DEMETRA
Alimentação, Nutrição & Saúde

Thais Campos Martins
Ana Paula Carlos Cândido[2]
Daniela da Silva Rocha[3]
Renata Maria Souza Oliveira[2]
José Otávio do Amaral Corrêa[4]
Michele Pereira Netto[2]

[1] Universidade Federal de Juiz de Fora, Faculdade de Medicina, Departamento de Saúde Coletiva, vinculada ao Departamento de Nutrição. Juiz de Fora, MG, Brasil.

[2] Universidade Federal de Juiz de Fora, Instituto de Ciências Biológicas, Curso de Nutrição, Departamento de Nutrição. Juiz de Fora, MG, Brasil.

[3] Universidade Federal da Bahia, Instituto Multidisciplinar em Saúde, Curso de Nutrição. Campus Anísio Teixeira. Vitória da Conquista, BA, Brasil.

[4] Universidade Federal de Juiz de Fora, Faculdade de Farmácia. Juiz de Fora, MG, Brasil

Correspondence
Michele Pereira Netto
michele.netto@ufjf.edu.br

Factors associated with duration of exclusive and total breastfeeding in municipal daycare centers in Juiz de Fora-MG, Brazil

Fatores associados ao tempo de aleitamento materno exclusivo e total em creches municipais de Juiz de Fora-MG, Brasil

Abstract

Objective: To identify factors associated with the duration of exclusive and total breastfeeding in children from the municipality of Juiz de Fora, Minas Gerais. *Methodology:* Cross-sectional study, with a sample of 548 and 416 children for the outcomes of duration of exclusive and total breastfeeding, respectively, performed with children under five years old enrolled in municipal daycare centers. Data on socioeconomic conditions, mother and children characteristics, and information about breastfeeding and introduction of complementary feeding were collected in interviews with the parents. Statistical analysis was performed through univariate linear regression, electing variables with p<0.20. Next, hierarchical multiple linear regression was developed, and final models were generated for the studied outcomes. *Results*: Only 6.2% of the children were exclusively breastfed until the sixth month and 16.1% were breastfed along with complementary feeding until two years of age. In the hierarchical analysis, the variables that showed association with the duration of exclusive breastfeeding were "cesarean section" (β= -12.35; p= 0.017) and "birth length" (β= 1.52; p= 0.022). For the duration of total breastfeeding, the variables "duration of exclusive breastfeeding" and "age of introduction of thickeners" were associated with the outcome (β=1,23, p=0,012; β=0,56; p=0,000, respectively). *Conclusion*: The factors associated with longer duration of exclusive and total breastfeeding were: natural birth, longer birth length, longer duration of

exclusive breastfeeding, and late introduction of thickeners in the child's food. These data show the importance of focusing on mother and child health, since prenatal care until the introduction of complementary feeding.

Keywords: Breast Feeding. Maternal and Child Health. Risk Factors. Linear Models.

Resumo

Objetivo: Identificar fatores associados ao tempo de aleitamento materno exclusivo e total em crianças do município de Juiz de Fora, Minas Gerais. *Metodologia:* Estudo transversal, com uma amostra de 548 e 416 crianças para os desfechos tempo de aleitamento materno exclusivo e total, respectivamente, desenvolvido com crianças menores de cinco anos matriculadas em creches municipais. As condições socioeconômicas, características maternas e das crianças, informações sobre aleitamento materno e introdução da alimentação complementar foram coletadas em entrevista aos pais. A análise estatística se deu através da regressão linear univariada, elegendo as variáveis com p<0,20. Em seguida, desenvolvida a regressão linear múltipla hierarquizada e gerados modelos finais para os desfechos estudados. *Resultados:* Foram amamentadas exclusivamente até o sexto mês e complementado até dois anos apenas 6,2% e 16,1% das crianças, respectivamente. Na análise hierarquizada, as variáveis que apresentaram associação ao tempo de aleitamento materno exclusivo foram: cesariana (β= -12,35; p= 0,017) e comprimento ao nascer (β= 1,52; p= 0,022). Para o tempo de aleitamento materno total, as variáveis tempo de aleitamento materno exclusivo e idade de introdução de engrossantes associaram-se ao desfecho (β=1,23, p=0,012; β=0,56; p=0,000, respectivamente). *Conclusão:* Os fatores associados a maior duração do aleitamento materno exclusivo e total foram: parto normal, maior comprimento ao nascer, maior duração do aleitamento materno exclusivo e idade de introdução tardia de engrossantes na alimentação da criança. Esses dados demonstram a importância da atenção à saúde ao grupo materno-infantil, desde o pré-natal até a introdução da alimentar complementar.

Palavras-chave: Aleitamento Materno. Saúde Materno-Infantil. Fatores de Risco. Modelos Lineares.

INTRODUCTION

Breastfeeding is a relevant subject due to its direct effects on patterns of mother-child morbimortality.[1] In Brazil, public policies on promotion, protection, and support of the practice were developed starting in 1980 in order to raise breastfeeding prevalence.[2] Such actions have contributed to an increase in the average duration of breastfeeding practices all over the country.[2]

Since 2002, the World Health Organization (WHO), through the Global Strategy for Infant and Young Child Feeding, recommends that every child is breastfed in an exclusive manner until the sixth month of life and until two years of age or more as a complementary practice.[3]

In 2012, there was a proposal to integrate the Brazilian Breastfeeding Network with the National Strategy for Healthy Complementary Feeding.[4] The Brazilian Breastfeeding and Feeding Network, included in the "Rede Cegonha" Program, reinforces and encourages the promotion of breastfeeding and healthy nutrition for children under two years old in the Unified Public Health System (SUS).[4]

The National Health Survey (PNS) from 1986, 1996, 2006, and 2013, which aimed to update the trends of the breastfeeding indicators in Brazil, showed an increased prevalence of exclusive breastfeeding among children under six months of age from 1986 to 2006, rising from 2.9% to 37.1%, and a stabilization of the number in 2013. A similar pattern was observed with breastfeeding prevalence, which increased from 37.4% to 56.3% between 1986 and 2006, but in 2013, slightly decreased to 52.1%.[5]

