The Predictive Power of Pain Characteristics and Sleep Quality on Fatigue in Adolescents with Cancer

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Abstract

Purpose

This study was conducted as descriptive, methodological, and cross-sectional research to determine the predictive power of pain characteristics and sleep quality on fatigue in adolescents with cancer.

Method

The study was conducted between November 2020 and April 2021 with 139 adolescents with cancer who reported pain. The study data were collected via an Adolescent Information Form, the Adolescent Pediatric Pain Tool, the Scale for the Assessment of Fatigue in Pediatric Oncology Patients Aged 13-18, and the Sleep Assessment Scale for Children with Cancer - Adolescent Form. Mean values, percentage calculations, Pearson correlation analysis, and linear regression analysis were used in the analysis of the data.

Results

There was a high level and negative correlation between pain characteristics (pain location, severity, and quality) of the adolescents participating in the study and their mean scores from the overall fatigue scale and its sub-dimensions and a high level and positive correlation with their mean scores from the overall sleep quality scale. Pain characteristics (pain location, severity, and quality) and sleep quality of adolescents with cancer explained 74% of fatigue.

Conclusions

Pain, sleep quality, and fatigue are symptoms that should be closely addressed in adolescents with cancer. Pain and sleep quality directly affect fatigue, and as sleep quality increases, fatigue decreases.

Introduction

As a result of medical developments in pediatric oncology, childhood cancers today are not seen as an acute or terminal disease but a life-threatening chronic disease [1]. However, while the methods used in cancer treatment increase the recovery rates, on the other hand, they can cause undesirable outcomes for the child and the family [1]. Cancer treatment can cause many disturbing symptoms in children. Pain, fatigue, and sleep problems are among the most common symptoms and constitute an important area in the care of children with cancer [2, 3].

Pain is a common experience in adolescents with cancer and is cited as one of the most common factors that impair quality of life. Pain in adolescents with cancer is seen depending on the nature of cancer, its treatment and side effects, and various interventional procedures [2, 4]. Adolescents' daily living activities are affected by pain, and problems, such as fatigue, decreased sleep quality, eating disorders, and falling school success, are experienced [5, 6]. Depending on various factors such as the type, location, duration, and cause of the pain, the fatigue and sleep quality of adolescents change [2, 3].

Fatigue is one of the common symptoms in adolescents with cancer. Some studies in the literature have shown that 51-86% of adolescents with cancer experience fatigue due to cancer and its treatment [3, 7, 8]. Adolescents with cancer are affected by symptoms, such as fatigue, anemia, pain, sleep problems, nausea, and vomiting. In particular, as the severity and the duration of pain that adolescents experience increase, their fatigue increases, as well [9, 10]. The child's need for rest increases depending on fatigue, and problems such as insomnia/excessive sleepiness are observed. Therefore, it is important to determine the factors that affect fatigue to plan care [10].

Frequent hospitalizations, physical symptoms, and the side effects of drugs/treatment are factors that cause sleep problems in adolescents with cancer. Sleep quality frequently decreases, especially due to side effects, such as pain, oral mucositis, and nausea-vomiting experienced by adolescents [11]. Some studies have reported that adolescents with chronic diseases such as cancer experience more sleep problems [11–13]. Inadequate and poor-quality sleep may lead to difficulties in performing daily functions, focusing and memory problems, low motivation, deterioration in mood, behavioral and cognitive problems, anxiety, and increased fatigue [11].

The effectiveness of interventions to treat fatigue and sleep problems depends on the accurate assessment of the factors that affect these symptoms. Considering the multidimensional nature of fatigue and sleep problems, it is important to determine each of the influencing factors [14]. For this reason, it is important to comprehensively evaluate pain, which is one of the important factors that affect fatigue and sleep quality, and to reveal the relationship between these three factors [14, 15]. A review of the literature indicated that fatigue, sleep quality, and pain were examined in detail separately, but studies on the relationship between these three symptoms and the predictive power of pain and sleep quality on fatigue were limited [4, 11, 15, 16]. Therefore, there is a need for studies on the predictive power of pain characteristics and sleep quality on fatigue in adolescents with cancer in our country.

