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Healthy eating attitudes of caregivers of children with special needs and their association with children's eating behaviors: a cross-sectional study

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Abstract

Background Caregivers of children with special needs play a crucial role in maintaining their overall health, including ensuring adequate nutrition and promoting healthy eating behaviors. Children with special needs often experience feeding difficulties due to motor, sensory, or behavioral challenges, which may lead to inadequate nutrient intake and growth delays. These challenges highlight the importance of caregivers' attitudes toward healthy eating, as their nutritional awareness and behaviors directly influence the dietary habits and well-being of these children. This study aimed to investigate the healthy eating attitudes of caregivers of children with special needs and to examine the relationship between these attitudes and children's eating behaviors.

Methods A descriptive and correlational design was employed. Data were collected from 194 caregivers using a Socio-Demographic Questionnaire, the Attitude Scale for Healthy Nutrition, and the Children's Eating Behavior Questionnaire. Data were analyzed using the Kolmogorov-Smirnov test, Mann-Whitney U test, Kruskal-Wallis test for group comparisons, and Spearman's correlation analysis.

Results Among participants, 83% were female, with a mean age of 45.86 ± 7.82 years. The mean healthy eating attitude score was 74.58 ± 11.96 (Min: 40- Max: 103). For children's eating behaviors, mean scores were 17.35 ± 5.57 (Min: 6- Max: 29) for satiety responsiveness, 16.23 ± 5.16 (Min: 5- Max: 25) for enjoyment of food, and 12.62 ± 4.90 (Min: 5- Max: 25) for food responsiveness. Caregivers' income significantly influenced eating attitudes, and those without chronic diseases demonstrated more positive attitudes. Children's eating behaviors varied by gender and type of special need. Positive caregiver attitudes were associated with higher enjoyment of food and lower emotional overeating and satiety responsiveness in children.

Conclusion Caregivers generally demonstrated strong healthy eating attitudes, which were associated with more adaptive eating behaviors in their children. Enhancing caregivers' healthy eating attitudes through targeted educational and psychosocial interventions may promote healthier eating patterns and improve the overall well-being of children with special needs.

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Keywords Caregiver, Child with special needs, Healthy eating attitude, Eating behavior

Introduction

Children with special needs are defined as individuals who experience permanent or temporary limitations in mental, physical, sensory, social, or communicative domains, and therefore require specialized educational or healthcare services [1]. According to the United Nations Children's Fund [2], approximately 240 million children worldwide live with disabilities, meaning that one in ten children lack access to essential resources such as health, education, and protection services. In Türkiye, data from the Ministry of National Education (2024) indicate that during the 2023–2024 academic year, there were 1,899 special education schools, including 504 primary, 496 secondary, and 536 high schools. A total of 559,725 students are enrolled in special education programs, with 352,773 being boys and 206,952 girls [3].

The primary caregiver of a child with special needs is defined as the individual responsible for most of the child's daily living activities, as well as for meeting the child's physical, emotional, financial, and social needs. Although primary caregivers are most often mothers, they may also include fathers, grandparents, siblings, or professional caregivers [4, 5]. The literature emphasizes that one of the key factors directly influencing the growth, development, and overall quality of life of children with special needs is nutrition [6–8]. Billich et al. (2024) reported that children with special needs often experience limited food variety due to motor and sensory difficulties or medication use, which may lead to growth retardation. Nutritional challenges encountered by these children also have significant psychological and emotional impacts on their primary caregivers [9]. In addition to the inherent demands of caring for a child with special needs, caregivers frequently face mealtime-related issues such as food refusal, chewing and swallowing difficulties, and non-adherence to diet routines. These problems can lead caregivers to perceive their child's nutritional intake as inadequate, thereby increasing caregiving burden, anxiety, and stress, ultimately reducing their overall quality of life [5, 10, 11].

In a study examining the roles of caregivers in nutrition, physical activity, and food access among children diagnosed with spina bifida, it was found that caregivers required further education in these areas [12]. Research investigating the attitudes, beliefs, and barriers of caregivers of children with Duchenne muscular dystrophy regarding nutrition and weight management revealed that preventing weight gain in their children was associated with the prevalence of healthy eating behaviors among caregivers. The primary barriers to achieving healthy nutrition included time constraints, selective food preferences, and insufficient nutritional knowledge [6]. In a study involving parents of children with autism spectrum disorder, spina bifida, and Down syndrome, it was reported that parental feeding behaviors and weight-related focus were associated with the children's body weight. Moreover, as parental awareness of their child's weight increased, parents exhibited more controlling feeding behaviors [13].

Nutrition plays a decisive role in the life course of individuals with health conditions. Therefore, the promotion of healthy eating behaviors among individuals with positive attitudes toward nutrition contributes not only to the preservation of their own health but also to the improvement of health outcomes in the children for whom they provide care [14]. Nutrition is a vital factor directly affecting overall health, quality of life, and susceptibility to disease. In contemporary society, acquiring healthy eating habits is crucial not only for meeting physiological needs but also for preventing obesity, chronic diseases, and eating behavior disorders. In this context, children with special needs represent a particularly vulnerable group, as physical, cognitive, or social limitations may adversely affect their dietary patterns [15]. However, studies examining the relationship between caregivers' attitudes toward healthy eating and their children's eating behaviors remain limited. Therefore, the aim of this study is to determine the relationship between primary caregivers' attitudes toward healthy nutrition and the eating behaviors of children with special needs.

Research Questions:

1. What is the level of healthy eating attitudes among caregivers?
2. What is the level of eating behaviors reported by caregivers for their children?
3. Do caregivers' healthy eating attitudes differ according to caregivers' sociodemographic characteristics?
4. Do children's eating behaviors differ according to their sociodemographic and clinical characteristics?
5. Is there a relationship between caregivers' healthy eating attitudes and children's eating behaviors?

Method

Study design

This study was designed as a descriptive and cross-sectional study.

Population and sample

The population of the study consisted of caregivers of children with special needs registered at the Center for Inclusive Living Research and Practice, affiliated with a foundation university in a province in western Turkey. Sample size calculation was performed using G*Power 3.1.9.4 software, with a Type I error of 0.05, a Type II error of 0.05, and an effect size of f = 0.35, indicating that at least 128 caregivers should be included in the study [16]. The study was completed with 194 caregivers.

Inclusion criteria

Caregivers aged 18–65 years who had been providing care for a child with special needs for at least six months, who were able to speak Turkish, and who agreed to participate in the study were included.

