

# Examination of Sleep Disturbance and Sleep-Related Problems in Children with Type 1 Diabetes

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## Abstract

**BACKGROUND/AIMS:** This research aimed to investigate the sleep disorders and sleep problems of children with type 1 diabetes (T1D).

**MATERIALS AND METHODS:** This research was descriptive and cross-sectional. This research was conducted with 105 parents of children with T1D who were admitted to a training and research hospital between June and August 2022. In the collection of the research data, the "Introductory Information Form" and the "Sleep Disorder Scale for Children (SDSC)" were used.

**RESULTS:** As a result of our research, the average total score of SDSC was found to be  $47.60 \pm 12.740$ . According to this result, the level of sleep disorders of the children participating in this study was below the average score. Significant differences were found in the sub-dimensions of Wakefulness Reactions Disorders, Sleep-Wakefulness Transition Disorders, and Excessive Sleepiness Disorders.

**CONCLUSION:** The parents participating in this study evaluated their children's sleep disorder levels as being below the average score. Since the sleep disorders of children with T1D are affected by familial characteristics and factors related to the disease, it is recommended to conduct further studies in order to identify sleep disorders and influencing factors so as to improve these conditions, and also to provide educational and counselling services to parents on these issues.

**Keywords:** Type 1 diabetes, children, sleep

## INTRODUCTION

Type 1 diabetes (T1D) disease occurs as a result of the autoimmune destruction of insulin-producing  $\beta$ -cells in the pancreas. Although its exact cause is not known, genetic and environmental factors are effective in accelerating this disease.<sup>1</sup> T1D is an important subtype of diabetes which occurs mostly in childhood.<sup>2</sup> The incidence of T1D in childhood is increasing globally.<sup>3</sup> Although it is often diagnosed during adolescence, the highest increase occurs in young children<sup>4</sup> and about

15-20% of new cases are diagnosed in children aged five years old or younger.<sup>5</sup>

Sleep health has been defined as "a multidimensional sleep-wake model that supports physical and mental well-being, adapted to individual, social and environmental influences." Healthy sleep is characterized by an adequate sleep duration, sleep efficiency, the subjective feeling of satisfaction, proper timing and constant alertness during the waking hours.<sup>6</sup> Children with chronic diseases, including T1D, have a higher

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risk of showing sleep-related problems such as insufficient sleep and daytime sleepiness than healthy children. Children with T1D are susceptible to sleep disturbances due to the effects of glucose and insulin on their central nervous system and an increased response to bodily stress.<sup>7</sup>

The interactions between sleep and T1D are reciprocal; disrupted sleep negatively affects glycaemic control, while uncontrolled blood sugar can also affect sleep.<sup>8,9</sup> In addition, nocturnal hypoglycaemia and the need for intervention can affect the amount of time spent in bed and the duration of sleep.<sup>10</sup> Nocturnal hypoglycaemia is one of the most feared conditions and it psychologically negatively affects the child and parent and leads to impaired sleep.<sup>11</sup> Since parents often wake up their children at night to prevent nocturnal hypoglycaemia, it is inevitable that children with T1D will have sleep problems and their parents will experience various difficulties in this regard.<sup>12</sup> Young people with T1D experience more sleep disturbance and a shorter sleep duration than their healthy peers.<sup>9,13</sup> Poor sleep quality also negatively affects diabetes management skills and overall well-being.<sup>14,15</sup>

This study aimed to determine the sleep disturbance and sleep-related problems of children with T1D.

## MATERIALS AND METHODS

This research was conducted as a descriptive and cross-sectional study. This research was conducted with the parents of children with T1D who were admitted to a training and research hospital for routine check-ups between June and August 2022. The G\*power 3.1.9.4 analysis program was used to calculate the sample size of this study. It was determined that at least 97 parents should participate in the sample of this study with an effect size of 0.30, a margin of error of 0.05%,  $df=96$  and 90% power. In total, one hundred and five parents participated in this study.

This study was approved by the University of Health Sciences Türkiye, Van Training and Research Hospital Ethics Committee (approval number: 2022/14-05, date: 24.06.2022).