This study was planned to determine the predictive power of pain characteristics and sleep quality on fatigue in adolescents with cancer. To do this, the following research questions were generated:

1. What are the pain characteristics of adolescents with cancer?
2. What are the mean fatigue and sleep quality scores of adolescents with cancer?
3. What is the relationship between pain characteristics, fatigue, and sleep quality in adolescents with cancer?
4. What is the predictive power of pain characteristics and sleep quality on fatigue in adolescents with cancer?

Methods

Study Design and Setting

The sample universe consisted of adolescents who were being treated at the Pediatric Oncology and Hematology Divisions of a university hospital located in Izmir and who had undergone chemotherapy between November 2020 and April 2021.

Participants

Participants were individuals who (a) were aged between 13 and 18, (b) were being treated at the Pediatric Oncology and Hematology, (c) who reported pain, (d) adolescents without nausea and vomiting, (e) adolescents not using sedative analgesics, (f) adolescents with a hemoglobin value above 10 mg/dl and (g) volunteered to participate in the study. Adolescents who were in the terminal period, had consciousness and/or sensory disorders, could not express themselves, were not literate, and did not want to participate were not included in the study. The minimum sample size required for the study was calculated using the GPOWER 3.0 statistical analysis software based on a Type I error of 0.05, Type II error of 0.20 (0.80 power) and 0.15 (medium) effect size, and the sample size required for multiple linear regression analysis was determined as 107 adolescents with cancer.

The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Checklist was used as a guideline (See Figure I). A total of 143 adolescents were evaluated for eligibility between November 2020 and April 2021. Individuals with communication problems ($n = 1$) and those who refused to participate ($n = 3$) were not included in the study. Therefore, a total of 139 adolescents were included in the study by using the convenience sampling method (Figure 1).

Outcome Measures

Adolescent Information Form

This form, which was created by the researchers based on the literature, consists of 12 questions, which were designed to obtain descriptive data about variables used in the study, such as age, gender, diagnosis, stage of the disease, type of treatment, duration of treatment, place of treatment, presence of painful procedures applied recently, presence of mucositis, use of analgesic medication recently, the status of undergoing surgery recently, and method of coping with pain [3, 14–16].

The Adolescent Pediatric Pain Tool (APPT)

This scale was originally developed by Savedra et al. (1993) as a multidimensional (location, intensity, severity and quality of pain) measurement instrument for self-report of pain by children and adolescents between the ages of 8 and 17. Its validity and reliability study in Turkish population was conducted by Gerceker et al. (2018) [16, 17]. It is frequently used in the evaluation of cancer pain and is a multidimensional self-report tool that measures the intensity and severity of the pain experience. Cronbach's alpha value of the total scale is 0.78. It consists of three independent parts:

- (1) the total number of body areas marked on body outline diagram for the measurement of pain location,

Assessment: The child can mark the anterior and posterior sides-upper extremity, lower extremity, head, neck, abdomen, chest, shoulder, back... so that the pain area location and number are evaluated.

- (2) word graphic rating scale for the measurement of pain intensity,

Assessment: With a 0-10 cm scale, the child evaluates the pain from 0-10 and defines the intensity of the pain by choosing one of "no pain, little pain, medium pain, large pain and worst possible pain".

- (3) word descriptor list, sensory, affective, evaluative and temporal word descriptors.

Assessment: Contains 15 word sections, marks the words describing the pain. The percentage is obtained by dividing the total number of words in each dimension by the total number of words in that dimension [16, 17].

The Scale for the Assessment of Fatigue in Pediatric Oncology Patients Aged 13-18

This scale was developed by Bektas and Kudubeş in 2014 [18]. It consists of questions that determine the fatigue status of pediatric oncology patients in the 13-18 age group. Cronbach's alpha value of the total scale was 0.99, the total factor load was between 0.82 and 0.95, and the total explained variance was 89.4%. There are a total of 32 items and 4 sub-dimensions on the scale. The general problems sub-dimension includes the first 19 items for determining the fatigue of pediatric oncology patients. The sleep problems sub-dimension consists of items from 20 to 25, which are used to identify

sleep-related problems due to the fatigue experienced by pediatric oncology patients. The cognitive problems sub-dimension includes items from 26 to 29, which are used to determine the cognitive problems that develop due to fatigue experienced by pediatric oncology patients. The treatment-related problems sub-dimension includes items between 30 and 32, which are used to determine the effect of the treatment received by pediatric oncology patients on fatigue. The scale has a 5-point Likert-type evaluation structure, and each item is scored between "1" and "5". Scores that can be obtained from the scale range between 32 and 160. The cutoff point of the scale is 75.5, and scores below 75.4 indicate that the adolescent is tired. Increased scores on the scale indicate decreased levels of fatigue.