Data collection instruments

Data were collected using a Socio-Demographic Information Form, the Attitude Scale for Healthy Nutrition, and the Children's Eating Behavior Questionnaire.

Socio-demographic information form

Developed by the researchers based on the literature [17, 18], the questionnaire consisted of 19 items. Five items addressed caregiver characteristics, including age, gender, presence of chronic disease, income status, and duration of caregiving. Fourteen items addressed the child's characteristics, including type of special need, age, gender, and eating behaviors.

Attitude Scale for Healthy Nutrition (ASHN)

Attitude Scale for Healthy Nutrition was developed by Tekkurşun Demir and Cicioğlu (2019). The scale is a 21-item, four-subscale Likert-type instrument. Responses to positively worded items range from "Strongly Disagree" to "Strongly Agree." Positively worded items are scored 1–5, while negatively worded items are reverse-scored (5 – 1). The subscales of the ASHN are as follows: Information on Nutrition (IN; items 1–5), Emotion for Nutrition (EN; items 6–11), Positive Nutrition (PN; items 12–16), and Malnutrition (MP; items 17–21). Total scores on the scale range from 21 to 105. Scores are interpreted as follows: 21 = very low, 23–42 = low, 43–63 = moderate, 64–84 = high, and 85–105 = ideal healthy eating attitude. Cronbach's alpha coefficients for the original scale were 0.90 for IN, 0.84 for EN, 0.75 for PN, 0.83 for MP, and 0.90 for the total scale [19]. In the present study, Cronbach's alpha coefficients were 0.90 for IN, 0.77 for EN, 0.70 for PN, 0.78 for MP, and 0.82 for the total scale.

Children's Eating Behavior Questionnaire (CEBQ)

The Children's Eating Behavior Questionnaire (CEBQ) was developed by Wardle et al. (2001) [20] and its Turkish validity and reliability were established by Yılmaz et al. (2011) for children aged 2–9 years. The questionnaire consists of 35 items and eight subscales, rated on a five-point Likert scale. The subscales are: Food Responsiveness (FR; items 12, 14, 19, 20, 28), Emotional Overeating (EOE; items 2, 13, 15, 27), Enjoyment of Food (EF; items 1, 3, 4, 5, 22), Desire to Drink (DD; items 6, 29, 31), Satiety Responsiveness (SR; items 7, 17, 21, 24, 26, 30, 33), Slowness in Eating (SE; items 8, 18, 34, 35), Emotional Undereating (EUE; items 9, 11, 23, 25), and Fussiness (F; items 10, 16, 32). The first four subscales (FR, EOE, EF, DD) reflect appetite or food approach behaviors, whereas the latter four subscales (SR, SE, EUE, F) reflect food avoidance or reduced appetite behaviors. The questionnaire is completed by parents. Higher scores indicate greater expression of the corresponding eating behavior. The multidimensional structure of the CEBQ allows for the early detection of tendencies toward obesity or under-eating in children, facilitating monitoring and preventive interventions before clinical symptoms arise. In the Turkish version, the overall reliability coefficient was 0.69, and subscale reliabilities ranged from 0.61 to 0.84 [21]. In the current study, Cronbach's alpha was 0.78 for the total scale, with subscale coefficients as follows: FR = 0.78, EOE = 0.79, EF = 0.83, DD = 0.73, SR = 0.69, SE = 0.83, EUE = 0.59, and F = 0.72.

Data collection

Data were collected between April 2025 and June 2025 through face-to-face, self-reported questionnaires administered by the researchers. Participation was voluntary, and informed consent was obtained from all caregivers who met the inclusion criteria. Completion of the data collection instruments took approximately 10 min.

Ethical considerations

Ethical approval for the study was obtained from the İstanbul Gedik University Non-Interventional Research Ethics Committee (Date: April 7, 2025; Decision No: E-56365223-050.04-2025.137548.89). Permission to use the measurement tools was obtained via e-mail from the original authors, and institutional approval was granted by the relevant organization. In addition, institutional permission to conduct the research was obtained verbally from the University-affiliated Center for Barrier-Free Living. Informed consent for the purpose and method of the study was obtained from all participating caregivers. The study was conducted per the principles of the Declaration of Helsinki.

Data analysis

Data were analyzed using the IBM SPSS for Windows version 26.0 (IBM Inc., NY, USA). Descriptive statistical methods (frequency, percentage, minimum–maximum

Table 1 Socio-demographic characteristics of caregivers ($n = 194$)

	n	%
Gender		
Female	161	83
Male	33	17
Income status		
Income exceeds expenses	60	30.9
Income equals expenses	95	49
Income is less than expenses	39	20.1
Chronic disease status		
Yes	59	30.4
No	135	69.6
Child's gender		
Female	71	36.6
Male	123	63.4
Type of Special Need		
Physical	46	23.7
Mental	107	55.2
Language and speech	41	21.1
Using a hand mixer when preparing food for your child		
Yes	59	30.4
No	135	69.6
The child's sitting at the table with the family		
Yes	152	78.4
No	42	21.6
Having problems with feeding the child		
Yes	92	47.4
No	102	52.6
Presence of muscle development deficiency in the child	83 111	42.8 57.2
Yes		
No		
The child's nutritional problems due to the medications he/she uses		
Yes	64	33
No	130	67
The child's regular attendance at the dentist		
Goes	74	38.1
Doesn't go	120	61.9
Your child's teeth brushing habit		
Yes	102	52.6
No	92	47.4
Age	Min:29 Max:71	45.86 ± 7.82
Child's age	Min:2 Max:23	13.53 ± 4.97

values, mean, and standard deviation) were used for data summarization. The normality of the data distribution was assessed using the Kolmogorov-Smirnov test. Since the data did not meet the assumptions of normality, nonparametric tests were used in the analysis. The Mann-Whitney U and Kruskal-Wallis tests were used to examine the relationships between sociodemographic variables and the scale scores, while Spearman's correlation analysis was applied to assess relationships between

Table 2 Descriptive distribution of scale mean scores

Scales	Min.-Max.	Mean ± SD.
Attitude Scale for Healthy Nutrition Total	40–103	74.58 ± 11.96
Information on Nutrition	5–25	18.68 ± 4.50
Emotion for Nutrition	6–30	18.91 ± 5.55
Positive Nutrition	7–25	18.69 ± 3.68
Malnutrition	5–25	18.30 ± 4.53
Children's Eating Behavior Questionnaire Total	56–143	97.24 ± 16.72
Food responsiveness	5–25	12.62 ± 4.90
Emotional overeating	4–19	8.73 ± 3.90
Enjoyment of food	5–25	16.23 ± 5.16
Desire to drink	3–15	8.73 ± 3.17
Satiety responsiveness	6–29	17.35 ± 5.57
Slowness in eating	4–20	11.02 ± 4.84
Emotional undereating	4–20	11.54 ± 3.65
Fussiness	3–15	8.23 ± 3.28

the scales. The level of statistical significance was set at $p < 0.05$.

