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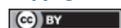
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## ORIGINAL ARTICLE

# Introduction of complementary foods in infants

## Introdução de alimentos complementares em lactentes

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### ABSTRACT

**Objective:** To analyze frequency, age and time trend of complementary feeding introduction in infants. **Methods:** Retrospective study of infants' data evaluated at nutrition sector of *Programa de Atenção aos Bebês* of *Programa Einstein na Comunidade de Paraisópolis* from 2012 to 2015. Survival analyzes were performed, and the outcome considered was the time until the introduction of each specific food. **Results:** Participants were 700 infants, with 5.5 months of median age. Water was the most consumed supplement (80.0%), followed by infant formula (64.1%) and juice (51.1%). Regarding the beginning of complementary feeding, water, infant formula and tea were the first to be introduced, with a median age of 3 months. It is noteworthy that almost one-fifth of the infants had already received processed foods. Water introduction proportions showed a significant tendency to increase over the years, and among infants at 6 months of age, varied from 72.8%, in 2012, to 91.1%, in 2015. The introduction of processed food category items presented a significant trend of change, showing, however, a reduction from 30.8%, in 2012, to 15.6%, in 2015, in this same age group. Among the processed foods, flour based thickeners (36.3%) and biscuits (26.3%) presented the highest proportions of consume. **Conclusion:** Water and infant formula were the most widely consumed and early introduced foods. Among the studied years, water introduction presented a significant tendency to increase and processed foods category to reduce consumption.

**Keywords:** Child health services; Infant; Infant nutrition; Supplementary feeding

### RESUMO

**Objetivo:** Analisar a frequência, a idade e a tendência temporal da introdução da alimentação complementar em lactentes. **Métodos:** Estudo retrospectivo dos dados de lactentes avaliados no setor de nutrição do Programa de Atenção aos Bebês do Programa Einstein na Comunidade de Paraisópolis entre os anos 2012 a 2015. Foram realizadas análises de sobrevivência, sendo que o desfecho considerado foi a idade até a introdução de cada alimento específico. **Resultados:** Foram avaliados 700 lactentes, com idade mediana de 5,5 meses. A água representou o complemento mais consumido (80,0%), seguida pela fórmula infantil (64,1%) e pelo suco (51,1%). Em relação ao início da alimentação complementar, água, fórmula infantil e chá foram os primeiros a serem introduzidos, com idade mediana de 3 meses. Destaca-se que quase um quinto dos lactentes já tinha recebido alimentos processados. A introdução da água apresentou tendência significativa de aumento ao longo dos anos, sendo que, entre os lactentes com 6 meses de idade, variou de 72,8%, em 2012, para 91,1%, em 2015. A introdução dos itens da categoria alimentos processados também apresentou tendência significativa de mudança, sendo, entretanto, de redução, variando de 30,8%, em 2012, para 15,6%, em 2015, nesta mesma faixa etária. Entre os alimentos processados, engrossantes (36,3%) e biscoitos (26,3%) apresentaram as maiores

proporções de consumo. **Conclusão:** Água e fórmula infantil foram os alimentos mais consumidos e mais precocemente introduzidos. Entre os anos estudados, a introdução da água apresentou tendência significativa de aumento e a categoria alimentos processados de redução de consumo.

**Descritores:** Serviços de saúde da criança; Lactente; Nutrição do lactente; Suplementação alimentar

## INTRODUCTION

The World Health Organization recommends exclusive breastfeeding (EBF) up to the age of six months and breastfeeding combined with complementary feeding up to the age of 2 years or over.<sup>(1)</sup>

Studies in the literature have shown the benefits of breastfeeding to mothers and infants alike. However, only 37% of infants under the age of 6 months are exclusively breastfed in low and middle income countries.<sup>(2)</sup> Varying prevalence (7.8% to 68.3%) of EBF has been documented in Latin American and Caribbean countries, despite increasing rates reported in most studies consulted.<sup>(3)</sup>

Two years or more of breastfeeding and exclusive breastfeeding during the first 6 months of life are also recommended by Brazil Ministry of Health.<sup>(4)</sup> However, despite increasing prevalence, breastfeeding does not meet these recommendations in the country. According to Brazilian data extracted from studies carried out between 1975 and 2008, the prevalence of EBF among infants aged under 6 months went from 3.1% to 41.0% in this period.<sup>(5)</sup>

