

UC Berkeley

UC Berkeley Previously Published Works

Title

Toddler milk: a scoping review of research on consumption, perceptions, and marketing practices.

Permalink

<https://escholarship.org/uc/item/3jr751cv>

Journal

Nutrition Reviews, 82(3)

Authors

Richter, Ana

Grummon, Anna

Falbe, Jennifer

et al.

Publication Date










2024-02-12

DOI

10.1093/nutrit/nuad057

Peer reviewed

Toddler milk: a scoping review of research on consumption, perceptions, and marketing practices

Ana Paula C. Richter ^{1,2}, Anna H. Grummon ^{3,4}, Jennifer Falbe ⁵, Lindsey Smith Taillie ^{2,6},
Deshira D. Wallace ^{1,2}, Allison J. Lazard ^{7,8}, Shelley D. Golden ^{1,8}, Jamie L. Conklin ⁹, and
Marissa G. Hall ^{1,2,8,*}

¹Department of Health Behavior, Gillings School of Global Public Health, University of North Carolina at Chapel Hill, Chapel Hill, North Carolina, USA

²Carolina Population Center, University of North Carolina at Chapel Hill, Chapel Hill, North Carolina, USA

³Department of Nutrition, Harvard T.H. Chan School of Public Health, Boston, Massachusetts, USA

⁴Department of Pediatrics, Stanford University School of Medicine, Palo Alto, California, USA

⁵Department of Human Ecology, University of California (UC) Davis, Davis, California, USA

⁶Department of Nutrition, Gillings School of Global Public Health, University of North Carolina at Chapel Hill, Chapel Hill, North Carolina, USA

⁷Hussman School of Journalism and Media, University of North Carolina at Chapel Hill, Chapel Hill, North Carolina, USA

⁸Lineberger Comprehensive Cancer Center, University of North Carolina at Chapel Hill, Chapel Hill, North Carolina, USA

⁹Health Sciences Library, University of North Carolina at Chapel Hill, Chapel Hill, North Carolina, USA

*Correspondence: Marissa G. Hall, 312 Rosenau Hall, CB#7440, University of North Carolina at Chapel Hill, Chapel Hill, NC 27599, USA.
E-mail: mghall@unc.edu.

Toddler milk is an ultra-processed beverage consisting primarily of powdered milk, caloric sweeteners, and vegetable oil. Pediatric health authorities do not support the use of toddler milk, and emerging evidence suggests that toddler-milk marketing practices may mislead consumers. However, studies have not synthesized the extent of toddler-milk marketing practices or how these practices affect parents' decisions about whether to serve toddler milk. We aimed to summarize the literature about toddler milk to identify what is known about: (1) parents' toddler-milk purchasing and feeding behaviors, (2) toddler-milk marketing, and (3) how marketing practices influence parents' beliefs and perceptions about toddler milk. Following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR), we systematically searched 8 databases (PubMed, APA PsycINFO, Scopus, Cochrane Central, Embase, CINAHL, Communication & Mass Media Complete, and Business Source Premier). We identified 45 articles about toddler milk. Studies were conducted in 25 countries across 6 continents. Five types of findings emerged: (1) consumption and feeding behaviors, (2) demographic correlates of toddler-milk purchasing and consumption, (3) misperceptions and beliefs, (4) increased sales, and (5) increased marketing and responses to marketing. The included articles suggested that toddler-milk sales are growing rapidly worldwide. Findings also revealed that toddler-milk packages (eg, labels, branding) resemble infant formula packages and that toddler-milk marketing practices may indirectly advertise infant formula. Purchasing, serving, and consumption of toddler milk were higher in Black and Hispanic populations than in non-Hispanic White populations, and parents with higher educational attainment and income were more likely to offer toddler milk to their children. Findings suggest a need for policies to prevent cross-marketing of toddler milk and infant formula,

reduce provision of toddler milk to infants and toddlers, and prevent caregivers from being misled about toddler-milk healthfulness.

Key words: breast-milk substitutes, growing-up milk, labeling, marketing, scoping review, toddler feeding, toddler formula, toddler milk.

INTRODUCTION

Children's diet during the first 1000 days of life has major implications for their longer-term dietary behaviors, obesity risk, and health.^{1–3} One dietary behavior receiving growing attention from researchers and policymakers is the consumption of toddler milk. Toddler milk (also called toddler formula, toddler drink, growing-up milk, or stage 3 or 4 milks) are milk-based products usually produced by infant formula companies and marketed as appropriate for children aged 9–36 months.^{4,5} Toddler-milk products are the fastest-growing “formula” category in the world.⁶ Although these products are marketed as beneficial to toddlers' health and development,⁷ they are ultra-processed drinks typically consisting of powdered milk, added sugar in the form of corn syrup solids or other sweeteners, and vegetable oils.^{6,7} Moreover, toddler-milk products contain less protein and more sodium than cow's milk.⁷ For these reasons, the World Health Organization considers toddler milk unnecessary for optimum child growth and development.⁸

Despite the growth in popularity of toddler-milk products over the past several decades,^{6,9} there remain key gaps in our understanding of these products. Little is known, for example, about the reasons for and context in which parents decide to serve toddler milk to their children. Additionally, emerging evidence suggests that current toddler-milk marketing practices, such as the use of health claims, may mislead consumers about the product's healthfulness,^{10–12} but research has not documented the full extent of toddler-milk marketing practices or how these practices affect parents' decisions about whether to serve their young children toddler milk. Similarly, studies have not synthesized the evidence regarding potential disparities in toddler-milk consumption or advertising exposure by income, education, or race/ethnicity, despite well-documented inequities in similar domains (eg, marketing and consumption of sugar-sweetened beverages [SSBs]).^{13,14} There are no comprehensive scoping reviews of literature on toddler milk, despite the growth of these beverages in young children's diets. Synthesizing the literature on toddler milk could inform policies regulating toddler-milk marketing, indicate important research gaps, and guide the development of

interventions to discourage overconsumption of toddler-milk products.

To address these gaps, a scoping review was conducted to summarize the literature on toddler milk. The review was guided by 3 key questions: (1) What is known about parents' purchasing and feeding behaviors regarding toddler milk, (2) What is known about toddler-milk marketing, and (3) How do marketing practices influence parents' beliefs and perceptions about toddler milk?

METHODS

Protocol and registration

A study protocol was developed in accordance with Arksey and O'Malley's 6-stage framework for scoping reviews¹⁵ and adhered to the guidelines of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR).¹⁶ The protocol was registered prior to data extraction via the Open Science Framework on February 25, 2022 (https://osf.io/k6nzx/?view_only=c3d736929aee4ba09bf45faf6225831a).

