Journal of Cancer Education (2019) 34:1130–1141
https://doi.org/10.1007/s13187-018-1419-4

The Effect of Fatigue-Related Education on Pediatric Oncology Patients' Fatigue and Quality of Life

Aslı Akdeniz Kudubes[1] · **Murat Bektas**[1] · **Kamer Mutafoğlu**[2]

Abstract

The identification of cancer-related fatigue as a clinical problem in pediatric oncology is an important phenomenon, and there are limited number of studies about raising the awareness of pediatric oncology patients and their parents. Fatigue-related education for patients and their parents before and during cancer treatment reduces the fatigue levels of patients. This study aims to analyze the effect of fatigue-related education for pediatric oncology patients aged 7–12 and their parents on their fatigue and quality of life. This study was conducted with 80 children with cancer and their parents who were assigned to either the control group ($n = 40$) or the experimental group ($n = 40$). The experimental group received a fatigue-related educational program. The data were collected three times: prior to the program, 3 months later, and 6 months afterwards. Multidimensional variance analysis, the Bonferroni adjusted t test and regression analysis were used to analyze the data. A significant difference was found among the experimental and the control group for total mean scores and the mean scores of subdimensions of the Scale for the Assessment of Fatigue—Child Form in terms of the interactions of group, time, and group*time ($p < 0.05$). Significant differences were found among the experimental and control groups' mean scores on the Scale for the Quality of Life—Child and Parents Form in terms of the interactions of group, time, and group*time ($p < 0.05$). Fatigue-related education is an effective education model as a way to reduce fatigue and increase the quality of life of children with cancer. The use of fatigue-related education by nurses in pediatric oncology clinics will have positive effects on children and their parents.

Keywords Cancer · Fatigue · Quality of life · Education of related fatigue

Introduction

Pediatric cancers constitute 0.5–1% of all malignancies. This rate differs depending on the age of the patients. An estimated 10,590 new cancer cases will be diagnosed among children 0 to 14 years of age in the USA in 2018 [1]. Cancer treatments have improved survival rates, although their side effects can cause disturbing symptoms for children [2, 3]. These symptoms include anemia, thrombocytopenia, leukopenia, nausea, vomiting, hair loss, weight loss, diarrhea, constipation, stomatitis, and fatigue [2, 3]. Fatigue, one of these symptoms, is a significant area in the care of children with cancer. The literature indicates that 51%–86% of children with cancer experience fatigue from cancer and cancer treatment [4–7].

Cancer-related fatigue has biological, psychological, and social effects that can differ from person to person. It is a distressing, persistent, subjective sense of tiredness or exhaustion related to cancer or cancer treatment that is not proportional to recent activity and interferes with normal functioning [8]. Cancer-related fatigue has negative effects on children's social life, school work, morale, and relationships with their peers. Fatigue in pediatric oncology patients is a multidimensional concept and has a variety of causes. Fatigue can occur due to negative side effects of cancer treatment, long-term pain, increase in the growth rate of tumor cells, surgical operations, psychological situations, and side effects of the medication for the symptoms of cancer and cancer treatment [9].

Fatigue from cancer and cancer treatment can be easily ignored by healthcare professionals. There are many reasons

✉ Aslı Akdeniz Kudubes
asliakdeniz@hotmail.com

Murat Bektas
mbekta@gmail.com

Kamer Mutafoğlu
kamer.mutaf@gmail.com

[1] Department of Pediatric Nursing, Dokuz Eylul University Faculty of Nursing, Inciralti, 35340 Izmir, Turkey

[2] Department of Pediatrics, Izmir University of Economics Faculty of Medicine, Izmir, Turkey

why fatigue is frequently not considered [10]. Firstly, the fatigue reported by children and their families is not considered a symptom that may warrant changes in drug doses. Secondly, children may not be able to express their feelings about the side effects of treatment as well as adults. Young kids may not be able to tell their parents about any changes in their physical strength or daily activities. However, older children may accept energy decline and fatigue as a consequence of having cancer. Thirdly, since fatigue is not described adequately by healthcare professionals, parents of children with cancer consider fatigue as a consequence of the disease, which requires no intervention. In addition, parents do not need to report the fatigue of their children to healthcare personnel who mostly focus on treatment of the disease. However, the diagnosis and management of fatigue reported by children and parents is of great importance for the treatment [11, 12].

Fatigue is one of the most important symptoms that affect the quality of life of children with cancer. The quality of life of children with cancer is diminished mainly by biological, psychological, and social problems exacerbated by cancer, surgeries, radiotherapy, chemotherapy, long-term hospitalization, side effects, isolation, changes in the course of the disease, interrupted school life, insufficient support systems, and the failure of coping methods. It is important to evaluate fatigue and its effects on the quality of life of pediatric oncology patients [13–15].

Symptom management education for patients who are trying to manage cancer-related problems increases their quality of life and adaptation to treatment. Therefore, it is very important to ensure the adaptation of children with cancer to treatment, to improve their quality of life, and to eliminate symptoms. Fatigue management education for pediatric oncology patients and their parents will help them cope with cancer-related symptoms and increase their quality of life [16–18].

Since fatigue has a profound effect on cancer patients' quality of life, nurses should continuously evaluate objective and subjective findings of the symptom of fatigue and factors affecting fatigue and plan appropriate nursing interventions to educate patients and their families [19]. The literature indicates that fatigue-related education for patients and their parents before and during cancer treatment reduces the fatigue levels of patients [17, 19].

There are many studies of the factors causing fatigue in children with cancer, factors reducing and increasing fatigue, and methods for evaluating these factors. However, the data on methods for coping with fatigue and training programs applied to reduce fatigue are considered inadequate. The identification of cancer-related fatigue as a clinical problem in pediatric oncology is an important phenomenon, and there are a limited number of studies about raising the awareness of pediatric oncology patients and their parents [17, 20]. This study aims to increase children's quality of life, reduce their fatigue levels, improve their general well-being, and contribute to the few nursing studies of fatigue in pediatric oncology in Turkey.

Methods

Study Design

This study analyzes the effect of fatigue-related education on the fatigue and quality of life of pediatric oncology patients aged 7–12 and their parents.

Subjects and Procedure

The sample calculation that was required for this study was performed using the GPOWER statistical analysis program with type I error as 0.05 and type II error as 0.20 (80% power) and effect size 0.5. In a study by Barrera et al. (2000) [21], the required sample size was determined to be 16 children and parents by using mean scores.