With regard to complementary feeding, 29% of infants aged 4 to 5 months globally, and 48% of infants at the same age living in Latin American and Caribbean countries, are estimated to have been fed solid, semi-solid or soft foods between 2010 and 2016.<sup>(6)</sup>

According to Brazilian data derived from the National Demographics and Health Survey 2006 and 2007, 40.1% of infants aged under 6 months had been fed other types of milk, with consumption of cow's milk and infant formula by 62.4% and 23% of infants, respectively.<sup>(7)</sup> A study investigating feeding practices in the first year of life of infants was carried out in Rio de Janeiro (RJ) between 1998 and 2008, and revealed significant downward trends in frequency of the four indicators evaluated in infants aged under 6 months: 26% for non-breast milk; 44% for water or tea; 38% for fruit or fruit juice and 31% for other food items. Still, the introduction of food items other than breast milk before the age of 6 months,

persisted in more than half (56.3%) of infants in 2008.<sup>(8)</sup>

Hence, infant feeding practices should be well understood to help promote exclusive breastfeeding and proper complementary feeding.

## OBJECTIVE

To analyze frequency, age and time trend of complementary feeding introduction in infants.

## METHODS

A retrospective study carried out between 2012 and 2015 at nutrition sector of *Programa de Atenção aos Bebês* (PAB) of *Programa Einstein na Comunidade de Paraisópolis* [Baby Care Program – Einstein Program at Paraisópolis Community].

The PAB offers educational activities for health promotion of children aged zero to 2 years, as a complementary action to infant care delivered at Primary Care Units. Participation in PAB was voluntary; all infants aged four months or over fed infant formula and infants aged 6 months on EBF were referred for counseling at educational workshops conducted by dietitians. However, whenever the introduction of food items prior to the age of four months was identified, the infants were referred for nutritional counseling appropriate for their age, with the reinforcement of EBF or infant formula.

Complementary feeding data were gathered from initial assessment during educational workshops. Specific forms containing questions related to the consumption or not of different food items and, in positive cases, the age at which food items were introduced, were used. Data were collected during group interviews with adults responsible for the infants. The following items were evaluated: infant formula, cow's milk, water, tea, juice, fruit, lunch, dinner and other food items categorized as processed (flour based thickeners, biscuits, yogurts, drinks – coconut water, soft drink and artificial juice – sugar/honey, processed baby food and sweets).

Frequency distribution of quantitative variables was investigated using histograms and boxplots. Given frequencies were not normally distributed, qualitative and quantitative variables were expressed as absolute and relative frequencies, and medians and interquartile ranges. Survival analysis was used to investigate the infant age at introduction to different food items. Time was expressed in months, from birth to age at

introduction of foods, as informed by parents or care persons upon initial assessment. In the case of food items that had not yet been introduced, the time from birth to assessment was described as event-free time and defined as censorship, which implied exclusion of the infant from the analysis from that age on. Timing of food introduction in different years of investigation was compared using Kaplan-Meier curves and log-rank test for trend. Kaplan-Meier curves estimate the percentage of infants that had already consumed or began consuming different food items according to age (months) at introduction. The log-rank test for trend compares Kaplan-Meier curves obtained in different years of investigation to detect upward and downward trends in rates of introduction to different food items in different years. Analyses were conducted using software packages R 3.1.3 and Survival. The level of significance was set at 5%.

This research project was approved by the Ethics Committee of *Hospital Israelita Albert Einstein*, CAAE: 57332816.5.0000.0071 and *Secretaria Municipal de Saúde de São Paulo*, CAAE: 57332816.5.3001.0086.

## RESULTS

The sample in this study comprised complementary feeding data collected from 700 infants between 2012 and 2015. Infant age at initial assessment ranged from 2.9 to 7.7 months (median age, 5.5 months). Frequency distributions of infants according to age at initial assessment and year of assessment are presented in table 1.

**Table 1.** Infants distribution, according to age at initial assessment and years of study

Year of assessment	Age (months)					Total
	2.9<4.0	≥4.0<5.0	≥5.0<6.0	≥6.0<7.0	≥7.0	
2012	4 (3.0)	47 (35.3)	52 (39.1)	30 (22.6)	0 (0)	133 (19.0)
2013	3 (1.9)	48 (30.6)	52 (33.1)	48 (30.6)	6 (3.8)	157 (22.4)
2014	3 (1.6)	48 (25.5)	74 (39.4)	63 (33.5)	0 (0)	188 (26.9)
2015	8 (3.6)	89 (40.1)	66 (29.7)	54 (24.3)	5 (2.3)	222 (31.7)
Total	18 (2.6)	232 (33.1)	244 (34.9)	195 (27.9)	11 (1.6)	700 (100)

Results expressed as n (%).

