotional regulation is likely associated with quality of life. Emotions are defined as multi-component whole-body responses[3], encompassing coordinated changes in subjective experience, behavior, and peripheral physiology. An emotion is elicited when an individual attends to a situation and appraises it as relevant to their personal goals (29).This definition assumes a temporal sequence of events consisting of three stages: first, an actual or imagined situation; second, the individual's attention to and appraisal of that situation; and third, the emergence of an emotional response. However, the process of emotion formation occurs rapidly through repeated situation–response appraisal cycles, and the individual's response in each cycle powerfully shapes subsequent emotion-generating cycles.Since individuals are active agents rather than passive recipients of emotions, the strategies they use to regulate their emotional responses can influence their quality of life (29). Emotion regulation refers to individuals' deliberate or automatic efforts to influence the type of emotions they experience, the timing of these emotions[4], and the way they are experienced or expressed[5], and it can affect a person's quality of life. Emotion regulation operates by modifying one or more components of emotion, including the eliciting situation, attention, appraisal, subjective experience, behavior, or physiological responses, and it is associated with perceived quality of life (29, 30).Emotion regulation can lead to emotional responses that vary in intensity or duration. However, evidence suggests that reducing the intensity or duration of negative emotions is particularly important for individuals (27). Accordingly, the effect of emotion regulation on perceived quality of life can be considered significant. Empirical evidence supports the impact of emotion regulation on the quality of life of individuals with diabetes. Hajati et al. demonstrated that group-based emotion regulation therapy grounded in acceptance led to improved self-care and enhanced quality of life in patients with type 2 diabetes (31).Inamurati[6] et al. also reported similar findings (32). Additionally, Mocan[7] et al. and Tarabay[8] et al. demonstrated that individuals with diabetes who have a lower quality of life tend to rely more on negative emotion regulation strategies and less on positive emotion regulation strategies (33, 34).The role of emotion regulation as a mediating mechanism in the relationship between familial and cognitive factors and the quality of life of diabetic patients is of particular importance. Family functioning can enhance the development of adaptive

1. Ehmann
2. Hu
3. multifaceted, whole-body responses
4. when they have them
5. experienced or expressed
6. Innamorati
7. Mocan
8. Tarabay

emotion regulation strategies by providing healthy emotional models, emotional support, and a safe environment (35). Similarly, health literacy, by enhancing patients' realistic understanding of their illness, reducing exaggerated concerns, and improving their ability to manage disease-related conditions, can influence how individuals process and respond to emotions (21, 24). Therefore, these two factors not only directly affect the quality of life of diabetic patients but also provide an indirect pathway for improving quality of life through their impact on emotional mechanisms. Since emotion regulation plays a key role in the daily experiences of diabetic patients and can determine how they adapt to the psychological and physical challenges of diabetes, a thorough examination of its mediating role can offer deeper insight into how family functioning and health literacy affect quality of life and reveal more effective intervention pathways. In this context, Yun[1] and colleagues reported on the mediating role of emotion regulation, indicating that dysfunctional family structures can lead to increased negative emotions; the greater the intensity of negative emotions, the more maladaptive the emotion regulation process becomes, whereas a reduction in negative emotions is associated with more adaptive emotion regulation (35). Moreover, when family functioning is inadequate, maladaptive emotion regulation patterns are transmitted, and the family cannot serve as an effective educational source for learning emotion regulation (36). Bois[2] and colleagues demonstrated that there is a significant relationship between family functioning and emotion regulation (37). Hang[3] and colleagues demonstrated that family functioning has a moderating effect on emotion regulation. Similarly, Pen and colleagues also confirmed the association between family functioning and emotion regulation (34). It can be assumed that health literacy is also related to emotion regulation in individuals with diabetes. Specifically, health literacy, by increasing awareness, knowledge, and skills related to diabetes management, can help reduce negative emotions arising from exaggerated predictions about disease outcomes and risks. Moreover, health literacy, by enhancing patients' sense of control over the severity and progression of the disease, provides a basis for employing cognitive reappraisal strategies. Health literacy refers to the comprehensive use of knowledge, skills, and attitudes related to health, which aids in the recognition, management, and the prevention of physical and psychological illnesses, thereby facilitating the maintenance and enhancement of health. This function can play an effective role in emotion regulation (38). Hossein[4], in a study on Australian and Bangladeshi participants, demonstrated that health literacy is positively associated with emotion regulation and mental health (39). Similarly, Hsu[5] and colleagues showed that participation of older adults in health literacy promotion programs was associated with improved quality of life, enhanced positive emotions, and better emotion regulation (40).Theoretical foundations and empirical evidence indicate that each of the variables—family functioning, health literacy, and emotion regulation—can be associated with quality of life. One existing gap is the simultaneous examination of these variables within multivariate predictive models to determine whether these relationships can be confirmed within an integrated framework for quality of life. Such a model allows for identifying which variables have greater explanatory power for quality of life. Furthermore, examining these relationships using structural equation modeling represents an innovative approach, in which the associations among family