The Sleep Assessment Scale for Children with Cancer - Adolescent Form

This scale was developed by Arıcıoğlu and Bektaş in 2018 [19]. It consists of questions that were designed to determine the sleep quality of children with cancer in the 13-18 age group. Cronbach's alpha value of the total scale was 0.96, the total factor load was between 0.54 and 0.90, and the total explained variance was 82.5%. The scale consists of 20 items in total. It is a 4-point Likert-type scale, and each item is scored between "1" and "4". Scores on the scale range between 20 and 80. Increased scores indicate decreased levels of sleep quality.

Data Collection Procedure

First of all, the purpose of the study was explained to all adolescents and their parents, and they were asked to sign an informed consent form. Then, data were collected via face-to-face interviews by the principal researcher using data collection forms. Data collection took approximately 10-15 minutes for each participant.

Ethical Considerations

Before the study was initiated, the permission of the owners of the scales used in the research was obtained via e-mail. The necessary institutional permission to conduct the research was obtained. The study was approved by the University Non-Interventional Clinical Research Ethics Committee (Decision No: 5699-GOA, 2020/27-34). The principal researcher explained the purpose of the study, and obtained verbal and written informed consent from all adolescents and their parents. Participants were allowed to withdraw from the study anytime without giving any reason.

Data Analysis

The data were analyzed using SPSS version 28.0 (IBM Corp). The Shapiro-Wilk-W test, histogram, and normal Q-Q plot were used for tests of normality. Frequency and percentage values were calculated for categorical variables. Mean and standard deviation values were calculated for features showing normality. Pearson correlation analysis was employed to evaluate the relationships between the sections of the Adolescent Pediatric Pain Tool (APPT) and the Scale for the Assessment of Fatigue in Pediatric Oncology Patients Aged 13-18 and the Sleep Assessment Scale for Children with Cancer - Adolescent Form. According to the cut-off point of the fatigue scale, the patients with scores less than 75.4 were determined as tired, and those with scores greater than this cut-off point were considered not tired. The predictive level of the adolescent's pain characteristics (pain location/the total number of body areas marked on body outline diagram, pain intensity, pain severity, and pain quality/total number of word descriptors) and sleep quality on fatigue was evaluated by logistic regression analysis. A variance VIF value of <10, a tolerance value of <0.2, and a condition index value of <15, which are independent variables, were included in the logistic regression analysis. Results were evaluated with a 95% confidence interval, and the $p < 0.05$ value was accepted as a significance level.

Results

Descriptive Characteristics of the Participants

The descriptive characteristics of the adolescents participating in the study are given in Table 1. The participants in this study were homogeneous in terms of descriptive characteristics ($p > 0.05$).

Table 1
Patient characteristics (n=139)

		M±SD	Min-Max
Age		12.6 ± 3.8	8–18
		n	%
Gender	Boy	71	51
	Girl	68	49
Diagnosis	Acute Lymphoblastic Leukemia	49	35.3
	Acute Myeloid Leukemia	11	7.9
	Ewing sarcoma	22	15.8
	Osteosarcoma	21	15.1
	Neuroblastoma	9	6.5
	Lymphoma	15	10.8
	Other tumors	12	8.6
Stage of the disease	New Diagnosis/Induction	10	7.3
	Consolidation	82	59.0
	Remission	45	32.3
	Relapse	2	1.4
Type of treatment	Chemotherapy	112	80.5
	Radiotherapy	10	7.3
	Surgical	15	10.8
	Bone marrow transplantation	2	1.4
Treatment Duration	1-4 months	60	43.3
	5 - 9 months	70	50.3
	Over 10 months	9	6.4
		M±SD	Min-Max
Number of chemotherapy cure		4.1 ± 3.6	1–15
		n	%
Site where chemotherapy received	Inpatient	112	80.5
	Outpatient	27	19.5
The presence of Mucositis	Yes	18	13.0
	No	121	87.0
Painful procedures in today and the past days	Port needle change	46	33.0
	Intravenous catheter change	22	15.9
	Lumbar puncture	22	15.9
	None	49	35.2
Surgery in today and the past days	Yes	17	12.3
	No	122	87.7
Use of pain medication in today and the past days	Yes	89	64
	No	50	36