Eligibility criteria

To be eligible, studies had to be peer-reviewed and report empirical data related to “toddler milk,” which was defined as a powdered milk drink intended for children ages 9–36 months. [Table 1](#) provides details on the inclusion and exclusion criteria. Studies could be from any country and published in any year. In addition, studies could include participants of any age, as long as the study focused on toddler milks. Eligible studies could measure a variety of outcomes related to toddler milk, including toddler-milk consumption, purchasing behaviors, serving behaviors, or behavioral intentions related to toddler-milk products; attitudes or perceptions about toddler-milk products; or reactions to marketing elements on toddler-milk products (eg, understanding, emotional responses). Studies measuring sales or purchases of toddler milk and studies of toddler-milk advertisements and marketing (including advertisements or marketing on product packaging, in

Table 1 Inclusion and exclusion criteria

Category	Include	Exclude
Population Intervention	Studies of any age NA	Animal studies Studies that provide toddler milks to children, regardless of the age of the consumer (eg, RCT or intervention studies examining the effect of toddler milks on health or developmental outcomes)
Comparators Outcomes	NA Studies measuring purchase behaviors, serving behaviors, behavioral intentions, or consumption behaviors related to toddler milks Studies measuring product beliefs, product attitudes, product perceptions of toddler milks Studies measuring reactions to marketing elements on toddler milks (eg, understanding, emotional reactions, elaboration) Studies measuring sales or purchases of toddler milks Studies measuring presence/type of toddler milk marketing in stores/at point-of-sale, or online, including studies of sponsorships Studies of ads/marketing for toddler milk <i>Notes.</i> Toddler milks are defined as powdered milk/formula intended for children aged 9–36 mo. These products may also be called “growing up” milk or “follow up formula” or other terms. Studies that examine “formula” when consumed by children 12 mo or older (even if also consumed by children <12 mo) were included.	NA Studies examining aggregate beverage categories that might include toddler milks, but that do not report results separately for toddler milks (eg, studies of “milk-based beverages” among young children that do not separately examine products meeting the definition of “toddler milks,” or studies that examine an aggregate “formula” category that might include formulas meant for children both younger and older than 9 mo) Studies examining formula that is not toddler milk (eg, formula meant for infants or for children aged 6–12 mo) and studies that are ambiguous as to whether formula is toddler milk (eg, describe “formula” without indicating that this is intended for children aged 9–36 mo) Studies of the nutritional content or ingredients in toddler milks (eg, iron content of toddler milks, presence or absence of nutrients in toddler milks)
Timing Setting Study design	Studies published anytime Any country Peer-reviewed original articles including: -Qualitative or quantitative empirical research of people, including ethnographies -Content analyses of toddler-milk marketing -Content analyses of toddler-milk packaging as related to claims, imagery, or other marketing elements -Quantitative research of sales or purchases of toddler milks	NA NA Studies that are not empirical studies such as regulatory analyses, editorials, scientific or expert opinions, protocol descriptions Exact duplicate publications Systematic reviews, meta-analyses, and other review articles Studies that are not peer-reviewed (dissertations, reports) Clinical case reports Policy briefs or position statements or commentaries/viewpoint Posters or conference abstracts
Language	Studies available in English (including those also published in another language, as long as an English-language version is available)	Studies published in languages other than English if the full text is not also available in English

Abbreviations: NA, not applicable; RCT, randomized controlled trial.

stores, at the point-of-sale, or online, and including studies of sponsorships as a form of advertising) were also included.

Studies that did not report empirical data (eg, regulatory analyses, editorials, or scientific or expert opinions) and studies that reported outcomes for aggregate beverage categories that might include toddler milk (eg, “breastmilk substitutes”) without reporting results separately for toddler milk were excluded. Additionally, studies where the main outcome was the nutritional content (eg, iron content) or ingredients (eg, presence or absence of nutrients) in toddler milk were excluded. Studies that examined the effect of toddler-milk consumption on health or development were also excluded

because these studies were irrelevant to the study’s research questions. Finally, studies that were not available in English were excluded.

Search strategy

A comprehensive search strategy was developed in collaboration with a health sciences librarian. The following 8 databases were searched from their dates of inception through the last search date of January 27, 2022: PubMed, Scopus, Cochrane Central Register of Controlled Trials, Embase, APA PsycINFO, CINAHL Plus with Full Text, Communication & Mass Media Complete, and Business Source Premier. One key

concept of toddler milk was searched using a variety of synonyms and cognates, including “growing up formula,” “breastmilk substitute,” “follow-on formulas,” and “toddler transitions.” Paired milk-based terms with sweetener and toddler terms were also used. The complete, reproducible search strategy for all databases is available in [Appendix S1](#) (please see the [Supporting Information online](#)). The reference list of all included articles was screened for additional articles. Following the search, all of the identified articles were exported to EndNote X9 (Clarivate™), where duplicates were removed, and then uploaded into the online software Covidence (Veritas Health Innovation, Melbourne, Australia; available at: www.covidence.org) to organize the study selection process.¹⁷

Study selection

Two investigators independently screened abstracts against the eligibility criteria, with discrepancies resolved by a third investigator. Then, 2 investigators independently screened full-text articles for inclusion, with discrepancies resolved by a third investigator.

Data extraction

For each article, data on study characteristics using a standardized data-extraction tool were extracted. Prior to extraction, 2 coders independently pilot-tested the extraction tool with a small sample ($k=3$) of included full-text articles to ensure all relevant data were captured. The study team discussed the pilot extraction and revised the coding form as needed. Data from the remaining articles were then extracted by a single coder using the standardized data-extraction form. For each study, the title, author, year, journal, country, setting of data collection, sample characteristics (eg, mean age), country's economic level (based on the 2021–2022 World Bank country classifications¹⁸), funding source, study aims, study design, outcomes, sample size, setting of population (eg, rural), characteristics of participants (eg, gender, race, income, and educational level, if reported), and key research findings related to toddler milk were recorded. For intervention studies and experiments, information on experimental conditions and outcomes was recorded. Studies were not scored on their quality, consistent with standard practices for scoping reviews.^{15,19}

Based on an initial review of the extracted data, study findings were grouped into 5 areas: toddler-milk consumption and feeding behaviors, demographic correlates of toddler-milk purchasing and consumption, perceptions of and beliefs about toddler milk, toddler-

milk sales, and toddler-milk marketing practices and responses to marketing.

RESULTS

Article selection

As detailed in [Figure 1](#), the database searches yielded 1916 records, of which 992 were duplicates. After excluding duplicates, 924 records remained. During the initial screening, 519 abstracts were excluded, leaving 405 articles assessed for full-text eligibility. After full-text screening, 40 articles were retained and extracted for inclusion in the scoping review. Through the process of checking references of included studies, 5 more articles were included, for a total of 45 articles. These 45 articles reported on 48 studies (3 articles reported on 2 separate studies each, ie, with separate research questions, samples, etc.). Details of included studies are shown in [Appendix S2](#) (please see the [Supporting Information online](#)).

Characteristics of included studies

Included studies came from across the world, including 12 from Asia, 12 from North America, 7 from Europe, 7 from Oceania, 3 from Africa, 1 from Latin America, and 4 from multiple regions. In total, included studies reported data from 25 countries, and 2 studies reported data from multiple countries ($n=70$ and 80). Most of the 48 included studies were conducted in high-income countries ($k=29$) or in lower-middle, middle-, or upper-middle-income countries ($k=16$). Three studies were conducted with participants from a range of country income levels. Most studies ($k=47$) were observational and 1 was experimental. Within the observational studies, 34 studies were cross-sectional or repeated cross-sectional studies, 3 were longitudinal, 6 were qualitative, and 4 were content analyses ([Table 2](#)).