1. Yun
2. Boyes
3. Hsu
4. Hossain.
5. Hsu

functioning, health literacy, and self-management, with emotion regulation as a mediating variable, are analyzed for predicting the quality of life is examined in an integrated manner. Ultimately, investigating these relationships within a population of individuals with diabetes can be considered a research innovation. Therefore, the present study examines the structural relationship of family functioning and health literacy with the quality of life of diabetic patients, with emotion regulation as a mediating variable, to determine whether family functioning and health literacy exert a structural effect on the quality of life of these patients through emotion regulation?

Method

Research Design: This study employed a correlational design and was conducted using structural equation modeling. In terms of data collection, the present research is descriptive, of a survey (field-based) type, and also classified as applied research.

Participants: The statistical population of this study included all male and female patients with type 2 diabetes in the first half of 2024 in the city of Lahijan. The sample size was determined based on the sampling logic commonly used in studies employing structural equation modeling.Bentler (1995) suggests that in such studies, the ratio of sample size to the number of estimable parameters should be at least 5:1, and preferably 10:1. Accordingly, the sample size in this study was determined based on the number of model parameters (41). In the present study, 50 estimable parameters were identified; therefore, based on the recommended 10:1 ratio, the sample size was set at 500 participants. However, to increase precision and ensure broader coverage, 700 questionnaires were distributed. Of these, 643 questionnaires were returned, and after screening, 636 questionnaires were deemed valid and suitable for analysis.After excluding outlier data, a total of 620 participants were included in the final analysis. A purposive sampling method was employed. Inclusion criteria for participation in the study were as follows: 1) diagnosis of type 2 diabetes based on relevant laboratory tests and confirmation by the treating physician; 2) at least a high school diploma (this criterion was selected due to the potential influence of education level on health literacy and to control for this variable); 3) age between 30 and 50 years (this age range was chosen because type 2 diabetes is less common under the age of 30, while age over 50 may act as a significant confounding variable affecting quality of life; thus, this variable was controlled by restricting the age range); and 4) absence of other acute or chronic physical illnesses and no history of substance abuse. These criteria were verified through direct questioning of participants and confirmation by their treating physicians.

Instruments

1. Quality of Life Questionnaire: This questionnaire was developed by a special working group commissioned by the World Health Organization. The initial version contained 100 items, which were later shortened to a 24-item form. The subscales are as follows: 1) Physical Health (items 3, 4, 10, 15, 16, 17, 18); 2) Psychological Health (items 5, 6, 7, 11, 19, 26); 3) Social Relationships (items 20, 21, 22). And 4) Environmental Health (items 8, 9, 12, 13, 14, 23, 24, 25): Higher scores indicate better quality of life. Responses are scored on a 5-point Likert scale, ranging from 1 (not at all) to 5 (completely). Items 3 and 4 are reverse-scored. Internal consistency, measured by Cronbach's alpha, has been reported as 0.80 for physical health, 0.76 for psychological health, 0.66 for social relationships, and 0.80 for environmental health. In the present study, Cronbach's alpha coefficients were 0.82 for physical health, 0.81 for psychological health, 0.68 for social relationships, and 0.80 for environmental health. Test-retest reliability over a 2- to 4-week interval has been reported in the range

of 0.73 to 0.87. Construct validity was assessed using confirmatory factor analysis, with a Comparative Fit Index (CFI) of approximately 0.90 and a Root Mean Square Error of Approximation (RMSEA) of approximately 0.06.The correlations between the dimensions ranged from 0.46 to 0.78, indicating moderate to strong associations among the subscales. In Iran, the internal consistency (Cronbach's alpha) for physical health, psychological health, social relationships, and environment has been reported as 0.81, 0.78, 0.68, and 0.77, respectively, with 0.88 for the total questionnaire. The test-retest reliability over a two-week interval was 0.76, and criterion validity, assessed via significant positive correlation with the General Health Questionnaire (GHQ), was reported as 0.56. Confirmatory factor analysis results also supported the four main factors, with model fit indices indicating acceptable values (CFI= 0.92, RMSEA= 0.058) (42).

