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Recent Progress in Nutrition

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Original Research

Does Accepting a Wider Variety of Foods Mean Eating Better? The Food Paradox of Children and Adolescents with Feeding Difficulties

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Academic Editor: Andrew S Day

Recent Progress in Nutrition
2026, volume 6, issue 2
doi:10.21926/rpn.2602006

Received: December 18, 2025
Accepted: May 18, 2026
Published: May 29, 2026

Abstract

This study descriptively investigates the food acceptance patterns and dietary profiles of neurotypical infants, children, and adolescents with Feeding Difficulties (FD) at a Brazilian pediatric reference center. It further examines whether a broader food repertoire translates into improved nutritional quality. The research, an observational, analytical cross-sectional study, analyzed data from 237 patients aged 10 to 204 months with FD. Findings revealed a discrepancy between family perceptions and professional assessments, with families underestimating the variety of foods their children accept. While the average number of accepted foods increased with age (from 19.68 items in infants to 29.46 in adolescents), suggesting an expansion of food exposure, this did not necessarily lead to improved nutritional quality. Infants' diets, despite being smaller in repertoire, showed a more favorable nutritional profile with more fruits and vegetables and fewer snacks and sweets. However, from preschool age onwards, the dietary profile worsened, marked by increased

intake of ultra-processed foods, snacks, sweets, and sugary drinks. The study identified a predominance of sweet-tasting, light-colored, solid, and "dissolvable" hard-solid texture foods among accepted items, reflecting sensory preferences**.** Ultra-processed and hyperpalatable foods, particularly sweets, showed increased acceptance from preschool age onward, while less chewing-demanding consistencies and infant formulas were characteristic of younger ages. This highlights the critical role of parental attitudes and early interventions to promote healthy eating habits, emphasizing that sensory preferences often guide food choices in children with FD, leading to a diet rich in less nutritious options.

Keywords
Feeding difficulties; food fussiness; infant feeding; infant nutrition; child nutrition; adolescent nutrition

1. Introduction

Access to adequate nutrition in the early years of life is essential for the formation of healthy eating habits and encourages the continuation of good choices in childhood and adulthood [1-4]. This dietary journey begins in utero through exposure to different flavors. It is transmitted from the mother's diet via amniotic fluid, continues after birth through breastfeeding, and progresses through the period of food introduction until reaching the family diet [1-3, 5].

These phases highlight the crucial role of parents/caregivers—in addition to the child's entire biopsychosocial context—in building eating skills through daily exposure to appropriate foods, seeking accurate information, and responsive parenting practices that facilitate an environment conducive to caregiver/child interactions in forming a healthy relationship not only about what to eat, but also how to eat, where to eat, and how much to eat [6-9].

Most neurotypical children go through these stages naturally and positively; however, about 20-30%, with a higher prevalence in the preschool age, may present more significant feeding challenges [10]. Some of these challenges are described as: acceptance of a limited number of foods, complete refusal of one or more food groups, constant search for preferred foods, difficulty in accepting different flavors, colors, consistencies, textures, disinterest at mealtimes, fear of trying new foods, limited appetite, among others [10].

In 2015, Kerzner and colleagues proposed the term feeding difficulties (FD) to name eating problems of different levels, which corroborate with inappropriate eating patterns and/or dynamics, with or without associated organic aspects, which can cause physical, nutritional, and sensory damage to the child, and psychosocial harm to the child and also to their family [8, 10].

Food selectivity is the most well-known FD, a major concern for parents/caregivers and often the reason they seek specialized professional guidance and monitoring for their children. Despite the considerable interest and wide dissemination of the topic of the "child who does not eat", with studies from different countries describing the food groups accepted and rejected by individuals with FD [11-16], studies are scarce in the literature that detail acceptance patterns in a sample of infants, children, and adolescents with FD, from different perspectives—numerical, sensory characteristics, and food groups—and that provide comparisons across these dimensions.

The literature defines highly selective eating as the acceptance of 15 or fewer foods [10]. However, there is a clear need to pay attention to the quality of what is accepted, since children with the same number of accepted foods may have completely different food and nutritional quality, just as one child may accept a limited number of good-quality foods. In contrast, another may accept many nutritionally inadequate foods.

Therefore, the objectives of this study were: I. to describe the dietary profile of infants, children, and adolescents with FD, treated at a Brazilian reference center, based on their food repertoires; II. to describe the sensory properties of the food items accepted in the form in which they are consumed; III. to identify which items are most accepted by children and adolescents with FD, in total and by food groups; and iv. to compare the number of foods accepted, as perceived by the family, with the professional record, based on the records made in the food inventory.

2. Methodology

2.1 Study Design

This study is characterized as a cross-sectional investigation of an observational, descriptive, and analytical nature, with a sample composed of neurotypical patients treated from April 2016 to December 2023 at a Brazilian pediatric reference center for FD who had completed the Food Inventory (FI) [17]. The center is part of the PENSI Institute–Research and Teaching in Child Health/Sabará Children's Hospital, located in São Paulo, SP, Brazil.

2.2 Sample

The sample was convenience-based, with patients of both sexes and of pediatric age. Ages were categorized according to pediatric clinical practice into the following age groups: infants (up to 23 months), preschoolers (24-71 months), schoolchildren (72-119 months), and adolescents (120-239 months), as this classification reflects fundamental milestones in child and adolescent development. The inclusion criteria were patients of both sexes with a confirmed diagnosis of FD after multidisciplinary care, and who had the FI form duly completed by the family and subsequently reviewed by the service's nutritionist. The exclusion criteria were patients who did not have the FI previously completed by the family and/or whose family recorded their dietary repertoire as "eats everything/accepts everything".

2.3 Data Collection

The FI is a clinical form sent when scheduling the first appointment and delivered, completed by the family, on the day of the appointment. The FI consists of three columns: (1) a column to be filled in with the foods that the patient accepts, regardless of quality and quantity, (2) foods that they used to accept but now reject, and (3) foods that they have never accepted. For the present study, only the was used.

