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Effectiveness of complementary feeding training for health professionals on the dietary practices of children under one year of age attending the Family Health Strategy in Rio de Janeiro

Efetividade de formação em alimentação complementar para profissionais de saúde sobre as práticas alimentares de crianças menores de um ano atendidas na Estratégia de Saúde da Família do Rio de Janeiro

Abstract

Objective: To assess the effectiveness of complementary feeding (CF) training on diets of children aged under 1 year enrolled in the Rio de Janeiro Estratégia de Saúde da Família (Family Health Strategy - ESF). *Method*: Controlled randomized community trial with six primary health units. The intervention consisted of complementary feeding training of health professionals coupled with supporting materials for the professionals and educational materials for the families. Children's diets were analyzed when they were four, six, nine and 12 months old. The intervention's effectiveness was assessed according to "intention to treat" and dose-response. *Results:* We studied 220 children in the Intervention Group (IG) and 225 in the Control Group (CG). The IG had higher proportions of breast feeding and lower proportions of nipple use than the CG at 12 months. The CG had lower proportion of consumption of ultra-processed or non-recommended foods at 4 months and higher proportion of adequate number of meals at 12 months. The energy density of foods and diet variety fell short of recommendations in both groups. The dose-response effect was only observed for nipple use at nine months. *Discussion:* The low level of

exposure to the intervention among mothers and children in the IG and the fact that guidance from professionals, when provided, was not always correct, may largely explain results. Conclusion: Although IG professionals had greater knowledge of CF than those in the CG, the diet profiles of children of both groups were similar and far from recommendations for practically all indicators analyzed.

Keywords: Complementary feeding. Ultra-processed foods. Health education..

Resumo

Objetivo: Avaliar a efetividade da formação em alimentação complementar (AC) sobre a alimentação de crianças menores de um ano atendidas na Estratégia de Saúde da Família (ESF) do Rio de Janeiro. *Método*: Ensaio comunitário randomizado controlado desenvolvido em seis unidades básicas de saúde. A intervenção consistiu em formação sobre alimentação complementar dirigida aos profissionais de saúde complementada por materiais de apoio aos profissionais e materiais educativos dirigidos às famílias. A alimentação das crianças foi analisada quando elas tinham quatro, seis, nove e 12 meses de idade. A efetividade da intervenção foi avaliada segundo "intenção de tratamento" e dose-resposta. Resultados: Foram estudadas 220 crianças no Grupo Intervenção (GI) e 225 no Grupo Controle (GC). O GI apresentou proporções maiores de amamentação e menores de uso de bicos que o GC aos 12 meses. O GC apresentou menor proporção de consumo de alimentos ultraprocessados ou não recomendados aos quatro meses e maior proporção de adequado número de refeições de sal aos 12 meses. A densidade energética de alimentos e a variedade da alimentação estavam aquém do recomendado em todos os acompanhamentos. O efeito dose-resposta foi observado somente para o uso de bico aos nove meses. *Discussão*: O baixo nível de exposição à intervenção entre mães de crianças do GI e o fato de que a orientação fornecida pelo profissional, quando ocorria, nem sempre era correta, podem explicar em grande parte os resultados. *Conclusão:* Ainda que os profissionais do GI apresentassem maior conhecimento sobre AC do que os do GC, os perfis alimentares das crianças de ambos os grupos foram semelhantes e distantes das recomendações para praticamente todos os indicadores estudados.

Palavras-chave: Alimentação complementar. Alimentos ultraprocessados. Educação em saúde.

INTRODUCTION

The introduction of adequate, timely and healthy complementary feeding is a critical and complex process involving biological, cultural, social and economic factors which interfere directly on infants' health and feeding practices.[1-4] Although the World Health Organization and the *Ministério da Saúde* (Ministry of Health) recommend exclusive breastfeeding until the sixth month of life and the introduction of adequate and healthy complementary feeding in this period,[1,2] studies carried out in Brazil have shown high prevalence of early weaning and untimely and inadequate introduction of complementary foods.[5-8]

The Brazilian government's effort to promote public policies in favor of healthy complementary feeding in the primary health care network is still incipient.[1,2] There have only been a few studies that show which strategies are most effective for subsidizing healthy complementary feeding promotion policies.[3,4]

We must conduct studies that contribute to the development of training strategies for health professionals and that assess the effectiveness of these strategies, both in terms of professionals' knowledge and in terms of children's eating practices. This study sought to assess the effectiveness of an educational activity on complementary feeding on dietary practices of children aged under one year enrolled in the Rio de Janeiro *Estratégia de Saúde da Família* (Family Health Strategy – ESF).

METHODS

This is a randomized controlled community trial. Unit selection considered the following criteria: being a *Clínica de Saúde da Família* (Family Health Clinic – CSF), having a full minimum ESF team and serving at least 120 children under one year of age per month. Seven units met these criteria. Two were located in the same community. To avoid contamination and over-representation of a specific study context, we chose to exclude one of the units from the final sample. The excluded unit was selected by random.

