Dietary intake quality and associated factors in one year-old children seen by primary healthcare services

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Abstract *The purpose of this paper was to analyze the food intake quality in one year-old children seen by a primary healthcare (PHC) service. This is a cross-sectional studied nested within a child oral health cohort study which collected data regarding children born in 2013 and monitored in Porto Alegre for two years. We applied a questionnaire on maternal variables and frequency of pediatric appointments, weight and height measurements, and children's food intake. To that end, a score was generated based on the points assigned according to SISVAN (meaning 'food and nutrition monitoring system,' run by the Brazilian Ministry of Health). A multivariate model was calculated using Poisson regression with robust variance. The sample comprised 249 children. We found 30.5% (76) of poor/regular dietary quality, which in the multivariate model was associated to the guardian's educational background, considering up to incomplete high school (PR = 2.14, CI95% = 1.03-4.44) and complete high school (PR = 1.70, CI95% = 0.81-3.54), as well as their failure to see a dentist (PR = 2.54, CI95% = 1.33-4.84) or having seen one before the age of four months (PR = 1.94, CI95% = 1.01-3.72). It is our conclusion that failing to see a dentist within the first year of life and lower maternal schooling negatively impact on children's dietary quality.*

Key words *Child health, Dietary intake, Child care, Nutritional epidemiology*

Introduction

Understanding dietary patterns in the first year of life may prove strategic for setting up health promotion and disease prevention initiatives from birth all the way to adult life. In 2016, 41 million children under the age of five years were overweight or obese. In 2025, this issue may affect 70 million children[1,2]. Chronic Non-Communicable Diseases (CNCDs) are the main source of the Global Burden of Disease in Brazil, and it is estimated that 58% of early years of healthy life lost are owed to CNCDs[3,4]. These health afflictions are somehow related to people's dietary habits. Considering these habits are formed in childhood, such period would be the perfect time for carrying out initiatives aimed at healthy eating practices[5]. Hence, it is possible to prevent future undesirable clinical outcomes related to malnutrition and excess weight, today seen as public health issues[6-8].

In Brazil, primary healthcare (PHC) priorities include promoting healthy eating and providing ongoing, all-around services to people and their families in all of their life stages, including early childhood[3]. The National Food and Nutrition Policy (PNAN, in Portuguese) was passed in 1999, and one of the main commitments taken on is to continually and systematically monitor the Brazilian population's dietary and nutritional situation[9]. To do that, the Ministry of Health has created a food and nutrition monitoring system (*Sistema de Vigilância Alimentar e Nutricional* - SISVAN) meant to be an important tool for tracking diet and nutrition throughout all life stages. It is also used to help put together and review public policies by identifying the most at-risk geographical areas, social strata and population groups when it comes to nutritional issues[10].

Promoting and restoring children's health are government priorities. Through the child care services offered via PHC, officials monitor children's growth and development to prevent diseases in childhood and adult life as well[11-13]. The interdisciplinary work carried out by teams of PHC professionals is relevant for communities because their health education strategies allow them to promote child health and empower mothers to provide children with quality of life[14]. Socio-economic factors such as maternal schooling and income levels have been pointed out as potential components in the process of improving the population's nutrition quality. The relationship between maternal schooling and nutrition quality is described in the literature and can

negatively or positively impact children's eating habits[15,16].

Understanding eating patterns in the first year of life is essential for creating proper nutrition behaviors aimed at the healthy development of children and their families, as well as for planning health education initiatives and programs carried out by PHC services. Considering the foregoing, the purpose of this study was to analyze the food intake quality and associated factors in one year-old children seen by a primary healthcare (PHC) service.

Methods

Design

This is a cross-sectional studied nested within a child oral health cohort study.

Setting

The study was carried out at the 12 clinics run by the Community Healthcare Service of Grupo Hospitalar Conceição (SSC-GHC) and located in the north side of Porto Alegre (RS), Brazil. It is a primary healthcare service ranking among the best within the National Healthcare System (SUS, in Portuguese). The work processes of its 39 family healthcare teams successively handle 90 to 95%, on average, of the health issues presented by the population within their areas[17]. The child care program in which this study was conducted is carried out by professionals from the family health team, the Family Health Support Center, and the Integrated Residency focusing on Family and Community Health. This interdisciplinary team comprises family practitioners, dentists, dental hygienists, registered nurses, licensed practical and nursing assistants, social workers, psychologists, nutritionists, pharmacists, and residents from various fields of knowledge such as nutrition, dentistry, psychology, nursing, pharmacy, medicine, and social work.