Foods initially described as accepted are referred to as "acceptance in the family's perception". This form is then reviewed and supplemented by the nutritionist by checking the foods referred to in three 24-hour dietary recalls (R-24 h) of the patient, also completed and delivered on the day of the appointment, as well as from the professional's questioning during the appointment about foods/products/preparations from various food groups possibly accepted by the patient, that is, it

aims to seek information on the patient's complete and current acceptance during the period of FD complaint, before any intervention and thus without bias.

2.4 Data Analysis

The accepted foods were counted individually, according to family and professional records, to enumerate and compare these data. However, as one of the objectives of the present study was to evaluate and analyze foods in the form in which they are consumed, after evaluation by a professional nutritionist, individually accepted foods (examples: banana, plain pasta, white rice, broccoli), preparations (examples: mozzarella pizza, Bolognese lasagna, vegetable soup with meat), and combinations (examples: banana smoothie with milk, French bread with butter, rice with carrots) were defined as food items.

The food items described in all FIs were tabulated in an Excel spreadsheet and classified, based on the subjective evaluation of the nutritionist, according to the following characteristics: flavor (sweet, salty, sour, bitter, and umami), color (white/yellow/orange, brown, red/pink/purple, and green), consistency (liquid, homogeneous paste, heterogeneous paste, soft, and solid) and texture (runny and smooth puree, smooth puree with rounded lumps, naturally soft, "dissolvable" hard solids, hard no dissolvable, fibrous foods, and chewy or sticky foods) [18-20].

In addition to sensory characteristics, the accepted items were classified according to the food groups described in "What We Eat in America" from 2017-2020 [21], which are: (1) Milk and dairy, (2) Protein foods, (3) Mixed dishes, (4) Grains and cereals, (5) Snacks and sweets, (6) Fruits and vegetables, (7) Beverages, non-alcoholic, (8) Fats, oils, condiments, sauces, and sugars (9) Baby foods and formulas, and (10) Other (NHANES-2017-2020). All groups have subgroups and food categories for a more specific assessment. The data were described in absolute and relative frequencies and presented as means for the total sample and by age group.

After tabulating the items accepted in the entire sample, the food varieties in the sample were evaluated, i.e., the diversity of food items mentioned without repetition, and these were classified and numbered by food group, in the total sample and by age group. It is essential to consider that variety encompasses different forms of consumption, i.e., the same food can be counted more than once if it is presented in other ways; for example, boiled egg, fried egg, scrambled egg, and omelet = 4 varieties.

To assess factors associated with food consumption across age groups, multinomial logistic regression analyses were performed, with infants as the reference category. Although the literature indicates a higher prevalence of FD in preschoolers, concerns may arise earlier. Thus, using infants as the reference group allows for a comparative understanding of the impact of dietary repertoire and sensory characteristics on food acceptance in subsequent age groups. The independent variables included sensory characteristics of foods (flavor, color, consistency, and texture), subgroups of food groups, and the breadth of the food repertoire, measured by the number of items accepted. The models were adjusted separately for each age group (preschool, school-age, and adolescent), and the results were expressed as odds ratios (OR) with respective 95% confidence intervals (95% CI). Statistical significance was set at $p < 0.05$.

2.5 Ethical Aspects

All procedures in this study complied with the ethical guidelines for research involving human subjects. This study was approved by the Research Ethics Committee (CAAE 77147024.9.0000.5567; opinion number: 6.768.239), with a waiver requested for the application of the Free and Informed Consent Form and Free and Informed Assent Form, as this was a retrospective analysis of medical records.

3. Results

The study was conducted based on data collected from 237 FI of infants, preschoolers, schoolchildren, and adolescents, all diagnosed with FD and treated at a specialized center, aged 10-204 months (median and mean of 42 and 53.19 months, respectively). The sample comprised 35 infants (14.77%), 144 preschoolers (60.76%), 45 schoolchildren (18.99%), and 13 adolescents (5.49%); 61.18% were male (Table 1).

Table 1 Description of demographic variables and food inventory of infants, children, and adolescents with feeding difficulties. CENDA-PENSI, São Paulo, 2025.

	n	**%**
Sex		
Female	92	38.82
Male	145	61.18
Age Group (age in months/mean)		
Infants (10-23 months/17.26 months)	35	14.77
Preschoolers (24-71 months/41.77 months)	144	60.76
Schoolchildren (72-119 months/92.88 months)	45	18.99
Adolescents (120-204 months/138.92 months)	13	5.49
Food inventory	**Mean**	
Accepted foods – family record (total = 3829)	16.16	
Accepted foods – professional record (total = 6226)	26.27	
Food items – considering the form of consumption (total = 5702)	24.06	
Ratio of accepted foods–professional/family	2.16	
Family food records (1-57 foods)	**n**	**%**
1-15 foods	129	54.43
16-25 foods	75	31.65
26-40 foods	27	11.39
41-57 foods	6	2.53
Professional nutritionist food record (6-57 foods)		
6-15 foods	35	14.77
16-25 foods	86	36.29
26-40 foods	90	37.97
41-57 foods	26	10.97

Record considering the form of consumption (5-51 food items)			
5-15 food items	43	18.14	
16-25 food items	99	41.77	
26-40 food items	81	34.18	
41-51 food items	14	5.91	
Food items accepted by age group	**Minimum**	**Maximum**	**Mean**
Infants	7	40	19.68
Preschoolers	5	51	23.27
Schoolchildren	5	45	28.42
Adolescents	15	46	29.46
Record of food variety	**Variety/ N. of the sample**	**Ratio variety /sample**	
10-204 months–total sample	920/237	3.88	
Infants	280/35	8.00	
Preschoolers	678/144	4.71	
Schoolchildren	425/45	9.44	
Adolescents	221/13	17.00	

According to family and professional records, an average of 16.16 and 26.27 foods were accepted, respectively, with an average ratio of 2.16 more foods after professional analysis. Based on family records, 54.43% of patients were considered highly selective, decreasing to 14.77% after professional evaluation (Table 1).

When considering the form of consumption, the average acceptance was 24.06 food items, where 18.14% of the sample accepted 15 or fewer items, with an average repertoire of 11.23 (between 5 and 15), an average age of 42.6 months (10-152 months), and the majority (69.76%) were male. Those who accepted more than 40 items represented 5.91% of the sample, with an average repertoire of 44 items (41-51), an average age of 87.86 months (42-131), and, similarly, the majority (64.29%) were male.