Of the six included units, two were *Unidades Básicas Amigas da Amamentação* (Primary Units Friends of Breastfeeding).[7] We started the random allocation into groups (Intervention Group - IG and Control Group - CG) by these two so as to guarantee that they would not be in the same group. Next, units were matched according to the number of children to whom they provide care per month and each pair was randomly allocated to the IG and CG.

The study's group of interest were children aged between four and 12 months who received care at the units. We excluded children who weighed <2,500 g at birth, those with congenital anomalies or cerebral palsy and those who were admitted to intensive therapy units after birth.

We identified children for inclusion in the IG and CG groups with help from *agentes comunitários de saúde* (community health agents – ACS) and the CSF managers. We identified those who were born the day following the training activity in each IG unit. The recruitment of children for the study lasted five months and took place when they turned four months old.

To calculate the sample, we considered three outcomes at different follow-up moments, namely: early introduction of complementary foods at the fourth month of life (70.8%); consumption of ultra-processed foods or foods with low nutritional value at the ninth month of life (78.6%) and consumption of ultra-processed foods or foods with low nutritional value at the twelfth month of life (80.6%). The prevalences of these outcomes, indicated above, were estimated using a database from a 2008 survey of children's eating practice that studied a representative sample of the population of children aged under one year who lived in the city of Rio de Janeiro.[8,9]

Considering each of the prevalences estimated for the outcomes described above, a 20% prevalence difference between intervention and control groups, an 80% test power, 5% significance level and 1:1 allocation ratio, the highest sample number obtained for calculating each outcome was 316 children, 158 in the IG and 158 in the CG.

Assuming a 30% loss, we estimated a total sample of 410 children, 205 in the IG and 205 in the CG. We chose to include in the study all children born in the IG and CG units in the study's recruitment period, respectively 318 and 301. The intervention consisted of a training in complementary feeding (CF) for all the unit professionals who were interested in the subject, along with the provision of supporting materials for the professionals and educational materials to be delivered by the professionals to the mothers/guardians. The training lasted nine hours, divided into three three-hour sections. The three training sections were scheduled according to each unit's availability and were offered twice in each in order to ensure the participation of the highest possible number of professionals.

During training, we presented to professionals specific CF guidance to be discussed with guardians when children were aged six, seven, nine and 12 months. They were also encouraged to schedule consultations or carry out home visits in these four moments of the first year of life, in order to provide timely guidance according to the child's age. A detailed description of the

training activity is available in Silva.[10] IG professionals were trained between July and October 2012. The training had an 89% coverage, considering participation in at least one section, and a 62% coverage considering all three sections. Professionals who participated in the training were ACS, nurses, nursing technicians, doctors, oral health technicians, dentists, nursing assistants and speech therapists.

The outcome was children's dietary practices at four, six, nine and 12 months, assessed through indicators constructed based on a theoretical model of CF:[11] early introduction of foods; timely complementary feeding; varied diet; adequate number of meals for the age; adequate food consistency; consumption of iron-rich foods; consumption of foods rich in vitamin A; consumption of ultra-processed/non-recommended foods; use of utensils with nipples; breastfeeding; use of added sugar. Children aged 120-149 days, 180-209 days, 270-299 days and 360-389 days were considered as being, respectively, four, six, nine and 12 months old.

The following variables were considered when characterizing children: mother's age, child's age (mean), gestational age (mean), mother's educational level (mean and categorized), family's income in terms of the minimum wage, primiparity, type of delivery, child's sex, mother's marital status, having access to treated water, mother's work, father present in child's life, receiving government benefits and attending day care.

IG and CG professionals were compared with regard to their level of knowledge of children's diets in the first year of life, expressed through two indicators: mean score in a questionnaire assessing level of knowledge of children's diet and proportion of professionals with adequate knowledge of CF (questionnaire score equal to or greater than 8.0). A detailed description of this questionnaire is available in Silva.[10] For this study, we used the data from the questionnaire administered immediately before we began data collection on children's dietary practices. The statistical significance of possible differences between the IG and the CG was assessed using Student's t test and the chi-squared test, using a 5% threshold of statistical significance.

For the children in the IG and the CG, we constructed the following variables related to the guidance provided by professionals: guardian received, in the 30 days prior to the interview, guidance regarding adequate children's diet (yes or no) and, if, so, how this guidance was provided (spoken, written, spoken and written); who provided the guidance; quality of the guidance (correct, partially correct, incorrect).

