



Informing Infant Nutrition: Timing of Infant Formula Advice, Infant Formula Choice and Preparation in the First 6 Months of Life

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ABSTRACT

Objective: To examine the sources and timing of advice formula feeding parents receive and how this and other factors influence the choice of formula product and formula preparation.

Design: Components of a cross-sectional survey.

Setting: A child and family health service in New South Wales, Australia.

Participants: Parents (n = 153) who were fully or partially formula feeding infants aged 0–6 months and who visited the service's facilities or its social media site.

Variables Measured: Type of formula, preparation of formula, and use and sources of formula feeding advice.

Analysis: Descriptive statistics, Mann-Whitney U or Pearson's chi-square tests, and inductive content analysis.

Results: The most common source of formula feeding advice was the formula tin/packet (96.6%). Although 79.2% received advice from a health professional, only 18.9% reported receiving this advice before using formula. Approximately half (48.0%) of the parents chose a standard cow's milk-based formula. The most common reason for their choice of formula type/brand was a personal recommendation (53.0%). Parents' responses indicated that nearly half (46.3%) incorrectly prepared the formula.

Conclusion and Implications: Although health professional advice was widely received, this was rarely before starting formula. Despite the current national infant feeding regulations, parents who were not exclusively breastfeeding their infants did not always receive timely, health professional advice about formula feeding.

Key Words: infant feeding, food policy, breast-milk substitutes, WHO code (*J Nutr Educ Behav.* 2022;54:908–915.)

Accepted June 5, 2022.

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Conflict of Interest Disclosure: The authors have not stated any conflicts of interest.

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<https://doi.org/10.1016/j.jneb.2022.06.002>

INTRODUCTION

Breastfeeding provides optimal nutrition for infants exclusively during their first 6 months of life, followed by breastfeeding alongside solid foods for at least 12 months.¹ Breastfeeding provides many health benefits for both the mother, such as the reduced risk of diabetes and breast cancer and the infant, such as the reduced risk of infections, asthma, and diabetes.¹ Infant formula is a safe alternative to breastfeeding, albeit with fewer health benefits.² Rates of formula feeding and breastfeeding differ across the world. However, it is estimated that 43% of infants are exclusively breastfed to 5 months worldwide.³ In Australia, around half of all infants are fed infant formula

to some extent in their first 6 months.⁴ Understanding formula feeding practices, such as the choice of formula and preparation of formula, and their determinants, such as information and support, is important as it impacts many infants worldwide.

Parents feeding with formula receive no, or very limited, information and support from health professionals,^{5–7} compared with breastfeeding advice and support.^{8,9} For example, an Australian study with mothers of infants aged 6 months showed that 51% were using formula, but only 38% had received any information about formula from a health professional.⁷ This can result in parents preparing formula in an unsafe manner⁵ or feeling uncertain about formula feeding.⁶ Some parents do have access to limited formula feeding advice and support from health professionals,^{8,10} but studies continue to find that parents have difficulty understanding differences between formula products and that there are few resources to assist them in choosing between products.^{11,12}

Available infant formulas range widely from the basic formula with milk-based or plant-based ingredients to premium formula with added ingredients such as probiotics and specialty formula designed and marketed for infants with specific conditions such as colic, reflux, or lactose intolerance. This abundance of choice can be confusing for parents, particularly without attendant advice or tools to easily understand the formula product information on packaging or advertising.^{11–13} This is important given the longstanding evidence that formula marketing affects infant feeding.^{14,15} Specifically, studies have shown that exposure to formula marketing decreases breastfeeding rates¹³ and impacts the type of formula chosen.^{11,15}

Studies from the US and the United Kingdom have found that more than half of parents incorrectly prepare formula.^{16,17} Incorrectly prepared formula can have negative health consequences for infants, including excess weight gain,¹⁸ hypernatremia when too concentrated,¹⁹ and hyponatremia when under concentrated.²⁰ In Australia, formula tins must provide

preparation techniques and a warning about following instructions exactly.²¹ However, these instructions are sometimes misunderstood by parents^{16,22,23} or ignored.^{16,22} One reason for ignoring instructions may be to make the formula stretch further because of cost.^{5,20}

The importance of adequate information, particularly from health professionals, about the correct use of formula is incorporated in the World Health Organization's International Code of Marketing of Breast-milk Substitutes (WHO Code).²⁴ In Australia, regulation in line with the WHO Code²⁴ states that infant formula and follow-on formula (for infants aged up to 12 months) must carry a warning stating that advice should be sought from a health professional before using formula.²¹ However, despite this warning statement, there is no evidence indicating how many parents seek advice from health professionals before they start using formula.