2. Family Assessment Device (FAD)[1]: This scale was developed by Epstein et al. (1983) to describe the organizational and structural characteristics of the family (43). The FAD consists of 60 items and seven subscales: Problem Solving[2] (items 2, 12, 24, 38, 50, 60), Communication (items 3, 14, 18, 29, 43, 52, 59), Roles (items 4, 10, 15, 23, 30, 34, 40, 45, 53), Affective Involvement (items 5, 9, 19, 28, 39, 49, 57), Emotional Responsiveness (items 13, 21, 22, 23, 33, 35, 37, 42, 54), Behavioral Control (items 7, 17, 27, 32, 44, 47, 48, 55, 58), and General Functioning (items 1, 6, 8, 11, 16, 20, 26, 31, 36, 41, 46, 51, 56). Responses are scored on a 5-point Likert scale from 1 to 5, with higher scores indicating better family functioning. Items reflecting unhealthy family functioning (items 1, 4, 5, 7, 8, 9, 13, 14, 15, 17, 19, 21, 22, 23, 25, 28, 31, 33, 34, 35, 37, 39, 41, 42, 44, 45, 47, 48, 51, 52, 53, 54, 58) are reverse-scored.

The internal consistency of this questionnaire across its subscales has been reported between 0.72 and 0.92, with 0.92 for the total questionnaire. Test-retest reliability over a period of two weeks to one month ranged from 0.70 to 0.85. Construct validity has been confirmed through confirmatory factor analysis, with model fit indices within acceptable ranges (CFI≈ 0.90, RMSEA≈ 0.06). Criterion validity has also been supported by significant positive correlations with other family functioning and psychological health measures, such as the Family Environment Scale (FES) and the General Health Questionnaire (GHQ). In the Iranian culturally adapted version, internal consistency (Cronbach's alpha) ranged from 0.70 to 0.88, and test-retest reliability ranged from 0.72 to 0.80 (42).

3. Health Literacy Questionnaire (HLQ): The Health Literacy Questionnaire was developed by Wahl et al. (2021). It consists of 43 items across nine dimensions. These dimensions are: 1) Feeling understood and supported by healthcare providers (items 1–3); 2) Having sufficient information to manage health (items 4–7); 3) Active health management (items 8–12); 4) Social support for health (items 13–17); 5) Appraisal of health information (items 18–22); 6) Ability to actively engage with healthcare providers (items 23–27); 7) Navigating the healthcare system (items 28–33); 8) Ability to find appropriate health information (items 34–38); and 9) Understanding health information (items 39–43). Responses are scored on a 5-point Likert scale, ranging from 1 (very low) to 5 (very high), with higher scores indicating higher health literacy. Content validity has been confirmed by expert evaluation. Reliability of the subscales, measured by Cronbach's alpha, ranges from 0.71 to 0.87, with composite reliability ranging from 0.88 to 0.96. Convergent validity has been reported between 0.62 and 0.87. Construct validity was supported using confirmatory factor analysis of the nine-dimensional model, with acceptable model fit indices (CFI= 0.92,

1. Family Assessment Device (FAD)

2 . Problem Solving

RMSEA= 0.05). Criterion validity has been confirmed through significant positive correlations with general health (r= 0.56), preventive behaviors (r= 0.48), and other related instruments (r= 0.52). Internal consistency for the dimensions ranged from 0.77 to 0.90, with 0.91 for the total questionnaire, and test-retest reliability over two administrations ranged from 0.72 to 0.85 (44).

4. Cognitive Emotion Regulation Questionnaire (CERQ): The Cognitive Emotion Regulation Questionnaire was developed by Garnefski[1] et al. (2001). The short form consists of 18 items, measuring nine subscales: Self-Blame (items 1 and 2), Other-Blame (items 17 and 18), Rumination (items 5 and 6), Catastrophizing (items 15 and 16), Putting into Perspective (items 13 and 14), Positive Refocusing (items 7 and 8), Positive Reappraisal (items 11 and 12), Acceptance (items 3 and 4), and Planning (items 9 and 10). Responses are scored on a 5-point Likert scale, ranging from 1 (never) to 5 (always). The score for each subscale ranges from 2 to 10, with higher scores indicating greater use of cognitive emotion regulation strategies. These strategies are generally classified into two main categories: adaptive (constructive) and maladaptive (non-constructive) strategies. Adaptive strategies include the subscales Putting into Perspective, Positive Refocusing, Positive Reappraisal, Acceptance, and Planning. Maladaptive strategies include Self-Blame, Other-Blame, Rumination, and Catastrophizing. Reliability of the instrument has been reported at 0.62 and above for the total score and subscales. Construct validity has been confirmed using a nine-factor confirmatory factor analysis, with acceptable model fit indices (CFI= 0.91, RMSEA= 0.05). Additionally, significant positive correlations have been reported with measures of psychological health and related constructs, including depression (r= 0.48) and anxiety (r= 0.52). Internal consistency of the subscales ranged from 0.68 to 0.83, with 0.85 for the total questionnaire. Test-retest reliability over two administrations ranged from 0.70 to 0.80. These findings indicate that the CERQ is a valid instrument for assessing cognitive strategies for coping with negative emotions in both clinical and non-clinical populations (45).

