



# Children with Feeding Difficulties Present Changes in the Development of Feeding Skills: A Study with a Control Group

## *Crianças com dificuldades alimentares apresentam alterações no desenvolvimento das habilidades de alimentação: estudo com grupo controle*

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### Abstract

**Introduction** Feeding skills (FS) are important to child development, as the delay in their presence could suggest feeding difficulties (FD) symptoms. The aim of the present study was to compare the development of three types of FS (autonomy to eat, posture at meals, and adequate use of cutleries) among children with FD and without FD.

**Methods** This was a case-control retrospective observational study. The sample consisted of 316 children from case and control groups in accordance with the presence (or not) of FD. The control group was recruited by convenience (verbal approaching at the emergency care unit), and the case group was based on the medical records collected at the reference center. A same-structured questionnaire was used for both groups.

**Results** Children with FD (63.2%) used baby-bottles in an inadequate way with a higher frequency after 24 months of age. Inadequate posture at meals was observed with higher frequency in children with FD (78.1%). Children without FD (89.1%) had more autonomy to eat. In children > 18 months old, this frequency was higher (90.6%).

**Conclusion** Children with FD showed changes on the development of FS. Inadequate posture at meals was associated with a 36-fold higher risk of having FD. Not eating alone after the age of 18 months was associated with a 6-fold higher risk of having FD, while not using baby bottles was associated with a lower risk (52%) of FD complaints. Delays in FS can be predictors of FD during childhood.

### Keywords

- ▶ child feeding
- ▶ baby bottle
- ▶ meals
- ▶ child development

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## Resumo

**Introdução** As habilidades na alimentação são importantes para desenvolvimento infantil, sendo que o atraso na presença pode sugerir sintomas de dificuldades alimentares (DA). O objetivo foi comparar o desenvolvimento em três tipos da habilidade da alimentação (autonomia para comer, postura as refeições, e uso adequado de talheres) entre crianças com e sem DA.

**Métodos** Estudo de caso-controle retrospectivo observacional. Amostra foi baseada em 316 crianças entre grupos casos e controles de acordo com a presença (ou não) de DA. O grupo controle foi recrutado por conveniência (abordagem verbal no pronto-atendimento) e grupo do caso foi baseado nos recordatórios médicos coletados no centro de referência. Questionário semi-estruturado foi utilizado em ambos grupos.

**Resultados** Crianças com DA (63,2%) utilizavam com maior frequência de modo inadequado as mamadeiras após 24 meses de idade. Postura inadequada nas refeições foi observada com frequência elevada em crianças com DA (78,1%). Crianças sem DA (89, 1%) tinha mais autonomia para comer. Em crianças com mais de 18 meses de idade essa frequência foi maior, sendo de 90,6%.

**Conclusão** Crianças com DA apresentaram maiores chances de não desenvolver habilidades na alimentação Postura inadequada as refeições associaram-se com risco de 36x a mais de apresentar DA. Comer sozinho após os 18 meses associou-se com risco de até 6x a mais para desenvolver DA, enquanto o não uso de mamadeiras associou-se com menor risco de 52% de chance para queixas de DA. Atrasos na habilidade da alimentação podem ser preditores das DAs na infância.

## Palavras-chave

- ▶ alimentação infantil
- ▶ mamadeiras
- ▶ refeições
- ▶ desenvolvimento infantil

## Introduction

Feeding difficulties (FD) are common during early childhood and have been identified as picky eating, food phobia, limited appetite, or as changed behaviors during meals. Picky eating is known as difficulty to try new foods and rejection of certain textures or food groups, and stress and difficulties during meals also are some of the examples of affected family reports.<sup>1-4</sup> The incidence in children with normal development is of between 25 and 45%, and of > 80% in children with intellectual disabilities.<sup>5,6</sup> Feeding difficulties can happen regardless of income status, weight status, family structure, and race/ethnicity, and tend to follow the child in all circumstances in which eating is involved (that is, school and family environment, and leisure time). This can be temporary or last forever, leading to behavioral, psychological, nutritional, and growth changes, when not followed-up by a health professional.<sup>7-10</sup>