We contacted 80 children with cancer and their parents who were admitted to the oncology clinic of the university hospital between April 27, 2015 and June 23, 2017 (40 children and their parents for the experimental group and 40 children and their parents for the control group) in order to indicate the differences between the variables clearly. The variables regarding children are age, gender, height, weight, hemoglobin value, number of hospitalization days, number of days of chemotherapy, diagnosis, type of treatment, corticosteroid use, nutritional status, catheter type, and training on coping with symptoms. In addition, the other variables examined are mother's age, father's age, mother's employment and education status, father's employment and education status, and income status of the family and caregiver.

The inclusion criteria were: (1) children aged 7–12 and diagnosed with cancer for more than 4 weeks with hemoglobin concentrations above the blood transfusion criteria (< 8 g/dl for hematologic malignancies and < 7 g/dl for oncologic malignancies) and their parents, (2) being literate, and (3) voluntary participation. In addition, the plans were to include children who were in the first to third day of their treatment in both the control and experimental groups. Children in the terminal stages of cancer, developmental disabilities children, and children who had undergone serious surgeries limiting their daily activities or causing organ loss were excluded from the study.

This study included 80 children with cancer in the 7–12 age group who met the inclusion criteria and their parents. The step-wedge design was used in the study. Randomization was not used. The control group included 40 children and their parents, and the experimental group included 40 children and their parents. Attention has been paid for the groups included in the study to be homogeneous in terms of age, gender, height, weight, hemoglobin value, number of hospitalization days, number of days received chemotherapy, diagnosis, type of treatment, corticosteroid use, nutritional status, and catheter type. Moreover, attention has been paid for the parents to be homogeneous in terms of mother's age, father's age, mother's employment and education status, father's employment and education status, and income status of the family. The children and parents who had similar variables with those in the control group (age, gender, height, weight, hemoglobin value, number of hospitalization days, number of days of receiving chemotherapy, diagnosis, type of treatment, corticosteroid use, nutritional status and catheter type, mother's age, father's age, mother's employment and education status, father's employment and education status, and income status of the family) were included in the experimental group. Pediatric oncology patients spend extended periods of time in the clinic due to disease and treatment processes. Throughout these processes, children and parents in the control and intervention groups communicate with each other. Therefore, it was determined children and parents who participate in the control group at first, and completed data collection of the control group. Firstly, it was initially completed data collection in the control group to prevent any interaction among the groups, and it was started to collection of data in the experimental group 2 months after the completion of the 6-month measurements of the control group. Demographic information, treatment information, fatigue, and quality of life scale pretest scores of the children and their parents who were admitted to the clinic were determined while the intervention group was established, and the children and their parents who have similar characteristics to the characteristics, quality of life and fatigue scale pretest scores of the children and their parents in the control group are included in the intervention group.

After a training program was provided to the children and parents in the experimental group, data of month 6 were collected and the study was completed, the same training plan was provided to the control group. Thus, it was aimed that the control group would reach training content after the study, benefit from the trainings, not be deprived of an intervention, the activity of which is proven, and not violate the ethical rules.

This study's data were collected by researchers. During data collection, each researcher visited the clinics every day and interviewed the families of the children who met the criteria. The written and oral consent of the children and their parents was obtained. The participation rate was 100%, and all the participants completed all the scales.

Research Material

The educational pamphlet for the children and parents included information on reducing pediatric oncology patients' fatigue. It was prepared by the researchers based on a review of the literature. Experts' opinions were consulted, and it was revised in accordance with their comments. Eight healthcare professionals were asked for their opinions of the educational content: a professor from the department of child health and diseases pediatric oncology, a professor from the school of physical therapy and rehabilitation, a professor and three associate professors from the department of child health and disease nursing, an associate professor from the department of oncology nursing, and a psychologist from the department of child psychiatry.

Coping training for fatigue consists of five modules (Fig. 1). Each educational module consisted of one or two 45-min sessions. The parents and children's educational programs were conducted separately. The educational content was presented using a video projector and an educational pamphlet. The educational activities involved the active participation of children and their parents in the experimental group. The participants attended the educational activities and applied them in the hospital using an interactive teaching method. Suitable educational tools such as role playing, exercises, games, and display boards were used in the sessions. In addition, game-playing activities were organized during the educational activities to engage the participants. Stress-reducing activities were organized for the children with coloring books and various materials (colorful papers, glue, crayons, felts, and activity books, etc.). These materials were hung on activity boards in the clinic hall to reward the children, and the children were encouraged to use them to reduce their stress. The training and activities in the modules were planned and conducted by the researchers so that they could be implemented in a standard and consistent manner. The children and parents in the control group were exposed to the same educational program as the children and parents in the experimental group.

Instruments

Data were collected before and after the educational program using the Child and Parent Information Form, the Symptom Assessment Scale Form for Patients, the Scale for the Assessment of Fatigue in Pediatric Oncology Patients Aged 7–12, the Scale for the Assessment of Fatigue in Pediatric Oncology Patients Aged 7–12 for Parents, and the Scale for the Quality of Life in Pediatric Oncology Patients Aged 7–12-Child and Parents Form. The data collection process took approximately 20–30 min.

The Child and Parent Information Form

This form was developed by the researcher based on the literature. It contains questions about the children's age, gender, weight, height, diagnosis, stage of cancer, treatments received, the use of medication other than chemotherapy, the ages of their parents, the educations of their parents, and their parents' income and employment status [22–24].

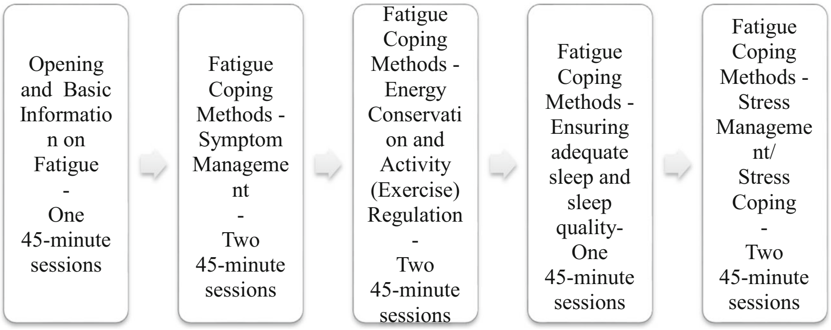

Fig. 1 Modules of coping training for fatigue

The Symptom Assessment Scale for Patients

This scale was developed by the researcher based on the literature to determine the prevalence of 27 symptoms experienced by children [22, 23, 25]. It is scored between 1 and 4. Higher scores indicate more symptoms. The response, never, is scored as 1 point and often is scored as 4 points. Eight academics, seven in the department of child health and disease nursing and one in the department of oncology nursing, were asked for their opinions about this form. They were asked to rate its items on a scale of 1 to 4 (1 = requires many changes, 4 = very appropriate). Their ratings were assessed using the Kendall test, which indicated that their consistency was adequate at 0.89.