The above results show a positive association between the number of items accepted and increasing age, with an average acceptance of 19.68 items by infants, 23.27 by preschoolers, 28.42 by schoolchildren, and 29.46 by adolescents (Table 1). This association is statistically significant, as shown by the logistic regression presented below.

As for the sensory characteristics of food items accepted in all FIs, 48.77% are sweet in taste, 63% are white/yellow/orange in color, 43.07% are solid in consistency, and 27.36% are “dissolvable” hard solid in texture, with changes in their distribution according to age group (Table 2 and Figure 1). The predominance of the characteristics of the sample reflects the sensory aspects of the items most mentioned in all FIs, listed in descending order in Table 3, with the ten most commonly consumed foods/preparations being French fries, salted popcorn, natural orange juice, white rice, banana, cassava starch biscuit, chocolate, French bread, cheese bread, and strawberry-flavored yogurt. The ranked consumption, with descriptions of the accepted consumption category forms by food group and age group, is presented in the attached Table S1.

Table 2 Sensory characteristics of food items accepted by infants, children, and adolescents with feeding difficulties, in the total sample and by age group. CENDA-PENSI, 2025.

	Total	Infants	Preschoolers	Schoolchildren	Adolescents
Sweet	48.77%	42.52%	50.49%	48.08%	47.26%
Salty	32.01%	29.61%	31.57%	33.78%	34.21%
Sour	2.47%	4.93%	2.42%	1.95%	0.26%
Bitter	1.68%	2.46%	1.34%	2.11%	1.83%
Umami	15.06%	20.47%	14.17%	14.07%	16.45%
White/yellow/orange	63.00%	68.52%	63.71%	59.50%	58.49%
Brown/Black	17.08%	10.60%	17.19%	19.23%	20.63%
Red/Pink/Purple	15.49%	13.94%	15.19%	16.73%	16.71%
Green	4.44%	6.97%	3.91%	4.53%	4.18%
Liquid	15.54%	10.89%	16.17%	16.34%	15.67%
Homogeneous paste	9.07%	11.32%	9.40%	7.42%	7.57%
Heterogeneous paste	2.19%	3.05%	2.15%	1.88%	2.09%
Soft	30.13%	38.33%	27.63%	32.13%	30.55%
Solid	43.07%	36.44%	44.64%	42.22%	44.13%
Runny and smooth puree	24.52%	21.21%	25.43%	24.32%	23.77%
Smooth puree with rounded lumps	3.05%	4.79%	2.86%	2.93%	2.81%
Naturally soft	4.70%	6.53%	4.98%	3.80%	3.60%
“Dissolvable”, hard solids	27.36%	28.30%	27.57%	26.34%	26.51%
Hard, nondissolvable	24.68%	16.84%	24.02%	27.77%	28.46%
Fibrous foods	11.43%	18.43%	10.68%	10.24%	10.40%
Chewy or sticky foods	4.26%	3.34%	4.44%	4.60%	4.45%

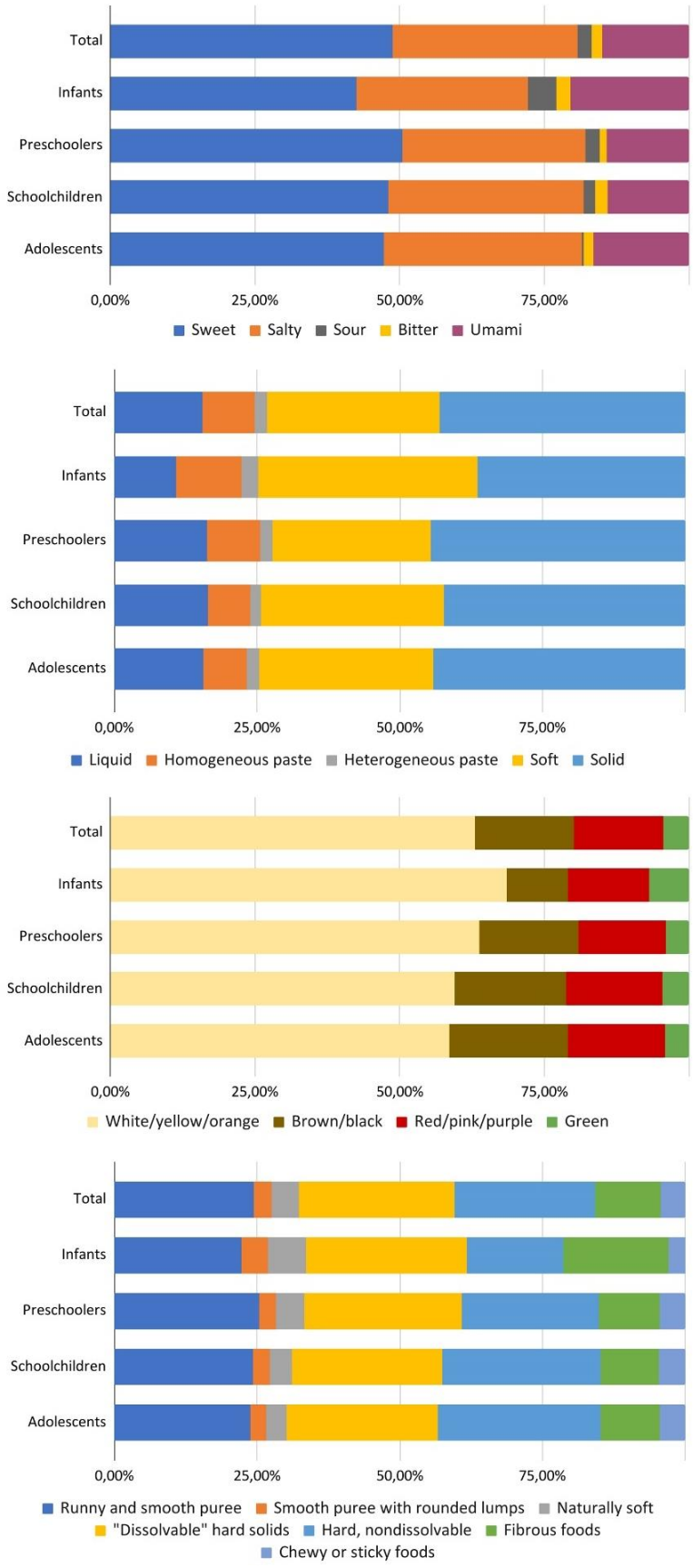

Figure 1 Evaluation of food items accepted by infants, children, and adolescents with feeding difficulties, according to taste, color, consistency, and texture, in the total sample and by age group. CENDA-PENSI, São Paulo, 2025.