Research implementation process: All ethical considerations were fully observed in this study. Participation was entirely voluntary, and no coercion was applied. The confidentiality of participants' information was strictly maintained, and participants were assured that their data would be used solely for research purposes. In addition, the approximate time required to complete the research instruments was communicated to participants prior to the study. Data were analyzed using SPSS version 23 and LISREL version 8.8. For inferential analyses, structural equation modeling was employed.

Results

The final sample of this study consisted of 620 male and female participants. The mean age of the participants was 43.23 ± 7.60 years. Of the total sample, 259 participants (41.8%) were female, nd 354 (57.1%) were male, while 7 individuals (1.1%) did not report their gender.Regarding marital status, 197 participants (31.8%) were single, 346 (55.8%) were married, and 62 (10%) were divorced or widowed; 15 individuals (2.4%) did not report their marital status.The educational level of the sample was as follows: 108 participants (17.4%) had a high school diploma or less, 130 (21%) held an associate degree, 260 (41.9%) had a bachelor's degree, 130 (21%) held a master's degree, and 45 (7.3%) had a doctoral degree. Twelve participants (1.9%) did not report their educational level.

1. Garnefski

Table 1. Mean and Standard Deviation of the Study Variables

Variable	Component	Score Range	Mean	Standard Deviation
Quality of Life	Physical Health	7–35	22.87	4.51
	Psychological Health	6–30	17.96	3.97
	Social Relationships	3–15	10.55	3.42
	Environmental Health	8–40	25.55	5.51
	Total Score	24–120	76.92	13.22
Emotion Regulation	Adaptive Emotion Regulation	10–50	34.88	7.04
	Maladaptive Emotion Regulation	8–40	28.29	5.03
Family Functioning	Problem Solving	6–30	18.92	3.89
	Communication	7–35	23.13	4.03
	Roles	9–45	29.25	5.08
	Affective Involvement	7–35	21.91	4.52
	Emotional Cohesion	9–45	30.11	5.10
	Behavior Control	9–45	28.20	5.02
	General Functioning	13–65	41.81	6.64
	Total Score	60–300	174.44	24.27
Health Literacy	Perceived Understanding by Providers	3–15	9.08	2.73
	Sufficient Health Management Knowledge	4–20	10.13	2.78
	Active Health Management	5–25	13.81	3.59
	Social Support for Health	5–25	15.92	3.36
	Health Information Evaluation	5–25	14.81	4.05
	Ability to Interact with Providers	5–25	14.76	4.06
	Navigating Health Care System	6–30	21.18	5.22
	Ability to Find Relevant Health Information	5–25	17.62	4.48
	Understanding Health Information	5–25	16.72	4.16
	Total Score	43–215	134.14	20.21

The findings indicated that participants reported a moderate level of quality of life across its various dimensions. The results also showed that the sample used both adaptive and maladaptive emotion regulation strategies at a relatively balanced level. Examination of family functioning further revealed that both the overall score and its specific dimensions were within the moderate range. In addition, participants' health literacy levels were evaluated as average.The correlation matrix demonstrated that quality of life was positively and significantly associated with emotion regulation, family functioning, and health literacy. A significant positive correlation was also observed between family functioning and both emotion regulation and health literacy. However, the relationship between emotion regulation and health literacy was not statistically significant. Overall, the pattern of correlations suggests that, except for the association between emotion regulation and health literacy, the study variables were positively and consistently related to one another in alignment with quality of life.

