


# Prevalence and determinants of complementary feeding indicators in the first year of life in the Southwest of Bahia State


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## Abstract

*Objectives: to estimate the prevalence of complementary feeding indicators and investigate its determinants.*

*Methods: cross-sectional study with 12-month-old children from Vitória da Conquista, Bahia. The indicators minimum diet diversity, minimum meal frequency and minimally acceptable diet were constructed and adapted to the current recommendations of the food guide for Brazilian children under two years of age. Poisson regression analysis was used, with hierarchical entry of variables in the multivariate model.*

*Results: the prevalence of minimum diet diversity was 38.8%, minimum meal frequency 47.9% and minimally acceptable diet 18.5%. Family income greater than one minimum wage was associated with minimal diet diversity (PR= 1.49; CI95%= 1.39-2.26); receiving guidance on complementary feeding was associated with a minimum meal frequency (PR= 1.37; CI95%= 1.05-1.78); and children who received exclusive breastfeeding for up to 6 months had significantly higher prevalences of all indicators compared to those who did not.*

*Conclusions: low prevalence of complementary feeding indicators was observed. The variables family income, receiving guidance on complementary feeding and offering exclusive breastfeeding for six months were associated with the highest prevalence of the studied indicators.*

**Key words** *Infant nutritional physiological phenomena, Infant's nutrition, Healthy diet*



## Introduction

In addition to being fundamental for children's growth and development, food plays an essential role in promoting and protecting health, especially in the first two years of life.<sup>1</sup> Especially in this phase, the insufficient quantity and low quality of complementary food, together with other unhealthy practices, represent a risk to children's health and nutrition.<sup>2,3</sup>

Indicators for evaluating feeding practices at childhood are central markers for the complementary feeding analysis.<sup>4</sup> Minimum diet diversity (MDD), minimum meal frequency (MMF) and minimally acceptable diet (MAD) are three of the nine complementary feeding indicators proposed by the World Health Organization (WHO) that permit monitoring the aspects related to infant feeding.<sup>1</sup>

On the national scene, the Ministry of Health (MH) also proposes indicators for evaluating complementary feeding practices, two of which deal with MAD and MMF. These indicators are used as markers of food consumption, serving as care and management tools at various health care levels.<sup>5</sup>

A data analysis from more than 80 low- and middle-income countries found that only one in four children under the age of two met the criteria for MAD, one in two consumed the recommended daily MMF and only one in six children had a MAD.<sup>2</sup> In Brazil, the *Estudo Nacional de Alimentação e Nutrição Infantil* (ENANI-2019) (National Child Feeding and Nutrition Study) reported a MDD prevalence of 57.1% in children aged six to 23 months and a MMF of 39.2% in those aged six to eight months, revealing very sub-optimal feeding practices.<sup>6</sup>

Some national studies have already evaluated complementary feeding using the indicators proposed by WHO and MH, as well as indicators adapted to previous national recommendations.<sup>7-11</sup> However, at the present moment, few studies have been published considering the definition of such indicators based on the most recent recommendations presented in the food guide for Brazilian children under two years of age, in addition to the relevance of identifying the factors that influence children's feeding practices, which makes this approach suitable for obtaining new evidence.<sup>6,12</sup>

In view of this, the aim of this study was to estimate the prevalence of complementary feeding indicators in children at 12 months of age and to investigate their determinants.

## Methods

This is a cross-sectional study, with data from a prospective cohort study entitled "*Acompanhamento das práticas de aleitamento materno e alimentação complementar em*

*crianças menores de dois anos residentes no município de Vitória da Conquista – Bahia*", (Follow-up of breastfeeding and complementary feeding practices in children under two years of age living in the city of Vitória da Conquista – Bahia), carried out between February 2017 and October 2019.<sup>13,14</sup> Vitória da Conquista is located in the Southwest region of the State, it is the third largest city in the State of Bahia, with a land area of 3,254.186 km<sup>2</sup>, an estimated 343,643 inhabitants in 2021 and a population density of 91.41hab/km.<sup>15</sup> The city has four maternity hospitals, one of which is run exclusively by the *Sistema Único de Saúde* (SUS), (Public Health System), another only a private hospital and two others which assist both SUS and private services.