### Data Collection Tools

The “Introductory Information Form” and the “Sleep Disturbance Scale for Children” were used as the data collection tools in this research. The “Introductory Information Form” contains questions regarding demographics, illness, the living environment and sleep. This form was prepared by the researchers within the scope of the literature.<sup>16,17</sup> The “Sleep Disturbance Scale for Children” was developed by Bruni et al.<sup>18</sup> Its validity and reliability studies have been conducted in many languages. The validity and reliability study of the scale in Turkish was conducted by Agadayi et al.<sup>19</sup> This scale is a Likert type scale which investigates sleep disturbance. In this scale, the child’s sleep disturbance is questioned in 26 items with 6 sub-dimensions. These sub-dimensions are Initiation and Persistence of Sleep Disturbance (UBSB; items 1, 2, 3, 4, 5, 10 and 11), Respiratory Disturbance during Sleep (RDDS) (USB; items 13, 14 and 15), Reactions and Alertness Disturbance (URB; items 17, 20 and 21), Sleep-Wake Transition Disturbance (SWTD) (UUGB; items 6, 7, 8, 12, 18 and 19), Disturbance of Excessive Sleepiness (DES) (AUB; items 22, 23, 24, 25 and 26) and Excessive Sweating during Sleep (UAT; items 9 and 16). The answers to the questions were between never (1 point) and always (5 points). A minimum score of 26 and a maximum score of 130 could be obtained from this scale. High scores are interpreted as indicating the presence of sleep disturbance. The Cronbach’s alpha value of this scale was 0.79.<sup>19</sup> In this study, it was found to be 0.84.

### Data Collection

The research data were collected by interviewing the parents who visited a training and research hospital. After the parents were informed about the purpose and content of this research, the data collection forms were filled out using a face-to-face interview method with those parents who agreed to participate in this research. The completion time of the data collection forms was about 20 minutes.

### Statistical Analysis

The data obtained from this study were evaluated using the SPSS 20 statistical software package. In the analysis of the data, number, percentage, average, standard deviation and minimum and maximum values were used. The conformity of continuous variables to a normal distribution was evaluated using Kolmogorov-Smirnov normality analysis. The Mann-Whitney U test was used in binary groups to determine differences between variables, the Kruskal-Wallis H test was used in groups of three or more, and Spearman’s Rank correlation analysis was used to determine relationship status.

## RESULTS

Table 1 shows the demographic characteristics of the parents who participated in this study. According to the table, 72.4% of the participants in this study were mothers and 27.6% were fathers. 86.7% of the participants were married, 55.3% were primary school graduates and 57.1% were working. The proportion of participants whose income was less than their expenses was 61%.

The duration since the diagnosis of diabetes in 31.4% of their children was between 1 and 3 years. 43.8% of the participants lived in the province where the study was conducted. 63.8% of the participants had a nuclear family structure and 65.7% of their children had more than two siblings. The average age of the parents who participated in this study was 39.32 years and the average age of their children was 10.95 years (Table 1).

Table 2 shows the distribution of characteristics related to diabetes and sleep. According to this table, 57.1% of the children slept with their siblings in separate rooms. 52.4% of the children consumed liquids before going to sleep. 17.1% of the children slept during the day, while 41% did not sleep and 41.9% slept sometimes in the daytime. 84.8% of the children had a digital device (phone, tablet, computer, etc.) which they used and 65.7% of them went to bed after 10 p.m. at night. 88.6% of the parents gave insulin to their children before going to sleep, 60% of the children took blood sugar drops during sleep and 61.9% of the children had a snack before going to sleep. Finally, 51.4% of the parents believed that diabetes had an effect on sleep (Table 2).

Table 3 shows the descriptive statistics of the individuals participating in this study according to the “Sleep Disturbance Scale for Children” and its sub-dimensions. According to the analysis, the average total score of the SDSC was  $47.60 \pm 12.740$ . When reviewing the sub-dimensions of this scale, “Sleep Initiation and Persistence Issues” had an average score of  $14.27 \pm 4.156$ , “RDDS” had an average score of  $4.29 \pm 1.911$ , “Vigilance Reactions” had an average score of  $4.09 \pm 1.522$ , “SWTD” had an average score of  $10.75 \pm 3.965$ , “DES” had an average score of  $9.75 \pm 4.300$  and “Excessive Daytime Sleepiness” had an average score of  $4.43 \pm 2.507$  (Table 3).

**Table 1. Distribution of demographic characteristics of the individuals participating in the study**

Variables	n	%	
Parent	Mother	76	72.4
	Father	29	27.6
Marital status	Married	91	86.7
	Single	14	13.3
Education level	Primary	58	55.3
	High school	27	25.7
	Bachelor	20	19.0
Employment status	Employed	60	57.1
	Unemployed	45	42.9
Income status	Less income than expenses	64	61.0
	Income equal to expenses	33	31.4
	Income more than expenses	8	7.6
Duration since child's diagnosis	Less than 1 year	31	29.5
	1-3 years	33	31.4
	4-6 years	17	16.2
	More than 6 years	24	22.9
Place of residence	Village/town	24	22.9
	District	35	33.3
	City	46	43.8
Type of family	Nuclear family	67	63.8
	Extended family	38	36.2
Number of siblings	No siblings	4	3.9
	One sibling	16	15.2
	Two siblings	16	15.2
	More than 2 siblings	69	65.7
Parent age	39.32±7.388		
Child age	10.95±4.128		
Total	<b>105</b>	<b>100.0</b>	

Table 4 shows the results of the analysis conducted to compare the average scores of the "Sleep Disturbance Scale for Children" and its sub-dimensions according to the demographic characteristics of the parents who participated in this study. According to the results of the analysis, a significant difference was found in the total of the "Sleep Disturbance Scale for Children" according to the income status variable of the parents ( $p<0.05$ ). According to this significant difference, the average score of those parents whose income was more than their expenses was lower than the average score of the parents whose income was less than or equal to their expenses.

