

Article

Relationship between Resilience and Quality of Life in Patients with Fear of Hypoglycemia: The Mediating Effects of Anxiety and Depression

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Abstract: Background: Fear of hypoglycemia is an important problem in individuals with diabetes and could produce a negative impact on blood glucose control and quality of life in individuals with type 1 diabetes. Aim: To analyze (1) the associations among resilience, diabetes-related quality of life, and anxiety and depression in patients with type 1 diabetes with fear of hypoglycemia and (2) whether anxiety and depression mediate the relationship between resilience and quality of life. Design: A non-experimental, descriptive correlational design was used. Methods: Participants were 30 patients with type 1 diabetes with fear of hypoglycemia. Data were collected using several questionnaires administered between September 2019 and March 2020. Results: Resilience played a significant role in the anxiety and depression that accompanies diabetes. Mediation analysis was performed to assess whether the association between resilience and quality of life was mediated by anxiety and depression in series. The results show that the effect of resilience was mainly mediated by anxiety but not by depression. Conclusions: This study provides further evidence that high resilience could be a protective factor against the development of psychological symptomatology, which has a high prevalence in chronic conditions such as diabetes and can improve quality of life. Impact: Our study addresses the relationship between the positive psychological characteristic of resilience and anxiety, depression, and quality of life and the association between these variables. The results indicate that resilience has a positive impact on quality of life in people with type 1 diabetes who experience fear of hypoglycemia. Moreover, health professionals who provide care to these individuals should consider implementing programs to build resilience.

Keywords: adult nursing; anxiety; depression; diabetes; quality of live; psychology

1. Introduction

Individuals with type 1 diabetes (T1D) comprise 5–10% of all patients with diabetes. T1D is due to the destruction of pancreatic β -cells through a cell-mediated autoimmune response. The main characteristic of T1D is the absence or near absence of β cell function [1]. For this reason, insulin therapy is essential for patients with T1D. Previous research suggests that keeping glucose levels within the target range prevents or delays diabetic complications [2]. T1D generates profound impacts

related to short-term (hypoglycemia) and long-term complications (cardiovascular disease, neuropathy, nephropathy and retinopathy) [3].

Living with T1D is a complicated illness that negatively impacts the quality of life of patients [4]. T1D not only has a physical impact, but it also affects the person on a psychological level. Individuals with T1D must have adequate knowledge and tools to interpret self-monitoring of blood glucose levels and to manage complex insulin treatment in addition to being aware of possible complications and applying continuous self-care [5]. Intensive insulin therapy is associated with an increase in the frequency of severe hypoglycemia. Therefore, the implementation of intensive treatment has increased the appearance of fear of hypoglycemia (FoH) [2].

2. Background

Hypoglycemia (plasma glucose concentration ≤ 70 mg/dL; ≤ 3.9 mmol/L) [1] is the most frequent acute complication experienced by individuals with insulinized T1D and type 2 diabetes [6,7]. In recent years, there has been increased interest in hypoglycemia to predict morbidity and mortality [8,9].

The main symptoms of hypoglycemia are dizziness, physical and psychological discomfort, cold sweat, nausea, and confusion. Severe hypoglycemia may result in loss of consciousness, seizures or even coma. These symptoms are highly aversive, potentially dangerous and cause the patient a strong sense of stress and fear [10]. Previous research has shown that low levels of anxiety or worry can help the individual to generate an appropriate response. However, high levels of anxiety can influence the person to be less aware of the signals of blood glucose levels and have fewer resources to cope with the situation [11]. This can influence diabetes self-control behaviors, resulting in a decrease in quality of life [7]. Newer technologies may help to reduce hypoglycemia but have not reduced FoH when it is not accompanied by other types of psychological intervention strategies. Having to depend on technology can raise levels of anxiety when technology malfunctions. The individual may also be anxious about being connected to many devices. It is important to provide patients with strategies to regulate and manage the emotions related to using this technology.