Toddler-milk consumption and feeding behaviors

The prevalence of toddler-milk consumption varied across studies, ranging from 0.04% to 85.9%^{20–28} depending on the study, population, behavior, and how the study defined toddler-milk consumption (eg, whether the study assessed current consumption vs ever consuming). One study estimated ever consuming toddler milk. This study compared feeding practices of Chinese- and Australian-born mothers and estimated that 11.7% of infants of Chinese-born mothers had ever consumed toddler milk, compared to 6.0% of infants of Australian-born mothers.²¹ The prevalence of current consumption of toddler milk ranged from 0.04% to

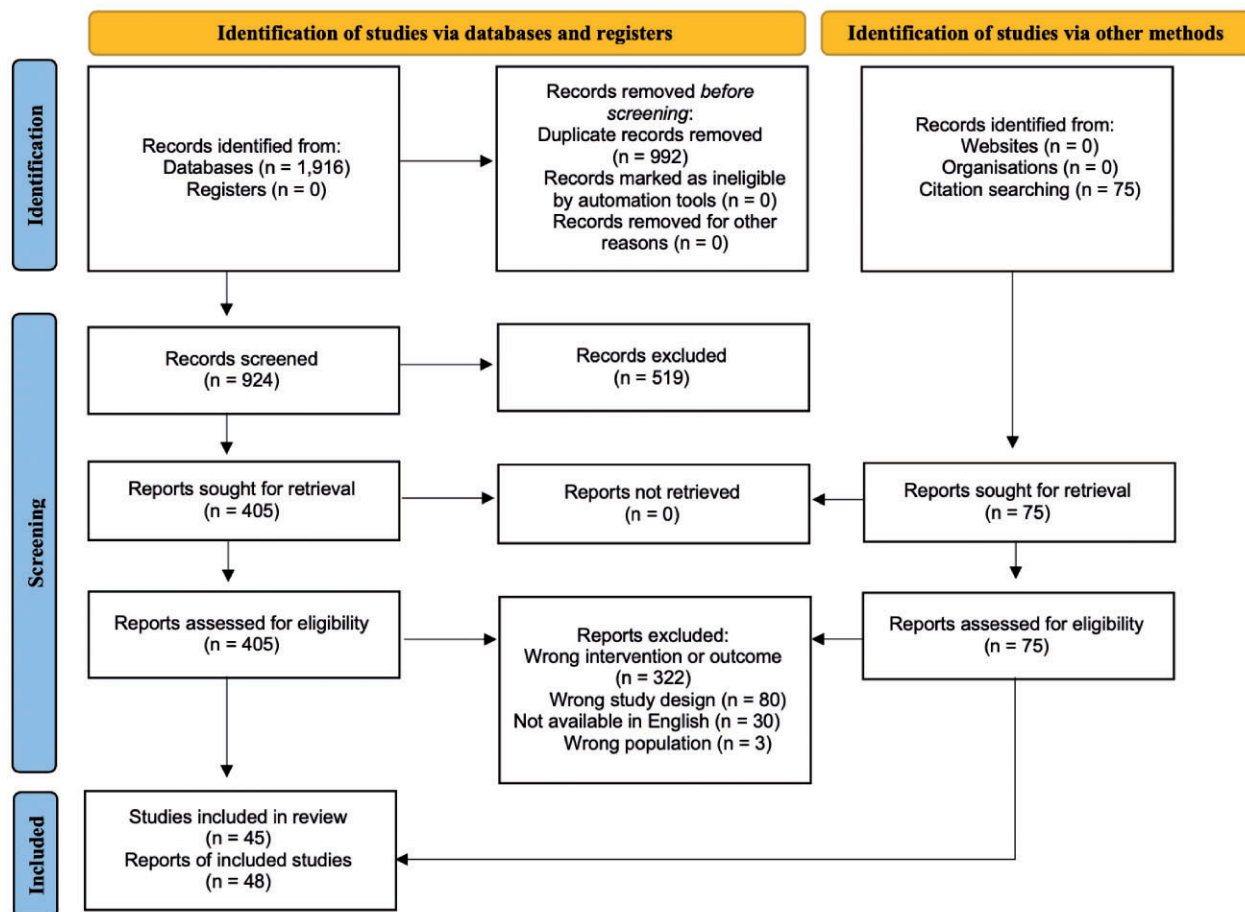


Figure 1 PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) 2020 flow diagram for new systematic reviews, which included searches of databases, registers, and other sources. Modified from Page et al (2021).¹⁶ For more information, visit www.prisma-statement.org/.

85.9%.^{20,22–28} For example, 1 study with a nonprobability sample from 2014 reported that 75% of urban Malaysian toddlers aged 12–17.9 months currently consumed toddler milk, compared to 85.9% of toddlers aged 18–24.5 months.²² Another study used nationally representative samples in France,²⁴ finding that, among children aged 0–35 months, the prevalence of current toddler-milk consumption increased from 24% in 2005 to 32% in 2013.²⁴ In another study from France, current consumption of toddler milk ranged from 7.5% to 54% in a cohort of 1184 children aged 0–35 months, with the highest prevalence among children aged 12–23 months in 2013.²⁶

Some studies ($k=5$) also reported the amount of toddler milk consumed using parent-reported food records.^{26,28–31} Overall, these studies found the highest consumption among children aged 12–17 months compared with younger and older children.^{26,28,30,31} For example, in a 2013 nationally representative survey in France, parents reported that their children aged

12–17 months consumed more toddler milk, on average (233 g/d), than children aged 10–11 months (109 g/d) and 18–23 months (222 g/d).²⁶ Similarly, a study using the Dutch National Food Consumption Survey also reported that from 2012 to 2014, children aged 12–17 months consumed 92.9 g per day of toddler milk compared to 56.2 g per day for children aged 18–23 months and 35.0 g per day for children aged 24–35 months.³⁰ A survey of Indonesian children aged 12–36 months in 2013–2014 found even higher toddler-milk consumption, with nearly 48% of the sample consuming 600 mL per day or more of toddler milk, compared to 15% consuming 300–600 mL per day and 37% consuming less than 300 mL per day.³¹

Studies also examined parents' provision or purchasing of toddler milks.^{10,12,32–35} For example, 1 randomized trial with a sample of US parents of children aged 1–5 years reported that 40% of the sample had ever served their child toddler milk.¹⁰ Another US study combined data from a nationally representative

Table 2 Characteristics of studies and study samples (k = 48)

Characteristics of studies	% or mean	k or SD
Characteristics of studies		
Year study published, % of studies		
1999-2010	4%	2
2011-2016	31%	15
2017-2022	65%	31
Region, % of studies		
Africa	6%	3
Asia	25%	12
Europe	15%	7
Latin America	2%	1
North America	25%	12
Oceania	15%	7
Multiple regions	8%	4
Economic level of country		
Low- and middle-income	33%	16
High-income	60%	29
More than 1 income level	6%	3
Study funding source		
Foundation	33%	16
Government	23%	11
Not disclosed	21%	10
No funding	8%	4
More than 1 source	8%	4
Academia	4%	2
Industry	2%	1
Study design		
Observational		
Cross-sectional	63%	30
Qualitative	12%	6
Repeated cross-sectional	8%	4
Content analysis	8%	4
Longitudinal	6%	3
Experimental	2%	1
Unit of analysis		
Children	19%	9
Adults/caregivers	33%	16
Toddler milk products	15%	7
Advertisements	13%	6
Stores	8%	4
Countries	4%	2
Others	8%	4
Characteristics of study samples (k = 25 studies of people)		
Children		
Mean age of children, mo	27.6	11.79
Gender		
Did not report gender	33%	3
Gender of sample, mean proportion in each category among those reporting		
Girls	59	20.01
Boys	41	20.02
Adults/caregivers		
Mean age of adults, y	32.47	3.40
Gender		
Percent not reporting gender	12.5%	2
Gender of sample, mean proportion in each category among those reporting		
Women	89	17.43
Men	14	17.67
Race/ethnicity		
Did not report race/ethnicity	84%	21

(continued)

Table 2 Continued

Characteristics of studies	% or mean	k or SD
Education		
Did not report education	24%	6
Income		
Did not report income	44%	11

Note. Some categories may not sum to 100% due to rounding.