In a sample of Australian parents feeding formula to infants aged < 6 months, we aimed to examine (1) the sources and timing of advice and (2) how the timing and source of advice, along with demographic and other factors, are related to the choice of formula product and formula preparation.

METHODS

Participants and Recruitment

Participants were recruited through Tresillian Family Care Centers (Tresillian), a child and family health service in New South Wales, Australia, via in-person advertising at 3 metropolitan parent support facilities and on this organization's social media page. Tresillian is a not-for-profit early parenting service available to all families with children aged 0–5 years. It provides free support around breastfeeding, infant nutrition, sleep, and settling as well as parenting and mental health screening and support for parents. Parents of infants aged < 6 months who were aged > 18 years and could read and understand the English language were eligible to participate in the

study. Exclusion criteria included: gestation < 35 weeks, ≤ 2500 g birth weight, living outside Australia, or a health condition affecting feeding. For the analysis presented here, only those respondents who reported current formula use were included. To access the online survey, interested parents clicked a link displayed at the organization's 3 facilities or on the social media page. Participant information about the study was provided in the introduction, and submitting the survey constituted informed consent. Physical copies of the participant information and questionnaire were also available at the organization's 3 facilities; these completed questionnaires were placed in a sealed box and collected by the research staff. The study protocol underwent full ethics committee review. It was approved by the Sydney Local Health District Human Research Ethics Committee and The University of Technology Sydney Human Research Ethics Committee.

Measures

We examined 4 outcomes: (1) whether parents received advice from a health professional (yes or no), (2) whether they received any advice before starting formula use (yes or no), (3) the type of formula they purchased (standard or premium/specialized [organic, extensively or partially hydrolyzed protein, milk other than standard cow's milk, and those marketed as premium or for specific infant medical issues, such as reflux]), and (4) the preparation of formula (correct or incorrect, [Table 1](#)).

We also explored why parents chose specific brands of formula and (if relevant) why they added additional formula or cereal to their infants' bottles. These issues were explored with open-ended questions.

Procedures

An online survey was developed, incorporating bespoke questions on infant nutrition and validated instruments on infant feeding behavior (analyzed elsewhere^{25,26}). The survey included demographic questions

Table 1. Items to Assess Formula Preparation Technique

Item	Response				
	Coded as Incorrect Preparation				Coded as Correct Preparation
If you make up formula milk from powder, are the scoops ^a	Rounded/heaped				Flat
If you make up formula milk from powder, are the scoops ^a	Tightly packed (pressed down)				Loosely packed
If you make up formula milk from powder, what do you add to the bottle first? ^a	Powder first				Water first
How many scoops of formula and how much water do you usually add per feed? ^b	Incorrect water-to-powder ratio				Correct water-to-powder ratio
I put infant cereal in my baby's bottle	Always	Mostly	Sometimes	Rarely	Never
I added more formula than is recommended on the tin	Always	Mostly	Sometimes	Rarely	Never

^aParticipant could also choose the option, "I don't use formula powder"; however, no participants selected this option; ^bResponse was reported as the number of formula scoops and amount of water in milliliters. We then checked these numbers against the formula-to-water ratio recommended for each type of formula.

(parent age, education, health care card [a concession card available for those receiving government support eg, unemployment benefits which provide subsidized health care], infant gender (male/female), age, and the number of siblings), age started formula, age weaned from breastfeeding/breast milk, formula type, preparation, and timing and sources of feeding advice. The formula type, preparation, and sources of feeding advice questions were based on questionnaires developed and used in previous infant feeding studies.^{27–29} The type of formula was recorded as the brand name and type, which was later hand-coded into a standard formula or premium/specialized formula using a reference guide³⁰ and the formula manufacturers' websites. Formula preparation was assessed by 6 items aligned to the steps in preparation when making formula from powder: (1) if the scoops were rounded/heaped or flat, (2) if the scoops were tightly or loosely packed, (3) if parents added the water or powder to the bottle first, (4) the number of scoops and amount of water, (5) if parents added cereal to the bottle and (6) if they put more powdered formula than recommended (Table 1). These were coded into 1 dichotomous variable (correct preparation [all items correct] or incorrect preparation [1 or more items incorrect]). Free-text questions asked

respondents to indicate the reasons for their choice of formula type and for adding any extra formula powder or cereal. The online survey was pilot-tested with a small number (n = 15) of parents recruited by snowball sampling and revised following feedback. For development and distribution, the online survey tool SurveyGizmo (Alchemer.com, 2022) was used.