Feeding difficulties have multifactorial causes, among which are organic problems, deficit and/or delay in motor skills and development, changes in oral and sensorial functions, and/or even behavioral and environmental changes.<sup>4,11</sup>

Feeding skills (FS) are associated with feeding difficulties and are very important to child development and eating. They can be defined as child skills to organize and coordinate motor and oral-motor functions to eat and meet the necessary nutritional requirements. These skills can be identified as eating alone, adequate posture during meals, and correct use of cutlery.<sup>6,11,12</sup> The development of FS also reflects the ability of the children in adequately sharing and interacting during meals. The interaction between caregivers and children, as well as habits and practices observed during these

moments, are important for shaping pediatric eating habits and for the development of eating.<sup>2,4</sup>

Most studies described the profile of children with feeding difficulties; however, it is not well-known on comparing children with feeding difficulties and without reported complaints. Thus, the aim of the present study was to compare the development of three types of feeding skills (autonomy in eating, posture during meals, and adequate use of cutlery) among children with FD and without any complaints of FD (control group).

## Methods

This was a retrospective case-control observational study, conducted at a reference center in feeding in the city of São Paulo, state of São Paulo, Brazil. The present study derived from a major study entitled "Family Meals" that aimed at studying differences between meals dynamics, parental practices, and feeding skills among a group of children with FD and a control group (that is, without reported FD). The ambulatory service is dedicated to support children and adolescents between zero and 18 years old with complaints of FD. Children with a diagnosis of eating disorders, according to the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5)<sup>13</sup> are excluded from the ambulatory service. Previous detail on the protocol of this service has been published elsewhere.<sup>14</sup> At the FD center, the service is multidisciplinary (pediatricians, speech pathologists, and dietitians), and both guidance and diagnosis are established by consensus after discussing the cases.<sup>14</sup>

The study population was based on a convenience sample, composed of 316 children between 8 and 94 months old, from both genders, divided into a case group ( $n = 149$ ) and a control group ( $n = 167$ ), with a previously defined minimal sample power 80% calculated using the post-hoc mode with the GPower version 3.1 software (Herinch-Heine Universität Düsseldorf, Germany). For the prevalence of FD, it was considered the prevalence from the total group of patients approached to control group, that was based on prevalence data found in the literature.

The case-control groups were subdivided based on the outcome “presence of FD”: case group (children with FD at the service) and control group (children without FD from the emergency room). The recruitment and selection of groups followed the process and criteria mentioned below. The participants from the control group were selected by verbal approach at the Emergency Unit of the Sabará Hospital Infantil between February and October, 2017. Only families who were waiting for low-urgency care were approached – nonemergency conditions with low risk of worsening in the next few hours, using the classification from the Sabará Hospital Infantil. After the approach, the caregivers were given time to consider their participation on the study, clarification on their doubts was provided, and the families were included after presenting the consent forms.

The present study was approved by the Institutional Review Board from the institution (CAAE: 06684918.9.0000.5567). The interviews occurred in the awaiting room, in a private venue. From the interviewed families, those who answered negatively to the question: “Your son/daughter gives you trouble to eat/shows difficulties to eat?”, which aimed at detecting complaints of FD, were selected to compose the control group. A total of 194 children was recruited, but after the assessment of the available data, records with incomplete information (loss due to time: families were called to be attended before ending the interview) were excluded, totaling 167 children between 8 and 94 months old from both genders in the control group.

The case group was created based on the medical record data of patients of the FD center (data collection conceived from previous study – CAAE 32939314.0.0000.5567). All patients with complaints of FD reported at the service, regardless of the FD type. The information taken from the medical records was collected by the staff from the FD center during an interview with the caregivers of the patients at the first appointment.<sup>14</sup> Families were recruited to consent with the use of the data from the medical records at the moment of admission in the ambulatory service, through a written form. The caregivers were given time consider their participation on the study, and the staff members were willing to clarify any doubts regarding their consent. All participants presented the consent forms signed by their parents/caregivers.