A significant difference was found in the "Sleep Initiation and Maintenance Problems (SIMP)" sub-dimension according to the parents' educational status ( $p<0.05$ ). According to this significant difference, the average score of those parents with a bachelor's degree was lower than the average score of the parents with only elementary or high school education.

**Table 2. Distribution of the child's characteristics related to illness and sleep**

Variables	n	%	
The child's sleeping place	In the same bed with the parent	3	2.9
	Same room with parents, separate bed	25	23.8
	Alone in a separate room	17	16.2
	In a separate room with siblings	60	57.1
Fluid consumption before sleep	Yes	55	52.4
	No	50	47.6
Daytime sleeping condition	Yes	18	17.1
	No	43	41.0
	Sometimes	44	41.9
Spending time with digital devices before sleep	Yes	89	84.8
	No	16	15.2
Child's sleep time	Between 8 p.m. and 10 p.m.	36	34.3
	After 10 p.m.	69	65.7
The way of taking insulin at night	Before sleeping	93	88.6
	Waking up	9	8.6
	Pump	3	2.8
Snacking before sleep	Yes	65	61.9
	No	40	38.1
Blood sugar drop during sleep	Yes	63	60.0
	No	42	40.0
The effect of diabetes on sleep status	Yes	54	51.4
	No	51	48.6
Total	<b>105</b>	<b>100.0</b>	

A significant difference was found in the "SWTD" sub-dimension according to the parents' income status ( $p<0.05$ ). According to this significant difference, the average score of those parents whose income was more than their expenses was lower than the average score of the parents whose income was less than or equal to their expenses.

A positive and statistically significant relationship was found between the "Excessive Sleepiness Disturbance (ESD)" sub-dimension and the age of the children. In other words, as the age of the children increased, ESD also increased (Table 4).

Table 5 shows the results of the analysis conducted to compare the average scores of the "Sleep Disturbance Scale for Children" and its sub-dimensions according to the information about the disease and sleep. According to the results of the analysis, a significant difference was found in the sum of the "Sleep Disturbance Scale for Children" according to the variables of the child's daytime sleeping status, their state of blood sugar drop during sleep and the negative effect of diabetes on their sleep ( $p<0.05$ ). According to these significant differences, the average score for those parents whose child/children slept during the day was higher than the average score of the parents whose child did not sleep during the day. The mean scores of those parents who stated that blood sugar negatively affected sleep in their children were higher than the average scores of those parents who stated that blood sugar did not negatively affect sleep in their children.

**Table 3. Minimum, maximum, average and standard deviation values obtained from the sleep disturbance scale and its sub-dimensions for children**

	Min.	Max.	Mean	SD
Problems with Sleep Initiation and Maintenance	8.00	28.00	14.27	4.156
Respiratory Disturbance During Sleep	3.00	13.00	4.29	1.911
Wakefulness reactions	3.00	11.00	4.09	1.522
Sleep Wakefulness Transition Disturbance	6.00	26.00	10.75	3.965
Excessive Sleepiness Disturbance	5.00	24.00	9.75	4.300
Excessive Sweating During Sleep	2.00	10.00	4.43	2.507
The Sum of the Scale	29.00	85.00	47.60	12.740

Min.: Minimum, Max.: Maximum, SD: Standard deviation.

**Table 4. Comparison of the average scores of the Sleep Disturbance Scale and sub-dimensions for children according to the descriptive characteristics of the individuals participating in the study**