The Scale for the Assessment of Fatigue in Pediatric Oncology Patients Aged 7–12

This scale was developed by Kudubeş, Bektaş, and Uğur in 2014 [26]. It consists of questions about the fatigue of pediatric oncology patients aged 7–12. The Cronbach's alpha of the entire scale was 0.98, its total factors loads were 0.71–0.94, and total variance being explained was 84.7%. It consists of 27 items in three subdimensions. The subdimension of general problems includes items 1 to 18. The subdimension of sleep problems includes items 19 to 24. The subdimension of problems regarding treatment includes items 25 to 27. This Likert type scale is scored between 1 (never) and 5 (always). The lowest possible score on the scale is 27 and the highest is 135. A score of 75 is the cutoff point. Scores of 74.9 or below indicate high levels of exhaustion. Higher scale scores indicate lower levels of fatigue [26].

The Scale for the Assessment of Fatigue in Pediatric Oncology Patients Aged 7–12 for Parents

This scale was developed by Kudubeş, Bektaş, and Uğur in 2014 [26]. It is intended for use with the Scale for the Assessment of Fatigue in Pediatric Oncology Patients Aged 7–12.The Cronbach's alpha of the entire scale was 0.95, total factors loads were 0.52–0.95, and total variance being explained was 85.7%. It consists of 27 items in three subdimensions. The subdimension of general problems includes items 1 to 18. The subdimension of sleep problems includes items 19 to 24. The subdimension of problems regarding treatment includes items 25 to 27. This Likert type scale is scored between 1 (never) and 5 (always). The lowest possible score on the scale is 27 and the highest is 135. A score of 82 is the cutoff point. Scores of 81.9 or less indicate high levels of fatigue. Higher scale scores indicate less fatigue [26].

The Scale for the Quality of Life in Pediatric Oncology Patients Aged 7–12-Child Form

This scale was developed by Kudubeş and Bektaş in 2015 [27]. It consists of questions about the quality of life of pediatric oncology patients aged 7–12. The Cronbach's alpha of the entire scale was 0.96, total factors loads were 0.55–0.91, and total variance being explained was 78.3%. It consists of 32 items, of which item 8 is scored in reverse. This Likert type scale is scored between 1 and 5 with 1 meaning never and 5 meaning always. The lowest possible score on the scale is 32 and the highest is 160. A score of 65 is the cutoff point. Scores of 64.9 or less indicate low quality of life, and scores over 65 indicate high quality of life of children. Higher scores indicate higher quality of life [27].

The Scale for the Quality of Life in Pediatric Oncology Patients Aged 7–12-Parents Form

This scale was developed by Kudubeş and Bektaş in 2015 [27]. It is intended for use with the Scale for the Quality of Life in Pediatric Oncology Patients Aged 7–12.The Cronbach's alpha of the entire scale was 0.96, total factors loads were 0.54–0.90, and total variance being explained was 82.5%. It consists of 32 items, of which item 8 is scored in reverse. This Likert type scale is scored between 1 and 5 with 1 meaning never and 5 meaning always. The lowest possible score on the scale is 32 and the highest is 160. A score of 93 is the cutoff point. Scores of 92.9 or less indicate low quality of life, and scores of 93 or more indicate high quality of life [27].

Data Analysis

Means and percentages were used to analyze the descriptive data. The threshold for significance was < 0.05. Skewness and kurtosis were used to test the normality of the data set, and their values ranged between − 1 and ± 1, indicating a normal distribution.

Two-way repeated measure ANOVA analysis was used in repeated measurements to compare scores on the scale for the assessment of fatigue in children and parents and mean scores on the scale for the quality of life by group, time, and group*time interactions. In the advanced analysis of the difference between the mean scores of the scale for the assessment of fatigue and the scale for the quality of life for children and their parents, one-way ANOVA analysis was used in repeated measurements to compare the mean scores of groups within the groups, and one-way ANOVA analysis and the Bonferroni adjusted *t* test were used to compare the control and experimental groups with each other. The Bonferroni adjusted *t* test, corrected in dependent groups, refers to the use of the quotient obtained by dividing the number of comparisons being made with the statistical significance critical value of 0.05 as the critical value of significance in binary comparisons [28]. The effect of the educational program on fatigue and quality of life was evaluated using regression analysis. Regression analysis was conducted to evaluate the effectiveness of the training program, and thus determined the extent to which the training program predicted fatigue and quality of life. The power and effect size of the study were calculated based on the regression analysis.

Ethical Considerations

This study was approved by the institutional review board of the university (IRB approval number: 1972-GOA-2015/07-47). Institutional permissions for the study were obtained. The written and verbal consent of the children and the parents were obtained after informing them about the purpose of the study.

Results

As a result of the analyses, it has been determined that the groups were not different in terms of age, gender, height, weight, hemoglobin value, number of hospitalization days, number of days received chemotherapy, diagnosis, type of treatment, corticosteroid use, nutritional status, catheter type, and symptom coping training, and the groups were homogeneous. In addition, it has been determined that the groups were not different in terms of mother's age, father's age, mother's employment and education status, father's employment and education, income status of family, and caregiver, and the groups were homogeneous ($p > 0.05$) (Table 1).

Table 2 shows the symptom frequency experienced by participant children and their parents in the experimental and control groups.

Multidimensional variance analysis was used in repeated measurements to determine whether there was any difference in total mean scores on the Scale for the Assessment of Fatigue—Child Form by group. The analysis found that there was a statistical significant difference between total mean scores in terms of the interactions of group ($F = 40.583$, $p = 0.000$), time ($F = 4.173$, $p = 0.017$), and group*time ($F = 154.691$, $p = 0.000$). Differences in the mean scores of subdimensions on the Scale for the Assessment of Fatigue—Child Form by group were also analyzed, and statistically significant differences were found in the mean scores on the subdimension of general problems by group ($F = 40.951$, $p = 0.000$), time ($F = 3.059$, $p = 0.049$), and group*time ($F = 151.124$, $p = 0.000$) interactions. Differences were also found between the mean scores of the subdimension of sleep problems by group ($F = 30.211$, $p = 0.000$), time ($F = 8.631$, $p = 0.000$), and group*time ($F = 104.191$, $p = 0.000$). Statistically, significant differences were found between the mean scores of the subdimension of problems regarding treatment in terms of group ($F = 47.207$, $p = 0.000$), time ($\mathrm{F} = 3.556$, $p = 0.031$), and group*time ($F = 177.980$, $p = 0.000$) interactions.