Table 3 The most frequently mentioned food items in the inventories of infants, children, and adolescents with feeding difficulties. CENDA-PENSI, São Paulo, 2025.

Numerical order	Ranking		N.	N Total = 237 % of the sample	Food group
1	1	French potato fries	130	54.85%	6- Fruits and vegetables
2	2	Salted popcorn	115	48.52%	5- Snacks and sweets
3	3	Natural orange juice	108	45.57%	7- Beverages
4	4	White rice	107	45.15%	4- Grains and cereals
5	5	Banana	106	44.73%	6- Fruits and vegetables
6	6	Cassava starch biscuit	104	43.88%	5- Snacks and sweets
7	7	Chocolate	96	40.51%	5- Snacks and sweets
8	8	French bread	85	35.86%	4- Grains and cereals
9	9	Cheese bread	84	35.44%	5- Snacks and sweets
10	10	Strawberry-flavored yogurt	78	32.91%	1- Milk and dairy
11	11	Red apple	77	32.49%	6- Fruits and vegetables
12	12	Savory biscuit	75	31.65%	5- Snacks and sweets
13	13	Pasta	64	27.00%	4- Grains and cereals
14	14	Petit Suisse cheese with strawberry preparation	62	26.16%	1- Milk and dairy
15	15	Whole grape juice	60	25.32%	7- Beverages
16	16	Sweet corn starch cookie	55	23.21%	5- Snacks and sweets
17	17	Fermented milk	54	22.78%	1- Milk and dairy
18	18	Purple grape	53	22.36%	6- Fruits and vegetables
19	19	Mango	48	20.25%	6- Fruits and vegetables
20	20	Watermelon	47	19.83%	6- Fruits and vegetables
21	21	Boiled Egg	46	19.41%	2- Protein foods
22	22	Strawberry	44	18.57%	6- Fruits and vegetables
23	23	Milk-based product	43	18.14%	9- Baby foods and formulas
24	23	Small bread roll	43	18.14%	5- Snacks and sweets
25	24	Brown beans	42	17.72%	2- Protein foods
26	24	Boiled corn	42	17.72%	6- Fruits and vegetables
27	25	Ready-made breaded Chicken breast fillet	41	17.30%	2- Protein foods
28	26	Chocolate ice cream	40	16.88%	5- Snacks and sweets
29	26	Cooked beef	40	16.88%	2- Protein foods
30	27	Whole milk	39	16.46%	1- Milk and dairy
31	28	Pear	38	16.03%	6- Fruits and vegetables
32	29	Brigadeiro	36	15.19%	5- Snacks and sweets
33	30	Chocolate cake	35	14.77%	5- Snacks and sweets
34	30	Corn snack cheese flavored	35	14.77%	5- Snacks and sweets

35	30	Boiled chicken	35	14.77%	2- Protein foods
36	31	Orange	34	14.35%	6- Fruits and vegetables
37	32	Mozzarella cheese	33	13.92%	1- Milk and dairy
38	32	Mozzarella pizza	33	13.92%	3- Mixed dishes
39	33	Scrambled egg	31	13.08%	2- Protein foods
40	34	Homemade light cake	30	12.66%	4- Grains and cereals
41	34	Gelatin dessert (red flavor)	30	12.66%	5- Snacks and sweets
42	34	Whole milk with chocolate powder	30	12.66%	1- Milk and dairy
43	35	Natural passionfruit juice with sugar	28	11.81%	7- Beverages
44	36	Cornflakes with sugar	27	11.39%	4- Grains and cereals
45	37	Broccoli	26	10.97%	5- Fruits and vegetables

Of the total food items listed in all FIs (n = 5,702), 25.61% (n = 1,460) were categorized in group 5 (Snacks and sweets) and 21.22% (n = 1,210) in group 6 (Fruits and vegetables), totaling 46.82% of the total sample (Table 4). These are reversed from preschool age onward, as shown in Figure 2. Infants had an average of 6.49 items from group 6 in their FI; preschoolers had 4.69, schoolchildren had 5.36, and adolescents had 5.08, with statistical significance in the infant age group compared to preschoolers (OR = 1.040; p = 0.000).

Table 4 Number of records in inventories and variety, segmented by food group, in the total sample and by age group, of infants, children, and adolescents with feeding difficulties. CENDA-PENSI, São Paulo, 2025.

1- Milk and dairy	**Records in inventories**	**Repres. in the sample %**	**Variety**	**Repres. in the sample %**	**6- Fruits and vegetables**	**Records in inventories**	**Repres. in the sample %**	**Variety**	**Repres. in the sample %**
Total	515	9.03	87	9.55	Total	1210	21.22	134	14.57
Infants	46	6.68	27	9.64	Infants	227	32.95	71	25.36
Preschoolers	311	9.28	59	8.70	Preschoolers	676	20.17	99	14.60
Schoolchildren	126	9.85	33	7.76	Schoolchildren	241	18.84	66	15.53
Adolescents	32	8.36	17	7.69	Adolescents	66	17.23	32	14.48
2- Protein foods					**7- Beverages**				
Total	655	11.49	94	10.21	Total	539	9.45	81	8.80
Infants	72	10.45	25	8.93	Infants	38	5.52	17	6.07
Preschoolers	347	10.36	74	10.91	Preschoolers	326	9.73	68	10.03
Schoolchildren	170	13.29	54	12.71	Schoolchildren	132	10.32	44	10.35
Adolescents	66	17.23	38	17.19	Adolescents	43	11.23	26	11.76
3- Mixed dishes					**8- Fats, oils, condiments, sauces, and sugars**				
Total	447	7.84	161	17.50	Total	68	1.19	20	2.17
Infants	47	6.82	35	12.50	Infants	4	0.58	4	1.43
Preschoolers	240	7.16	106	15.63	Preschoolers	44	1.31	17	2.51
Schoolchildren	126	9.85	69	16.24	Schoolchildren	16	1.25	10	2.35
Adolescents	34	8.88	28	12.67	Adolescents	4	1.04	3	1.36
4- Grains and cereals					**9- Baby foods and formula**				
Total	665	11.66	104	11.30	Total	143	2.51	24	2.61
Infants	89	12.92	40	14.29	Infants	40	5.81	16	5.71
Preschoolers	388	11.58	79	11.65	Preschoolers	93	2.78	15	2.21
Schoolchildren	144	11.26	40	9.41	Schoolchildren	9	0.70	6	1.41