Moreover, individuals with diabetes have a nearly two-fold probability of experiencing anxiety and depression as the general population [12], which has a negative psychological impact on the individual's quality of life and well-being [13,14]. The presence of this symptomatology has been associated with FoH [15] and decreases quality of life [16,17]. Several studies have shown that these psychological symptoms negatively impact quality of life in persons with diabetes [18,19]. The presence of these symptoms, especially anxiety and depression, correlated significantly with a reduced general well-being and affected feeling of positive well-being in these patients [20]. Depression not only directly affects the mental health of patients with T1D, but it also can affect their confidence in treatment, self-efficacy and sense of control [21].

Conversely, positive psychological characteristics, such as resilience, have been prospectively associated with superior health outcomes in different medical conditions [22]. Resilience is defined as the capacity to achieve positive outcomes despite exposure to significant challenges [23]. In the case of diabetes, resilience, self-efficacy, and positive affect have been linked to improved glycemic control, greater health behavior adherence, and lower mortality [24]. Resilience has been proven to play a role in ameliorating the stressors that can lead to depression [25]. In fact, previous studies have shown that interventions focused on psychological characteristics increase well-being and decrease depression [26]. Suffering from a chronic disease such as diabetes that generates high levels of anxiety and depression, due to the continuous and constant deterioration that it causes, and the effects on quality of life, makes resilience a protective variable of physical and mental health. These people must face unfavorable situations in the emotional, social, family, and physical areas, so they must change their entire lifestyle to adapt it to their new health condition [5]. Resilience can help people to face the challenges associated with diabetes and its associated psychological consequences [27]. For this reason, there is a need to study whether resilience is associated with anxiety and depression in individuals with T1D with FoH and whether this relationship influences quality of life.

3. The Study

Aims

The aim of this study was to analyze the relationships between resilience, diabetes-related quality of life, and anxiety and depression. The hypotheses were that (a) resilience would show positive associations with quality of life and (b) anxiety and depression would mediate the association between resilience and quality of life.

4. Method

4.1. Design

A non-experimental, descriptive correlational design was used.

4.2. Participants

The study sample was recruited from the cohort of T1D patients under follow-up at the Diabetes Unit of the Endocrinology and Nutrition Department at Virgen Macarena University Hospital in Seville, Spain. The unit cares for a total of 1200 patients over 18 years of age. Fifty patients agreed to participate, 20 of whom were excluded due to inability to go to the center for evaluations or because they did not reach a score of 28 on the fear of hypoglycemia questionnaire (FH-15) [28]. This questionnaire aims to detect individuals with a high risk of hypoglycemia and high levels of FoH. The FH-15 enables FoH to be quantified with a summed 15-item questionnaire. The authors set the cut-off point of the scale at 28 with the Youden index (0.543) [28]. These 50 patients were invited because the specialists had identified in consultation that their fear of hypoglycemia made decision-making difficult. In addition, these patients went to the hospital for their routine visit during the time the data was collected. Sixty percent of the people invited had a score greater than 28 on the fear of hypoglycemia questionnaire. Thirty patients who scored above 28 were eligible to enroll in the study. Patients were diagnosed with T1D according to the criteria established by the American Diabetes Association and insulinized from the onset of the disease. In an initial interview, patients completed the FH-15 [28].

4.3. Data Collection

The area specialists from the Virgen Macarena University Hospital contacted the target sample at the time they attended their routine check-up with the specialist. Informed consent was sought from patients interested in participating in the study. These participants completed the FH-15 and those patients with a score greater than 28 attended a second appointment where they completed the rest of the tests in the presence of the researchers. Data were collected using several questionnaires. These were administered between September 2019 and March 2020. Data were collected on sociodemographic characteristics (collected to describe the sample), FoH, resilience (independent variable), anxiety and depression (mediating variables), and quality of life (dependent variable).