The quality of the guidance was assessed based on the content of the guidance reported by the mother, taking into account whether or not the child was being breastfed. The quality of

the guidance was classified as correct when the professionals informed guardians of the correct introduction of foods in terms of age, consistency, frequency and type of food, in addition to encouraging continuing breastfeeding after the initial six months, and exclusively breastfeeding children under six months of age who were being breastfed at the moment of the interview. The guidance was classified as partially correct when it presented correct and incorrect content (ex: "you should being to introduce foods to your child at six months and you should start with juices and soup"). Lastly, the guidance was classified as incorrect when none of its contents were correct. We also constructed a variable regarding whether or not guardians had doubts after receiving guidance.

For children in the IG, we constructed exposure variables related to receiving educational material, such as: guardian received educational material; which professional provided the material; guardian read the material; guardian had difficulty understanding the material. We further constructed a summary statistic of the level of exposure to the intervention, which was categorized as: high, low or unexposed. We classified as having a high exposure level IG children whose guardians had received the educational material and, in the previous 30 days, had been given guidance regarding feeding; as having low exposure level, those whose guardians had been exposed to only one of the actions (delivery of educational materials or guidance); and as not having been exposed to the intervention those children whose guardians had not been exposed to either action.

For data collection, we created a questionnaire based on a literature review of CF, on the questionnaire proposed by the WHO[12] and on the questionnaire used in surveys conducted during vaccination campaigns in Brazilian municipalities.[13] It encompassed questions regarding families' sociodemographic characteristics, child's food consumption in the previous 24 hours, feeding guidance provided by health professionals in the previous 30 days and, for children in the IG, whether or not they received the educational materials.

The questionnaire was administered by trained researchers in four home visits to guardians' homes. The visits took place when the children were four (120-149 days), six (180-209 days), nine (270-299 days) and 12 months (360-389 days) old.

Children in the IG and CG were initially compared in terms of their sociodemographic characteristics to assess the groups' homogeneity with regard to potential confounding factors for the outcomes of interest that could possibly not be equally distributed between the groups during the randomization process. Both groups were also compared with regard to professionals' knowledge regarding CF before fieldwork began.

The intervention's effectiveness on dietary practices at four, six, nine and 12 months of age was assessed according to "intention to treat". The statistical significance of possible differences between the IG and the CG was assessed using Student's t test and the chi-squared test, using a 5% threshold of statistical significance. We further carried out logistical regression analyses for each outcome of interest, using the group in which the child was placed (IG or CG) as the independent variable and controlling for possible confounding factors. For sociodemographic variables with $p<0.2$ in the statistical comparison of the two groups, we carried out bivariate analyses with each analyzed outcome indicator. Next, we carried out multiple regression analyses considering each outcome indicator as a dependent variable, the allocation group (IG and CG) as the independent variable and, as possible confounding factors, the variables with $p<0.05$ in the bivariate analyses for each of the outcomes of interest.

We also carried out a dose-response analysis in order to verify a possible difference of the intervention's effect on exposed and unexposed in the IG, following the same procedures described above.

We used the software Epi-info 6.04 to calculate sample size. The data were typed into Google Docs and the analyses were carried out in the software SPSS 17.0.

The study was approved by the *Comitê de Ética da Prefeitura do município do Rio de Janeiro* (Rio de Janeiro Municipal Government's Ethics Review Board; research protocol n. 193/11. CAAE n. 0077.0.314.000-11). All individuals who participated in the study signed an Informed Consent Form.

RESULTS

The number of professionals included in the study was 176 in the IG and 131 in the CG. The number of children included in the IG was 220, 192, 152 and 141, respectively, in the first, second, third and fourth follow-ups. In the CG, those numbers were, respectively, 225, 199, 208 and 208. The main reasons for loss during recruitment and/or follow-up were related to changes in families' addresses, records with wrong addresses and families being followed in the private health sector, and not at the unit included in the study. Children's mean age at each follow up

was 4.36 at four; 6.31 at six; 9.29 at nine; and 12.3 at 12 months, with no differences observed between IG and CG.

The sociodemographic characterization of children and mothers upon entering the study is presented in table 1. Overall, they were children of young mothers (25.8 years) who had, on average, 8.7 years of schooling and who, for the most part, lived with a partner (79.7%), did not work (75.3%), had a monthly family income inferior to two times the minimum wage (58.7%), had access to treated water (84.2%) and had had cesarean deliveries (57.0%). On average, children were born at a gestational age of 39.1 weeks and, for the most part, did not attend daycare (97.3%) and had fathers who were present in their lives (87.3%).

Table 1. Sociodemographic characteristics of children at enrollment into the study according allocation group (Intervention (IG) or Control (CG)). Intervention study in Primary Health Care Units of the *Estratégia de Saúde da Família* (Family Health Strategy). Rio de Janeiro Municipality, 2012-2014.