Participants

This study is part of a wider study whose purpose is to look into the childhood-health associated factors in an oral healthcare program dedicated to children aged 0 to 12 months seen by a primary healthcare service. They make up a cohort of live births within the area covered by the SSC-GHC in 2013. Specifically for this study,

we evaluated data from the first follow-up visit of 249 children aged between 12 and 24 months and their mothers/guardians.

Inclusion criteria encompassed children born in 2013 in the area covered by the SSC-GHC's 12 clinics and who were duly registered with and being monitored by the Children's Program, in addition to their mother/father/guardian being the person in charge of the child's dental care and present at all medical and dental appointments at the clinic. The exclusion criteria were children with special needs or syndromes, children who had been away from the area covered by the SSC-GHC's clinics for longer than six consecutive months, and mothers/fathers/guardians who lacked cognitive skills to answer the study's questionnaires. According to Grupo Hospitalar Conceição's manual on the health care of children aged 0 to 12 years, children should ideally be seen by a doctor seven times in their first year of life. This is a suitable period of time for offering immunizations and health promotion and disease prevention advice. Children should also see a dentist within such timeframe.

Sample

Guardians and children were selected from a probability sample of the 12 health clinics for the cohort study. In the area covered by the SSC-GHC in 2013, 674 children were born. Out of them, 469 children saw a dentist for the first time before the age of 12 months. For this study, we included children aged up to 24 months who were seen at the clinics and whose guardians answered the dietary intake questionnaires for this age bracket, totaling 249 children.

The sample's power was calculated for the analysis of associated factors. The parameters used were the following: 95% confidence level, outcome prevalence (poor/regular food intake) in the non-exposed group ranging from 23% (secondary child care provider – father) to 28% (child's age – 12 months or younger), exposed/non-exposed ratio between 1:1(child's gender) and 1:5 (child's age at first appointment), prevalence ratios between 1.7 (child's gender, guardian's number of children, child care monitoring in place) and 2.0 (secondary child care provider). A minimum power of 80% was found. The exposure variables used for the calculations above were: child's gender, guardian's age, guardian's schooling, guardian's number of children, marital status, secondary child care provider, child enrolled in day care, and child care monitoring in place.

All of the participants' guardians agreed to take part in the research and signed an Informed Consent Form before being included in the study. The study was approved by Grupo Hospitalar Conceição's Ethics and Research Committee.

Variables

Maternal

Data were collected with respect to schooling, age, and number of children Data also included their family income and mothers' opinion on whether their family income was adequate. The frequency of child care appointments was analyzed via the healthcare service's information system.

Children

Children's dietary intake was assessed by means of a questionnaire answered by the children's mothers/guardians and containing the questions in the marker Form for dietary intake of children under the age of two years, which form was put together by the Ministry of Health's[18] food and nutrition monitoring system (*Sistema de Vigilância Alimentar e Nutricional* - SISVAN). The study variables included how long children were fed solely breast milk and the introduction of items such as sugar, meat, vegetables, and ferrous sulfate in their diet. The questionnaires were applied by interviewers previously trained for the research. Weight and height measurements were collected by professionals belonging to the healthcare teams.

The total score derived from the SIVAN Form comprised the 15 questions, ranging from 0 to 17 points. For analysis purposes and due to the absence of a total qualitative indicator in the SISVAN Form, we used a score classed into quintiles[19]. By so doing, we were able to turn the raw score into percentages using the following equation: standard score = (raw score/17) x 100. Via the standard score, the sample was divided into five groups: (a) very poor (≤ 20%); (b) poor (21%-40%); (c) regular (41%-60%); (d) good (61%-80%); (e) excellent (> 80%).