4.4. Measures

Wagnild and Young's Resilience Scale [29,30]. This is a 25-item, self-report questionnaire. Subscales are scored on a 7-point scale ranging from 1 (strongly disagree) to 7 (strongly agree). The items are grouped into five subscales: meaningful life (purpose), perseverance, self-reliance, equanimity, and existential aloneness. The scale also provides an overall measure of resilience. For this study, the overall scores were used. Higher scores indicate high resilience. In our sample, the overall resilience dimension showed adequate internal consistency with a Cronbach's alpha of 0.90.

Beck Depression Inventory [31,32]. This is a 21-item self-report questionnaire to evaluate the presence and severity of depressive symptomatology. Each item is rated on a 4-point scale from 0 to 3, with total scores ranging from 0 to 63. The Beck Depression Inventory, also used in previous studies on people with diabetes [20,33], showed adequate internal consistency in our sample, with a Cronbach's alpha of 0.92.

State Trait Anxiety Inventory [34,35]. This is a self-evaluation scale that measures state and trait anxiety. The test consists of a 40-item questionnaire, divided into 20 items that evaluate how participants feel about anxiety "right now, at this moment" through four scales (state anxiety) and 20 items that assess how people "generally feel" about anxiety (trait anxiety). For this study, only the scores in the second subscale were used. The 20-item trait anxiety scores range from 1 (not at all) to 4 (very much so) yielding total scores between 20 and 80, where higher scores indicate greater anxiety. In our sample, this scale showed adequate internal consistency with a Cronbach's alpha of 0.92. The State Trait Anxiety Inventory, like The Beck Depression Inventory, has been used in a population with diabetes [20].

Diabetes Quality of Life [36]. This questionnaire consists of 46 questions distributed in four dimensions: satisfaction, impact, social/vocational concern, and diabetes concern. The satisfaction dimension is scored from 1 (very satisfied) to 5 (very dissatisfied). Impact and concern scales are rated from 1 (no impact or I never worry) to 5 (it always affects me or always worries me). The Diabetes Quality of Life questionnaire showed adequate overall reliability indexes for all the scales. The alpha coefficients ranged from $\alpha = 0.65$ to 0.89.

4.5. Ethical Considerations

The study protocol was in accordance with the Declaration of Helsinki and was reviewed and approved by the Institutional Review Board of Virgen Macarena University Hospital.

Procedures approved by the institutional review board of the hospital were used to obtain consent from the patients who expressed interest in participating in the study.

5. Results

5.1. Data Analyses

SPSS version 25 was used to analyze the data [37]. Descriptive analyses were performed to describe the demographic characteristics of the sample. Cronbach's alpha was used to assess the reliability of the measures in this sample. Correlations between resilience, anxiety, and depression to determine how each of these was related to quality of life were calculated.

Mediation analysis was carried out to assess whether the relationship between resilience and quality of life was mediated by anxiety and depression in series. This analysis was chosen because one of the objectives of this study was to ascertain whether the effect of resilience towards quality of life occurs directly, or whether this effect occurs through a third mediating variable (anxiety and depression), that is, whether there is an indirect effect. This procedure has been widely used in different studies in similar fields of application [38,39]. It was assumed that resilience (X) would be associated with anxiety (M1), which would be related to depression (M2), influencing quality of life (Y). Analyses were carried out on each of the dimensions of quality of life as a dependent variable. A serial mediator model comprising two mediators of anxiety and depression yielded three indirect effects that add up to a total indirect effect. The indirect effects in this model were (a) through anxiety; (b) through depression; and (c) through anxiety and depression. Significant correlations based on multivariable linear regression were incorporated into the mediation model. Specifically, the SPSS PROCESS Macro provided by Hayes and Preacher was used for testing a serial mediation model using model 6 and 10,000 bootstrap samples [40]. Bootstrapping is a procedure to estimate the sampling distribution using multiple samples with replacement of one random sample [41]. Point estimates and 95% bias-corrected bootstrap confidence intervals (CI) were calculated for the indirect effects. Point estimates were considered significant when zero was not contained within the CI.