Sociodemographic variables	IG (n=220)[a]	CG (n=225)[a]
	Proportions	
Sex		
Male	55.5	54.0
Feminine	44.5	45.8
Mother's age by category		
< 20 years	21.6	16.4
20 – 29 years	48.2	52.0
≥ 30 years	30.0	31.6
Primiparity	50.9	35.6
Type of delivery		
Vaginal	43.4	42.2
Cesarean	56.6	57.9
Marital situation		
With partner	79.7	75.7
Without partner	20.9	24.3
Mother's educational level		
Incomplete primary	28.7	25.5
Complete primary	36.1	37.1
Complete secondary	35.2	34.4
Mother works	22.6	26.7
Father present in child's life	89.0	85.7

Table 1. Sociodemographic characteristics of children at enrollment into the study according allocation group (Intervention (IG) or Control (CG)). Intervention study in Primary Health Care Units of the *Estratégia de Saúde da Família* (Family Health Strategy). Rio de Janeiro Municipality, 2012-2014. (continues)

Sociodemographic variables	IG (n=220)[a]	CG (n=225)[a]
Child attends daycare	1.8	3.6
Household with access to treated water	80.9	87.5
Family receives government benefits	25.7	17.3
Family income (in terms of minimum wage)		
< 1	14.5	8.3
1 – 1.9	46.9	47.9
2 – 2.9	26.6	26.7
≥ 3	12.1	17.1
	Means (standard deviation)	
Child's age (in months)	4.4 (0.28)	4.3 (0.33)
Mother's age (in years)	25.6 (6.63)	26.0 (6.62)
Gestational age (in weeks)	39.0 (2.00)	39.1 (1.83)
Years of schooling (in years)	8.67 (2.56)	8.63 (2.35)

[a]Missing data varied between 0 and 4%.

As for professionals' knowledge of children's diet in the first year of life, at the beginning of children's enrollment in the study, there were differences between the IG and the CG for both indicators we examined: the average scores obtained in the evaluation questionnaires were 8.50 and 6.70, respectively, and the proportions of professionals with adequate knowledge were 72.4 and 15.8%, respectively. These differences were statistically significant (p<0.001).

As for the guidance provided by professionals regarding children's diets in the IG, we observed that the proportion of interviewees who reported having been provided guidance, regardless of whether or not they received the educational material, varied between 39.1% (in the second follow up) and 14.9% (in the last follow up) (table 2). When participants received guidance, in most cases, it was provided by the doctor. The distribution of the manner in which the guidance was provided (spoken, written or spoken and written) varied in each follow up, oscillating between spoken and spoken and written. The proportion of accounts of incorrect guidance, which was 43.8% when children were four months old, was reduced at each follow up,

reaching zero when the children completed 12 months. On the other hand, the proportion of correct guidance did not reach 40.0% in any of the follow ups. In all follow ups, the percentage of interviewees who reported having doubts regarding children's diets after receiving guidance was low.

The proportion of guardians who received the educational material varied between 6.4% (in the first follow up) and 31.2% (in the last follow up), regardless of whether or not they received guidance. In all follow ups, the materials were mainly distributed by ACS or nurses. Of those who received the materials, most read them - between 85.7% (in the first follow up) and 90% of interviewees (in the third) - and a small proportion (between 0.0% and 10%) had doubts when reading the material.

Regarding the level of exposure to the intervention, we observed that more than 50% of IG children were not exposed to the intervention in all of the study's follow ups. The proportion of children in this condition varied between 63.2% (in the first follow up) and 53.6% (in the second follow up), as table 2 shows.

Table 2. Guidance by a health professional and quality of this guidance according to allocation group (Intervention (IG) and Control (CG)) and receiving the study's educational material (Intervention Group) by follow up wave. Intervention study in Primary Health Care Units of the Estratégia de Saúde da Família (Family Health Strategy). Rio de Janeiro Municipality, 2012 – 2014.

