

Perspective: Novel Commercial Packaging and Devices for Complementary Feeding

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ABSTRACT

In recent years, so-called baby food pouches and other novel packaging and devices have been marketed for complementary feeding. To date, no experimental studies have been conducted to determine health and nutrition effects or the safety of baby food pouches and related feeding devices. Yet, these products hold the potential to fundamentally change the ways in which infants and children consume solid foods in infancy and early childhood. In this review, a selection of complementary feeding devices and their potential effects on breastfeeding, formula-feeding, safe and appropriate complementary feeding, and the timely transition to family foods are explored. Because manufacturers have innovated older designs of traditional feeding bottles and pacifiers for complementary feeding, perspectives on potential health effects and the safety of devices are drawn from research on feeding bottles and pacifiers. Recommendations include scaling up research on the safety, nutrition, and health impacts of commercial packaging and devices. In addition, manufacturers should ensure that devices conform to consumer product safety commission specifications and that instructions for use are in line with policies protecting pediatric dental health. Marketing of commercial devices and packaging should conform to the International Code of Marketing of Breastmilk Substitutes. *Adv Nutr* 2018;9:581–589.

Keywords: complementary feeding, teats, pacifiers, bottles, baby food pouches, devices, packaging, pediatric dentistry, marketing, International Code

Introduction

Commercial complementary food (CCF), commonly called “baby food,” is an integral component of infants’ diets in high-income countries (1–3). Market reports show that a single leading brand of CCF in the United States sold 199 million units (\$235 million value) in 2017 (4, 5). Seemingly paradoxical to these sales numbers, a counter homemade feeding trend called “baby-led weaning” (BLW) has emerged (6, 7). In contrast to the mid-20th century approach to complementary feeding, whereby infants are spoon-fed pureed solid foods (7, 8), the BLW approach allows infants and young children to explore and independently grasp whole solid foods (finger foods) or family foods by first using their own hands and, later, utensils to feed themselves (9).

Current empirical evidence on health outcomes as a result of the BLW approach, as compared with other approaches to complementary feeding, is still limited (6).

In tune with the modern concept of infant-feeding autonomy, infant food manufacturers have innovated traditional feeding bottles and artificial teats to create a niche market. Commercial packaging and devices for self-feeding directly from the package or device have emerged in recent years. “Baby food pouches” and other novel complementary feeding devices have been developed to accommodate feeding of both homemade food and CCF. Although empirical research is limited, a market survey of 16 countries in 2014 reported that annual sales of baby food pouches in the United States grew by 7%, and sales in Ukraine grew by 916%, with 528% in Brazil, 316% in Portugal, 264% in Russia, 184% in the Netherlands, and 125% in Spain (10).

Contemporary packaging and feeding devices hold the potential to fundamentally change how infants and children consume solid foods in infancy and early childhood. The primary objective of this article is to describe a selection of novel commercial complementary feeding devices and packaging available on the global market. Insights into how

