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ORIGINAL

Family influence on the nutritional status and eating habits of six to nine year-old children

Influência familiar no estado nutricional e hábito alimentar de crianças de seis a nove anos

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ABSTRACT

Objective

To investigate whether caregivers' attitudes, beliefs, practices, alimentary habits, and nutritional status influence the alimentary habits and nutritional status of children aged six to nine years.

Methods

This cross-sectional study included 164 children and a family member (caregiver) each (n=164), carried out in the family health units of the municipality of *Ribeirão Preto* (SP), Brazil. Weight and height measurements were performed; each child was then evaluated by the application of both the Child Feeding Questionnaire and 24h recall (for calculating the Healthy Eating Index Revised), in addition to the assessment of adherence to healthy eating steps of the Ministry of Health, through a questionnaire.

Results

The results showed that the prevalence of being overweight was 18.3% in children and 32.9% in caregivers, and the prevalence of obesity was 15.9% and 37.9%, respectively. Most of the 56 children categorized as overweight also had overweight caregivers (82.1%; n=46). Concerns regarding children's weight control were higher among caregivers

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responsible for overweight children (3.6±1.29). In contrast, caregivers responsible for children below or at normal weight demonstrated a greater tendency toward getting children to eat (3.3±0.97 and 3.9±0.99, respectively). The average score; of the children's Brazilian Healthy Eating Index Revised (50.0±13.6) was similar to that of their caregivers (56.5±12.1).

Conclusion

Caregivers have a direct influence on the nutritional status and eating habits of children; therefore, they should be targeted in the processes of nutritional intervention for the prevention and treatment of childhood obesity.

Keywords: Child nutrition. Feeding behavior. Food consumption. Nutritional status. Pediatric obesity.

RESUMO

Objetivo

Este estudo se propôs a investigar se atitudes, crenças, práticas, hábitos alimentares e estado nutricional dos responsáveis influenciam os hábitos alimentares e o estado nutricional de crianças de 6 a 9 anos.

Métodos

Estudo transversal com 164 crianças e um respectivo responsável por sua alimentação (n=164), desenvolvido em Unidades de Saúde da Família do município de Ribeirão Preto (SP). Realizaram-se aferição de peso e estatura, aplicação do Questionário de Alimentação da Criança e Recordatório Alimentar de 24 horas (para cálculo do Índice de Qualidade da Dieta Revisado), além de verificação da adesão aos Passos da Alimentação Saudável do Ministério da Saúde, por meio de um questionário.

Resultados

Os resultados obtidos mostraram que as prevalências de sobrepeso foram de 18,3% nas crianças e de 32,9% nos responsáveis, e as prevalências de obesidade foram de 15,9% e 37,9%, respectivamente. Os responsáveis da maioria das 56 crianças que apresentaram excesso de peso também tinham excesso de peso (82,1%; n=46). A preocupação com o peso da criança foi maior entre os responsáveis das crianças acima do peso (3,6±1,29). Por outro lado, uma maior pressão para comer foi identificada entre os responsáveis com crianças com baixo peso ou peso normal (3,3±0,97 e 3,9±0,99, respectivamente). O escore médio do Índice de Qualidade da Dieta Revisado das crianças (50,0±13,6) foi muito similar ao dos responsáveis (56,5±12,1).

Conclusão

Os responsáveis exercem influência direta no estado nutricional e hábitos alimentares das crianças, devendo ser alvos nos processos de intervenção nutricional para a prevenção e o tratamento da obesidade infantil.

Palavras-chave: *Alimentação infantil. Comportamento alimentar. Consumo de alimentos. Estado nutricional. Obesidade pediátrica.*

INTRODUCTION

Obesity is characterized by excessive accumulation of fat at a level that could be malign to health [1,2]. Studies indicate that childhood obesity is a risk factor to developing dyslipidemia and insulin resistance even in childhood [3]. According to global estimates, in 2016, more than 340 million children and adolescents (between 5 and 19 years old) were overweight or obese [1]. There was a pronounced increase in the proportion of overweight children in Brazil, mainly in the age group of 5 to 9 years of age, between 1989 and 2009. Among boys in this age group, overweight individuals reached 34.8%, and among girls, this index reached 32%, whereas the overall obesity rate among boys was 4.1% and among girls 11.8% [4].