Brazil has one of the most advanced regulations for breastfeeding protection in the world, ensuring several women's rights and providing favorable conditions for breastfeeding. Despite the upward trend of this practice, the early interruption of exclusive breastfeeding is still one of the most important public health problems, being a common reality in the country.[6]

There are multiple factors associated with breastfeeding, and different social, cultural, and biological contexts can influence the initiation and duration of the practice.[7,8] In national and international literature, biological, socioeconomic, cultural, and demographic factors stand out in the subject.[7,9] A systematic review of epidemiologic studies on breastfeeding in Brazil found that the most frequently associated factors were place of residence, mother's age, mother's education, lack of mother's employment, child's age, non-use of pacifier, and access to primary health care.[7] In the international study, which used secondary data from Ghana Demographic and Health Survey, socioeconomic and demographic factors were the most associated with breastfeeding, such as income, education, and place of residence.[9]

The objective of this study was to identify the factors associated with the duration of exclusive and total breastfeeding in children under five years old enrolled in municipal childcare centers in the municipality of Juiz de Fora – MG.

METHODS

This is a cross-sectional epidemiological study that was part of a broader research titled "Evaluation of the nutritional status of iron and vitamin A in children under five years old in municipal daycare centers in the municipality of Juiz de Fora – MG", whose objective was to evaluate the nutritional status of iron and vitamin A and the associated factors in children under five years old between 2012 and 2013. To reach this objective, the research had a total sample of 809 children.

The research followed the recommendations of the Ministry of Health, Resolution number 466/2012, and was approved by the Research Ethics Committee of the University Hospital of Universidade Federal de Juiz de Fora (Federal University of Juiz de Fora), CAAE 0208.0.180.000-10. In order to include the children in the study, participation was voluntary, and parents or guardians were requested to sign the Informed Consent Form, with all the nominal data kept in confidentiality. The study was developed in the municipality of Juiz de Fora, Minas Gerais, in the Zona da Mata region of the state, which has 50 municipal daycare centers. 2,837 children were enrolled, divided between the Central, Eastern, Northeastern, North, Northwestern, Southeastern, and South regions of the city. 15 daycare centers in the urban zone of the North, Northeastern, South, and Southeastern regions of the municipality were chosen by convenience, considering characteristics of higher social vulnerability.

Open Epi version 3.01 was used in order to determine the sample size. For the calculations, the study considered the total number of children under five years old regularly enrolled full time in all of the daycare centers in the municipality (2,837 children), with a maximum estimate of prevalence of 50%, considering that this is a comprehensive project that encompasses several outcomes to study. Precision was 5% and confidence interval was 95% (CI95%), resulting in a minimum sample of 339 children. The researchers worked with 548 children to determine the outcome duration of exclusive breastfeeding (DEBF) and 416 children for the outcome duration of total breastfeeding (DTBF). Both outcomes were composed of children under five years old distributed as follows: 24.9% of the children under two years old; 66.8% of the children between 2 and 4 years of age, and 8.3% over four years old.
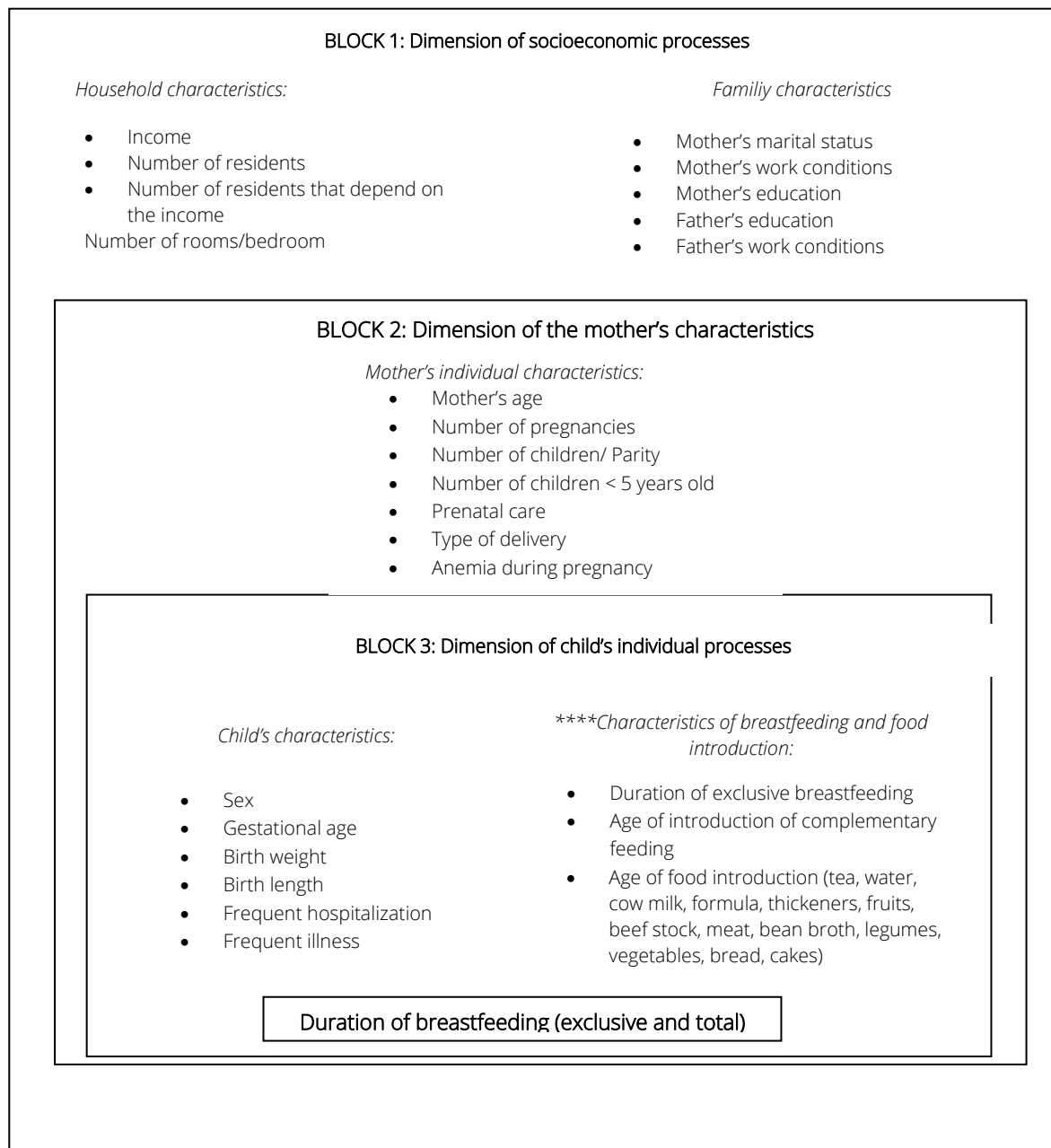
A few of the studied variables had a difference in sample size due to lack of knowledge of the interviewee or to the absence of the child's guardian during the application of the questionnaire. Additionally, the children that were still breastfeeding were not counted in the DTBF outcome, which justifies the difference between the samples of the two studied outcomes (DEBF and DTBF). However, it is worth mentioning that the number of children was adequate to the previously determined estimates.