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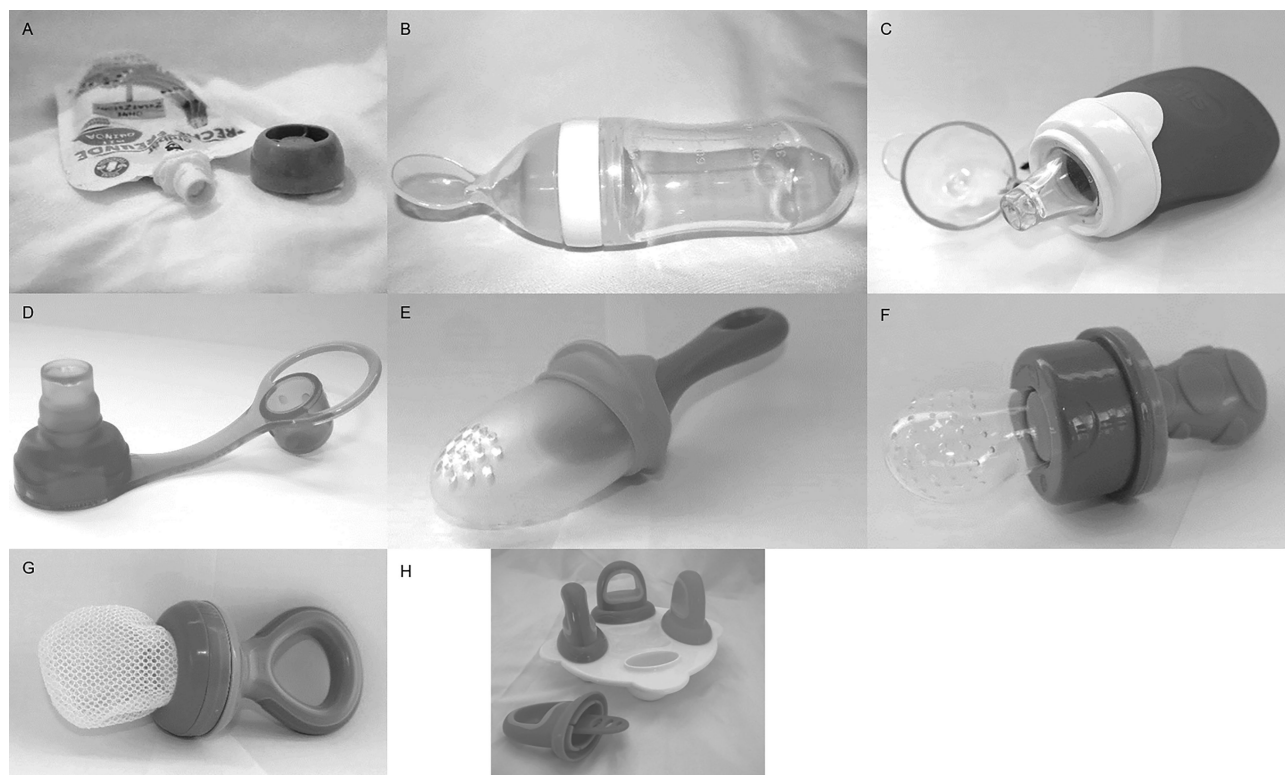


FIGURE 1 Selection of containers and artificial teats for complementary feeding. (A) Disposable food pouch with spout-shaped implement. (B) Silicone feeding bottle with spoon-shaped implement. (C) Silicone feeding bottle with teat-shaped implement. (D) Silicone feeding teat with silicone cap; teat slides over food-pouch spout. (E) Silicone feeding teat; teat attaches to grip via snapping mechanism. (F) Silicone feeding teat; teat attaches to grip via twisting mechanism. (G) Fabric mesh feeding teat; teat attaches to grip via twisting mechanism. (H) Plastic grips and freezing tray; teat forms via filling tray, inserting grip, and freezing.

modern devices and packaging might be affecting breastfeeding, formula-feeding, safe and appropriate complementary feeding, and the timely transition to family foods are given. Foreseeable nutrition, dental health, safety, and marketing aspects are explored.

Modern Containers, Packaging, and Teats Designed for Complementary Feeding

Modern complementary feeding containers have innovated older designs of feeding bottles, whereas novel artificial teats designed for complementary feeding have innovated older designs of pacifiers. **Figure 1** shows photographs of a selection of modern containers and artificial teats that are designed for complementary feeding, and **Table 1** gives descriptions of device and packaging materials and characteristics.

