Original Article

Effects of web-based education on HbA1c, quality of life and depression levels in adolescents with type 1 diabetes

Sema İçel,[1] **Birgül Özkan[2]**

[1]Department of Health Sciences, Gaziantep Islam, Science and Technology University, Gaziantep, Türkiye
[2]Department of Mental Health and Disease Nursing, Ankara Yıldırım Beyazıt University Faculty of Health Sciences, Ankara, Türkiye

Abstract

Objectives: Type 1 diabetes mellitus (T1DM) can create physical, psychological, and social problems, obliging the individual to adopt considerable changes in lifestyle. This study was conducted to determine the effect of diabetes education by using the web-based Watson's human care model on HbA1c, levels of depression, and quality of life of T1DM adolescents.

Methods: This study was conducted between January and December 2017. The research had an experimental design with pre- and post-test control groups. The participants were randomly assigned to the experimental and control groups. The study was conducted with 30 adolescents between 11 and 18 years old. Adolescents in the experimental group were trained using the web-based Watson's human care model, live video interviews were made in 14 sessions and these interviews were recorded.

Results: It was observed that there was a significant decrease in levels of depression for adolescents of the experiment group before and after web-based education (p=0.000); a significant increase in quality of life (p=0.000) and a positive significant change in the levels of HbA1c (p=0.001).

Conclusion: It is recommended that developed and extended Diabetes Education prepared based on web-based Watson's human care theory.

Keywords: Depression; quality of life; type 1 diabetes; Watson's human care theory; web-based education.

Type 1 diabetes mellitus (T1DM) is a physical disease that affects every aspect of life and it can create physical, psychological, and social problems, obliging the individual to adopt considerable changes in her/his lifestyle. The prevention and diagnosis of bio-psychological problems are necessary to ensure metabolic control in individuals with diabetes.[1,2] However, difficulties arise in the management of diabetes in adolescence due to rapid growth, weight gain, and changing hormone levels. These changes in adolescence not only create challenges in calculating the necessary insulin doses to be administered for treatment but they can also often induce psychosocial problems, anxiety about the future, feelings of being different from peers, and resentment for being dependent.[1]

Adolescents can experience negative feelings, such as anxiety, fear, uneasiness, unwillingness, and psychological distress in coping with diabetes. Feeling these negative emotions continuously can cause non-adherence to medical treatment, diet, and regular workouts.[3] Anxiety and depression are usually the most common psychological symptoms in adolescents with diabetes mellitus (DM). Depression in diabetes patients acts unfavorably on adaptation mechanisms, quality of life, response to treatment, prognosis, control of diabetes, course of diabetes, and mortality and morbidity rates. Symptoms of depression and symptoms of DM can reciprocally aggravate the severity of the other. Studies suggest that symptoms of depression and DM are correlated

positively.[4] Quality of life is as much important as depression in adolescents with DM. It is known that the quality of life in these patients is related to adaptation processes and is adversely affected with failures in adaptation.

Education is crucial to ensure treatment success in diabetes and lead the adolescents and family members to take part in the treatment and follow-up processes actively.[5] Studies suggest that web-based and technological education programs receive adolescents' attention considerably and yield effective results; due to the interest of adolescents in internet technologies.[6] Therefore, the internet has become a preferred tool for educating adolescents in various fields. The use of the internet for self-education offers an important opportunity for the individual. The favorable effects of patient education with web-based tools have been demonstrated in the literature. A study on adolescents aimed to convert the potential harms of computer technology into benefits by developing interesting education programs and useful software so that adolescents could be both trained and entertained at the same time. Besides its convenience for use, the internet is readily accessible for many people as long as it is implemented widely. Due to these features of the internet technology, web-based education provides many benefits for the individual; allowing for logging in anytime and anywhere for education, adjusting the pace of learning according to individual competencies, receiving selected education without hindering work activities and productivity, planning education schedules and intervals, and repeating selected education sessions.[7,8]

Jean Watson, a nurse theorist, recommends the use of technology scientifically to train and provide care to adolescents with diabetes. Watson conceptualizes the provision of nursing care as a personalized and scientific, moral, esthetic, and professional interpersonal process requiring the interaction of two individuals through physical, mental, psychological, and sociocultural channels. The rationale for selecting Watson's theory of human caring is that the theory argues to establish wellbeing and share common values through trust and relationships so that diseases can be prevented and holistic and alternative treatment interventions can be implemented based on principles of education-learning, decision-making at the individuals free discretion, respect for the autonomy of the individual, congruency of the emotional and spiritual needs, and scientific problem-solving steps. The theory of human caring combines mental-body-spirit concepts and emphasizes the importance of holistic support.[9]

The use of education and follow-up models based on theories including care by combining them with technology is not very common to use in adolescent education but it is a rising value in the care concept. Due to an insufficient number of studies on this subject, this study was conducted by assuming that it will contribute to the body of literature.[1,8,10]

> **What is presently known on this subject?**
> - Incorrect diabetes management has negative effects on depression and quality of life.
> - Watson's human care theory has shown high effectiveness in improving adolescent diabetes management.
>
> **What does this article add to the existing knowledge?**
> - Web-based education has the potential to reduce depression levels and improve the quality of life of adolescents with type 1 diabetes.
>
> **What are the implications for practice?**
> - The dissemination of Watson's human care theory-based web education in diabetes management will be effective.