Model Fit Indices: The model fit indices were examined to evaluate the adequacy of the proposed structural model. The chi-square to degrees of freedom ratio was statistically significant (χ^2= 3400.45, df= 203, p< 0.0001). The Adjusted Goodness-of-Fit Index (AGFI) was 0.585. The Root Mean Square Error of Approximation (RMSEA) was significant at p< 0.001, and the Standardized Root Mean Square Residual (SRMR) was 0.10, indicating an acceptable fit between the data and the proposed model. Furthermore, the Normed Fit Index (NFI) and the Comparative Fit Index (CFI),with values of 0.610 and 0.612, respectively, were statistically significant at the levels of 0.003 and 0.001. These findings indicate that the proposed model differs significantly from the baseline (null) model, which assumes no relationships among the study variables assumed.

Table 2. Pearson Correlation Test

Variable	Quality of Life	Emotion Regulation	Family Functioning	Health Literacy
Quality of Life	1			
Emotion Regulation	0.341**	1		
Family Functioning	0.463**	0.265**	1	
Health Literacy	0.537**	0.085	0.289**	1

*Note: **p< 0.01

Higher scores in emotion regulation indicate more adaptive (positive) emotion regulation, whereas lower scores indicate more maladaptive (negative) emotion regulation.

Table 3. Factor Loadings of Indicator Variables on Latent Constructs

Path	Unstandardized Coefficient	Standard Error	t-value	Standardized Coefficient
Factor loading of Physical Health on Quality of Life	1			0.656
Factor loading of Psychological Health on Quality of Life	0.777	0.066	11.82	0.576
Factor loading of Social Relationships on Quality of Life	0.696	0.057	12.24	0.601
Factor loading of Environmental Health on Quality of Life	1.43	0.099	14.49	0.769
Factor loading of Adaptive Emotion Regulation	1			0.645
Factor loading of Maladaptive Emotion Regulation	1.03	0.116	8.94	0.934
Factor loading of Problem Solving on Family Functioning	1			0.673
Factor loading of Communication on Family Functioning	0.983	0.068	14.44	0.637
Factor loading of Roles on Family Functioning	1.43	0.087	16.59	0.744
Factor loading of Affective Involvement on Family Functioning	1.50	0.080	18.86	0.867
Factor loading of Emotional Cohesion on Family Functioning	1.36	0.087	15.80	0.704
Factor loading of Behavior Control on Family Functioning	1.34	0.085	15.72	0.700
Factor loading of General Functioning on Family Functioning	2.10	0.115	18.22	0.830
Factor loading of Perceived Understanding by Providers on Health Literacy	1			0.868
Factor loading of Sufficient Health Management Knowledge on Health Literacy	0.392	0.048	8.14	0.332
Factor loading of Active Health Management on Health Literacy	0.260	0.046	4.08	0.171
Factor loading of Social Support for Health on Health Literacy	0.682	0.056	12.21	0.479
Factor loading of Health Information Evaluation on Health Literacy	1.54	0.056	27.46	0.901
Factor loading of Ability to Interact with Providers on Health Literacy	1.11	0.063	17.76	0.649
Factor loading of Navigating Health Care System on Health Literacy	0.732	0.090	5.42	0.334
Factor loading of Ability to Find Relevant Health Information on Health Literacy	0.426	0.079	5.42	0.226
Factor loading of Understanding Health Information on Health Literacy	0.452	0.073	6.19	0.257

The findings indicated that all observed indicators for the four latent constructs, namely quality of life, emotion regulation, family functioning, and health literacy, exhibited statistically significant factor loadings. In other words, each indicator made a significant contribution to explaining its corresponding latent construct.

The significance of the factor loadings was confirmed based on t-values greater than 1.96 at the 0.05 significance level ($t > 1.96$).

Table 4. Effects Among the Study Variables

Path	Unstandardized Coefficient	Standard Error	t-value	Standardized Coefficient	R^2
Direct effect of Emotion Regulation on Quality of Life	0.122	0.030	4.11	0.186	0.516
Direct effect of Family Functioning on Quality of Life	0.252	0.059	4.24	0.223	0.516
Direct effect of Health Literacy on Quality of Life	0.638	0.067	9.58	0.511	0.516
Direct effect of Family Functioning on Emotion Regulation	0.716	0.118	6.09	0.415	0.182
Direct effect of Health Literacy on Emotion Regulation	0.043	0.097	0.45	0.023	0.182
Indirect effect of Family Functioning on Quality of Life	0.087	0.025	3.45	0.077	-
Indirect effect of Health Literacy on Quality of Life	0.005	0.012	0.45	0.004	-

The findings indicated that emotion regulation had a significant positive effect on quality of life among individuals with diabetes (t> 1.96). Family functioning exerted a significant positive direct effect on quality of life. Additionally, the indirect effect of family functioning on quality of life through emotion regulation was also positive and statistically significant (t> 1.96).