Fatigue And Sleep Quality Scores Of The Participants

The mean score of the adolescents in the study from the Scale for the Assessment of Fatigue in Pediatric Oncology Patients Aged 13-18 was 86.63 ± 40.17 . According to the score obtained from this scale, 49.6% (n=69) of the adolescents were determined as tired, and 50.4% (n=70) were determined as not tired. The mean scores of the adolescents participating in the study from the sub-dimensions of the scale were 51.50 ± 23.68 for general problems sub-dimension, 16.27 ± 7.77 for sleep problems sub-dimension, 10.63 ± 5.24 for cognitive problems sub-dimension, and 8.22 ± 3.79 for treatment-related problems sub-dimension. In addition, it was determined that the mean score of the adolescents from the Sleep Assessment Scale for Children with Cancer was 51.35 ± 17.07 .

Pain Characteristics Of The Participants

The pain characteristics (pain location, intensity, severity, and quality) of the adolescents in the study are given in Table 2. Pain in adolescents was determined to localize in the lower extremities (43.9%) and shoulders (56.8%). The total number of body areas marked on the body outline diagram was 3.58 ± 1.17 , and pain intensity was evaluated as 6.34 ± 2.11 . Most of the patients stated that they had little pain (34.5%) and medium pain (27.3%). The number of pain descriptors chosen by the children was 34.42 ± 14.31 .

Table 2
Pain Location, Intensity, Severity and Quality according to the Adolescent Pediatric Pain Tool (N=139)

Pain Location, intensity, Severity and quality according to the Adolescent Rating Pain Tool (ARPT)					n	%		
Pain Location (Front)	Upper extremities				9	6.5		
	Lower extremities				61	43.9		
	Head and neck				35	25.1		
	Abdomen				25	18.0		
	Chest				9	6.5		
Pain Location (Back)	Upper extremities				10	7.2		
	Lower extremities				22	15.8		
	Shoulder				79	56.8		
	Head				28	20.2		
					M±SD (Min-Max)			
The total number of body area marked on body outline diagram					3.58 ± 1.17 (2-5)			
Pain intensity ratings (0–10)					6.34 ± 2.11(4-10)			
Pain Severity	No pain (0)				-	-		
	Little pain (1)				48	34.5		
	Medium pain (2)				38	27.3		
	Large pain (3)				34	24.5		
	Worst possible pain (4)				19	13.7		
					n	%	n	%
Pain descriptors ^a (Sensory)	Aching	79	56.8	Burning	93	66.9		
	Hurting	94	67.6	Hot	72	51.8		
	Like an ache	91	65.5	Cramping	102	73.4		
	Like a hurt	79	56.8	Crushing	93	66.9		
	Sore	78	56.1	Like a pinch	93	66.9		
	Hitting	114	82.0	Pressure	87	62.6		
	Punching	88	63.3	Itching	93	66.9		
	Throbbing	93	66.9	Like a sting	94	67.6		
	Like a pin	66	47.5	Scratching	92	66.2		
	Cutting	92	66.2	Stinging	96	69.1		
	Pin like	88	63.3	Shocking	98	70.5		
	Like a sharp knife	107	77.0	Shooting	99	71.2		
	Sharp	78	56.1	Numb	102	73.4		
	Stabbing	78	56.1	Stiff	94	67.6		
	Blistering	100	71.9	Swollen	95	68.3		
				Tight	84	60.4		
Pain descriptors ^a (Evaluative)	Miserable	85	61.2	Annoying	84	60.4		
	Bad	84	60.4	Never goes away	73	52.5		
	Horrible	83	59.7	Uncontrollable	53	38.1		
	Uncomfortable	84	60.4					
Pain descriptors ^a	Awful	73	52.5	Terrifying	60	43.2		
^a Multiple fields are marked								