Variable	PSIM	RDDS	WR	SWTD	ESD	ESDS	Sum scale
	X ± SD	X ± SD	X ± SD	X ± SD	X ± SD	X ± SD	X ± SD
<b>Parent</b>							
Mother	14.56±4.45	4.44±2.00	4.09±1.44	10.69±4.04	10.02±4.34	4.38±2.47	48.21±13.44
Father	13.51±3.19	3.89±1.61	4.10±1.73	10.89±3.81	9.03±4.16	4.58±2.62	46.03±10.72
Test	U=984.5 p>0.05	U=911.5 p>0.05	U=1080.0 p>0.05	U=1047.5 p>0.05	U=938.5 p>0.05	U=1041.5 p>0.05	U=1054.5 p>0.05
<b>Marital status</b>							
Married	14.16±4.11	4.34±2.00	4.06±1.54	10.80±4.10	9.61±4.13	4.47±2.54	47.46±12.54
Single	15.00±4.52	4.00±1.10	4.28±1.38	10.42±3.03	10.64±5.34	4.21±2.32	48.57±14.41
Test	U=562.5 p>0.05	U=631.5 p>0.05	U=540.5 p>0.05	U=635.5 p>0.05	U=586.5 p>0.05	U=613.5 p>0.05	U=630.0 p>0.05
<b>Education level</b>							
Primary	14.43±4.52	4.62±2.29	4.24±1.53	11.36±4.54	10.08±4.44	4.56±2.62	49.31±14.56
High school	15.51±3.65	3.81±1.38	4.22±1.78	9.96±3.05	9.92±4.77	4.44±2.57	47.88±11.14
Bachelor	12.15±2.81	4.00±0.91	3.50±0.88	10.05±2.98	8.55±2.99	4.05±2.08	42.30±6.56
Test	KW=10,247 p<0.05 1>3 2>3	KW=3,042 p>0.05	KW=4,010 p>0.05	KW=1,471 p>0.05	KW=1,365 p>0.05	KW=0,251 p>0.05	KW=2,486 p>0.05
<b>Employment status</b>							
Employed	14.10±4.02	4.18±1.79	3.90±1.44	10.85±3.90	9.20±0.02	4.58±2.46	46.81±12.00
Unemployed	14.51±4.36	4.44±2.06	4.35±1.59	10.62±4.09	10.48±4.58	4.24±2.57	48.66±13.72
Test	U=1284.5 p>0.05	U=1256.0 p>0.05	U=1123.0 p>0.05	U=1294.0 p>0.05	U=1110.5 p>0.05	U=1187.5 p>0.05	U=1262.0 p>0.05
<b>Income status</b>							
Less income than expenses	14.73±4.39	4.54±2.21	4.17±1.57	11.26±3.60	10.31±4.70	4.75±2.58	49.78±13.19
Income equal to the expenses	13.63±3.79	3.87±1.31	4.12±1.55	10.27±4.69	9.06±3.60	4.03±2.36	45.00±12.23
Income more than expenses	13.25±3.49	4.00±0.75	3.37±0.51	8.62±2.66	8.12±2.85	3.62±2.32	41.00±5.87
Test	KW=1,186 p>0.05	KW=1,877 p>0.05	KW=1,569 p>0.05	KW=6,108 p<0.05 1>3 2>3	KW=2,665 p>0.05	KW=3,522 p>0.05	KW=5,961 p<0.05 1>3 2>3
<b>Duration since diagnosis</b>							
Less than 1 year	13.90±4.12	4.06±1.36	4.22±1.74	10.48±3.31	8.45±3.60	4.32±2.53	45.45±10.75

**Table 4. Continued**

Variable	PSIM	RDDS	WR	SWTD	ESD	ESDS	Sum scale
	X ± SD	X ± SD	X ± SD	X ± SD	X ± SD	X ± SD	X ± SD
1-3 years	14.18±3.81	4.30±2.31	4.03±1.42	11.00±4.38	10.27±3.95	4.66±2.68	48.45±11.84
4-6 years	14.76±4.61	5.05±2.41	4.17±1.38	11.64±4.15	10.35±4.52	4.17±2.27	50.17±14.44
More than 6 years	14.54±4.52	4.04±1.42	3.95±1.51	10.12±4.11	10.29±5.23	4.45±2.50	47.41±15.18
Test	KW=0.554 p>0.05	KW=3,301 p>0.05	KW=1,026 p>0.05	KW=2,015 p>0.05	KW=5,070 p>0.05	KW=0.325 p>0.05	KW=1,674 p>0.05
<b>Place of residence</b>							
Village/town	13.33±3.37	4.33±1.78	4.00±1.28	10.00±3.81	9.45±4.19	4.20±2.51	45.33±11.88
District	14.54±4.53	4.51±2.42	3.91±1.31	10.60±3.54	10.17±4.55	4.80±2.81	48.54±13.25
City	14.56±4.24	4.10±1.50	4.28±1.77	11.26±4.33	9.58±4.22	4.28±2.26	48.08±12.90
Test	KW=1,346 p>0.05	KW=0.428 p>0.05	KW=0.792 p>0.05	KW=1,547 p>0.05	KW=0.617 p>0.05	KW=0.558 p>0.05	KW=1,313 p>0.05
<b>Type of family</b>							
Nuclear family	14.20±4.15	4.14±1.76	4.05±1.57	10.76±3.44	9.52±4.51	4.50±2.57	47.20±12.35
Extended family	14.39±4.22	4.55±2.13	4.15±1.44	10.73±4.79	10.15±3.91	4.31±2.40	48.31±13.53
Test	U=1236.5 p>0.05	U=1111.0 p>0.05	U=1175.0 p>0.05	U=1156.5 p>0.05	U=1081.0 p>0.05	U=1236.0 p>0.05	U=1227.0 p>0.05
<b>Number of siblings</b>							
(1) No	11.50±2.38	3.50±0.57	5.00±4.00	11.00±2.16	7.00±1.41	3.75±0.95	41.75±6.60
(2) One	14.87±4.78	4.62±2.15	4.00±1.21	11.93±3.29	9.25±3.10	5.00±2.94	49.68±11.90
(3) Two	15.25±4.21	4.37±2.70	4.06±1.34	10.81±3.39	11.37±6.10	4.68±2.77	50.56±13.98
(4) More than two	14.07±4.04	4.24±1.69	4.07±1.43	10.44±4.29	9.65±4.08	4.28±2.41	46.78±12.89
Test	KW=3,288 p>0.05	KW=1,604 p>0.05	KW=0.255 p>0.05	KW=4,132 p>0.05	KW=2,533 p>0.05	KW=0.816 p>0.05	KW=3,067 p>0.05
Parent age <sup>f</sup>	-0.004	-0.027	-0.050	-0.070	0.032	-0.017	-0.028
Child age <sup>f</sup>	0.073	0.106	0.067	-0.026	0.218*	-0.085	0.050