The direct effect of health literacy on quality of life was positive and significant (t> 1.96). However, the indirect effect of health literacy on quality of life through emotion regulation was not statistically significant (t< 1.96).

Furthermore, family functioning had a significant positive direct effect on emotion regulation (t> 1.96), whereas the direct effect of health literacy on emotion regulation was not significant (t< 1.96).

Overall, the model explained 51.6% of the variance in quality of life and 18.2% of the variance in emotion regulation through the respective exogenous variables.

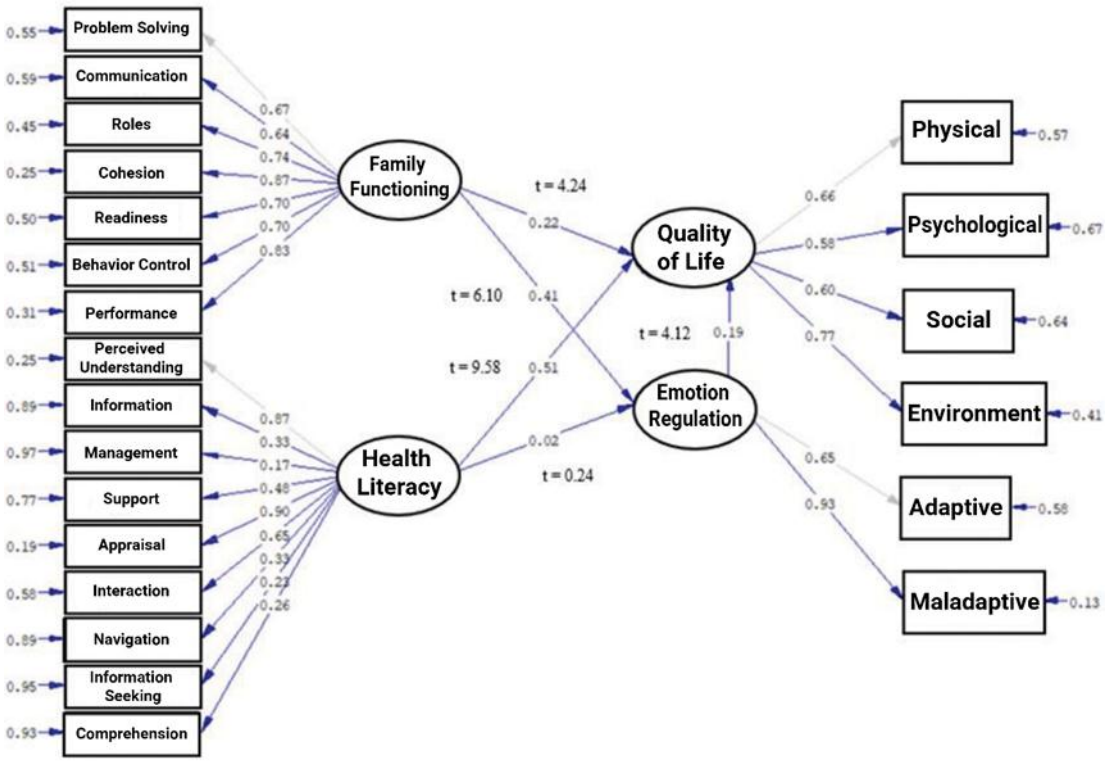

Figure 1. Standardized Coefficients Among the Study Variables and t-values Between the Study Variables