Adolescents	44	11.49	17	7.69	Adolescents	1	0.26	1	0.45
5- Snacks and sweets					**10- Others**				
Total	1460	25.61	215	23.37	Total	0		0	
Infants	126	18.29	45	16.07	Infants	0		0	
Preschoolers	926	27.63	161	23.75	Preschoolers	0		0	
Schoolchildren	315	24.63	103	24.24	Schoolchildren	0		0	
Adolescents	93	24.28	59	26.70	Adolescents	0		0	

Total food records listed and categorized in the study: 5702.

Total varieties (different foods or per number of preparations) listed in all inventories: 920.

Infants–Total food records: 689/Food varieties: 280.

Preschoolers–Total food records: 3351/Food varieties: 678.

Schoolchildren–Total food records: 1279/Food varieties: 425.

Adolescents–Total food records: 383/Food varieties: 221.

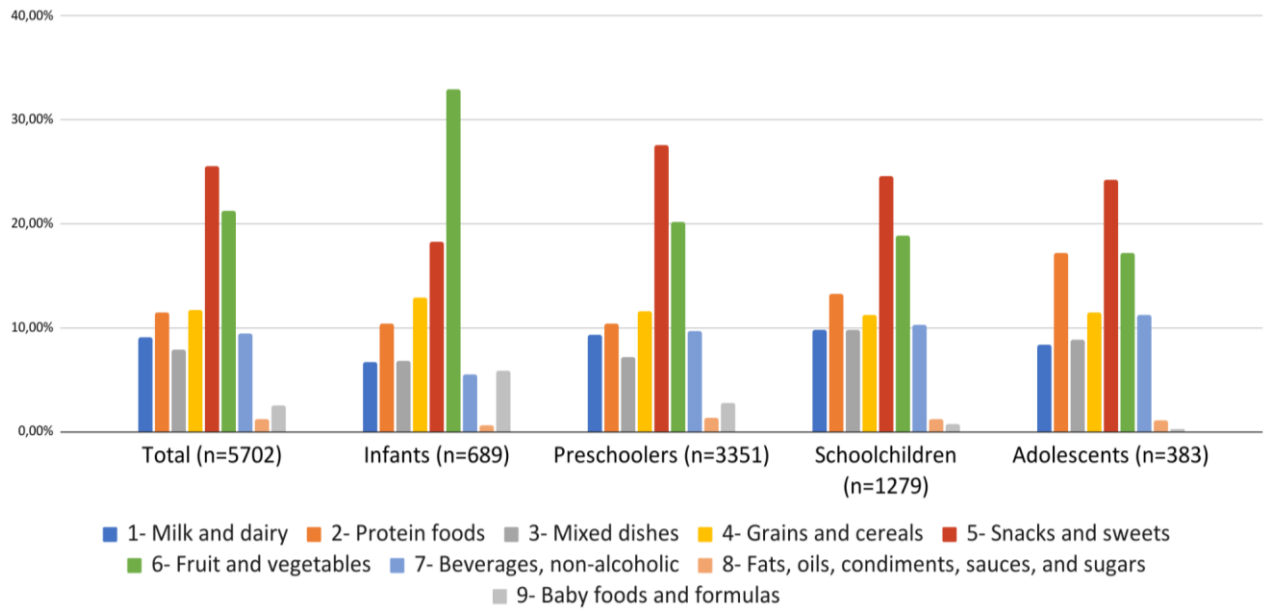

Figure 2 Distribution of food items, according to food group, accepted by infants, children, and adolescents with feeding difficulties, in the total sample and by age group. CENDA-PENSI, São Paulo, 2025.

It is worth noting that group 6 has three subgroups: Fruits, Vegetables excluding potatoes, and White potatoes, representing 55.12%, 26.70%, and 18.18% of the group, respectively. White potatoes, a starchy vegetable, accounted for 8.37%, 18.20%, 24.07%, and 30.3% of the total group for infants, preschoolers, schoolchildren, and adolescents, respectively. For all age groups, White potatoes were the most frequently mentioned food in group 6, followed by bananas and apples (see Table S1). In the absence of potatoes, these averages drop to 5.94, 3.84, 4.07, and 3.54 items, indicating that white potatoes were a vegetable that positively affected the average acceptance of group 6 as age increased.

As for group 5, there was an average score of 6.43, 7, and 7.15 items in the FI of preschoolers, schoolchildren, and adolescents, respectively; almost double that of infants (3.6 items), data that reflect the statistically significant presence of the Snacks and Sweets group represented by the subgroups analyzed and positively associated with the higher age groups, using infants as the reference category.

Groups 2 (Protein foods) and 9 (Baby foods and formulas) were also associated with age, positively and negatively, respectively. Infants had an average of 2.06 items categorized in group 2 in their AI, rising to 2.41, 3.78, and 5.08 in the AI of preschoolers, schoolchildren, and adolescents, respectively. These data are in line with the distinct representativeness of this group - 10.45% and 17.23% - of the total records of infants compared to those of adolescents (Table 4). Group 9, on the other hand, was a marker of typical infant consumption compared to all age groups (OR = 0.971; p = 0.000), ranging from 5.81% of the infant sample to 0.26% of the adolescent sample.