Differences by group between the total mean scores on the Scale for the Quality of Life—Child Form were examined, and statistically significant differences were found between the mean scores by group ($F = 50.247$, $p = 0.000$), time ($F = 7.120$, $p = 0.001$), and group*time ($F = 127.426$, $p = 0.000$) interactions (Table 3).

Multidimensional variance analysis was used in repeated measurements to determine whether there were any differences between the groups' total mean scores on the Scale for the Assessment of Fatigue—Parents Form. Statistically significant differences were found between the mean scores by group ($F = 40.583$, $p = 0.000$), time ($F = 4.173$, $p = 0.017$), and group*time ($F = 154.691$, $p = 0.000$) interactions. It was also determined that there were statistically significant differences between the mean scores in the subdimension of general problems by group ($F = 37.356$, $p = 0.000$), time ($F = 4.351$, $p = 0.014$), and group*time ($F = 132.883$, $p = 0.000$) interactions. There was no significant difference between the mean scores in the subdimension of sleep problems in terms of time ($F = 0.496$, $p = 0.610$), but there were statistically significant differences by group ($F = 40.322$, $p = 0.000$), and group*time ($F = 174.957$, $p = 0.000$) interactions. There were statistically significant differences between the mean scores in the subdimension of problems regarding treatment by group ($F = 46.378$, $p = 0.000$), time ($F = 11.921$, $p = 0.000$), and group*time ($F = 226.271$, $p = 0.000$) (Table 4).

Table 1 Descriptive characteristics of pediatric oncology patients and their parents

Descriptive characteristics		Experimental group		Control group		X^2/t	p
		X ± Sd		*X* ± Sd			
Age		9.35 ± 2.19		9.07 ± 1.71		0.625	0.534
Height		134.40 ± 14.28		132.12 ± 9.27		0.845	0.401
Weight		32.15 ± 10.67		31.65 ± 47.11		0.248	0.805
Mother's age		37.10 ± 6.16		36.42 ± 5.80		0.504	0.616
Father's age		39.55 ± 7.09		39.12 ± 6.31		0.283	0.778
Hemoglobin value	Pretest	10.54 ± 1.96		10.44 ± 0.88		0.279	0.781
	Posttest 1	10.02 ± 1.65		10.25 ± 0.91			
	Posttest 2	9.90 ± 1.66		9.99 ± 0.77			
		n	%	*n*	%	X^2/t	p
Gender						0.818	0.366
Female		15	37.5	19	47.5		
Male		25	62.5	21	52.5		
Diagnosis						0.202	0.653
Oncological diseases		23	57.5	21	52.5		
Hematologic diseases		17	42.5	19	47.5		
Type of treatment						0.464	0.496
Chemotherapy		22	55.0	25	62.5		
Combination therapy		18	45.0	15	37.5		
Receiving status of corticosteroid therapy						0.082	0.775
No		7	17.5	8	20.0		
Yes		33	82.5	32	80.0		
Type of catheter						2.400	0.121
Intravenous catheter		7	17.5	13	32.5		
Implanted port catheter		33	82.5	27	67.5		
Receiving status of symptom management education						0.082	0.775
No		8	20.0	7	17.5		
Yes		32	80.0	33	82.5		

It was examined whether there was any difference between the groups' total mean scores on the Scale for the Quality of Life—Parents Form and statistically significant differences were found between the mean scores by group ($F = 51.125$, $p = 0.000$), time ($F = 5.517$, $p = 0.005$), and group*time ($F = 135.464$, $p = 0.000$) interactions.

The relationship between the educational program with fatigue and quality of life was examined, and a highly positive significant relationship was determined on the Scale for the Assessment of Fatigue—Child Form and the Scale for the Assessment of Fatigue—Parents Form ($p < 0.01$). A strong negative significant relationship was determined on the Scale for the Quality of Life—Child Form and the Scale for the Quality of Life—Parents Form ($p < 0.01$).

The interaction rate of changes in the children's fatigue levels and quality life was examined (Table 5). The educational program explains 71% ($R^2 = 0.712$) of a decline in fatigue and reduced fatigue by 0.844 ($\beta = 0.844$) times. The educational program explains 65.5% ($R^2 = 0.655$) of an increase in quality of life and increased quality of life by 0.809 ($\beta = -0.809$) times.

The interaction rate of changes in the parents' assessment of fatigue levels and quality of life was examined (Table 6). The educational program explains 71.2% ($R^2 = 0.712$) of a decline in fatigue level and reduced fatigue by 0.844 ($\beta = 0.844$) times. The educational program explains 75.7% ($R^2 = 0.757$) of an increase in quality of life and increased quality of life by 0.870 ($\beta = -0.870$) times.

Power and effect size were evaluated using regression analysis. The power and effect size of the Scale for the Assessment of Fatigue—Child Form were found to be 0.98 and (f^2) 0.31, respectively. The power and effect size of the Scale for the Quality of Life—Child Form were found to be 0.99 and (f^2) 0.29, respectively. In addition, the power and effect size of the Scale for the Assessment of Fatigue—Parents Form were found to be 0.99 and (f^2) 0.23, respectively. The power and effect size of the Scale for the Quality of Life—Parents Form were found to be 0.99 and (f^2) 0.21, respectively.

Table 2 Symptom frequency experienced by those in the experimental and control groups

