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Children with feeding difficulties tend to high protein and milk-based supplements' intake – how to break this cycle?

Crianças com dificuldades alimentares consomem proteínas e suplementos lácteos em quantidades excessivas – como romper este ciclo?

Abstract

Objectives: To identify the profile of milk and proteins intake by children with feeding difficulties (FD), compare intakes with recommendations for age and investigate association with FD patterns. ***Methods:*** Retrospective cross-sectional study with 119 children aged between six months and 14 years (sampling power >90%). The following data were collected from medical records: age, sex, FD type, hemoglobin and ferritin levels, BMI, food selectivity pattern, macronutrients and milk intake patterns (except breast milk), feeding complaint, mother's parenting style, coercive practices and self-feeding habits. Student t-tests, Anova, GLM and Spearman's correlation, significance level below 5% and 95% CI were used. ***Results and discussion:*** there was an excessive daily absolute protein consumption for all age groups ($p<0.024$), and the highest

percentage of milk in total protein intake was found in children less than 3 years (51.7% to 55%). Milk intake alone provided 80% to 138% of daily protein needs (below 8 years). Children using milk-based supplements tend to a reduced consumption of non-milk foods. The highest milk protein consumption was associated with mothers with indulgent profile (p=0.033) and coercive habits (p=0.043), with no relationship with the other variables. ***Conclusions:*** there was excessive protein intake and a relationship between reduced intake of other protein sources and use of milk-based supplements. Indulgent and coercive parenting behaviors were associated with more milk consumption. It is emphasized the need for guidance about the replacement of meals and nutritional supplementation in FD conditions.

Keywords: Feeding difficulties. Childhood. Dietary intake. Dietary protein. Milk intake. Nutritional supplements.

Resumo

Objetivos: Identificar o perfil de consumo de leite e proteínas em crianças com dificuldades alimentares (DA), comparar a ingestão às recomendações para idade e buscar associação com padrões da DA. ***Métodos:*** Estudo transversal retrospectivo com 119 crianças entre seis meses e 14 anos (poder amostral >90%). Coletaram-se de prontuários: idade, sexo, tipo de DA, dosagens de hemoglobina e ferritina, IMC, padrão de seletividade alimentar, ingestão de macronutrientes e padrões da ingestão de leite (exceto leite materno), queixa alimentar, estilo parental materno, práticas coercivas e hábitos de autoalimentação. Utilizaram-se testes ***t***-Student, Anova, GLM e correlação de Spearman, nível de significância menor que 5% e IC 95%. ***Resultados e discussão:*** Houve consumo proteico absoluto diário excessivo em todas as faixas etárias (p<0,024), e a maior contribuição percentual de leite para o consumo proteico total se deu abaixo de três anos (51,7% a 55%). A ingestão isolada de leite supriu de 80% a 138% das necessidades proteicas diárias (abaixo de 8 anos). Crianças com uso de suplementos lácteos tenderam para redução de consumo de alimentos não lácteos. O maior consumo proteico e de leite se associou ao perfil indulgente das mães (p=0,033) e a hábitos coercitivos (p=0,043), sem relação com as demais variáveis. ***Conclusões:*** Houve ingestão proteica excessiva e relação entre ingestão reduzida de outras fontes proteicas e uso de suplementos de base láctea. Comportamentos maternos indulgentes e coercivos foram associados ao maior consumo de leite. Reforça-se a necessidade de orientação quanto à substituição de refeições e suplementação nutricional em quadros de DA.

Palavras-chave: Dificuldade alimentar. Crianças. Ingestão dietética. Proteínas. Leite. Suplementação nutricional.