Results

Among the caregivers who participated in the study, 83% were female, 30.9% reported having an income higher than their expenses, and 69.6% stated that they did not have any chronic diseases. It was determined that 63.4% of the caregivers' children were male, and 55.2% of the children had an intellectual disability as their primary type of special need.

Regarding caregiving practices, 69.6% of caregivers reported using a hand mixer while preparing meals for their children, and 78.4% stated that their children sat at the dining table together with them. More than half of the caregivers (52.6%) reported experiencing problems related to their child's nutrition. Additionally, 57.2% of caregivers stated that their children had inadequate muscle development, while 67% reported encountering problems related to the medications used within the scope of their child's special needs.

It was also found that 61.9% of caregivers did not take their children for regular dental check-ups, and 52.6% reported that their children had a habit of brushing their teeth. The mean age of the caregivers was 45.86 ± 7.82 years, and the mean age of the children was 13.53 ± 4.97 years (Table 1).

In Table 2, the mean total score of the caregivers on the ASHN was 74.58 ± 11.96. The mean subscale scores were 18.68 ± 4.50 for Information on Nutrition, 18.91 ± 5.55 for Emotion for Nutrition, 18.69 ± 3.68 for Positive Nutrition, and 18.30 ± 4.53 for Malnutrition.

The mean total score of the CEBQ was 97.24 ± 16.72. The mean subscale scores were as follows: Satiety Responsiveness 17.35 ± 5.57, Enjoyment of Food 16.23 ± 5.16, Food Responsiveness 12.62 ± 4.90, Emotional

Undereating 11.54 ± 3.65, Slowness in Eating 11.02 ± 4.84, Emotional Overeating 8.73 ± 3.90, Desire to Drink 8.73 ± 3.17, and Fussiness 8.23 ± 3.28.

In Table 3, the comparison of caregivers' healthy eating attitudes according to selected sociodemographic characteristics is presented. The Information on Nutrition scores of female caregivers (18.97 ± 4.37) were significantly higher than those of male caregivers (17.24 ± 4.91) ($p < 0.05$). Caregivers who reported having an income higher than their expenses (20.91 ± 5.81) had significantly higher Emotion for Nutrition subscale scores compared to those whose income was equal to their expenses (18.01 ± 4.72), and caregivers whose income was equal to their expenses had significantly higher scores than those whose income was lower than their expenses (18.00 ± 6.30) ($p < 0.05$). Caregivers whose income was equal to their expenses (19.31 ± 4.18) and those whose income was lower than their expenses (19.02 ± 4.64) had significantly higher Malnutrition subscale scores compared to caregivers whose income exceeded their expenses (16.25 ± 4.37) ($p < 0.05$).

Caregivers without chronic diseases had significantly higher total ASHN scores, Information on Nutrition subscale scores, and Malnutrition subscale scores than caregivers with chronic diseases ($p < 0.05$). The Malnutrition subscale scores of male children (19.13 ± 4.45) were significantly higher than those of female children (16.88 ± 4.34) ($p < 0.05$). Caregivers of children with intellectual disabilities had significantly higher Information on Nutrition scores compared to caregivers of children with physical disabilities ($p < 0.05$). Additionally, caregivers of children with intellectual disabilities had significantly higher Malnutrition subscale scores compared to those of children with physical or speech and language impairments ($p < 0.05$). Caregivers who did not use a hand mixer when preparing food for their children had significantly higher total ASHN scores, as well as higher Information on Nutrition, Positive Nutrition, and Malnutrition subscale scores, compared to those who used a hand mixer ($p < 0.05$).

Caregivers who reported no nutritional problems with their children had higher Malnutrition subscale scores (19.40 ± 4.49) than those who reported experiencing problems (17.09 ± 4.28). Caregivers of children with insufficient muscle development had significantly higher Emotion for Nutrition scores (20.03 ± 5.20) compared to those whose children did not have such problems (18.08 ± 5.67) ($p < 0.05$). Finally, caregivers who reported that their children attended regular dental check-ups had significantly higher Malnutrition subscale scores, and those who stated that their children had a regular toothbrushing habit had significantly higher Information on Nutrition subscale scores than their counterparts ($p < 0.05$).

As shown in Table 4, the mean scores of Food Responsiveness, Satiety Responsiveness, Emotional Undereating, and Fussiness were significantly higher among male caregivers compared to female caregivers ($p < 0.05$). Caregivers whose income was equal to or less than their expenses had significantly higher Enjoyment of Food scores compared to those whose income exceeded their expenses ($p < 0.05$). Conversely, caregivers whose income exceeded their expenses had significantly higher Slowness in Eating scores than those whose income was equal to or less than their expenses ($p < 0.05$).

Caregivers with chronic diseases (9.57 ± 2.90) had significantly higher Desire to Drink scores compared to those without chronic diseases (8.36 ± 3.23) ($p < 0.05$). Male children showed higher Enjoyment of Food scores, whereas female children had higher Slowness in Eating scores ($p < 0.05$). Children with intellectual disabilities exhibited higher Enjoyment of Food scores than those with physical or speech/language impairments ($p < 0.05$). Conversely, children with physical or speech/language impairments demonstrated higher Slowness in Eating scores compared to those with intellectual disabilities ($p < 0.05$).

Caregivers who did not use a hand mixer while preparing food had significantly higher Enjoyment of Food and Fussiness scores compared to those who used a hand mixer ($p < 0.05$). In contrast, caregivers who used a hand mixer reported higher Satiety Responsiveness and Slowness in Eating scores than those who did not ($p < 0.05$). Caregivers whose children did not experience feeding problems had higher Enjoyment of Food and Fussiness scores, while those whose children experienced feeding problems had higher Desire to Drink, Satiety Responsiveness, and Slowness in Eating scores ($p < 0.05$).