Symptoms	Pre-education				Post-education (third month)				Post-education (sixth month)			
	Experimental group		Control group		Experimental group		Control group		Experimental group		Control group	
	n	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%
Nausea												
Never	10	25.0	4	10.0	39	97.5	2	5.0	22	55.0	3	7.5
Little	0	0.0	17	42.5	1	2.5	18	45.0	16	40.0	16	40.0
Medium	18	45.0	14	35.0	0	0.0	14	35.0	2	5.0	16	40.0
Very much	12	30.0	5	12.5	0	0.0	6	15.0	0	0.0	5	12.5
Vomiting												
Never	11	27.5	5	12.5	39	97.5	2	5.0	22	55.0	3	7.5
Little	0	0.0	17	42.5	1	2.5	18	45.0	16	40.0	16	40.0
Medium	18	45.0	13	32.5	0	0.0	14	35.0	2	5.0	16	40.0
Very much	11	27.5	5	12.5	0	0.0	6	15.0	0	0.0	5	12.5
Mucositis												
Never	22	55.0	21	52.5	37	92.5	21	52.5	19	47.5	17	42.5
Little	1	2.5	1	2.5	0	0.0	2	5.0	0	0.0	4	10.0
Medium	9	22.5	13	32.5	1	2.5	9	22.5	16	40.0	11	27.5
Very much	8	20.0	5	12.5	2	5.0	8	20.0	5	12.5	8	20.0
Weakness												
Never	0	0.0	2	5.0	0	0.0	0	0.0	4	10.0	0	0.0
Little	2	5.0	17	42.5	29	72.5	17	42.5	36	90.0	3	7.5
Medium	25	62.5	15	37.5	10	25.0	14	35.0	0	0.0	23	57.5
Very much	13	32.5	6	15.0	1	2.5	9	22.5	0	0.0	14	35.0
Loss of weight												
Never	1	2.5	4	10.0	0	0.0	2	5.0	2	5.0	0	0.0
Little	5	12.5	19	47.5	29	72.5	17	42.5	38	95.0	4	10.0
Medium	20	50.0	11	27.5	10	25.0	13	32.5	0	0.0	25	62.5
Very much	14	35.0	6	15.0	1	2.5	8	20.0	0	0.0	11	27.5
Lack of appetite												
Never	2	5.0	1	2.5	10	25.0	1	2.5	13	32.5	0	0.0
Little	5	12.5	19	47.5	19	47.5	18	45.0	27	67.5	3	7.5
Medium	21	52.5	12	30.0	10	25.0	13	32.5	0	0.0	26	65.0
Very much	12	30.0	8	20.0	1	2.5	8	20.0	0	0.0	11	27.5
Sleep difficulties												
Never	4	10.0	14	35.0	16	40.0	14	35.0	19	47.5	7	17.5
Little	11	27.5	23	57.5	20	50.0	22	55.0	4	10.0	5	12.5
Medium	16	40.0	1	2.5	3	7.5	3	7.5	17	42.5	20	50.0
Very much	9	22.5	2	5.0	1	2.5	1	2.5	0	0.0	8	20.0

Discussion

This was associated with the content of the educational program effectively helping the children and parents to cope with cancer-related symptoms, reduce fatigue, and increase the quality of life. The increase in symptoms in the control group was due to increased fatigue and reduced quality of life. The literature on symptom prevalence in children with cancer indicates that children have a high prevalence of symptoms during cancer and its treatment. The findings of this study are compatible with the literature [4–7].

This study found significant differences between experimental and control groups' total scores on the Scale for the Assessment of Fatigue—Child Form and the Scale for the Assessment of Fatigue—Parents Form by group, time, and both group*time. An increase in the experimental group parents' total scores on the Scale for the Assessment of Fatigue by time was also statistically significant. This study's findings

Table 3 The comparison of the experimental and control groups' mean scores on the Scale for the Assessment of Fatigue in Pediatric Oncology Patients Aged 7–12 and the Scale for the Quality of Life in Pediatric Oncology Patients Aged 7–12—Child Form ($n = 80$)

Time/group		Pretest *X* ± SS	Posttest 1 *X* ± SS	Posttest 2 *X* ± SS		*F*	*p*
Assessment of Fatigue in Pediatric Oncology Patients Aged 7–12	Experimental group	46.32 ± 16.26	67.92 ± 11.34	77.87 ± 3.43	Group	40.583	0.000
	Control group	65.42 ± 23.71	50.45 ± 16.50	29.47 ± 8.32	Time	4.173	0.017
					Group*time	154.691	0.000
Assessment of Fatigue in Pediatric Oncology Patients Aged 7–12	Experimental group	31.27 ± 10.99	45.52 ± 8.27	53.05 ± 1.03	Group	40.951	0.000
Subdimension of general problems	Control group	44.00 ± 16.77	33.67 ± 11.22	19.62 ± 5.41	Time	3.059	0.049
					Group*time	151.124	0.000
Assessment of Fatigue in Pediatric Oncology Patients Aged 7–12	Experimental group	4.77 ± 1.92	7.52 ± 1.19	9.00 ± 0.01			
Subdimension of problems regarding treatment	Control group	7.05 ± 2.69	5.42 ± 1.56	3.27 ± 1.01	Group	47.207	0.000
					Time	3.556	0.031
					Group*time	177.980	0.000
Scale for the Quality of Life in Pediatric Oncology Patients Aged 7–12—Child Form	Experimental group	57.95 ± 16.79	81.17 ± 9.43	89.07 ± 7.38			
	Control group	75.30 ± 21.69	63.42 ± 15.60	40.62 ± 13.18	Group	50.247	0.000
					Time	7.120	0.001
					Group*time	127.426	0.000

are compatible with the literature, which indicates that increased symptom prevalence increases fatigue, and help with managing fatigue reduces it [17, 29, 30]. This study found that after the educational program there was a reduction in the prevalence of symptoms in the experimental group, and that the control group's prevalence of symptoms increased with time, which may be one of the reasons for the increase in fatigue in the control group. The educational program for the experimental group helped them to manage symptoms, reduced their symptoms, and also reduced their fatigue levels. The educational program raised their awareness that fatigue is a symptom about which healthcare professionals should be informed. The educational program also reduced fatigue by encouraging children to increase their activities and to regulate their sleeping patterns. The educational program increased children's self-confidence by helping them to manage their stress and improve their quality of life. Thanks to the educational program, the children perceived playing games in the hospital as an effective way to manage stress and rid themselves of the idea that there was nothing to do when they were hospitalized. Playing games increased the daily activities of a child and reduced fatigue levels by relieving their stress and thus improving their quality of life.

Significant differences were found between the experimental and control groups' scores in the subdimension of general problems on the Scale for the Assessment of Fatigue—Child Form and the Scale for the Assessment of Fatigue—Parents Form by group, time, and both group*time. This discussion section mainly concentrates on the area of activities and exercises as a subdimension of general problems on the Scale for the Assessment of Fatigue. The literature indicates that individual exercise programs for children reduce fatigue levels [31, 32]. The findings of this study are compatible with the literature. The educational program reduced fatigue by encouraging children to increase their activities and motivating them to exercise.

This study found significant differences between the experimental and control groups' scores in the subdimension of sleeping problems on the Scale for the Assessment of Fatigue—Child Form by group, time, and group*time. Significant differences were also found between their scores in the subdimension of sleeping problems on the Scale for the Assessment of Fatigue—Parents Form by time and time*group, but not found by time. The literature on the effect of sleeping problems of children with cancer on their fatigue levels indicates that children with sleeping problems have higher levels of fatigue. The findings of this study are compatible with the literature, an increase in sleeping problems increases fatigue while interventions to provide sleep hygiene and regular sleeping pattern reduce it [33–35]. In this study, children and their parents were informed by an educational program about how to reduce fatigue by establishing regular sleeping patterns by keeping their bedrooms dark, limiting naps to 20–30 min, determine awake and sleep time and increasing their motivation, which effectively reduced their sleeping problems. However, there was no difference in the parents' scores by time which may be due to the fact that over time parents start to consider increased sleep-related fatigue to be normal. In addition, as the prevalence of symptoms in the control group increased over time, their sleeping patterns were negatively affected and caused an increase in sleeping problems which increased their fatigue levels.