Variable	4 months[1]	6 months			9 months			12 months		
	GI (%)	GI (%)	GC (%)	p	GI (%)	GC (%)	p	GI (%)	GC (%)	p
Mother/guardian received feeding guidance from a health professional in the past 30 days	35,5	39,1	35,2	0,432	20,8	12,9	0,078	14,9	3,9	0,000
Professional who provided guidance										
Community health agent	5,1	2,7	2,9	0,002	3,4	5,9	0,058	0,0	25,0	0,072
Doctor	62,8	61,3	81,2		69,0	94,1		75,0	50,0	
Nurse	28,2	29,3	4,3		27,6	0,0		20,0	12,5	
Nutritionist	0,0	0,0	1,4		0,0	0,0		0,0	0,0	
Dentist	0,0	0,0	0,0		0,0	0,0		0,0	0,0	
Others	3,8	6,7	10,1		0,0	0,0		0,0	12,5	
How was the guidance provided										
Spoken	64,1	46,6	48,5	0,819	67,7	52,9	0,379	38,1	87,5	0,006
Written	3,8	2,7	4,4		3,2	0,0		0,0	12,1	
Spoken and written	32,1	50,7	47,1		29,0	47,1		61,9	0,0	
Quality of the guidance provided										
Correct	39,7	35,7	23,8	0,153	36,7	20,0	0,505	38,9	66,7	0,016
Partially correct	16,4	42,9	41,3		50,0	60,0		61,1	0,0	
Incorrect	43,8	21,4	34,9		13,3	20,0		0,0	33,3	
Mother/guardian had doubts after guidance	5,1	7,2	14,7	0,162	3,3	6,3	0,644	0,0	12,5	0,099
Mother/guardian received the study's educational material	6,4	18,8	–	–	24,5	–	–	31,2	–	–
Professional who delivered the material										
Community health agent	50,0	88,2	–	–	32,3	–	–	29,3	–	–
Doctor	14,3	5,9	–	–	16,1	–	–	7,3	–	–
Nurse	28,6	5,9	–	–	45,2	–	–	39,0	–	–
Nutritionist	0,0	0,0	–	–	0,0	–	–	2,4	–	–
Dentist	0,0	0,0	–	–	0,0	–	–	22,0	–	–
Others	7,1	0,0	–	–	6,4	–	–	0,0	–	–
Mother/guardian read the material	85,7	88,9	–	–	90,0	–	–	88,4	–	–
Difficulty understanding the material	0,0	5,6	–	–	10,0	–	–	2,9	–	–
Summary indicator of level of exposure to intervention[2]										
High	5,0	11,5	–	–	9,0	–	–	6,4	–	–
Low	31,8	34,9	–	–	27,6	–	–	33,3	–	–
Unexposed	63,2	53,6	–	–	63,4	–	–	60,3	–	–

[1] The variables presented in this table ar not available for CG children at 4 months of age.

[2] High - received professional guidance and educational material / Low - received professional guidance or educational material / Not exposed - received neither guidance nor educational material.

When compared with the IG, the proportion of mothers/guardians in the CG who received guidance was lower when children were aged six, nine and 12 months and, in the last follow up, only 3.9% of guardians were given guidance, with a statistically significant difference between the groups (table 2). The guidance provided was, for the most part, spoken or spoken and written. We observed, however, that, at 12 months, more than 80% of mothers/guardians in this group received only spoken guidance, while in the IG, 62% of guardians received spoken and written guidance (table 2). As in the IG, in most cases, the doctor was the professional responsible for providing guidance.

As for outcome indicators (table 3), at four months old, the vast majority of children were breastfed (80.1%), but were also given a liquid or food other than breast milk (84.2%), mainly water (65.8%), other milks (51.5%) and porridge (35.7%), and made use of utensils with nipples (74.8%). There were no statistically significant differences between the IG and the CG. The consumption of ultra-processed/non-recommended foods was already a reality for 18.1% of children and was more common among those in the IG (22.7%) than in the CG (13.5%), with statistically significant differences even after adjusting for confounding variables (mother's work, income and attending day care) (p=0.041).

Table 3. Indicators of complementary feeding according to age and allocation group (Intervention or Control). Intervention study in Primary Health Care Units of the *Estratégia de Saúde da Família* (Family Health Strategy). Rio de Janeiro Municipality, 2012 – 2014.

Indicators	4 months[1]				6 months[2]				9 months[3]				12 months[4]			
	IG (n=220)	CG (n=225)	p	Total (%)	IG (n=192)	CG (n=199)	p	Total (%)	IG (n=192)	CG (n=199)	p	Total (%)	IG (n=192)	CG (n=199)	p	Total (%)
Breastfeeding	80.5	79.6	0.813	80.1	75.5	70.9	0.298	73.1	68.4	60.1	0.105	63.9	64.5	34.1	0.000*	46.4
Early introduction of complementary foods	86.4	82.2	0.230	84.3	_	_	_	_	_	_	_	_	_	_	_	_
Timely complementary feeding	_	_	_	_	74.5	62.3	0.010*	68.3	_	_	_	_	_	_	_	_
Adequate number of meals	_	_	_	_	59.9	57.8	0.672	58.8	50.7	56.7	0.253	54.2	59.5	83.3	0.000*	71.4
Varied diet	_	_	_	_	15.1	9.5	0.094	12.3	33.6	28.8	0.340	30.8	31.9	24.0	0.150	27.9
Correct consistency	_	_	_	_	54.2	49.2	0.330	51.7	69.0	80.2	0.018*	75.4	37.2	72.7	0.000*	55.1
Consumption of ultra-processed or non-recommended foods	22.7	13.5	0.011*	18.1	78.2	74.0	0.362	76.1	95.1	98.9	0.037*	97.2	92.8	79.8	0.001*	86.3
Consumption of iron-rich foods	_	_	_	_	69.8	67.3	0.601	68.5	91.4	89.9	0.621	90.6	95.7	97.1	0.490	96.4
Consumption of foods rich in vitamin A	_	_	_	_	60.4	60.8	0.938	60.6	66.4	65.9	0.908	66.1	63.1	46.2	0.002*	54.7
Nipple use (pacifier and bottle)	72.3	77.3	0.219	74.8	78.1	85.4	0.061	81.8	71.7	89.9	0.000*	82.2	67.4	87.5	0.000*	77.5

[1] missing data varied between 0 and 0.9%;
[2] missing data varied between 0 and 9.4%;
[3] missing data varied between 0 and 12%;
[4] missing data varied between 0 and 16.3%.