To measure the children's weight and height, digital pediatric scales were used (Indústrias Filizola S/S, scale model BP Baby) as well as anthropometers from various brands available at the health clinics. The nutritional diagnosis was established via the World Health Organization's[20] BMI (Body Mass Index: weight/height²) curves and Stature for Age according to age bracket and gender[10].

Statistical analysis

A descriptive analysis was conducted to find the absolute and relative frequencies of the categorical variables, and the median and interquartile interval of the asymmetrically distributed numerical variable.

To analyze the associated factors, crude and adjusted analyses were conducted via Poisson regression with robust variance adjustment. The adjusted analysis was conducted via the backward selection method according to the hierarchical analysis model. The variables were child's age (months), child's gender and guardian's age (years) at level 1 (to check how much a younger or older/more experienced mother improved or worsened child care, and whether the child's age and gender was also related to their diet); guardian's schooling, guardian's number of children, marital status, secondary child care provider, and whether the child was enrolled in day care at level 2 (variables which traditionally impact children's health), and child's age (month) at their first dental appointment, whether there was child care monitoring in place and income at level 3 (health care variables that may be related to one another and may impact the advice given on a healthy diet for children and its implementation). The analysis was hence controlled for variables at the same level and levels above, and variables with a p value < 0.20 were kept in the model. All statistical analyses were carried out using the Stata IC 13.1 statistical package.

Results

Of the 249 children evaluated 51.8% (129) were male and 77.1% (192) were over the age of 12 months. Only 28.9% (72) of the children studied had had proper child care monitoring via the seven minimum appointments in the first year. As for the mothers interviewed, 37.0% (92) were complete high school. In terms of day care, 72.7% (181) said their child was not enrolled in it, and 58.2% (145) had seen a dentist between the ages of five and 12 months (Table 1).

The study found there were still some inadequacies regarding the children's dietary intake in their first year of life, despite 39.8% (99) of the children studied had been fed solely breast milk until the age of six months, 16.1% (40) had been fed solely breast milk until the age of 4 months and 16.2% (39) had been fed solely breast milk until the age of 1 month or had never been breast fed. Most mothers had behaved properly by not giving their children food that is not advisable before the age of six months (Table 2). However, 62.7% (163) and 51.8% (129) of the sample studied had been given, respectively, processed or powdered juice and soft drinks in the month before the questionnaire was applied (Table 2). The final rating of the dietary intake per score showed that 30.5% of the population studied obtained a poor/regular score (≤ 20% to 60% in terms of diet quality).

The hierarchical analysis model pointed out there is a greater prevalence of poor/regular quality regarding the children of guardians with the lowest levels of schooling. Up to incomplete high school and complete high school, the probability was 2.14 (CI95%=1.03-4.44) and 1.70 (CI95%=0.81-3.54) times higher, respectively, compared to guardians who had college degrees or higher. Additionally, the study also found a greater prevalence of poor/regular quality among children who had not seen a dentist or did so up to the age of eight months, a 2.54 (CI95%=1.33-4.84) and 1.65 CI95%=1.01-3.72) times greater probability, respectively, compared to children who had been seen by a dentist between the ages of nine and 12 months (Table 3).

Regarding weight/height figures, children deemed to have poor/regular diet quality presented with 8.6% (5) and 13.8% (8) low and high weight/age classification. In terms of their BMI, 15.8% (9) and 8.0% (11) of the children were obese for poor/regular and good/excellent diet quality, respectively. With respect to their height/age classification, 17.2% (10) of the children whose diet was poor/regular presented short stature, while 13.1% (18) of those given a good/excellent diet presented short stature. No associations were found between the variables for the associations above.

Discussion

The primary healthcare service looking after the sample of mothers and children seeks to fulfill the essential PHC requirements as their first point of contact as well as all-around care provider over time in a coordinated manner[21]. The clinic's professionals offer pre-natal care and keep on monitoring the family as children grow, thereby setting up a bond between the healthcare team and the newborns' families[22]. Few studies were found in Brazil about the nutritional diagnosis and feeding patterns for the studied popu-

Table 1. Characteristics of the sample studied regarding socio-demographic and child care variables, according to children's guardians using healthcare clinics run by SSC-GHCa, in Porto Alegre/Brasil, 2017. (N = 249).