Commercial Containers for Complementary Feeding

Feeding bottles have been traditionally used for feeding liquids, primarily human milk or commercial infant formula, to infants. Novel feeding bottles and containers differ from traditional bottles in that they have been explicitly designed for complementary feeding. Feeding bottle walls

have traditionally been made from hard plastics or glass. Modern containers and packaging designed for complementary feeding use softer, more flexible plastics, silicone, or pouches (polyester, aluminum foil, and polypropylene). Softer container walls facilitate rapid passage of solid foods when pressure is applied to the outside walls of the container. Containers and packaging designed for complementary feeding may either be disposable or reusable containers. They may either have a fixed or detachable implement (artificial teats, straws, spouts, or porous spoons) that are designed for direct feeding from the container. Implements come in a variety of shapes, sizes, and materials and are commonly called “teats,” “squeeze spoons,” “spouts,” “food pouch spouts,” and “snack spouts.”

Food pouches with spouts (**Figure 1A**) are designed for self-feeding, whereas spoon-shaped implements for feeding bottles (**Figure 1B**) or spoon-shaped implements for food pouches (not pictured) allow for feeding by a caregiver. The food pouch pictured in **Figure 1** is a disposable, single-use design, which was prefilled with an industrially produced ready-to-eat food puree. However, there are also a range of reusable complementary food pouches that are designed for use with homemade purees. Manufacturers have used lighter weight, more durable, and disposable food pouch designs

TABLE 1 Containers and artificial teats for complementary feeding and their descriptions

	Description
Containers	
Disposable food pouch with spout-shaped implement	Two-piece polyester, aluminum foil, and polypropylene “food pouch” marketed for feeding solid foods and self-feeding. Consists of feeding pouch with combined hard-plastic teat. Teat opening is wide for rapid passage of solid foods from the pouch when pressure is applied to the outside walls of the pouch or suction is applied to the spout. Includes “antichoking” plastic cap for closing.
Silicone feeding bottle with spoon-shaped implement	Three-piece, reusable silicone feeding bottle with hard-plastic detachable spoon. Product is designed and marketed for feeding solid foods. The plastic spoon includes a large proximal perforation for passage of solid foods from the feeding bottle to the spoon. Solid foods pass out of the bottle when pressure is applied to the outside walls. Includes hard-plastic cap for spoon-shaped implement.
Silicone feeding bottle with teat-shaped implement	Five-piece silicone and plastic reusable feeding device designed for feeding solid foods. Consists of transparent plastic lid, elastic band, silicone feeding bottle, and silicone teat with attached plastic rim. Teat has wide opening for rapid passage of solid foods when pressure is applied to the outside of walls or suction is applied to the teat.
Artificial teats	
Silicone feeding teat with silicone cap; teat slides over food-pouch spout	One-piece silicone reusable feeding device marketed for feeding solid foods. Consists of a silicone teat with wide opening for passage of solid foods and attached silicone cap. Marketed for use with food pouch, whereby the teat slides over top of the food pouch spout.
Silicone feeding teat; teat attaches to grip via snapping mechanism	Three-piece silicone and hard-plastic reusable feeding device marketed for filling and feeding solid foods. Teat detaches through “snapping” mechanism.
Silicone feeding teat; teat attaches to grip via twisting mechanism	Three-piece silicone and hard-plastic reusable feeding device marketed for filling and feeding solid foods. Teat detaches through twisting mechanism.
Fabric mesh feeding teat; teat attaches to grip via twisting mechanism	Three-piece fabric mesh and hard-plastic reusable feeding device marketed for filling and feeding solid foods. Teat detaches through a twisting mechanism.
Plastic grips and freezing tray; teat forms via filling tray, inserting grip, and freezing	Five-piece reusable hard-plastic feeding device marketed for filling, freezing, and feeding solid foods and liquids. Plastic grip inserts and plastic tray marketed for forming and freezing solid foods or liquids into frozen teats.

in order to minimize food preparation, shorten meal times, and accommodate feeding away from home. Whether food pouches are disposable or reusable, packaging innovations have made container walls more flexible in order to facilitate infant self-feeding.