Records within the same age range in relation to the control group (between 8 and 94 months old) from both genders were selected to reduce confounding factors during posteriori analyses, totaling 149 participants. The interview with the caregivers was based on the same version of a

structured questionnaire that was applied both to the case group (as part of the daily routine of the attendance in the FD center) and to the control group. They were selected based on the following variables to analyses of the present study:

- Demographic information: age (months old) and gender of the child;
- Shared meals: number of meals shared in the week;
- Presence of adults eating at the same time: yes/no;
- Feeding skills, classified following normal patterns for the age of the children.<sup>12</sup>
  - Autonomy to eat (“children eating alone/handle foods”): yes/no;
  - Posture at meals (adequate if a feeding chair or seat adapter was used to give meals, and inadequate if using other postures such as sofa, floor, lap, among others);
  - Use of baby bottles (adequate if children make the use of glasses or straws after 24 months old and inadequate if the use of baby bottles persisted after 24 months old).

The statistical analysis was performed, after checking the consistency of the data, using IBM SPSS Statistics for Windows, version 21.0 (IBM Corp., Armonk, NY, USA). Gender, educational background, meal characteristics, and FS were compared between the case and control groups using univariate analyses through chi-squared tests and logistic regressions. The Student t-test was used to verify associations with the age of the child. Regression models were used to verify associations between the presence or absence of FD and FS. For all analyses, a level of significance of 5% was considered, with a confidence interval (CI) of 95%.

## Results

Data from 167 patients without FD in the control group and from 149 patients with FD were included. All participants were on the age range between 8 and 94 months old. A total of 50.3% of the patients of the control group were female; in the FD group, 35.3% of the patients were female (► **Table 1**). The average age of the control group was  $42.8 \pm 19.6$  months old, and the average age of the FD group was  $37.5 \pm 19.6$  months old (95%CI: - 9.6– - 1.1;  $p = 0.014$ ).

Regarding FS, children with FD used baby bottles in an inadequate manner after 24 months old with a higher frequency (63.2%) in comparison with children without FD (45.2%) (► **Table 2**). There were no differences between groups ( $p = 0.090$ ) regarding the use of baby bottles, with 62.8% in the FD group and 54.2% in the control group. The results of regression models showed that not using baby bottles after 24 months old was associated with a 52% lower chance of presenting complaints of FD (► **Table 2**).

Regarding eating alone, there was a higher frequency among children without FD (89.1%) compared with children with FD (56.4%). When observed in ages > 18 months old, this relationship is further strengthened, with 90.6% of the children without FD and 60.2% of the children with complaints of FD (► **Table 1**). Regarding the logistic regression

**Table 1** Demographic characteristics, feeding skills, and meals of case and control groups. São Paulo, 2017

Variables	Total n (%)	FD group n (%)	Control group n (%)	p-value*
Gender (n = 316)				
Male	179 (56.6)	96 (64.4)	83 (49.7)	0.009
Female	137 (43.4)	53 (35.6)	84 (50.3)	
Use of baby bottle after 24 months old				
Yes	128 (53.1)	67 (63.2)	61 (45.2)	0.004
No	113 (46.9)	39 (36.8)	74 (54.8)	
General use baby bottle (regardless of age) (n = 309)				
Yes	179 (57.9)	89 (62.8)	90 (54.2)	0.090
No	130 (42.1)	54 (37.8)	76 (45.8)	
Skills for eating alone (n = 298)				
Yes	222 (74.5)	75 (56.4)	147 (89.1)	0.000
No	76 (25.5)	58 (43.6)	18 (10.9)	
Skills for eating alone after 18 months old (n = 273)				
Yes	213 (78.0)	68 (60.2)	145 (90.6)	0.000
No	60 (22.0)	45 (39.8)	15 (9.4)	
Adequate posture during meals (n = 303)				
Yes	181 (59.7)	30 (21.9)	151 (91.0)	0.000
No	122 (40.3)	107 (78.1)	15 (9.0)	
Number of shared meals in the week (n = 304)				
0	96 (31.6)	67 (48.9)	29 (17.3)	0.000
1–5	98 (32.2)	42 (30.7)	56 (33.5)	
6–10	61 (20.1)	19 (13.8)	42 (25.1)	
> 10	49 (16.1)	9 (6.6)	40 (24.0)	
Adults eating at the same time (n = 296)				
Yes	199 (67.2)	43 (33.1)	156 (93.9)	0.000
No	97 (32.8)	87 (66.9)	10 (6.1)	