\*p<0.05, †: Spearman’s rank correlation, Kw: Kruskal-Wallis H test, U: Mann-Whitney U test, PSIM: Problems with Sleep Initiation and Maintenance, RDDS: Respiratory Disturbance During Sleep, WR: Wakefulness reactions, SWTD: Sleep-Wake Transition Disturbance, ESD: Excessive Sleepiness Disturbance, ESDS: Excessive Sweating During Sleep, SD: Standard deviation.

A significant difference was found in the “Wakefulness Reactions Disturbance (WRD)” sub-dimension according to daytime sleeping status and snacking before going to sleep (p<0.05). According to these significant differences, the average score of those parents whose child slept during the day and those whose child sometimes slept was higher than the average score of the parents whose child did not sleep during the day. The average score of the parents of those children who snacked before going to sleep was lower than the average score of the parents of children who did not snack before going to sleep.

A significant difference was found in the “SWTD” sub-dimension according to the variables of daytime sleepiness, blood sugar drop during sleep, and the negative effect of diabetes on sleep (p<0.05). According to these significant differences, the average score of those parents whose child slept during the day and those whose child sometimes slept was higher than the average score of the parents whose child did not sleep during the day. The average score of those parents whose child’s blood sugar dropped during sleep was higher than the average score of those whose child’s blood sugar did not drop during sleep. The average score of those parents who indicated that blood sugar had a negative effect on sleep was higher than the average score of those who indicated that blood sugar had no negative effect on sleep. A significant difference was

found in the “ESD” sub-dimension according to the variables of daytime sleepiness, spending time with a digital device before sleep, blood sugar drop during sleep and the negative effect of diabetes on sleep (p<0.05). According to these significant differences, the average score of those parents whose child slept during the day was higher than the average score of those whose child did not sleep during the day. The average score of those parents whose child spent time with a digital device before sleep was higher than the average score of those whose child did not spend time with a digital device before sleep. The average score of those parents whose child’s blood sugar dropped during sleep was higher than the average score of those whose child’s blood sugar did not drop during sleep. The average score of those parents who indicated that blood sugar had a negative effect on sleep was higher than the average score of those who indicated that blood sugar had no negative effect on sleep (Table 5).

Table 6 shows the distributions of the children’s sleeping times at night and how quickly they fell asleep after going to bed. According to this table, 33.3% of the children slept between 8 and 9 hours per night. In addition, 39% of the children fell asleep within 15 to 30 minutes after going to bed (Table 6).

