

Nutritional status, health-related quality of life and caregiver nutrition knowledge in children with cerebral palsy: a cross-sectional study from Türkiye

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Abstract

Background

Children with cerebral palsy (CP) are at high risk of impaired nutritional status and most depend entirely on a caregiver for feeding, so caregiver nutrition knowledge is assumed to shape both dietary intake and health-related quality of life (HRQoL). These domains are rarely assessed together; this study examined their interrelationships in children with CP.

Methods

In this cross-sectional study, 112 orally fed children with CP aged 6–12 years and their caregivers were recruited consecutively from a rehabilitation clinic in Istanbul, Türkiye. Gross motor function was classified with the Gross Motor Function Classification System (GMFCS). Nutritional status was assessed with CP-specific weight-for-age percentile charts and a three-day retrospective food record analysed in BeBiS against the Turkish Dietary Guidelines (TÜBER 2022). HRQoL was measured with the PedsQL 4.0 Generic Core Scales and the CP Quality of Life Questionnaire for Children (CPQoL-Child), and caregiver knowledge with the Parental Nutrition Knowledge Scale.

Results

Of the 112 children (57.1% girls; mean age 9.65 ± 2.19 years), 21.4% fell into an underweight and 52.7% into an overweight category; 52.7% were GMFCS level I–II. Energy adequacy fell from $82.08 \pm 28.17\%$ at 6–8 years to $69.94 \pm 23.80\%$ at 9–12 years ($p = 0.018$), with parallel declines in folate, calcium and iron adequacy (all $p < 0.05$), while energy from fat rose (36.03% vs 40.41% ; $p = 0.016$). Knowledge scores were highest among university-educated parents ($p < 0.05$), yet the highest energy and macronutrient intakes occurred in children of middle-school-educated mothers ($p < 0.001$). Nutrition knowledge correlated only weakly with the CPQoL Fatigue domain ($r = 0.200$, $p = 0.034$) and not with total CPQoL, total PedsQL or weight category. The CPQoL Eating Activities domain correlated most strongly with the CPQoL total ($r = 0.819$, $p < 0.001$), and CPQoL and PedsQL totals were strongly correlated ($r = 0.745$, $p < 0.001$).

Conclusions

Dietary adequacy declined with age while adiposity was common, and caregiver nutrition knowledge did not translate into better intake or HRQoL. Nutrition support should move beyond knowledge transfer towards practical, individualised counselling within multidisciplinary follow-up, with routine monitoring of feeding-related quality of life.

Background

Cerebral palsy (CP) is a group of permanent disorders of movement and posture attributed to non-progressive disturbances in the developing fetal or infant brain [1]. It is the most common cause of physical disability in childhood, with a reported global prevalence of approximately 2–3.5 per 1000 live births [2, 3]; a prevalence of 4.4 per 1000 live births has been reported for Türkiye [4]. Beyond impaired motor control, CP is frequently accompanied by epilepsy, cognitive and communication difficulties, dysphagia and gastrointestinal problems [5].

Feeding difficulties affect a large proportion of children with CP and, through inadequate energy intake, increased losses, impaired absorption and variable energy requirements, constitute a major risk factor for undernutrition, growth failure and secondary health complications [4, 6, 7]. Malnutrition in CP is frequently accompanied by gastrointestinal complications such as gastro-oesophageal reflux and constipation, which further reduce intake [38]. Reported prevalence of malnutrition in this population varies widely across settings and assessment methods [8], and a national survey in Türkiye has documented a high burden of undernutrition among children with CP [39]. Disease severity, graded with the Gross Motor Function Classification System (GMFCS) [9], influences not only mobility but also energy requirement, nutritional status and quality of life [10]. Because body composition in CP differs substantially from that of typically developing peers, conventional growth references perform poorly in this group and CP-specific, GMFCS-stratified growth charts have been developed [11, 12].

Most children with CP depend on a caregiver for meal preparation, food modification and feeding assistance because of oral-motor dysfunction, chewing and swallowing difficulty and cognitive limitations [13, 14]. The caregiver's nutrition knowledge is therefore considered a critical determinant of what the child actually eats and, indirectly, of the child's quality of life. Evidence from the general paediatric literature, however, indicates that the association between nutrition knowledge and dietary intake is modest and mediated by socioeconomic and practical factors [15], and the question has rarely been addressed in CP.