Abbreviation: FD, Feeding difficulties.

\*chi-squared test.

models, not eating alone after 18 months old was associated with a 6-fold higher risk of presenting FD (► **Table 2**).

Inadequate positions during meals was verified with a higher frequency in children with FD (78.1%) than in children without FD (9%) (► **Table 1**). Inadequate posture during meals was associated with a 36-fold higher risk of presenting FD (► **Table 2**).

Regarding meals (► **Table 1**), children with FD did not share family meals during the week (48.9%) at a higher frequency than to children without FD (17.3%). Children

without FD ate at the same time as their parents (93.3%) at a higher frequency than those with FD (33.1%).

## Discussion

The present study observed that children with complaints of FD showed a higher frequency of inadequate use of baby bottles and of inadequate posture during meals, as well as less skills in eat alone when compared with the group of children without FD. There was an association between these

**Table 2** B values of the associations between eating and the presence or absence of feeding difficulties. São Paulo, 2017

Variable	Exp (B)	95%CI	p-value
No use of baby bottle after 24 months old	0.48	0.29;0.81	0.006
No eating alone (lack of self-feeding) after 18 months old	6.4	3.3; 12.3	0.000
Inadequate posture at meals	35.9	18.4; 69.9	0.000

Abbreviation: CI, confidence interval; Exp (B), exponential.

variables and the presence of FD, as well as with sharing a lower number of family meals per week.

Regarding the introduction of different utensils, most infants acquire initial skills for weaning from baby bottles and using of glasses with different sizes and shapes, in addition to eating tools.<sup>12</sup> After 24 months old, the prolonged use of baby bottles is unnecessary and harmful to the development of normal swallowing, chewing, occlusion, and speech, increasing the risk of cavities and weight gain, leading to inadequate eating replacements.<sup>15</sup>

Furthermore, in children in an adequate eating transition, less use of baby bottle at 15 months old, better eating acceptance, and lower prevalence of food selectivity were confirmed.<sup>16,17</sup> The clinical importance of this practice is evident, since milk (the main food ingested via baby bottle) is replacing meals, impacting the appetite and ingestion of children,<sup>1</sup> as well as reducing exposure to solid foods and meals. The use of baby bottles is usually associated with the presence of FD, in the form of replacement of meals and concern of the mother regarding the reduction of this food.<sup>1</sup> When the prolonged use of baby bottles is identified, its discouragement is essential, either due to issues related to the normal development of swallowing, chewing, occlusion, and speech, or due to inadequate food replacements and their relation with meals and FD.<sup>1</sup>

Regarding eating alone, Carruth et al.<sup>15</sup> argue that this skill is developed during the 2 first years of life and that most children can eat alone or demonstrate skills related to eating alone between the ages of 15 and 18 months old. Motor and oral development are prerequisites both for eating alone and for the adequate use of cutlery, and any delay in this process needs to be assessed and followed-up.<sup>11,12</sup> The American Academy of Pediatrics suggests that the ability to seat and bring the hands and other objects to the mouth is significant to initialize the autonomy of the eating process, with the introduction of foods that can be eaten with the hands (finger foods).<sup>7</sup>

Eating alone is an important step for the development of independence and self-confidence, in addition to chewing and swallowing quality and to all sensorial and emotional aspects involved during eating. Children should progressively demonstrate independence from adults; thus, it is important to highlight that the attitude of the caregivers toward food can influence the development of the autonomy of children. Evidence demonstrate that cultural differences interfere in maternal expectations and encouragement to eating alone.<sup>6,12</sup>