Table 5. Comparison of the score averages of the Sleep Disturbance Scale and sub-dimensions for children according to information about illness and sleep							
Variables	PSIM	RDDS	WR	SWTD	ESD	ESDS	Sum Scale
	X ± SD	X ± SD	X ± SD	X ± SD	X ± SD	X ± SD	X ± SD
In the same bed with parent	13.33±1.15	4.00±1.00	3.33±0.57	11.00±2.00	8.33±2.30	3.33±0.57	43.33±2.30
Same room with parents, separate bed	14.12±4.42	4.60±2.46	4.12±1.36	11.56±4.44	9.00±4.41	5.24±3.01	48.64±14.06
Alone in a separate room	13.94±5.04	3.70±0.91	4.41±2.23	9.64±2.99	10.35±5.18	4.35±2.69	46.41±13.62
In a separate room with sibling	14.48±3.92	4.35±1.88	4.03±1.37	10.71±4.05	9.96±4.08	4.18±2.23	47.73±12.38
Test	KW=0.883 p>0.05	KW=1.294 p>0.05	KW=0.909 p>0.05	KW=2,091 p>0.05	KW=2,802 p>0.05	KW=2,476 p>0.05	KW=0.680 p>0.05
<b>Fluid consumption before sleep</b>							
Yes	14.52±4.43	4.36±1.89	4.27±1.71	11.25±4.11	10.18±4.59	4.76±2.65	49.36±13.74
No	14.00±3.85	4.22±1.94	3.90±1.26	10.20±3.75	9.28±3.93	4.08±2.30	45.68±11.35
Test	U=1298.5 p>0.05	U=1295.5 p>0.05	U=1249.5 p>0.05	U=1180.5 p>0.05	U=1224.5 p>0.05	U=1162.5 p>0.05	U=1189.0 p>0.05
<b>Daytime sleeping condition</b>							
(1) Yes	14.88±5.42	4.61±2.68	4.94±2.26	11.88±4.61	11.33±6.13	5.44±3.31	53.11±17.09
(2) No	13.65±3.44	4.23±1.92	3.58±0.87	9.46±3.07	8.55±3.81	4.39±2.44	43.88±9.98
(3) Sometimes	14.63±4.22	4.22±1.52	4.25±1.49	11.54±4.18	10.27±3.59	4.06±2.11	49.00±12.29
Test	KW=0.850 p>0.05	KW=0.262 p>0.05	KW=6,637 p<0.05 2<1 2<3	KW=6,860 p<0.05 2<1 2<3	KW=6,709 p<0.05 2<1	KW=1,611 p>0.05	KW=6,183 p<0.05 2<1
<b>Spending time with digital devices before sleep</b>							
Yes	14.46±4.30	4.26±1.76	4.10±1.42	11.03±4.04	10.10±4.36	4.43±2.50	48.40±12.92
No	13.25±3.08	4.43±2.65	4.06±2.04	9.18±3.18	7.81±3.44	4.43±2.60	43.18±10.98
Test	U=609.5 p>0.05	U=658.0 p>0.05	U=648.5 p>0.05	U=508.5 p>0.05	U=455.00 p<0.05	U=711.0 p>0.05	U=508.5 p>0.05
<b>Child's sleep time</b>							
Between 8 p.m. and 10 p.m.	14.27±3.97	4.27±2.03	4.22±1.75	10.91±3.57	9.16±3.98	4.44±2.48	47.30±11.66
After 10 p.m.	14.27±4.27	4.30±1.85	4.02±1.39	10.66±4.17	10.05±4.45	4.43±2.53	47.76±13.34
Test	U=1220.0 p>0.05	U=1220.5 p>0.05	U=1199.0 p>0.05	U=1144.5 p>0.05	U=1082.5 p>0.05	U=1215.0 p>0.05	U=1197.5 p>0.05
<b>The way of taking insulin at night</b>							
Before sleeping	14.19±4.22	4.26±1.88	4.11±1.53	10.69±3.84	9.95±4.34	4.49±2.46	47.73±12.53
Waking up	15.44±4.06	5.00±2.34	4.11±1.69	12.22±5.28	8.55±4.12	4.33±3.31	49.66±16.05
Pump	13.33±2.30	3.00±0.00	3.33±0.57	8.00±1.73	7.00±2.00	3.00±1.00	37.66±3.51
Test	KW=0.995 p>0.05	KW=5,499 p>0.05	KW=0.721 p>0.05	KW=2.399 p>0.05	KW=3.302 p>0.05	KW=1,457 p>0.05	KW=2,866 p>0.05
<b>Snacking before sleep</b>							
Yes	14.13±4.19	4.26±1.97	3.83±1.23	10.86±4.10	10.03±4.33	4.63±2.57	47.75±12.80
No	14.50±4.13	4.35±1.81	4.52±1.83	10.57±3.76	9.30±4.26	4.12±2.39	47.37±12.79
Test	U=1235.5 p>0.05	U=1221.0 p>0.05	U=1024.5 p<0.05	U=1281.0 p>0.05	U=1144.0 p>0.05	U=1125.0 p>0.05	U=1232.0 p>0.05
<b>Blood sugar drop during sleep</b>							
Yes	14.66±4.45	4.63±2.22	4.25±1.70	11.63±4.10	10.96±4.75	4.71±2.59	50.87±13.92
No	13.69±3.63	3.78±1.15	3.85±1.18	9.42±3.38	7.92±2.64	4.02±2.34	42.71±8.81
Test	U=1167.0 p>0.05	U=1033.5 p<0.05	U=1181.0 p>0.05	U=872.5 p<0.05	U=782.5 p<0.05	U=1107.5 p>0.05	U=846.5 p<0.05
<b>The effect of diabetes on sleep status</b>							
Yes	14.70±4.78	4.59±2.20	4.09±1.44	11.59±4.23	11.12±5.08	4.94±2.80	51.05±14.70
No	13.82±3.35	3.98±1.50	4.09±1.61	9.86±3.48	8.29±2.61	3.90±2.04	43.96±9.05

