

Baby bottle

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A **baby bottle** is a bottle with a teat (also called a nipple in the US) to drink directly from. It is typically used by infants and young children when a mother does not breastfeed, or if someone cannot (as conveniently) drink from a cup, for feeding oneself or being fed.

In particular it is used to feed infant formula, expressed breast milk or pediatric electrolyte solution.

Contents

- 1 Dimensions and design
 - 1.1 Teats (or nipples)
 - 1.2 Vented bottles
 - 1.3 Variations and accessories
- 2 Cleaning and sterilization
- 3 Regulation
- 4 History
- 5 Controversy
- 6 See also
- 7 References
- 8 External links



A girl being fed by bottle

Dimensions and design

A large-sized bottle typically holds 280 ml; the small size 150 ml. It is composed of a bottle itself, a teat, a ring to seal the teat to the bottle, a cap to cover the teat and optionally a disposable liner.

The height-to-width ratio of bottles is high (relative to adult cups) because it is needed to ensure the contents flood the teat when used at normal angles; otherwise the baby will drink air. However, if the bottle is too tall, it easily tips. There are asymmetric bottles that ensure the contents flood the teat if the bottle is held at a certain direction.

Teats (or nipples)



A baby bottle of yesteryear (c. 1950s). The double-ended bottles did not have two teats: they had a teat and a valve. Photo credit: Time Tunnel museum.

The teat itself is generally designed to be slimmer than the mother's nipple. Specialized teats are marketed that report attempting to mimic the shape of the breast to help babies to switch back and forth between bottle feeding and breastfeeding for cases where "nipple confusion" occurs.^[1]

Teats come in a selection of flow rates, marketed to be based on the age of the infant. Different flow rate teats either have more holes or larger holes. Variable flow rate teats are available for older infants. The hole is asymmetric so that by turning the bottle/teat, different flows can occur. Specialized teats are available for infants with cleft palate.

Vented bottles

"Vented" bottles allow air to enter the bottle while the baby is drinking without the need to break the baby's suction during feeding. Alternatively a bottle liner can be used to enclose the formula instead of directly in the bottle. The liner collapses as the formula is drained.

Vented bottles work by allowing air to enter while preventing the liquid inside from escaping. It works by an "anti-vacuum skirt" in the base of the teat, where it forms a seal with the bottle. The skirt acts as a one way valve, allowing air to enter the bottle but not liquids to leave. If the sealing ring is tightened too much, the skirt is compressed too tightly to allow it to open and the bottle will not vent. If the sealing ring is too loose, liquid leaks from the bottle.

There are multiple patents for technologies in this area. Initial designs called for a complex spring and valve system that was impossible to clean and sterilize. Current research is in specialized materials with microscopic pores that allow the entry of air without the escape of liquids. This avoids the caregiver having to get the sealing ring tension just right. It remains to be seen whether these materials can withstand the rigours of daily cleaning and sterilization. Another competitor, Dr. Brown's, offers a system whereby the vented air is conducted through a tube to the bottom of the bottle where the airspace is when the bottle is in use. This avoids the vented air from bubbling through the liquid and unnecessarily aerating the liquid. The aeration may cause nutrients in "human milk and infant formula (to) decrease in concentration . . . to a level that may be clinically significant".^[2]

Variations and accessories

Bottles may be designed to attach directly to a breast pump for a complete "feeding system" that maximizes the reuse of the components. Such systems include a variety of drinking spouts for when the child is older. This converts the bottle into a sippy cup, a cup with lid and spout for toddlers, which is intermediate between a baby bottle and an open top cup. Bottles that are part of a feeding system may include handles that can be attached. The ring and teat may be replaced by a storage lid.

Accessories for bottles include cleaning brushes and drying racks. Brushes may be specially designed for a specific manufacturer's bottles and teats. Bottle warmers warm previously made and refrigerated formula. Coolers designed to fit a specific manufacturer's bottles are available to keep refrigerated formula cold. Special formula powder containers are available to store pre-measured amounts of formula so that caregivers can pre-fill bottles with sterile water and mix in the powder easily. The containers are typically designed to stack together so that multiple pre-measured amounts of formula powder may be transported as a unit.



An infant being fed by bottle



A large-sized feeding bottle designed to transfer breast milk.

Specialty, "designer" bottles are now quite common as novelty gifts for parents or just something interesting for the child. They either have special logos or are of special shapes (e.g., animals). Depending on the shape, these bottles can be quite difficult to clean. Another specialty bottle is made from heat sensitive materials that act as a built-in thermometer. If the contents are too hot, the bottle changes color.

Institutions can purchase ready-to-feed formula in containers that can be used as baby bottles.^[3] The lid screws off and is replaced by a disposable teat when the formula is ready to be used. This avoids storing the formula with the teat and possibly clogging the teat holes when formula is splashed within the bottle and dries.