The cohort that led to this study included puerperal women and their babies who were hospitalized at the time of childbirth in all the maternity hospitals in Vitória da Conquista between March and October 2017. Children whose mothers lived in Vitória da Conquista, with a gestational age of 37 weeks or more, born healthy and not twins were considered eligible for the study. Children born to mothers who were carriers of a human immunodeficiency virus, who had a malformation that impaired breastfeeding, and those who lived in rural areas of the city were excluded.

The sample calculation for the cohort considered the incidence of exclusive breastfeeding (EBF) of 59.3% of children at the end of the first month,<sup>16</sup> relative risk of 1.2, power of 80% and confidence level of 95%. The minimum number of participants was 252, to which 30% was added for possible losses, resulting in a minimum sample of 328 mother-baby pairs. For this study, the sample power was calculated considering a 95% confidence interval and the prevalence of adequacy of each of the indicators investigated (MDD 38.8%, MMF 47.9% and MAD 18.5%), resulting in a power that ranged from 96.3% to 100%.

Participants in the cohort were assessed at birth (baseline) and followed up through home visits at 30 days, six, 12 and 24 months. At the baseline of the cohort from which this study originated, 388 mother/baby pairs were assessed. Over the course of the study, 26.7% of the participants (n=97) were lost due to changes in telephone contact, address or giving up. For this study, the sample consisted of the follow-up at 12 months (n=286).

Data collection at baseline was carried out in the maternity by trained interviewers who collected the information available in the medical records and administered the questionnaire to the puerperal women 24 hours after childbirth. The variables collected at baseline and used in this study were: family income ( $\leq 1$ ;  $>1$  minimum wage); maternal schooling ( $\leq 8$ ;  $>8$  years of schooling); maternal age ( $<20$ ;  $20-34$ ;  $\geq 35$  years); parity

(primiparous; multiparous); maternal race/skin color (white/yellow; black/mixed); newborn's sex (female; male); birth weight (<2,500g; ≥2,500g). At six and 12 months of age, home visits were made and questionnaires were administered to the children's mothers. From the questionnaire administered at six months, the variable EBF until six months of age was extracted (no; yes), based on the mother's answer to the question: "Until when (days) was the child exclusively breastfed?". Among the data collected at 12-month follow-up, the following variables were used in this study: current maternal work (no; yes); maternal marital status (without a partner; with a partner); receiving guidance on complementary feeding at childcare appointments (no; yes); person responsible for feeding the child (mother and/or father; grandmother/other).

To analyze the complementary feeding indicators, questions were used regarding the receipt of other types of milk besides breastmilk; consistency and frequency of food intake; and food groups consumed the previous day, collected at the 12-month follow-up. To avoid memory bias, the questionnaires were structured to obtain detailed information on food consumption and the respondents were encouraged to describe reliably the food offered to the children the previous day. From this information, we obtained the number of children who met the food consumption criteria, considering the definitions of the complementary feeding indicators, adapted to the recommendations of the food guide for Brazilian children under two years of age.<sup>12</sup>

The definition of the MDD and MMF indicators proposed by WHO in 2021,<sup>1</sup> as well as by the Ministry of Health in 2015<sup>2</sup> present minimum requirements to be met in the child's diet. However, the current national recommendations presented in the food guide for Brazilian children under the age of two provide guidelines that constitute ideal adequacy targets.<sup>12</sup> Therefore, in this study, these indicators were adapted to characterize local dietary practices using the ideal criteria recommended nationally as a parameter, rather than the minimum established in the original version of the indicators, as described below:

- a) MAD: Consumption of food from six food groups on the previous day (breast milk or milk other than breast milk; fruit; vegetables; meat and eggs; beans; cereals and root vegetables);
- b) MMF: Daily consumption of five meals with adequate consistency for breastfed children: breakfast, two main meals (lunch and dinner) and two snacks between the main meals; or six meals with adequate consistency for non-breastfed children: breakfast, two main meals (lunch and dinner), two snacks between the main meals and a milk meal (supper);

- c) MAD: Combination of MDD and MMF indicators.

Statistical analyses were carried out using Stata software version 14.0 (Stata Corp, College Station, Texas, USA). Descriptive statistics were used to characterize the sample and estimate the prevalence of the complementary feeding indicators assessed, with the qualitative variables expressed as absolute and relative frequencies.