As for the analysis of the diversity of food items/records in all FIs, 920 varieties were identified, with a higher prevalence in group 5 (Snacks and sweets - 23.37%, 215 varieties), followed by group 3 (Mixed dishes - 17.50%, 161 varieties) and 6 (Fruits and vegetables - 11.30%, 134 varieties) - Figure 3. Adolescents had a higher average food variety ratio compared to the other groups (Table 1); this

result shows that they have a greater choice in their diet, however, based on a greater variety of two main groups - 2 and 5, representing 43.89% of the diversity of adolescents' diets (Figure 3). Table 4 details, by food group, the representativeness, in absolute values and percentages, of the total records in the inventories and varieties, in the total sample, and by age group.

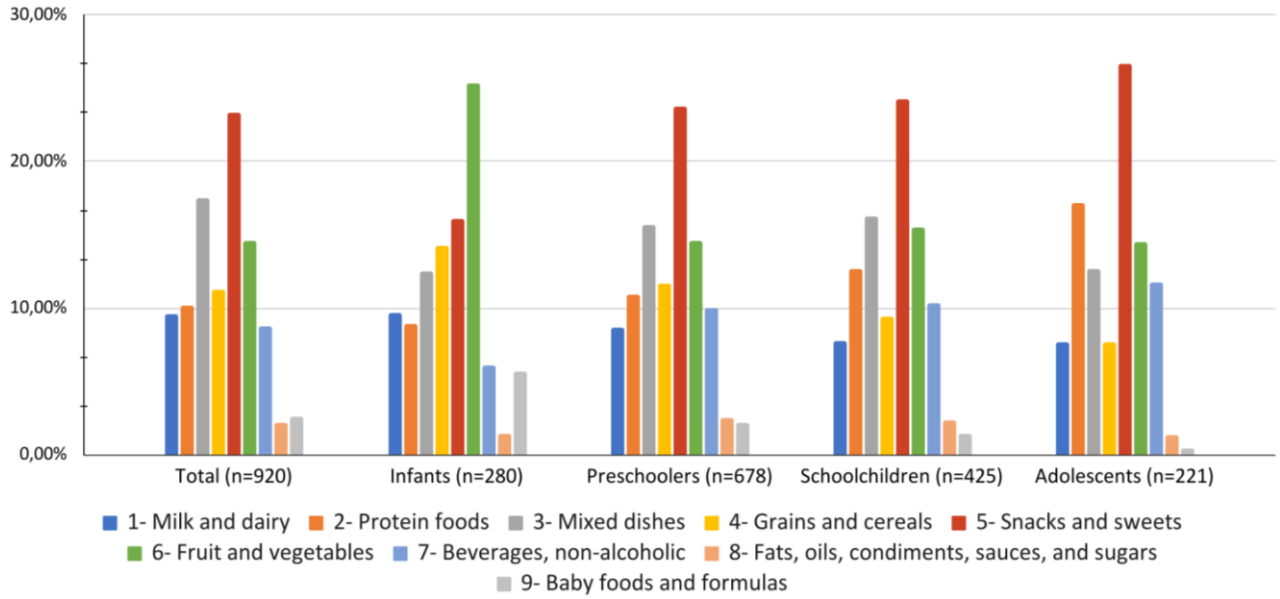

Figure 3 Representativeness of food varieties, categorized by group, accepted by infants, children, and adolescents with feeding difficulties, in the total sample and by age group. CENDA-PENSI, São Paulo, 2025.

Taking infants as the reference category, there are marked differences across age groups in food repertoire, sensory characteristics, and accepted food subgroups. The results of the multivariate logistic regression are presented in Table 5, and the differences in the sensory attributes of accepted items across age groups are presented in Table 2 and Figure 1.

Table 5 Multivariate logistic regression of dietary profile characteristics of infants, children, and adolescents with feeding difficulties. CENDA-PENSI, São Paulo, 2025.

						95% Confidence Interval (Exp B)	
	Age group	B	Standard Errors	Sig.	Exp (B)	Low Limit	Upper Limit
Preschoolers	Interception	-0.500	0.561	0.372			
	Food repertoire	0.056	0.005	0.000	1.057	1.046	1.068
	Soft consistency	-0.667	0.148	0.000	0.513	0.384	0.686
	SubGroup = Candy	1.330	0.466	0.004	3.782	1.518	9.422
	SubGroup = Flavored Milk	2.438	1.190	0.04	11.445	1.110	118.009
	SubGroup = Other Desserts	1.126	0.477	0.01	3.083	1.211	7.851
	SubGroup = Quick Breads and Bread Products	1.516	0.499	0.002	4.554	1.711	12.117
	SubGroup = Sweet Bakery Products	0.904	0.425	0.03	2.471	1.073	5.687
Schoolchildren	Interception	-2.692	0.662	0.000			
	Food repertoire	0.103	0.006	0.000	1.109	1.096	1.122
	Sweet taste	0.786	0.304	0.01	2.195	1.209	3.986
	Salty taste	0.614	0.258	0.01	1.848	1.114	3.064
	Homogeneous paste consistency	-2.423	1.101	0.02	0.089	0.010	0.767
	Soft consistency	-0.410	0.169	0.01	0.663	0.476	0.924
	SubGroup = Cereals	-1.964	0.785	0.01	0.140	0.030	0.635
	SubGroup = Infant Formula	-2.200	0.852	0.01	0.111	0.020	0.600
	SubGroup = Mixed dishes, Grain-based	1.516	0.676	0.025	4.554	1.211	17.125
	SubGroup = Mixed dishes, soups	-1.944	0.716	0.007	0.143	0.035	0.582
	SubGroup = Other Desserts	1.133	0.527	0.03	3.104	1.105	8.720
	SubGroup = Savory Snacks	1.193	0.571	0.03	3.297	1.076	10.098
Adolescents	Interception	-4.267	0.941	0.000			
	Food repertoire	0.116	0.007	0.000	1.123	1.108	1.139
	Sour taste	-2.467	1.125	0.02	0.085	0.009	0.770
	Soft consistency	-0.739	0.222	0.001	0.478	0.309	0.737
	SubGroup = Infant Formula	-3.117	1.453	0.03	0.044	0.003	0.763
	SubGroup = Other Desserts	1.394	0.697	0.04	4.032	1.028	15.807
	SubGroup = Quick Breads and Bread Products	1.942	0.753	0.01	6.974	1.594	30.513

Reference category: **Infants.**

Dependent variable: Age group.