Some bottles have been specifically designed to reduce colic in babies but there is little evidence that these actually do any good. The bottles are designed to minimize the intake of air during feeding.^[4]

Cleaning and sterilization

In the UK, the current advice given by NHS Choices remains to sterilize baby bottles,^[5] which is deemed as especially important for newborn and high-risk infants (i.e., those susceptible to infection). Sterilization is also recommended in Australia, such as by Milton sterilizing fluid.^[6] A current recommendation in the US is that bottle sterilization can be replaced by cleaning with hot soapy water.^[7]

Regulation

While infant formula is highly regulated in many countries, baby bottles are not. Only the materials of the teat and bottle itself are specifically regulated in some countries (e.g. British Standards BS 7368:1990 "Specification for babies' elastomeric feeding bottle teats"^[8]). In the USA, the Food and Drug Administration (FDA) also regulates teats^[9] and the bottle materials. In 1985 it tightened allowable levels of nitrosamines released from bottle teats.^[10] A 1999 *Consumer Reports* study suggested that some polycarbonate bottles release unsafe amounts of Bisphenol A; however industry critics contended the study demanded unreasonable conditions to which the bottles were subject.^{[11][12]} Findings since, however, have renewed the initial concerns (see Bisphenol A - Possible Health Risks).^{[13][14][15]}

In 2011 use of bisphenol A in baby bottles was forbidden in all EU countries.^[16] From 2012, other countries started following the American Food and Drug Administration's initiative to regulate baby bottles. For instance, Argentina, Brazil and Ecuador now prohibit bisphenol A in baby bottles. Korea extended the regulation to a list of five chemicals, now banned from all children's products including baby bottles.

History

Bottles with hard spouts date to early in recorded time, as evidence by archeological finds (see image).^{[17][18]} The first consisted of urns made of various materials, with an opening at one end for filling the bottle, and a second at the other to be put into the baby's mouth.^[18] Animal horn was another common early material (dating to 13th century, *ibid.*), examples of which survive as images in woodcuts. Soft nipples of various materials were introduced early in the history of feeding (e.g., leather, or dried cow's teat filled with cloth);^[19] many were very difficult to clean.



Animal shaped ceramic feeding bottle from Regensburg, Germany (ca. 1350-800 BCE)

Although Elijah Pratt of New York patented the first rubber nipple in 1845,^[17] it took until the 20th century before materials and technology improved sufficiently to allow manufacture of a soft nipple that was practical for use: the invention of vulcanized rubber (1840s) provided a material that was soft and could eventually be manufactured in volume (early 1900s),^[20] and could withstand the heat of sterilization. (As these sources note, "early black Indian rubber... had a very strong pungent smell", and did not survive repeated exposures to hot water.)

The first glass nursing bottle was patented by American C.M. Windship in 1841, but required that it "be superimposed on the mother's breast so that the nursing infant would be deceived into thinking that the milk was coming directly from the mother".^[21] As the group *American Collectors of Infant Feeders* notes, by "the late 1800s a large variety of glass nursing bottles were produced in the United States", and the U.S. Patent Office had issued more than 200 patents for various designs of nursing bottles by the 1940s—designed to lie flat or stand up straight, with openings on their sides or ends, with detachable or permanently attached nipples, etc.^[21] The American and British markets eventually saw the introduction of heat-resistant upright Pyrex bottles, narrow-necked versions in the 1950s and wide-neck versions a decade later,^[22] with plastic bottles appearing widely, a further decade on.

Innovations such as the introduction of a working check valve in the nipple (to provide unidirectional flow of the liquid food) appeared as early as 1948 in a patent to J.W. Less,^[23] and was picked up by others including Owens-Illinois Glass,^[24] eventually making its way into Gerber and all modern pressure-balancing bottle designs,^[25] as well as adult drinking cups and various other products requiring fluid flow under vacuum.^[26]

The modern business of producing bottles in the developed world is substantial: in 1999 it was reported that the UK "feeding and sterilising equipment sector ... stands at £49m... [where] [s]ales of feeding bottles account for 39%" or £19.1m of that market.^[27]

Controversy

The 2014 summary policy statement of the American Academy of Pediatrics (AAP) makes no specific mention of bottle feeding, but makes clear that "[b]reastfeeding and human milk are the normative standards for infant feeding and nutrition", and refers to decisions regarding the supply of infant nutrition as "a public health issue and not only a lifestyle choice... [g]iven the documented short- and long-term medical and neurodevelopmental advantages of breastfeeding".^{[28][29]} The AAP policy recommends breastfeeding exclusively for six months, continuing it with introduction of complementary foods, with an overall duration of "1 year or longer as mutually desired by mother and infant".^[29] The body of the policy statement notes and cites literature indicating that, in addition to the importance of mother's milk, the manner of the food delivery has implications: that "breastfed infants self-regulate intake volume", whereas bottle-fed infants receiving expressed breast milk or formula have "increased bottle emptying, poorer self-regulation, and excessive weight gain in late infancy", and that such early practice of self-regulation correlate with adult patterns of weight gain (*ibid.*).

The AAP policy notes that "[m]edical contraindications to breastfeeding are rare".^[29] The transmission of some viral diseases through breastfeeding is reportedly preventable, e.g., by expressing breast milk and subjecting it to Holder pasteurization.^[30]

In response to public pressure felt from policies de-emphasizing bottle- and formula-feeding, efforts have arisen to support mothers experiencing physiologic or other difficulties in breastfeeding, and sites include individual views that attempt to weaken the scientific case of the AAP policy,^[31] a book of the personal experiences and views of one mother committed to bottle/formula feeding, *Bottled Up*, by Suzanne Barston, has appeared.^[32]

See also

- Baby Friendly Hospital Initiative
- Breastfeeding promotion
- Haberman Feeder
- Infant formula
- International Code of Marketing of Breast-milk Substitutes
- List of bottle types, brands and companies

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External links

- History of the feeding bottle (http://www.babybottle-museum.co.uk/)
- Babycentre.co.uk (http://www.babycentre.co.uk/baby/formula/howbottlefeedexpert/) Step-by-step guide to bottle-feeding baby.

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