At six months, 73.1% of children were still being breastfed, with no statistically significant difference between groups (table 3). Timely CF was recorded for 68.3% of children, with higher proportions among children in the IG (74.5%) when compared with those in the CG (62.3%) (p=0.01) (table 3). However, this difference was no longer statistically significant in the multivariable analysis that controlled for confounding variables (mother's work and receiving government benefits) (table 4). The number of adequate meals for the age was observed among 58.8% of children, with similar values in both groups. We observe, therefore, that, despite the high frequency of the timely CF indicator, the offer of meals at an adequate number was a less recurring practice at this age (table 3).

Still at six months, 51.7% of children received meals with an adequate consistency, 68.5% were given iron-rich foods, 60.6% ate foods rich in vitamin A and 12.3% had a varied diet, that is, a diet which included all food groups. Use of utensils with nipples was recorded for 81.8% of children, while the consumption of ultra-processed/non-recommended foods was observed for 76.1%.

At nine months, 63.9% of children were still being breastfed, and this practice was more prevalent among children in the IG (68.4%) than in the CG (60.1%), however this difference was not statistically significant. Of the total of children in the study, 54.2% ate an adequate number of meals and 30.8% had a varied diet, with similar proportions in both groups. Additionally, 75.2% of children ate foods with an adequate consistency, with a higher proportion of children in the CG (80.2%) than in the IG (69%) (p<0.018). However, this difference was not statistically significant in the multiple model (table 4). At that age, the proportion of children who ate ultra-processed/non-recommended foods was higher than 95% overall and was a little higher in the CG (98.9%) when compared with the IG (95.1%) (p=0.037).

Table 4. Model adjusted for the main complementary feeding indicators for each follow up wave. Intervention study in Primary Health Care Units of the *Estratégia de Saúde da Família* (Family Health Strategy). Rio de Janeiro Municipality, 2012 – 2014.

Indicators	4 months		6 months		9 months		12 months	
	Adjusted OR[1]	(95% CI)	Adjusted OR	(95% CI)	Adjusted OR	(95% CI)	Adjusted OR	(95% CI)
Early introduction	1.453[2]	0.861 – 2.453						
Ultra-processed	1.698[3,7]	1.021 – 2.824					2.083[2,5]	0.935 – 4.640
Nipple			0.660[2]	0.390 – 1.120	0.702[5,7]	0.395 – 1.247	0.356[2,5,7]	0.197 – 0.646
Varied diet								
Correct consistency					0.764[2,6]	0.424 – 1.361	0.597[2,3,5,6]	0.338 – 1.054
Vitamin A			1.051[4]	0.696 – 1.587	1.114[4]	0.701 – 1.770	1.515[5]	0.938 – 2.445
Iron							0.606[6]	0.156 – 2.351
Adequate meal							0.532[3,4,5,6]	0.290 – 0.975
Breastfeeding							3.019[2,3,4,5,6,7]	1.809 – 5.041

[1] Base category: Intervention Group; [2] adjusted for mother's work; [3] adjusted for income; [4] adjusted for receiving benefits; [5] adjusted for attending daycare, [6] adjusted for treated water;

[7] p-value < 0.05.

Still at that age, the consumption of foods rich in vitamin A and iron was recorded for 66.1% and 90.6% of children in the study, respectively, with similar proportions in the IG and the CG. The use of utensils with nipples remained high in both groups and was higher in the CG (89.9%) than in the IG (71.7%) (p<0.001), even after adjusting for confounding variables (table 4).

When children reached 12 months, 46.4% of women continued to breastfeed their children. Breastfeeding at that age was expressively higher among children in the IG (64.5%) when compared with those in the CG (34.1%), p<0.001. The CG had higher percentages than the IG for the outcomes "correct food consistency" (p<0.001) and "adequate number of meals" (p<0.001), with only the latter difference remaining statistically significant after adjusting for confounding variables (p=0.041) (table 4).

We observed a dose-response effect only for nipple use at nine months (table 5). For the indicators related to adequate number of meals, diet variety and food consistency, despite a lack of statistical significance, we observed an expressive difference in the indicators' percentages according to exposure level at nine months, with better results in the exposed groups.

Table 5. Complementary feeding indicators from four to 12 months of age, according to level of exposure to intervention in the Intervention Group. Intervention study in Primary Health Care Units of the Estratégia de Saúde da Família (Family Health Strategy). Rio de Janeiro Muncipality, 2012 – 2014.