Overall, water was the most widely used complement (80.0%), followed by infant formula (64.1%) and juice (51.1%). Infant formula and tea were the first complementary food items to be introduced (median age of 3 months). Almost one fifth of infants had

already been fed processed foods. However, the fact that infants had been introduced to more than one processed food item at different ages precluded estimating a common starting date (Table 2).

**Table 2.** Food items distribution and age at first introduction

Food items	n (%)	Introduction (months) [IQR]
Infant formula		3.0 [1.0-4.0]
No	251 (35.9)	
Yes	449 (64.1)	
Cow's milk		4.0 [3.0-5.0]
No	627 (89.6)	
Yes	73 (10.4)	
Water		3.0 [2.0-4.0]
No	140 (20.0)	
Yes	560 (80.0)	
Tea		3.0 [2.0-4.0]
No	632 (90.3)	
Yes	68 (9.7)	
Juice		4.0 [4.0-5.0]
No	342 (48.9)	
Yes	358 (51.1)	
Fruit		5.0 [4.0-5.0]
No	360 (51.4)	
Yes	340 (48.6)	
Lunch		5.0 [4.0-5.0]
No	512 (73.1)	
Yes	188 (26.9)	
Dinner		5.0 [4.0-5.0]
No	669 (95.6)	
Yes	31 (4.4)	
Processed foods		-
No	563 (80.4)	
Yes	137 (19.6)	
Total	700 (100)	

IQR: Introduction expressed as median and interquartile range.

Tables 3 and 4 show the proportion of infants who received or who had already received the evaluated food items, according to each age (months) at introduction. Infant formula (13.9%) and water (11.3%) were the first liquid foods to be introduced. Water consumption by infants aged 6 months at the time of introduction tended to increase significantly over time, going from 72.8% in 2012 to 91.1%, in 2015. No significant trends regarding the introduction of other liquid foods were observed.

**Table 3.** Infants distribution, according to age (months) at introduction to liquid foods and years of study

Food items/years	Age at introduction to food item (months)							p value
	0	1	2	3	4	5	6	
Water (n=692)								0.008
2012	6.1	12.1	24.2	35.7	51.0	64.3	72.8	
2013	12.7	24.8	38.2	56.7	71.3	79.3	86.2	
2014	6.5	12.0	29.3	39.7	63.6	77.7	84.8	
2015	17.4	23.7	37.4	52.1	68.0	78.0	91.1	
Total	11.3	18.6	32.9	46.7	64.4	75.7	85.1	
Tea (n=699)								0.472
2012	2.3	3.0	4.5	9.1	11.4	13.9	13.9	
2013	0.0	0.0	3.2	3.8	5.8	5.8	5.8	
2014	1.1	1.6	2.1	2.1	3.8	4.5	6.1	
2015	1.4	2.3	5.9	9.5	12.3	13.0	17.8	
Total	1.1	1.7	4.0	6.2	8.4	9.4	11.3	
Infant formula (n=698)								0.177
2012	11.3	18.8	31.6	40.6	51.9	57.2	62.6	
2013	13.4	19.7	29.9	42.0	54.1	58.1	66.9	
2014	9.6	14.4	25.7	36.9	54.0	63.3	65.1	
2015	19.5	24.4	36.7	45.2	58.5	62.9	72.2	
Total	13.9	19.6	31.2	41.4	55.0	60.9	67.3	
Cow's milk (n=700)								0.330
2012	0.0	0.0	1.5	6.8	9.9	14.9	18.0	
2013	0.0	0.0	0.0	1.3	5.2	9.0	10.9	
2014	0.0	0.0	1.6	4.3	8.6	11.5	16.4	
2015	0.5	1.4	1.8	4.1	5.9	9.8	11.4	
Total	0.1	0.4	1.3	4.0	7.2	11.0	13.9	
Juice (n=696)								0.563
2012	0.8	0.8	2.3	12.1	35.8	53.6	69.8	
2013	0.0	0.0	1.3	8.3	28.2	45.5	68.7	
2014	0.0	0.0	0.5	3.7	19.4	48.9	62.3	
2015	0.0	0.0	1.4	11.0	31.0	49.5	69.7	
Total	0.1	0.1	1.3	8.6	28.2	49.2	67.6	

p value adopted in log-rank test for trend.