Participants were asked if they received and followed advice from 9 potential sources of information. These included 5 professional sources: (1) midwives; (2) child and family health nurses (CFHN; including Tresillian nurses), who are specialist nurses who have advanced education or training on infant development, including infant feeding³¹; (3) general practitioners (GP); (4) practice nurses (PN), who are nurses working in a GP practice; and (5) pharmacist or pharmacy staff. In addition, 4 nonprofessional sources were included: (1) friends, (2) family, (3) formula packets/tins, and (4) online. Participants could also add other sources of advice, categorized into health professional and nonprofessional sources. All responses were coded into 1 dichotomous variable (advice from a health professional or no advice from a health professional). The timing of advice was assessed by 1 dichotomous item: Was the advice received before starting formula? (response options: yes or

no). The participants were asked for the source of this advice, and responses were coded into advice from a health professional or advice from other sources.

Data Analysis

Descriptive statistics were used to explore the sample characteristics and formula type, preparation, advice timing, and advice source. Mann-Whitney U and Pearson's chi-square tests were used to examine differences in participant characteristics for the dichotomous variables. Effect sizes were calculated using odds ratio and Cramer's V^{32} and interpreted on the basis of standard effect size guidelines (large $r = 0.37$, medium $r = 0.24$, and small $r = 0.10$).³³ Missingness was assessed by comparing complete cases with incomplete cases included in the analysis presented here (ie, those reporting current formula use) and appeared to be similar. Therefore, an available-case analysis was conducted, assuming missing data were missing at random. Inductive content analysis, a systematic method of classifying and analyzing textual data, was used for the open-ended questions.³⁴ The unit of analysis for the inductive content analysis was each participant's response, and the procedure involved first open coding of the response, then grouping codes and finally categorization of codes.³⁴ One researcher conducted

this analysis. Proportions of response in each category and subcategory were reported, each unit of analysis could be coded in multiple categories, and exemplar quotes for each subcategory were reported (Supplementary Table 1).

RESULTS

Participant Characteristics

In total, 445 parents responded to the survey. The current sample consisted of 153 (34.4%) of these respondents who indicated they were currently feeding with formula. The majority of participants were mothers (99.3%), 51% were mixed feeding (with formula and breast milk), and 49% were formula feeding their infants (Table 2). Only 10 (6.5%) had never breastfed their infant.

Sources of Advice (n = 149)

The majority (79.2%) of participants received information or advice about

formula feeding from at least 1 health professional (Table 3), with CFHNs and GPs being the most common (Supplementary Table 2). Respondents generally reported following health professional advice (at least partially), with only a minority not following any of the advice given (Supplementary Table 2). The formula tin was the most cited source of information or advice (96.6%); however, 5 participants reported not receiving any information or advice from the tin, and 3 participants reported they did not follow the information or advice on the tin (Supplementary Table 2). Overall, only 3 participants reported receiving no advice at all.

There was no difference between the group who received advice from a health professional and those who did not with regard to demographics, except for infant age when the formula was started (Supplementary Table 3). Those who had received advice from health professionals had

started formula when their infant was younger (median 7 days) compared with those who had not received advice (median 21 days).

Timing of Advice (n = 148)

Although 32.4% of respondents reported receiving advice before starting formula, only 18.9% identified receiving this advice from a health professional (Table 3). There was no difference between the group who received advice before starting formula feeding and those who did not receive advice before starting formula feeding with regard to the tested demographics, except for feeding status and the infant's age when formula feeding started (Supplementary Table 3). Parents who were mixed feeding had 3.8 times higher odds of getting any advice before starting formula than those full formula feeding. The parents who did get advice before starting formula started when their infant was older (median age 21 days) compared with those who did not get advice before starting (median 7 days; Supplementary Table 3).

Formula Type (n = 152)

Almost half the participants (48.0%) used a standard formula, whereas 52.0% used a specialized formula (Table 3). There were no statistical differences in the proportion of parents using a standard or specialized formula by parent or infant demographics or by whether they had received advice from a health professional or before starting formula (Supplementary Table 3).