Indicators	4 months				6 months				9 months				12 months			
	Exposed (%)	Unexposed (%)	OR	95% CI	Exposed (%)	Unexposed (%)	OR	95% CI	Exposed (%)	Unexposed (%)	OR	95% CI	Exposed (%)	Unexposed (%)	OR	95% CI
Breastfeeding	80.0	80.0	1.00	0.404 – 2.472	76.4	74.8	1.09	0.564 – 2.118	66.7	68.6	0.92	0.419 – 2.006	64.3	64.7	0.98	0.485 – 1.987
Early introduction of complementary foods	85.7	86.7	0.92	0.326 – 2.611	–	–	–	–	–	–	–	–	–	–	–	–
Timely complementary feeding	–	–	–	–	78.7	70.9	1.62[3]	0.827 – 3.160	–	–	–	–	–	–	–	–
Adequate number of meals	–	–	–	–	61.8	58.3	1.23[3]	0.680 – 2.204	59.0	45.7	1.71	0.811 – 3.595	58.3	60.2	0.92	0.448 – 1.904
Varied diet	–	–	–	–	15.7	14.6	1.19[3]	0.531 – 2.648	43.6	29.5	1.85	0.863 – 3.941	37.5	28.2	1.53	0.744 – 3.127
Correct consistency	–	–	–	–	57.3	51.5	1.18[3]	0.661 – 2.110	76.3	65.0	1.74	0.739 – 4.073	59.3	62.8	0.86	0.423 – 1.753
Consumption of ultra-processed or non-recommended foods	25.7	32.8	0.67[1,2,3]	0.284 – 1.579	67.5	75.0	0.69	0.360 – 1.326	91.7	91.8	0.98	0.245 – 3.908	96.3	98.8	0.33	0.029 – 3.723
Consumption of iron-rich foods	–	–	–	–	70.8	68.9	1.09	0.588 – 2.028	92.3	90.5	1.26	0.329 – 4.853	96.4	95.3	1.33	0.236 – 7.536
Consumption of foods rich in vitamin A	–	–	–	–	61.8	59.2	1.11	0.623 – 1.991	66.7	66.7	1.00	0.459 – 2.181	69.6	58.8	1.61	0.786 – 3.282
Nipple use (pacifier and bottle)	68.6	73.3	0.82[2]	0.284 – 1.579	83.1	73.8	1.76[4]	0.838 – 3.682	53.8	77.1	0.35	0.159 – 0.752[5]	67.9	67.1	1.04	0.505 – 2.132

[1]– father present in child's life; [2] – mother's educational level; [3] – treated water; [4] – type of delivery; [5]–p valor < 0.05

DISCUSSION

Although professionals of units allocated to the IG had greater knowledge regarding complementary feeding at the beginning of children's enrollment in the study, we observed similar profiles of dietary practices among children in the IG and the CG for practically all indicators in the four follow ups. Except for nipple use, we did not observe a dose-response effect. These findings lead to a reflection regarding contextual factors that may have occurred and interfered in the complex causal chain between intervention and outcomes.[14]

The first aspect that may help explain these results is the fact that intervention coverage among IG families was low. It is also worth noting the low proportion of families that received guidance from a health professional in the CG.

In the case of IG children, in addition to the low proportions of guardians who received the study's educational material, another aspect worth noting is the fact that, although that material was mostly provided by ACS, the guidance was largely provided by doctors. The educational material, which should serve as a facilitator for providing guidance and, therefore, serve as a support to dietary practices at the children's homes, does not seem to have played this role.

In focal groups that were carried out as a formative step for formulating the educational materials and professionals' training activity, participants discussed aspects of the ESF operational dynamics that may help us understand these findings. A recurring account was that ACS work is increasingly concentrated on scheduling consultations and on administrative tasks, leaving less time for educational activities. Doctors, in turn, stated that they have to provide care to a large number of children in a short period of time. Both mothers and doctors stated that there was no space for discussing children's diets in routine pediatric appointments and that the subject was only addressed if the mother or guardian indicated having doubts about it. The training offered by the study seems not to have been sufficient to fully revert this culture and establish children's diets as an indispensable topic in pediatric appointments.

The second aspect worth noting is that the quality of the guidance provided to IG guardians fell short of expectations, considering that, in the beginning of children's enrollment, the proportion of professionals with adequate knowledge of CF was high. A factor that may explain this finding, at least in part, concerns cultural aspects, beliefs and taboos that permeate dietary practices in this stage of life, both among professionals and among guardians. Professionals have difficulty revising knowledge they acquired during their professional training and incorporating new information into their routines. This leads the guidance they provide to be conflicting and based on personal and professional experience and on materials from

commercial sources,[15] allowing third parties to occupy this space and provide often inadequate guidance on children's diets.[16,17] Often, neighbors, family members, and friends are the ones responsible for informing and guiding food introduction.[18,19]

Our finding should be interpreted with caution, however, since the analysis of guidance quality was based on mothers' accounts, and not through direct observation, by a researcher, of the guidance provided by health professionals.