Poisson regression analysis with robust variances was used to assess the associated factors with complementary feeding indicators. Initially, a bivariate analysis was carried out between each outcome and the independent variables, estimating crude prevalence ratios and respective confidence intervals. Next, the variables that showed statistical significance at a level of 20% ( $p < 0.20$ ) in the bivariate analysis were selected for inclusion in the multivariate model. In the multivariate analysis, the variables were entered hierarchically in blocks, in the following order: Block 1 - Socioeconomic and maternal characteristics; Block 2 - Child's characteristics; Block 3 - Characteristics of feeding practices, according to the hierarchical conceptual model shown in Figure 1, which was constructed based on a previously proposed theoretical model.<sup>17</sup>

The variables in the more distal blocks remained as adjustment factors for those in the hierarchically lower block. The statistically significant association ( $p < 0.05$ ) between a given study factor and each of the complementary feeding indicators, after adjusting for the factors in the same block and in the higher hierarchical blocks, indicated the existence of an independent effect of that factor. The Akaike Information Criterion (AIC) was used to test the quality of the adjustment of the model.

The research project of which this paper is a part of was submitted to and approved by the Research Ethics Committee of the *Universidade Federal da Bahia* on December 12, 2016 (CAAE no. 62807516.2.0000.5556 and protocol no. 1.861.163).

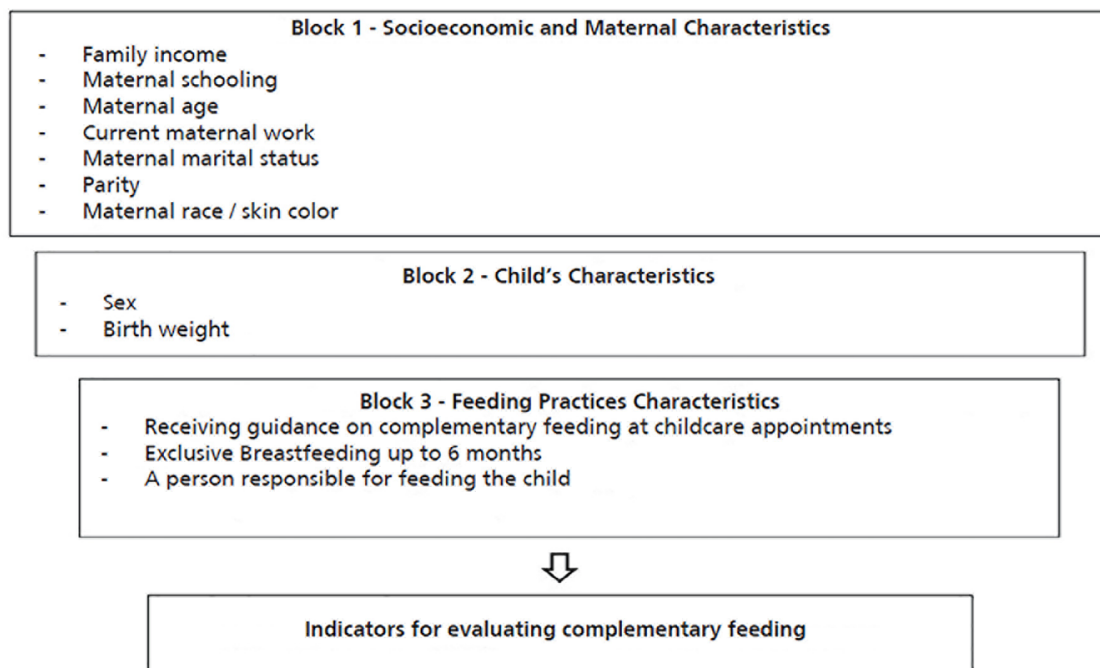
## Results

In relation to sociodemographic and maternal characteristics, most mothers had a family income of over one minimum wage, more than eight years of schooling, were between 20 and 34 years old and were multiparous. As for the children's feeding practices, 67.1% of the mothers reported having received guidance on complementary feeding from health professionals and 16.4% kept EBF until the child was six months old (Table 1).

The prevalence of compliance with complementary feeding indicators at 12 months among the studied children

Figure 1

Hierarchical conceptual model<sup>17</sup> of the determinants of complementary feeding indicators in the first year of life.



was 38.8% (n=111) for MDD, 47.9% (n=137) for MMF and 18.5% (n=53) for MAD (Figure 2).