Content analysis identified 9 major categories for selecting formula (Supplementary Table 1). Each parent response included up to 3 of these major categories (eg, "made in Australia, organic, recommended," participant 430). The most cited reason was a recommendation cited in 53% of responses. This category included recommendations from a health professional, friends, family, or social media, prescribed formula, or formula used by the birth hospital. The other major categories included infant health or behavior (eg, 28% of responses: "Because she doesn't

Table 2. Participant Characteristics (n = 153)

Characteristics	n (%) or Mean ± SD; Median (Interquartile Range)
Feeding status (n = 153)	
Formula feeding	75 (49)
Mixed feeding	78 (51)
Age started formula, d	30.1 ± 40.5; median: 14 (40)
Age weaned from breast milk, wk (n = 62)	6.3 ± 5.0; median: 5 (6)
Infant demographics (n = 153)	
Only child	109 (71.2)
More than 1 child	44 (28.8)
Age of baby, wk (n = 152)	14.4 ± 6.5; median 14 (11)
Gender (n = 149)	
Boy	74 (49.7)
Girl	75 (50.3)
Parent demographics (n = 140)	
Mother	139 (99.3)
Father	1 (0.7)
Age, y	
20–24	14 (10)
25–29	43 (30.7)
30–34	50 (35.7)
35–39	27 (20)
40–44	5 (3.6)
Education ^a diploma (or lower)	72 (52.6)
Education ^a university	65 (47.4)
Health care card ^b	
No	118 (84.9)
Yes	21 (15.1)

^an = 137; ^bn = 139.

Table 3. Primary Outcomes: Source and Timing of Advice, Type of Formula, and Preparation of Formula

Variables	n (%)
Source of advice (n = 149)	
Advice from a health professional	118 (79.2)
No advice from a health professional	31 (20.8)
Timing of advice (n = 148)	
No advice before starting to give formula	100 (67.6)
Any advice (health professional or other sources) before starting to give formula	48 (32.4)
Advice from a health professional before starting to give formula	28 (18.9)
Type of formula (n = 152)	
Standard	73 (48.0)
Premium/specialized ^a	79 (52.0)
Preparation of formula (n = 148)	
Correct preparation	80 (53.7)
Incorrect preparation ^b	69 (46.3)

^aPremium/specialized formula premium, organic, extensively or partially hydrolyzed protein, milk other than standard cow's milk, those marketed for specific infant medical issues (eg, reflux), and formulas only available on prescription from a doctor; ^bIncorrect preparation = 1 + incorrect responses to 6 preparation items (see Table 1).

throw it up," participant 935), marketing attributes (14% of responses: eg, "Packaging," participant 507), perceived quality (13% of responses: eg, "Apparently it's the closest to breast milk due to the protein percentages," participant 1062), trial and error (10% of responses: eg, "I tried other formulas but they made him upset and constipated," participant 245), previous use (9% of responses: eg, "This is the brand I gave my older daughter. Seems to be ok with her as well," participant 245), ingredients (7% of responses: eg, "Wanted organic," participant 97), pragmatic reason (5% of responses, eg, "Husband picked up," participant 862), and "No reason in particular," participant 595 (1% of responses).

Preparation of Formula (n = 149)

Nearly half (46.3%) of the participants made 1 or more errors in their preparation of formula (Table 3). The most commonly reported error was using tightly packed scoops (n = 53; 35.6%), followed by incorrect water to powder ratios (n = 8; 5.4%), and rounded/heaped rather than flat scoops (n = 7; 4.7%). Eight (5.4%) reported adding extra formula powder or cereals to the bottle for the following reasons (n = 5):

"nutrition," participant 808, that the infant was starting solids soon (n = 2), so the infant would "sleep longer," participant 525, and because the infant was "underweight and doesn't seem to drink a lot of volume," participant 1070. There were no statistically significant differences between parents preparing formula correctly or incorrectly by the demographics or by the timing of advice from a health professional (Supplementary Table 3).

DISCUSSION

Preparing and feeding infant formula is important for healthy infant growth and development. Despite this, there are few studies^{5,11,12,15,16,22} on the factors influencing parents' decision-making and practices about formula feeding. This study provides novel information about when and from whom parents received advice, the formula they chose and why, and how they prepared it. Key findings were that nearly all parents received formula advice from a health professional at some point, although this was rarely before beginning formula feeding. In this general population, parents typically consulted health professionals in primary health care settings such as GPs (family

physicians), nurses, and midwives rather than those with specialist skills in infant nutrition and dietetics. Health professionals and the formula tin were the main sources of formula feeding information and advice, with almost all parents following both sources.

Although other studies have indicated that health professionals are a source of formula feeding advice for some parents,^{8,10} they also reported lower proportions receiving advice. Similar to another Australian study,⁸ in this study, health professional advice was more likely to be given when infants were younger. However, it was not necessarily received before they had started formula feeding. Previous qualitative research reported similar findings and indicated that some parents began formula feeding in a rushed manner and may not have had time to seek or receive advice before beginning.¹¹ This rush may be associated with starting at a younger age when breast milk supply is still being established. This could also account for the finding that those who received advice before starting formula began using formula when their infant was older.