5.2. Socio-Demographic and Clinical Characteristics of the Participants

The characteristics of the sample are shown in Table 1. The study participants ranged in age from 20 to 58 years with a mean age of 38.4 years, 31% male and 69% female. Of the participants, 41.4% reported having some type of complication associated with diabetes.

Table 1. Sociodemographic and clinical characteristics of the participants.

Characteristics	N		
Marital Status			
Married	9		
Single	6		
Divorced	5		
Cohabiting	3		
No reply	7		
Clinical Variables	Range	Mean	SD
Years of evolution	2–53	24.89	12.49
HbA1c	6.20–10.30%	8.02	1.00
Average blood glucose	127–334	177.75	43.06
Time in hypoglycemia (<70 mg/dL)	0–39%	7.57	9.30
Time in hyperglycemia (>180 mg/dL)	9–90%	50.89	20.85
Time in range (70–180 mg/dL)	10–79%	41.60	17.23

5.3. Descriptive Analyses

Means, standard deviations, and Pearson correlations among the main study variables are shown in Table 2.

Table 2. Means, standard deviations, and Pearson correlations among the main study variables.

	M	SD	1	2	3	4	5	6	7
1. Total resilience	129.04	23.78	—						
2. Trait anxiety	24.17	15.19	−0.76 **	—					
3. Depression	12.82	11.18	−0.84 **	0.90 **	—				
4. Satisfaction	40.43	11.86	0.49 *	−0.54 **	−0.45 *	—			
5. Impact	42.03	12.62	−0.60 **	0.77 **	0.67 **	−0.63 **	—		
6. Social concern	17.62	5.69	−0.43 **	0.61 **	0.55 **	−0.30	0.62 **	—	
7. Diabetes concern	12.65	3.40	−0.52 **	0.67 **	0.60 **	−0.46 *	0.70 **	0.54 **	—

* $p < 0.005$. ** $p < 0.001$.

Significant high positive correlations were found between resilience and depression and trait and state anxiety, and moderate positive correlations were found between resilience and satisfaction, impact, social/vocational concern, and diabetes concern. Further positive correlations were found between depression and anxiety and satisfaction, impact, social/vocational concern, and diabetes concern.

5.4. Multiple Mediating Effects of Anxiety and Depression

The indirect effects of resilience on quality of life via both anxiety and depression were evaluated with serial mediation model of Preacher and Hayes with a 95% CI based on 10,000 bootstrap samples [42]. All the mediated indirect effects of a specific path are shown in Figure 1.

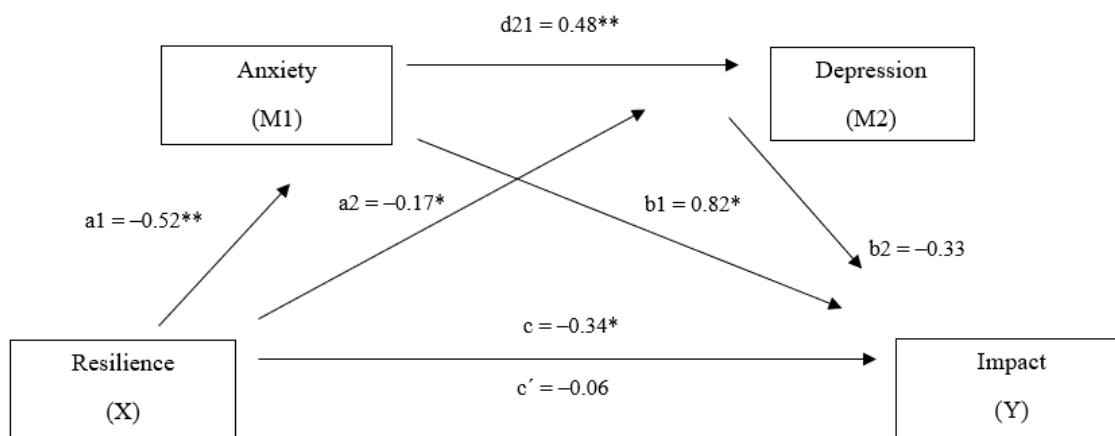


Figure 1. Multiple mediation model indicating the direct effect and path coefficients connecting resilience to impact on quality of life via anxiety and depression in series. The coefficient c is the total effect between resilience and impact, and c' is the direct effect of resilience on impact, while unstandardized regression coefficients control for the M1 and M2 values in the model. $* p < 0.005$. $** p < 0.001$.