The use of human caring theory (HCT)-based education and follow-up tools facilitated by technology is not common in adolescent patients; however, it is a rising value in caring practices. This study was conducted to contribute to the information in the literature as the number of studies investigating this subject is limited. This study was conducted to determine the effect of diabetes education by using the web-based Watson's human care model on HbA1c, levels of depression, and quality of life of T1DM adolescents.

Hypotheses of the Research

Hypothesis 1: Practicing web-based Watson's human care theory-oriented education model favourably effects HbA1c levels in adolescents with T1DM.

Hypothesis 2: Practicing web-based Watson's human care theory-oriented education model favorably effects depressive behaviors in adolescents with T1DM.

Hypothesis 3: Practicing web-based Watson's human care theory-oriented education model reduces the frequency of symptoms experienced by adolescents diagnosed with T1DM.

Hypothesis 4: Practicing web-based Watson's human care theory-oriented education model improves the disease-related quality of life impairments in adolescents diagnosed with T1DM.

Materials and Method

Design of the Study

This study was conducted between January and December 2017. The research had an experimental design with pre- and post-test control groups. The participants were randomly assigned to the experimental and control groups.

Sample

The research was conducted in the pediatric endocrinology department of Adiyaman University Education and Research Hospital in the city center of Adiyaman. For this study, all adolescents (41 adolescents) in the age range from 11 to 17 years registered in the endocrine outpatient clinic were included in the study universe. After informing the families of eligible patients about the research; the patients, whose families did not
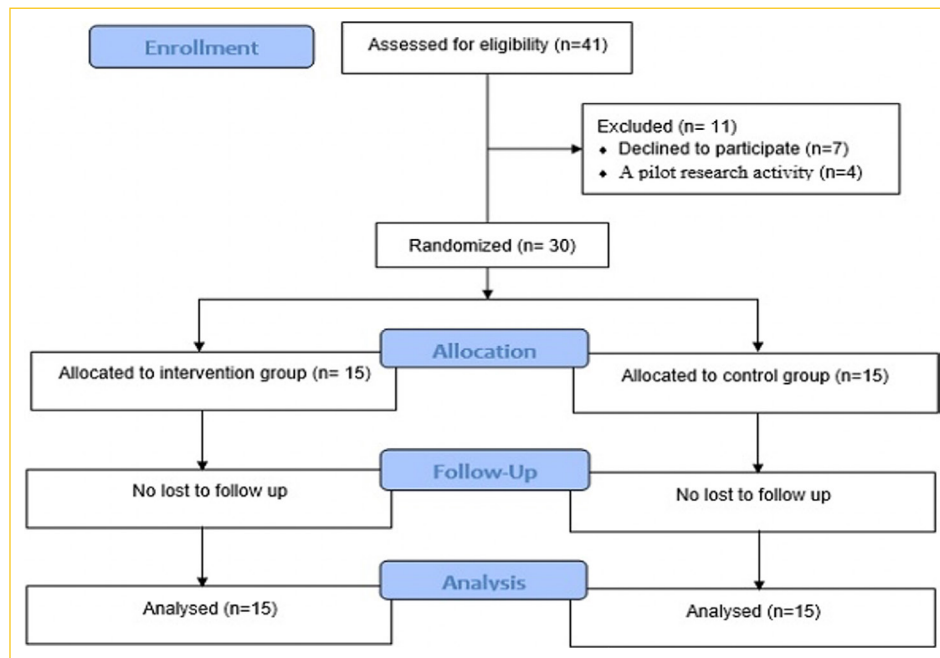
Figure 1. Study CONSORT flow diagram.

agree to participate in the research for various reasons (the head of the family does not allow her/his child to meet with other people, the family environment is not suitable) were excluded. The remaining 34 adolescents (83%) were included in the research sample. A pilot research activity was conducted with 4 adolescents with T1DM; who met the inclusion criteria. Thirty adolescents; who met the inclusion criteria of the research were administered the identification form for individuals with diabetes, children's depression inventory (CDI), and the pediatric quality of life inventory (PedsQL) for diabetes. The statistical analysis for the homogeneity of the descriptive data and the disease management data proved that was homogeneous. Then, the adolescents were listed by their names to be randomized into two groups. Fifteen adolescents corresponding to the odd numbers in the list were assigned to the experiment group and the remaining 15 adolescents corresponding to the even numbers in the list were assigned to the control group (Fig. 1). Based on the power analysis of all scales to be used in the research, it was determined that including 15 patients to the experiment group and 15 patients to the control group was adequate with 0.8 power and an effect size of 0.9 at a significance level of $\alpha=0.05$.