INTRODUCTION

Food refusal or aversion to certain foods can be characterized as feeding difficulty (FD). Often observed in pediatric clinic, it mainly affects children aged two to five years and may impair growth and development, in social and emotional spheres.[1,2] Prevalence of FD is described as 20-60% of the child population in (world data).[3] In Brazil, data indicate a prevalence of 37% in children under age six in the Northeast region [4] and 44% in São Paulo (Machado et al, ***in press***)[a] FD is a condition found in all socioeconomic levels, regardless of the child's nutritional status, family structure or race to which they belong, and which accompanies them in the school, family or leisure routines.[5-7] As a consequence, FD makes parents/caregivers feel insecure about the child's proper intake of energy and nutrients to thrive.[2] Such concern is justified, if one considers that restriction to some food groups and the monotony of consistencies and flavors contribute to the risk of nutritional deficits in this phase of life, even when there is excessive consumption of energy.[2,8] Due to such concern, parents have difficulty to set limits and allow excessive intakes of the foods that the child accepts well, making use of food supplementation and/or complementation sometimes unnecessary,[2] almost always consisting of milk-based meals.[8-11] Frequent replacement of textured foods by milk can lead to an excessive intake of protein in childhood, since these foods have high protein content. Some studies in international literature show that such complementation ends up encouraging replacement of solids by milk in children's diets in the long term;[12] that the gradual increase of milk/formulas tend to aggravate the FD conditions and reduce the energy contribution of foods in the diet[12-14] and reduce appetite during mealtimes.[15] However, few studies examined milk intake and proteins adequacy in this specific population as well as the association of FD patterns with milk intake,[11,16] and more investigations on the topic are necessary.

Given the above, the aim of the present study was to compare the protein intake by children with FD with their needs, to map the milk intake profile and verify the existence of its association with FD patterns.

METHODS

This is a retrospective cross-sectional study conducted at the ***Centro de Dificuldades Alimentares*** – CDA (Center for Feeding Difficulties), a pioneering outpatient service for children and adolescents aged 0 and 18 years with FD complaints (except diagnosis of feeding disorders according to DSM-5).[17] The pediatric feeding management in the center consists of a joint consultation with a pediatrician, speech therapist and dietitian, followed by a multidisciplinary discussion to establish conducts. FD is diagnosed as "poor appetite", "restless child", "feeding fear", parents' misperception, "food selectivity" and "organic causes".[1] Subsequent management may range from dietary plans, food and nutrition educational activity to referral to a speech pathologist for a therapy to restore oral functions, use of medications or referral to other complementary services.

The study used convenience sampling with sampling power above 90% for comparison between dietary intake and recommendations, and included 119 patients between August 2014 and December 2017. Patients aged between six months and 14 years, whose medical records were complete and with a full three-day food record for analysis of dietary intake, were selected. All patients submitted the Free Consent Form signed by their parents/legal guardians, and the research project was approved by the Ethics Committee of Instituto PENSI/ José Luiz Egygio Setúbal Foundation (CAAE: 32939314.0.0000.5567). Data for the medical records were collected in interviews with parents/caregivers, in the first consultation with the team, according to published protocol.[3] The following information was obtained from the medical records:

- About the child:

  Personal data: age (months, corrected for premature children, distributed in groups of "7-12 months", "1-3 years", "4-8 years" and "9-13 years"), sex, kind of FD, biochemical levels of hemoglobin and ferritin, all of them classified according to age criteria[18] and IMC z-score;[19]

  Food intake: severity of food type selectivity ("high selective" – children who accept less than 15 types of foods; or "mild selective" – children who accept more than 15 types of foods),[1] total amount of foods accepted by the child (food inventory developed by the service),[20] and macronutrients intake (absolute consumption/adjusted for daily energy percentage, compared with recommendations for age).[21]

[a] Machado, RHV; Maximino, P; Ramos, CdC; Ricci, R; Carvalho, MJR; Fisberg M. ***Aspectos comportamentais e ambientais associados ao desenvolvimento das dificuldades alimentares da infância*** (Behavioral and environmental aspects associated with the development of feeding difficulties in childhood). Centro de Dificuldades Alimentares (Center for Feeding Dificulties). Instituto PENSI/ São Paulo. In press.

Milk consumption was assessed according to total daily intake (ml), protein density (g ptn/ml) and calorie density (kcal/ml), total intake of proteins supplied by milk-based meals (formula, fluid milk, soybean extract, supplements) and complementation with chocolate milks, protein--calorie supplements or mucilage. Protein and calorie density was calculated considering the addition of such complements, as described in the food records. Breast milk intake was excluded from the analysis.