Obesity has a multifactorial character, among its main causes, and environmental factors stand out, such as socioeconomic conditions, lifestyle, and eating habits [2,5-9]. Several instruments are used to assess food intake, which is one of the aspects of eating behavior [5,8,10-19]. However, there is no foolproof

assessment of the food consumption method [20,21]. The 24-hour recall is the most suitable approach to quantify and assess food and nutrient intake [7,18,22,23].

Eating behavior is complex: it is not restricted to consumption patterns but encompasses everything from choice and purchase to food preparation and the act of eating. Eating behavior involves several environmental, nutritional, psychological, social, and cultural factors [2,18,24-26]. Nutritional knowledge alone does not guarantee healthy eating habits because the actual behavior is dependent on food beliefs, taboos, and so on [25,27]. Children's eating behavior is most susceptible to external interference because they are not the ones purchasing and preparing the food they consume [11,17,26-29], in addition to attitudes, control practices, and beliefs of family members in relation to their food that directly influence the construction of eating habits even in childhood [9,15,25,30,31].

The influence of caregivers on children's nutritional status should be investigated and detailed in order to increase the possibilities of intervention in the family environment, which may impact the prevention and treatment of childhood obesity. Therefore, this study aimed to investigate the influence of attitudes, beliefs, and eating practices of those responsible, and their nutritional status, on the eating habits and nutritional status of children.

METHODS

This was a cross-sectional study that evaluated 164 children aged between 6 and 9 years, together with a caregiver responsible for feeding them (n=164), who lived in the area covered by 1 of the 9 Family Health Units (FHU) in the city of *Ribeirão Preto* (SP), Brazil. The sample was defined based on the total number of children enrolled at FHU (n=4,401) in the municipality. The sample size was established based on the variance of results from a pilot study [32].

The study received approval from the Ethics Committee (decision number CAAE n. 49127115.5.0000.5407). Data collection was performed by the principal researcher at the FHU between April and July 2016. The sampling process was random; children accompanied by the caregivers who attended the FHU during this period were invited to participate in the study. An interview was conducted in an FHU room, with both children and caregivers, and they also underwent anthropometric assessment (weight and height measurement).

A sample characterization questionnaire consisting of identification and sociodemographic data (age, gender, parent-child relationship) of the children and their respective caregivers was used. Weight and height were computed with a compact scale and stadiometer (digital scale, with a capacity of 180kg and graduation of 100g: stadiometer with a wooden ruler, extension up to 213cm, and accuracy of 0.1cm). For the measurements, the children and their caregivers were instructed to remove ornaments, shoes, items from the pockets and hair props, standing upright in the center of the device, with arms extended along the body and head at right angles to the neck, looking at a fixed point at eye level. The nutritional status evaluation was based on the Body Mass Index (BMI), respecting the cutoffs for age group children older than 5 years and adolescents up to 19 years old, adult caregivers (aged between 20 and 59 years) e elderly (60 years or older) [33].

The caregivers' nutritional status was established according to life phases (adolescent, adult, and elderly). Still, to enable better visualization of the parents' nutritional status (n=164), the classification results were grouped and presented together through absolute and relative frequency as well as that of children. McNemar's test was applied to compare the children's nutritional status and their cares.

To assess the viewpoints, attitudes, and practices of parents in relation to children's feeding and the possible relationship between these factors and child obesity, a Brazilian version of the Child Feeding Questionnaire (CFQ) was applied [34]. The CFQ consists of 31 questions, divided into 7 factors: 4 factors that measure the report of parents' beliefs regarding their child's obesity-prone diet (Perceived Responsibility, Perceived Parent Weight, Perceived Child Weight, and Concern About Child Weight) and 3 factors that measure parental control practices and attitudes about child feeding (Restriction, Pressure to Eat, and Monitoring) [34].

As proposed by the authors of the original as well as those of the Brazilian version, the 31 questions of the CFQ are rated on a 5-point range from 1 to 5. Each question was scored, and there ultimately emerged a mean score for each factor [34]. In this analysis, questions 11, 12, and 13 (concerning the child weight perception factor) were withdrawn because the ages of the children in this study did not make it possible to obtain answers to these questions for all children.

The Child Feeding Questionnaire score results are presented in terms of their median (Q1-Q3) and minimum-maximum values. The Kruskal-Wallis test was applied to establish the relationship between each of the 7 CFQ factors and the children's nutritional status. For CFQ factors that presented $p<0.05$, in the Kruskal-Wallis test (Factors 3, 4, and 6), Dunn's test was performed.