					n	%
(Affective)	Dying	53	38.1	Dizzy	104	74.8
	Crying	115	82.7	Sickening	76	54.7
	Frightening	120	86.3	Suffocating	85	61.2
	Screaming	73	52.5			
Pain descriptors ^a	Always	980	57.6	Forever	90	64.7
(Temporal)	Off and on Comes on all of a sudden	110	79.1	Once in a while	95	68.3
	Constant	118	84.9	Sometimes	111	79.9
	Continuous	116	83.5	Steady	102	73.4
Pain Quality		M ± SD		Min-Max		
Type of Word Descriptors	Sensory	20.32 ± 8.22		9-31		
	Evaluative	3.51 ± 1.92		1-6		
	Affective	5.15 ± 3.03		1-9		
	Temporal	6.29 ± 2.23		3-9		
	Total number of word descriptors	34.42 ± 14.31		14-52		
^a Multiple fields are marked						

Correlation of Pain Characteristics, Fatigue, and Sleep Quality by Sample Characteristics

The relationship between pain characteristics, fatigue, and sleep quality of the adolescents participating in the study is given in Table 3. While a high level and negative correlation was found between the pain location and quality (total number of sensory, evaluative, affective, and temporal word descriptors) of the adolescents participating in the study and their mean scores from the total fatigue scale and its sub-dimensions, there was a moderate and negative relationship between pain intensity and severity and the mean scores obtained from the total fatigue scale, general problems sub-dimension, sleep problems sub-dimension, and treatment-related problems sub-dimension (Table 3).

Table 3
Correlations of Pain Characteristics, Fatigue and Sleep Quality

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. The total number of body area marked on body outline diagram	1													
2. Pain intensity	0.815	1												
3. Pain severity	0.815	1.000	1											
4. Sensory	0.973	0.832	0.832	1										
5. Affective	0.976	0.839	0.839	0.999	1									
6. Evaluative	0.975	0.846	0.846	0.997	0.999	1								
7. Temporal	0.973	0.821	0.821	0.996	0.996	0.991	1							
8. Total number of word descriptors	0.976	0.832	0.832	0.997	0.999	0.995	0.999	1						
9. Fatigue ^a	-0.879	-0.686	-0.686	-0.832	-0.835	-0.824	-0.850	-0.844	1					
10. Fatigue ^a /General problems	-0.879	-0.679	-0.679	-0.831	-0.834	-0.822	-0.849	-0.843	-0.996	1				
11. Fatigue ^a /Sleep problems	-0.862	-0.677	-0.677	-0.814	-0.818	-0.806	-0.833	-0.827	0.993	0.981	1			
12. Fatigue ^a /Cognitive problems	-0.878	-0.711	-0.711	-0.838	-0.840	-0.831	-0.851	-0.847	0.986	0.972	0.984	1		
13. Fatigue ^a /Problems with treatment	-0.844	-0.655	-0.655	-0.797	-0.800	-0.789	-0.815	-0.809	0.972	0.952	0.977	0.970	1	
14. Sleep quality ^b	0.819	0.681	0.681	0.798	0.799	0.792	0.805	0.803	-0.852	-0.842	-0.852	-0.855	-0.834	1
^a : Scale for the Assessment of Fatigue in Pediatric Oncology Patients Aged 13-18, ^b : Sleep Assessment Scale for Children														
**All correlations were significant at the 0.01 level (2-tailed).														

While there was a high level and positive correlation between adolescents' pain location and quality (total number of sensory, evaluative, affective, and temporal word descriptors) and their mean scores from the total sleep quality scale, a moderate and positive correlation was found between participants' pain intensity and severity and their mean scores from the total sleep quality scale. In addition, a high level and negative correlation was found between participants' mean scores from the total fatigue scale and its sub-dimensions and their mean scores from the total sleep quality scale (Table 3).

