

Detection of problematic feeding symptoms in childhood: Utility of the PediEAT questionnaire in populations with and without disabilities

Detección de síntomas de alimentación problemática en la infancia: Utilidad del cuestionario PediEAT en poblaciones con y sin discapacidad

María Elisabeth Cieri^{a,b,c}, Ana Laura Condinanzi^{a,b}, Carla Gil^{a,b}, Gabriela Macagno^a, Eduardo Cuestas^{a,b,d}, María de las Mercedes Ruiz Brunner^{a,b,c}

^aInstituto de Investigaciones Clínicas y Epidemiológicas (INICyE), Facultad de Ciencias Médicas, Universidad Nacional de Córdoba. Córdoba, Argentina.

^bCentro de Investigación en Medicina Traslacional Severo Amuchástegui (CIMETSA), Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET), Instituto Universitario de Ciencias Biomédicas de Córdoba (IUCBC). Córdoba, Argentina.

^cCentro de Investigaciones en Nutrición Humana (CenINH), Escuela de Nutrición, Facultad de Ciencias Médicas, Universidad Nacional de Córdoba. Córdoba, Argentina.

^dHospital Nuestra Señora de la Misericordia. Facultad de Ciencias Médicas. Universidad Nacional de Córdoba. Córdoba. Argentina.

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What do we know about the subject matter of this study?

There is a high prevalence of feeding disorders in children, especially those with disabilities, but identifying them can be difficult without specific tools.

What does this study contribute to what is already known?

This study shows the usefulness of PediEAT as a tool for detecting feeding problems in children, especially those with disabilities. Greater concern was identified in the dimensions of physiological symptoms, selective eating, and oral processing, highlighting the association between family perception and the results of screening instruments such as PediEAT.

Abstract

Feeding difficulties are common in childhood. The PediEAT questionnaire helps in identifying feeding problems in children up to 7 years of age. **Objective:** To assess symptoms associated with problematic feeding observed by families and/or caregivers of Argentine children aged 6 months to 7 years who consume solid foods through the implementation of the PediEAT tool, with and without reported disabilities. **Subjects and Method:** Observational, analytical, cross-sectional study. Sequential sampling was conducted. The self-administered PediEAT questionnaire, previously adapted and validated, was used with families and/or caregivers of children aged 6 months to 7 years who had started

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consuming solid foods. Age, nutritional status, socio-educational characteristics, and PediEAT dimensions were analyzed. The dimensions of the questionnaire were compared between those whose caregivers perceived problematic feeding and those who did not. Categorical variables were evaluated using the Chi-square test with Fisher's correction, with a significance level of $p < 0.05$. **Results:** 310 children were evaluated. The average age was 3 years and 8 months (± 1 year and 8 months). 13.2% had a reported disability and 41.3% (95% CI 35.8–47.0) of the children's caregivers stated that they perceived problematic feeding or were unsure about it. Additionally, 39% (95% CI 33.5–44.7) showed malnutrition, either due to excess or deficiency. Compared to the group without reported disabilities, the group with disabilities showed greater concern in the dimensions of physiological symptoms ($p = 0.009$), selective/restrictive eating ($p = 0.033$), and oral processing ($p < 0.0001$). The perception of feeding problems, as reported by families, was significantly associated with the identification of problematic feeding concerns according to the PediEAT ($p < 0.001$). **Conclusions:** The group with disabilities shows a higher prevalence of eating problems, and the PediEAT helped identify the specific areas of these problems perceived by families.

Introduction

Feeding is a fundamental process in child development and growth. However, both children with and without reported disabilities, one of the various factors that can affect feeding is the presence of difficulties during mealtimes (difficulty accepting textures, prolonged feeding times, nausea and/or discomfort during the feeding process, refusal to eat certain foods)^{1,2}. The prevalence of feeding difficulties is estimated to be between 25% and 50% among young children without reported disabilities^{1,2}. In children with disabilities, this figure rises to 80% due to alterations in muscle tone and oral or sensory difficulties¹. Although there is still no consensus on the definition of feeding problems due to their complexity, multiple causes, and heterogeneity, in general, problematic feeding is understood to be identified when a child does not progress in food intake at the expected stages for their age and development². Feeding problems include difficulties related to physiological symptoms, problematic feeding behaviors, selective eating, food refusal, and oral processing difficulties (related to dysphagia). When feeding problems become severe, they can lead to nutritional deficiencies, failure to meet nutritional and/or energy needs, and imbalances related to psychosocial functioning, known as avoidant/restrictive food intake disorder (ARFID)³.