Independent variables: Food subgroup. Flavor. Color. Consistency. Texture. And food repertoire.

Among preschoolers, each additional food accepted in the repertoire increased the chances of belonging to this age group by 5.7% (OR = 1.057; $p < 0.001$). Soft consistency was negatively associated with infant feeding (OR = 0.513; $p < 0.5$). On the other hand, the introduction of ultra-processed and/or hyperpalatable foods stood out, reflected in the increase in the subgroups Sweets (OR = 3.782; p = 0.004), Flavored milks (OR = 11.445; p = 0.040), Other desserts (OR = 3.083; p = 0.010), Quick Breads and Breads Products (OR = 4.554; p = 0.002), and Sweet Bakery Products (OR = 2.471; p = 0.030) subgroups, evidencing a nutritional change already in preschool age.

Among schoolchildren, each additional item in the repertoire increased the likelihood of belonging to this age group by 10.9% (OR = 1.109; $p < 0.001$). In addition, sweet (OR = 2.195; p = 0.010) and salty (OR = 1.848; p = 0.010) flavors were positively associated with this age group. On the other hand, less chewing-demanding consistencies, such as homogeneous paste (OR = 0.089; p = 0.020) and soft (OR = 0.663; p = 0.010), as well as the subgroups Cereals (OR = 0.140; p = 0.010), Soups (OR = 0.143; p = 0.007), and Infant formulas (OR = 0.111; p = 0.010) subgroups, were markers for infants. In contrast, mixed grain-based meals—translated as pizza, pasta with toppings, stuffed breads, etc. (OR = 4.554; p = 0.025), other desserts (OR = 3.104; p = 0.030), and salty snacks (OR = 3.297; p = 0.030) strongly characterized schoolchildren, reinforcing the presence of foods with a less favorable nutritional profile in this group.

Among adolescents, the food repertoire was also a positive predictor, with the most significant increase among the groups, in which each additional food accepted in the repertoire increased the likelihood of belonging to this age group by 12.3% (OR = 1.123; $p < 0.001$). Characteristics such as sour taste (OR = 0.085; p = 0.020), soft consistency (OR = 0.478; p = 0.001), and infant formula subgroup (OR = 0.044; p = 0.030) significantly reduced the probability of classification in this age group, showing that these attributes are markers of typical infant consumption. In contrast, the presence of the other desserts subgroup (OR = 4.032; p = 0.040) and the Quick breads and baked products subgroup (OR = 6.974; p = 0.010) significantly increased the chance of belonging to the adolescent age group.

The multinomial logistic regression model showed a statistically significant overall fit ($\chi^2(177) = 1089.515$, $p < 0.001$), indicating that the independent variables collectively contributed to distinguishing between age groups. The Nagelkerke pseudo-R^2 was 0.196, suggesting moderate explanatory power.

Goodness-of-fit statistics showed mixed results, with the deviance test indicating adequate model fit (p = 1.000), while the Pearson test was significant ($p < 0.001$), which may reflect sensitivity to sample size and model complexity.

The model correctly classified 59.2% of the cases overall. However, classification accuracy varied substantially across age groups, with high accuracy for preschool children (96.2%) and considerably lower accuracy for adolescents (0.8%), school-aged children (9.4%), and infants (4.4%).

In general, food repertoire was a positive predictor at all ages, progressively increasing the chances of belonging to higher age groups. Infants were characterized by the presence of items with less chewing-intensive consistencies (paste-like and soft), sour flavors, cereals, soups, and infant formulas. At the same time, preschoolers are introduced to a wide variety of ultra-processed foods and sweets. Schoolchildren increased their consumption of sweet and savory foods, desserts, snacks, and mixed dishes (preparations), and adolescents had the widest repertoire, with a predominance of snacks, desserts, and baked products, accompanied by the almost total abandonment of infant formulas and consistencies typical of the initial phase, as well as sour-tasting foods.

4. Discussion

This study evaluated the foods accepted by infants, children, and adolescents with FD treated at a specialized center, as an extension of another study on the same topic already published [22]. After professional review and acceptance supplementation, it became clear that families perceived their children as more selective than they had been.

Although less selective numerically across all age groups, the prevalence of sensory characteristics—sweet taste, white/yellow/orange color, solid consistency, and "dissolvable" hard-solid texture—reflects early and high acceptance of foods indicative of low nutritional quality. It is important to note that the present study conducted descriptive associations, without inferring causality. This study highlights the importance of welcoming and addressing family complaints and concerns about the challenges inherent in child development, which are intertwined with food learning, as early as possible.

A progressive increase in the average number of food items accepted (from 19.68 among infants to 29.46 among adolescents) was observed, suggesting an expansion of food exposure and of sensory-motor and cognitive development throughout childhood, potentially contributing to dietary diversification. However, Taylor et al. [23] report that there is no consensus on the temporal variation in this prevalence. They describe that some authors have identified age-related changes. On the other hand, other studies have not identified significant variation in food selectivity with advancing age [24, 25].

In this sense, counterproductive parental attitudes during the food learning stage, motivated by fear and insecurity that the child will lose weight, fail to grow, or become ill, can shed light on the difficulty of imposing healthy limits, early exposure to hyperpalatable foods, reduction in the variety of nutritionally appropriate foods offered, and increased provision of foods preferred by the child. Such attitudes increase the risk of prolonging a common phase of selectivity and neophobia, which, for most children, is transient, consolidating, and aggravating the complaint that the child does not eat what is expected [7, 26-28].

The discrepancy between the average number of foods accepted and the average ratio of 2.16 more foods after professional evaluation highlights the importance of data-collection methodology and family perceptions on children's eating behavior. There is evidence that parents tend to underestimate their children's actual food variety [17]. Machado et al. found that 39.7% of mothers of children with FD had a controlling parenting style, which may favor the practice of choosing what the child should eat or what they eat more of; these behaviors can limit the possibility of a more varied diet. The assessment conducted by trained professionals, in turn, tends to capture food acceptance in different contexts and preparations more accurately.