The 2 main health professional sources of advice were GPs and CFHNs, who work in primary health and community settings. Recent Australian studies report CFHNs having high confidence in providing formula feeding advice, likely because of their focus on infant feeding and health.^{35,36} However, GPs do not necessarily have any education and training specifically in infant feeding. A UK study found GPs were less confident than health visitors (UK equivalent to Australian CFHNs) in providing infant feeding information.³⁷ There is very little understanding of the extent of knowledge or information sources about formula feeding among GP, CFHN, and other health professionals, such as dietitians. A recent qualitative study in Australia found that CFHNs reported lacking education and training about bottle feeding.³⁸ In the United Kingdom and Australia, some health professionals rely on manufacturer advertising for information.^{39,40} In contrast, other studies report that health professionals feel that their

access to information on formula feeding (from manufacturers or otherwise) is limited.^{41,42} Unfortunately, current Australian infant feeding guidelines do not provide enough detail for health professionals to ably assist parents in choosing between different formula types.⁴³

Consistent with older studies from the US,^{15,44} the current research found that Australian parents' formula choice was influenced by various factors, including recommendations, price, and suitability for the infant. Indeed, most parents indicated that they followed the advice for most sources of information. However, the relative impact of these sources and whether they are contradicting or complementary is unclear. One US study found the most common reason for parents' choice of formula was that the birth hospital used it.¹⁵ This was also among the top reasons parents cited in the current study, even though in Australia, the exposure to formula samples at hospital discharge is minimal, unlike in the US, in which most had received formula samples.¹⁵

This study identified gaps in parents' understanding of formula feeding and preparation. Nearly half the participants reported at least 1 incorrect practice in preparing formula. This concurs with other evidence using objective methods (eye-tracking and observed formula preparation) that both unintended and intended deviations from the correct preparation occur.^{18,22} However, in this context, neither access to health professional advice, the timing of advice, or any other tested demographic variables were associated with (in)correct preparation. This builds on previous research from the US that also found demographic variables were not associated with formula preparation practices but did not investigate advice or timing of advice.¹⁶ Unlike previous research, this study also explored why parents added cereal or extra formula. Although only a small minority did so, their reasons were illuminating and showed that some parents held unfounded beliefs about the benefits of extra formula or formula with cereal for infant sleep or diet.²²

Among the present sample, most had not discussed their decision to

formula feed with a health professional before using formula. As noted above, previous qualitative research had also identified this finding¹¹; however, to our knowledge, this is the first study to quantify this aspect of the timing of formula information and advice. Although the reasons for this are unclear, they have not received timely support for breastfeeding or mixed feeding, when needed, or advice on the correct use of formula. Timely advice for infant feeding is important to support responsive feeding practices,⁴⁵ particularly when feeding with formula.⁴⁶ Formula supplementation of otherwise breastfed infants can lead to formula completely replacing breastfeeding.⁴⁷ What is interesting in the current study is that more of the parents who were mixed feeding (46.1% vs 18.1%) had received advice before starting formula than parents who were exclusively formula feeding. The continuation of (partial) breastfeeding may result from their interaction with those they sought advice.

The finding that most had not discussed their decision to formula feed with a health professional before using formula has implications for the regulation of formula and the wider health care system in Australia and other countries with similar regulations. The Manufacturers and Importers Agreement⁴⁸ and Food Standards Australia New Zealand (FSANZ) regulations²¹ regulate formula products and marketing in Australia. In line with article 9.2 of the WHO code,²⁴ FSANZ regulations explicitly state that formula packaging should warn parents to consult a health professional before starting to feed their infant formula products.²¹ Data from the current study clearly show that parents were not doing so in most cases. This is despite being in a health care context with access to universal free early parenting CFHN services.³¹ Possible reasons for parents not receiving timely advice may be that parents do not see or read the warning instructions on formula packages²² or there could be the perception that health professionals do not talk about formula and/or only focus on breastfeeding^{11,49} and the stigma felt by some parents

about formula feeding.^{10,11} However, these later explanations do not account for the finding that most parents in the current study received advice about formula at some point from a health professional. Furthermore, this warning label approach assumes that parents have relatively high English literacy levels. It represents a passive approach to infant feeding advice that directs much of the responsibility on the parent to seek the advice, rather than health professionals providing proactive or anticipatory guidance.