Based on the bivariate analysis (Table 2), considering  $p < 0.20$ , the following variables were included in the multivariate model for the MDD indicator: maternal age, family income, maternal work, receiving guidance on complementary feeding at childcare appointments and EBF up to six months. As for MMF, the following variables were included in the multivariate model: maternal age, maternal work, birth weight, receiving guidance on complementary feeding at childcare appointments and EBF up to six months. Regarding to MAD, the following variables were included in the multiple model: maternal schooling, family income, receiving guidance on complementary feeding at childcare appointments and EBF up to six months.

The multivariate analysis showed that the prevalence of MDD was 49% higher among children with a family income of more than one minimum wage (PR=1.49; CI95%=1.39-2.26). Children whose mothers received guidance on complementary feeding during childcare visits (PR=1.37; CI95%=1.05-1.78) had a higher prevalence of adequacy in the MMF indicator. Receiving EBF for six months positively influenced all the indicators. Thus, the prevalence of MDD was 44% higher among children who received EBF up to six months (PR=1.44; CI95%=1.07-1.95), 49% higher for MMF (PR=1.49; CI95%=1.31-1.79) and 46% for MAD (PR=1.46; CI95%=1.19-1.96) compared to children who did not receive EBF (Table 3).

## Discussion

Analysis of the estimates of complementary feeding indicators adapted to current national recommendations, in children at 12 months of age, shows that complementary feeding practices are far from the ideal recommendations in the sample studied. Just over a third of the children received a diet with minimal diversity, less than half consumed the minimum number of meals a day and only approximately one in five children achieved MAD. In addition, higher family income, EBF up to the sixth month of life and receiving guidance on complementary feeding had a positive impact on the prevalence of adequacy of the indicators.

The MDD reflects on the variety of food included in a child's diet that can meet their nutritional necessity for adequate growth and development.<sup>1</sup> When considering the daily consumption of six food groups, a small number of children met the MDD indicator.

Other local studies, carried out between 2006 and 2017 in Brazilian cities with children aged between six and 23 months, corroborate these findings by identifying MDD in only 24% to 35.5% of the children assessed.<sup>8,10,18,19</sup> According to data from ENANI-2019<sup>6</sup>, the prevalence for the MDD indicator in the Northeast was 48.5%, a result higher than identified in this analysis, but much lower than the ideal. In this sense, the low prevalence of this indicator is a concern, since a poorly diversified diet can result in a lower intake of micronutrients and, consequently, damage

**Table 1**

Socioeconomic and maternal characteristics related to the feeding practices of children in the first year of life in Vitória da Conquista/BA, Brazil, 2018 (N = 286).			
Characteristics	n	%	CI95% <sup>a</sup>
<i>Socioeconomic and maternal</i>			
Family income <sup>b</sup>			
≤ 1 minimum wage	70	26.0	21.1-31.6
> 1 minimum wage	199	74.0	68.4-78.9
Maternal age (years)			
≤8	65	22.7	18.2-28.0
>8	221	77.3	72.0-81.8
Maternal age (years)			
<20	34	11.9	8.6-16.2
20-34	201	70.3	64.7-75.3
≥35	51	17.8	13.8-22.7
Maternal race/skin color			
White/yellow	69	24.1	19.5-29.5
Black/mixed	217	75.9	70.5-80.5
Maternal work			
No	126	44.1	38.4-49.9
Yes	160	55.9	50.1-61.6
Marital Status			
Without partner	37	13.0	9.5-17.4
With partner	249	87.0	82.6-90.5
Parity			
Primiparous	141	49.3	43.5-55.1
Multiparous	145	50.7	44.9-56.5
<i>Related to children's eating practices</i>			
Receiving guidance on complementary feeding during childcare			
No	94	32.9	27.6-38.6
Yes	192	67.1	61.4-72.4
Responsible for the child's feeding			
Mother/father	216	75.5	70.2-80.2
Grandmother/other	70	24.5	19.8-29.8
Exclusive breastfeeding up to six months			
No	239	83.6	76.5-85.6
Yes	47	16.4	12.5-21.2

<sup>a</sup>CI95%=95%Confidence Interval; <sup>b</sup>Family income presented n less than 286 (data ignored, n=17).