- Data on the family routine: main complaint regarding feeding, mother's parenting style (according to Hughes criterion, who classify styles as responsible, controlling, indulgent or absent)[22] and use of coercive practices (physical strength and distractions) at mealtimes. The presence of self-feeding habits was also collected for analyses.

To assess data, the SPSS v21 software was used. Descriptive analysis was performed by frequencies of distribution (%) for categorical variables, and mean ± standard deviation and quartiles for continuous variables. Student t-tests, Anova, GLM (general linear model and Spearman correlation tests were used for association tests, with significance level below 5% and 95% CI.

RESULTS

The assessed sample was mostly made up of male children (68.7%), mean age of 49.6 ± 35.9 months (p25% 24; p50% 39; p75% 63), ranging from seven months to 12.8 years. Of these patients, 44.2% were 1-3 years old, 36.7% 4-8 years old, 12.2% 9-13 years old and a minority of 6.8% between 6-12 months. The most frequent diagnosed FD type was food type selectivity (46.9%), followed by poor appetite and parental misperception, both with a prevalence of 14.3%), organic causes (8.8%), feeding fear (6.1%), restlessness (4.1%) or other causes (5.4%). The major complaint in the sample was "child with poor appetite and selective" (42.1%), followed by "child with poor appetite and low weight gain" (39.3%), "child that does not eat solid foods" (9.7%) and "overweight and selective child" (9%). The average IMC z-score was -0.02 ± 1.4 (p25% -0.79; p50% -0.14; p75% +0.76), which was considered normal according to age and sex standards.

Dietary intake patterns

Distribution of macronutrients intake (%) is described in Fig. 1. Despite the mean distribution was adequate when adjusted for total energy consumed, the absolute daily intake (g/day) of proteins in the sample exceeds the recommended intakes in all age groups ($p<0.024$; student's t-test), as shown in Fig. 2. Additionally, the only group dependent on consumption of milk-based meals for an appropriate intake of proteins was of

children aged between 1 and 3 years (88% of the needs were met by non-dairy foods); the other age groups exhibited protein intake sufficient to supply the daily needs, even not considering milk/dairy foods. In children aged 1-3 years, 51.7% of daily protein intake was associated with milk consumption.

In Fig. 3, the dietary intake is compared with the addition of nutritional supplements to milk. The mean age in both groups ranged from 39 and 48 months, and daily protein recommendation was 19g/day. The results of this comparison indicate that – for children not fed supplements – milk intake alone represents only 75% of daily protein recommendation, and total daily intake exceeds recommendations by 230%. In the group of children with use of supplements (around 20.9% of the sample), milk intake represents 103.6% of protein daily requirements, but total daily intake exceeds recommendations by 217%, which indicates that in this group of children there likely is a lower intake of "non-dairy foods".

Figure 1. Energy distribution (%) from macronutrients intake (n=119) in children with feeding difficulties. Instituto PENSI, Brazil, 2017.