Abbreviations: k, number of studies; SD, standard deviation.

survey with data from a panel of Hispanic households and found that 44% of parents of children aged 3 years and younger had served toddler milk to their younger toddlers (aged 12–23 months) in the past month, while 41% had served toddler milk to their older toddlers (aged 24–36 months).³⁴ Considering toddler-milk purchases, a 2011 US study with Latino parents found that nearly half (44%) reported ever purchasing toddler milk.¹² Another US study examined the frequency of toddler-milk provision to infants aged 6–11 months and toddlers aged 13–36 months and found that 17–28% and 20–21% of caregivers reported serving toddler milk in the past month to young toddlers (13–23 months) and older toddlers (24–36 months), respectively.³² In addition, nearly 50% of both younger and older toddlers were served toddler milk daily.³² Another study examined serving behaviors across 4 Asian Pacific countries and found that 27.5% of the children in the study were fed toddler milk never or less than once per month, while a similar proportion (27.8%) were fed toddler milk 7 times or more per week.³³

Demographic correlates of toddler-milk purchasing and consumption

Five studies examined demographic correlates of purchasing and consumption of toddler milk.^{25,32–35} With regard to race/ethnicity, 3 US studies suggest that non-Hispanic White individuals were less likely to serve toddler milk to their children than other racial/ethnic groups.^{32,34,35} For example, 1 US study found that Asian caregivers were approximately 3 times more likely than non-Hispanic White caregivers to serve infant formula and/or toddler milk to toddlers aged 12–36 months in the past month.³⁴ Another study with a nonprobability sample of US Latino and non-Latino parents found that the predicted probability that Latino parents had ever purchased toddler milk was 59%, compared to 43% among non-Latino parents.³⁵ A third study assessed toddler-milk provision to infants and toddlers among a US nonprobability sample. This study found that Black caregivers were more likely to serve toddler milk to their infants aged 6–11 months than

both less-acculturated and more-acculturated Hispanic caregivers, but not compared with non-Hispanic White caregivers.³² For toddlers aged 13–36 months, caregivers who were non-Hispanic Black, Asian, and less-acculturated Hispanic were more likely to provide toddler milk than non-Hispanic White caregivers.³²

With regard to age of caregivers, 2 studies found that younger caregivers were more likely to buy or serve toddler milk than older caregivers.^{33,35} A cross-sectional study that included a nonprobability sample of mothers with a child aged 12–36 months from 4 Asia Pacific countries found that mothers aged 36 years and older were less likely to feed their children toddler milk once per week or more compared with mothers aged 30 years and younger.³³

Several studies examined socioeconomic correlates of toddler-milk provision, including caregivers' education and income.^{25,32–35} Studies indicated that caregivers with higher educational attainment (ie, college degree or more) were more likely to serve or purchase toddler milk than those with lower educational attainment.^{33–35} Similarly, 2 studies examined income as a predictor of toddler-milk behaviors, with both finding that more affluent caregivers were more likely to serve toddler milk to their children.^{25,32} One study using a convenience sample of US adults, for example, found that higher-income households were more likely to serve toddler milk to toddlers aged 12–26 months than both middle- and low-income households; however, there were no differences between higher-income households and either middle- or lower-income households in the likelihood of serving infants aged 6–11 months toddler milk.³² Similarly, a study of Filipino children aged 6–23.9 months found that the prevalence of current toddler-milk consumption was higher among more affluent children compared with both middle-class and less-affluent children.²⁵

A small number of studies examined other demographic predictors of toddler-milk-related behaviors.^{33,35} For example, 1 US study assessed the predicted probability of having ever purchased toddler milk across demographic groups, and found that men (predicted probability = 58%) were more likely to report having ever purchased toddler milk than women (predicted probability = 45%).³⁵ Another study assessing toddler-milk usage across 4 Asia Pacific countries reported that children who were fed with infant formula in their first 12 months of age were more likely to be fed toddler milk once per week or more compared with children who were not fed infant formula.³³ Finally, 1 US study reported that both parents' and children's SSB consumption was positively associated with the likelihood of the parent having ever purchased toddler milk.³⁵

Perceptions of and beliefs about toddler milk

Several of the included studies ($k = 6$) analyzed consumers' perceptions of and beliefs about toddler milk, including assessing the understanding of what is a toddler-milk product, reasons for serving toddler milk, and healthfulness perceptions.^{12,34–38} Two qualitative studies suggested that participants have difficulty distinguishing toddler milk from infant formula.^{36,37} For example, a qualitative study with Australian women expecting a first baby reported that most participants identified toddler milk as “formula” and “infant formula.”³⁶ Another qualitative study with Italian mothers of children aged younger than 3 years asked participants to define at first glance a toddler-milk product from ads in 3 popular Italian parent magazines.³⁷ Approximately one-third (33%) of participants said it was formula, 31% said it was milk, 19% provided a specific brand of milk, and 5% thought it was infant formula.³⁷ The remaining 12% of participants gave generic answers such as breast-milk substitutes.³⁷ Only 1 participant in the study correctly identified the product as toddler milk.³⁷

Studies suggested that parents served toddler milk because they perceived it to have nutritional and health benefits.^{12,35} For example, in a quantitative study with a convenience sample of 58 US Latino parents of children aged 2–18 years, of whom only 24% were parents of children aged 0–3 years, parents reported potential reasons that other people might provide toddler milk included to provide nutrients (72%), to support growth (52%), to help with brain development (41%), because it is healthy (19%), and because it is healthier than regular milk (12%).¹² A second study with US Latino parents using similar measures likewise found that the top reasons for providing toddler milk were believing that toddler-milk products provide vitamins and nutrients (57%), support growth (51%), and support brain development (38%).³⁵ Other reasons for providing toddler milk included saving money compared with buying infant formula. In a study of Peruvian mothers of infants aged less than 9 months, for example, parents reported changing from infant formula to toddler-milk products because toddler milk was less expensive.³⁸

Three studies analyzed caregivers' perceptions of toddler-milk healthfulness, including perceptions of how toddler milk compares to cow's milk. One US study of 1078 parents found that most parents perceived toddler milk as equally healthy (38%) or healthier (44%) than cow's milk.³⁵ Another study with a sample of US Latino parents ($n = 58$) reported that 39% of the parents believed that it would be healthy for a child to drink toddler milk every day, whereas only 22% of parents said it would be unhealthy.¹² This study also asked

parents to provide open-ended explanations of their healthfulness ratings; common responses included that toddler milk contained vitamins or other beneficial ingredients, that it was a healthy product, and that the participant had consumed toddler milk as a child.¹² A third study with a nonprobability sample of US parents of children aged 3 years and younger found that 60% of participants agreed that toddler milk provides nutrition that toddlers do not get from other foods or beverages.³⁴ Although most studies suggested that parents may have misperceptions about the healthfulness of toddler milks, 2 studies from the United States found that most parents were aware that toddler milk contains added sugar.^{12,34}

Toddler-milk sales

Two studies reported on the availability of toddler milk, while 9 reported on sales of toddler milk.^{6,39–46} All studies reporting on sales found increases in sales over time, with variation in growth rates.^{6,39–44} One study examined Euromonitor data on sales volumes (kg) per child by World Bank country income level and reported that total toddler-milk sales volumes globally grew by 220% from 2005 to 2019, and that toddler milk comprised 48% of total sales by volume of breast-milk substitutes for all countries in 2019.⁴⁵ The study also projected sales to increase by 15.4% between 2019 and 2024, and found strong growth of sales volume per child from 2005 to 2019 in toddler milk in many upper-middle (249%) and lower-middle (204%)–income countries.⁴⁵ Another study of US toddler-milk sales found that annual sales volume of toddler milk increased by 158% from 1 million kg in 2006 to 3 million kg in 2015.⁴²