Table 5. Continued

Variables	PSIM	RDDS	WR	SWTD	ESD	ESDS	Sum Scale
	X ± SD	X ± SD	X ± SD	X ± SD	X ± SD	X ± SD	X ± SD
Test	U=1287.0 p>0.05	U=1175.5 p>0.05	U=1358.0 p>0.05	U=1036.5 p<0.05	U=930.0 p<0.05	U=1110.5 p>0.05	U=999.0 p<0.05

Kw: Kruskal-Wallis H test, U: Mann-Whitney U test, PSIM: Problems with Sleep Initiation and Maintenance, RDDS: Respiratory Disturbance During Sleep, WR: Wakefulness reactions, SWTD: Sleep-Wake Transition Disturbance, ESD: Excessive Sleepiness Disturbance, ESDS: Excessive Sweating During Sleep, SD: Standard deviation.

Table 6. Distributions of night sleeping time and falling asleep time of the children participating in this study

Questions	n	%	
How many hours does your child sleep most nights?	9-11 hours	30	28.6
	8-9 hours	35	33.3
	7-8 hours	32	30.4
	5-7 hours	7	6.7
	Less than 5 hours	1	1.0
How quickly does your child usually fall asleep after going to bed?	Less than 15 minutes	39	37.1
	Between 15-30 minutes	41	39.0
	Between 30-45 minutes	8	7.6
	Between 45-60 minutes	7	6.7
	More than 60 minutes	10	9.5
<b>Total</b>	<b>105</b>	<b>100.0</b>	

## DISCUSSION

Sleep greatly affects people's health and their quality of life. Sleep is a concept with social, psychological and physiological dimensions.<sup>20</sup> Sleep in children and adolescents with T1D can often be disrupted due to hypoglycaemia, hyperglycaemia and their parents' diabetes care behaviours.<sup>15</sup> Sleep disturbance can negatively affect the progression of this disease and cause the development of complications.<sup>17</sup>

As a result of this research, the average total score of the SDSC was  $47.60 \pm 12.740$ . According to this result, the level of sleep disturbance of the children who participated in this study was below the average score. In other words, the children who participated in this study had a low level of sleep disturbance. In the study of Agadayi et al.<sup>19</sup> the average total score of the SDSC answered by mothers was  $40.9 \pm 10.1$ , while the total score average of the scale answered by fathers was  $40.2 \pm 10.3$ . The results of the present research are in parallel with the literature. Six sub-dimensions of the SDSC were used within the scope of the research. According to the demographic characteristics of the surveyed parents with regards to the "Sleep Disturbance Scale for Children", when we look at the "SWTD" sub-dimension, a significant difference was detected in terms of the parents' income status ( $p < 0.05$ ). The average score of those parents whose income was more than their expenses was lower than the average score of those whose income was less than or equal to their expenses. A significant difference was found in the "SIMP" sub-dimension according to the parents' educational status ( $p < 0.05$ ). According to the results of this research, the average score of those parents who graduated with a bachelor's degree was lower than the average score of those who only graduated from elementary or high school. From the literature, a study conducted with the parents of 299 primary school students in Türkiye found significant differences between the family's income status, education status, bedtime resistance and sleep duration.<sup>21</sup> In the present research, a significant relationship was found between age and the "ESD" sub-dimension. In

other words, as the age of the children increased, the ESD also increased. From a study found in the literature, according to the parent group having SDSC sleep problems, the average score of the subscale with the highest UUGB SWTD during the day was in elementary school.<sup>17</sup> A significant difference was found in the "WRD" sub-dimension according to daytime sleep status and snacking before going to sleep ( $p < 0.05$ ). A significant difference was found in the "ESD" sub-dimension according to the variables of the child's daytime sleeping status, spending time with a digital device before sleep, blood sugar drop during sleep and the negative impact of diabetes on sleep ( $p < 0.05$ ). According to these significant differences, the average score of those parents whose child slept during the day was higher than the average score of those whose child did not sleep during the day. The average score of those parents whose child spent time with a digital device before sleep was higher than the average score of those whose child did not spend time with a digital device before sleep. Sleep problems are affected by television, bedtime resistance, delays in starting to sleep and anxiety during sleep and thus they lead to shortened sleep durations.<sup>22</sup> From the literature, total sleep time and total duration of TV viewing were investigated in one study. 51% of respondents reported to having a TV set in the child's bedroom. For those children with a TV in the room, "night terrors", "nightmares", "sleep talking" and "being tired at wake-up" responses were seen to have significantly higher scores.<sup>23</sup>