Variables	N	%
Child's age (months)		
12 or younger	57	22.9
Over 12 months	192	77.1
Child's gender		
Male	129	51.8
Female	120	48.2
Guardian's age (years)		
Under 25	71	28.5
25 – 29	64	25.7
30 – 34	62	24.9
35 or older	52	20.9
Guardian's schooling		
Incomplete High school	119	47.7
Complete High school	92	37.0
College education or beyond	38	15.3
Guardian's number of children		
1	133	53.4
2 or more	116	46.6
Marital status		
Single/Divorced/Widowed	64	25.7
Married/Living together	185	74.3
Secondary child care provider		
Father	178	71.5
Grandmother	71	28.5
Child enrolled in day care		
No	181	72.7
Yes	68	27.3
Child's age (months) at first dental appointment		
No appointment	47	18.9
1 – 4	57	22.9
5 – 8	87	34.9
9 – 12	58	23.3
Child care monitoring in place		
No	177	71.1
Yes	72	28.9
Income (BRL1,000) – mdn (P25 – P75)	1.6 (1-2.5)	
Dietary quality		
Poor/regular (≤ 20% to 60%)	76	30.5
Good/excellent (61% a > 80%)	173	69.5

[a]Grupo Hospitalar Conceição's Community Healthcare Service.

lation's age bracket, which shows the pioneering aspect of this research effort and how important it is to continue studying this specific population.

Less than half of the studied sample was fed solely breast milk. That percentage is similar to the one found by the Survey on the Prevalence of Breastfeeding in Brazilian Cities, which found 41% of the children were fed solely breast milk in their first six months of life[23]. In a study conducted in Bahia on a sample of mothers and children up to the age of two years, the researchers suggested the public policies related to the interruption of breastfeeding should be reviewed and pointed out the need to consider socio-demographic, anthropometric, biological and obstetric environmental factors[24]. That is why it is important to ensure healthcare teams are close to the assisted families so the former can advise the latter on the everyday challenges related to breastfeeding.

The National Food and Nutrition Policy (PNAN, in Portuguese) mentions that the Brazilians' diet comprises a combination of traditional fare like rice and black beans along with ultra-processed foodstuffs such as soft drinks and sweets, whose intake has been on the rise year upon year[3]. In this study, the results about the intake of obesity-inducing foods like powered juice, soft drinks, and thickened porridge corroborate the results previously found by studies that had also looked into the diet of children aged zero to five years and related the improper intake of carbohydrates and excess fat to their family routine[25], which leads us to believe nutrition advice should be directed at the family as a whole, according to their socio-cultural possibilities and realities.

A recent study assessed the effectiveness of the National Strategy for a Healthy Supplementary Diet (ENPACS, in Portuguese) in 340 children aged six to 12 months and found the strategy had had a positive impact as it had helped decrease the intake of foodstuffs deemed unhealthy, such as ultra-processed foods and beverages like soft drinks and juice[26]. Those findings point out the need to expand healthy eating strategies and interventions, especially when we also consider that more than half of the children in this study had had processed juice or soft drinks in the 24 hours that preceding the application of the questionnaire.

The results obtained from the analysis of maternal variables showed an association between lower schooling levels and the children's poor/regular diet quality. This finding is in agreement with another study that looked into the diet qual-

Table 2. Marker form and Dietary Intake score points – Children aged between 6 months and 2 years, according to children's guardians using healthcare clinics run by SSC-GHCa, in Porto Alegre/Brasil, 2017. (N = 249).