In addition to this selection of containers, there are also a number of versatile, reusable complementary food pouches on the market that can be used for feeding both liquids and solids. For example, some manufacturers’ websites and instructions for reusable complementary food pouches recommend that consumers fill food pouches with commercial infant formula and attach artificial teats directly to the food pouch for formula-feeding. Other instructions direct that food pouches be filled with homemade complementary food and be attached to hard spouts for complementary feeding. Finally, some food pouches are designed for direct expression of breast milk into the food pouch and may be directly attached to artificial teats for breast-milk feedings.

Manufacturer Marketing Claims on Containers and Packaging

Manufacturers of food pouches advertise use for both “at home” or “on-the-go,” and advertise food pouches as a method to increase feeding “independence” and “self-feeding.” **Table 2** gives an overview of selected devices, manufacturer marketing claims, and instructions for use.

At least one reusable container is marketed specifically for use by infants and young children with developmental or physical disabilities (**Figure 1C**) through advertisement via images and text on the manufacturer’s website. On

its website, the manufacturer recommends product use for “feeding difficulties, feeding challenges, picky eating and special needs” as well as specific medical diseases, disorders, and syndromes—namely, autism, Down syndrome, cerebral palsy, oral aversions, feeding tubes, and feeding and swallowing disorders. Using this example, it is crucial that commercial complementary feeding devices are clearly distinguished from medical devices marketed for medical purposes, to ensure patient safety, as well as to ensure necessary follow-up through appropriate global postmarket surveillance systems (11).

Commercial Teats for Complementary Feeding

Traditionally, pacifiers have been used to soothe an upset, crying infant during stressful or painful episodes, including during teething, and to promote and prolong sleep (12). Pacifiers are composed of 3 parts: an artificial teat, a guard or flange that covers the lips and prevents the artificial teat from accidentally being swallowed, and a grip that is attached to the guard and is used for inserting and removing the pacifier into and from the infant’s mouth (12). Artificial teats designed for complementary feeding differ from traditional pacifiers in terms of their design and their intended purpose, because they are both designed and marketed for feeding complementary food. Devices come in a variety of shapes, sizes, and materials and with a variety of names, including “nibblers,” “teethers,” or “soft pouch toppers.”

Soft pouch toppers (**Figure 1D**) were designed to be used together with food pouches. Design innovations of pacifier-like devices include changes to the grips, which have

TABLE 2 Containers and artificial teats for complementary feeding and manufacturer claims and instructions for use

Device type	Manufacturer's country	Location of manufacture	Manufacturer claims and instructions for use							
			Marketed age, mo	Intended for self-feeding	Adult supervision	Clean before use	Avoid tooth decay	Avoid falls	Intended for teething	Prevents choking
Disposable food pouch with spout-shaped implement	Germany	European Union	≥12	Yes	Yes	No	Yes	No	No	No
Silicone feeding bottle with spoon-shaped implement	China	China	None	No	Yes	No	No	Yes	No	No
Silicone feeding bottle with teat-shaped implement	United States	China	≥48	Yes	Yes	Yes	No	No	No	No
Silicone feeding teat with silicone cap; teat slides over food-pouch spout	United States	China	≥6	Yes	Yes	Yes	No	No	No	No
Silicone feeding teat; teat attaches via snapping mechanism	United States	China	≥6	Yes	Yes	Yes	No	No	Yes	No
Silicone feeding teat; teat attaches via twisting mechanism	Germany	Germany	≥8	Yes	Yes	Yes	Yes	Yes	No	Yes
Fabric mesh feeding teat; teat attaches via twisting mechanism	United States	China	≥6	Yes	Yes	Yes	Yes	Yes	No	No
Plastic grips and freezing tray; teat forms via filling tray, inserting grip, and freezing	United States	China	≥6	Yes	Yes	Yes	No	Yes	Yes	No

traditionally been small, cumbersome grips intended for grasping by adults. Larger grips serve the purpose of being easier to grasp and for use by less dexterous infants and young children (Figure 1E–H). It seems clear that the concept of infant feeding autonomy is also the intention of artificial teats designed for complementary feeding. This is shown both through the described advancements in grip design and through marketing that uses images of infants that self-feed with the devices. This concept aligns with contemporary approaches to complementary feeding, whereby infants are encouraged to grasp and place whole foods in their own mouths (6).