Health-related quality of life (HRQoL) in CP is assessed both with generic paediatric instruments such as the Pediatric Quality of Life Inventory (PedsQL) and with condition-specific instruments such as the CP Quality of Life Questionnaire for Children (CPQoL-Child); the two capture partly different constructs and are recommended for combined use [16, 17]. Understanding how nutritional status relates to HRQoL is central to designing interventions, yet studies that assess nutritional status, HRQoL and caregiver nutrition knowledge concurrently in the same sample are scarce, and Turkish data are particularly limited.

This study therefore aimed to examine, simultaneously and in a single sample of orally fed children with CP aged 6–12 years, (i) nutritional status assessed with CP-specific growth references and dietary records, (ii) HRQoL assessed with both a generic and a condition-specific instrument, and (iii) caregiver nutrition knowledge, and to describe the relationships among them.

Methods

Study design and setting

This descriptive, cross-sectional study was conducted at the Physical Therapy and Rehabilitation Clinic of a private hospital (Istanbul Güneşli Erdem Hospital) in Istanbul, Türkiye, between January and [MONTH] 2026. The manuscript is reported in accordance with the STROBE statement for cross-sectional studies [18].

Participants

Children were eligible if they were aged 6–12 years, had a diagnosis of CP made by a paediatric neurologist or paediatrician, were able to feed orally, and if both child and caregiver consented to participate. Children were excluded if they had a coexisting chronic disease (including epilepsy), if oral feeding had been discontinued entirely (i.e. children fed exclusively by enteral tube), or if the family declined participation or withdrew.

Eligible children attending the clinic during the study period were invited consecutively. The required sample size was calculated with G*Power 3.1 for a two-tailed Pearson correlation with $\alpha = 0.05$, power $(1 - \beta) = 0.80$ and an expected effect size of $r = 0.30$, yielding a minimum of 85 child–caregiver dyads. A total of 112 dyads meeting the eligibility criteria were enrolled.

Data collection

Sociodemographic and clinical data. A researcher-developed form was used to record the child's age and sex, clinical characteristics related to feeding, regular medication use and parental education level. Gross motor function was classified by the researcher using the GMFCS, which assigns children with CP to five levels according to self-initiated movement, with particular emphasis on sitting, walking and wheeled mobility [9].

Anthropometry and growth assessment. Body weight (kg) and height (cm) were recorded and BMI was calculated as weight divided by height squared (kg/m^2). Because growth patterns of children with CP differ from those of typically developing children and standard references are inadequate for this population [11], growth was interpreted using the CP-specific, sex- and GMFCS-stratified weight-for-age percentile charts developed by Brooks et al. from 102,163 weight measurements in 25,545 children with CP [12]. Children were assigned to one of eight categories defined by these charts (high-risk underweight, severe underweight, underweight, mild underweight, ideal weight, mildly overweight, overweight, severely overweight).

Dietary assessment. Daily energy and nutrient intake was assessed with a three-day retrospective food record completed with the caregiver, who reported the type, amount and cooking method of all foods

consumed by the child over the preceding three days. The three-day mean was analysed with the BeBiS (Nutrition Information System) software, and energy, macronutrient and micronutrient intakes were compared with the age- and sex-specific reference values of the Turkish Dietary Guidelines (TÜBER 2022) [19] to derive adequacy percentages (intake as a percentage of the reference value). A food frequency questionnaire covering milk and dairy products, meat, eggs, legumes, cereals, vegetables and fruit, nuts and packaged foods was administered to describe dietary patterns.

Health-related quality of life. Two instruments were used. The PedsQL 4.0 Generic Core Scales comprise 23 items in four domains (physical health and activities, 8 items; emotional functioning, 5; social functioning, 5; school functioning, 5); items are transformed to a 0–100 scale, with higher scores indicating better HRQoL [20]. Turkish validity and reliability of the age-appropriate forms has been established [21, 22]. The CPQoL-Child comprises 65 items in seven domains (daily activities, school activities, movement and balance, pain and impact of disability, fatigue, eating activities, and communication), with a parent-proxy form for ages 4–12 years and a child self-report form for ages 9–12 years; higher scores indicate better HRQoL [23]. The Turkish version has been validated by Atasavun Uysal et al. [24]. For both instruments the child self-report form was used when the child's age and cognitive function permitted, and the parent-proxy form otherwise. Permission to use both instruments was obtained from the authors of the Turkish validation studies.