It was necessary to calculate the power of the study *a posteriori*, since the sample calculation was executed for the more comprehensive research and a few variables presented a difference in the sample size. For such, Open Epi version 3.01 was used, utilizing the power to compare two means and considering a confidence interval of 95%. The significant variables of the final models, such as type of delivery, birth length, duration of exclusive breastfeeding, and age of introduction of thickeners, presented power of 72.06%, 62.21%, 99.52%, and 99.96% respectively.

The following factors were considered as inclusion criteria: children under the age of five, enrolled full time in daycare, and who did not present any chronic disease diagnosed before the research or reported by the parents.

All of the data were collected in the daycare centers. In order to attain information regarding the children, a questionnaire was used with the parents or guardians with information about socioeconomic conditions, characteristics of the mother and the children, breastfeeding, and introduction of complementary feeding. Chart 1 describes the variables used in the study.

Quadro 01. Modelo conceitual hierárquico para determinação dos fatores associados ao tempo de aleitamento materno exclusivo e total em crianças de creches municipais de Juiz de Fora, MG, Brasil, 2012/2013

BLOCK 1: Dimension of socioeconomic processes

Household characteristics:

- Income
- Number of residents
- Number of residents that depend on the income
Number of rooms/bedroom

Familiy characteristics

- Mother's marital status
- Mother's work conditions
- Mother's education
- Father's education
- Father's work conditions

BLOCK 2: Dimension of the mother's characteristics

Mother's individual characteristics:
- Mother's age
- Number of pregnancies
- Number of children/ Parity
- Number of children < 5 years old
- Prenatal care
- Type of delivery
- Anemia during pregnancy

BLOCK 3: Dimension of child's individual processes

Child's characteristics:

- Sex
- Gestational age
- Birth weight
- Birth length
- Frequent hospitalization
- Frequent illness

****Characteristics of breastfeeding and food introduction:*

- Duration of exclusive breastfeeding
- Age of introduction of complementary feeding
- Age of food introduction (tea, water, cow milk, formula, thickeners, fruits, beef stock, meat, bean broth, legumes, vegetables, bread, cakes)

Duration of breastfeeding (exclusive and total)

****Characteristics of breastfeeding and food introduction are variables used to determine only the total duration of breastfeeding; the other variables are common to both outcomes studied

The statistical analysis was developed on SPSS (Statistical Package for the Social Sciences), version 21.0. In order to characterize the sample, the categorical variables were described by absolute and relative frequencies, and the quantitative variables, by measuring central tendency and dispersion. Initially, univariate linear regression analysis was performed to verify the factors associated with DEBF and DTBF in the participating children. The evaluated independent and dependent variables are described in chart 1, which refers to the conceptual model for the determining factors of the outcomes and was adapted from the model proposed by Alves, Oliveira & Rito.[10] It is important to note that the variables "breastfeeding" and "introduction of complementary feeding" were analyzed only for the DTBF outcome.

Next, hierarchical multiple linear regression was applied. The variables that presented statistical significance inferior to 20% in the univariate analysis (p<0,20) were included in the multivariate model. In the multivariate analysis, the variables were hierarchically inserted in blocks.[11] For factors associated with DEBF, the variables were: Block 1 – socioeconomic variables; Block 2 – variables of the mother; Block 3 – characteristics of the children. The variables for factors associated with DTBF were: Block 1 – socioeconomic variables; Block 2 – variables of the mother; Block 3 – characteristics of the children, characteristics of breastfeeding, and food introduction, according to the conceptual model for determination of DEBF and DTBF (chart 1). The statistical analysis of hierarchical multiple linear regression was applied using the backward method, which initially incorporated all variables of each block separately and, afterwards, by steps. Each may or may not be eliminated, and the decision to remove the variable is made based on partial F-tests.

The hierarchical multiple analysis was performed in the following manner: initially, all variables from block 1 were incorporated with p<0.20, previously evaluated by the univariate analysis, and which belonged to the highest hierarchical level. Afterwards, the effect on the outcome was analyzed. The remaining variables were added along with variables from block 2. Again, the ones that remained were added in the analysis along with variables from block 3. Finally, the remaining variables composed the final model. This methodology was applied to determine the factors for the duration of both exclusive and total breastfeeding.

For the interpretation of the results, the identification of statistically significant association happened when $p<0.05$ between certain factor and DEBF and DTBF in days. The analysis of explanatory power was performed by R square change, and the significance of the final model was evaluated by ANOVA.

RESULTS

Regarding the socioeconomic characteristics of the sample, it was observed that approximately 20% of the families had income inferior to one minimum wage in effect that year, with an average of 1.7±0.95 wage/month. 48% of the mothers and 52.5% of the fathers had up to eight years of education. 10.3% of the fathers were unemployed and 30.8% of the mothers did not have a job. 47.6% of the mothers were single, separated or widows.

Regarding the characteristics of the mothers, 14% were between 16 and 19 years old, with an average of 28.4±6.45 years old; the average number of pregnancies was 2.41±1.45; 31.9% were primiparous; 98.7% had prenatal care, with an average of appointments of 8.89±4.9 during pregnancy; 24.9% had anemia during pregnancy, and 50.6% of the women reported natural birth.