To facilitate the movement of solid foods from the artificial teat into the infant's mouth, there have been diverse innovations. For example, there are silicone teats with multiple perforations or teats composed of fabric mesh (Figure 1E–G). These artificial teats are marketed to be filled with chopped, fresh fruit and vegetables or with pureed foods, whereas frozen teats (Figure 1H) are marketed to be filled with breast milk, juices, or homemade or commercial purees, and then frozen.

Presumably, contemporary artificial teats for complementary feeding are also intended to extend the time of pacification through arousing the infant's gustatory interest in the feeding device. This practice has been used in indigent Hispanic populations of Mexican descent, who use so-called honey pacifiers (13, 14). Honey pacifiers resemble traditional pacifiers but have a round, bulbous artificial teat that is filled with honey or corn syrup (13). A survey of daycare centers in Bangalore, India, reported that dipping traditional pacifiers into honey or sugar was a common practice (15). This practice has also been reported in other parts of India, France, and Italy (16–18).

Introducing young infants to “tastes” of solid foods is also evocative of what has been named an “educational diet” (19). Educational diets are used in some areas of the world and use small amount of foods to “introduce” infants to the taste of foods, especially staple foods, which are dominant in their culture (19).

Manufacturer Marketing Claims on Artificial Teats

Marketing of artificial teats for complementary feeding could potentially be used to replace traditional feeding utensils, like spoons, at the time of introduction of solid foods if manufacturers use phrases like “baby's first foods.” Other advertisements for devices that encourage self-feeding of homemade foods advertise “reduction of waste” and promotion of cost savings compared with industrial “baby food pouches.” There are at least some devices using so-called implicit health messaging for commercial complementary feeding devices. Implicit health messaging is the use of media that aims to influence the perception of a product to be healthful (20). This is shown through a manufacturer's promotion of devices using words like “fresh,” “wholesome,” and “homemade” and photographs of colorful, healthy foods

like whole fruit and vegetables or the provision of healthy recipes for infant food purees.

Some devices are marketed with names like “teethers,” which implies that they should be used during eruption of primary teeth. Frozen teats (Figure 1H) are one such product advertised for soothing infants’ sore gums. The manufacturer of at least one other silicone feeding teat reviewed (Figure 1E) also recommended chilling foods within the device for the purpose of soothing infants’ gums during teething. Still, some contemporary teats designed for complementary feeding might be used or marketed under the premise of a reduction in the risk of choking on solid foods. Only one product reviewed here explicitly claimed a reduction in choking risk (see Table 2).

Potential Risk for Replacement of Milk Feedings in Early Infancy

Until ~6 mo of age, the “tongue-extrusion reflex,” which aims to expel solid foods placed in the mouth, prevents solid foods from reaching the back of the mouth for swallowing (21). Current global recommendations for the timing of complementary food are to introduce solid foods from 6 mo of age with continued breastfeeding (22, 23). However, “industrial baby food” and “baby food pouches” in some countries are marketed to infants from 4 mo of age, according to respective national or regional policies (24, 25). A preliminary search of the literature revealed no studies on the relation between complementary feeding device use and infant age.

Artificial teats and containers for complementary feeding reviewed here were marketed for infants and children aged ≥6 mo. However, only one product reviewed mentioned in the instructions for use that the device should not be used as a pacifier. This is concerning because pacifiers are used by many families in early infancy, and teats intended for complementary feeding mimic pacifiers in their look and design. Therefore, commercial complementary feeding devices hold the potential to be misunderstood as a safe method to introduce solid foods to very young infants. Any complementary feeding with pacifier-like devices before 6 mo of age, however trivial the amount of nutrients conveyed, would replace breast-milk feedings or infant formula in non-breastfed infants. As such, artificial teats intended for complementary feeding that mimic pacifiers should contain instructions for use that devices should not be used as pacifiers. This is important to reduce the risk of introduction of complementary food to very young infants, as well as to protect primary teeth from prolonged exposure to sugars in complementary food.