According to the scores obtained from the Scale for the Assessment of Fatigue in Pediatric Oncology Patients Aged 13-18, 49.6% (n=69) of the adolescents were determined as tired.

The logistic regression analysis results showed that pain characteristics (pain location/total number of body area marked on the body outline diagram, pain intensity, pain severity, and pain quality/total number of word descriptors) and sleep quality predicted 74% of fatigue. In the logistic regression analysis, the sleep quality variable showed a significant effect, and increasing the score of sleep quality indicated that the risk of fatigue decreased by 1.123 ($\beta = 1.123$) (Table 4).

Table 4. The Level by Which the Pain Characteristics and Sleep Quality of the Adolescents with Cancer Predicted Their Fatigue (n=139)

Scale for the Assessment of Fatigue in Pediatric Oncology Patients Aged 13-18							
Model 1							
	Beta	SE	Wald	Sig	Exp (B)	95 % Confidence Interval	
						Lower	Upper
The total number of body area marked on body outline diagram	0.083	1.237	0.005	0.946	1.087	0.096	12.273
Pain intensity rating	0.126	0.280	0.203	0.653	1.134	0.655	1.964
Total number of word descriptors	0.083	0.105	0.631	0.427	1.087	0.885	1.335
Sleep Assessment Scale for Children	0.116	0.035	11.194	0.001	1.123	1.049	1.202
Nagelkerke R ²			0.740				
Cox & Snell R ²			0.555				
-2Log likelihood			80.100				
Hosmer and Lemeshow test			X ² = 15.210, df=8, p = 0.055				

B: Beta, SE: Standard Error, Df: Degree of freedom, Sig: Significance, Exp (B): Standardized Beta

Discussion

Adolescents experience many symptoms during cancer treatment, and a single symptom can bring about the emergence of different symptoms [20]. Although pain symptom is one of the most frequently reported symptoms during treatment and disease process, it also leads to many conditions, such as fatigue, weakness, insomnia, anxiety, and depression [2]. Pediatric oncology nurses play a key role in pain assessment and identifying potential strategies for managing pain and pharmacological and non-pharmacological treatments [21]. Self-report scales are the gold standard for assessing pain in adolescents, and validated pain assessment tools are available to guide clinicians in assessing pain. However, most pain assessment tools are unidirectional and generally assess pain intensity. Pain should be evaluated with versatile pain measurement tools and electronic evaluation diaries in adolescents [22, 23]. When the pain characteristics of the adolescents participating in this study were examined, it was found that most of them experienced pain in the lower extremities and shoulders and that the pain intensity was 6.34 ± 2.11 . Patients used sensory pain descriptors, such as burning (66.9%), numb (67.6%), and punching (63.3%), to define pain quality. Chemotherapy-induced neuropathic pain is frequently encountered in children with cancer, too. This pain was described as burning, shooting, numbness, and tingling in patients [24]. Evaluation of the quality of pain and determination of the cause of pain in this population is of significance in understanding whether there is motor impairment. The APPT that we used in this study is not limited to the single dimension of pain intensity, it can help discriminate between nociceptive and neuropathic pain [25]. APPT may also be used to provide a deeper understanding of the pain experience. It has been used in very few studies, but it is recommended for routine use in clinical practice and research [26]. In a study in which the effectiveness of Pain Buddy was evaluated through APPT, less moderate to severe pain was experienced in the intervention group [27]. However, no study with a large pediatric population with cancer using APPT was found. In this respect, the study sheds light on the pain characteristics of adolescents with cancer.

Fatigue is a fairly common symptom in children with cancer. It can affect children with cancer for years, starting from the diagnosis process [8]. Cancer-related fatigue may not be addressed in detail in pediatric population. Fatigue appears to be an expected symptom as a result of aggressive treatment in pediatric cancers [28]. In our study, adolescents had high mean fatigue scores (86.63 ± 40.17), and 49.6% of them were evaluated as tired according to the scores. This result showed that half of the adolescents with cancer who participated in the study experienced the symptoms of fatigue intensely. In a study conducted with adolescents with cancer and their parents, it was reported that fatigue was inevitable and unpredictable and that it threatened normal life [29]. Some studies in the literature have reported that fatigue can be reduced through education and symptom management interventions [7, 30].