Among other foods, feeding of processed foods tended to decrease significantly in infants aged 6 months at the time of introduction, going from 30.8% in 2012 to 15.6% in 2015 (Table 4).

**Table 4.** Infants distribution, according to age (months) at introduction to other food items and years of study

Food items/years	Age at introduction to food item (months)							p value
	0	1	2	3	4	5	6	
Fruit (n=698)								0.467
2012	0.0	0.0	0.0	3.0	18.4	35.0	63.2	
2013	0.0	0.0	0.0	5.7	28.5	49.0	77.3	
2014	0.0	0.0	0.5	3.2	21.2	51.9	74.2	
2015	0.0	0.0	0.5	5.4	24.1	46.0	67.3	
Total	0.0	0.0	0.3	4.4	23.2	46.5	71.3	

p value adopted in log-rank test for trend.

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**Table 4.** Infants distribution, according to age (months) at introduction to other food items and years of study

Food items/years	Age at introduction to food item (months)							p value
	0	1	2	3	4	5	6	
Lunch (n=698)								0.694
2012	0.0	0.0	0.0	0.8	14.7	26.4	36.4	
2013	0.0	0.0	0.0	1.3	9.1	18.2	44.3	
2014	0.0	0.0	0.5	1.1	11.3	27.5	46.7	
2015	0.0	0.0	0.0	1.4	11.2	27.0	45.3	
Total	0.0	0.0	0.1	1.1	11.4	25.1	44.5	
Dinner (n=699)								0.907
2012	0.0	0.0	0.0	0.0	0.8	4.3	7.8	
2013	0.0	0.0	0.0	0.0	1.3	4.1	8.0	
2014	0.0	0.0	0.0	0.0	2.7	4.2	7.5	
2015	0.0	0.0	0.0	0.0	1.4	4.6	8.1	
Total	0.0	0.0	0.0	0.0	1.6	4.3	7.8	
Processed foods (n=699)								0.006
2012	0.8	0.0	3.0	8.3	16.9	24.2	30.8	
2013	0.0	0.6	1.3	4.5	15.7	25.1	33.3	
2014	0.0	0.0	1.6	5.3	13.0	18.0	24.7	
2015	0.5	0.9	0.9	5.0	10.1	15.6	15.6	
Total	0.3	0.6	1.6	5.6	13.4	20.1	25.2	

p value adopted in log-rank test for trend.

Flour based thickeners (36.3%) and biscuits (26.3%) were the most widely consumed processed foods. The fact that infants may have been fed more than one processed food item should be emphasized (Table 5).

**Table 5.** Processed food distribution, according to years of study

Processed foods	Year				Total
	2012	2013	2014	2015	
Thickeners	8 (20.0)	21 (42.9)	22 (51.2)	11 (28.2)	62 (36.3)
Biscuits	12 (30.0)	18 (36.7)	7 (16.3)	8 (20.5)	45 (26.3)
Yogurt	7 (17.5)	6 (12.2)	3 (7.0)	9 (23.1)	25 (14.6)
Drinks	3 (7.5)	0 (0.0)	4 (9.3)	7 (17.9)	14 (8.2)
Sugar/honey	6 (15.0)	1 (2.0)	1 (2.3)	4 (10.3)	12 (7.0)
Processed baby food	1 (2.5)	3 (6.1)	3 (7.0)	0 (0.0)	7 (4.1)
Sweets	3 (7.5)	0 (0.0)	3 (7.0)	0 (0.0)	6 (3.5)
Total	40 (100.0)	49 (100.0)	43 (100.0)	39 (100.0)	171 (100.0)

Results expressed as n (%).

## DISCUSSION

This study described infant complementary feeding practices reported upon initial assessment by a nutrition service.

Infants in this sample were based in Paraisópolis region, in the city of São Paulo. Studies carried out in the State of São Paulo (SP) were therefore extracted from literature for comparative purposes. Still, differences in date, location and sample between studies and their potential impacts on results must be accounted for. Also, infants in this sample aged 2.9 to 7.7 months and were assessed via a specific form to evaluate the introduction to food items, in contrast with other methods described in literature, such as food consumption the day before, or in the last three days of a 60-day period, prior to interview with the responsible for the infant.