To evaluate the frequency of adherence to the Ministry of Health's 9 steps for a healthy diet, for both children and caregivers was used in the questionnaire by Vinholes *et al.* [35]. After determining each individual's adherence or non-adherence to each of the 9 steps, 3 categories were created: high adherence (adherence meets 7 to 9 steps), average adherence (adherence meets 4 to 6 steps), and low adherence (adherence meets no more than 3 steps). For associations between nutritional status and step adherence (both children and caregivers), Fisher's exact test was performed.

To evaluate the overall quality of children's and caregivers' diets, the 24h recall technique, referring to the previous day's feeding, was applied. The 24h recall was used to calculate the Brazilian Healthy Eating Index Revised (BHEI-R), the current Brazilian version of the Healthy Eating Index (HEI), originally developed in the United States. The BHEI-R has 12 elements: 9 of them are based on the food groups of the first Food Guide for the Brazilian Population (total cereals; whole grains; total fruits; whole fruits; total vegetables; dark green and orange vegetables and legumes; milk and derivatives; meat, eggs, and legumes; and oils), 2 components are nutrients (sodium and saturated fat), and the last component consists of calories from Solid Fats, Alcohols, and Added Sugars (SoFAAS) [36-40].

The Brazilian Healthy Eating Index Revised was calculated according to the instructions listed in the roadmap provided by the Food Consumption Assessment Research Group [41]. The final rating of the BHEI-R can range from 0 to 100 [38]. Three procedures were employed to draw conclusions from the BHEI-R evidence: (1) data were analyzed descriptively; (2) paired t-Student test (comparing the scores of children and their caregivers); and (3) individuals who obtained a final score greater than the third tertile were categorized with an adequate diet (BHEI-R>61.7 points for caregivers and BHEI-R>57.0 for children). All data were computed and analyzed using statistical tests appropriate to the objectives and through descriptive statistics. The significance level was set at 5% ($p<0.05$) [42-44].

RESULTS

The sample consisted of 164 children aged 6 to 9 years (and their respective caregivers): 96 (58.5%) were female and 68 (41.5%) were male. The age division was: 6-7 years and 8-9 years, both with 82 (50%) children. Of the 164 responsible, the majority (n=158; 96.3%) were female. The age groups of the

caregivers were: 18-29 years (n=34; 20.7%), 30-44 years (n=88; 53.7%), 45-59 years (n=26; 15.8%), and 60 years or older (n=16; 9.8%). Mothers represented most of the caregivers (n=123; 75.0%), but there were also some grandparents (n=28; 17.1%), fathers (n=6; 3.6%), and other caregivers (n=7, 4.3%).

The Table 1 presents the categorization of the nutritional status of the children and their caregivers, separated by age group, and Table 2 shows an association (p<0.01) between the nutritional status of the children and their caregivers. It is noteworthy that of the 56 children who were overweight (overweight or obese), 46 caregivers were overweight, and 72.3% of the caregivers who had an adequate weight also had their child with an appropriate weight.

Table 1 – Nutritional status of the participants. *Ribeirão Preto* (SP), Brazil, 2016.

Nutritional status	n	%
Children	164	100
Severe thinness	1	0.6
Thinness	5	3.0
Normal	102	62.2
Overweight	30	18.3
Obesity	18	11.0
Severe obesity	8	4.9
Caregivers	164	100
Underweight	1	0.6
Normal weight	47	28.6
Pre-obesity	54	32.9
Obesity class I	37	22.6
Obesity class II	16	9.8
Obesity class III	9	5.5

Table 2 – Comparison between classification of the nutritional status of children and their respective caregivers. *Ribeirão Preto* (SP), Brazil, 2016.

Nutritional status (Children)	Nutritional status (Caregivers)								p-value*
	Under-weight		Normal weight		Over-weight		Total		
	n	%	n	%	n	%	n	%	
Underweight	0	0.0	3	6.4	3	2.6	6	3.7	
Normal weight	1	100	34	72.3	67	57.8	102	62.2	<0.01
Overweight	0	0.0	10	21.3	46	39.6	56	34.1	
Total	1	100	47	100	116	100	164	100	

Note: For the classification of nutritional status, the cutoff points for each age group were considered and subsequently grouped. *McNemar's test: a significance level of 5%.