Various standardized instruments have been developed to screen for feeding problems, allowing the symptoms of eating disorders in children to be identified and quantified. One of these is the Pediatric Eating Assessment Tool (PediEAT), a questionnaire used to assess feeding behavior and difficulties in children aged 6 months to 7 years⁴⁻⁶. The PediEAT has recently been cross-culturally adapted in Argentina and other countries^{7,8} and has proven to be a valid and reliable tool for detecting feeding problems, providing crucial

information for early intervention and the design of therapeutic strategies.

Although feeding problems in early childhood are common and standardized instruments exist for their detection, to our knowledge, few studies in Argentina and Latin America have implemented the PediEAT to characterize these difficulties in the general population. Likewise, there is little evidence on the differences in problematic feeding symptoms between children without reported disabilities and those with disabilities, or on the degree of agreement between caregivers' perceptions and the results obtained with tools such as the PediEAT.

The objective of this study was to evaluate the symptoms associated with problematic feeding as perceived by families and/or caregivers of Argentine children aged 6 months to 7 years who eat solid foods using the PediEAT tool. In addition, we aimed to compare different aspects of problematic feeding between children without reported disabilities and those with disabilities, and between those children whose caregivers observed problematic feeding and those who did not.

Subjects and Method

Observational, analytical, cross-sectional study using a digital survey. The digital survey was conducted on the LimeSurvey platform from the servers of the National University of Córdoba. Data for this study were collected from May to December 2021. Families were invited to participate in the study through a call for participants on the official social media accounts of our Institute of Clinical and Epidemiological Research (INICyE-FCM-UNC). This strategy allowed for greater dissemination and contact with the community, ensuring voluntary and informed participation.

The sample consisted of caregivers of children between 6 months and 7 years of age, with and without reported disabilities, who eat solid foods and reside in Argentina. The inclusion criteria were that caregivers be over 18 years of age, have access to the internet, be literate in Spanish, and accept the terms and conditions of the informed consent to participate freely and voluntarily. Families whose children did not eat solid foods orally were excluded from the study. The sample size to estimate the frequency of the population was calculated considering a significance level of $\alpha = 0.05$ and a statistical power of 80% ($\beta = 0.20$), assuming a hypothetical frequency of feeding difficulties of 20% and a confidence interval of 95%. With these parameters, a sample size of 246 subjects was obtained. Symptoms of problematic feeding were analyzed, data on nutritional status were collected (families reported the last weight and length/height recorded by the health professional in the child's health record), socio-educational characteristics of the families were assessed, and a question was asked about the family's perception of the child's feeding habits. In addition, the variables of overcrowding (represented by the ratio between the total number of people in the household and the total number of rooms or spaces available) and critical overcrowding (living in a home where there are three or more people per room on average) were considered^{9,31}.

Symptoms of Problematic Feeding in Childhood

The PediEAT questionnaire is a screening tool with 80 items that assesses four dimensions: physiological symptoms, problematic feeding behaviors, selective/restrictive eating, and oral processing^{5,6}. The variable of feeding difficulties was analyzed using the Argentine version of the PediEAT questionnaire, which was culturally adapted and previously published⁸. Parents and/or caregivers completed the PediEAT questionnaire about their perception of their children's feeding behavior. The instrument was completed with categorical responses according to a Likert scale corresponding to "never," "almost never," "sometimes," "often," "almost always," and "always." Based on the score obtained, the results for each category are classified as "not a concern," "a concern," or "a major concern"⁴⁻⁶. For statistical analysis, when a dichotomous variable was required, the variables "a concern" and "a major concern" were combined into "a concern".

Nutritional status

To assess nutritional status, data on weight and length/height reported by parents from the most recent medical check-ups were collected. Cases in which the child's sex was not reported or in which there were errors in the data were excluded. Based on this information, z-scores for weight-for-age (WAZ), height-

for-age (HAZ), and body mass index-for-age (BAZ) were calculated. According to WHO reference standards, nutritional status was assessed and categorized as follows: normal: those with WAZ, HAZ, and BAZ between -1.99 and 1.99 z-scores; undernutrition: those with WAZ, HAZ, and/or BAZ <-2.00; overweight: those with BAZ between 2.00 and 2.99; obesity: those with BAZ > 3.00¹⁰.