However, the dilemma for health professionals when considering providing parents with proactive or anticipatory guidance about evidence-based formula feeding is a commitment to promoting breastfeeding, when supporting formula feeding is seen as undermining parents' confidence in successful breastfeeding.^{38,50} Although there is no simple answer to this dilemma, 1 approach is not to classify parents into feeding categories but rather have a family-centered approach.⁵⁰ Another approach is to consider the broader environment in which parents make these decisions; breastfeeding promotion should protect the environment for both formula feeding and breastfeeding parents (and parents to be) from marketing strategies pushing formula.⁵¹

There are several limitations of this study. It is a self-report survey with a self-selected sample of Australian parents. In addition, recruiting via a child and family health service and their social media page may have resulted in a sample experiencing more parenting difficulties than others, and the sample may be more help-seeking than the general population. Responses from parents of young infants who may be tired or stressed are likely affected by recall bias or social desirability bias, especially regarding formula preparation practices.⁵² The measures have good face validity, but further validation of the formula feeding items used in this paper is required. Preparation of the formula was self-reported, not observed; therefore, the true errors in preparation are not apparent. Observational studies and studies quantifying the concentration of prepared

formula via chemical analysis are needed to validate the self-reported formula preparation items. Only 1 researcher conducted the content analysis, which therefore lacks inter-coder agreement.

IMPLICATIONS FOR RESEARCH AND PRACTICE

Further research is needed to understand health professionals' practice and knowledge around formula feeding and whether and from where they get any ongoing education and training. There is a need for further research about parents' formula preparation and why unintentional and intentional errors occur. The in-hospital supplementation of otherwise breastfed infants is known to influence breastfeeding, but less is known about how it influences parents' ongoing infant formula feeding, which indicates a need for more research. Future research could also consider how often parents receive health professional advice and how influential this avenue of advice is compared with other sources. Importantly, the findings from the current study highlight the need to understand why parents start formula feeding without getting professional advice and how to remedy this situation.

Parents using formula to feed their infants often do not receive health professional advice before using formula. This has important practice and policy implications as current regulations in Australia designed to protect and support breastfeeding and support the correct use of formula specifically require formula tins to carry a warning that breastfeeding is the optimal infant nutrition and that parents should seek health professional advice before using formula. This warning is not producing the desired effect that parents discuss formula with a health professional before starting formula. Furthermore, many parents are making errors in preparing formula, despite the mandatory detailed instructions on the packaging, thereby questioning the efficacy of the manufacturers and importers and FSANZ regulations to protect breastfeeding and ensure the proper use of infant formula.

ACKNOWLEDGMENTS

This work was supported by the Health Futures Development Grant from the Faculty of Health, University of Technology Sydney. The funder had no role in the design, analysis, or writing of this article. The authors want to acknowledge Tresillian Family Care Centres and their staff for their support in advertising this study and recruiting participants and thank the parents who participated.

SUPPLEMENTARY DATA

Supplementary data related to this article can be found at <https://doi.org/10.1016/j.jneb.2022.06.002>.