Children without muscle development deficiency had higher Enjoyment of Food scores, whereas those with muscle development deficiency had higher Satiety Responsiveness and Slowness in Eating scores ($p < 0.05$). Children who attended regular dental check-ups had significantly higher Enjoyment of Food and Fussiness scores, while those who did not attend regular dental check-ups showed higher Satiety Responsiveness and Slowness in Eating scores ($p < 0.05$). Similarly, children with a regular toothbrushing habit had higher Enjoyment of Food and Fussiness scores, while those without this habit had higher Satiety Responsiveness and Slowness in Eating scores ($p < 0.05$).

As shown in Table 5, the total score of the ASHN was found to be negatively correlated with Emotional Overeating (r = -0.156), Satiety Responsiveness (r = -0.205), and Emotional Undereating (r = − 0.143), while it showed a positive correlation with Enjoyment of Food ($r = 0.194$). The Information on Nutrition subscale was moderately positively correlated with Enjoyment of Food ($r = 0.335$),

Table 3 Distribution of Socio-demographic characteristics of caregivers according to the attitude scale for healthy nutrition ($n = 194$)

Socio-demographic Characteristics	Attitude Scale for Healthy Nutrition Total	Information on Nutrition	Emotion for Nutrition	Positive Nutrition	Malnutrition
	Mean ± SD.	**Mean ± SD.**	**Mean ± SD.**	**Mean ± SD.**	**Mean ± SD.**
Gender					
Female	75.33 ± 11.86	18.97 ± 4.37	19.25 ± 5.58	18.83 ± 3.85	18.27 ± 4.53
Male	70.93 ± 11.93	17.24 ± 4.91	17.24 ± 4.91	17.96 ± 2.60	18.48 ± 4.56
Z	-1.782	**-2.048**	-1.903	-1.715	-0.133
p	0.075	**0.041**	0.057	0.086	0.894
Income status					
Income exceeds expenses[a]	73.65 ± 12.63	17.98 ± 3.86	20.91 ± 5.81	18.50 ± 3.98	16.25 ± 4.37
Income equals expenses[b]	74.88 ± 11.22	18.94 ± 4.56	18.01 ± 4.72	18.61 ± 3.66	19.31 ± 4.18
Income is less than expenses[c]	75.28 ± 12.87	19.10 ± 5.21	18 ± 6.30	19.17 ± 3.27	19.02 ± 4.64
KW	0.660	4.480	**10.772**	0.910	**19.583**
p	0.719	0.106	**0.005**	0.634	**0.000**
			a > b, b > c		**b > a, c > a**
Chronic disease status					
Yes	72.05 ± 10.24	17.81 ± 4.43	19.74 ± 5.83	18.01 ± 3.68	16.47 ± 4.83
No	75.69 ± 12.52	19.05 ± 4.49	18.54 ± 5.40	18.98 ± 3.66	19.11 ± 4.16
Z	**-2.197**	**-1.968**	-1.393	-1.949	**-3.510**
p	**0.028**	**0.049**	0.164	0.051	**0.000**
Child's gender					
Female	73.45 ± 12.16	18.59 ± 4.16	19.53 ± 5.77	18.43 ± 3.94	16.88 ± 4.34
Male	75.23 ± 11.84	18.73 ± 4.70	18.54 ± 5.41	18.83 ± 3.53	19.13 ± 4.45
Z	-0.906	-0.453	-1.225	-0.569	**-3.464**
p	0.365	0.651	0.221	0.560	**0.001**
Type of Special Need					
Physical[a]	72.00 ± 11.39	17.71 ± 4.46	18.78 ± 5.68	18.00 ± 4.33	17.50 ± 4.09
Mental[b]	75.66 ± 12.54	18.99 ± 4.83	18.39 ± 5.52	19.07 ± 3.42	19.21 ± 4.44
Language and speech[c]	74.65 ± 10.81	18.95 ± 3.46	20.39 ± 5.33	18.00 ± 4.33	16.85 ± 4.78
KW	2.902	**4.073**	0.197	1.757	**7.033**
p	0.088	**0.044**	0.657	0.185	**0.008**
		b > a			**b > a, b > c**
Using a hand mixer when preparing food for a child					
Yes	71.49 ± 10.25	17.69 ± 3.37	19.47 ± 6.37	17.72 ± 3.45	16.59 ± 4.33
No	75.94 ± 12.43	19.11 ± 4.86	18.66 ± 5.15	19.11 ± 3.71	19.05 ± 4.42
Z	**-2.440**	**-2.991**	-0.940	**-2.330**	**-3.641**
p	**0.015**	**0.003**	0.347	**0.020**	**0.000**
Having problems with feeding the child					
Yes	73.60 ± 11.11	18.58 ± 3.75	19.51 ± 5.86	18.44 ± 3.34	17.09 ± 4.28
No	75.45 ± 12.66	18.76 ± 5.10	18.37 ± 5.23	18.91 ± 3.97	19.40 ± 4.49
Z	-0.945	-0.889	-1.555	-1.016	**-3.875**
p	0.345	0.374	0.120	0.310	**0.000**
Presence of muscle development deficiency in the child					
Yes	74.68 ± 10.54	18.36 ± 3.76	20.03 ± 5.20	18.39 ± 3.86	17.92 ± 4.16
No	74.50 ± 12.95	18.91 ± 4.98	18.08 ± 5.67	18.90 ± 3.54	18.59 ± 4.79
Z	-0.250	-1.613	**-2.404**	-0.632	-1.295
p	0.802	0.107	**0.016**	0.527	0.195
The child's nutritional problems due to the medications he/she uses					
Yes	73.23 ± 10.63	18.03 ± 3.48	20.26 ± 6.03	18.01 ± 3.57	17 ± 3.83
No	75.23 ± 12.54	19 ± 4.91	18.25 ± 5.19	19.02 ± 3.70	18.95 ± 4.72
Z	-1.159	**-2.316**	**-2482**	-1.702	**-3.353**
p	0.246	**0.021**	**0.013**	0.089	**0.001**
The child's regular attendance at the dentist					
Yes	75.52 ± 12.43	19.16 ± 4.37	18.16 ± 5.08	19.06 ± 3.60	19.13 ± 4.76
No	73.99 ± 11.67	18.38 ± 4.57	19.37 ± 5.79	18.45 ± 3.72	17.8 ± 4.32
Z	-0.652	-1.091	-1.617	-0.863	**-2.231**
p	0.514	0.275	0.106	0.388	**0.026**