Studies conducted with children aged up to 24 months old demonstrated that hungry children tend to use the spoon at ~ 5.4 months old, to use the fingers to pick foods at 8.8 months old, and to use the fingers to eating smooth foods by themselves at 13.5 months old. Regarding the use of spoons, it was observed that, at 12 months old, 38% of the mothers used spoons to feed their children as a priority mode; 54% equally divided this function with the child, and 8% let their child eat alone. Although individual variations can be found, these data can be used to guide mothers regarding feeding practices and encouragement to meal autonomy.<sup>15,18</sup> A delay

in this process can indicate the presence of FD, and the maintenance of this behavior can prevent from providing a prognostic.<sup>6,12</sup>

Regarding motor skills, with increased muscle tonus and control, children can be fed initially on adapted slope chairs, gradually moving to other positions until reaching 90°. An adequate position during meals is important to motor development, oral functions, and motor feeding skills, because it can help with hand-to-mouth coordination, bilateral coordination, and with feeding as a whole, favoring autonomy and participation in family meals.<sup>12</sup>

A review study identified situations as the inadequate position of these children (slope position out the age group) to avoid the scape of the food and help swallowing with the gravity aid, as well as the preferential offer of semi-solid foods to help on acceptance, as factors that results on inadequate development of feeding skills with significant changes on motor-oral development, making them more likely for swallowing disorders with foods from different textures and consistencies and, consequently, subject to difficulties with solid foods.<sup>4</sup>

Young children eating is a fundamentally relational process and multi-systemic. These principles applied to all the formed dyads adult-children.<sup>19</sup> Eating is the first shared task in the relationship between mother and child, and changes in this relationship can affect the style of the interaction and the development of eating.<sup>19</sup> There is a gap on the literature regarding behavioral and environment issues related to eating and to the presence of FD. Previous studies showed that the parent-child interaction is an important characteristic to be observed in cases of food selectivity.<sup>7,20</sup>

Despite the period of readiness from the central nervous system, the maturation of motor-oral skills is secondary to experiences of the child with the environment, and eating and learning vary according to the opportunities offered.<sup>12</sup> Children with FD share a lower number of family meals, as shown in the present study, and even though FD can be disruptive when it comes to eating with their families, the learning process of eating occurs essentially during meals. Family meals are known as protective for issues beyond nutritional aspects.<sup>3</sup>

The present study presents limitations, including the question used to compose the control group ("Your son/daughter gives trouble to eat/presents difficulties to eat?"). Nevertheless, this is consistent with the space and moment in which the data collection was conducted. It is important to consider that parents from the control group were in a moment of apprehension, possibly worried with more acute health conditions; thus, to minimize the report bias, questions related to daily habits from families of both groups were selected. Furthermore, it can be observed that the families included in the present study presented different socioeconomic status, considering the nature of the services (center of FD and emergency care unit), although data on consumer goods and income have not been reported. The interviews were always conducted with the mothers of the children, and no reports from other caregivers were obtained. To minimize selection sample bias for the choice

of the control group was made independently of the attendance of food issues and exposure factors.

There is a lack of comparisons between the feeding skills of children with FD and those of children without reported complaints; thus, the present study contributed for further elucidation on the theme and with knowledge of fundamental importance to support assertive and effective guidelines, as well as early interventions and diagnostics.

## Conclusion

Children with FD showed a higher frequency of inadequate use of baby bottles and of inadequate posture during meals, as well as less skills to eat alone, when compared with the group of children without FD. These variables were associated with the risk of FD, and their importance to an adequate development of eating and to the prevention of difficulties becomes evident. The importance of the responsiveness of the adult-child dyad during the meals should be highlighted, so that the adult can adapt to the practices, offer learning opportunities, and encourage family meals.

### Conflict of Interests

The authors have no conflict of interests to declare.

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