Table 4 The comparison of the experimental and control groups' total mean scores on the Scale for the Assessment of Fatigue in Pediatric Oncology Patients Aged 7–12 for Parents and the Scale for the Quality of Life in Pediatric Oncology Patients Aged 7–12-Parents Form ($n = 80$)

Time/group		Pretest X ± SS	Posttest 1 X ± SS	Posttest 2 X ± SS	F	p
Scale for the Assessment of Fatigue in Pediatric Oncology Patients Aged 7–12 for Parents	Experimental group	46.32 ± 16.26	67.92 ± 11.34	77.87 ± 3.43	Group	40.583 0.000
	Control group	65.42 ± 23.71	50.45 ± 16.50	29.47 ± 8.32	Time	4.173 0.017
					Group*time	154.691 0.000
Scale for the Assessment of Fatigue in Pediatric Oncology Patients Aged 7–12 for Parents Subdimension of General Problems	Experimental group	31.27 ± 10.99	45.22 ± 7.82	51.25 ± 2.96	Group	37.356 0.000
	Control group	44.00 ± 16.77	33.68 ± 11.23	19.63 ± 5.41	Time	4.351 0.014
					Group*time	132.883 0.000
Scale for the Assessment of Fatigue in Pediatric Oncology Patients Aged 7–12 for Parents Subdimension of Sleep Problems	Experimental group	10.38 ± 3.93	14.05 ± 2.19	18.00 ± 0.01	Group	40.322 0.000
	Control group	14.38 ± 4.62	11.32 ± 3.91	6.60 ± 2.03	Time	0.496 0.610
					Group*time	174.957 0.000
Scale for the Assessment of Fatigue in Pediatric Oncology Patients Aged 7–12 for Parents Sub-Dimension of Problems Regarding Treatment	Experimental group	4.78 ± 1.93	7.95 ± 1.44	7.73 ± 1.50	Group	46.378 0.000
	Control group	6.85 ± 2.44	5.43 ± 1.57	3.25 ± 0.89	Time	11.921 0.000
					Group*time	226.217 0.000
Quality of Life in Pediatric Oncology Patients Aged 7–12—Parents Form	Experimental group	57.48 ± 16.49	81.20 ± 10.07	90.77 ± 5.47	Group	51.125 0.000
	Control group	75.42 ± 22.16	63.05 ± 14.82	41.27 ± 14.24	Time	5.517 0.005
					Group*time	135.464 0.000

This study found significant differences between the experimental and control groups' scores in the subdimension of problems regarding treatment on the Scale for the Assessment of Fatigue—Child Form by group, time, and group*time. Significant differences were also found among the experimental and control groups' scores in the subdimension of problems regarding treatment on the Scale for the Assessment of Fatigue—Parents Form by group and group*time, but not found by time. The literature indicates that fatigue particularly after treatment is relatively higher than in other stages of the disease [36, 37]. This study's findings are compatible with the literature. This study's educational program helped the children manage their stress and their social activities. It was effective before, during, and after treatment, reducing their fatigue by entertaining them. Trying to distract patients' attention from troubling thoughts is frequently used to manage nausea, vomiting, and pain, which were the most prevalent symptoms, particularly in the experimental group. The educational program included various activities intended to manage stress, to distract their attention from troubling thoughts and to raise parents' awareness. These methods successfully reduced the children's fatigue levels by distracting them. However, there was no difference between the first and second final test for parents, mainly due to the fact that the social activities performed by the children were regarded as playing games by their parents, and their parents probably assumed that playing games would not affect their fatigue levels [36, 37].

Significant differences were found between the experimental and the control groups' total mean scores on the Scale for the Quality of Life—Child Form and the Scale for the Quality of Life—Parents Form in terms of group, time, and group*time. The literature on the examination of the relationship between fatigue levels and quality of life of children with cancer suggests that an increase in fatigue levels negatively affect quality of life of children [30, 38, 39]. The findings of this study are compatible with the literature: increased fatigue reduces quality of life, and proper nursing interventions have a positive effect on quality of life. This study's educational program for the experimental group increased their quality of life by helping them to manage symptoms and encouraging them to engage in stress-reducing social activities. An increase in the symptom burden of children with cancer has a negative effect on their quality of life. The educational program reduced the experimental group's fatigue levels and increased their biological quality of life by addressing the symptoms of fatigue and reducing the prevalence of symptoms. The psychological and social aspects of the children's quality of life were also addressed by including games, one of the most important parts of children's lives, in the educational program. Distracting children's attention from troubling thoughts helps them manage their stress and increases their quality of life. Information about activity planning and sleeping patterns has positive effects on the behaviors and activities that improve children's quality of life [30, 38–41].

Literature indicates that there are many factors that affect and examine the effect size of fatigue and quality of life [13, 14, 42–44]. This study's educational program was found to affect multiple dimensions of fatigue and quality of life. This finding is significant because it demonstrates the effectiveness of this study. The educational program for children and parents included important information affecting fatigue and quality of life, sleep, nutrition, and symptom management and stress-relieving activities. It was also designed to meet child-specific needs. The power and effect size of educational

Table 5 The predictive power of the educational program on the change in fatigue and quality of life based on the children's self-assessment

Variable	Fatigue					Quality of life				
	B	SH	*β*	*t*	*p*	*B*	SH	*β*	*t*	*p*
Constant				10.456	0.000				9.072	0.000
Experiment*	67.500	4.862	0.844	13.882	0.000	−65.800	5.405	−0.809	12.173	0.000
R	0.844					0.809				
R^2	0.712					0.655				
F	192.707					148.181				
p	0.000					0.000				
DW (1.5–2.5)**	2.167					1.574				

*While coding, the experimental group was coded as 1 and the control group was coded as 0

**Regression analysis assumes no correlation between independent and dependent variables as well as no correlation between error terms. SPSS has developed a simple criterion for correlation problems. The Durbin Watson statistic determines whether there is a correlation between statistical error terms and records values between 0 and 4. If the statistical value is around 2, it is interpreted as no correlation. Values close to 0 indicate high-positive correlation, whereas values close to 4 indicate high-negative correlation

programs on the fatigue and quality of life of children and their parents are not available in the literature on fatigue-related education. Therefore, these findings were not discussed and compared with the literature. However, these findings indicate that this is a practical and effective study.