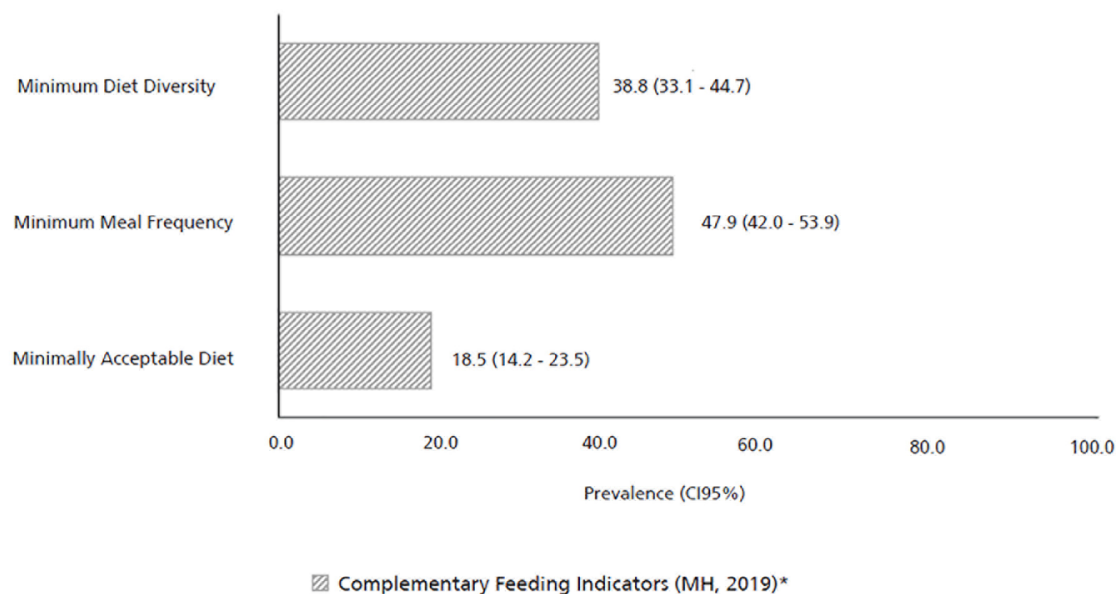
physical and cognitive health, as well as leading to delays in growth in children under two years of age.<sup>20,21</sup>

In relation to MMF, the results also showed a low prevalence of this indicator, noting that most children did not receive the minimum number of meals recommended by the current national guidelines.<sup>12</sup> These data are

similar to the national panorama, confirmed by data from ENANI-2019<sup>6</sup> which found a MMF prevalence in Brazil of only 39.2% among children aged six to eight months, varying from 23.8% to 52% between the five regions of the country. In the Northeast, only 34.6% of the children met the MMF parameters.<sup>6</sup>

**Figure 2**

Prevalence of complementary feeding indicators in children in the first year of life in Vitória da Conquista/BA, Brazil, 2018.

\*Ministry of Health (*Ministério da Saúde - BR*), 2019.<sup>12</sup>

WHO emphasizes that eating less frequently than the ideal, compromises the total daily intake of energy and micronutrients, which can also lead to delayed growth, dwarfism and nutritional deficiencies that can increase the risk of morbidity and mortality at childhood.<sup>1</sup>

MAD also had a low prevalence in the studied children, which was to be expected since this indicator results from the combination of MDD and MMF indicators. Similarly, a study carried out in 2008 with 76 cities in the State of São Paulo showed a low prevalence of MAD, observed in only 28.9% of the children aged between six and 12 months.<sup>19</sup> Other analyses showed a variation in prevalence of between 20.3% and 46%, which could be attributed to the form this indicator was constructed.<sup>9,11</sup>

Regarding to the determinants of complementary feeding indicators, higher family income was positively associated with MDD, corroborating other international studies.<sup>22,23</sup> Children from families with higher monthly incomes, they have more financial resources and, have greater access to diversified food than children from low-income families.<sup>24</sup>

In line with the present study, results from ENANI-2019<sup>6</sup> showed a higher prevalence of MDD and MMF in children whose families had a higher income, but no significant difference. These findings suggest that financial inequality is reflected in the quality of children's diets, with Brazil being one of the nations with the highest income inequality in the world.<sup>25</sup>