Inclusion Criteria

• There should be internet access and a computer in the home environment,

• The adolescent should have been diagnosed with T1DM at least 6 months ago,

• The adolescent should not have any other chronic disease other than T1DM.

Development of Applications and Evaluation Tools for the Research

Development of the Education Guide

The education material to be used in the research consisted of two modules. The education guide was developed based on the information in the literature. Furthermore, experts in the field were consulted for their opinions. The information about the education material modules are presented below:

Module 1: Physical and Psychosocial Complications Observed in Individuals with Type 1 Diabetes and Their Coping Methods

The education guide was developed using the information in the literature review. Of the healing processes and nursing approaches described by Watson; the second (faith-hope), sixth (problem-solving), and seventh (teaching-learning) processes were used. These features were associated with the characteristics of adolescents in the development process of the education booklet. Necessary messages were conveyed through fictional stories to avoid the loss of interest of the adolescent. The physiological and psychosocial problems; which can be most frequently faced by adolescents, were discussed in this module. These problems and potential coping methods against them were narrated by using Watson's human caring processes and respective wording (You Got the Control - You Hold the Strings - The Solution Is You).

Module 2: General Information on Diabetes

During the development phase of this module, the official website of the Republic of Turkey's Ministry of Health and the
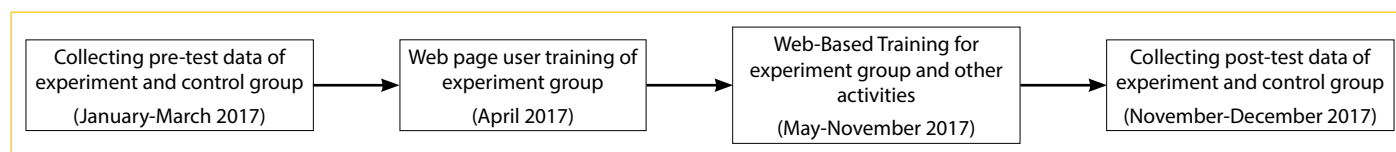
| Collecting pre-test data of experiment and control group (January-March 2017) | → | Web page user training of experiment group (April 2017) | → | Web-Based Training for experiment group and other activities (May-November 2017) | → | Collecting post-test data of experiment and control group (November-December 2017) |

Figure 2. Flow of the research.

websites providing information about diabetes were reviewed. The guide for adolescents with T1DM was reviewed and this education module about general themes of diabetes was developed as a short, effective, and easy-to-understand one.

Development of the Website

A web-based application was developed to interact with adolescents and to follow them up. The web-based application contained Watson's HCT-oriented education materials about laboratory test results, multimedia presentations to inform the adolescents in the experimental group; general information about diabetes, nutrition, exercise, and insulin therapy; information about potential complications associated with diabetes, photographs of activities held with the participation of adolescents with T1DM; and social interaction media through peer forums, discussion boards, blogs, chat rooms, and pages for experience sharing. The links in the menu direct the user to the pages; where psychosocial effects of diabetes are addressed through fictional stories.

Conduct of the Research

This research was conducted on adolescents with T1DM as illustrated in the flowchart in Figure 2.

Collecting Pre-and Post-test Data from the Experiment and Control Groups

Using the contact information of the participants was called on the phone to schedule appointments for collecting the pre- and post-test data. Data collection forms were administered to the adolescents in the experiment and control groups for pre- and post-test phase of the research. DISCERN Web Site Evaluation Instrument was applied to the adolescents in the experiment group to evaluate the web-based application utilized for education in the post-test phase of the research.

Web-based Education for the Experiment Group

A web-based application was developed to interact with adolescents and to follow them up. Video calls with adolescents were scheduled at their convenience. Video interviews were conducted individually through Skype every 15 days for approximately 30 min, in full compliance with the program. In these interviews, the clinical picture of diabetes (daily blood sugar measurement values, amount of insulin applied, complications experienced, exercises done) and the psychosocial status (stress, anger, depression, feeling lonely, etc.) of adolescents

were discussed. A total of 14 interviews with 15-day intervals were made with each adolescent. All video interviews were carried out by the first researcher and they were all recorded.

Ethical Aspect of Research

Approval for the research was acquired from the Ethics Committee of Ankara Yıldırım Beyazıt University (June 02, 2016/339). This study was conducted in accordance with the Declaration of Helsinki regarding ethical issues. Each participant in the research signed a consent form before his or her inclusion in the study.

Data Collection Tools

The use of scales assigned for this study was ensured by obtaining permission from the researchers who previously proved the validity and reliability of those scales.

Identification Form for Individuals with Diabetes

An identification form comprising 50 questions was developed based on the information in the literature to collect demographic data from individuals with T1DM.

Physiological Finding Registration Form

This form was developed based on the information in the literature to record medical data of the patients; including HbA1c levels, blood glucose monitoring results, and the insulin dose.