Discussion

The findings of the present study indicated that family functioning has a significant positive direct effect on the quality of life of individuals with diabetes. This result is consistent with previous research in this field (14–16) and underscores the central role of the family in the lived experience of patients with diabetes.In explaining this finding, it can be argued that families constitute an integral component of the healthcare system (46). Based on Bowen's[1] Family Systems Theory, the family should be viewed as an interconnected system in which members are emotionally interdependent and mutually influential (47). The patient is influenced by the family's interactional patterns and emotional support, which in turn affect self-care behaviors and overall quality of life. Given that a substantial portion of diabetes management takes place within the home environment and that the management of this chronic condition is inherently complex, many patients become partially dependent on their family caregivers. Therefore, positive family functioning plays a crucial role in shaping the quality of life experienced by individuals with diabetes (48). Furthermore, research indicates that diabetes is associated with significant physical and psychological consequences that adversely affect patients' quality of life, whereas effective family functioning can mitigate these negative outcomes (5-7). The family can play a critical supportive role by facilitating necessary lifestyle modifications aimed at managing the physical and psychological complications that diminish quality of life. These include increasing physical activity, regulating sleep patterns, adhering to dietary recommendations, maintaining appropriate health and hygiene practices, and ensuring medication adherence. In addition, given the higher prevalence of depression and anxiety among individuals with diabetes, optimal family functioning may reduce the severity of these psychological difficulties (12). According to Antonovsky's Salutogenic[2] Theory, the sense of coherence[3] developed within the family context acts as a positive psychological resource, enhancing an individual's ability to cope adaptively with life's stresses and pressures. This sense of coherence enables individuals to perceive their life circumstances as comprehensible, manageable, and meaningful (49). Consequently, such family functioning provides a suitable theoretical explanation for the positive effect of family functioning on the quality of life of individuals with diabetes. The results indicated that family functioning has a significant direct effect on emotion regulation in individuals with diabetes. This finding is consistent with previous research in the field (35, 37, 50). In explaining this outcome, it can be argued that poor family functioning is associated with increased negative emotions, which in turn lead to the use of maladaptive emotion regulation strategies, whereas optimal family functioning can mitigate this process (35). Furthermore, as the primary context for emotional learning, the family transmits emotion regulation patterns to its members, and dysfunctional family functioning can contribute to the development of maladaptive emotion regulation patterns (36). Third, in families with poor functioning, members often rely on maladaptive strategies to cope with external stressors, placing them at greater risk. Under such conditions, difficulties in emotion regulation are associated with higher levels of stress and psychological distress, leading to significant negative outcomes, particularly for children (27, 51, 52). The findings of the study indicated that emotion regulation has a significant direct effect on the quality of life of individuals with diabetes. This result is consistent with previous studies examining the impact of emotion regulation on the quality of life of

1. Bowen's
2. antonovsky salutogenic theory
3. Sense of coherence

diabetic patients (32, 53–57). The use of maladaptive emotion regulation strategies, such as self-blame, rumination, catastrophizing, and blaming others, has been observed in individuals with psychological disorders (45). Individuals with diabetes face greater stress and disease-related limitations, which likely make emotion regulation more challenging. This difficulty may lead them to rely on maladaptive emotion regulation strategies more frequently than adaptive ones. In contrast, adaptive emotion regulation strategies do not produce such negative outcomes, and therefore, this difference can influence the quality of life in diabetic patients. Unlike maladaptive strategies, positive emotion regulation strategies—such as positive reappraisal of an initial stressor and refocusing attention on positive stimuli—generate positive emotional responses, such as gratitude[1], and improve quality of life. Furthermore, cognitive emotion regulation strategies can facilitate coping with the stress associated with chronic illness and play a prominent role within theoretical frameworks of stress and coping (58).

The findings of the study indicated that family functioning has a significant positive indirect effect on the quality of life of individuals with diabetes through the mediating role of emotion regulation. This result is consistent with previous research in this area (59–60). Studies have shown that poor family functioning leads to increased negative emotions and the use of maladaptive emotion regulation strategies, whereas optimal family functioning is associated with enhanced positive emotions and the employment of adaptive emotion regulation strategies. In the present study, the direct effect of family functioning on maladaptive emotion regulation was also confirmed. Ultimately, both emotional experiences (positive or negative) and emotion regulation strategies (adaptive or maladaptive) contribute to their impact on quality of life (61). Emotion regulation is one of the key mechanisms through which family functioning can influence the quality of life of individuals with diabetes. Families with healthy functioning—particularly in the domains of intimacy, cohesion, effective communication, and adaptability—promote more adaptive emotional strategies among members and create an environment in which individuals learn to identify, understand, modulate, and appropriately express their emotions (59). Such an environment increases the likelihood of employing adaptive emotion regulation strategies, such as reappraisal, problem-solving, and acceptance, which are associated with reduced stress, improved self-care, enhanced motivation, and more effective management of chronic conditions, including diabetes (60). In contrast, poor family functioning—such as ineffective communication, high conflict, or insufficient emotional support—leads to increased use of maladaptive strategies, including rumination, catastrophizing, or emotional suppression. These strategies are associated with heightened anxiety and depression, treatment avoidance, and reduced quality of life (59, 60). Given that individuals with diabetes are more sensitive to emotional fluctuations and that stress can disrupt blood glucose control, treatment adherence, and self-efficacy, emotion regulation serves as a meaningful mediating mechanism. Family functioning influences the type and quality of emotional strategies, which in turn determine how an individual copes with the illness, appraises the reality of the disease, and experiences its psychological and physical consequences. Consequently, emotion regulation serves as the pathway through which family functioning affects quality of life; in other words, a healthy family indirectly enhances the quality of life of individuals with diabetes by increasing adaptive strategies and reducing