Table 3 (continued)

Socio-demographic Characteristics	Attitude Scale for Healthy Nutrition Total	Information on Nutrition	Emotion for Nutrition	Positive Nutrition	Malnutrition
	Mean ± SD.	**Mean ± SD.**	**Mean ± SD.**	**Mean ± SD.**	**Mean ± SD.**
Your child's teeth brushing habit					
Yes	75.57 ± 12.17	19.41 ± 4.55	18.45 ± 5.25	18.85 ± 3.73	18.86 ± 4.57
No	73.46 ± 11.68	17.86 ± 4.32	19.42 ± 5.85	18.51 ± 3.64	17.69 ± 4.42
Z	-0.811	**-2.464**	-1.327	-0.296	-1.898
p	0.417	**0.014**	0.185	0.767	0.058

and negatively correlated with Satiety Responsiveness (r = -0.217) and Slowness in Eating (r = -0.217) ($p < 0.05$). The Emotion for Nutrition subscale showed a positive correlation with Slowness in Eating ($r = 0.157$, $p = 0.029$) and a negative correlation with Emotional Undereating (r = -0.178) ($p < 0.05$).

The Positive Nutrition subscale was negatively correlated with Emotional Overeating (r = -0.160), Satiety Responsiveness (r = -0.201), and Slowness in Eating (r = -0.162), while it was positively correlated with Enjoyment of Food ($r = 0.174$). The Malnutrition subscale showed moderate negative correlations with Emotional Overeating (r = -0.232), Desire to Drink (r = -0.228), and Satiety Responsiveness (r = -0.321), and weak negative correlation with Slowness in Eating (r = -0.264), while it was positively correlated with Enjoyment of Food ($r = 0.221$) ($p < 0.05$).

Discussion

In this study, the relationship between the healthy eating attitudes of primary caregivers of children with special needs and the eating behaviours of these children was examined. A total of 194 parents participated in the study, and the mean total score obtained from the Healthy Eating Attitude Scale was 74.58 ± 11.96 (Min: 40; Max: 103). Considering the scale's score classification, this value indicates that caregivers have a high level of attitude toward healthy eating. This finding suggests that caregivers generally have a positive attitude that supports healthy eating. Similarly, the high attitude scores toward healthy eating found in the study by Fışkın and Ölçer (2022) support the positive attitude level in this research [22]. The mean total score of the Children's Eating Behavior Questionnaire was 97.24 ± 16.72 (Min: 56; Max: 143). This result indicates that children's eating behaviors are at a moderate level and open to improvement in certain areas. This is consistent with the findings in the literature that children's eating behaviors are mostly assessed as moderate [23–25].

Significant associations were found between caregivers' sociodemographic characteristics and the subscales of the Attitude Scale for Healthy Nutrition scale. Female caregivers demonstrated higher levels of knowledge about nutrition compared to male caregivers. This finding may be explained by the higher proportion of female participants in the study sample (83%) and the greater caregiving responsibility that women typically assume for children.

Similarly, Subaşı et al. (2024) reported that women had higher levels of nutritional knowledge compared to men [26]. In parallel, Uluç and Durukan (2021) found that female students had significantly higher levels of nutritional knowledge and healthier eating habits than male students. These findings are consistent with and support the results of the present study [27].

When evaluated according to income level, it was found that caregivers whose income was equal to or less than their expenses had higher Malnutrition subscale scores. This finding supports the association between economic insufficiency and unhealthy eating habits. Fışkın and Ölçer (2022) reported that women with higher incomes had higher mean scores on healthy eating attitudes [22]. On the other hand, a study conducted in Malatya found no significant relationship between mothers' economic status and their eating behaviours, which the researchers attributed to the economic homogeneity of the sample [28].

Caregivers without chronic diseases demonstrated significantly higher healthy eating attitudes and levels of nutritional knowledge. However, the same group also exhibited higher Malnutrition subscale scores. In their study, Lewis et al. (2009) reported that individuals with chronic diseases were more likely to use nutrition labels and had greater awareness of national nutrition campaigns, yet they consumed higher amounts of carbohydrates and proteins [29]. These findings indicate that knowledge and awareness about nutrition alone may not be sufficient, and individuals often face difficulties translating this knowledge into sustainable eating behaviours.

Caregivers of children with intellectual disabilities were found to have higher levels of nutritional knowledge compared to caregivers of children with other types of disabilities. This finding may be explained by the more frequent occurrence of feeding difficulties in children with intellectual disabilities [27] and by caregivers' increased efforts to acquire relevant knowledge in this area. In the literature, a study conducted with mothers of typically developing children aged 3–6 years also

Table 4 Distribution of Socio-demographic characteristics of caregivers according to the children's eating behavior questionnaire ($n=194$)