Toddler-milk marketing and responses to marketing

Seventeen studies analyzed outcomes related to toddler-milk marketing.^{5,9,12,36,37,47–58} The included studies indicated that toddler-milk advertising has been increasing over time⁴² and that television is the most common venue where participants see these ads.^{52,59} A study examining print ads marketing breast-milk substitutes from 2 Australian magazines reported an increase of 450% in ads of other breast-milk substitutes classified as not formula (which include toddler milk) from 1990 to 2005, with toddler milk responsible for nearly 30% of this increase.⁹ Another study examining ads in South-East Asia from 2015 to 2016 found that the ads for toddler milk represented 94% of the ads for breast-milk substitutes in Cambodia, 73% in Myanmar, and 89% in Vietnam.⁶⁰ Studies have reported substantial variability in the frequency of having seen or read

ads for toddler milk, with estimates ranging from 14% to 92%.^{12,49,51,52}

Three studies reported that toddler-milk retailers use a range of advertising strategies, including frequent use of health claims and images of babies,^{10,37,60} and 1 qualitative study reported that 99% of toddler-milk ads in magazines in Taiwan used rational appeals (ie, nutrition quality or promotional offer) and 49.8% of the ads used emotional appeals (ie, happy child or cartoon characters).⁵⁸ A study examining marketing of breast-milk substitutes in Italian magazines reported that all toddler-milk ads contained a slogan (~25% of the overall space), an image (~50%), and a detailed description of the product (~25%).³⁷ The slogans indicated that the products could address children's health problems (eg, difficulty sleeping or digesting) and could elicit positive emotions such as love and affection. The ads often also contained images that reinforced the slogan's message.³⁷ Similarly, a study reviewing the promotion of products under the scope of the International Code of Marketing of Breastmilk Substitutes found that toddler-milk ads often conveyed that the product would address all areas of toddlers' health and development, including helping them become smarter and taller.⁶⁰

The included studies also suggested that toddler-milk product marketing practices may contribute to consumers' difficulty in distinguishing infant formula and toddler-milk products. For example, a cross-sectional survey assessing toddler-milk package characteristics in Cambodia, Nepal, Senegal, and Tanzania found that 66% of toddler-milk products had color schemes or brand names similar to infant formula products, and that 20–85% had slogans, mascots, or symbols similar to infant formula products.⁵⁶ A qualitative study examining toddler-milk ads in Australia found that toddler-milk ads are designed to position formula brands comparable to breastfeeding.³⁶ The same study exposed participants to 6 toddler-milk ads and found that many of the parents believed that they were seeing ads for infant formula when in fact they were viewing ads for toddler milk.³⁶ Similarly, in another study with mothers or women expecting a child in Australia, where infant formula ads are not allowed, participants were asked whether they had seen "formula" ads. Most participants (67%) believed they had seen ads for commercial infant formula when, in fact, they had seen ads for toddler milk.⁴⁹

Several studies ($k=6$) examined characteristics of toddler-milk packaging.^{5,47,54–57} Four studies reported that products often display front-of-package health or nutrition claims.^{5,54,56,57} A cross-sectional study in Australia found that the number of claims or messages on individual toddler milk products ranged from 0 to 26 in 2019 and that, on average, each toddler-milk

product had 5 general health claims (use of which is regulated in Australia), 3 nutrition content claims (regulated), 2 health-related ingredient messages (not regulated), 1 child-specific message, 1 environmental message or claim, and 2 other, nonspecified messages (all not regulated).⁵⁴ Similarly, a study analyzing toddler-milk products in supermarkets in Spain found that all toddler-milk products included nutritional claims, and that 60% of the products included claims that have not been authorized by the European Food Safety Authority, such as “it is a source of iron, contributes to adequate learning in children.”⁵⁷ One US study examined toddler-milk labeling practices across 17 toddler-milk products from 8 manufacturers and found that all toddler-milk packages included nutrient or ingredient claims and that most also included 1 or more nutrient/ingredient claim linked to a claim about child health or development.⁵ In addition, the study found that toddler-milk packages often stated that there was a scientific basis for offering the product to toddlers or that experts recommend its consumption.⁵

Several studies examined consumer reactions to the front-of-package claims and other marketing practices. The majority reported that health claims increased the appeal of toddler milks.^{10,12,34–36,47,56} For example, 1 experiment exposed US parents ($n = 2190$) to a toddler-milk product showing a claim about brain development, a claim about immunity, or a neutral control claim on the front-of-package.¹⁰ The study reported that parents who were exposed to the brain-development claim or the immunity claim were more likely to incorrectly believe that toddler milk was as healthy or healthier than cow’s milk compared with those who saw the control claim.¹⁰ The health-related claims also led to higher intentions to give the toddler milk to one’s child, higher perceived product healthfulness, and stronger beliefs that pediatricians would recommend the product compared with the control claim.¹⁰ Similarly, 3 studies of reactions to toddler-milk packaging found that some parents extended the meaning of health claims as a broader statement about the overall healthfulness of toddler milk.^{10,12,35} Similarly, 1 qualitative study reported that mothers uncritically accepted the health claims in toddler-milk ads,³⁶ and another study with US caregivers of infants and toddlers found that most participants agreed with common toddler-milk marketing claims and that participants who agreed with the claims were more likely to serve toddler milk to their children.³⁴ Finally, a qualitative study with Australian mothers found that the volume of text in toddler-milk ads, and not necessarily the content of claims, was the most commonly reported feature of toddler-milk labels.⁴⁷

DISCUSSION

This scoping review synthesized the current literature about toddler-milk consumption, sales, marketing, and perceptions. Toddler milk was defined as milk-based products marketed as appropriate for children aged 9–36 months, consistent with prior research.⁵ A total of 45 articles reporting on 48 studies were examined. Although studies were conducted across the world, the majority were set in high-income countries, such as the United States and Australia. This review found that toddler-milk sales are growing rapidly worldwide,^{6,42} which is concerning given that the World Health Organization has sustained that toddler-milk products are unnecessary and may undermine “sustained breastfeeding up to two years or beyond.”⁸ The included studies also documented the range of marketing practices used to advertise toddler milk, suggested that toddler-milk marketing likely functions as indirect advertising for infant formula,^{36,37,48} and found that toddler-milk packages (ie, labels, branding) resemble infant formula packages, which may explain why many consumers confuse toddler milk for infant formula.^{5,36,47,48}

Studies found a wide range of prevalence of consumption and provision of toddler milk,^{20–26} with estimates varying according to the study, population, and behavior assessed. One limitation of the current research on toddler-milk consumption is that most studies have relied on nonprobability samples: of the 11 studies assessing the consumption and provision of toddler milk,^{10,20–26,32–34} 7 used nonprobability sampling. Additional studies with nationally representative samples would help establish the population prevalence of toddler-milk consumption and provision behaviors. Additionally, most studies estimating the prevalence of toddler-milk-related behaviors used a single cross-sectional survey; longitudinal studies, including repeated cross-sectional studies, would be useful for estimating trends in consumption over time. Finally, studies varied in how they estimated the prevalence of toddler-milk consumption (eg, some measured ever consumption, while others measured current consumption); more closely harmonizing measures across studies would allow researchers to compare estimates of consumption across studies and over time.