Caregiver nutrition knowledge. The nutrition knowledge of the child's primary caregiver was measured with the Parental Nutrition Knowledge Scale used by Ulu [25]. Written permission was obtained from the scale developer. Total scores were used to classify caregivers as having low or high nutrition knowledge according to the scale's scoring procedure.

Statistical analysis

Data were analysed with IBM SPSS Statistics 27.0 (IBM Corp., Armonk, NY, USA). Normality of the continuous variables was assessed with the Kolmogorov–Smirnov test and the assumption of normal distribution was met. Categorical variables are presented as frequencies and percentages and continuous variables as mean $\pm$ standard deviation with minimum and maximum values. Two-group comparisons were made with the independent-samples t test and comparisons across three or more groups with one-way ANOVA. Relationships between continuous variables were examined with Pearson correlation coefficients. All tests were two-tailed and $p < 0.05$ was considered statistically significant. No adjustment for multiple comparisons was applied.

Ethics

The study was approved on 24 December 2025 by the Non-Interventional Clinical Research Ethics Committee of Istanbul Aydın University (decision no. 269/2025). The aim, procedures and confidentiality principles of the study were explained verbally to all caregivers and to those children whose cognitive level allowed comprehension, and written informed consent was obtained from caregivers and written

assent from children where applicable. The study was conducted in accordance with the Declaration of Helsinki.

Results

Participant characteristics

A total of 112 children with CP and their primary caregivers were included. Sixty-four children (57.1%) were girls and 48 (42.9%) were boys; 74 (66.1%) were aged 9–12 years and 38 (33.9%) were aged 6–8 years, with a mean age of 9.65 ± 2.19 years. Mean body weight was 32.7 ± 12.8 kg, mean height 129.2 ± 16.2 cm and mean BMI 18.9 ± 4.9 kg/m². Characteristics of the sample are shown in Table 1.

According to the CP-specific percentile charts, 24 children (21.4%) fell into one of the four underweight categories, 29 (25.9%) were of ideal weight and 59 (52.7%) fell into one of the three overweight categories. The sample was distributed across all five GMFCS levels, with 52.7% at levels I–II and 32.1% at levels IV–V (Table 1).

Energy and nutrient intake

Mean daily energy intake was 1270.40 ± 409.43 kcal in girls and 1126.64 ± 408.14 kcal in boys ($p = 0.068$), corresponding to energy adequacy of $77.53 \pm 26.76\%$ and $69.42 \pm 24.20\%$, respectively ($p = 0.101$). Protein intake was significantly higher in girls (50.57 ± 16.54 g vs 43.73 ± 17.20 g; $p = 0.036$), as were sodium intake (2187.51 ± 1052.83 mg vs 1686.01 ± 580.13 mg; $p = 0.002$), sodium adequacy (121.42% vs 97.93% ; $p = 0.011$), zinc intake (7.40 ± 2.74 mg vs 6.11 ± 2.15 mg; $p = 0.008$) and zinc adequacy (90.81% vs 75.87% ; $p = 0.024$). Mean sodium intake in girls exceeded the recommended upper limit of 2000 mg/day. Selected results by sex are given in Table 2.

Comparison by age group revealed a consistent pattern of declining adequacy with age (Table 3). Energy adequacy fell from $82.08 \pm 28.17\%$ in the 6–8 year group to $69.94 \pm 23.80\%$ in the 9–12 year group ($p = 0.018$) and protein adequacy from $228.26 \pm 72.35\%$ to $149.09 \pm 56.07\%$ ($p < 0.001$). Adequacy percentages were also significantly lower in the older group for water (42.27% vs 34.44% ; $p = 0.001$), riboflavin (134.14% vs 97.97% ; $p < 0.001$), folate (112.65% vs 74.21% ; $p < 0.001$), vitamin C (152.10% vs 96.33% ; $p = 0.011$), potassium (106.71% vs 68.08% ; $p < 0.001$), calcium (72.50% vs 55.55% ; $p = 0.003$), iron (69.65% vs 55.93% ; $p = 0.020$) and zinc (93.57% vs 79.70% ; $p = 0.045$). In contrast, the proportion of total energy derived from fat was significantly higher in the older group (40.41% vs 36.03% ; $p = 0.016$), as was fat adequacy (134.70% vs 120.10% ; $p = 0.016$).