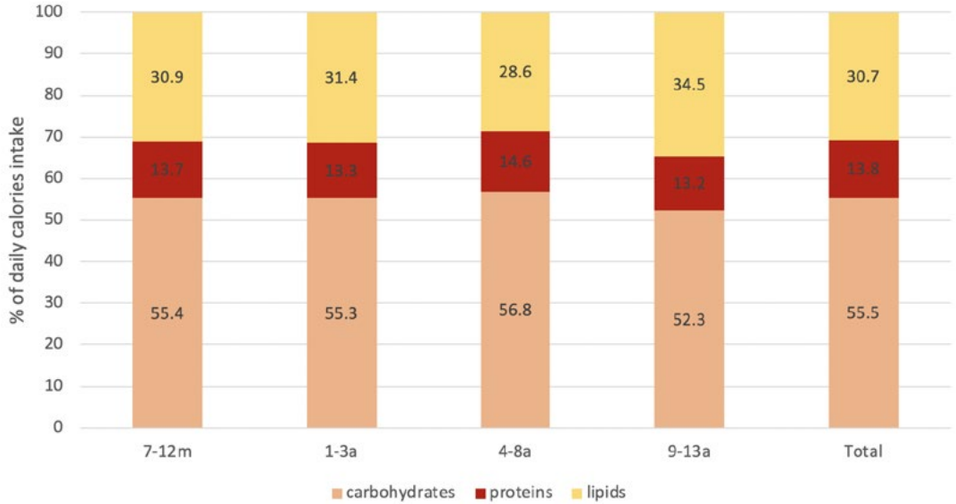
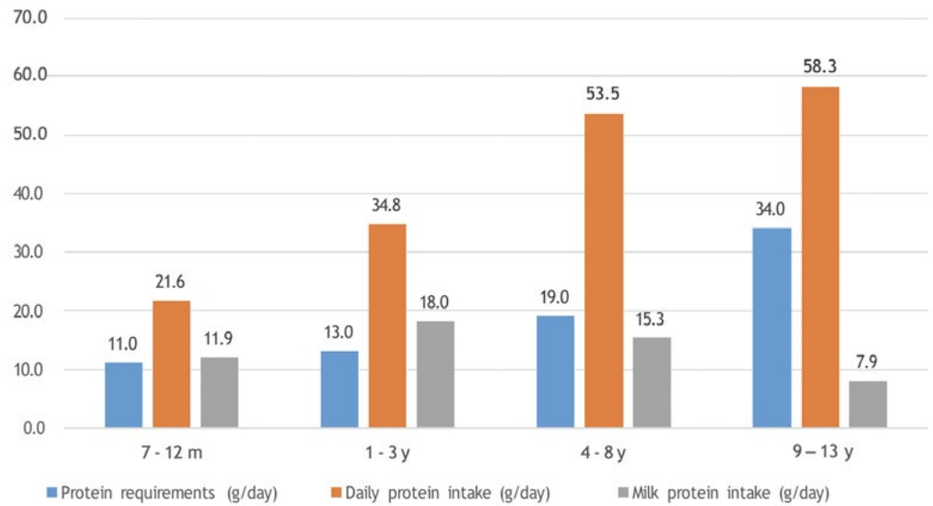
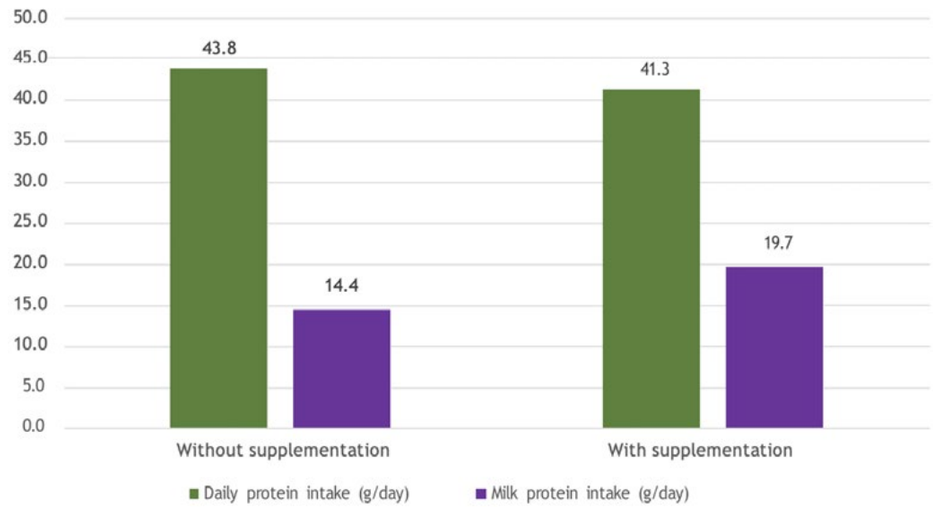


Figure 2. Comparison of protein intake with recommendations for age (g/day) (n=119) in children with feeding difficulties. Instituto PENSI, Brazil, 2017.



*Student t-test for comparisons between intake and recommended levels for age: 7-12m- Dif. 10.6 95%CI 1.95-19.2 p=0.024; 1-3y- dif. 21.8 95%CI 17.9- 25.7 p=0.000; 4-8y -Dif. 34.5 95%CI 20.8-48.3 p=0.000; 9-13y - dif. 24.3 95%CI 3.7-44.8 p=0.024.

Figure 3. Comparison between daily protein intake (g/day) according to use or not of nutritional supplements added to milk in children with feeding difficulties. Instituto PENSI, Brazil, 2017.