Family perception of nutrition

Before administering the PediEAT questionnaire, an initial question was included to inquire about families' perceptions of their child's feeding habits. They were asked whether they perceived their child to have problematic feeding habits, with the possible responses being "yes," "no," or "not sure".

Socio-educational characteristics

Information was requested on the sex and age of the child and their caregivers. Each family identified one of its members as the main breadwinner. The socio-educational characteristics of the families were assessed based on the educational level of the main breadwinner, the presence or absence of overcrowding according to the indicators of the National Institute of Statistics and Censuses (INDEC), and whether they lived in a low-income neighborhood as determined by national surveys¹¹. Low-income neighborhoods are those where more than half of the population does not have a land title or regular access to two or more basic services (piped water, electricity with an individual household meter, and/or sewer system).

Disability

Families reported in the questionnaire whether their child had any type of disability. If so, they were asked whether they had a single disability certificate and what the diagnosis was. The type of disability was then classified for analysis according to motor, intellectual, visual, hearing, or mixed disability.

Statistical analysis

Continuous variables were described as means with standard deviation (SD); discrete variables were described as percentages with 95% CI. To assess nutritional status, weight and length/height reported by caregivers based on their last medical check-up were considered, and the WHO Anthro Plus V 1.0.4. software was used to assign Z scores to anthropometric variables. Tests were performed to analyze statistically significant differences in the different dimensions of the PediEAT between children with no reported disability and those with disabilities. In addition, the dimensions of the questionnaire were compared according to whether caregivers perceived feeding problems

or not. For this purpose, categorical variables were evaluated using the Chi2 test with Fisher's correction. Continuous variables were evaluated with the t-test or Mann-Whitney test, depending on the nature of the variable. Significance was set at a value of $p < 0.05$. Statistical calculations were performed using MedCalc software version 12.5.0.0.

Ethical considerations

The research was approved by the ethics committee of the National Clinical Hospital of the Faculty of Medical Sciences of the National University of Córdoba (CIEIS HNC-FCM), ruling of 08/12/2021. Families signed written consent to participate in the research.

Results

A total of 310 subjects were included in the study, 86.8% of whom were children with no reported disability and 13.2% with a disability (Supplementary Figure 1, available *online*).

Regarding the characteristics of the families, most respondents were women/mothers, followed by others (e.g., grandparents, siblings). In terms of socio-educational level, most families did not live in overcrowded conditions, had completed secondary education or

higher, and did not belong to low-income neighborhoods. The mean age of caregivers was 35 years (SD 7.4) (Table 1).

Regarding the group of children with disabilities, 75.6% had intellectual disabilities [including Down syndrome, autism spectrum disorder (ASD), pervasive developmental disorder (PDD), epilepsy, and specific speech and language disorder]; 7 (17.1%) had motor disabilities (e.g., cerebral palsy, VACTERL association, laminopathy, kernicterus); 2 (4.9%) had mixed disabilities, and in one case (2.4%), caregivers did not specify the type of disability (Table 2).

When caregivers were asked if they perceived their children to have feeding problems, 21.0% answered "yes," 58.7% answered "no," and 20.3% said they were "not sure." Of 256 children, 39% were malnourished, with 43.7% (112) presenting undernutrition and 28.5% (73) overnutrition. Differences in the perception of feeding problems between families of children with and without reported disabilities were evaluated, and statistically significant differences were found ($p = 0.001$). In the group with disabilities, 39% of caregivers reported feeding difficulties, compared to 18.2% in the group without reported disabilities. These results indicate that families of children with disabilities perceive feeding problems more frequently (Table 3A).

Table 1. Sociodemographic characteristics of caregivers who completed the survey

Characteristics	n	%	95% CI
<i>Relationship with the child</i>			
Mother	292	94.2	90.9; 96.5
Father	6	1.9	0.7; 4.1
Other	12	3.9	2.3; 6.7
<i>Caregiver's sex</i>			
Female	268	86.5	82.2; 90.1
Male	17	5.5	3.2; 8.6
Missing data	25	8.1	5.3; 8.7
<i>Overcrowding</i>			
Yes	22	7.1	4.5; 10.5
Critical overcrowding	11	3.5	1.7; 6.2
No	277	89.4	85.4; 92.6
<i>Educational level of the primary caregiver</i>			
No formal education or incomplete primary education	4	1.3	0.3; 3.3
Completed primary education or incomplete secondary education	15	4.8	2.7; 7.8
Completed secondary education or incomplete tertiary/university education	108	34.8	29.5; 40.4
Completed tertiary/university education or postgraduate education	183	59.0	53.3; 64.5
<i>Lives in a low-income neighborhood</i>			
Yes	42	13.8	10.1; 18.1
No	263	86.2	81.8; 89.8