In regards to the individual characteristics of the children, the average age was 32.72±11.67 months and 59% were male. The frequency of low birth weight and prematurity was 14% and 16%, respectively. The average birth length was 47.92±3.83cm; and birth weight, 311,2±644,79g. According to the parents, 41% of the children got sick frequently. Regarding breastfeeding practices, it was verified that 94.4% of the children were breastfed, but only 6.2% of the mothers exclusively breastfed until the sixth month after birth, with an average of 59.09±57.54 days. For duration of total breastfeeding, only 16.1% of the women breastfed their children until they were at least two years old, with a total average time of 299.07±292.22 days.

In table 1, variables with p<0.20 in the univariate analysis are presented, explanatory for socioeconomic, mothers' and children's individual characteristics, as well as DEBF. The described variables that had association with the studied outcome were: income higher or equal to one minimum wage, with a tendency to increase the DEBF (p=0.010); cesarean section, with negative association with the outcome (β= -12.56; p=0.011); and child's birth length, which revealed a directly proportional association – as the birth length in cm increased, so did the DEBF in 1.5 days (p=0.020).

Table 1. Univariate linear regression model explanatory for socioeconomic, individual, and mother's characteristics, and duration of exclusive breastfeeding in children from municipal daycare centers from Juiz de Fora – MG, Brazil, 2012/2013.

Variable	Coefficients (β)	Standard error	F- test	p-value
Income: ≥ 1 minimum wage	24,18	9,30	2,59	0,010*
Parity: multipara	8,26	5,27	1,56	0,118
Prenatal care: not executed	-35,65	21,85	-1,63	0,103
Children under 5 years old	-4.65	3.78	-1.23	0.192
Type of delivery: cesarean section	-12,56	4,95	-2,53	0,011*
Birth length	1,55	0,66	2,34	0,020*

Variables with p<0.20 were maintained.
*Variables with p<0.05.

The socioeconomic variables, as well as the mothers' and children's individual characteristics, breastfeeding, and introduction of complementary feeding explanatory for DTBF, which presented p<0.20 in the univariate analysis, are described in table 2. The following factors were significant for the outcome: duration of mother's education, birth length, duration of exclusive breastfeeding, age of introduction of complementary feeding, as well as age of introduction of tea, water, cow milk, industrialized formulas, thickeners (cornstarch, children's cereal, among others), fruits, beef stock, meat, bean broth, legumes, and vegetables. Among the significant variables, only the duration of mother's education was inversely associated with DTBF.

Table 2. Univariate linear regression model explanatory for socioeconomic, individual, and mother's characteristics, and duration of total breastfeeding in children from municipal daycare centers from Juiz de Fora – MG, Brazil, 2012/2013.

Variable	Coefficients (β)	Standard error	F- test	p-value
Duration of mother's education	-16,14	5,03	-3,20	0,001*
Mother's age in years	-2,95	2,25	-1,31	0,190
Prenatal care: not executed	-170,39	120,09	-1,41	0,157
Child's birth weight	0,041	0,025	1,64	0,102
Child's birth length	9,16	4,42	2,07	0,039

Table 2. Univariate linear regression model explanatory for socioeconomic, individual, and mother's characteristics, and duration of total breastfeeding in children from municipal daycare centers from Juiz de Fora – MG, Brazil, 2012/2013. (continues)

Variable	Coefficients (β)	Standard error	F- test	p-value
Duration of exclusive breastfeeding in days	1,36	0,23	5,87	0,000*
Age of introduction of complementary feeding in days	1,20	0,22	5,31	0,000*
Age of introduction of tea in days	0.22	0.11	1.99	0.047*
Age of introduction of water in days	1.03	0.21	4.70	0.000*
Age of introduction of cow milk in days	0.88	0.69	12.92	0.000*
Age of introduction of industrialized formulas in days	0.54	0.18	3.01	0.003*
Age of introduction of thickeners in days	0.62	0.07	8.36	0.000*
Age of introduction of fruits in days	1.05	0.18	5.66	0.000*
Age of introduction of beef stock in days	0.48	0.19	2.44	0.015*
Age of introduction of meats in days	0.30	0.10	3.00	0.003*
Age of introduction of bean broth in days	0.51	0.16	3.13	0.002*
Age of introduction of legumes in days	0.57	0.16	3.48	0.001*
Age of introduction of vegetables in days	0.31	0.089	3.57	0.000*
Age of introduction of tea in days	0.22	0.11	1.99	0.047*

In the hierarchical multivariate analysis for factors associated with DEBF, the first inclusion was related to the socioeconomic characteristics from block 1; the variable "income" presented p<0.20 and was inserted in the model through the backward methodology, but did not remain for the second stage. Therefore, all variables from block 2 with p<0.20 were inserted. Parity, number of children under five years of age, and type of delivery remained in the model and revealed association with the outcome. In the last stage, variables from block 3 were inserted,

as well as birth length, and the variables that remained from block 2. Finally, the final model explanatory for DEBF was created (table 3).

Table 3. Final model of hierarchical multiple linear regression explanatory for duration of exclusive breastfeeding in children from municipal daycare centers from Juiz de Fora-MG, Brazil, 2012/2013

Variable	Coefficients (β)	Standard error	F- test	p-value
BLOCK 2				
Type of delivery: cesarean section	-12.35	5.14	-2.40	0.017*
Parity: Multipara	9.37	5.43	1.72	0.085
BLOCK 3				
Birth length	1.52	0.66	2.29	0.022*

**Variables with p<0,05.
*Nagelkerke R Square 0.184/ ANOVA (p=0.002)

The final model of hierarchical multiple linear regression explanatory for DEBF is described in table 3; in such, type of delivery and birth length were the variables that remained with statistical significance until the end. None of the variables from block 1, related to socioeconomic factors, remained in the final model. Cesarean section, a variable from the intermediate block, showed a tendency to decrease the DEBF (β= -12.35; p= 0.017); birth length, which belongs to the most proximal block to the outcome, was directly proportional to the DEBF (β= 1.52; p= 0.022). The significance of the final model was p=0.002, analyzed by ANOVA; and the explanatory power evaluated through Nagelkerke R Square was approximately 18%.

In order to determine the factors associated with DTBF, in the first stage, among the variables from block 1, the variable "duration of mother's education" presented p<0.20, was inserted in the model through the backward methodology and remained. Afterwards, it was inserted in the second stage along with variables "mother's age" and "execution of prenatal care", which are variables from block 2 with p<0.20. In that stage, only "mother's education" remained. In the last stage, "mother's education" remained and variables from block 3 were inserted, finally generating the final model explanatory for DTBF (table 4).