Daily milk intake was higher in the group of children aged seven months and three years, 7% higher than the total intake recommended for this age (maximum of 500ml/day). The children in this age group also had higher values of energy density in the milk--based meal and were the second group with the highest use of nutritional supplementation. Protein and energy densities in the milk-based meals were similar for the age groups, but there was a 1.5-time decrease derived from milk intake as age increased (1-3 years for 9-13 years, p=0.034 Anova test). Table 1 describes these results in details, according to the age group.

Associations with feeding difficulty patterns

Table 2 shows tests of association with FD patterns, after adjustments for age. The GLM test shows that there wasn't a significant effect of the variables in the dietary intake of the sampled children, except for parenting style and use of physical coercion as stimulus for eating. Children whose mothers were classified as indulgent exhibited higher milk-related protein consumption than the children of controlling mothers (+8.6g; 95%CI 0.47-16.7; p=0.033) and responsive mothers (+8.5g; 95%CI 0.18-16.8; p=0.043). Children who were forced to eat tend to drink more milk during the day, regardless of age (+196ml; 95%CI 6.7-385; p=0.043). Spearman's correlation was used to compare the dietary intake of the sample and the amount/types of foods eaten by the children, their biochemical levels and BMI. The results did not confirm the associations (R Spearman <0.4), and confirmatory analyses with linear regression were not carried out.

Table 1. Milk intake patterns in children with feeding difficulty. Instituto PENSI, Brazil, 2017.

	7-12 months	1-3 years	4-8 years	9-13 years	Total
			% or mean ± SD		
Milk intake (N=125)					
Daily intake (ml)	531.4±271.8	541.7±271.2	445.9±249.5	319±221	480.7±264.3
Calorie density (kcal/ml)	0.8±0.1	1.0±0.7	0.8±0.5	0.7±0.3	0.9±0.6
Protein density (g/ml)	0.04±0.05	0.04±0.02	0.03±0.01	0.03±0.01	0.03±0.02

Table 1 continued

	7-12 months	1-3 years	4-8 years	9-13 years	Total
			% or mean ± SD		
Kind of milk (N=128)					
Follow-up formula	100%	49.1%	7.7%	--	30.5%
Milk compound	--	14%	7.7%	--	9.4%
Fluid milk	--	31.6%	71.2%	100%	52.3%
Nutritional supplement	--	5.3%	11.5%	--	7%
Soybean extract	--	--	1.9%	--	0.8%
Use of milk-added complements (N=129)					
Nutritional supplement	11.1%	22.8%	23.5%	8.3%	20.9%
Chocolate milk	11.1%	10.5%	41.2%	75%	28.7%
Mucilage	--	8.8%	7.8%	8.3%	7.8%

Table 2. Milk and protein intake according to the characteristics of feeding difficulty. Instituto PENSI. Brazil. 2017.

	Milk intake (ml/day)	p	Daily protein intake (g/d)	p	Milk-derived protein intake (g/d)	p
			Mean ± SD			
Type of feeding difficulty (n=119)						
Restless child	483.8±210.3	0.21	37.7±13.6	0.19	22.3±15.3	0.77
Poor appetite	507.6±257.4		40.6±22.4		16±8.7	
Phobia	597±379.5		37.1±28.4		17.1±10.3	
Misperception	455.5±241.9		31.1±16.9		12.2±8.5	
Organic causes	664.8±325		38.8±30.2		19.8±14.1	
Food selectivity	463.5±244		46.5±30.2		16.1±12.1	
Other causes	204.4±77		98.5±102.8		5.8±1.6	
Severity of food selectivity (N=84)						
High selectivity	549.3±289.1	0.54	30.8±16.8	0.39	18.9±11	0.82
Mild selectivity	478±262		45.4±31.5		15.4±12.3	
Serum hemoglobin levels (g/dl) (N=95)						
Normal	501.4±240	0.09	43.1±36.5	0.57	16.1±11.2	0.16
Anemia	210±101		42.5±8.7		6.1±2.3	
Serum ferritin levels (mcg/l) (N=83						
Normal	477.5±227	0.33	40.1±28.8	0.58	14.6±9.8	0.36
Iron Depletion	796±309		43.4±1.1		25±10	
Mother parenting style (N=108)						
Responsive	478.7±298.6	0.32	50.3±37.1	0.88	14.2±10.2	<0.043
Controlling	446±226		43.6±26.1		12.3±8.2	
Indulgent	520.3±305.7		40.5±39.6		20.7±14.9	
Absent	475.7±237.7		44±32.5		15.2±7.5	
Main feeding complaint (N=119)						
"Poor appetite and low weight gain"	507.6±287.5	0.34	35.1±18.8	0.20	16±10.2	0.99
"Poor appetite and selective"	482.3±212.3		44.3±25.7		14.7±8.7	
"Overweight and selective"	267.3±154.5		72.5±74.2		11±14	
"Does not eat solid foods"	520±351.3		43.6±21.8		21±18.5	