Regarding the impact on the quality of life dimension, mediation analysis confirmed a significant positive effect of resilience on anxiety and depression. Likewise, anxiety, but not depression, was a significant and positive predictor of impact on quality of life. A significantly positive relationship was also found between both mediating variables. The results of this analysis showed that the total effect of resilience on impact was significant (CI: $-0.9645, -0.012$). The indirect effect test based on the bootstrap procedure was significant for the indirect effect of resilience through anxiety (CI: $-0.8907, -0.0788$) (see Figure 1).

Taking into account the satisfaction dimension, neither anxiety nor depression were significant predictors of satisfaction (see Figure 2).

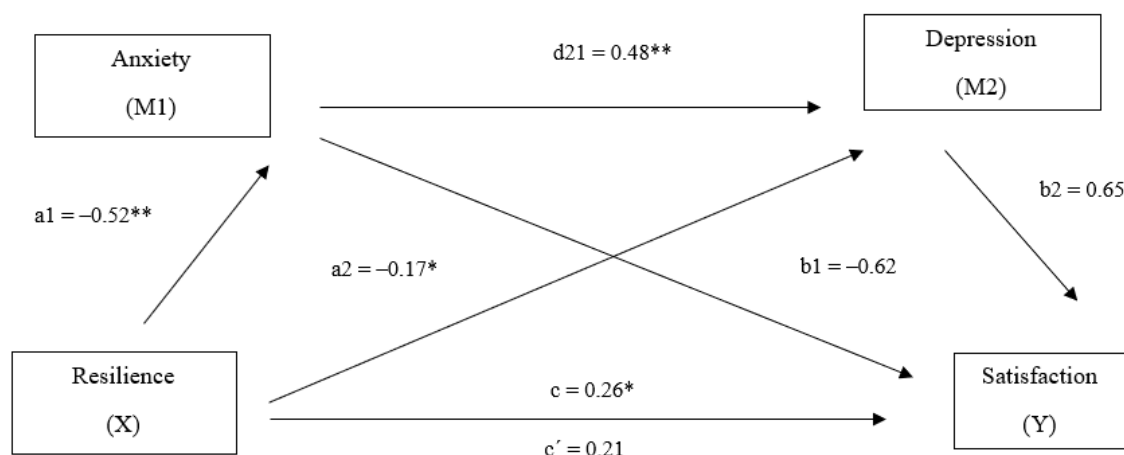


Figure 2. Multiple mediation model displaying the direct effect and path coefficients associating resilience with satisfaction via anxiety and depression in series. The coefficient c is the total effect between resilience and satisfaction, and c' is the direct effect of resilience on satisfaction, while unstandardized regression coefficients control for the M1 and M2 values in the model. $* p < 0.05$. $** p < 0.001$.

Concerning the social concern dimension, anxiety, but not depression, was a significant and positive predictor of social concern. The total effect of resilience on social concern was not significant (CI: $-0.2669, 0.0165$). The indirect effect test based on the bootstrap procedure was significant for the indirect effect of resilience through anxiety (CI: $0.562, 0.6962$) (see Figure 3).