CDI

CDI was developed by Kovacs to determine the severity of depression in children. CDI was derived from the beck depression inventory. It comprises of additional items specific to childhood depression such as the items about the situation in the school and relationships with friends. The inventory was developed by using a language that could be easily understood by children and adolescents in ages from 6 to 17 years. It was adapted into Turkish by Öy (1990). CDI comprises 27 items. The answers given are given scores ranging from 0 to 2. High scores indicate the level of depression, and the highest score that can be obtained from the scale is 54. The cut-off point of the scale is 19.[4] In our study, Cronbach's alpha coefficient was 0.95.

PedsQL

The Inventory was developed by Varni et al.[11] (2003). It measures the quality of life both generally and specific to the disease. PedsQL was adapted into Turkish by Ayar. The inventory

consists of 28 items and is divided into 5 sub-scales. When calculating the total score of the scale, a linear conversion is applied and converted to 0–100 points. If all questions are answered as "never," 100 points can be obtained, if "rarely," 75 points can be obtained, if "sometimes," 50 points can be obtained, if "often," 25 points can be obtained, and if "almost always," 0 points can be obtained. A high total score obtained from the scale indicates that the health-related quality of life is good.[12] In our study, Cronbach's alpha coefficient was 0.90.

DISCERN Website for the Evaluation Scale

DISCERN (quality criteria for consumer health ınformation) instrument; which was developed by Charnock et al.[13] (1997) and adapted into Turkish in our country by Gökdoğan et al.[14] (2003) was used in the research. The guide to the DISCERN quality criteria is used to evaluate the quality and reliability of the written materials that present health-related information. The instrument consists of 16 questions in total. Each question is given a score between 1 and 5 (5: appropriate, 1: not appropriate). At the end of the evaluation, a low total score indicates low quality and a high score indicates high quality. A total of 15 points indicates that the prepared web page has low information quality, and 75 points indicate that it has high information quality.[15]

Data Analysis

Quantitative analysis methods were used to evaluate the research data. Statistical Packages for the Social Sciences 20.0 statistics package program was used for analyzing the quantitative data of the research. The descriptive statistical analysis of the quantitative data was performed using numbers, percentages, and frequency distributions. The statistical tests used in the analysis included the Chi-square test, the Mann–Whitney U test, the Wilcoxon signed-rank test, and the non-parametric analysis of variance (Kruskal–Wallis Test) test.

Results

No statistically significant differences were found in age, gender, and education status between the adolescents in the experiment and control groups moreover, no statistically significant differences were detected in the duration of diabetes, recording status of monitored blood glucose levels, recording frequency of blood glucose levels, and receiving assistance between the experiment and control groups (p>0.05) (Table 1).

Table 2 demonstrates that the mean post-test HbA1c levels were statistically significantly different between the experiment and control groups (p<0.005). The provision of web-based Watson's HCT-oriented education resulted in statistically significant lower mean post-test HbA1c level; which was the primary dependent variable, in the adolescents with T1DM in the experiment group.

Table 2 demonstrates a statistically significant difference in the mean scores of CDI between the experiment and control groups (p<0.005).

The post-test scores obtained from the PedsQL and its sub-scales were statistically significantly different between the experimental and control groups (p<0.005) (Table 2).

Figure 3 shows that the users assigned full scores (100%) to the following items defining the website; including "The published information is up to date," "the website is unbiased and balanced," "the website refers to areas of uncertainty," "the website describes the risks of each treatment option," and "the website supports joint decisions" (100%). However, the users assigned the lowest score (60%) to the following item: "The website addresses the use of more than one treatment option." The users stated that they found the website generally "reliable" (86.7%).

Discussion

Statistically significant differences were found in the mean post-training levels of HbA1c and the severity of depression between the adolescents with T1DM in the experiment and control groups. Furthermore, it was determined that the post-training quality of life scores and subscale scores (diabetes symptoms, treatment barriers, treatment adherence, anxiety, and communication) of the experiment group were favorably and statistically significantly different from the scores obtained in the control group. The adolescents in the experiment group found the newly developed website tool generally beneficial, effective, and reliable.

No statistically significant differences were found in age, gender, and education status between the adolescents in the experiment and control groups (p>0.005). These results for participant characteristics are similar to those reported by similar studies in the literature.[16–18] No statistically significant differences were detected in the duration of diabetes, recording status of monitored blood glucose levels, recording frequency of blood glucose levels, and receiving assistance between the experiment and control groups (p>0.005). The majority of participants were found out to have received the diagnosis recently. The literature review revealed that similar results were reported by similar studies.[16–18] These findings suggest that the provision of Watson's HCT-oriented education and consultancy to adolescents in the 1st year of diabetes diagnosis will be beneficial to overcome the barriers of adaptation to the disease process. Our research results about receiving assistance for disease management were parallel to the results of similar studies.[16] The adolescent may avoid talking about her/his diabetes due to the increased interpersonal sensitivity in adolescent ages. It is recommended that the sensitivity of adolescents should be respected and her/his sharing thoughts with close peers should be supported. The adolescent should be trained about potential coping strategies against fears of

Table 1. Distribution of the descriptive characteristics and diabetes management status of adolescents in the experiment and control groups (n=30)