Table 2 continued

	Milk intake (ml/day)	p	Daily protein intake (g/d)	p	Milk-derived protein intake (g/d)	p
			Mean ± SD			
Feeding behaviors						
Use of distractions during meals (N=103)						
Yes	450.9±213.8	0.84	40.4±26.1	0.87	14.9±10.1	0.34
No	516.9±342.7		56.2±49.4		18.8±14.6	
Physical coercion (N=115)						
Yes	524.6±250	0.043	38.6±24	0.47	17.1±11.1	0.39
No	436.7±282		51.1±42.3		14.3±11.6	
Self-feeding abilities (N=105)						
Yes	451.6±219	0.87	42.8±25.7	0.91	15.8±11.6	0.45
No	516.9±296.7		41.9±20.4		14.7±9.3	

General Linear Model adjusted for age

DISCUSSION

The results of the present research show a population with food selectivity, normal BMI. The protein intake observed in the analyses was normal when compared with the other macronutrients, adjusted for energy, but it was high when absolute intake was considered (g/day), in relation to recommendations for age, for all age groups investigated.

Literature cites a growing trend toward consumption of protein foods by urban population in Brazil, with a dietary pattern mostly consisting of milk during the first two years of life.[23] Several studies describe milk intake in childhood, but with divergent consumption data. In a study conducted in Rio de Janeiro,[24] with children in vulnerable socioeconomic condition, aged less than four years and without control for feeding complaints, the average consumption of milk varied between 390 and 430ml/day. The majority of children (88%) drank milk regularly, and a lower percentage (15%) was fed milk prepared at an inappropriate dilution rate (excess of powder milk added to water), raising the protein content of the milk-based meal. In addition, the authors cite Brazilian data of other studies describing milk consumption by children of the same age ranging from 300 and 450ml/day, volumes that are mostly lower than the mean intake found in the present study. With respect to general protein consumption, study with 1-3 year children enrolled in public day care centers in São Paulo, protein intake was considered insufficient for age (18.2 g/day),[25] whereas a study with children from southern Brazil, aged less than five years,23 indicated an appropriate intake

of total proteins by the majority of the individuals (88%), and 12% of the children indicated excessive intake. In the population study Nutri-Brasil Infância[26] (Nutri-Brazil Childhood), the protein intake compared to AMDR in 2-6 year children from public and private schools in the country was slightly higher than the present sample (about 15% versus 13% in current results). Only 6% of the assessed children showed an excessive consumption of protein.

No other Brazilian studies describing protein consumption or volume of milk were found in children with FD, which makes it impossible to make more in-depth comparisons. Comparisons with children without diagnosis of feeding complaints enable to infer that their milk intake pattern is higher than that described in most of the works published in the country, but that the total protein consumption adjusted for dietary energy intake is similar to some population studies and international data. The diverging results of different studies may be due to the socioeconomic level of the populations assessed.