Table 2. Characteristics of children whose feeding was assessed using the PediEAT questionnaire

	Total (n = 310)			Children without reported disabilities (n = 269)			Children with disabilities		
	n	%	95%CI	n	%	95%CI	n	%	95%CI
Sex									
Female	122	39	33.5;44.6	113	42	36; 48.1	9	22	10.5; 37.6
Male	138	45	39.4;50.7	113	42	36; 48.14	25	61	44.5; 75.8
Missing data	50	16	12.1;20.5	43	16	11.8; 20.9	7	17	7.2; 32.1
Age (months)									
6 - 11	31	10	6.9;13.9	28	10	7.0; 14.7	3	7	1.5; 19.9
12 - 35	85	27	22.1;32.3	76	28	22.9; 34.0	9	22	10.5; 37.6
36 - 59	100	32	26.8;37.5	85	32	26.0; 37.5	15	37	22.0; 53.0
60 - 84	94	30	24.9;35.4	80	30	24.3; 35.6	14	34	20.0; 50.5

Table 3. Nutritional status and perceived problematic feeding among children with and without reported disabilities

	Total	Children without reported disabilities	Children with disabilities	Chi-square (χ^2)
	n (%[95%CI])	n (%[95%CI])	n (%[95%CI])	
A. Perceived problematic feeding by caregivers				
	(n = 310)	(n = 269)	(n = 41)	
Yes	65 (21.0 [16.6; 26])	49 (18.2 [13.8;23.3])	16 (39 [24.2;55.5])	0.001
No	182 (58.7 [53; 64.2])	168 (62.5 [56.4;68.2])	14 (34.1 [20.0;50.5])	
Not sure	63 (20.3 [16; 25.2])	52 (19.3 [14.8;24.6])	11 (26.8 [14.2;42.9])	
B. Nutritional status				
	(n = 256)	(n = 224)	(n = 32)	
Undernutrition	36 (14.1 [10; 19])	27 (12.1 [8.1; 17.1])	9 (28.1 [13.7; 46.7])	0.002
Normal	156 (60.9 [54.6; 67])	145 (64.7 [58; 71])	11 (34.4 [18.6; 53.2])	
Overweight	35 (13.7 [9.7; 18.5])	26 (11.6 [7.7; 16.5])	9 (28.1 [13.7; 46.7])	
Obesity	29 (11.3 [7.7; 15.8])	26 (11.6 [7.7; 16.5])	3 (9.4 [2; 25])	

In addition, we analyzed whether there were differences in nutritional status between children with and without reported disabilities. Subjects with disabilities had a higher proportion of undernutrition compared to their peers ($p = 0.002$). Children with disabilities had a higher frequency of undernutrition (28.1% vs. 12.1%) and overweight (28.1% vs. 11.6%) compared to children without reported disabilities (Table 3B).

In children with disabilities, the results of the PediEAT questionnaire showed a higher frequency of “concerned” and “very concerned” in problematic feeding symptoms than in those without disabilities. The greatest differences were observed in the physiological symptoms ($p = 0.009$), selective/restrictive eating ($p = 0.030$), and oral processing ($p < 0.000$) dimensions. The difference in problematic eating behaviors was the only dimension that was not statistically significant ($p = 0.057$), although there is a trend

toward greater concern in the group of children with disabilities (Table 4).

Subsequently, the variable corresponding to the PediEAT questionnaire “families’ perception of feeding problems” was compared with the question of whether families observe feeding difficulties in their children.

It was found that among families who do not perceive feeding problems, most of them did not express significant concern as identified by the PediEAT questionnaire across all dimensions. In contrast, in families who do perceive feeding problems, there is a higher prevalence of “concern” identified by the PediEAT questionnaire in all dimensions. Statistically significant differences were observed in all dimensions, with p -values < 0.001 , indicating that the family’s perception of problematic feeding is significantly associated with problematic feeding outcomes identified by the PediEAT instrument (Table 5).