Characteristics of adolescent		Experiment group		Control group		Tests	p
		n_D	%	n_K	%		
Age						LR=17.544	0.107
11–12		5	33.3	7	46.7		
13–14		7	46.7	2	13.3		
15–16		3	20.0	6	40.0		
Gender						χ^2=0.536	0.464
Female		8	53.3	6	40.0		
Male		7	46.7	9	60.0		
Education level						LR=6.517	0.259
6–7 grade		5	33.3	7	46.7		
8–9 grade		7	46.7	2	13.3		
10–11 grade		3	20.0	6	40.0		
Items	**Options**						
How long have you have diabetes?	1–3 years	3	20.0	5	33.3	LR=0.537	0.463
	3–5 years	7	46.7	5	33.3		
	5–7 years	1	6.7	2	13.3		
	7–9 years	2	13.3	3	20.0		
	More than 9 years	2	13.3	0	0		
How often do you measure your blood glucose?	<4 times a day	2	13.3	2	13.3	LR=1.449	0.694
	4 times a day and more	9	60.0	6	40.0		
	In a week	3	20.0	5	33.3		
	Does not measure regularly	1	6.7	2	13.3		
Do you record your blood glucose levels?	Yes	9	60.0	5	33.3	χ^2=2.143	0.143
	No	6	40.0	10	66.7		
Do you receive assistance for the management of your diabetes?	Yes	14	93.3	15	100.0	LR=1.421	0.233
	No	1	6.7	0	0.0		
Total		15	100.0	15	100.0		

LR: Logistic regression.

limitations or social exclusion. It should be ensured that the adolescent should be assisted in diabetes management.

This study demonstrates that the mean post-test HbA1c levels were statistically significantly different between the experiment and control groups (p=0.003<0.005). Similar results were reported in the literature. Altundağ et al.[16] reported lower HbA1c levels in adolescents in the experiment group; who underwent training, but no changes were observed in the adolescents in the control group. The literature review revealed reported similar results and determined that the mean value of HbA1c decreased in adolescents in the experiment group at the end of the training period but no significant changes occurred in the control group.[19,20] Our study results are parallel to those reported in the literature. These results suggest that web-based training is effective in diabetes management in adolescents with T1DM and that web-based Watson's HCT-oriented diabetes training should be widely used.

This study demonstrates a statistically significant difference in the mean scores of CDI between the experiment and control groups (p=0.000<0.005). Our study results of CDI are parallel to those reported in the literature. Stahl-Pehe et al.[21] found out that depressive symptoms were related to Hb1Ac levels and that favorable results can be obtained through adequate interventions and approaches early at the time of diagnosis. Öner and Arslantaş reported no tendency to develop depression in 78.9% of the adolescents included in the study.[22] Bächle et al.[23] found out that depressive symptoms were related to Hb1Ac levels. We think that the web-based Watson's HCT-oriented diabetes education will favorably affect adolescents with T1DM so that they can better cope with depression periods that may develop due to several challenges of the transition period from childhood to adolescence; including adjustment problems resulting from peer interactions, exam stress that will be commonly faced during the school years, problems of feeling different from

Table 2. Distribution of the pre- and post-test mean HbA1c levels, CDI and PedsQL scores by the experiment and control groups (n=30)

	Experiment group	Control gruop	Mann-Whitney U Test	
			Z	p
Mean HbA1c levels				
Pre-test	9.11±2.22	8.96±0.93	-0.498	0.618
Post-test	8.21±1.59	10.12±1.60	-2.947	0.003*
CDI				
Pre-test	18.46±12.76	15.73±11.85	-0.623	0.533
Post-test	4.93±3.69	20.73±9.09	-4.258	0.000*
PedsQL				
Pre-test	38.33±13.26	40.60±14.43	-0.582	0.561
Post-test	82.79±10.51	41.28±14.32	-4.543	0.000*
Sub-dimensions				
Symptoms of diabetes				
Pre-test	38.33±17.24	41.96±17.95	-0.581	0.561
Post-test	77.57±11.22	42.44±17.95	-4.295	0.000*
Treatment barriers				
Pre-test	33.75±15.27	33.75±15.45	-0.253	0.800
Post-test	85.41±9.92	33.91±15.34	-4.596	0.000*
Treatment adherence				
Pre-test	40.47±16.18	45.00±22.00	-0.292	0.770
Post-test	87.85±13.21	46.90±20.55	-4.081	0.000*
Anxiety				
Pre-test	42.77±16.32	37.22±29.52	-1.191	0.233
Post-test	82.22±18.59	38.91±28.61	-3.800	0.000*
Communication				
Pre-test	34.99±26.20	31.66±31.37	-0.543	0.587
Post-test	87.22±23.75	36.11±28.11	-3.654	0.000*