In studies carried out with low-income communities as well as the one mentioned earlier, which was conducted in public schools,[25] it can be seen that the greater the food insecurity, the lower is protein consumption.[27] The sample studied in the present paper exhibited a trend of increase in protein consumption (with predominance of milk products), but it is worth emphasizing that the majority of the individuals are from families with high purchasing power (users of private clinical service). Data on the protein intake of the present sample were similar to those described in international studies such as the cohort study conducted in India,[28] who monitored children in the first two years of life, and the proteins intake was described as similar to the results of this study (31 g/day), higher than recommended for age. Likewise, in the Netherlands, the mean protein intake found among toddlers was also high (42.1 g/day), even higher than the present study.[29]

In the present sample, the protein intake by the children was sufficient even when considering non-dairy sources. Children aged between 1-3 years were the only ones who depended on milk to meet the daily protein requirement, and also the age group with the highest intake of milk volume and calories. It should be emphasized that the volume of milk consumed by children in this age (541.7 ml/day) was much higher than the one found in other study with a similar sample, with an average daily consumption of 379 ml/day.[28]

It was also found in the present sample a lower intake of total proteins by the children receiving nutritional supplementation, but a higher protein intake from milk sources, with an excess of milk protein higher than the children without supplement. Such result indicates the importance of providing guidance to parents not only with regard to adequate milk volume but also on the indiscriminate use of nutritional supplements in order to avoid unnecessary supplementation.[11,30] Additionally, children using supplementation had a lower intake of protein sources, which can indicate a relationship between the use of supplements and less consumption of other foods. Sharp et al.[16] suggest that children are often supplemented to fill a nutritional gap caused by low food intake. As a consequence, the use of supplements associated with milk attenuates the parents' concern and focus on food education and ends up strengthening the exclusion of certain food groups.[11,16]

In the context of FD, when comparing the consumption of milk protein between ages, it can be inferred that the 1 to 3-year age group may represent a risk window for an excessive milk intake and, consequently, aggravation of FD. This is because in this period there are changes in the dietary habits of children, who tend to increase their autonomy and food selectivity.[8] These changes may end up in triggering the parents' concern about their children`s nutrition, leading to more use of milk/dairy foods and nutritional supplementation,[8,16] forming a vicious cycle. Therefore, the present results constitute an alert for professionals in the management of FD to pay attention to the volume of milk consumed by the children and make possible relationships with feeding complaints.

Proper guidance to parents may play a key role in FD management, considering that their behavior was associated with the milk protein feeding of the children studied. Children of indulgent mothers exhibited a higher protein intake than those of authoritarian parents. In addition, children who were forced to eat had a greater volume of milk intake. Corroborating such findings, other authors[8,10] reported a relationship between severe food selectivity and the parents' habit of commenting on and depreciating the eating habits of their children, in addition to forcing them to eat a larger amount of foods. As a consequence, food selectivity suggests that more milk is offered to the children to replace other foods, enhancing the parents' response and behavior.

Although several authors associate feeding problems with milk consumption and the quality of the child diet,[8,10] the present study did not find an association between the FD variables and intake of protein of milk sources, when the child's age is considered. In this case, the age of onset of eating problems may be the major risk factor for an excessive intake of milk proteins in childhood. Studies indicate that the earlier a FD appears, the higher the risk of replacement of textured foods by milk-based meals.[8,10] Therefore, an early and adequate diagnosis is essential in order to enable effective interventions and prevention of excessive consumption of protein in childhood.[1]

The study has limitations such as the lack of a control group and analysis of consumption of milk only, classified as "milk-based meal" and non-inclusion of other supplementary milk/dairy products to the diet. However, the findings have contributed to increase the scarce literature on this topic and reinforced the importance of assessing feeding habits

in childhood and the interruption of unnecessary nutritional supplementation that health professionals and the media often suggest to the parents to reassure them, but which will likely perpetuate the feeding difficulty.

CONCLUSIONS

The children assessed exhibited protein intake above recommended levels. Those who received nutritional supplementation associated with milk had less protein intake from other food sources. Mothers' indulgent behavior was associated with higher milk consumption (and – consequently – of proteins).

The age of occurrence of feeding problems was considered the major risk factor for an excessive milk intake. The study points to the importance of appropriate guidance on the unnecessary use of nutritional supplements, substitution of milk for solid-food meals and responsive behaviors to prevent protein overload in the child diet.

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Contributors

Maximino P is the main researcher and participated in all stages of the work. Machado RHV contributed to the conception, analysis and interpretation of data. Ricci R, Ramos CC and Carvalho MJR participated in data collection and discussion of results. Fisberg M supervised and oriented all stages of the study.

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