Table 4. PediEAT scores for problematic feeding in children with typical development and children with disabilities

	Total			Children without reported disabilities (n = 269)			Children with disabilities (n = 41)			Chi-square (χ^2) p
	Not a concern	A concern	A major concern	Not a concern	A concern	A major concern	Not a concern	A concern	A major concern	
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	
Physiologic Symptoms	261 (84.2)	20 (6.5)	29 (9.4)	233 (86.6)	14 (5.2)	22 (8.2)	28 (68.3)	6 (14.6)	7 (17.1)	0.009
Problematic Mealtime Behaviors	238 (76.8)	18 (5.8)	54 (17.4)	212 (78.8)	13 (4.8)	44 (16.4)	26 (63.4)	5 (12.2)	10 (24.4)	0.057
Selective / Restrictive Eating	167 (53.9)	44 (14.2)	99 (31.9)	152 (56.5)	38 (14.1)	79 (29.4)	15 (36.6)	6 (14.6)	20 (48.8)	0.033
Oral Processing	291 (93.9)	11 (3.5)	8 (2.6)	259 (96.3)	7 (2.6)	3 (1.1)	32 (78.8)	4 (9.8)	5 (12.2)	< 0.0001
Total	243 (78.4)	22 (7.1)	45 (14.5)	218 (81)	18 (6.7)	33 (12.3)	25 (61)	4 (9.8)	12 (29.3)	0.009

Table 5. PediEAT scores according to caregivers' perception of feeding

PediEAT Dimensions	Children without perceived feeding difficulties (n = 182)			Children with perceived feeding difficulties (n = 128)			*p
	Not a concern	A concern	A major concern	Not a concern	A concern	A major concern	
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	
Physiologic Symptoms	165 (90.7)	7 (3.8)	10 (5.5)	96 (75)	13 (10.2)	19 (14.8)	0.001
Problematic Mealtime Behaviors	169 (92.9)	5 (2.7)	8 (4.4)	69 (53.9)	13 (10.2)	46 (35.9)	< 0.0001
Selective / Restrictive Eating	125 (68.7)	24 (13.2)	33 (18.1)	42 (32.8)	20 (15.6)	66 (51.6)	< 0.0001
Oral Processing	180 (98.9)	0 (0)	2 (1.1)	111 (86.7)	11 (8.6)	6 (4.7)	< 0.0001
Total	170 (93.4)	8 (4.4)	4 (2.2)	73 (57)	14 (10.9)	41 (32)	< 0.0001

*Chi-square test χ^2 .

Discussion

This study found a higher prevalence of problematic feeding in children with disabilities. The culturally adapted PediEAT questionnaire proved useful for identifying and assessing the different dimensions of child feeding in both populations (with and without reported disabilities), which is essential for the early detection of feeding problems¹².

Similar to previous studies, the results of this study confirm that children with disabilities have a higher prevalence of feeding problems compared to those without them^{1,2}. In this study, 39% of children with disabilities had feeding problems, which is in line with

previous research that found a prevalence of 50 to 80% of feeding problems in children with conditions such as cerebral palsy, Down syndrome, and ASD^{13-16,21,22}. The feeding problems observed in this study can be explained by a complex interaction of neuromotor and sensory factors. Alterations in muscle tone, which can manifest as hypotonia or hypertonia, directly impact posture and the control necessary for safe and effective feeding. Oral difficulties, including limitations in sucking, chewing, swallowing, and saliva management, are the result of impaired muscles in the mouth, tongue, and pharynx. Additionally, the presence of sensory disorders can exacerbate these difficulties, generating aversions or sensitivities to certain food textures, fla-

vors, or odors, further limiting their ability to eat adequately and efficiently, compromising their nutritional status and overall development^{14,17}. Likewise, previous studies have reported that between 40% and 50% of parents or caregivers perceive that their typically developing child may have feeding problems^{18,19}, which coincides with our findings and reinforces the importance of considering family perception as an early indicator of risk^{4,20}.

In terms of nutritional status, a worrying aspect was the high rate of malnutrition among participants, both under- and overnutrition, which highlights the close relationship between feeding difficulties and nutritional status¹. Children with disabilities had a higher proportion of undernutrition, which can be considered as one of the consequences of difficulty in adequate intake or of developing selective, restrictive, or disorganized eating patterns. These results are consistent with a recent study in which more than 30% of children presented with under- and overnutrition associated with feeding problems, nutritional imbalances, and physical growth disorders²³. The decision to use the WHO ranges responds to the need to ensure that the results are comparable with international studies and global public health benchmarks¹⁰. However, it is important to note that in some Latin American countries, such as Chile, Mexico, Peru, and Colombia, more sensitive cut-off points have been adopted for the definition of overweight and obesity ($Z\text{-BMI}/A \geq +1.0$ and $\geq +2.0$, respectively), for early detection and intervention²⁴⁻²⁸.