Transition from Milk Feedings to Complementary Food in Late Infancy

Contemporary devices are not only of concern in terms of potential replacement of breast milk or infant formula feedings in early infancy but for optimal complementary feeding in late infancy. The consistency (smooth, lumpy, crunchy) of complementary food is important for acquainting infants

with various food textures (26). Current recommendations for complementary feeding in later infancy are to introduce a range of food textures (22, 23). Still, little is known about how infants and children learn to eat foods with various textures (27).

In terms of texture, in order to allow suction of food through “food spouts,” modern food pouches are exclusively filled with smooth purees. Around 8 mo of age, most infants are able to grasp small pieces of food, commonly called “finger foods,” to feed themselves and, developmentally, infants learn to make “munching” movements with their mouths (22). Therefore, older infants who are frequently or exclusively fed food purees from food pouches might be foregoing developmental experiences with lumpy and finger foods. Studies have shown that delaying the introduction of lumpy foods in infancy may increase the risk of feeding difficulties later on (28, 29). Therefore, research is needed in order to explore the relation between food pouch use and feeding difficulties in infancy.

Transition to Family Foods in Early Childhood

Around 12 mo of age, young children are developmentally ready to begin consuming the same foods that are eaten by their families, called “family foods” (22, 23). However, some contemporary complementary devices and baby food pouches are recommended by manufacturers for use by young children starting from or after 12 mo of age.

Chewing foods makes eating pleasurable through enhancement of food textures, taste, and smell (27). Food pouches ultimately forego the need for mastication. Similarly, artificial silicone and fabric mesh teats do not allow infants and young children to fully chew and manipulate foods in their mouths.

Movements of the tongue, lips, and jaw in infancy undergo a transformation from immature movements to differentiated and refined movements required for biting, chewing, and bolus formation in childhood (30). Learning to bite, chew, and form a bolus is crucial for the development of higher levels of muscular precision and articulated movements of the mouth used in speech (30). Evidence from nonhuman studies shows that feeding animals solely pureed diets led to altered mandibular anatomy, muscle weakness, and altered eruption of teeth and oral cavity spaces (27). More research should be conducted to investigate if infants and young children who commonly consume pureed foods are missing important developmental milestones, such as learning mastication of foods.

A search of the scientific literature revealed that, no studies have investigated the perception of texture, taste, and smell of foods that are chewed compared with those consumed through “food spouts” and “nibblers” in early childhood. Therefore, it is unclear if infants and young children eating whole compared with pureed foods in food pouches or whole foods within teats are being exposed to the same sensory experiences. Empirical studies are needed to understand the relation between contemporary feeding device and food pouch use and its relation to feeding difficulties,

food aversion, swallowing, choking, speech pathology, and related disorders. Furthermore, because some manufacturers of baby food pouches recommended use starting from 12 mo of age, it is also worth investigating how manufacturer recommendations influence the transition to family foods in early childhood.

Pediatric Dental Outcomes Associated with Artificial Teat Use

Infants are born with an innate ability to suck, which presents by 34 wk in utero and disappears by ~4 mo of age (21). Sucking is categorized into “nutritive” and “nonnutritive” sucking, a distinction between different movements, breathing, and swallowing patterns. Nutritive sucking refers to long, deep suck-swallow-breathe patterns and is used by the infant to obtain nourishment from the breast or bottle and is audible (21, 31). Nonnutritive sucking is used by infants to calm, regulate, organize, and explore their environment, and it refers to light, continuous sucks that are inaudible (21, 32). Pacifiers have traditionally been used to appease innate nonnutritive sucking behaviors in infancy.