Tabela 4. Final model of hierarchical multiple linear regression explanatory for duration of total breastfeeding in children from municipal daycare centers from Juiz de Fora-MG, Brazil, 2012/2013

Variable	Coefficients(β)	Standard error	F-test	p-value
Block 3				
Duration of exclusive breastfeeding in days	1.23	0.48	2.57	0.012*
Age of introduction of thickeners in days	0.56	0.08	6.80	0.000*
Age of introduction of legumes in days	0.29	0.30	0.96	0.334
Age of introduction of vegetables in days	0.15	0.09	1.76	0.079

* Variables with p<0.05.
**Nagelkerke R Square* 0.189/ *ANOVA* (p=0.000)

The final model explanatory for DTBF is described on table 4. The variables that remained with statistical significance were: DEBF and age in days of the introduction of food thickeners that showed directly proportional association with the outcome (β =1.23, p=0.012; β=0.56; p=0.000, respectively). None of the variables from block 1 and 2 remained in the final model. Through ANOVA, the final model was significant (p=0.000); the explanatory power evaluated through Nagelkerke R Square was approximately 19%.

DISCUSSION

It is estimated that 823,000 annual deaths could have been avoided in low- and medium-income countries, in 2015, if breastfeeding practices were amplified to almost universal levels. Increasing the duration of breastfeeding to 12 months per child in high-income countries and to two years per child in low- and medium-income countries, more than 22,216 lives would be saved per year.[12] The combination of high levels of mortality and low prevalence of exclusive breastfeeding increases cases of preventable deaths in children under six months.[12]

In the present study, it was verified that 94.4% of the children were breastfed, but only 62% were exclusively breastfed until the sixth month after birth; regarding duration of total breastfeeding, only 16.1% of the women breastfed their children until two years of age. These

results show the need for intervention to reach a higher prevalence of breastfeeding, especially in an exclusive manner until six months of age, considering the importance of this practice for the mother's and child's health and for the prevention of morbimortality.

The present study found that 48% of the mothers had up to eight years of education and 26.6% were formally married. Santos et al.,[13] studying breastfeeding in children up to two years old assisted in primary care in Recife, Pernambuco, also found similar percentages for the mother's marital status, in which 23.4% were married. Regarding mother's education, 37.9% studied for less than eight years. 29% of the families made less than one minimum wage in the present study. In Rocha et al.'s research,[14] which evaluated exclusive breastfeeding with mothers who had children between 6 and 12 months in Viçosa-MG, this number was 72%. The frequencies of adolescent mothers and natural birth were 14% and 50.6%, respectively. Santos et al.[13] found 20.5% of adolescent mothers and 46.1% of natural birth.

There are many factors that could influence the studied outcomes. Epidemiological studies that evaluate determining factors are very relevant to find out the social and biological determinants.[11]

Among the several social and economic factors that could influence breastfeeding, in the present study, families with an income ≥ 1 minimum wage presented higher DEBF through the univariate analysis; regarding mother's education, the higher the duration, the lower was the DTBF.

Alves, Oliveira & Rito[10] demonstrated that women with income lower than one minimum wage presented lower prevalence of exclusive breastfeeding. However, when analyzing breastfeeding in general terms, in Victora et al.'s review,[1] breastfeeding was one of the few positive behaviors related to health in low- and medium-income countries, being less frequent in wealthier countries.

In Boccolini, Carvalho & Oliveira's systematic review,[7] mother's education was a widely investigated factor in the selected studies, observing association between mother's education and exclusive breastfeeding with unanimous findings: low education was associated to early interruption of exclusive breastfeeding – as opposed to the present study, which did not find an association between mother's education with DEBF, but inverse association with DTBF.

The longer duration of mother's education could be related to the ease to assimilate the information learned during prenatal appointments, which may contribute to the success of breastfeeding practices. On the other hand, longer education also contributes to the placement of women in the job market, which, in turn, could limit exclusive breastfeeding.[13] This supports

the findings of this study, which found inverse association of mother's education with DTBF. In Santos et al.'s study,[13] no statistical difference was observed relating DEBF with mother's education.

In Flores et al.'s review,[15] there was lower prevalence of children between 12 and 23 months old who have been breastfed, as well as among those whose head of the family had higher level of education and who belonged to the highest quintile of possession of goods (6-11 and 12-23 months).

There is a contradiction in the relationship between socioeconomic level and breastfeeding, since most of the time, families in high socioeconomic levels would also have higher levels of education, implying better understanding of the practice and its benefits. However, these families also have greater access to acquire substitutes for breast milk, pacifiers, and bottles. Mothers in lower socioeconomic levels, and probably with lower education, would struggle to comprehend the information given to them, but also to access infant formulas, pacifiers, and bottles.[16] This is a complex and contradictory relationship due to the socioeconomic and cultural homogeneity of the populations.[17]

Women are increasingly more included in the job market and more active in the household expenses, which is a sociocultural change that could influence the practice of breastfeeding.[13] However, the present study did not find association of the mother's working conditions with DEBF and/or DTBF.

The marital status is also a social variable that may influence breastfeeding practices. In Alves, Oliveira & Rito's study,[10] there was an association between not living with a partner and a prevalence of exclusive breastfeeding 24% inferior to that of women who live with their partners. In Souza, Sodré & Silva's,[18] as well as in the present study, there was no statistical difference between marital status and DEBF, but it is obvious that the partner's support is fundamental to the success of the practice of breastfeeding.

Besides family support, it is known that a breastfeeding support network is also extremely important to the success of the practice. In this support network, the following are included: family, access to health services, health professional's support, return to work and support from social organizations through the participation of society in monitoring public policies regarding promotion, protection and support of breastfeeding, which impacts reproductive, maternal, neonatal, and children's health.[19]

In this study, no socioeconomic variable was statistically significant in the multivariate analysis. However, these associations are not always evidenced by multivariate models, possibly

due to the socioeconomic and cultural homogeneity of the studied populations.[17] It is important to mention that health promotion through educational programs geared towards a change in the population's habits requires intense action in the wide social determinants for health, varying in the communication between society, socioeconomic, cultural, environmental, and political factors.[20]

Mother's characteristics are in the more intermediate level of the conceptual model, such as: mother's age, number of pregnancies, parity, information about prenatal care, type of delivery, and presence or not of anemia during pregnancy. Among those, cesarean section was associated with lower DEBF in the univariate analysis, keeping the association in the hierarchical multivariate final model. None of the characteristics of the intermediate level were associated with DTBF.