Conclusion and Implications for Practice

This study concluded that its fatigue-related educational program effectively reduced the fatigue and increased the quality of life of pediatric oncology patients, thus contributing to the Turkish and international literature on the subject. The use of fatigue-related education by nurses in pediatric oncology clinics will have positive effects on children and their parents. Since fatigue is an easily ignored symptom, fatigue-related educational programs will effectively raise awareness about fatigue and its management.

This is an intervention study. The training in the study was conducted through the use of one-on-one interviews with both children and parents in an interactive environment. Psychosocial support was provided to children and their parents by including games and activities during the training. A rich training content was created by including subjects such as symptoms of fatigue, strategies to use in coping with other symptoms leading to fatigue, and ways of ensuring regular sleep. Also, subjects included teaching appropriate activities and exercises, and strategies to cope with stress.

It was observed that children and parents culturally did not report symptoms of fatigue to healthcare staff because they regarded fatigue as a natural process of the disease. This leads to under-reporting of fatigue. In addition, the healthcare personnel do not consider fatigue as a symptom because of a shared culture.

Limitations

In the research process, the training program was held in the meeting room in the hematology-oncology clinic of a university hospital at a time determined together with the child and the

Table 6 The predictive power of the educational program on the change in fatigue and quality of life based on the parents' assessment

Variable	Fatigue					Quality of life				
	B	SH	*B*	*T*	*p*	*B*	SH	*β*	*T*	*p*
Constant				10.456	0.000				10.470	0.000
Experiment*	67.500	4.862	0.844	13.882	0.000	−71.950	4.613	−0.870	15.598	0.000
R	0.844					0.870				
R^2	0.712					0.757				
F	192.707					243.295				
P	0.000					0.000				
DW (1.5–2.5)	2.167					1.592				

*While coding, the experimental group was coded as 1 and the control group was coded as 0 parent via a barcovision purchased by project budget. However, during the training of the last three children and their parents, the pediatric clinic was moved to a different area within the hospital. Because there is no private meeting room in the new area of the clinic, the training of the last three children and their parents has been made in single rooms where children are treated. The symptom evaluation form used in the study was developed by the researchers. Expert opinions were obtained and the content validity index was calculated in order to ensure the reliability and validity of the evaluation form. This situation constitutes a limitation for the study.

Funding This study was supported by TÜBİTAK 3001-Starting R&D Projects Funding Program with the project number 115S806.

Compliance with Ethical Standards

Conflict of Interests The authors declare that they have no conflicts of interest.

Statement of Informed Consent This study was approved by the institutional review board of the university (IRB approval number: 1972-GOA-2015/07-47). Institutional permissions for the study were obtained. The written and verbal consent of the children and the parents were obtained after informing them about the purpose of the study.

References

1. Cancer Facts & Figures 2018 - American Cancer Society. https://www.cancer.org/content/dam/cancer-org/research/cancer-facts-and-statistics/annual-cancer-facts-and-figures/2018/cancer-facts-and-figures-2018.pdf. Accessed 23 June 2018.
2. Andersen C, Adamsen L, Moeller T, Midtgaard J, Quist M, Tveteraas A, Rorth M (2006) The effect of a multidimensional exercise programme on symptoms and side-effects in cancer patients undergoing chemotherapy-the use of semi-structured diaries. Eur J Oncol Nurs 10(4):247–262. https://doi.org/10.1016/j.ejon.2005.12.007
3. Woodgate RL (2008) Feeling states: a new approach to understanding how children and adolescents with cancer experience symptoms. Cancer Nurs 31:229–238. https://doi.org/10.1097/01.NCC.0000305731.95839.
4. Jalmsell L, Kreicbergs U, Onelöv E, Steineck G, Henter J (2006) Symptoms affecting children with malignancies during the last month of life: a nationwide follow up. Pediatrics 117(4):1314–1320. https://doi.org/10.1542/peds.2005-1479
5. Cleve LV, Muñoz CE, Savedra V (2012) Symptoms in children with advanced cancer: child and nurse reports. Cancer Nurs 35(2):115–125. https://doi.org/10.1097/NCC.0b013e31821aedba
6. Williams PD, Williams AR, Kelly KP, Dobo C, Gieseking A, Connor R, Ridder L, Potter N, Del Favero D (2012) Symptom checklist for children with cancer. Cancer Nurs 35(2):89–98. https://doi.org/10.1097/NCC.0b013e31821a51f6.
7. Turan SA, Esenay FI, Güven M (2016) Kanserli çocuklarda kemoterapi sonrası görülen semptomlar. J Curr Pediatr 14:74–81
8. National Cancer Comprehensive Network Guidelines, 2010. https://www.nccn.org/store/login/login.aspx?ReturnURL=https://www.nccn.org/professionals/physician_gls/pdf/fatigue.pdf. Accessed 13 June 2017.
9. Waller A, Caroline NL (2007) Handbook of pallative care in cancer. Woburn Butterworth-Heineman, Massachusetts
10. Karakoç T (2008) Kanser hastalarında yorgunluk ve hemşirelik bakımı. Fırat Sağlık Hizmetleri Dergisi 3(8):99–118
11. Davies B, Whitsett SF, Bruce A, McCarthy P (2002) A typology of fatigue in children with cancer. J Pediatr Oncol Nurs 19(1):12–21. https://doi.org/10.1053/jpon.2002.30012
12. Mooney-Doyle K (2006) An examination of fatigue in advanced childhood cancer. J Pediatr Oncol Nurs 23(6):305–310. https://doi.org/10.1177/1043454206293269
13. De Bolle M, De Clercq B, De Fruyt F, Benoit Y (2008) Self- and parental perspectives on quality of life in children with cancer. J Psychosoc Oncol 26:35–47
14. Matzioua V, Perdikarisb P, Felonic D, Moshovi M, Tsoumakas K, Merkouris A (2008) Cancer in childhood: children's and parents' aspects for quality of life. Eur J Oncol Nurs 12:209–216. https://doi.org/10.1016/j.ejon.2007.10.005
15. Tomlinson D, Hinds PS, Bartels U, Hendershot E, Sung L (2011) Parent reports of quality of life for pediatric patients with cancer with no realistic chance of cure. J Clin Oncol 29(6):639–645. https://doi.org/10.1200/JCO.2010.31.4047
16. Tahmasebi M, Yarandi F, Eftekhar Z, Montazeri A, Namazi H (2007) Quality of life in gynecologic cancer patients. Asian Pac J Cancer Prev 8:591–592
17. Genc RE, Conk Z (2008) Impact of effective nursing interventions to the fatigue syndrome in children who receive chemotherapy. Cancer Nurs 31(4):312–317. https://doi.org/10.1097/01.NCC.0000305740.18711.c6
18. Berger AM, Mitchell SA, Jacobsen PB, Pirl WF (2015) Screening, evaluation, and management of cancer-related fatigue: ready for implementation to practice? CA Cancer J Clin 65(3):190–211. https://doi.org/10.3322/caac.21268
19. Yesilbalkan ÖU, Karadakovan A, Göker E (2009) The effectiveness of nursing education as an intervention to decrease fatigue in Turkish patients receiving chemotherapy. Oncol Nurs Forum 36(4):215–222. https://doi.org/10.1188/09.ONF.E215-E222
20. Kestler SA, LoBiondo-Wood G (2012) Review of symptom experiences in children and adolescents with cancer. Cancer Nurs 35(2):E31–E49. https://doi.org/10.1097/NCC.0b013e3182207a2a
21. Barrera M, Pringle LB, Sumbler K, Saunders F (2000) Quality of life and behavioral adjustment after pediatric bone marrow transplantation. Bone Marrow Transplant 26(4):427–435. https://doi.org/10.1038/sj.bmt.1702527
22. Woodgate RL, Degner LF (2003) Expectations and beliefs about children's cancer symptoms: perspectives of children with cancer and their families. Oncol Nurs Forum 30(3):479–491. https://doi.org/10.1188/03.ONF.479-491
23. Woodgate RL, Degner LF, Yanofsky R (2003) A different perspective to approaching cancer symptoms in children. J Pain Symptom Manag 26(3):800–817. https://doi.org/10.1016/S0885-3924(03)00285-9
24. Taş F, Yılmaz HB (2008) Pediatrik onkoloji hastalarında yaşam kalitesi kavramı. Turk. J Oncol 23(2):104–107
25. Yılmaz BH, Muslu GK, Taş F (2009) Çocukların kansere bağlı yaşadıkları semptomlar ve yorgunluğa ebeveyn bakışı. Turk. J Oncol 24(3):122–127
26. Kudubes AA, Bektas M, Ugur O (2014) Developing a scale for the assessment of fatigue in pediatric oncology patients aged 7-12 for children and parents. Asian Pac J Cancer Prev 15(23):10199–10207. https://doi.org/10.7314/APJCP.2014.15.23.10199
27. Kudubes AA, Bektas M (2015) Developing a scale for quality of life in pediatric oncology patients aged 7-12-children and parent forms. Asian Pac J Cancer Prev 16(2):523–529. https://doi.org/10.7314/APJCP.2015.16.2.523