When intake was compared across maternal education categories, the highest energy and macronutrient intakes were found not in children of university-educated mothers but in children of middle-school-educated mothers (energy 1494.24 ± 475.30 kcal vs 993.53 ± 308.62 kcal in the university group; $p < 0.001$). The same pattern was observed for energy adequacy (91.81% vs 62.20% ; $p < 0.001$), protein,

carbohydrate, folate, sodium, potassium, calcium adequacy and iron (all $p < 0.05$). By paternal education, calcium adequacy ($p = 0.025$), iron intake ($p = 0.041$) and iron adequacy ($p = 0.020$) were likewise highest in children of middle-school-educated fathers.

Across the eight CP-specific percentile categories, only the proportion of energy from fat and fat adequacy differed significantly (both $p = 0.011$), with the highest values in the high-risk underweight category. Energy, protein and carbohydrate intakes did not differ significantly between weight categories (all $p > 0.05$).

Health-related quality of life

Mean total CPQoL-Child score was 57.21 ± 24.49 . The highest domain score was Pain and Impact of Disability (67.69 ± 27.13) and the lowest was School Activities (45.03 ± 36.66). Mean total PedsQL score was 48.31 ± 18.64 (range 0–97.5), with Emotional Functioning highest (59.87 ± 25.42) and Physical Health and Activities lowest (35.02 ± 24.60). Descriptive scale results are presented in Table 4.

On the CPQoL-Child, the Eating Activities domain score was significantly higher in girls than in boys (71.09 ± 30.15 vs 51.56 ± 34.18 ; $p = 0.002$) and differed significantly by maternal education, being highest among children of middle-school-educated mothers ($p = 0.025$). The Communication domain differed significantly across weight categories, with the highest score in the severely overweight category ($p = 0.025$). No PedsQL domain differed significantly by sex, age group, parental education or weight category (all $p > 0.05$).

Correlations among nutritional status, HRQoL and caregiver nutrition knowledge

Mean total Parental Nutrition Knowledge Scale score was 9.15 ± 1.84 (range 4–14); 75 caregivers (67.0%) were classified as having high and 37 (33.0%) as having low nutrition knowledge. Scale scores were significantly highest in the university-educated group for both mothers (10.80 ± 1.47 vs 8.38 ± 1.39 in the primary-school group; $p < 0.001$) and fathers (10.19 ± 1.25 vs 8.12 ± 1.40 ; $p = 0.001$).

Correlations among the scales are shown in Table 5. Within the CPQoL-Child, the Eating Activities domain showed the strongest correlation with the total score ($r = 0.819$, $p < 0.001$), followed by Movement and Balance ($r = 0.813$), Communication ($r = 0.790$) and School Activities ($r = 0.786$). Total CPQoL-Child and total PedsQL scores were strongly and positively correlated ($r = 0.745$, $p < 0.001$). Among the CPQoL domains, Fatigue correlated most strongly with the total PedsQL score ($r = 0.657$, $p < 0.001$).

Caregiver nutrition knowledge was significantly correlated with only one of the thirteen HRQoL domain and total scores examined, the CPQoL Fatigue domain, and the association was weak ($r = 0.200$, $p =$

0.034). No significant correlation was found between caregiver nutrition knowledge and total CPQoL score ($r = 0.116$, $p = 0.222$), total PedsQL score ($r = 0.110$, $p = 0.250$) or weight category ($p = 0.823$).

Food consumption frequency

Cereals (bread, rice, pasta) were the food group most frequently consumed daily (65.2%), followed by fruit (63.4%), milk and yoghurt (62.5%), vegetables (55.4%), cheese (54.5%) and eggs (48.2%). Meat, poultry and fish were most commonly consumed 1–2 times per week (54.5%), as were legumes (62.5%). Packaged sweet products (chocolate, biscuits, cake) were consumed daily by 17.9% and 4–6 times per week by a further 18.8%, so that 36.7% of children consumed them on most days of the week; 13.4% consumed packaged salty snacks daily, while 44.6% never consumed sugar-sweetened carbonated drinks (Table 6).

Discussion

In this sample of orally fed school-aged children with CP, three findings stand out: the coexistence of underweight (21.4%) and overweight (52.7%) within the same clinic population; a marked decline in energy and micronutrient adequacy between the 6–8 and 9–12 year age groups; and the absence of any meaningful association between caregiver nutrition knowledge and either the child's dietary intake or HRQoL.