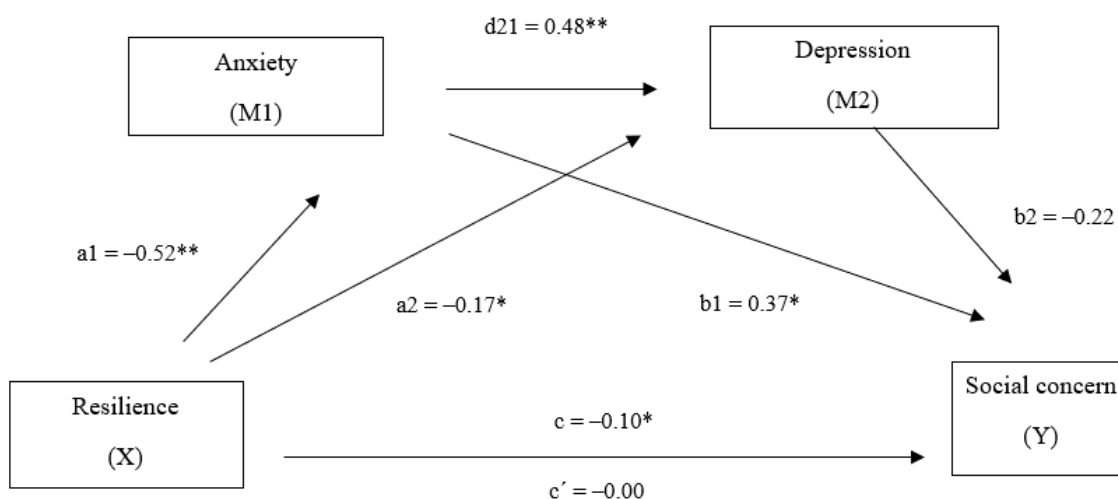


Figure 3. Multiple mediation model displaying the direct effect and path coefficients associating resilience with social concern via anxiety and depression in series. The coefficient c is the total effect between resilience and social concern, and c' is the direct effect of X on Y , while unstandardized regression coefficients control for the $M1$ and $M2$ values in the model. $* p < 0.05$. $** p < 0.001$.

Lastly, regarding the diabetes concern dimension, anxiety, but not depression, was a significant and positive predictor of diabetes. The total effect of resilience on social concern was not significant (CI: $-0.1401, 0.0211$), nor were the indirect effects (CI: $-0.2332, 0.0033$, CI: $-0.0402, 0.810$, CI: $-0.724, 0.1208$, respectively) (see Figure 4).

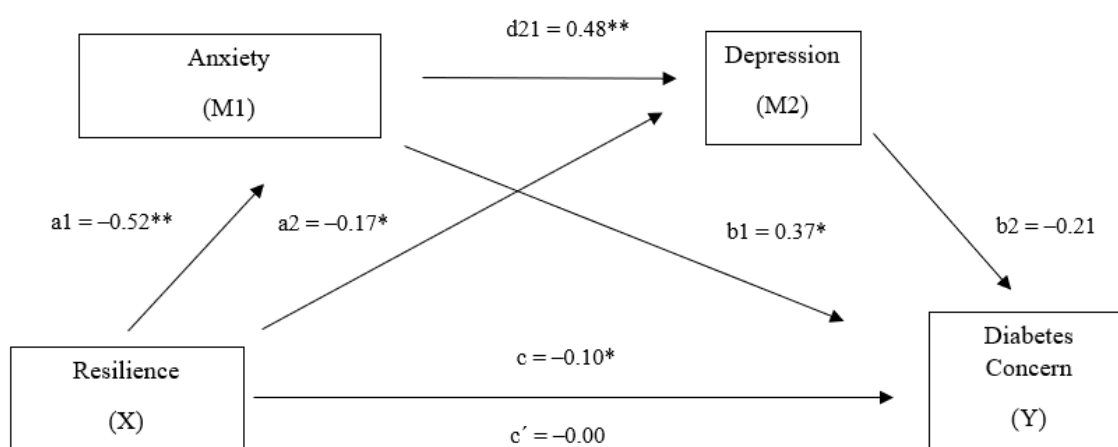


Figure 4. Multiple mediation model displaying the direct effect and path coefficients associating resilience with diabetes concern via anxiety and depression in series. The coefficient c is the total effect between resilience and diabetes concern, and c' is the direct effect of X on Y while controlling for the $M1$ and $M2$ values in the model are unstandardized regression coefficients. $* p < 0.05$. $** p < 0.001$.