Another factor that may explain both the low level of exposure to the intervention and the lower-than-expected quality of the guidance provided by professionals is the turnover of professionals who participated in the training activity: 27.3% of them left their respective units during the study.

A third aspect worth discussing is the time elapsed between professionals' training and the interviews with children's guardians at each follow up: from 4.4 (first child) to 9.8 months (last child recruited) in the first; and from 12.2 to 17.4 months in the last follow up. Although we showed that, four months after the training activity, professionals retained knowledge on CF, there is no way to guarantee that this continued to be true over time. Additionally, even if professionals could retain this knowledge, the fact that no activities took place to reinforce the subject among professionals may have led them to lose motivation. Complementary analyses of the outcome indicators according to time elapsed since the training activity may provide additional information on this subject.

One of the study's limitations is the fact that the training activity design focused fundamentally on aspects related to the provision of feeding guidance, not including, due to time constraints, a more structured approach of counseling,[20-22] a theme that is addressed in other training opportunities offered to health professionals, but that would be of great value for the intervention we studied.

The second limitation concerns a possibly insufficient control of potential confounding factors, since we did not include in the analyses the existence of other children under the age of five years in the same household as the child enrolled in the study, due to inconsistencies in the recording of this information in the questionnaire. This is an important factor associated with the diets of children under one year of age, since they share foods with other children and family members in their homes, in addition to the mother/guardian having to divide their attention between multiple children.[23]

A further limitation was the fact that the questionnaire used to assess children's eating practices was not validated. It is worth noting, however, that the instrument was based on the

questionnaire proposed by the WHO[12] and on the dietary practices questionnaires used in vaccination campaigns,[13] and was previously tested.

Another aspect that deserves attention is the fact that guardians of children in the CG were approached at all follow-up moments to answer the questionnaire on dietary practices. We cannot rule out the possibility that the interviews that took place when the children were four, six and nine months of age contributed to the mothers reflecting on their children's diets and altering, to some extent, their practices (intervention bias).

One of the study's strengths is the adoption of a theoretical model which served as a basis and afforded coherence between the formulation of the training activity and the construction of both the questionnaire used to assess dietary practices and the outcome indicators we examined. Another aspect worth noting is the design of the training activity, structured based on focus groups with professionals and mothers in which their main doubts and difficulties were raised. Additionally, the content, approach techniques and presentation format were previously tested.

The fact that the training was directed toward ESF multidisciplinary teams can also be considered a strength, since the activity was designed to be carried out as part of units' routine, which speaks in favor of the feasibility of its implementation in the reality of the Unified Health System. Additionally, this design contemplated not only sensitizing professionals, but also providing them skills for handling complementary feeding.

Although the sample was not designed for a survey of CF practices, an additional contribution of the study was to provide precious and rarely available information regarding the dynamics of diets over the course of the first year of life among children enrolled in the ESF, using indicators constructed specifically for this life stage. In addition to the introduction of other foods in the first six months of life, already reported in other surveys over the previous decades,[9,24-26] we were able to observe the presence of ultra-processed/non-recommended foods at four months of age and the increase in the proportion of children who consume them at six, nine and 12 months of age. Studies carried out in southern Brazil corroborate our findings.[27-29] On the other hand, the energy density assessed through meal consistency and diet variety, two crucial components of CF, fell short of recommendations among the children included in the study at all follow up moments.

CONCLUSIONS

Our findings reiterate the urgency of implementing effective actions for promoting healthy CF, the importance of qualifying the approach to CF in the primary health care network and the need to develop activities that contemplate the counseling approach, establish regular reinforcements of the subject and motivate professionals. In addition to training professionals already inserted into the health network, it is crucial that we review the curricula of university courses in the health field. Otherwise, continuous training activities will always have the difficult task of deconstructing an inadequate approach to CF.

The early presence of ultra-processed foods in children's diets and the increase in their consumption over the first year of life point to the need to include indicators that monitor these practices in population surveys and food and nutrition surveillance systems. They also point to the importance of longitudinal analyses that enable us to develop our knowledge of feeding dynamics over the first year of life and to know the impact of interventions such as this one in different contexts.

Lastly, it is worth recording that the inadequate profile of dietary practices shown in this study for the enrolled children reiterates the urgency of public policies that integrate activities that encourage, support and protect healthy eating that go beyond the guidance and counseling provided within primary health care. These policies should encompass measures to protect children from consumption of ultra-processed foods,[30] including regulatory actions directed at reducing families' exposure to these products.[12]

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Silva GB contributed to conception and design, fieldwork, data analysis and interpretation, drafting the manuscript; Castro IRR contributed to conception and design, fieldwork coordination, data analysis and interpretation, revision of final manuscript; Faria SC, Oliveira JM contributed to conception and design, fieldwork, revision of final manuscript.

Conflict of interests: the authors declare no conflicts of interest.