Common habits during infancy and early childhood include extended feeding bottle use and habits of nonnutritive sucking on digits and pacifiers, referred to as nonnutritive sucking habits. It is unclear if the type of sucking that infants and young children use while using complementary feeding devices is nutritive or nonnutritive because there have been no studies published on the subject. The distinction between nutritive and nonnutritive sucking is important because research has shown that nonnutritive sucking habits are associated with changes in the maxillary dental arch and interarch relations (33) and distinct oral health outcomes such as deciduous dental malocclusion and changes in facial morphology (34–37). This includes irregular vertical contact between the deciduous teeth in the upper and lower jaw (malocclusion) as well as irregular distances between the upper and lower front teeth (overjet) (34, 36, 38–41).

Companies that manufacture pacifiers have advertised that pacifiers support proper sucking, feeding, and dental development; however, little empirical evidence exists on those outcomes in relation to pacifier use (42).

Early Childhood Caries

In terms of early childhood cavities, the American Academy of Pediatric Dentistry encourages caregivers to implement preventive practices that can decrease the risk of caries, including avoidance of frequent consumption of sugary liquids and solid foods from a feeding bottle and avoidance of feeding bottles entirely after 12–18 mo (43). Despite these recommendations, studies have shown that the majority ($\geq 75\%$) of young children in the United States use a bottle beyond 12 mo of age and in Great Britain most children ($\geq 65\%$) are still using bottles after 18 mo of age (44). Based on a preliminary search, no information from empirical studies was found on the incidence of food pouch use during infancy and early childhood. In terms of global recommendations on marketing of feeding bottles and teats, there is currently

no specification for a maximum recommended age that manufacturers may recommend feeding bottles, teats, or related complementary feeding devices to children (45).

The risk of caries is greatest if sugars are consumed frequently (46). Therefore, it is advised to avoid cariogenic foods generally and to limit them to meal times (43). Following this advice, the practice of filling artificial teats with fruit purees to be sucked for extended periods outside of meal times holds the potential for cariogenic effects on primary teeth. Instructions of 3 manufacturers reviewed here caution consumers against allowing infants to spend “extensive” time sucking on food packaging and devices and to not allow infants to fall asleep with devices in their mouths (see Table 2). On the other hand, 2 manufacturers recommended devices specifically for teething. Manufacturer instructions to fill artificial frozen teat trays with fruit juices and fruit purees for consumption are at odds with current pediatric dental advice to avoid acidic complementary food and drinks, particularly fruit juices (47). In fact, it is now recommended to avoid fruit juices before 1 y of age (47). In young children aged 12–36 mo, fruit juice intake should be limited to a maximum of 4 fluid ounces/d (47). In this regard, future studies on dental outcomes, including cariogenic effects, related to complementary feeding devices are warranted.

Device Specifications and Safety

A study from the United States investigated injuries associated with the use of bottles and pacifiers, and showed that the majority of injuries were lacerations to the mouth resulting from a fall while using the product (48). Other than falls, choking on both foods and small objects remains an important risk for infant morbidity and mortality in the United States (49, 50). Data from a survey of 181 parents in France on complementary feeding showed that 54% of parents reported a fear of infant choking on small pieces of food (51). Contemporary feeding devices seem to address caregiver fears of infant choking on foods by offering a method whereby only very small pieces of food or purees are able to pass through cloth mesh or perforated silicone teats. Furthermore, caps on food pouches are marketed and patented with an “antichoking” design (52). There is, however, no current evidence to support the presumption that modern artificial teats or food-pouch caps actually mitigate the risk of choking on foods. A study comparing self-reported choking instances in spoon-fed infants with infants eating whole solid foods found no difference in choking risk (53).