This study found that younger caregivers, those from a minoritized population, and those with higher education or income are more likely to serve toddler milk to their children.^{32–35} This pattern differs from research on SSB consumption, which finds that higher socioeconomic status is related to lower SSB consumption,⁶¹ but mirrors prior studies that found income and education to be positively related to infant formula use.⁶² Additionally, included studies, mostly from the

United States, reported that Asian, Black, and Hispanic/Latino populations were more likely to purchase, serve, and consume toddler milk than non-Hispanic/Latino White populations.^{32,34,35} These results are consistent with studies showing higher consumption of SSBs among Black and Hispanic/Latino adults and children compared with non-Hispanic White groups in the United States.^{61,63–65} Hence, these findings raise health equity concerns given that research has documented targeted marketing of other unhealthy food products to minoritized populations.⁶⁶ It is possible that caregivers who are Black or Hispanic are exposed to more marketing of toddler milk given their higher exposure to SSB marketing. Although existing research suggests that age, race/ethnicity, education, and income predict parents' toddler-milk serving behaviors, it is unknown how these characteristics might interact with one another. Future research would benefit from taking an intersectional approach to understand whether overlapping identities (eg, being both high income and Hispanic/Latino) influence parents' toddler-milk behaviors.

The findings provide evidence that many consumers confuse infant formula and toddler-milk products, in part because both products' advertisements and packages tend to look similar (ie, similar colors, logos, graphics, and branding).^{5,36,48,49} The similarity of toddler-milk and infant formula advertising and packaging suggests that food companies may be using toddler milk as part of a "line extension" strategy (ie, advertising 1 product to promote others) to circumvent laws and international regulations that prohibit advertising of infant formula. Regulations restricting or banning infant formula advertising may need to be updated to also address toddler-milk marketing and reduce indirect advertising of infant formula via toddler-milk ads and package characteristics (ie, cross-promotion). The studies in this review also suggested that, overall, toddler-milk marketing practices could undermine public health efforts to encourage breastfeeding, contribute to confusion about toddler milk, and increase parents' likelihood of serving their infants toddler milk.^{10,34,36,48,49}

The reviewed studies found that many parents believe that toddler-milk products are healthy and that the perceived nutritional benefits of toddler milk drive parents' decision to serve toddler milk.^{12,35} Many parents also hold incorrect beliefs about toddler milk—for example, believing that toddler milk is healthier than cow's milk.^{12,34} These misperceptions are perhaps unsurprising given that companies use a variety of health-focused strategies to market toddler milk, including front-of-package health claims.^{10,36,37,60} Together, the included studies suggest a need for strategies to correct misperceptions about toddler milk. For example, regulators could ban misleading or scientifically unsubstantiated

marketing claims or require that toddler-milk products display added-sugar disclosures or warning labels (eg, "WARNING: This product contains added sugar") on the front of the package. In the United States, for example, the Food and Drug Administration has the authority to provide food companies with guidance to ensure that toddler-milk labels are "clear, transparent, and accurate."^{5,67} This might include guidelines about how companies should label toddler milks to differentiate them from infant formulas, what health and nutrition claims are appropriate under what circumstances, and what types of advertising are likely to be misleading.⁵

This scoping review highlighted several important directions for future research on toddler milk. For example, the majority of included studies were conducted in high-income countries; additional studies in lower-income countries are warranted. Second, few studies have examined the causal impact of front-of-package marketing on caregivers' perceptions and beliefs about toddler milk. Future studies using randomized designs would allow for rigorous evaluation of the impacts of toddler-milk marketing and of interventions to address overconsumption of these products. Third, a relatively small number of included studies reported on demographic correlates of toddler-milk consumption or provision, and none reported on correlates of exposure to toddler-milk advertising. More studies examining demographic variation in toddler-milk-related outcomes will be important for identifying and addressing any disparities in these outcomes. Fourth, future research should address the lack of a standard definition of toddler milk to ensure consistency in measurement and comparability across studies.

Strengths and limitations

Strengths of this study include a comprehensive search across 8 electronic databases conducted in partnership with a trained research librarian and that studies addressing a wide variety of outcomes were included. In addition, this scoping review included studies from across the world, allowing us to examine global trends in toddler-milk consumption, marketing, and perceptions. Limitations include that review of grey literature was not included; excluding grey literature ensures replicability of a search by other researchers and that only studies that had undergone peer review were included, but means that relevant studies that were not peer-reviewed may have been missed. Another limitation is that the heterogeneity of study designs, as well as the breadth of our research questions, precluded conducting a quantitative synthesis of study findings. Additionally, data extraction was undertaken by 1 author. Finally, study quality was not assessed.

CONCLUSION

Toddler-milk sales are increasing rapidly around the world, particularly in lower- and upper-middle income countries. Toddler-milk advertising and packaging resemble infant formula products, making it challenging for consumers to distinguish between toddler milk and infant formula and contributing to cross-promotion of these products. This scoping review also found that caregivers provide toddler milk because they perceive it to have nutritional and health benefits, which may be because toddler-milk products frequently display health and nutrition claims that caregivers tend to accept uncritically. Together, the findings from this review suggest a need for policies to prevent cross-marketing of toddler milk and infant formula, reduce unnecessary provision of toddler milk to infants and toddlers, and prevent caregivers from being misled about toddler-milk healthfulness.

Acknowledgments

We thank Chisom Ojukwu, Emmanuel Saint-Phard, Phoebe Ruggles, and Sydney E. Wright for their research assistance.

Author contributions. A.P.C.R., A.H.G., J.F., and M.G.H. designed the research; J.L.C. performed the literature search; A.P.C.R. led the data extraction and analysis, and drafted the first version of the manuscript. A.H.G. and M.G.H. contributed to the critical version of the manuscript. All authors read and approved the final manuscript.

Funding. This study was supported by a grant from Healthy Eating Research, a national program of the Robert Wood Johnson Foundation (to A.P.C.R. and A.H.G.). A.P.C.R. was supported by F31HD108962 from the Eunice Kennedy Shriver National Institute of Child Health and Human Development of the National Institutes of Health. A.H.G. was supported by K01HL158608 from the National Heart, Lung, and Blood Institute of the National Institutes of Health. M.G.H. was supported by K01HL147713 from the National Heart, Lung, and Blood Institute of the National Institutes of Health. J.F. was supported by K01DK113068 from the National Institute of Diabetes and Digestive and Kidney Diseases of the National Institutes of Health. This research also received support from the Population Research Infrastructure Program awarded to the Carolina Population Center (P2C HD050924) at The University of North Carolina at Chapel Hill by the Eunice Kennedy Shriver National Institute of Child Health and Human Development.

The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health or the Robert Wood Johnson Foundation.

Declaration of interest. The authors have no relevant interests to declare.

Abbreviation: SSB, sugar-sweetened beverage.

Supporting Information

[Appendix S1 Search strategy report](#)

[Appendix S2 Study information: country, population, design, aims, and findings](#)