In a study by Warkentin et al.,[21] cesarean section was associated with lower prevalence of breastfeeding. Type of delivery and gestational age influence the prevalence of breastfeeding - cesarean section and preterm birth are negatively associated with this practice.[13] In Alves et al.'s study,[22] cesarean section was responsible for high occurrence of a late start to breastfeeding. Due to the trauma caused by the surgical delivery, it is common for mothers not to be able to breastfeed in the first few hours after birth, since their endocrinal responses are altered.

Natural birth contributes to the early beginning of breastfeeding,[18] which implies that it also helps maintain the exclusive modality.[7] Both natural birth and early beginning of breastfeeding are encouraged practices in public health services, which is extremely important for the encouragement of exclusive breastfeeding and maintenance of the breastfeeding practice until the child is two years old.[23]

Mother's age and parity may also represent breastfeeding experience.[24] Gusmão et al.[25] found an association between higher parity and exclusive breastfeeding, as well as in Santos et al.'s study,[13] in which 51.1% of the cases, the infant was the first child, which implies that primiparity could be associated with early weaning.

Regarding mother's age, Santos et al.[13] did not find statistical differences with DEBF, as well as Guimarães et al.[26] and the present study. However, the intermediate ages seem to be protective for exclusive breastfeeding,[13] since both adolescent mothers[13] and those over 35 years old tend[27] to discontinue the practice early.

Another important factor that could be associated with breastfeeding is prenatal care, although this association has not been found in the present study. A review by Boccolini et al.[7] indicated a low number of prenatal appointments as a risk factor for exclusive breastfeeding.

Vieira et al.[28] consider that low commitment to prenatal care may indicate women who take less care of their own health; and Demétrio et al.[29] affirm that this low commitment may reflect on the low access to information sources about breastfeeding.

Among the characteristics of the proximal block regarding duration of exclusive and total breastfeeding, the individual characteristics of the children can also influence the practice. In Santos et al.'s study,[13] the male sex was associated with lower prevalence of exclusive breastfeeding. Other studies indicate higher chance of early interruption of breastfeeding in male children.[7,19] However, there was no statistical difference between genders and the studied outcomes in the present study.

The birth conditions of the child can influence breastfeeding as well, such as gestational age and birth weight and length, since they're the ones that reflect or not immaturity at birth.[30] In the present study, longer birth length was associated with longer DEBF. It is already proven that premature babies or those with low birth weight have significatively lower chances of timely breastfeeding than full-term infants,[31] especially due to the immaturity and fragility of a premature baby, difficulties in breast suction, prolonged hospitalization time, and consequently, separation of mother and child, among other factors.[30]

In this study, another birth aspect that was associated with DEBF was birth length, which is also very relevant to the research. It is known that birth conditions also reflect on early breastfeeding still in the delivery room,[30,32] and type of delivery may also interfere in the maintenance of exclusive breastfeeding.[21,22] The process of establishing and maintaining the breastfeeding practice with immaturity at birth (low birth weight and/or prematurity) is very complex due to impaired suction reflections.[30]

The early beginning of breastfeeding practices improves children's health and helps adequate growth. It is also worth mentioning the importance of other factors for the child's health, such as age, birth length, residence quality, and mother's age and education.[32]

Regarding the DTBF outcome, the characteristics of breastfeeding and introduction of complementary feeding were also tested in a more proximal level. In the univariate analysis, DEBF, age of introduction of complementary feeding, age of introduction of tea, cow milk, formula, thickeners, fruits, beef stock, beef, bean broth, legumes, and vegetables had a directly proportional association with the outcome. When performing the multivariate and hierarchical analysis, among those aspects, those that remained associated with longer DTBF were: longer DEBF and later age of introduction of thickeners (cornstarch, children cereal, among others).

However, exclusive breastfeeding is only recommended until the sixth month of life; after this period, it should be complemented until two years of age or more.[3]

The period of complementary feeding requires attention, since the introduction of non-healthy foods can jeopardize the continuity of breastfeeding.[33] There are also future harms to the child, considering that the consumption of such foods contributes to the development of overweight and obesity, both in medium and short term.[33,34] Furthermore, it is possible that the weaning is triggered by the consumption of non-healthy foods, since children could lose interest in breast milk because due do the acquisition of new tastes.[33]

The present study identified directly proportional association of time of introduction of food thickeners with DTBF – the earlier this type of food was introduced, the shorter the DTBF was. It is common knowledge that these foods are industrialized, and most contain additives that can characterize them as ultraprocessed foods,[34] which could change the child's taste and jeopardize breastfeeding.[33]

The ingestion of liquids (water, tea, juice, etc.) along with breast milk before six months of age is a frequent practice and, even if sporadic, could result in a reduction of breast milk consumption. As a result, there is less extraction and production of milk, contributing to early weaning, less weight gain by the child, and higher risk of diarrhea.[34] Additionally, thickeners are usually added to liquids when given to infants, which can also jeopardize breastfeeding.

The early complementation exposes children to contamination of food and feeding devices (nipples and bottles); and there is still risk for reactions to non-human proteins or to colorings present in industrialized foods. The latter is reinforced by lower ingestion of antibodies that are present in breast milk and by the immaturity of the infant to digest substances.[35,36] Besides the effects on children, early or inadequate complementation could also harm mothers, causing problems such as: breast engorgement, mastitis, quicker return of fertility, jeopardized connection between mother and child, and economic effects.[36]

It is important to consider different aspects of food introduction, such as adequate time, which is six months of age, food consistency, and appropriate quality and quantity for the consumption of all food groups.[33] According to the food guide for children under two years old,[33] a child's nutrition must be adequate to satisfy the nutritional needs and must be composed of breast milk and healthy food items, preferably natural food.