1. gratitude

maladaptive strategies (48, 59, 61). The findings of the study indicated that health literacy has a significant direct effect on the quality of life of individuals with diabetes, with higher levels of health literacy associated with improved quality of life. This result is consistent with previous research (17–19, 22, 28, 40, 54). As defined in the concept of quality of life, living conditions, health, safety, the physical and natural environment, leisure quality, and other related dimensions are considered key components of quality of life. On the other hand, health literacy entails individuals' knowledge, motivation, and competence to access, understand, evaluate, and utilize health information, which is closely related to the aforementioned components of quality of life. Moreover, health literacy can influence the quality of life of individuals with diabetes through several pathways: Adherence to treatment (World Health Organization, 2016), the quality of preventive service utilization (20, 21), frequency of hospitalizations (21), healthcare and treatment costs (23), and resolution of communication barriers with healthcare professionals all contribute to increased diabetes knowledge and greater participation in physical and exercise activities (62). Furthermore, health literacy fosters an internal health locus of control in individuals with diabetes, meaning that disease management shifts from reliance on chance or fate toward self-management and control over health through personal actions and medical interventions. This internal control ultimately leads to an improvement in quality of life (50). The results of this study indicated that health literacy does not have a significant effect on emotion regulation in individuals with diabetes. This finding is not consistent with previous studies (40, 39). The discrepancy between the present results and those studies that confirmed a relationship between health literacy and emotion regulation may be attributed to differences in the population and sample characteristics between this study and the aforementioned research. Additionally, in this study, the relationships between variables were examined within a more complex structural model. One characteristic of complex multivariable models is that two variables may be correlated yet lack a direct structural relationship; this can result from shared covariance among exogenous variables. The study hypothesized that health literacy, by generating knowledge in the domains of health and disease, could help patients regulate negative emotions associated with their condition, anticipate and control emotions arising from the physiological effects of the disease, identify illness-related cognitive errors, and mitigate the impact of unrealistic threat perceptions and false beliefs. However, the results of the study did not support this hypothesis. A probable explanation for this finding is that emotion regulation skills or patterns are largely formed during developmental periods, prior to the onset of disease. Gross and Thompson note that emotion regulation strategies are primarily shaped by early life experiences, environmental patterns during development, the intensity of emotions, and defensive styles, which together establish the predominant form of emotion regulation. Therefore, the influence of family on emotion regulation has a more empirically grounded basis compared to the effect of health literacy on emotion regulation (29). Since the direct effect of health literacy on emotion regulation was not significant, its indirect effect on quality of life through the mediating variable of emotion regulation was also non-significant, which is consistent with the logic of mediation models within the framework of structural equation modeling. This study has several limitations that may affect the internal and external validity of its findings. Among these limitations is the inability to examine or control for the duration of diabetes in the participants. Additionally, variables, such as adherence to medication, duration and quality of received healthcare services, and

lifestyle and dietary patterns of individuals with diabetes were not controlled, despite the fact that each of these factors could influence the outcomes under investigation. Furthermore, the construct of quality of life encompasses considerable conceptual and theoretical diversity; therefore, the use of a single measurement instrument to assess quality of life, despite its validity and reliability, can be considered a limitation of the study. The findings of this research highlight the necessity of interventions that simultaneously focus on improving family functioning and strengthening emotion regulation skills in individuals with diabetes. These two factors not only directly enhance quality of life, but family functioning also exerts a significant effect through emotion regulation. Accordingly, it is recommended that targeted educational and supportive programs be designed and implemented for families, aiming to enhance communication quality, increase family cohesion, and strengthen emotional support, thereby creating conditions that facilitate the use of adaptive emotion regulation strategies in patients with diabetes. On the other hand, given the direct role of health literacy in improving quality of life, it is essential to provide comprehensive education, simplify treatment-related information, and strengthen patients' self-management skills; although this variable did not show a significant indirect effect through emotion regulation. In this regard, designing multidimensional interventions that encompass both health literacy education and the enhancement of emotional and family skills can lead to the sustainable improvement of quality of life for patients with diabetes and increase the effectiveness of diabetes care programs.

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