Variables	Points[b]	N(%)
Was your child breastfed yesterday?*		
No	0	123 (49.4)
Yes	1	126 (50.6)
If not, how old was your child when he/she stopped breastfeeding?*		
Never	0	14 (11.4)
< 120 days	1	40 (32.5)
≥ 120 days	2	69 (56.1)
How long was your child fed exclusively breast milk?		
< 1 month or never	0	39 (16.2)
Up to 1 month	0	11 (4.4)
Up to 2 months	1	14 (56)
Up to 3 months	1	20 (8.0)
Up to 4 months	2	40 (16.1)
Up to 5 months	2	26 (10.4)
Up to 6 months	3	99 (39.8)
Yesterday your child ate – n(%)		
Vegetables	1	206 (82.7)
Fruit	1	222 (89.2)
Meat	1	205 (82.3)
Black beans	1	208 (83.5)
Watching TV	0	69 (27.7)
Stove-cooked food	1	218 (87.6)
Porridge and milk or milk thickened with flour	0	82 (32.9)
Ferrous sulfate	1	75 (30.1)
Was your child given honey/molasses/sugar/sugarcane hard candy before the age of 6 months?		
No	1	200 (80.3)
Yes	0	49 (19.7)
Was your child fed soft baby food/stove-cooked food before the proper age?*		
No	1	139 (55.8)
Yes	0	110 (44.2)
Has your child drunk processed or powdered juice in the past month?		
No	1	97 (37.3)
Yes	0	163 (62.7)
Has your child drunk carbonated soft drinks in the past month?		
No	1	120 (48.2)
Yes	0	129 (51.8)

[a]Grupo Hospitalar Conceição's Community Healthcare Service. [b] Points tallied according to answers, totaling 0 to 17, for the SISVAN tool's total score. *questions which depend on interviewees' answers are assigned points to only one of the two first questions.

ity of 1,282 children aged seven to 10 years in the city of Vitória (ES) using an indicator based on what they usually had for breakfast. Approximately 41% of the children presented a low-quality diet, which was associated to low maternal schooling and absence of a father in the home[16]. On the other hand, a study with 1,371 pairs of mothers and children aged zero to 35 months in a rural area found that having a higher education degree was associated to both a greater adhesion to proper eating practices recommended by the WHO and to inadequate practices, which included highly processed snacks and sugary beverages. Therefore, a higher educational level did not prove to be a guaranty of better eating practices[15]. In another study with children between the ages of two and nine years, a diet high in fat and sugar contents was associated to parents' low-

Table 3. Crude and adjusted analysis of the variables' association in a study finding a poor/regular dietary quality score, according to children's guardians using healthcare clinics run by SSC-GHCa, in Porto Alegre/Brasil, 2017. (N = 249).

Variables	Poor/regular dietary quality	Crude Analysis		Adjusted Analysis	
		PR (IC95%)	p	PR (IC95%)	p
Level 1					
Child's age (months)			0.65		0.61
12 or younger	28.1	1		1	
Over 12 months	31.3	1.11(0.70-1.77)		1.13(0.71 – 1.79)	
Child's gender			0.13		0.14
Male	34.9	1.35(0.92-1.98)		1.33(0.91 – 1.94)	
Female	25.8	1		1	
Guardian's age (years)			0.09		0.10
Under 25	36.6	1.59(0.88-2.85)		1.57(0.88 – 2.80)	
25 – 29	21.9	0.95(0.48-1.87)		0.94(0.48 – 1.86)	
30 – 34	38.7	1.68(0.93-3.02)		1.66(0.92 – 2.99)	
35 or older	23.1	1		1	
Level 2					
Guardian's schooling			0.05*		0.03*
Incomplete High school	35.3	1.92(0.94-3.91)		2.14(1.03-4.44)	
Complete High school	29.4	1.59(0.76-3.35)		1.70(0.81-3.54)	
College education or beyond	18.4	1		1	
Guardian's number of children			0.08		0.09
1	35.3	1.41(0.96-2.09)		1.45(0.95-2.20)	
2 or more	25.0	1		1	
Marital status			0.08		0.09
Single/Divorced/Widowed	39.1	1.42(0.96-2.08)		1.39(0.95-2.05)	
Married/Living together	27.6	1		1	
Secondary child care provider			0.09		0.09
Father	33.7	1.50(0.93-2.41)		1.50(0.93-2.41)	
Grandmother	22.5	1		1	
Child enrolled in day care			0.41		0.49
No	32.0	1.22(0.77-0.90)		1.17(0.75-1.81)	
Yes	26.5	1		1	
Level 3					
Child's age (months) at first dental appointment			0.03		0.04
No appointment	44.7	2.59(1.35-4.96)		2.54 (1.33-4.84)	
1 – 4	33.3	1.93(0.99-3.79)		1.94(1.01-3.72)	
5 – 8	29.9	1.73(0.90-3.32)		1.65(0.87-3.10)	
9 – 12	17.2	1		1	
Child care monitoring in place			0.56		0.47
No	31.6	1.14(0.74-1.75)		1.17(0.76-1.81)	
Yes	27.8	1		1	
Income (BRL1,000) – mdn (P25 – P75)		0.88(0.76-1.02)	0.09	0.92(0.78-1.08)	0.31