Controlling symptoms such as pain and sleep quality can reduce fatigue [31]. In a study with a very small sample conducted with children with leukemia and their families, children reported that they experienced intense symptoms of pain, sleep disturbance, and fatigue for three days after receiving chemotherapy [32]. In our study, the pain, sleep quality, and fatigue symptoms of the adolescents were evaluated, and a moderate and high negative correlation was found between the pain characteristics of the adolescents participating in the study and their fatigue levels, and a moderate and high positive correlation was found between the pain characteristics and sleep quality. Pain, sleep quality, and fatigue are symptoms that affect each other. Many symptoms such as fatigue are not experienced alone but can lead to increased treatment-related symptoms such as sleep disturbance, depression, pain, and decreased physical performance [2, 33, 34].

In our study, adolescents' mean score from the sleep assessment scale was 51.35±17.07, accordingly, it can be said that their sleep quality was moderate. In a study, it was reported that most of the children with cancer experienced inadequate sleep during the hospitalization process [35]. It was reported that sleep disorders were frequently experienced in children with cancer and that sleep hygiene was not satisfactory [36]. In another study, most of the adolescents and young adults (84%) had poor sleep quality [37]. In this study, the predictive power of pain characteristics and sleep quality on fatigue was investigated, and it was found that adolescents' pain characteristics and sleep quality explained 74% of fatigue. It was observed that sleep quality was the only variable that had a significant effect and that as sleep quality increased, fatigue decreased by 1.1 times. Fatigue is one of the most common symptoms and is usually accompanied by symptoms, such as pain, nausea, and poor sleep quality [20]. It is associated with sleep disturbances. Sleep can be disrupted by the hospital environment, medication, and changes in normal childhood development. Continuation of sleep disorders during treatment reduces sleep quality. Although pharmacological and non-pharmacological interventions for symptoms, such as pain, nausea, and vomiting, have advanced, adolescents continue to struggle with the symptom of decreased sleep quality [3]. This study, which investigated the effect of pain and quality of sleep on fatigue, revealed the close relationship between these three variables. Fatigue is highly affected by pain and sleep quality. Although it is stated that these symptoms are seen very frequently in studies evaluating the frequency of symptoms, this study reveals the necessity of controlling pain and increasing sleep quality to reduce fatigue. Pain, sleep disturbance, and fatigue symptoms experienced by children can also affect the quality of life of families. More comprehensive studies are needed to examine children's symptom patterns, multiple factors affecting symptoms, and health outcomes during treatment.

Limitations

This study was conducted in a clinical setting in Turkey, which limits the generalization of the findings to different populations. Adolescents without pain were not included in this study. This exclusion criterion was determined to evaluate the effect of pain characteristics on fatigue. Adolescents without pain could also be included in this study.

Implications for Nursing

Health professionals considering the outputs of this study should be aware of the possible effects of pain and sleep quality on fatigue. Particularly, pediatric hematology-oncology nurses should consider evaluating the sleep quality, presence of pain, and characteristics of pain in the adolescent comprehensively when evaluating fatigue in clinical practice. Therefore, they should address these variables together in nursing care plans. In addition, pediatric hematology-oncology nurses must be advocates of the implementation of evidence-based interventions recommended for coping with symptoms. Further studies in different populations are needed to better understand the relationship between these three variables. Moreover, it is thought that investigation of the emergence of pain and other symptoms in adolescents and their effects on quality of life will be effective in providing multifaceted holistic care.

Conclusion

Due to the disease itself and its treatment, adolescents experience several symptoms at the same time, try to cope with these symptoms, and in the meantime, many different conditions such as fatigue and insomnia may develop in adolescents. This is an important study revealing the effect of pain characteristics and sleep quality on fatigue in adolescents with cancer. The results of this study emphasize that pain symptoms and sleep quality are important determinants of reducing fatigue. Health professionals working in this field should know that pain and sleep quality are important predictors and that they should plan their interventions by being aware that interventions to cope with these symptoms can be effective in preventing other symptoms that may occur.

Declarations

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Ethics Committee Approval

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Figures

Figure 1

Participant flow diagram.