6. Discussion

To the best of our knowledge, this is the first study to demonstrate the multiple mediating effects of anxiety and depression on the association between resilience and quality of life in patients with FoH. Our findings suggest that resilience plays a significant role in the anxiety and depression that accompany diabetes. The hypothesis that resilience has an influence on anxiety and depression has been explored in different studies [26], but research has yet to clarify why people with high resilience report better quality of life than others when confronted with the difficulties arising from living with diabetes and its complications such as FoH. The results of the sequential mediation analysis, carried out to test the hypothesis that depression and anxiety mediate variables of the relationships between

resilience and quality of life, show that the effect of resilience was mainly mediated by anxiety but not by depression.

In line with previous studies [43–46], the results of this study show that individuals displaying higher resilience avoided the potentially adverse effects of anxiety and reported healthier levels of psychological adaptation and functioning when dealing with chronic illness. The ability to cope with stressors is one of the keys to resilience [23]. Thus, implementing effective coping strategies (which may include seeking instrumental social support, positive reinterpretation, and acceptance) would help these patients to reduce anxiety and improve their quality of life as the presence of these symptoms correlated significantly with a reduced general well-being [47,48]. These results suggest that high resilience may protect against the development of psychiatric diseases, which have a high prevalence in diabetes. Resilience could imply resistance to stressful conditions associated with diabetes and is associated with individual differences in response to stress, in addition to its protective factors.

7. Limitations

Limitations regarding the interpretation of the results of our study should be mentioned. Some variables, such as gender, could influence the investigated relationship. For example, previous literature has pointed out that T1D female patients showed lower quality of life and of depressive and anxious symptoms [49]. Moreover, there are controversial data on gender differences in fear of hypoglycemia [50]. These differences need further research and a comprehensive psychological evaluation. The cross-sectional study design limits causal inference due to uncertainty about the direction of the associations. As this was a cross-sectional study, conclusions concerning associations between variables can only be made for the specific point in time of the study, and causal relationships, even over the long term, cannot be established. Accordingly, longitudinal studies should be conducted to further clarify causality. Another limitation was the small sample size; therefore, caution must be exercised when extrapolating results. Finally, longitudinal studies should be undertaken with larger samples in order to analyze the process of adapting to disease in individuals with FoH.

8. Implications for Research and Practice

The present study provides several implications for clinical practice in patients with FoH. Health professionals should consider the levels of anxiety and depression as well as the personal resources the patient has to deal with diabetes. The clinical practice guidelines [1] and the organizational strategies for diabetes care included in the National Health System [51] highlight the importance of improving care for psychological and mental health problems of the patient with T1D. Thus, it is recognized that the assessment of the psychological and social status should be included as part of the comprehensive approach for people with diabetes and promotes specific care in individuals with mental health disorders that may be responsible for the instability of diabetes [51]. However, there have been no programs that include therapeutic and psychological education strategies in adult patients with T1D specific for the management of FoH [52]. This approach can aid in the design of treatment plans to positively impact the quality of life of these individuals. Interventions in people with T1D may work best if they include building resilience as this may help to reduce anxiety and depression, which affects quality of life in individuals with T1D and FoH. Through these interventions, individuals with diabetes can develop psychological resilience skills to adjust to health challenges.

9. Conclusions

In this study, anxiety mediated the association between resilience and quality of life in individuals with T1D with FoH. The participants appeared to cope better with the anxiety caused by FoH. These variables should be taken into account to individualize interventions and improve health outcomes. These results can help health professionals to identify effective methods to maintain and foster the development of these positive characteristics in the population to improve coping capacity and prepare patients for the difficulties of living with a chronic disease. It is necessary to complement

diabetes education with training in psychological techniques to improve resilience as a tool for improving quality of life and maintaining control objectives, which are the main objectives of clinical care. Our findings call attention to the importance of developing intervention programs focused on strengthening resilience to improve the quality of life of people with diabetes.

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