Although there have been no reported cases of choking on complementary feeding devices, there has been at least one recall of a disposable infant food pouch and one recall of a food-pouch topper in the United States, due to potential choking hazards from hard plastic spouts that became damaged during manufacturing (54, 55). Contemporary artificial teats designed for complementary feeding have various mechanisms (twisting, pulling, or snapping) for attaching and detaching artificial teats onto their respective grips. The question at hand is, rather, whether artificial teats

themselves once detached from their grips pose choking hazards to infants and young children. For example, in the United States, manufacturers must comply with the Consumer Product Safety Commission requirements for pacifiers, which stipulate that the artificial teat and mouth guard should be molded together to prevent accidental separation, which could lead to asphyxiation (12, 56). Designs of modern complementary feeding devices presented here therefore are at odds with this specification, because artificial teats are purposefully designed to be separated from the mouth guard for the purpose of filling the teat with food.

Manufacturers should comply with respective consumer safety specifications for pacifier-like products. Where they do not yet exist, consumer safety organizations should recommend standards for teats designed for complementary feeding. Empirical studies on choking in infancy and childhood should not only consider the prospect of choking on foods but of choking on complementary feeding devices themselves.

Marketing of Commercial Complementary Feeding Devices for Infants and Young Children

The International Code of Marketing of Breastmilk Substitutes and subsequent World Health Assembly resolutions (the International Code) is a global set of recommendations intended to protect, promote, and support breastfeeding, optimal complementary feeding, and optimal nutrition during early infancy and early childhood (57). Global recommendations are currently in place for ensuring the ethical marketing of commercial nutrition products such as commercial infant formula, follow-up formula, toddler milks, industrial baby food and beverages, bottle-fed complementary food, bottles, and teats (58, 59). However, contemporary artificial teats and containers designed for complementary feeding, like those reviewed here, seem to blur the lines of what has traditionally been understood to be “artificial teats,” “feeding bottles,” and “bottle-fed complementary food.” A preliminary search revealed no formal assessments of marketing claims on packaging and devices intended for complementary feeding for their compliance to the International Code. Meanwhile, global recommendations for marketing of commercial nutrition products do not specify a minimum or maximum age for marketing commercial complementary feeding devices specifically. Nevertheless, packaging and device manufacturers should comply to the same ethical marketing practices as outlined for other commercial nutrition products (59). In terms of future nutrition policy, with the advent of novel complementary feeding devices and packaging, it is prudent to reappraise the scope of the International Code and the commercial nutrition devices that it regulates.

Limitations

This review is limited to a selection of examples of modern devices and packaging designed and marketed for complementary feeding. It is not an exhaustive or comprehensive review of products on the global market. Devices were selected on the basis of convenience and in terms of availability

for electronic order placement and available shipment to Germany. When selecting devices for inclusion, diversity in materials (silicone, plastic, fabric mesh) was sought in order to portray a spectrum of different types of modern devices. Therefore, this selection is not necessarily a reflection of the most commonly used or widely available complementary feeding devices. The names of brands, color photographs, names of product lines, and names of manufacturers have been omitted to avoid unintended endorsement of specific commercial products.

Conclusions

In line with contemporary complementary feeding approaches, whereby infants and young children are trusted to feed themselves, there has been a corresponding growth of a niche market for novel contemporary feeding devices. To date, few to no experimental studies have been conducted to determine health and nutrition effects or safety of “baby food pouches” and complementary feeding containers marketed for infants and young children. Nevertheless, contemporary complementary feeding devices and packaging hold the potential to fundamentally change the ways in which infants and children consume solid foods in early life.

In summary, research on nutrition and health outcomes related to commercial packaging and devices should be scaled up. Research on the effects of novel artificial teats and complementary food containers and packaging on feeding behaviors and difficulties, developmental milestones, and dental health is needed. In terms of safety, complementary feeding device specifications should conform to guidelines set by consumer product safety commissions. Research is needed on the marketing of commercial complementary feeding devices. Marketing claims on packaging and devices should conform to those for similar commercial nutrition products covered by the International Code.

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