Children with T1D may be especially vulnerable to sleep disturbances as parents may delay bedtime if their blood sugar levels are outside the target range and they often wake their children up during the night to monitor their blood sugar and treat episodes of hypoglycaemia or hyperglycaemia.<sup>24</sup> In the present research, the average score of those parents whose child's blood sugar dropped during sleep was higher than the average score of those whose child's blood sugar did not drop during sleep. The average score of those parents who indicated that blood sugar had a negative effect on sleep was higher than the

average score of those who indicated that blood sugar had no negative effect on sleep. In another study consisting of 75 children with T1D and 49 controls, 65.3% of all participants in both groups had sleep problems; children with T1D slept less and experienced more daytime sleepiness problems compared to the controls.<sup>25</sup> In the present study, a significant difference was found in the "SWTD" sub-dimension of the SDSC according to the variables of daytime sleepiness, blood sugar drop during sleep and the negative effect of diabetes on sleep ( $p < 0.05$ ). In another study, the SWTD was the subscale with the highest average score.<sup>17</sup> The results of the present research are similar to the literature. In the present research, 33.3% of the children slept between 8 and 9 hours per night. In addition, 39% of the children fell asleep between 15 and 30 minutes after going to bed. In a study conducted with 111 participants with T1D, which is similar to the sample of the present study, the children slept less than the recommended amount of sleep for this age group of children of approximately nine hours and were found to be in poor glycaemic control, which showed that less sleep is associated with poor management and glycaemic control. In the same study, it was reported that especially later bedtimes and a greater social jetlag were associated with poor glycaemic control.<sup>26</sup> In another study, 60 people formed the control group with 60 T1D patients. In that study, significantly more adolescents with 60 T1D delay starting to sleep, non-REM sleep and sleep efficiency, and arousal index significantly lower compared to the controls to have sleep rapid eye activity are stated.<sup>27</sup> In addition to the direct physiological effects of sleep on glycaemic control, insufficient or poor-quality sleep have an indirect behavioural effect on diabetes management. Sleep disturbance, including bedtime resistance and night-time waking, have been associated with greater behavioural problems in school-age children.<sup>28</sup> In the present research, most children also slept late. According to Monzon et al.<sup>13</sup>, as sleep duration decreases due to increased frequencies of waking up at night, parental stress due to night care, anxiety about the illness, and constant monitoring, cortisol levels rise and glycaemic control is poor. In Farabi's<sup>17</sup> study with 130 people, it was reported by parents that 45.1% of their children's sleep duration was 8-9 hours per night. The results of this research are in line with the literature.

### Study Limitations

Our research had some limitations. Our research sample size was small and our findings cannot be generalized to the larger child population.

### CONCLUSION

As a result of this research, the parents who participated in this study evaluated the level of sleep disturbance of their children as being below the average score. The SDSC was affected in the dimensions of WRD, SWTD, and ESD, with significant differences being found in these sub-dimensions. When the sources of the sleep problems of children with T1D were examined, it was seen that the sleep of these children was affected by their condition. Since the sleep disturbances of those children with T1D are affected by familial characteristics and factors related to their disease, it is recommended to conduct further studies in order to identify sleep disturbance and influencing factors so as to improve these conditions, and to provide educational and counselling services to their parents on these issues.

### MAIN POINTS

- Diabetes has a negative effect on sleep.
- The sleep problems of those children with chronic diseases are affected by familial characteristics.
- Parental education is important for the sleep health of children with diabetes.

### ETHICS

**Ethics Committee Approval:** This study was approved by the University of Health Sciences Türkiye, Van Training and Research Hospital Ethics Committee (approval number: 2022/14-05, date: 24.06.2022).

**Informed Consent:** It wasn't obtained.

### Authorship Contributions

Concept: Z.K., F.K.Ö., D.Ç.B., Design: Z.K., F.K.Ö., D.Ç.B., Data Collection and/or Processing: Z.K., G.G., C.K., S.Y., Analysis and/or Interpretation: F.K.Ö., D.Ç.B., Literature Search: F.K.Ö., D.Ç.B., Writing: F.K.Ö., D.Ç.B.

### DISCLOSURES

**Conflict of Interest:** No conflict of interest was declared by the authors.

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