REFERENCES

1. Pérez-Escamilla R, Segura-Pérez S, Lott M. *Feeding Guidelines for Infants and Young Toddlers: A Responsive Parenting Approach*. Durham, NC: Healthy Eating Research; 2017. Available at: https://healthyeatingresearch.org/wp-content/uploads/2017/02/her_feeding_guidelines_report_021416-1.pdf. Accessed January 26, 2020.
2. Nader PR, Huang TTK, Gahagan S, et al. Next steps in obesity prevention: altering early life systems to support healthy parents, infants, and toddlers. *Child Obes*. 2012;8:195–204. doi:10.1089/chi.2012.0004.
3. Institute of Medicine. *Early Childhood Obesity Prevention Policies*. Washington, DC: National Academies Press; 2011. doi:10.17226/13124.
4. Pomeranz JL, Harris JL. Federal regulation of infant and toddler food and drink marketing and labeling. *Am J Law Med*. 2019;45:32–56. doi:10.1177/009858819849991.
5. Pomeranz JL, Romo Palafox MJ, Harris JL. Toddler drinks, formulas, and milks: labeling practices and policy implications. *Prev Med*. 2018;109:11–16. doi:10.1016/j.jypmed.2018.01.009.
6. Baker P, Smith J, Salmon L, et al. Global trends and patterns of commercial milk-based formula sales: is an unprecedented infant and young child feeding transition underway? *Public Health Nutr*. 2016;19:2540–2550. doi:10.1017/S1368980016001117.
7. Harris JL, Fleming-Milici F, Frazier W, et al. *Baby Food Facts 2016 Nutrition and Marketing of Baby and Toddler Food and Drinks*. Uconn Rudd Center for Food Policy & Obesity; 2017. Available at: http://www.uconn-ruddcenter.org/files/Pdfs/BabyFoodFACTS_FINAL.pdf. Accessed January 14, 2022.
8. World Health Organization. Information concerning the use and marketing of follow-up formula. Published 2013. Available at: https://www.who.int/nutrition/topics/WHO_brief_fufandcode_post_17July.pdf. Accessed January 29, 2020.
9. Smith J, Blake M. Infant food marketing strategies undermine effective regulation of breast-milk substitutes: trends in print advertising in Australia, 1950–2010. *Aust N Z J Public Health*. 2013;37:337–344. doi:10.1111/1753-6405.12081.
10. Richter APC, Duffy EW, Smith Taillie L, et al. The impact of toddler milk claims on beliefs and misperceptions: a randomized experiment with parents of young children. *J Acad Nutr Diet*. 2022;122:533–540, e3. doi:10.1016/j.jand.2021.08.101.
11. Romo-Palafox M, Gershman H, Pomeranz J, et al. *Marketing Claims on Infant Formula and Toddler Milk Packages: What Do Caregivers Think They Mean?* Uconn Rudd Center for Food Policy & Obesity; 2019.
12. Duffy EW, Taillie LS, Richter APC, et al. Parental perceptions and exposure to advertising of toddler milk: a pilot study with latino parents. *IJERPH*. 2021;18:528. doi:10.3390/ijerph18020528.
13. Dodd AH, Briefel R, Cabili C, et al. Disparities in consumption of sugar-sweetened and other beverages by race/ethnicity and obesity status among United States schoolchildren. *J Nutr Educ Behav*. 2013;45:240–249. doi:10.1016/j.jneb.2012.11.005.
14. Mazarello Paes V, Hesketh K, O'Malley C, et al. Determinants of sugar-sweetened beverage consumption in young children: a systematic review. *Obes Rev*. 2015;16:903–913. doi:10.1111/obr.12310.
15. Arksey H, O'Malley L. Scoping studies: towards a methodological framework. *Int J Soc Res Methodol*. 2005;8:19–32. doi:10.1080/1364557032000119616.
16. Page MJ, McKenzie JE, Bossuyt PM, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *BMJ*. 2021;372:n71. doi:10.1136/bmj.n71.
17. Covidence Systematic Review Software. Published 2022. Available at: <https://www.covidence.org/>. Accessed January 27, 2022.