Researching factors associated with DEBF and DTBF using hierarchical conceptual structures help interpret the results in the light of social and biological knowledge. Multivariate

and hierarchical analytical methods are very relevant in order to handle the complex interrelationships between variables.[11]

Boccolini et al.[7] propose in their review a hierarchical theoretical conceptual model, as well as Alves, Oliveira & Rito,[10] which, through a cross-sectional study, also suggest a conceptual model that can assist the planning of data collection and the statistical modeling strategy for epidemiological studies related to breastfeeding practices. It is important that future studies consider variables in a hierarchical manner for association with exclusive and total breastfeeding, as conceptual models are useful strategies for the adequation of epidemiological studies and factors associated with the studied outcome.[7]

Finally, it is valid to mention the limitations of the present study. Considering that it is a cross-sectional epidemiological study, recall bias may be a limitation, especially in older children. The proportion of children over four years old was 8.3%, and the mothers or guardians may not have remembered information given a long time ago, such as regarding the pregnancy period, breastfeeding, and child's birth characteristics. This could also have impacted the sample difference between a few variables, but did not jeopardize the final sample size.

CONCLUSION

The factors associated with longer duration of exclusive and total breastfeeding were natural delivery, longer birth length, longer duration of exclusive breastfeeding, and later introduction of thickeners in the child's food. Health professionals must be alert to these factors, guiding and encouraging women about breastfeeding practices considering how relevant they are to mother-child health.

REFERENCES

1. Victora CG, Bahl R, Barros AJD, França GVA, Horton S, Krasevec J, et al. Breastfeeding in the 21st century: epidemiology, mechanisms, and lifelong effect. Lancet, 2016 Jan 30; 387(10017):475-90. https://doi.org/10.1016/S0140-6736(15)01024-7.

2. Rea MF. Reflexões sobre a amamentação no Brasil: de como passamos a 10 meses de duração. Cad Saúde Pública, 2003;19(Suppl 1):37-45. http://dx.doi.org/10.1590/S0102-311X2003000700005.

3. Word Health Organization. WHO/Unicef. Global strategy for infant and young child feeding; 2002.

4. Brasil. Ministério da Saúde. Atenção ao Pré-Natal de Baixo Risco. Departamento da Atenção Básica - Editora do Ministério da Saúde: Brasília; 2012.

5. Boccolini CS, Boccolini PMM, Monteiro FR, Venâncio SI, Giugliani ERJ. Tendência de indicadores do aleitamento materno no Brasil em três décadas. Revista de Saúde Pública. 2017;51:108. https://doi.org/10.11606/S1518-8787.2017051000029.

6. Barbosa GEF, Silva VB, Pereira JM, Soares MS, Filho RAM, Pereira LB, *et al*. Dificuldades iniciais com a técnica da amamentação e fatores associados a problemas com a mama em puérperas. Rev. Paul. Pediatr. 2017;35(3):265-272. http://dx.doi.org/10.1590/1984-0462/;2017;35;3;00004.

7. Boccolini CS, Carvalho ML, Oliveira MIC. Fatores associados ao aleitamento materno exclusivo nos primeiros seis meses de vida no Brasil: revisão sistemática. Rev. Saúde Pública. 2015;49(31):91. http://dx.doi.org/10.1590/S0034-8910.2015049005971.

8. Pinheiro JMF, Menêzes TB, Brito KMF, Melo ANL, Queiroz DJM, Sureira TM. Prevalência e fatores associados à prescrição/solicitação de suplementação alimentar em recém-nascidos. Rev. Nutr. 2016;29(3):367-375. http://dx.doi.org/10.1590/1678-98652016000300007.

9. Fosu-Brefo R, Arthur E. Effect of timely initiation of breastfeeding on child health in Ghana. Health Econ Rev. 2015;5(8):1-8. http://dx.doi.org/10.1186/s13561-015-0044-8.

10. Alves JS, Oliveira MIC, Rito RVVF. Orientações sobre amamentação na atenção básica de saúde e associação com o aleitamento materno exclusivo. Ciência & Saúde Coletiva. 2018;23(4):1077-1088.http://dx.doi.org/10.1590/1413-81232018234.10752016

11. Victora CG, Huttly SR, Fuchs SC, Olinto MT. The role of conceptual frameworks in epidemiological analysis: a hierarchical approach. J Epidemiol. 1997;26:224-7. http://dx.doi.org/10.1093/ije/26.1.224.

12. Walker N, Tam Y, Friberg IK. Overview of the Lives Saved Tool (LiST). BMC Public Health. 2013;13 (suppl 3):S1. https://doi.org/10.1186/1471-2458-13-S3-S1.

13. Santos EM, Silva LS, Rodrigues BFS, Amorim TMAX, Silva CS, Borba JMC, et al. Avaliação do aleitamento materno em crianças até dois anos assistidas na atenção básica do Recife, Pernambuco, Brasil. Ciênc. Saúde Coletiva. 2019;24(3):1211-1222. http://dx.doi.org/10.1590/1413-81232018243.126120171.

14. Rocha GP, Oliveira MCF, Ávila LBB, Longo GZ, Cotta RMM, Araújo RMA. Condicionantes da amamentação exclusiva na perspectiva materna. Cad. Saúde Pública 2018;34(6):e00045217. http://dx.doi.org/10.1590/0102-311X00045217.

15. Flores TR, Nunes BP, Neves RG, Wendt AT, Costa CS, Wehrmeister FC, et al. Consumo de leite materno e fatores associados em crianças menores de dois anos: Pesquisa Nacional de Saúde, 2013. Cad. Saúde Pública. 2017;33(11):e00068816. http://dx.doi.org/10.1590/0102-311x00068816.

16. Martins CC, Vieira GO, Vieira TO, Mendes CM. Fatores de riscos maternos e de assistência ao parto para interrupção precoce do aleitamento materno exclusivo: estudo de coorte. Rev Baiana Saúde Pública. 2011;35(Supl. 1):167-168.

17. Lira PIC, Ferreira LOC. Epidemiologia da anemia ferropriva. In: Kac, G.; Sichieri, R.; Gigante, DP. Epidemiologia nutricional [online]. Rio de Janeiro: Editora FIOCRUZ/Atheneu. 2007;297-323. Disponível em: <http://books.scielo.org/id/rrw5w/pdf/kac-9788575413203-20.pdf>. Acesso em: 15 jun. 2019.