The median values of the 7 factors of the CFQ were as follows: Perception of Responsibility: 4.3 (CI95% 1.3-5.0); Parental Weight Perception: 3.2 (CI95% 2.0-5.0); Perception of Child's Weight: 3.0 (CI95% 1.7-5.0); Concern about the child's weight: 3.2 (CI95% 1.0-5.0); Restriction: 3.3 (CI95% 1.0-4.6); Pressure to Eat: 3.75 (CI95% 1.0-5.0); and monitoring: 4.0 (CI95% CI 1.0-5.0). The results of the 7 factors of the CFQ were also separated according to children's nutricional status (see Table 3 for detailed results) in order to verify if any stronger correlations could be obtained. In Factor 3, the significant difference was between underweight and normal weight. In Factors 4 and 6, a statistically significant difference was only found between normal weight and underweight.

Table 3 – Descriptive analysis of the 7 factors of the Child Feeding Questionnaire, with results separated by children's nutritional status. *Ribeirão Preto* (SP), Brazil, 2016.

Factors of the CFQ	Child NS	n	Min	Q1	M	Q3	Max	*p*-value*
Perceived Responsibility	Below weight	6	3.3	4.0	4.8	5.0	5.0	0.50
	Suitable weight	102	1.3	4.0	4.3	5.0	5.0	
	Overweight	56	1.3	3.7	4.3	5.0	5.0	
Perceived Parent Weight	Below weight	6	2.5	3.0	3.1	3.2	3.5	0.25
	Suitable weight	102	2.0	3.0	3.0	3.2	4.7	
	Overweight	56	2.2	3.0	3.2	3.5	5.0	
Perceived Child Weight	Below weight	6	2.0	2.3	2.8	3.0	3.0	<0.01
	Suitable weight	102	1.7	3.0	3.0	3.0	3.7	
	Overweight	56	2.3	3.0	3.0	3.3	5.0	
Concern About Child Weight	Below weight	6	2.0	2.7	3.5	4.3	4.7	<0.01
	Suitable weight	102	1.0	1.7	2.7	3.7	5.0	
	Overweight	56	1.0	2.5	3.7	5.0	5.0	
Restriction	Below weight	6	1.6	2.5	2.7	3.7	4.0	0.44
	Suitable weight	102	1.0	2.6	3.2	3.6	4.6	
	Overweight	56	1.0	2.7	3.5	3.9	4.6	
Pressure to Eat	Below weight	6	2.2	2.2	3.5	4.0	4.5	<0.01
	Suitable weight	102	1.0	3.5	4.0	4.7	5.0	
	Overweight	56	1.0	2.0	2.5	4.0	5.0	
Monitoring	Below weight	6	1.0	1.7	3.5	5.0	5.0	0.85
	Suitable weight	102	1.0	3.0	4.0	5.0	5.0	
	Overweight	56	1.0	3.0	4.0	5.0	5.0	

Note: *Kruskal-Wallis test: a significance level of 5%; CFQ: Child Feeding Questionnaire; M: Median; Max: Maximum; Min: Minimum; NS: Nutritional Status; Q1: 1º Quartile; Q3: 3º Quartile.

Table 4 shows the frequencies of adherence to healthy eating steps of children and caregivers separated by the nutritional status. To compare the variables (adherence levels and nutritional status), Fisher's exact test was performed, which showed an association between adequate weight and the levels of medium and high adherence ($p<0.01$).

Table 4 – Absolute and relative frequency of parents' adherence to the 9 steps of healthy eating, separated by nutritional status. *Ribeirão Preto* (SP), Brazil, 2016.

Level of adherence to the steps of healthy eating	Nutritional status								*p*-value*
	Under-weight		Normal weight		Over-weight		Total		
	n	%	n	%	n	%	n	%	
Child									<0.01
High adherence(7-9)	0	0.0	38	37.3	7	12.5	45	27.4	
Average adherence (4-6)	5	83.3	64	62.7	41	73.2	110	67.1	
Little adherence (0-3)	1	16.4	0	0.0	8	14.3	9	5.5	
Total	6	100	102	100	56	100	164	100	
Caregivers									<0.01
High adherence (7-9)	0	0.0	22	46.8	21	18.1	43	26.2	
Average adherence (4-6)	1	100	24	51.1	87	75.0	112	68.3	
Little adherence (0-3)	0	0.0	1	2.1	8	6.9	9	5.5	
Total	1	100	47	100	116	100	164	100	

Note: *Fisher's exact test: significance level 5%.