It is important to highlight the association between caregivers' perceptions and the results of the PediEAT questionnaire. The study showed that children whose parents/caregivers perceived problematic feeding were more likely to have feeding problems according to the PediEAT results, especially in the areas of problematic feeding behaviors and selective eating⁴. This highlights the importance of perception as a valid indicator for the early detection of feeding problems, which is essential for early intervention and the improvement of eating behaviors in childhood. We have observed that the family's perception that there is a feeding difficulty is associated with a higher proportion of children who score in the range of concern on the PediEAT. In our sample, only 6.6% of children without a perceived problem by the family fell into that range, while the proportion rose to 42.9% when caregivers expressed concern. This finding is consistent with other studies that highlight the importance of families' perceptions of problematic feeding, as it is more likely that there is a problem that should be investigated by health professionals²⁰.

An interesting fact is that the surveys were collected during the COVID-19 pandemic (May to December 2021), which is a relevant contextual factor, as fami-

ly eating routines, food availability, and/or interaction dynamics in the home may have been altered, influencing caregivers' perceptions of their children's eating behaviors.

An interesting finding of this study is the significant difference in the prevalence of problematic feeding according to the PediEAT questionnaire between children with and without reported disabilities. Those with disabilities showed greater concerns in the PediEAT about physiological symptoms, selective/restrictive eating, and oral processing, suggesting that children with certain conditions are at greater risk of developing multifactorial feeding difficulties⁷. These results suggest the need to design specific intervention strategies so that children with conditions can address their feeding difficulties from a comprehensive approach, considering all necessary interventions.

Limitations and Strengths

Although the study has the limitation of an uneven distribution between the groups of children with and without reported disabilities, which merely reflects the reality of the problem, it is important to note that the sample size was considerable, providing a solid basis for analysis. In addition, a good number of positive responses were obtained in the PediEAT questionnaire, suggesting adequate identification of children with feeding problems within the sample studied.

However, relying exclusively on caregivers' perceptions as a source of information about problematic feeding introduces potential informant bias, where the interpretation and reporting of difficulties may vary between families and may not necessarily reflect objective clinical assessment²⁹. Additionally, the assessment of nutritional status was based on information provided by parents or caregivers, which could also be susceptible to perception or memory biases, rather than objective measurements. Social desirability bias may also have influenced caregivers' responses, leading to a possible underestimation or overestimation of their children's feeding problems and nutritional status²⁹.

Despite these considerations, a strength of the study is the use of the PediEAT questionnaire, an instrument culturally adapted to the reference population. The research demonstrated a significant association between family perceptions of problematic feeding and PediEAT scores, supporting its usefulness in capturing difficulties as experienced by those who directly observe children. This family perspective, although subjective, is clinically relevant for early detection and complements future assessments³⁰. Furthermore, the data were analyzed using statistical tests appropriate for the type of variables and study design, allowing for an adequate assessment of the significance of the

associations found. In addition, the application of the PediEAT in children with and without disabilities is a relevant contribution and provides preliminary evidence that can guide future research in this area.

Conclusion

There is evidence that problematic feeding is more prevalent in children with reported disabilities compared to those without them. Significant differences were identified in physiological symptoms, selective/restrictive eating, and oral processing, highlighting the importance of early assessments to detect difficulties.

When families perceive problems in their children's feeding, the PediEAT questionnaire proved to be a useful screening tool for assessing which aspects of eating might be causing the problem. It is important to note that the results of the PediEAT questionnaire must then be followed up with an evaluation by a health professional, as it is a screening tool and not a diagnostic tool.

Ethical Responsibilities

Human Beings and animals protection: Disclosure the authors state that the procedures were followed ac-

ording to the Declaration of Helsinki and the World Medical Association regarding human experimentation developed for the medical community.

Data confidentiality: The authors state that they have followed the protocols of their Center and Local regulations on the publication of patient data.

Rights to privacy and informed consent: The authors have obtained the informed consent of the patients and/or subjects referred to in the article. This document is in the possession of the correspondence author.

Conflicts of Interest

Authors declare no conflict of interest regarding the present study.

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