REFERENCES

1. Victora CG, Bahl R, Barros AJD, et al. Breastfeeding in the 21st century: epidemiology, mechanisms, and lifelong effect. *Lancet*. 2016;387:475–490.
2. Felice JP, Rasmussen KM, Geraghty SR. The evolution of breast pumps and bottles and a revolution in infant feeding ed. In: Ventura AK, ed. *Bottle-Feeding: Perceptions, Practices and Health Outcomes*, Nova Science Publishers; 2018.
3. United Nations Children's Fund (UNICEF). *From the First Hour of Life: Making the Case for Improved Infant and Young Child Feeding Everywhere*. UNICEF; 2016. <https://www.unicef.org/media/49801/file/From-the-first-hour-of-life-ENG.pdf>. Accessed November 21, 2019.
4. Adhikari P, Cooper-Stanbury M. *Australian National Infant Feeding Survey: Indicator Results*. Australian Institute of Health and Welfare; 2011.
5. Ellison RG, Greer BP, Burney JL, et al. Observations and conversations: home preparation of infant formula among a sample of low-income mothers in the Southeastern US. *J Nutr Educ Behav*. 2017;49:579–587.e1.
6. Lee E. Health, morality, and infant feeding: British mothers' experiences of formula milk use in the early weeks. *Sociol Health Illn*. 2007;29:1075–1090.
7. Newby R, Brodribb W, Ware RS, Davies PSW. Internet use by first-time mothers for infant feeding support. *J Hum Lact*. 2015;31:416–424.
8. Appleton J, Fowler C, Laws R, Russell CG, Campbell KJ, Denney-Wilson E. Professional and non-professional sources of formula feeding advice for parents in the first six months. *Matern Child Nutr*. 2020;16:e12942.
9. Komninou S, Fallon V, Halford JCG, Harrold JA. Differences in the emotional and practical experiences of exclusively breastfeeding and combination feeding mothers. *Matern Child Nutr*. 2017;13:e12364.
10. Fallon V, Komninou S, Bennett KM, Halford JCG, Harrold JA. The emotional and practical experiences of formula-feeding mothers. *Matern Child Nutr*. 2017;13:e12392.
11. Appleton J, Laws R, Russell CG, Fowler C, Campbell KJ, Denney-Wilson E. Infant formula feeding practices and the role of advice and support: an exploratory qualitative study. *BMC Pediatr*. 2018;18:12.
12. Malek L, Fowler H, Duffy G, Katzer L. Informed choice or guessing game? Understanding caregivers' perceptions and use of infant formula labelling. *Public Health Nutr*. 2019;22:273–286.
13. Cattaneo A, Pani P, Carletti C, et al. Advertisements of follow-on formula and their perception by pregnant women and mothers in Italy. *Arch Dis Child*. 2015;100:323–328.
14. Piwoz EG, Huffman SL. The impact of marketing of breast-milk substitutes on WHO-recommended breastfeeding practices. *Food Nutr Bull*. 2015;36:373–386.
15. Huang Y, Labiner-Wolfe J, Huang H, Choiniere CJ, Fein SB. Association of health profession and direct-to-consumer marketing with infant formula choice and switching. *Birth Issues Perinat Care*. 2013;40:24–31.
16. Labiner-Wolfe J, Fein SB, Shealy KR. Infant formula—handling education and safety. *Pediatrics*. 2008;122(suppl 2):S85–S90.
17. McAndrew F, Thompson J, Fellows L, Large A, Speed M, Renfrew MJ. *Infant Feeding Survey 2010*. Health and Social Information Centre; 2012.
18. Altazan AD, Gilmore LA, Guo J, et al. Unintentional error in formula preparation and its simulated impact on infant weight and adiposity. *Pediatr Obes*. 2019;14:e12564.
19. Leung C, Chang WC, Yeh SJ. Hypernatremic dehydration due to concentrated infant formula: report of two cases. *Pediatr Neonatol*. 2009;50:70–73.
20. Hansen R. Hyponatraemic seizure in a 6-month-old infant due to water