*: p<0.005. HbA1c: Hemoglobin A1c test; CDI: Children's depression inventory; PedsQL: Pediatric quality of life inventory.
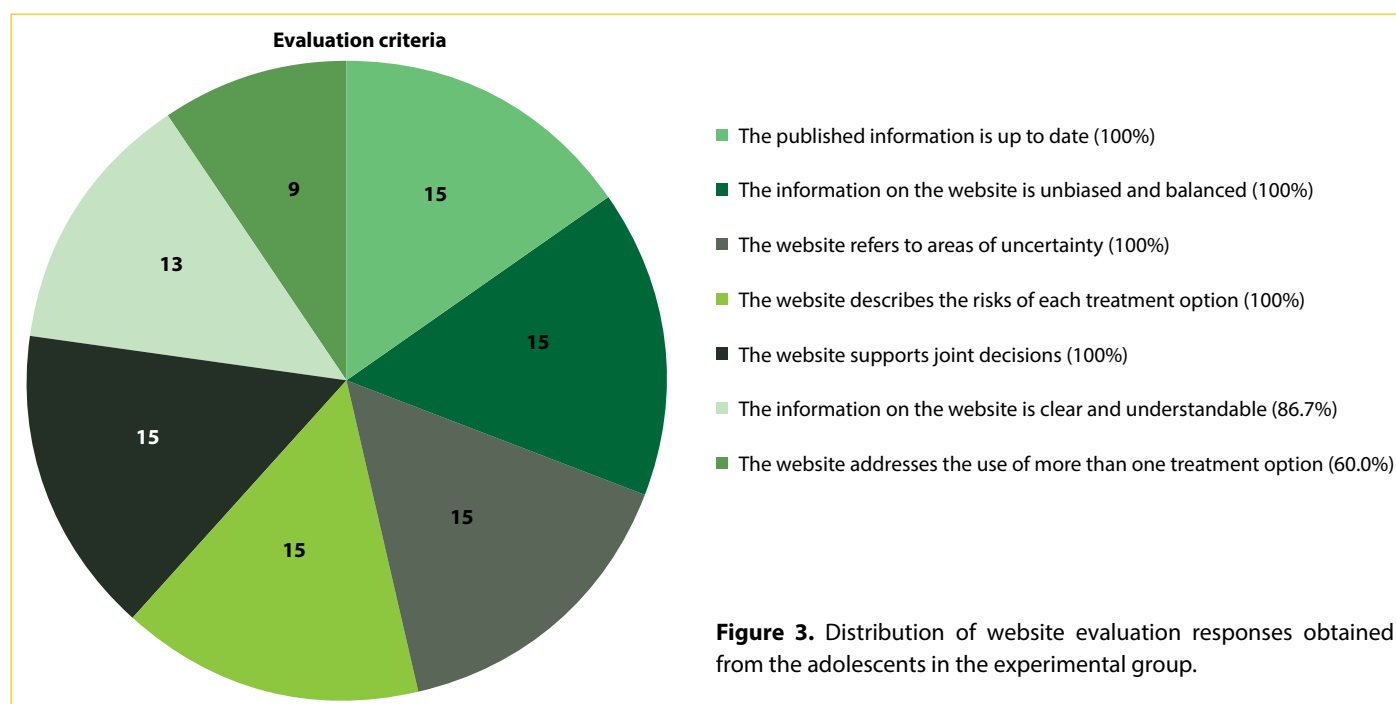
peers, difficulties in establishing social relationships, and failure to overcome diabetes-related physical changes in the body.

The post-test scores obtained from the PedsQL and its sub-scales were statistically significantly different between the experimental and control groups (p=0.000<0.005). Duras investigated the quality of life in T1DM patients and determined that the quality of life scores of children with T1DM were lower than healthy children with similar demographic characteristics. [17] Our study results of PedsQL are similar to those reported in the literature. A study found out that the quality of life, anxiety, physical activity, and HbA1c levels were significantly correlated in individuals with T1DM.[24] Another study conducted in Montenegro found that individuals with type 1 diabetes had poorer quality of life compared to healthy individuals and that reduced levels of HbA1c improved their quality of life levels favorably.[25] A study investigating the quality of life in high school students with T1DM reported that motivational education conducted under the titles of "planning in advance," "positive thinking," and "support seeking" increased the quality of life levels favorably.[26]

Quality of life improves in T1DM adolescent patients when they accept their disease in the circle of family, friends, and school; as well as, when they improve their self-control, manage diabetes effectively, and cope with diabetes complications. Therefore, the provision of support and consultancy to T1DM adolescent patients are of major importance.