Socio-demographic Characteristics	Children's Eating Behavior Questionnaire	Food Responsiveness	Emotional Overeating	Enjoyment of Food	Desire to Drink	Satiety Responsiveness	Slowness in Eating	Emotional Undereating	Fussiness
	Mean ± SD.	**Mean ± SD.**	**Mean ± SD.**	**Mean ± SD.**	**Mean ± SD.**	**Mean ± SD.**	**Mean ± SD.**	**Mean ± SD.**	**Mean ± SD.**
Gender									
Female	95.47 ± 16.42	12.27 ± 4.99	8.70 ± 3.99	16.35 ± 5.31	8.61 ± 3.29	16.76 ± 5.55	10.83 ± 4.97	11.18 ± 3.51	8.05 ± 3.29
Male	105.87 ± 15.66	14.33 ± 4.09	8.90 ± 3.43	15.66 ± 4.41	9.30 ± 2.53	20.21 ± 4.85	11.93 ± 4.10	13.30 ± 3.86	9.09 ± 3.13
Z	**-3.522**	**-2.376**	-0.666	-0.911	-1.299	**-3.203**	-1.493	**-3.155**	**-1.840**
p	**0.000**	**0.018**	0.506	0.362	0.194	**0.001**	0.135	**0.002**	**0.066**
Income status									
Income exceeds expenses[a]	100.41 ± 16.17	12.81 ± 5.54	9.45 ± 4.12	14.03 ± 5.31	9.36 ± 3.18	19.31 ± 4.89	13.81 ± 4.93	11.33 ± 3.48	7.85 ± 3.34
Income equals expenses[b]	94.66 ± 17.63	12.58 ± 4.27	8.43 ± 3.66	17.02 ± 4.65	8.27 ± 3.05	16.09 ± 5.75	9.49 ± 4.17	11.46 ± 3.71	8.35 ± 3.07
Income is less than expenses[c]	98.64 ± 14.48	12.41 ± 5.38	8.38 ± 4.05	17.71 ± 5.18	8.87 ± 3.36	17.38 ± 5.39	10.43 ± 4.44	12.05 ± 3.79	8.51 ± 3.67
KW	-0.433	-0.481	-1.341	**-3.204**	-0.687	-1.824	**-3.385**	-0.860	-0.899
p	0.665	0.630	0.180	**0.001** **b > a, c > a**	0.492	0.068	**0.001** **a > b, a > c**	0.390	0.369
Chronic disease status									
Yes	99.03 ± 16.37	12.61 ± 4.82	9.27 ± 3.87	15.62 ± 5.04	9.57 ± 2.90	17.79 ± 5.44	11.69 ± 4.94	11.44 ± 3.62	8.15 ± 2.95
No	96.45 ± 16.87	12.62 ± 4.95	8.50 ± 3.90	16.50 ± 5.21	8.36 ± 3.23	17.15 ± 5.64	10.72 ± 4.78	11.58 ± 3.67	8.26 ± 3.42
Z	-0.748	-0.110	-1.476	-1.269	**-2.683**	-0.827	-1.321	-0.501	-0.123
p	0.454	0.912	0.140	0.204	**0.007**	0.408	0.186	0.616	0.902
Child's gender									
Female	99.46 ± 17.74	12.59 ± 5.16	9.09 ± 4.16	14.94 ± 5.37	8.87 ± 3.10	18.16 ± 5.57	13.08 ± 4.81	11.52 ± 3.43	8.40 ± 3.32
Male	95.95 ± 16.03	12.64 ± 4.76	8.52 ± 3.74	16.98 ± 4.91	8.65 ± 3.23	16.87 ± 5.54	9.82 ± 4.46	11.55 ± 3.78	8.13 ± 3.26
Z	-1.609	-0.019	-0.805	**-2.420**	-0.493	-1.637	**-4.494**	-0.129	-0.777
p	0.108	0.985	0.421	**0.016**	0.622	0.102	**0.000**	0.897	0.437
Type of Special Need									
Physical[a]	96.19 ± 14.66	12.67 ± 4.22	8.78 ± 3.55	14.54 ± 4.50	9.04 ± 3.27	17.82 ± 4.92	11.63 ± 4.46	11.36 ± 3.31	7.54 ± 2.72
Mental[b]	96.51 ± 17.53	12.77 ± 5.09	8.59 ± 3.92	17.43 ± 4.99	8.72 ± 3.28	16.38 ± 5.87	9.94 ± 4.72	11.38 ± 3.91	8.50 ± 3.45
Language and speech[c]	100.31 ± 16.64	12.17 ± 5.16	9.04 ± 4.26	15.00 ± 5.59	8.39 ± 2.78	19.34 ± 4.95	13.14 ± 4.85	12.14 ± 3.30	8.29 ± 3.35
KW	0.162	0.000	0.309	**11.747**	0.333	2.300	**4.831**	0.046	2.459
p	0.688	0.997	0.578	**0.001** **b > a, b > c**	0.564	0.129	**0.028** **a > b, c > b**	0.831	0.117
Using a hand mixer when preparing food for a child									
Yes	98.32 ± 15.01	12.15 ± 4.20	8.94 ± 3.72	13.91 ± 4.99	8.711 ± 3.14	19.57 ± 4.64	13.11 ± 4.51	11.76 ± 3.25	7.37 ± 2.82
No	96.77 ± 17.44	12.82 ± 5.17	8.64 ± 3.98	17.25 ± 4.92	8.74 ± 3.20	16.37 ± 5.68	10.10 ± 4.70	11.44 ± 3.82	8.60 ± 3.40
Z	-0.154	-0.751	-0.755	**-4.091**	-0.067	**-3.794**	**-4.039**	-0.576	**-2.328**
p	0.877	0.453	0.450	**0.000**	0.947	**0.000**	**0.000**	0.564	**0.020**
Having problems with feeding the child									
Yes	100.32 ± 15.88	11.96 ± 5.19	8.78 ± 3.90	13.92 ± 5.31	9.56 ± 3.18	20.34 ± 4.50	13.5 ± 4.48	11.96 ± 3.28	7.18 ± 3.15
No	94.46 ± 17.04	13.21 ± 4.57	8.69 ± 3.91	18.32 ± 4.04	7.98 ± 2.99	14.64 ± 5.06	8.78 ± 4	11.15 ± 3.92	9.17 ± 3.10
Z	-1.917	-1.933	-0.295	**-5.871**	**-3.463**	**-7.185**	**-6.685**	-1.877	**-4.071**
p	0.055	0.053	0.768	**0.000**	**0.001**	**0.000**	**0.000**	0.061	**0.000**
Presence of muscle development deficiency in the child									
Yes	99.22 ± 17.09	12.14 ± 4.98	8.72 ± 3.72	14.45 ± 5.35	9.20 ± 3.30	19.02 ± 5.55	13.46 ± 4.75	11.56 ± 3.32	7.91 ± 3.30
No	95.75 ± 16.35	12.98 ± 4.83	8.74 ± 4.04	17.56 ± 4.62	8.37 ± 3.04	16.09 ± 5.28	9.18 ± 4.04	11.52 ± 3.89	8.46 ± 3.25
Z	-1.056	-1.142	-0.172	**-3.892**	-1.765	**-3.555**	**-5.929**	-0.049	-1.089
p	0.291	0.253	0.864	**0.000**	0.078	**0.000**	**0.000**	0.961	0.276
The child's nutritional problems due to the medications he/she uses									
Yes	100.15 ± 17.48	12.15 ± 5.24	8.85 ± 4	13.70 ± 5.28	9.81 ± 3.25	20.26 ± 5.08	14.14 ± 4.59	11.43 ± 3.35	7.04 ± 3.21
No	95.80 ± 16.21	12.85 ± 4.73	8.67 ± 3.86	17.48 ± 4.64	8.2 ± 3.01	15.91 ± 5.25	9.48 ± 4.19	11.59 ± 3.80	8.81 ± 3.16
Z	-1.072	-1.070	-0.254	**-4.548**	**-3.256**	**-5.216**	**-6.066**	-0.238	**-3.447**
p	0.284	0.285	0.799	**0.000**	**0.001**	**0.000**	**0.000**	0.812	**0.001**