When comparing children's levels of adherence to the healthy eating steps with those of their respective caregivers, it was observed that for the 45 children who demonstrated high adherence, 21 (46.7%) of the

caregivers also demonstrated high adherence. Twenty-four (53.3%) of the caregivers demonstrated average adherence, and none demonstrated low adherence. Among the 110 children who demonstrated average adherence, 84 (76.4%) of the caregivers demonstrated average adherence, 20 (18.2%) demonstrated high adherence, and only 6 (5.4%) demonstrated low adherence.

The interval of the third tertile of the BHEI-R score, which indicates a healthy diet, was found to vary between 61.7 and 92.0 points for caregivers and 57.0 and 85.3 points for children. Female children obtained a higher mean BHEI-R score (52.0±14.38) than male children (47.3±11.97); this mean difference was approximately 4.7 points, and the difference between the 2 groups was found to be statistically significant (p<0,05). Figure 1 shows caregivers' and children's dispersion indicators of the BHEI-R by age group. When a comparison was made between the paired data (paired *t*-test) of the BHEI-R of the children and their respective caregivers with the BHEI-R, the estimated difference was 6.5 points.

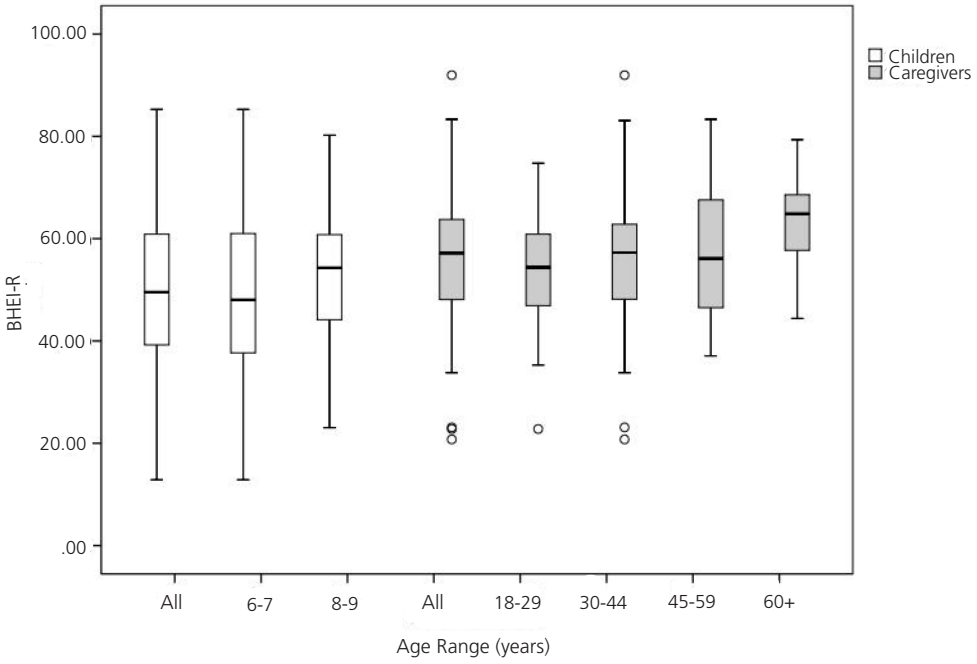

Figure 1 – Brazilian Healthy Eating Index Revised of caregivers and children, separated by age group. *Ribeirão Preto* (SP), Brazil, 2016.
Note: BHEI-R: Brazilian Healthy Eating Index Revised.

DISCUSSION

The mean scores of the monitoring factor did not significantly differ among caregivers of children with different nutritional status, a pattern was noted: caregivers responsible for normal weight children had the highest score, followed by those responsible for overweight children. Lastly, caregivers who monitor less are those whose children are underweight, similar to other studies [30,45].