This study also showed that children who received EBF up to six months of age had a higher prevalence of adequacy in all the indicators assessed. A study on Brazilian children aged 6 to 24 months showed that

breastfed children who did not have contact with non-human milk are more likely to have a diversified and healthy diet, and are 19% less likely to consume unhealthy food rich in sugar, salt and fat.<sup>26</sup>

One factor that can influence the acceptance and diversity of food is contact with the flavors of food ingested by mothers through breast milk.<sup>27</sup> Evidence also suggests that women who breastfeed exclusively for six months also try to follow other recommendations about their children eating healthy.<sup>28</sup>

This study showed that children whose mothers had received guidance on complementary feeding during childcare visits were more likely to be fed by the recommended MMF. In this sense, childcare professionals are essential for promoting healthy complementary feeding.<sup>29</sup>

Studies show that mothers who have received guidance on feeding their children are more likely to feed their children appropriate food, confirming that healthy eating habits at childhood are influenced by mothers' greater knowledge of appropriate nutrition.<sup>24,30</sup>

Thus, the results of this study reinforce the importance of health professionals disseminating recommendations on infant feeding, encouraging the adoption of healthy habits at childhood. In this sense, the food guide for Brazilian children under the age of two is an important tool to be used to guide family members on complementary feeding.<sup>12</sup>

This study has some limitations. Firstly, the use of information on food consumed on a single day, which may not reflect the child's usual diet, although this is the recommended form to assess the diet.<sup>1,5</sup> Another aspect

Table 2

Crude analysis of factors associated with minimum diet diversity, minimum meal frequency and minimally acceptable diet in the children's first year of life from Vitória da Conquista/BA, Brazil, 2018 (N = 286).

Variables	Minimum diet diversity				Minimum meal frequency				Minimally acceptable diet			
	n	%	PR <sup>a</sup> (CI95%) <sup>b</sup>	p	n	%	PR <sup>a</sup> (CI95%) <sup>b</sup>	p	n	%	PR <sup>a</sup> (CI95%) <sup>b</sup>	p
<i>Block 1 – Maternal and socioeconomics Characteristics</i>												
Maternal race/skin color				0.727				0.774				0.940
White/yellow	28	40.6	1.00		32	46.4	1.00		13	18.8	1.00	
Black/mixed	83	38.3	0.94 (0.68-1.31)		105	48.4	1.04 (0.78-.39)		40	18.4	0.98 (0.56-1.72)	
Maternal Age (years)				0.114				0.132				0.202
<20	9	26.5	1.00		11	32.4	1.00		2	5.8	1.00	
20 - 34	77	38.3	1.44 (0.80-2.61)		104	51.7	1.59 (0.97-2.65)		40	19.9	3.38 (0.85-13.38)	
≥ 35	25	49.0	1.85 (0.99-3.47)		22	43.1	1.33 (0.75-2.38)		11	21.5	3.66 (0.86-15.56)	
Maternal schooling (years)				0.528				0.265				0.159
≤ 8	23	35.4	1.00		27	41.5	1.00		8	12.3	1.00	
>8	88	39.8	1.12 (0.78-1.62)		110	49.7	1.19 (0.87-1.65)		45	20.4	1.65 (0.82-3.33)	
Marital Status				0.620				0.940				0.957
Without partner	13	35.1	1.00		18	48.7	1.00		7	18.9	1.00	
With partner	98	39.5	1.12 (0.71-1.79)		119	48.0	0.99 (0.69-.41)		46	18.6	0.98 (0.47-2.01)	
Family income				0.016				0.932				0.146
≤1 minimum wage	19	27.1	1.00		33	47.1	1.00		9	12.8	1.00	
>1 minimum wage	90	45.2	1.67 (1.10-2.52)		95	47.7	1.01 (0.76-1.35)		42	21.1	1.64 (0.84-3.20)	
Maternal work				0.051				0.195				0.387
No	53	35.6	1.00		68	45.6	1.00		25	16.8	1.00	
Yes	58	42.3	1.33 (0.99-1.77)		69	50.4	1.17 (0.92-1.50)		28	20.4	1.24 (0.75-2.03)	
Parity				0.861				0.210				0.398
Primiparous	54	38.3	1.00		57	40.4	1.00		18	16.7	1.00	
Multiparous	57	39.3	1.02 (0.77-1.37)		80	55.2	1.36 (0.86-1.75)		35	24.1	1.89 (0.72-3.18)	
<i>Block 2 – infants' characteristics</i>												
Sexo				0.915				0.654				0.280
Male	57	38.5	1.00		69	46.6	1.00		31	20.9	1.00	
Female	54	39.1	1.01 (0.76-1.36)		68	49.3	1.05 (0.83-1.35)		22	15.9	0.76 (0.46-1.24)	
Birth weight (g)				0.286				0.139				0.509
<2,500	2	20.0	1.00		8	80.0	1.00		1	10.0	1.00	
≥2,500	109	39.5	1.97 (0.57-6.89)		129	46.7	0.58 (0.41-1.01)		52	18.8	1.88 (0.29-12.33)	
<i>Block 3 – Feeding practices characteristics</i>												