18. Souza MHN, Sodré VRD, Silva FNF. Prevalência e fatores associados à prática da amamentação de crianças que frequentam uma creche comunitária. Ciênc. Enferm. 2015;21(1):55-67. http://dx.doi.org/10.4067/S0717-9553201500010 0006.

19. LEAL, MC, Szwarcwald CL, Almeida PVB, Aquino EML, Barreto ML, Barros F, et al. Saúde reprodutiva, materna, neonatal e infantil nos 30 anos do Sistema Único de Saúde (SUS). Ciênc. Saúde Coletiva, Rio de Janeiro. 2018;23(6):1915-1928. http://dx.doi.org/10.1590/1413-81232018236.03942018.

20. World Health Organization (WHO). Commission on Social Determinants of Health. Closing the gap in a generation: health equity through action on the social determinants of health. Final Report of the Commission on Social Determinants of Health. Geneva; 2008.

21. Warkentin S, Taddei JAAC, Viana KJ. Colugnati FAB. Exclusive breastfeeding duration and determinants among Brazilian children under two years of age. Revista de Nutrição.2013;26(3):259-269. http://dx.doi.org/10.1590/S1415-52732013000300001.

22. Alves BR, Pereira TAS, Ibiapina DFN, Costa GA. Prevalência de aleitamento materno em crianças de 6 meses a 2 anos de idade atendidas em um hospital infantil. Revista Interdisciplinar. 2018;11(4):75-83.

23. Domingues RM, Dias MA, Nakamura-Pereira M, Torres JA, d'Orsi E, Pereira AP, et al. Processo de decisão pelo tipo de parto no Brasil: da preferência inicial das mulheres à via de parto final. Cad Saúde Pública. 2014;30(Supl 1):S101-16. http://dx.doi.org/10.1590/0102-311X00105113.

24. Vieira GO, Martins CC, Vieira TO, Oliveira NF, Silva LR. Fatores preditivos da interrupção do aleitamento materno exclusivo no primeiro mês de lactação. J Pediatr (Rio J.).2010;86(5):441-4. http://dx.doi.org/10.1590/S0021-75572010000500015.

25. Gusmão AM, Béria JU, Gigante LP, Leal AF, Schermann LB. Prevalência de aleitamento materno exclusivo e fatores associados: estudo transversal com mães adolescentes de 14 a 16 anos em Porto Alegre, RS, Brasil. Ciên Saúde Colet. 2013;18(11):3357-68. http://dx.doi.org/10.1590/S1413-81232013001100025.

26. Guimarães CMS, Conde RG, Brito BC, Gomes-Sponholz FA, Oriá MOB, Monteiro JCS. Comparação da autoeficácia na amamentação entre puérperas adolescentes e adultas em uma maternidade de

Ribeirão Preto, Brasil. Texto Contexto Enfer. 2017;26(1):e4100015. http://dx.doi.org/10.1590/0104-07072017004100015.

27. Caminha MF, Batista Filho M, Serva VB, Arruda IKG, Figueiroa JN, Lira PIC. Tendências temporais e fatores associados à duração do aleitamento materno em Pernambuco. Rev. Saúde Pública. 2010;44(2):240-8. http://dx.doi.org/10.1590/S0034-89102010000200003.

28. Vieira TO, Vieira GO, Oliveira NF, Mendes CMC, Giugliani ERJ, Silva LR. Duration of exclusive breastfeeding in a Brazilian population: new determinants in a cohort study. BMC Pregnancy Childbirth. 2014;14(1):175. http://dx.doi.org/10.1186/1471-2393-14-175.

29. Demétrio F, Pinto EJ, Assis AMO. Fatores associados à interrupção precoce do aleitamento materno: um estudo de coorte de nascimento em dois municípios do Recôncavo da Bahia, Brasil. Cad Saúde Pública. 2012;28(4):641-54. http://dx.doi.org/10.1590/S0102-311X2012000400004.

30. Esteves TMB, Daumas RP, Oliveira MI, Andrade CAF, Leite IC. Fatores associados à amamentação na primeira hora de vida: revisão sistemática. Rev. Saúde Pública. 2014;48(4):697–708. http://dx.doi.org/10.1590/S0034-8910.2014048005278.

31. Venancio SI, Escuder MML, Saldiva SRDM, Giugliani ERJ. Breastfeeding practice in the Brazilian capital cities and the Federal District: current status and advances. J Pediatr (Rio J). 2010;86(4):317-324. http://dx.doi.org/10.1590/S0021-75572010000400012.

32. Brasil. Departamento de Atenção Básica. Secretaria de Atenção à Saúde. Ministério da Saúde. Dez passos para uma alimentação saudável: guia alimentar para crianças menores de dois anos. Um guia para o profissional da saúde na atenção básica. 2a Ed. Brasília: Ministério da Saúde; 2013.

33. Horta B, Mola C, Victora C. Long-term consequences of breastfeeding on cholesterol, obesity, systolic blood pressure and type 2 diabetes: a systematic review and meta-analysis. Acta Paediatr 2015;104(467):30-7. http://dx.doi.org/10.1111/apa.13133.

34. Brasil. Guia alimentar para a população brasileira. Secretaria de Atenção à Saúde: Departamento de Atenção Básica Brasília: Ministério da Saúde; 2. ed.; 2014.

35. World Health Organization (WHO). Infant and young child feeding: model chapter for textbooks for medical students and allied health professionals. Geneva: WHO; 2009.

36. Smith HA, Becker GE. Early additional food and fluids for healthy breastfed full-terminfants. Cochrane Database of Systematic Rev. 2016;30(8):CD006462. http://dx.doi.org/10.1002/14651858.CD006462.pub4

Contributors

Cândido ANC, Oliveira RMS, Corrêa JOA, and Pereira Netto M participated in the design and conception of the study and in data collection; Rocha DS participated in the design and conception of the study; Martins TC, Rocha DS, and Pereira Netto M participated in data analysis and interpretation; Martins TC drafted the manuscript of the study; Martins TC and Pereira Netto M participated in the review and approval of the final manuscript.

Conflicts of interest: the authors declare no conflicts of interest.