The high proportion of children in overweight categories contrasts with the high prevalence of undernutrition usually reported for CP [8, 26]. Two features of the present sample plausibly explain this. First, only orally fed children were enrolled and children with coexisting chronic disease were excluded, removing precisely the subgroup at highest nutritional risk. Second, more than half of the sample was GMFCS level I–II; ambulatory children with CP are frequently insufficiently active and have high sedentary time, a combination that, together with an energy-dense, cereal- and snack-based diet, favours excess fat accumulation [27]. The finding also underlines the limitation of BMI as a single-dimension index in CP: body composition in this population differs in fat-free mass distribution, and functional-level-based assessment has been recommended instead [28]. The near-absence of differences in energy, protein and carbohydrate intake across the eight percentile categories in our data supports this argument – weight category did not discriminate dietary intake, and the only significant differences concerned fat as a proportion of energy.

The age-related decline in adequacy was consistent across energy, protein, folate, calcium, iron, potassium, riboflavin and vitamin C. Since requirements rise steeply during the pubertal growth spurt while absolute intake in our sample remained essentially unchanged between the age groups (1205.71 vs 1210.38 kcal), the fall in adequacy reflects an unmet increase in requirement rather than reduced consumption. This is consistent with reports that energy and micronutrient insufficiency in CP is structural rather than episodic [29, 30]. The simultaneous rise in the proportion of energy from fat in the older group suggests a shift towards energy-dense but micronutrient-poor foods and indicates that fat

quality and processed-food intake should be addressed alongside energy adequacy in clinical follow-up. The food frequency data support this reading: more than a third of children consumed packaged sweet products on most days, while meat, poultry, fish and legumes were largely restricted to 1–2 times per week.

The relationship between maternal education and dietary intake was not linear. The highest energy and macronutrient intakes were recorded among children of middle-school-educated mothers, whereas nutrition knowledge scores rose monotonically with parental education. Several explanations are plausible and cannot be distinguished with the present design: higher parental education may be associated with more restrictive food choices and greater concern about excess weight, or with underestimation of the individual energy requirement of a child with CP; alternatively, employment patterns may reduce the time available for the prolonged, assisted mealtimes that children with CP require. A comparable dissociation has been described in caregivers of children with CP, among whom the majority of those caring for undernourished children considered the amount they offered to be sufficient [31].

The central negative finding of this study is that caregiver nutrition knowledge, although clearly patterned by parental education, was essentially unrelated to the child's HRQoL. Of the thirteen HRQoL domain and total scores tested, only the CPQoL Fatigue domain reached significance, with a weak coefficient ($r = 0.200$) that would not survive correction for multiple testing. Nutrition knowledge was likewise unrelated to weight category. This mirrors the wider literature, in which nutrition knowledge explains only a small share of variance in dietary intake [15], and points to the knowledge–practice gap as the operative problem: caregiver burden and stress, time constraints, the severity of the child's oral-motor impairment and household socioeconomic circumstances all intervene between knowing and doing [31, 32]. The practical implication is that nutrition education for these families should not be limited to information delivery. Structured, low-cost caregiver training programmes that rehearse feeding technique, texture modification and meal composition have improved feeding outcomes in comparable populations [33, 34].

The CPQoL Eating Activities domain showed the strongest correlation of any domain with the total CPQoL score ($r = 0.819$), placing the feeding process at the centre of condition-specific quality of life in CP rather than at its periphery. Dysphagia, mealtime complications and prolonged feeding duration affect the child and the caregiver simultaneously, and the strength of this association argues for including feeding-related quality of life as an outcome when nutrition interventions are evaluated. The link between nutritional status and HRQoL in CP has been demonstrated elsewhere: in a large Indian cohort, malnutrition was an independent predictor of poorer health-related quality of life [40]. The strong correlation between total CPQoL and total PedsQL scores ($r = 0.745$) in our data indicates that the generic and condition-specific instruments measure overlapping but complementary constructs [16]; notably, no PedsQL domain differed across any of the descriptive subgroups examined, whereas the CPQoL detected differences by sex, maternal education and weight category, suggesting that the generic instrument alone is less sensitive to within-CP variation.