The results show a predominance of sweet-tasting, light-colored (white/yellow/orange), solid-consistency, and "dissolvable" hard solid-texture foods, reflecting sensory preferences observed since childhood. The innate preference for sweet taste is widely documented and considered an adaptive biological response related to energy detection and food safety [13, 29].

Considering safety as well, the same can be said of light or neutral coloring, a characteristic of the foods most frequently mentioned in the FI in this study—French fries, popcorn, orange juice, white rice, banana, and cookies. Studies emphasize the association of this characteristic with greater predictability and less possibility of interference from other foods, since children with FD

tend to refuse foods with strong colors or a “mixed” appearance, allowing for greater sensory tolerance, less aversion, and, consequently, greater acceptance [12, 16].

On the other hand, sour and bitter flavors and green colors, which become less relevant in food records as age increases and are mainly associated with fruits and vegetables, are innately rejected because they are associated with unpleasant—or poorly tolerated—flavors and poisonous substances [13, 14]. In this study, broccoli was the first green vegetable to appear in the table ranking the most mentioned items in the IA, accepted by only 10.97% of the sample. These results reinforce the importance of continued exposure to foods with these characteristics, as tolerance and acceptance result from food- and sensory-learning.

The predominance of snacks and sweets (group 5 - 25.61%) and fruits and vegetables (group 6 - 21.22%) in the sample suggests that, despite the presence of markers of healthy eating, there is significant competition from ultra-processed foods, especially from preschool age onwards. Findings from other studies corroborate this. Xi et al. [14] found that, in a sample of 747 child-caregiver dyads, preschool children with neophobia consumed fewer fruit and vegetables and more snacks and sugary drinks. Cooke et al. [11] indicated that children with high neophobia tended to eat vegetables less frequently than their peers. Jomaa et al. [15] found that consumption of sweets and sweetened beverages was higher in preschoolers than in infants, and that, compared with dietary guidelines, the lowest dietary adherence was observed for vegetables and fruits.

Such descriptive reversal, characterized by increased consumption of snacks and sweets and a proportional reduction in fruits and vegetables, is consistent with the literature on children’s eating patterns, with and without FD [14, 15, 30, 31]. Foods not recommended for children under 2 years of age were found in the FIs, such as strawberry-flavored yogurt (the most mentioned yogurt in the FIs of infants), French fries (the most mentioned food and form of consumption in group 6 at all ages), as well as savory and sweet cookies, ice cream, and ready-made sweetened fruit drinks. However, in infant dietary intake, protein foods, mixed dishes, and grains are better prepared using techniques such as boiling, sautéing, and baking.

In older age groups, the highest levels of added sugar (petit suisse cheese, fermented milk, chocolate-flavored UHT milk drinks, chocolate, candy, corn-based breakfast cereals, soft drinks, sweetened fruit drinks, soy-based drinks), salt (sauces and condiments, mixed and/or prepared foods), and fat (breaded chicken breast, pizza, pastries, hamburgers, stroganoff) gain ground at the expense of other recommended foods. Once again, this highlights the importance of parents in shaping their children’s food choices, as more palatable foods tend to be preferred and included in their children’s repertoires.

Although it is critical to consider an individual’s sensory preferences, since infants, children, and adolescents with FD may not consume what is recommended due to sensory aspects they cannot tolerate, it becomes the task of the specialized nutrition professional to work with the patient and their family to align preparation techniques that include better food choices with acceptable sensory characteristics.

This study has limitations. First, the design is cross-sectional, which allows for identifying associations but not causal relationships between variables. Thus, although it is possible to state that certain sensory characteristics or food subgroups are associated with specific age groups, as observed through multivariate logistic regression, it is not possible to establish whether they are the cause or consequence of dietary development throughout childhood and adolescence. Another limiting factor is the absence of a formal test of the association between food repertoire and diet

quality, as only descriptive analysis was performed. In addition, collecting information on accepted foods and their sensory characteristics may be subject to bias, mainly when obtained from parental reports. Parents tend to underestimate or overestimate the acceptance of certain foods, especially those considered "unhealthy" or ultra-processed. Finally, the sample was drawn from a private pediatric referral center in Brazil, which may not be representative of all Brazilian children, particularly those from different cultural backgrounds and socioeconomic levels.

Furthermore, the sample studied may not reflect the country's cultural, regional, and socioeconomic diversity, as the collection was conducted at a private referral service. Eating patterns and sensory repertoires are strongly influenced by cultural aspects, food availability, and family eating practices. Therefore, the results should be interpreted with caution when extrapolating them to other populations.

Despite its limitations, we emphasize that the study considers not only the variety of foods accepted but also their sensory characteristics and subgroup classification, offering a multidimensional view of the sample's eating behavior. Few national studies address food repertoire from this combined perspective. Traditionally, studies on child nutrition focus only on frequency or quantity of consumption, without incorporating aspects such as preparation/presentation, consistency, or flavor.

5. Conclusion

The findings indicate that a broader food repertoire does not necessarily translate into better diet quality. Infants with FD treated at a Brazilian referral center had a repertoire 50% smaller than that of other age groups. Still, it consisted of foods with a more favorable nutritional profile, with a greater presence of fruits and vegetables and less acceptance of snacks, sweets, and baked products. From preschool age onwards, the dietary profile worsens, characterized by increased acceptance and consumption of ultra-processed foods, especially snacks, sweets, and sugary drinks. These results highlight an early shift toward less healthy dietary patterns and reinforce the need for continuous interventions to promote balanced eating among children with FD.

Author Contributions

RR and LRN were responsible for the data collection and writing. WCM, KRS and NGP were responsible for writing and correction of the text. MF and PM were responsible for the idea, writing and revising the manuscript.

Competing Interests

The authors have declared that no competing interests exist.

AI-Assisted Technologies Statement

AI was used for correction of writing, translating and for tables formatting. Softwares used were Grammarly and DeepL. All scientific content, data interpretation, and conclusions were developed independently by the author. The authors have thoroughly reviewed and edited the AI-assisted text to ensure its accuracy and accept full responsibility for the content of the manuscript.

Additional Materials

The following additional materials are uploaded at the page of this paper.

1. Table S1: Most accepted category and form of consumption, by food group, according to age group, of children and adolescents with eating difficulties. CENDA-PENSI, São Paulo, 2025.

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