*Linear trend for p-value. aGrupo Hospitalar Conceição's Community Healthcare Service.

er schooling levels. Additionally, the researchers also found an association between a healthier diet and parents' higher schooling levels[27].

Regarding the child care monitoring conducted by the teams, although it was not significantly associated to diet quality in this study, it is

widely known that having children's growth and development monitored by healthcare services contributes to positive outcomes with respect to several aspects. An exploratory study about child care found that nurses act as intermediaries in the child care process and noted that, although the nursing team is the main mediator, other professionals in the team, such as nutritionists, social workers, and physicians, are needed to complement the conducts[28].

This study also considered the child's age at their first appointment with a dentist, which in the GHC's Community Healthcare Service is included in child care focusing on all-around, multi-professional care. Nutrition advice is an essential part of dental appointments, considering the strong association between diet and cavities in early childhood[29]. Children who did not see a dentist or saw one by the age of eight months presented a higher prevalence of poor/regular diet quality compared to children who saw a dentist between the ages of nine and 12 months. This finding may be related to the dietary transition taking place from the age of four months (when mothers go back to work after their maternity leave) and from six months (when sole breastfeeding ends). Also, by the time the children are nine months old, their guardians are likely better equipped to provide them with a healthier diet and follow the advice given by healthcare teams. However, it is possible the appointment-with-dentist variable and socio-economic variables are collinear, and that is why such association should be regarded with caution and examined in greater detail in future studies.

Even though the variables related to number of children, marital status, secondary child care provider, and day care enrollment were not associated to poor/regular diet quality, they are considered important factors for assessing children's eating habits. In this study, the fact that no associations were found may be explained by the size of the sample. It should also be noted that height/weight assessments were carried out by more than one person and therefore are a limitation as

they may contain procedural deviations despite the prior training provided to the professionals. Nevertheless, we would like to point out that, although this is a cross-sectional study, it is nested within a child health cohort study which plans to make future observations and assessments over time.

Poverty-associated factors such as health, nutrition, and socio-economic issues make it harder for children in developing countries to reach their development potential[30]. Such evidence agrees with the findings from this study in which, upon the analysis of maternal variables, mothers who had lower schooling levels provided their children with lower quality food. Considering that improving the levels of schooling is a major challenge for governments and society, it is important that initiatives providing encouragement and information on exclusive breast milk diet and good quality food feature more prominently in public healthcare policies. In a childhood obesity-prevention intervention study on child feeding practices among 456 low-income Hispanic families whose children were aged 3.4 months on average, the intervention group presented a higher prevalence of exclusive breastfeeding and was less likely to introduce supplementary and liquid foods compared to the control groups[31].

It should be noted that most studies are not related to the age bracket looked into by these authors, which makes it difficult to carry out a more accurate comparison and justifies conducting new studies on children's first year of life. This study is relevant from the standpoint of its findings obtained through innovative research methods devised for a primary healthcare service and may be used as a model for future studies. It is our conclusion that lower maternal schooling and failing to see a dentist within the first year of life negatively impact on children's dietary quality. We need to expand the discussion about dietary intake quality in the first years of life and intensify the monitoring of food intake, height/weight assessments, and family awareness-raising via primary healthcare services.

Collaborations

LG Freitas and DDF Silva participated in the project design, collection, analysis, interpretation of data and writing of the manuscript. C Stein, E Cousin, MAP Cortés and JB Hilgert participated in the analysis, interpretation of data, writing and relevant critical review of the intellectual content of the manuscript.

Acknowledgments

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