Strengths and limitations

The strengths of this study include the use of CP-specific, GMFCS-stratified growth references rather than general population charts, the concurrent administration of a generic and a condition-specific HRQoL instrument, and the simultaneous assessment of caregiver nutrition knowledge, dietary intake and HRQoL in the same sample.

Several limitations must be acknowledged. The cross-sectional design precludes causal inference. Recruitment from a single rehabilitation clinic and the exclusion of children with coexisting chronic disease and of those who were not orally fed limit generalisability, in particular to the most severely affected children, in whom nutritional risk is greatest. The number of children screened and the number of families declining participation were not recorded, so participation bias cannot be quantified. Body weight and height were obtained by report rather than by standardised measurement by the research team, which may introduce misclassification of weight category. Dietary intake was assessed with a three-day retrospective record completed by caregivers and is therefore subject to recall and social-desirability bias; retrospective records may under-represent usual intake in children with CP, in whom mealtime duration and intake vary considerably from day to day [35]. GMFCS level and CP subtype were recorded but not entered as covariates in the analytic models, so the observed associations are unadjusted; the analyses were also unadjusted for multiple comparisons, and the weak Fatigue–nutrition knowledge association in particular should be regarded as hypothesis-generating. Internal consistency coefficients for the instruments were not recalculated in the present sample. Finally, biochemical markers of micronutrient status were not obtained, so reported adequacy percentages reflect intake rather than nutrient status.

Conclusions

In orally fed school-aged children with CP attending a rehabilitation clinic in Istanbul, underweight and overweight coexisted, dietary adequacy declined markedly between the 6–8 and 9–12 year age groups, and feeding-related quality of life was the domain most closely tied to overall condition-specific quality of life. Caregiver nutrition knowledge increased with parental education but was not reflected in the child's dietary intake, weight category or quality of life.

These findings suggest that energy requirements in CP should be estimated with condition-specific equations rather than general paediatric equations, and that nutrition interventions should be individualised by GMFCS level. Routine nutritional screening at every rehabilitation contact would allow risk to be detected before it becomes clinically apparent, although no screening tool has yet been validated specifically for CP [36]. Biochemical monitoring of folate, calcium and iron status merits routine consideration in the 9–12 year age group, and counselling should explicitly address glycaemic load and processed-food intake given the high frequency of packaged sweet products. The CPQoL Eating Activities domain is a candidate outcome measure for monitoring the effectiveness of nutrition interventions. Above all, caregiver-directed nutrition support should be practical and skills-based – menu

planning, texture modification, micronutrient supplementation – rather than purely informational, and a dietitian should be a standard member of the multidisciplinary CP care team, in line with the shift in this field from reactive to anticipatory nutrition management [37]. Longitudinal studies with larger samples that include tube-fed children, model GMFCS level and CP subtype from the outset, and incorporate biochemical markers are needed to establish the causal pathways suggested here.

Abbreviations

ANOVA: Analysis of variance; BeBiS: Beslenme Bilgi Sistemi (Nutrition Information System); BMI: Body mass index; CP: Cerebral palsy; CPQoL-Child: Cerebral Palsy Quality of Life Questionnaire for Children; GMFCS: Gross Motor Function Classification System; HRQoL: Health-related quality of life; PedsQL: Pediatric Quality of Life Inventory; SD: Standard deviation; SPSS: Statistical Package for the Social Sciences; STROBE: Strengthening the Reporting of Observational Studies in Epidemiology; TÜBER: Türkiye Beslenme Rehberi (Turkish Dietary Guidelines)

Declarations

Ethics approval and consent to participate

The study was approved by the Non-Interventional Clinical Research Ethics Committee of Istanbul Aydın University on 24 December 2025 (decision no. 269/2025) and was conducted in accordance with the Declaration of Helsinki. Written informed consent was obtained from the parent or legal guardian of every participating child, and written assent was additionally obtained from children whose cognitive level permitted.

Consent for publication

Not applicable. The manuscript contains no individual person's data in any form.

Availability of data and materials

The datasets generated and analysed during the current study are not publicly available because they contain information that could compromise the privacy of the participating children and families, but are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

EK and ŞA conceived and designed the study. EK collected the data and performed the statistical analysis. ŞA supervised the study and verified the analytical methods. EK drafted the manuscript. ŞA critically revised the manuscript for important intellectual content. Both authors read and approved the final manuscript.

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Tables

Tables 1 to 6 are available in the Supplementary Files section.

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