In the literature review, we did not find any studies on adolescents with T1DM; who underwent web-based education using Watson's HCT principles. However, several studies on different populations demonstrated favorable effects of Watson's HCT-oriented education and provision of care on patient outcomes. A study; investigating the effects of web-based education on type 1 and type 2 diabetes patients in Denmark, administered a food frequency questionnaire (FFQ) to the participants and reported that the diet program prepared according to the responses obtained from FFQ was found effective on diabetes. [6] In Demir's study; which coefficient of variation shows primary glycemic variability decreased significantly although unstable at the end of education in impaired hypoglycemia awareness

Evaluation criteria

- The published information is up to date (100%)
- The information on the website is unbiased and balanced (100%)
- The website refers to areas of uncertainty (100%)
- The website describes the risks of each treatment option (100%)
- The website supports joint decisions (100%)
- The information on the website is clear and understandable (86.7%)
- The website addresses the use of more than one treatment option (60.0%)

Figure 3. Distribution of website evaluation responses obtained from the adolescents in the experimental group.

patients.[27] Another study investigated post-intervention; diabetes knowledge improved significantly (p=0.001). The majority of participants (86%) indicated a preference for web-based instruction as a stand-alone program or as an adjunct to traditional classroom education, particularly citing the advantage of being able to engage the material at their own pace.[10]

The healthcare system in our country allows for the follow-up and the provision of care for a limited duration at limited convenience and only when patients attend outpatient clinic visits. This situation limits understanding the patient comprehensively and adds difficulties to the treatment and follow-up processes. Furthermore, limitations in the healthcare system hinder effective patient education activities. Therefore, web-based education tools are advantageous for patients since they allow access to disease information regardless of location and without time limitations.

Our study results are similar to results reported by previous studies in the literature. Despite some differences among groups, Watson's HCT-oriented education and caring plans diminished the severity of complications and improved the quality of life of individuals. All of these studies utilized the framework of education-caring-healing suggested by Watson's theory and respective methods and processes although the study population characteristics were variable across different studies. Tektas and Çam investigated the study and found that the scores of anxiety, depression, hopelessness, and prenatal attachment were significantly different between the intervention and control groups (p=0.000).[28] Durgun and Okumuş reported diminished unfavorable effects of infertility and improved self-sufficiency and adjustment capacity with

Watson's HCT-oriented provision of nursing care in women; who underwent infertility treatment.[29] Another study investigated the effects of Watson's HCT on chronic diseases, demonstrating that Watson's model reflected the essence of the nursing occupation well and it could easily be implemented to nursing care practice due to its human-centered nature.[30]

Limitations

In this research, the entire universe was reached. However, the generalizability of this research is limited due to the small sample size. The selected age range of 11–18 years can be another limitation of the research.

Conclusion

Statistically significant differences were found in the mean post-education levels of HbA1c and the severity of depression between the adolescents with T1DM in the experiment and control groups. The adolescents in the experiment group found the newly our study results suggest that educational and social activities for adolescents with T1DM should be more commonly held, further research and studies should be conducted to investigate different education tools, and educational and social activities should be promoted by respective institutions. Furthermore, our study demonstrates that the widespread use of this web-based tool will provide benefits.

Because there are no studies on adolescents with T1DM in the literature, investigating the use of models, scales, and tools used in our study; we think that our study can be a reference point for further research.

References

1. Karahan Okuroğlu G, Ecevit Alpar Ş. Effect of Web-based diabetes training program on diabetes-related knowledge, attitudes, and skills of health professionals: A randomized controlled trial. Jpn J Nurs Sci 2019;16:184–93.

2. Madrigal MA, López M, Sánchez A, Cao MJ, Castro MJ, Jiménez JM. Type 1 diabetes mellitus in pediatric patients and its impact on relationships in the family environment. Diabetes Metab Syndr Obes 2020;13:4973–80.

3. Charalampopoulos D, Hesketh KR, Amin R, Paes VM, Viner RM, Stephenson T. Psycho-educational interventions for children and young people with Type 1 Diabetes in the UK: How effective are they? A systematic review and meta-analysis. PLoS One 2017;12:e0179685.

4. Muscatello MR, Troili GM, Pandolfo G, Mento C, Gallo G, Lanza G, et al. Depression, anxiety and anger in patients with type 1 diabetes mellitus. Recenti Prog Med 2017;108:77–82.

5. McGuire HC, Ji L, Kissimova-Skarbek K, Whiting D, Aguirre F, Zhang P, et al. Type 1 diabetes mellitus care and education in China: The 3C study of coverage, cost, and care in Beijing and Shantou. Diabetes Res Clin Pract 2017;129:32–42.

6. Bentzen SM, Knudsen VK, Christiensen T, Ewers B. Relative validity of a web-based food frequency questionnaire for patients with type 1 and type 2 diabetes in Denmark. Nutr Diabetes 2016;6:e232.

7. Avdal EU, Uran BNÖ, Pamuk G, Yildirim JG, Konakçi G, Ateş M, et al. Investigation of the effect of web-based diabetes education on metabolic parameters in people with type 2 diabetes: A randomized controlled trial. J Infect Public Health 2020;13:1892–8.

8. Knox ECL, Quirk H, Glazebrook C, Randell T, Blake H. Impact of technology-based interventions for children and young people with type 1 diabetes on key diabetes self-management behaviours and prerequisites: A systematic review. BMC Endocr Disord 2019;19:7.

9. Clark CS. Watson's human caring theory: Pertinent transpersonal and humanities concepts for educators. Humanities 2016;5:21.