28. Eral G, Ertem VH (2013) Nicel verilerin yer aldığı bağımsız ve bağımlı gruplarda uygulanan istatistiksel yöntemler. Çocuk Dergisi 13(4):138–140
29. Takken T, van der Torre P, Zwerink M, Hulzebos EH, Bierings M, Helders PJ, van der Net J (2009) Development, feasibility and efficacy of a community-based exercise training program in pediatric cancer survivors. Psychooncology 15(4):440–448. https://doi.org/10.1002/pon.1484
30. Ullrich CK, Dussel V, Hilden JM, Sheaffer JW, Moore CL, Berde CB, Wolfe J (2010) Fatigue in children with cancer at the end of life. J Pain Symptom Manag 40(4):483–494. https://doi.org/10.1016/j.jpainsymman.
31. Yeh CH, Man Wai JP, Lin US, Chiang YC (2011) A pilot study to examine the feasibility and effects of a home-based aerobic program on reducing fatigue in children with acute lymphoblastic leukemia. Cancer Nurs 34(1):3–12. https://doi.org/10.1097/NCC.0b013e3181e4553c
32. Tanır MK, Kuğuoğlu S (2012) Olgu sunumu: Akut lenfoblastik lösemi (ALL)' li çocuğun evde egzersiz programının sürdürülmesi. Ankara Sağlık Hizmetleri Dergisi 11(1):51–61
33. Hinds PS, Hockenberry M, Rai SN, Zhang L, Bassem RI, McCarthy K, Cremer L, Rodriguez-Galindo C (2007) Nocturnal awakenings, sleep environment interruptions, and fatigue in hospitalized children with cancer. Oncol Nurs Forum 34(2):393–402. https://doi.org/10.1188/07.ONF.393-402
34. Zupanec S, Jones H, Stremler R (2010) Sleep habits and fatigue of children receiving maintenance chemotherapy for all and their parents. J Pediatr Oncol Nurs 27(4):217–228. https://doi.org/10.1177/1043454209358890
35. Rosen G, Brand SR (2011) Sleep in children with cancer: case review of 70 children evaluated in a comprehensive pediatric sleep center. Support Care Cancer 19(7):985–994. https://doi.org/10.1007/s00520-010-0921-y
36. Eiser C, Eiser JR, Stride CB (2005) Quality of life in children newly diagnosed with cancer and their mothers. Health Qual Life Outcomes 3(1):29. https://doi.org/10.1186/1477-7525-3-29.
37. Hockenberry MJ, Hooke MC, Gregurich M, McCarthy K (2009) Carnitine plasma levels and fatigue in children/adolescents receiving cisplatin, ifosfamide, or doxorubicin. J Pediatr Hematol Oncol 31(9):664–669. https://doi.org/10.1097/MPH.0b013e3181b259a7
38. Lashlee M, O'hanlon-Curry J (2007) Pediatric home chemotherapy: infusing quality of life. J Pediatr Oncol Nurs 24(5):294–298. https://doi.org/10.1177/1043454207304908
39. Meeske KA, Patel SK, Palmer SN, Nelson MB, Parow AM (2007) Factors associated with health-related quality of life in pediatric cancer survivors. Pediatr Blood Cancer 49(3):298–305. https://doi.org/10.1002/pbc.20923
40. Hörnquist JO (1982) The concept of quality of life. Scand J Soc Med 10(2):57–61
41. Pınar R (1997) Sağlıkla ilgili yaşam kalitesi. Sendrom Dergisi 9(9): 117–124
42. Payot A, Barrington KJ (2011) The quality of life of young children and infants with chronic medical problems: review of the literature. Curr Probl Pediatr Adolesc Health Care 41(4):91–101. https://doi.org/10.1016/j.cppeds.2010.10.008
43. Barsevick AM, Irwin MR, Hinds P, Miller A, Berger A, Jacobsen P, Ancoli-Israel S, Reeve BB, Mustian K, O'Mara A, Lai JS, Fisch M, Cella D (2013) Recommendations for high-priority research on cancer-related fatigue in children and adults. J Natl Cancer Inst 105(19):1432–1440. https://doi.org/10.1093/jnci/djt242
44. Bower JE (2014) Cancer-related fatigue mechanisms, risk factors, and treatments. Nat Rev Clin Oncol 11(10):597–609. https://doi.org/10.1038/nrclinonc.