- intoxication. *J Paediatr Child Health*. 2017;53:717–719.
21. Food Standards Australia New Zealand. Standard 2.9.1 Infant formula products. In: Standards F, ed. *Standard 2.9.1. Food Standards Gazette No. FSC962017*. <https://www.legislation.gov.au/Details/F2017C00332>. Accessed January 30, 2019.
 22. Malek L, Duffy G, Fowler H, Katzer L. Use and understanding of labelling information when preparing infant formula: evidence from interviews and eye tracking. *Food Policy*. 2020;93.
 23. Wallace LS, Rosenstein PF, Gal N. Readability and content characteristics of powdered infant formula instructions in the United States. *Matern Child Health J*. 2016;20:889–894.
 24. World Health Organization. *International Code of Marketing of Breast-Milk Substitutes*. World Health Organization; 1981.
 25. Russell CG, Appleton J, Burnett AJ, et al. Infant appetitive phenotypes: a group-based multi-trajectory analysis. *Front Nutr*. 2021;8:749918.
 26. Jansen E, Russell CG, Appleton J, et al. The feeding practices and structure questionnaire: development and validation of age appropriate versions for infants and toddlers. *Int J Behav Nutr Phys Act*. 2021;18:13.
 27. Lakshman RR, Landsbaugh JR, Schiff A, Hardeman W, Ong KK, Griffin SJ. Development of a questionnaire to assess maternal attitudes towards infant-growth and milk feeding practices. *Int J Behav Nutr Phys Act*. 2011;8:35.
 28. Baughcum AE, Powers SW, Johnson SB, et al. Maternal feeding practices and beliefs and their relationships to overweight in early childhood. *J Dev Behav Pediatr*. 2001;22:391–408.
 29. Denney-Wilson E, Laws R, Russell CG, et al. Preventing obesity in infants: the growing healthy feasibility trial protocol. *BMJ Open*. 2015;5:e009258.
 30. Blair M, Frazer C, Gaskin K. *The Feeding Guide*. 7th ed. James Fairfax Institute of Paediatric Nutrition; 2014.
 31. Schmied V, Fowler C, Rossiter C, Homer C, Kruske S. CHoRUS team. Nature and frequency of services provided by child and family health nurses in Australia: results of a national survey. *Aust Health Rev*. 2014;38:177–185.
 32. Field A. *Discovering Statistics Using IBM SPSS Statistics*. 5th ed. SAGE edge; 2018.
 33. Fritz CO, Morris PE, Richler JJ. Effect size estimates: current use, calculations, and interpretation. *J Exp Psychol Gen*. 2012;141:2–18.
 34. Elo S, Kyngas H. The qualitative content analysis process. *J Adv Nurs*. 2007;62:107–115.
 35. Laws R, Campbell KJ, van der Pligt P, et al. Obesity prevention in early life: an opportunity to better support the role of maternal and child health nurses in Australia. *BMC Nurs*. 2015;14:26.
 36. Cheng H, Eames-Brown R, Tutt A, et al. Promoting healthy weight for all young children: a mixed methods study of child and family health nurses' perceptions of barriers and how to overcome them. *BMC Nurs*. 2020;19:84.
 37. Redsell SA, Atkinson PJ, Nathan D, Siriwardena AN, Swift JA, Glazebrook C. Preventing childhood obesity during infancy in UK primary care: a mixed-methods study of HCPs' knowledge, beliefs and practice. *BMC Fam Pract*. 2011;12:54.
 38. Kotowski J, Fowler C, Orr F. Bottle-feeding, a neglected area of learning and support for nurses working in child health: an exploratory qualitative study. *J Child Health Care*. 2022;26:199–214.
 39. Battersby S. An evaluation of midwives' knowledge of formula feeding and their role in supporting mothers who formula feed their infants. *J Fam Health Care*. 2010;20:192–197.
 40. Berry NJ, Jones SC, Iverson D. Relax, you're soaking in it: sources of information about infant formula. *Breastfeed Rev*. 2011;19:9–18.
 41. Dykes F, Richardson-Foster H, Crossland N, Thomson G. 'Dancing on a thin line': evaluation of an infant feeding information team to implement the WHO code of marketing of breast-milk substitutes. *Midwifery*. 2012;28:765–771.
 42. McInnes RJ, Wright C, Haq S, McGranachan M. Who's keeping the code? Compliance with the international code for the marketing of breast-milk substitutes in Greater Glasgow. *Public Health Nutr*. 2007;10:719–725.
 43. National Health and Medical Research Council. *Infant Feeding Guidelines*. National Health and Medical Research Council; 2013.
 44. Afferback S, Carter SK, Anthony AK, Grauerholz L. Infant-feeding consumerism in the age of intensive mothering and risk society. *J Con Cult*. 2013;13:387–405.
 45. Redsell SA, Slater V, Rose J, Olander EK, Matvienko-Sikar K. Barriers and enablers to caregivers' responsive feeding behaviour: a systematic review to inform childhood obesity prevention. *Obes Rev*. 2021;22:e13228.
 46. Guell C, Whittle F, Ong KK, Lakshman R. Toward understanding how social factors shaped a behavioral intervention on healthier infant formula-feeding. *Qual Health Res*. 2018;28:1320–1329.
 47. Tarrant M, Lok KYW, Fong DYT, et al. Effect of a hospital policy of not accepting free infant formula on in-hospital formula supplementation rates and breast-feeding duration. *Public Health Nutr*. 2015;18:2689–2699.
 48. Australian Government Department of Health. Marketing in Australia of infant formulas: manufacturers and importers agreement. <https://www.accc.gov.au/system/files/public-registers/documents/D15%2B143530.pdf>. Accessed January 30, 2019.
 49. Lagan BM, Symon A, Dalzell J, Whitford H. The midwives aren't allowed to tell you': perceived infant feeding policy restrictions in a formula feeding culture – the Feeding Your Baby Study. *Midwifery*. 2014;30:e49–e55.
 50. Trickey H, Newburn M. Goals, dilemmas and assumptions in infant feeding education and support. Applying the theory of constraints thinking tools to develop new priorities for action. *Matern Child Nutr*. 2014;10:72–91.
 51. Komninou S. Bottled up: the emotional and practical experiences of bottle-feeding mothers in developed countries ed. In: Ventura AK, ed. *Bottle-Feeding: Perceptions, Practices and Health Outcomes*. Nova Science Publishers; 2018.
 52. Bruun S, Buhl S, Husby S, et al. Breast-feeding, infant formula, and introduction to complementary foods—comparing data obtained by questionnaires and health visitors' reports to weekly short message service text messages. *Breastfeed Med*. 2017;12:554–560.

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