Receiving guidance on complementary feeding during childcare				0.021			0.010			0.163
No	27	28.7	1.00	43	45.7	1.00	13	13.8	1.00	
Yes	84	43.8	1.52 (1.07-2.18)	94	79.0	1.37 (1.03-1.99)	40	20.8	1.50 (0.85-2.68)	
Responsible for the child's feeding				0.962			0.500			0.469
Mother and/or father	84	38.9	1.00	94	43.5	1.41 (0.85-1.79)	38	17.6	1.00	
Grandmother/other	27	38.6	0.99 (0.71-1.39)	43	61.4		15	21.4	1.22 (0.71-2.08)	
EBF up to 6 months				0.004			0.004			0.012
No	82	35.2	1.00	14	26.4	1.00	5	9.4	1.00	
Yes	29	54.7	1.55 (1.15-2.10)	123	52.8	1.50 (1.13-1.97)	48	30.6	1.46 (1.19-1.96)	

EBF= exclusive breastfeeding; <sup>a</sup> PR= Prevalence Ratio; <sup>b</sup> CI95%=95% Confidence Interval.

**Table 3**

Adjusted analysis of factors associated with minimum diet diversity, minimum meal frequency and minimally acceptable diet in the children's first year of life in Vitória da Conquista/BA, Brazil, 2018 (N = 286).

Variables	Minimum diet diversity		Minimum meal frequency		Minimally acceptable diet	
	PR <sup>a</sup> (CI95%) <sup>b</sup>	p	PR <sup>a</sup> (CI95%) <sup>b</sup>	p	PR <sup>a</sup> (CI95%) <sup>b</sup>	p
<i>Block 1 - Maternal and socioeconomic characteristics</i>						
Family income						
≤ 1 minimum wage	1.00					
> 1 minimum wage	1.49 (1.39-2.26)	0.046				
<i>Block 3 - Characteristics of feeding practices</i>						
Guidance on complementary feeding						
No			1.00			
Yes			1.37 (1.05-1.78)	0.016		
EBF up to 6 months						
No	1.00		1.00		1.00	
Yes	1.44 (1.07-1.95)	0.015	1.49 (1.31-1.79)	0.003	1.00 (1.19-1.96)	0.008
<b>Akaike information criterion</b>						
	Model 1	Model 3	Model 1	Model 3	Model 1	Model 3
	418.1	413.0	480.3	474.1	286.7	285.2

<sup>a</sup> PR= Prevalence Ratio; <sup>b</sup> CI95%= 95% Confidence Interval.

concerns the fact that data collection took place before the publication of the current recommendations in the food guide for Brazilian children under two years of age; however, the previous recommendations do not differ in terms of the number of meals and the presence of all the food groups on a daily basis.

On the other hand, the strength of this study is the use of indicators constructed in accordance with current national guidelines, thus contributing to updating scientific evidence on complementary feeding in the country.

In conclusion, this study showed low prevalence rates for the three complementary feeding indicators in the first year of life. The factors that contributed to the better prevalence of the indicators studied were higher family income, breastfeeding for up to six months and parental guidance on complementary feeding during childcare. This finding reinforces the importance of monitoring these feeding practices in children under two years old to guide the implementation of public actions and policies aiming at healthy complementary feeding, with a view to intensify strategies in improving this reality.



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## Authors' contribution

Barbosa CB contributed to the analysis, interpretation of data and writing of this article. Magalhães EIS aid to critically review the analysis and intellectual content of the article. Rocha DS contributed to the conception, design, coordination of the study, data collection and critical revision of the content of this article. All the authors have approved the final version of the article and declare no conflict of interest.

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