10. Fitzgerald SA, Zavala VEM, Blanco KYR, Cupertino AP, Geana VM, Ellerbeck EF. Acceptability and feasibility of web-based diabetes instruction for Latinos with limited education and computer experience. J Health Dispar Res Pract 2016;9:94–102.

11. Varni JW, Burwinkle TM, Jacobs JR, Gottschalk M, Kaufman F, Jones KL. The PedsQL in type 1 and type 2 diabetes: Reliability and validity of the pediatric quality of life inventory generic core scales and type 1 diabetes module. Diabetes Care 2003;26:631–7.

12. Ayar D, Öztürk C. The importance of quality of life in children with type 1 diabetes mellitus. Dokuz Eylül Üniv Hemşirelik Fak Elektron Derg [Article in Turkish] 2013;6:99–101.

13. Charnock D, Shepperd S, Needham G, Gann R. DISCERN: An instrument for judging the quality of written consumer health information on treatment choices. J Epidemiol Community Health 1999;53:105–11.

14. Gökdoğan F, Kır E, Özcan A, Cerit B, Yıldırım Y, Akbal S. Eğitim kitapçıkları güvenilir mi? 2. Uluslararası & IX. Ulusal Hemşirelik Kongresi Kongre Kitabı, 2003 September 7-11, Antalya; 2003.

15. Karakus E Z, Özer Z, Boncuk H. The effect of web based patient education on symptom management and quality of life of patients with diagnosed lung cancer. 1st International Health Sciences and Life Congress; 2018 May 02-05; Burdur; 2018.

16. Altundağ S. The effect of social support and education at adaptation to disease in children with type 1 diabetes mellitus. Pamukkale Med J [Article in Turkish] 2017;11:137–44.

17. Duras E, Bezen D, Özkaya O, Dursun H. Evalution of the quality of life of patients followed up with diagnosis of type 1 diabetes mellitus. J Curr Pediatr 2018;16:72–85.

18. Musa DI, Agbana BE, Adeola MF, Idache BM, Abu S, Iwuagwu TE. Diagnostic performance of central and generalized adiposity in detecting risk of diabetes mellitus in adolescents. Afr Health Sci 2022;22:119–26.

19. Bayram S, Kızıltan G, Akın O. Effect of adherence to carbohydrate counting on metabolic control in children and adolescents with type 1 diabetes mellitus. Ann Pediatr Endocrinol Metab 2020;25:156–62.

20. Gökşen D, Atik Altınok Y, Ozen S, Demir G, Darcan S. Effects of carbohydrate counting method on metabolic control in children with type 1 diabetes mellitus. J Clin Res Pediatr Endocrinol 2014;6:74–8.

21. Stahl-Pehe A, Glaubitz L, Bächle C, Lange K, Castillo K, Tönnies T, et al. Diabetes distress in young adults with early-onset Type 1 diabetes and its prospective relationship with HbA1c and health status. Diabet Med 2019;36:836–46.

22. Öner K, Arslantaş H. Depression, internet addiction and related factors in adolescents of high school students. 6th World Nursing and Healthcare Conference, 2016 August 15-16; London; 2016.

23. Bächle C, Lange K, Stahl-Pehe A, Castillo K, Holl RW, Giani G, et al. Associations between HbA1c and depressive symptoms in young adults with early-onset type 1 diabetes. Psychoneuroendocrinology 2015;55:48–58.

24. Mutlu EK, Mutlu C, Taşkıran H, Özgen İT. Relationship between physical activity level and depression, anxiety, quality of life, self-esteem, and HbA1c in adolescents with type 1 diabetes mellitus. Turk J Physiother Rehabil 2017;28:38–46.

25. Samardzic M, Tahirovic H, Popovic N, Popovic-Samardzic M. Health-related quality of life in children and adolescents with type 1 diabetes mellitus from Montenegro: Relationship to metabolic control. J Pediatr Endocrinol Metab 2016;29:663–8.

26. Fredette J, Mawn B, Hood K, Fain J. Quality of life of college students living with type 1 diabetes: A qualitative view. West J Nurs Res 2016;38:1595–610.

27. Demir G, Özen S, Çetin H, Darcan Ş, Gökşen D. Effect of education on impaired hypoglycemia awareness and glycemic variability in children and adolescents with type 1 diabetes mellitus. J Clin Res Pediatr Endocrinol 2019;11:189–95.

28. Tektaş P, Çam O. The effects of nursing care based on watson's theory of human caring on the mental health of pregnant women after a pregnancy loss. Arch Psychiatr Nurs 2017;31:440–6.

29. Durgun Ozan Y, Okumuş H. Effects of nursing care based on watson's theory of human caring on anxiety, distress, and coping, when ınfertility treatment fails: A randomized controlled trial. J Caring Sci 2017;6:95–109.

30. Erbay Ö, Yıldırım Y, Fadıllıoğlu Ç, Aykar FŞ. Use of watson's theory of human caring in nursing care of patients with hypertensive attack: Case report. Turk J Card Nurs [Article in Turkish] 2018;9:82–8.