One study carried out between 2009 and 2010 with children aged zero to 6 years at a Family Health Unit, located in the city of Campinas (SP), revealed inadequate (consumption of foods prior to 6 months of age) introduction to liquid (water, tea and fruit juice) and solid (fruit puree, salted puree, meat, cereals and legumes) foods in 73.5% and 48.1% of cases, respectively. Similar consumption proportions of water (75.7%) and lower of fruit juice (49.2%) and tea (9.4%) were noted in this study. With regard to solid foods consumption, similar proportions of fruit (46.5%) and lower of lunch (25.1%) and dinner (4.3%) were documented.<sup>(9)</sup>

Two additional studies evaluated food consumption in a similar manner of ours (*i.e.*, using survival analysis). The first was carried out in Campinas (SP) between 2004 and 2005 with children under the age of 2 years, and was based on food consumption on the day of interview. Findings revealed similar consumption proportions of water (13.5% *versus* 11.3%) and juice (0.8% *versus* 0.1%), and lower of tea (20.6% *versus* 1.1%) by infants prior to the first month of age, compared to this study. Up to the age of four months, proportions corresponded to 61.5% *versus* 46.7% (water), 53.5% *versus* 6.2% (tea) and 44.8% *versus* 8.6% (juice). The proportion of infants fed water (92.4% *versus* 75.7%), tea (67.7% *versus* 9.4%) and fruit juice (86.4% *versus* 49.2%) up to the age of sixth months were higher compared to this study. Median age at first introduction to food items was also higher compared to this study (120 *versus* 90 days for water and tea; 150 *versus* 120 days for fruit juice).<sup>(10)</sup> In the second study, children living in São Paulo (SP) were followed to the age of one year, from 1998 to 1999. Median age at introduction was 28 days for water and tea, and 160 days for fruits. Values were lower compared to findings of this study (90 days for water and tea; 150 days for fruit). Median age at introduction to cereals, root vegetables, green vegetables, legumes, meat, beans and eggs, ranged from 150 to 217 days, compared to 150 days (introduction to lunch and dinner) in this study. However, the fact that food consumption in this

study was defined as food items consumed for at least 3 days over a 60-day period should be accounted for.<sup>(11)</sup>

One study carried out in the city of Botucatu (SP), in 2004, with children under one year of age evaluated food consumption on the day prior to data collection. Comparative analysis of results between that and this study revealed higher consumption proportions of tea (30.7% *versus* 4.0%), fruit (4.1% *versus* 0.3%) and juice (5.6% *versus* 1.3%) by infants up to the age of 3 months. In infants aged 6 months or under, values remained higher for tea (26.3% *versus* 9.4%) and fruit (54.1% *versus* 46.5%), but were lower for juice (38.4% *versus* 49.2%) consumption.<sup>(12)</sup>

An upward trend in early introduction to water was detected over the course of this study. This increase may have reflected introduction to other food items, given water should be offered when infants are introduced to infant formula, cow's milk and/or complementary food items. However, no significant trends in the introduction to these food items were observed.

The Ministry of Health has been working to promote breastfeeding and healthy complementary feeding for children aged under 2 years in the country.<sup>(13-15)</sup> Positive effects of these strategies have been reported, both from EBF<sup>(16)</sup> and infant complementary feeding<sup>(17)</sup> perspectives. Significant downward trends in early introduction of processed foods to infants over time may have reflected these policies.

Despite breastfeeding intentions on the part of virtually all mothers,<sup>(18)</sup> systematic literature reviews have pinpointed several EBF-related factors that may impact the implementation of this practice. In the first review, maternal age and education, number of pre-natal visits and neonate birthweight, were some of the factors identified via a hierarchical theoretical model proposed, according to proximity of the variable to the outcome.<sup>(19)</sup> In the second review, breastfeeding determinants were categorized as structural (sociocultural and market-related), local (health systems and services, family, community, job and workplace) and individual (maternal and infant characteristics, and mother-child relationship) levels.<sup>(20)</sup> In addition to these factors, difficulties identified in literature regarding infant nutritional counselling practices,<sup>(21)</sup> as well as potential impacts of family-related factors on breastfeeding maintenance<sup>(22)</sup> and of child nutrition information disseminated over the internet<sup>(23)</sup> must be taken into account.

Nutritional counselling is thought to be a challenging practice, given its multifactorial nature. The implementation of strategies aimed to promote EBF and proper complementary feeding must be viewed in the light of these factors, if well-established positive

impacts of EBF on infant and child health and nutrition are to be achieved.

## CONCLUSION

This study described infant complementary feeding introduction practices. Water and infant formula were the most widely used food items and the ones introduced at an earlier age. Water consumption tended to increase while processed food consumption tended to decrease significantly over the course of the study period.

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