It was evident that when restricting the consumption of certain foods, caregivers took into account the weight of their child. The highest mean of restriction practices was detected among caregivers responsible

for children with severe obesity, followed by those caring for obese and overweight children [3,30,46]. This is consistent with the literature identifying this practice as a caregiver's first choice to control overweight children's consumption of unhealthy foods [3,9]. However, this practice is classified as dangerous in the long term because the child bases the choice and quantity of food on parental rules and not on knowledge about nutrition or indicators of hunger and satiety [9,30,46].

The mean scores of CFQ factors in Karp's *et al*. [45] study were similar to the present study, with the greatest similarity in Perceived Responsibility (Karp *et al*. [45]: 4.3; present study: 4.2), showing that when working with a caregiver who is not necessarily the mother, it is possible to consider the individual most present in the daily life of the child and who may exert a greater influence on the eating habit, since it is he/she who often selects, prepares, and makes available the foods that the child consumes.

A study showed that children/adolescents from the most dysfunctional families demonstrated the greatest interest in food (regardless of the parents' weight). Children who perceived their family environments as supportive and who had the freedom to express their feelings demonstrated a more controlled food intake and healthier eating styles [47].

Aiming to include children whose main caregiver is an adult other than the mother, some studies defined caregivers as those most involved in the care of the child [45-49]. However, the results of this study illustrated that women are still the main caregivers of children.

Lorenzato *et al.* [34] pointed out that children's nutritional status is correlated with that of their caregivers, reinforcing the importance of the family environment in the development of children's eating habits and, consequently, in their nutritional status. Other studies have shown that, in addition to genetic factors, many factors in the family environment can directly interfere with children's eating behavior, especially strategies adopted by those responsible for feeding them [2,5,25,27,30].

Children's and caregivers' levels of adherence to the healthy eating steps were very similar (67.1% of the children and 68.3% of the caregivers demonstrated average adherence). It is noteworthy that all children with normal weight demonstrated average or high adherence, while among caregivers with normal weight, only 1 demonstrated low adherence to the steps. Almost half of the caregivers who demonstrated high adherence were overweight, and these individuals may be inadequate in the amount of food consumed and not in quality.

It is to be noted that the ingestion of foods considered healthy, both by children and their caregivers, does not indicate the exclusion of high-calorie foods with low nutritional content [8,11,50]. One can also think about reverse causality, where the individual who identifies a health problem, such as being overweight, starts to look for a healthier diet as part of the treatment or prevention of diseases.

Among the children with high adherence (n=45), a large proportion had normal weight (n=38). Of the 112 children with average adherence, 84 caregivers also demonstrated average adherence. All children with high adherence had caregivers with average or high adherence. The similarity found between the levels of adherence to the steps of healthy eating for children and their caregivers suggests a similar eating pattern among family members. It should be emphasized that in a cross-sectional study, the results found cannot infer a causal relationship, or even that consumption data are considered usual because only a 2-hour recall was applied.

The mean of the children's BHEI-R score was lower than that of their caregivers, indicating a greater need for dietary modification. Among the children, the girls obtained significantly higher scores than boys ($p<0,05$), similarly to findings of other studies [10,51]. Other studies using the BHEI-R have also demonstrated that a large percentage of individuals have a score that indicates the need for diet modification

[36,23]. The pattern of food consumption by caregivers is increasingly pointed out as one of the factors associated with the child's food pattern, and this influence started even in early childhood [50].

Several explanations have been offered to account for individuals' eating behavior and nutritional status, particularly during childhood. Family-members have crucial importance in this regard because their attitudes and control practices affect children. Nonetheless, it is necessary to highlight and bring awareness to the fact that the causes of obesity exceed environmental factors.

It is not possible to jointly assess all aspects of the family influence on children's nutritional status and eating habits. In this context, a drawback of this research was to evaluate part of the spectrum of children's eating behavior and their respective caregivers. A second shortcoming worth mentioning was evaluating the eating behavior in a single day, which may not always correspond to the habitual behaviors of the sampled individuals.

CONCLUSION

The nutritional status and the caregivers' food consumption are associated with nutritional status and children's food consumption. Some control practices of caregivers in relation to the child's food, such as pressure to eat and restriction, were connected to the perception that the caregivers had in the context of the child's nutritional status, highlighting these common practices, but which can cause a loss in behavior development child's long-term diet.

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CONTRIBUTORS

GP SILVA contributed to the conception and design of the study, analysis and interpretation of data. SS ALMEIDA and TM BRAGA COSTA contributed to the conception and design and final version approval of article.

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