Table 4 (continued)

Socio-demographic Characteristics	Children's Eating Behavior Questionnaire	Food Responsiveness	Emotional Overeating	Enjoyment of Food	Desire to Drink	Satiety Responsiveness	Slowness in Eating	Emotional Undereating	Fussiness
	Mean ± SD.	**Mean ± SD.**	**Mean ± SD.**	**Mean ± SD.**	**Mean ± SD.**	**Mean ± SD.**	**Mean ± SD.**	**Mean ± SD.**	**Mean ± SD.**
The child's regular attendance at the dentist									
Yes	98.41 ± 14.66	13.31 ± 4.77	9.17 ± 3.62	17.70 ± 5.04	8.28 ± 3.11	16.27 ± 5.67	9.89 ± 4.12	11.98 ± 3.24	9.02 ± 3.29
No	96.51 ± 17.89	12.20 ± 4.95	8.46 ± 4.05	15.33 ± 5.05	9.00 ± 3.19	18.01 ± 5.43	11.71 ± 5.12	11.26 ± 3.86	7.74 ± 3.18
Z	-0.357	-1.371	-1.763	**-3.143**	-1.515	**-2.322**	**-2.330**	-1.189	**-2.637**
p	0.721	0.170	0.078	**0.002**	0.130	**0.020**	**0.020**	0.234	**0.008**
Your child's teeth brushing habit									
Yes	97.15 ± 17.57	12.97 ± 4.81	8.94 ± 4.01	17.60 ± 4.73	8.44 ± 3.24	16.02 ± 5.64	9.78 ± 4.50	11.70 ± 3.61	8.97 ± 3.34
No	97.33 ± 15.82	12.23 ± 4.99	8.51 ± 3.78	14.71 ± 5.22	9.05 ± 3.08	18.81 ± 5.14	12.39 ± 4.86	11.35 ± 3.70	7.41 ± 3.02
Z	-0.699	-0.969	-0.722	**-3.828**	-1.335	**-3.525**	**-3.661**	-0.488	**-3.318**
p	0.484	0.333	0.470	**0.000**	0.182	**0.000**	**0.000**	0.625	**0.001**

Table 5 Relationship between attitude scale for healthy nutrition and eating behavior in children

		Attitude Scale for Healthy Nutrition Total	Information on Nutrition	Emotion for Nutrition	Positive Nutrition	Malnutrition
Food Responsiveness	r	-0.060	0.052	-0.032	-0.068	-0.099
	p	0.403	0.470	0.656	0.349	0.168
Emotional Overeating	r	**-0.156**	-0.046	-0.025	**-0.160**	**-0.232**
	p	**0.031***	0.521	0.726	**0.026***	**0.001***
Enjoyment of Food	r	**0.194**	**0.335**	-0.020	**0.0174**	**0.221**
	p	**0.007***	**0.000***	0.783	**0.014***	**0.002***
Desire to Drink	r	-0.098	-0.031	0.036	-0.030	**-0.228**
	p	0.173	0.669	0.619	0.676	**0.001***
Satiety Responsiveness	r	**-0.205**	**-0.217**	0.043	**-0.201**	**-0.321**
	p	**0.004***	**0.002***	0.552	**0.005***	**0.000***
Slowness in Eating	r	-0.122	**-0.217**	**0.157**	**-0.162**	**-0.264**
	p	0.091	**0.002***	**0.029***	**0.024***	**0.000***
Emotional Undereating	r	**-0.143**	-0.028	**-0.178**	-0.068	-0.117
	p	**0.047***	0.697	**0.013***	0.344	0.103
Fussiness	r	-0.083	0.087	-0.141	-0.058	-0.065
	p	0.250	0.226	0.051	0.423	0.366

*$p < 0.05$

reported that the Information on Nutrition subscale of the Attitude Scale for Healthy Nutrition scale had the highest mean score. These findings suggest that, regardless of children's developmental characteristics, caregivers tend to possess substantial knowledge regarding their children's nutrition [22].

Significant differences were observed in children's eating behaviour, as measured by the Children's Eating Behaviour Questionnaire (CEBQ), according to certain sociodemographic characteristics. Specifically, children from families with incomes exceeding their expenses had higher Satiety Responsiveness scores but lower Enjoyment of Food scores. Conversely, Güncan (2025) reported no significant association between parental income and children's eating behaviours, which was attributed to the limited socioeconomic diversity of the sample, as participants were recruited from a single district [30].

When examining children's eating behaviours according to gender, it was found that boys had higher Enjoyment of Food scores compared to girls, whereas girls exhibited higher Slowness in Eating scores than boys. Similarly, Hamurcu (2023) reported that male students scored higher on the Enjoyment of Food subscale compared to female students. A review of the literature indicates that girls tend to show more positive attitudes towards fruits and vegetables, while boys are more inclined to consume meat, processed foods, and high-fat or sugary products [31–33]. These findings suggest that boys may approach eating more freely and experience greater enjoyment from food, potentially due to reduced body image pressures compared to girls [34].

When examining eating behaviours according to the type of disability, children with intellectual disabilities exhibited higher Enjoyment of Food scores, whereas children with physical or speech/language impairments showed higher Slowness in Eating scores. A study investigating feeding skills in children with neurodevelopmental disorders reported that children with intellectual

disabilities particularly struggled with chewing, children with autism had difficulties with drinking through a straw, and children with cerebral palsy experienced pronounced challenges in both chewing and swallowing [35]. Moreover, the study concluded that the group with the poorest feeding behaviours was children with cerebral palsy. These findings suggest that in individuals with physical impairments, slower muscle function and limited motor skills prolong the feeding process, making it more challenging. In our study, children with muscle weakness ate more slowly, while those without muscle difficulties enjoyed their meals more, supporting this observation.

Regarding the use of a hand mixer during meal preparation, children from families who used a mixer exhibited quicker satiety, slower eating, and lower food fussiness, whereas children from families who did not use a mixer derived greater enjoyment from their meals. Similarly, children experiencing feeding problems scored higher on Desire to Drink, Satiety Responsiveness, Slowness in Eating, and Fussiness, whereas children without feeding problems enjoyed their meals more. Taken together, these findings suggest that both the methods used during food preparation and the child's feeding difficulties have multidimensional effects on eating behaviours, particularly influencing satiety, fussiness, and eating speed. A meta-analysis examining the effects of food texture on appetite and intake reported that solid foods significantly reduced hunger compared to liquids, and that thicker foods provided longer-lasting satiety than watery or liquid foods [36].