18. World Bank. World Bank country and lending groups. Published 2021. Available at: <https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups>. Accessed June 19, 2022.
19. Pham MT, Rajić A, Greig JD, et al. A scoping review of scoping reviews: advancing the approach and enhancing the consistency. *Res Synth Methods*. 2014;5:371–385. doi:10.1002/jrsm.1123.
20. Bramhagen AC, Axelsson I. Iron status of children in southern Sweden: effects of cow's milk and follow-on formula. *Acta Paediatr*. 1999;88:1333–1337. doi:10.1111/j.1651-2227.1999.tb01046.x.
21. Bolton KA, Kremer P, Hesketh KD, et al. Differences in infant feeding practices between Chinese-born and Australian-born mothers living in Australia: a cross-sectional study. *BMC Pediatr*. 2018;18:209. doi:10.1186/s12887-018-1157-0.
22. Khor GL, Shyam S, Misra S, et al. Correlation between dietary intake and serum ganglioside concentrations: a cross-sectional study among Malaysian toddlers. *BMC Nutr*. 2016;2:74. doi:10.1186/s40795-016-0113-3.
23. Cairncross CT, Stonehouse W, Conlon CA, et al. Predictors of vitamin D status in New Zealand preschool children. *Matern Child Nutr*. 2017;13:E12340. doi:10.1111/mcn.12340.
24. Bocquet A, Vidailhet M. Nutri-Bébé 2013 study part 2. how do French mothers feed their young children? *Arch Pediatr*. 2015;22:1057–1059. doi:10.1016/S0929-693X(15)30741-7.
25. Jacquier EF, Angeles-Agdeppa I, Lenighan YM, et al. Complementary feeding patterns of Filipino infants and toddlers lack diversity, especially among children from poor households. *BMC Nutr*. 2020;6:51. doi:10.1186/s40795-020-00376-1.
26. Chouraqui JP, Tavoularis G, Emery Y, et al. The French National Survey on Food Consumption of children under 3 years of age—Nutri-Bébé 2013: design, methodology, population sampling and feeding practices. *Public Health Nutr*. 2018;21:502–514. doi:10.1017/S1368980017002518.
27. Duffy EW, Kay MC, Jacquier E, et al. Trends in food consumption patterns of US infants and toddlers from Feeding Infants and Toddlers Studies (FITS) in 2002, 2008, 2016. *Nutrients*. 2019;11:2807. doi:10.3390/nu11112807.
28. Yu P, Denney L, Zheng Y, et al. Food groups consumed by infants and toddlers in urban areas of China. *Food Nutr Res*. 2016;60:30289. doi:10.3402/fnr.v60.30289.
29. Mulyo JH, Sunardi, Jamhari Irahm. Behaviour of brand switching of milk product for young children aged 1-3 years in consumers of middle to lower socioeconomic class in urban communities in malang. *IOP Conf Ser Earth Environ Sci* 2021;905:012087. doi:10.1088/1755-1315/905/1/012087.
30. Pustjens AM, Jacqueline Jozefina Maria Castenmiller JJM, te Biesebeek JD, et al. Dietary intake of protein and fat of 12- to 36-month-old children in a Dutch Total Diet Study. *Eur J Nutr*. 2022;61:439–446. doi:10.1007/s00394-021-02653-6.
31. Sjarif DR, Yuliarti K, Iskandar WJ. Daily consumption of growing-up milk is associated with less stunting among Indonesian toddlers. *Med J Indones*. 2019;28:70–76. doi:10.13181/mji.v28i1.2607.
32. Romo-Palafox MJ, Harris JL. Caregiver's provision of non-recommended commercially prepared milk-based drinks to infants and toddlers. *J Nutr Educ Behav*. 2021;53:643–653. doi:10.1016/j.jneb.2021.05.006.
33. Willcox JC, Februhartanty J, Satheanoppakao W, et al. Commercial growing up milks: Usage frequency and associated child and demographic factors across four Asia Pacific countries. *J Hum Nutr Diet*. 2021;34:524–533. doi:10.1111/jhn.12851.
34. Romo-Palafox MJ, Pomeranz JL, Harris JL. Infant formula and toddler milk marketing and caregiver's provision to young children. *Matern Child Nutr*. 2020;16:e12962. doi:10.1111/mcn.12962.
35. Duffy EW, Taillie LS, Richter APC, et al. Toddler milk perceptions and purchases: the role of Latino ethnicity. *Public Health Nutr*. 2021;24:2911–2919. doi:10.1017/S1368980021000264.
36. Berry NJ, Jones S, Iverson D. It's all formula to me: women's understandings of toddler milk ads. *Breastfeed Rev*. 2010;18:21–30.
37. Cattaneo A, Pani P, Carletti C, et al.; Follow-on Formula Research Group. Advertisements of follow-on formula and their perception by pregnant women and mothers in Italy. *Arch Dis Child*. 2015;100:323–328. doi:10.1136/archdischild-2014-306996.
38. Rothstein JD, Winch PJ, Pachas J, et al. Vulnerable families and costly formula: a qualitative exploration of infant formula purchasing among peri-urban Peruvian households. *Int Breastfeed J*. 2021;16:11. doi:10.1186/s13006-021-00356-6.
39. Hadihardjono DN, Green M, Stormer A, et al. Promotions of breastmilk substitutes, commercial complementary foods and commercial snack products commonly fed to young children are frequently found in points-of-sale in Bandung City, Indonesia. *Matern Child Nutr*. 2019;15:e12808. doi:10.1111/mcn.12808.
40. Blackman KCA, Smiley S, Valentine W, et al. The earliest food deserts: availability of infant and follow-on formula, and lactation support products among stores in black and non-Hispanic white zip codes in Los Angeles County. *Matern Child Health J*. 2022;26:863–871. doi:10.1007/s10995-021-03196-2.
41. Choi YY, Ludwig A, Andreyeva T, et al. Effects of United States WIC infant formula contracts on brand sales of infant formula and toddler milks. *J Public Health Policy*. 2020;41:303–320. doi:10.1057/s41271-020-00228-z.
42. Choi YY, Ludwig A, Harris JL. US toddler milk sales and associations with marketing practices. *Public Health Nutr*. 2020;23:1127–1135. doi:10.1017/S1368980019003756.
43. Rojas CA, Wei H. Spillover mechanisms in the WIC infant formula rebate program. *J Agric Food Ind Organ*. 2019;17:1–14. doi:10.1515/jafio-2018-0019.
44. Davis DE, Oliveira V. *Manufacturers' Bids for WIC Infant Formula Rebate Contracts, 2003-2013*. EIB-142, U.S. Department of Agriculture, Economic Research Service; 2015.
45. Baker P, Santos T, Neves PA, et al. First-food systems transformations and the ultra-processing of infant and young child diets: the determinants, dynamics and consequences of the global rise in commercial milk formula consumption. *Matern Child Nutr*. 2021;17:e13097. doi:10.1111/mcn.13097.
46. Champeny M, Pereira C, Sweet L, et al. Point-of-sale promotion of breastmilk substitutes and commercially produced complementary foods in Cambodia, Nepal, Senegal and Tanzania. *Matern Child Nutr*. 2016;12(Suppl 2):126–139. doi:10.1111/mcn.12272.
47. Berry NJ, Jones SC, Iverson D. Relax, you're soaking in it: sources of information about infant formula. *Breastfeed Rev*. 2011;19:9–18.
48. Berry N, Jones S, Iverson D. Circumventing the WHO code? An observational study. *Arch Dis Child*. 2012;97:320–325. doi:10.1136/adc.2010.202051.
49. Berry N, Jones S, Iverson D. Toddler milk advertising in Australia: infant formula advertising in disguise? *Australas Mark J*. 2012;20:24-27. doi:10.1016/j.ausmj.2011.10.011
50. Champeny M, Hou K, Diop EI, et al. Prevalence, duration, and content of television advertisements for breast milk substitutes and commercially produced complementary foods in Phnom Penh, Cambodia and Dakar, Senegal. *Matern Child Nutr*. 2019;15(Suppl 4):e12781. doi:10.1111/mcn.12781
51. Feeley AB, Ndeye Coly A, Sy Gueye NY, et al. Promotion and consumption of commercially produced foods among children: Situation analysis in an urban setting in Senegal. *Matern Child Nutr*. 2016;12:64–76. doi:10.1111/mcn.12304.
52. Hidayana I, Februhartanty J, Parady VA. Violations of the international code of marketing of breast-milk substitutes: Indonesia context. *Public Health Nutr*. 2017;20:165–173. doi:10.1017/S1368980016001567.
53. Hickman N, Morgan S, Crawley H, et al. Advertising of human milk substitutes in United Kingdom healthcare professional publications: an observational study. *J Hum Lact*. 2021;37:674–682. doi:10.1177/08903344211018161.
54. McCann JR, Russell CG, Campbell KJ, et al. Nutrition and packaging characteristics of toddler foods and milks in Australia. *Public Health Nutr*. 2021;24:1153–1165. doi:10.1017/S1368980020004590.
55. Pries AM, Mulder A, Badham J, et al. Sugar content and nutrient content claims of growing-up milks in Indonesia. *Matern Child Nutr*. 2021;17:e13186. doi:10.1111/mcn.13186.
56. Pereira C, Ford R, Feeley AB, et al. Cross-sectional survey shows that follow-up formula and growing-up milks are labelled similarly to infant formula in four low and middle income countries. *Matern Child Nutr*. 2016;12(Suppl 2):91–105. doi:10.1111/mcn.12269.
57. Frades Payo A, Royo Bordonada M. Nutrient composition and sugar content of dairy products targeting young children in supermarkets. *Rev Pediatr Aten Primaria*. 2018;20:353–363.
58. Chen YC, Chang JS, Gong YT. A content analysis of infant and toddler food advertisements in Taiwanese popular pregnancy and early parenting magazines. *J Hum Lact*. 2015;31:458–466. doi:10.1177/0890334415576513.
59. Emerson J, Kouassi F, Oka Kouamé R, et al. Mothers' and health workers' exposure to breastmilk substitutes promotions in Abidjan, Côte d'Ivoire. *Matern Child Nutr*. 2021;17:E13230. doi:10.1111/mcn.13230.
60. Vinje KH, Phan LTH, Nguyen TT, et al. Media audit reveals inappropriate promotion of products under the scope of the International Code of Marketing of Breast-milk Substitutes in South-East Asia. *Public Health Nutr*. 2017;20:1333–1342. doi:10.1017/S1368980016003591.
61. Han E, Powell LM. Consumption patterns of sugar-sweetened beverages in the United States. *J Acad Nutr Diet*. 2013;11:343–53. doi:10.1016/j.jand.2012.09.016.
62. Neves PAR, Barros AJD, Gatica-Dominguez G, et al. Maternal education and equity in breastfeeding: trends and patterns in 81 low- and middle-income countries between 2000 and 2019. *Int J Equity Health*. 2021;20:20. doi:10.1186/s12939-020-01357-3
63. Boehm R, Cooksey Stowers K, Schneider GE, et al. Race, ethnicity, and neighborhood food environment are associated with adolescent sugary drink consumption during a 5-year community campaign. *J Racial Ethn Health Disparities*. 2022;9:1335–1346. doi:10.1007/s40615-021-01074-9
64. Winkler MR, Lenk K, Erickson D, et al. Secular trends and customer characteristics of sweetened beverage and water purchasing at US convenience and other small food stores, 2014-2017. *Int J Behav Nutr Phys Act*. 2022;19:37. doi:10.1186/s12966-022-01268-2.
65. Bleich SN, Vercammen KA, Koma JW, et al. Trends in beverage consumption among children and adults, 2003-2014. *Obesity (Silver Spring)*. 2018;26:432–441. doi:10.1002/oby.22056.
66. Harris JL, Frazier W, Kumanyika S, et al. *Increasing Disparities in Unhealthy Food Advertising Targeted to Hispanic and Black Youth*. Salud America: Rudd Center for Food Policy & Obesity; Council in Black Health; 2019. Available at: <http://uconn-ruddcenter.org/files/Pdfs/TargetedMarketingReport2019.pdf>. Accessed November 21, 2020.
67. Harris JL, Pomeranz JL. Infant formula and toddler milk marketing: Opportunities to address harmful practices and improve young children's diets. *Nutr Rev*. 2020;78:866–883. doi:10.1093/nutrit/nuz095