In this study, it was concluded that feeding problems associated with medications used by children due to their special needs significantly affected their eating behaviours. Children experiencing such problems had significantly higher scores on Satiety Responsiveness, Slowness in Eating, and Desire to Drink. These findings suggest that medications may exert different effects on appetite, satiety mechanisms, and feeding behaviours. Conversely, children who did not experience feeding problems despite medication use enjoyed their meals more but were more selective in their food choices. This finding implies that parental feeding practices or individual differences in the child may play a role in children who do not experience feeding difficulties despite medication use.

Aykutlu et al. (2024) examined the differential effects of medication on eating behaviours in children with attention-deficit/hyperactivity disorder (ADHD) and reported that stimulant medication alone may reduce obesity risk, whereas the combined use of stimulants and antipsychotics could lead to problematic eating behaviours [37]. Similarly, Phillips (2014) highlighted that stimulant medications used in ADHD treatment have appetite-suppressing effects, which may increase the risk of weight loss and growth retardation [38]. Moreover, in the absence of medication, impulsive eating behaviours could increase obesity risk, emphasizing the multidimensional relationship between pharmacological treatment and nutrition. Lee et al. (2022) evaluated the effects of methylphenidate on growth over 24 months in children and adolescents by assessing height, weight, and BMI z-scores, finding significant reductions, which were attributed to appetite suppression and weight loss. These findings underscore the importance of monitoring weight status and eating behaviours, particularly in individuals with special needs receiving pharmacological treatment [39].

In our study, oral and dental health factors were found to significantly influence children's eating behaviours. Children who regularly attended dental check-ups and maintained toothbrushing habits had higher scores on Enjoyment of Food and Fussiness, whereas children who did not attend regular check-ups or lacked toothbrushing habits had higher scores on Satiety Responsiveness and Slowness in Eating. These results suggest that oral hygiene and routine dental care play an important role not only in physical health but also in shaping children's feeding experiences and eating behaviour quality. Nembhwani and Winnier (2020) reported that among children aged 3–6 years, higher scores on the subscales Desire to Drink, Satiety Responsiveness, Emotional Undereating, Emotional Overeating, and Fussiness were associated with increased dental caries, whereas higher scores on Food Responsiveness and Enjoyment of Food were associated with reduced caries [40]. Similarly, Shqair et al. (2022) found that children with dental caries exhibited higher Desire to Drink and Satiety Responsiveness scores compared to caries-free children [41].

It was found that caregivers' healthy eating attitudes were significantly associated with certain dimensions of children's eating behaviours. Children of caregivers with higher healthy eating attitudes exhibited lower levels of Emotional Overeating and Emotional Undereating, and higher levels of Enjoyment of Food. This finding indicates that caregivers with positive attitudes towards healthy eating foster a more enjoyable and healthier relationship with food in their children. Costarelli et al. (2022) reported that parents' health and nutrition literacy significantly influenced their child-feeding practices [42]. Similarly, Hashemzadeh et al. (2024) found that mothers' nutrition literacy decreased children's consumption of fast food, fried foods, and sweets, while increasing intake of fruits, vegetables, and dairy products [43]. In addition, Silva et al. (2021) reported that 82% of overweight children had parents who were also overweight [44].

Studies examining factors affecting children's eating behaviours have indicated that parental eating habits and

feeding strategies are among the most influential determinants of children's nutrition. Another similar study highlighted that parents' healthy eating attitudes play a crucial role in shaping their children's eating behaviours; being a positive role model promotes healthy eating habits, whereas pressure and restriction can lead to overeating, food fussiness, or unhealthy eating choices in children [45]. The literature also demonstrates that parents with a high tendency for emotional eating may use food as a reward, restriction, or emotional regulation tool, which increases emotional eating behaviours in children [46]. These findings underscore that negative eating behaviours in children can lead to risky patterns, and that caregivers' eating attitudes play a decisive role in shaping children's eating behaviours.

Conclusion and recommendations

This study examined the healthy eating attitudes of caregivers of children with special needs and their children's eating behaviours. The findings revealed that caregivers' socio-demographic characteristics and the type of disability in children significantly influenced both caregivers' eating attitudes and children's feeding behaviours. Female caregivers demonstrated higher knowledge levels, differences in income were associated with positive or negative eating attitudes, and caregivers without chronic illnesses exhibited healthier eating attitudes. Furthermore, children's gender and type of disability were found to shape their eating behaviours.

Correlation analyses between the scales indicated that positive attitudes toward healthy eating were positively associated with Enjoyment of Food and negatively associated with Emotional Overeating, Satiety Responsiveness, and Emotional Undereating. These results suggest that caregivers' attitudes toward healthy eating directly affect their children's dietary habits. Therefore, developing nutrition education programs for caregivers is crucial for promoting healthy eating behaviours in children and alleviating challenges encountered during caregiving.

Accordingly, regular nutrition education programs should be designed and implemented for caregivers of children with special needs. Intervention programs should be tailored to address socio-demographic differences (e.g., gender, income, chronic illness) and specific needs. Family-based approaches should be adopted to support healthy eating habits in children. Multidisciplinary support involving healthcare professionals (e.g., nurses, dietitians, psychologists) is recommended. Future research should include larger sample sizes and conduct comparative studies focusing on different types of disabilities.

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Author contributions
1 Study design: TÖ, TÇT, GK. 2. Data collection: TÖ, TÇT. 3 Data analysis: TÖ. 4. Study supervision: TÖ, TÇT, GK. 5. Manuscript writing: All authors reviewed the manuscript confirmed the final version of the manuscript.

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Data availability
Data available on request from the authors.

Declarations

Ethics approval and consent to participate
Ethical approval for the study was obtained from the İstanbul Gedik University Non-Interventional Research Ethics Committee (Date: April 7, 2025; Decision No: E-56365223-050.04-2025.137548.89). Permission to use the measurement tools was obtained via e-mail from the original authors, and institutional approval was granted by the relevant organization. Informed consent for the purpose and method of the study was obtained from all participating caregivers. The study was conducted per the principles of the Declaration of Helsinki.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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