FEEDING BOTTLE COLIC

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AN intelligent, primiparous woman, who was confined in hospital, delivered herself of a healthy male infant weighing 8½ lb. at birth. The mother's nipples were inverted and for this reason her lactation was suppressed at the outset, the baby being fed on reconstituted, half-cream, dried milk from an upright feeding bottle. They were discharged home on the tenth day, the infant having regained its birthweight. Artificial feeding from an upright bottle was continued at home, and although increasing feeding difficulty was encountered the mother persisted for two weeks before seeking advice. By that time both she and her baby were in a pitiful state. The baby was obviously dehydrated, restless and miserable. He wailed nearly all day and night and had frequent spasms of abdominal pain, drawing up his legs with each paroxysm. His stools were frequent, small, green, and accompanied by flatus. In the preceding six hours he had been vomiting back the smallest of feeds. The abdomen was distended and tympanitic to percussion but, apart from this and the dehydration, no abnormality was found on examination. The mother was almost distracted with worry, frustration, and lack of sleep. When the baby was offered a feed he grabbed the teat hungrily and sucked it for about ten seconds; then, rejecting the teat, he resumed his wail and could not be coaxed to take the teat again. Shortly afterwards he eructated a small amount of milk and wind.

Using a boat-shaped bottle with teat and valve adjusted to give an easy flow, the baby was given small but increasing feeds of glucose water, which were retained. Next day he took a mixture of milk and glucose water hungrily and by the third day he was taking normal feeds of half-cream milk and sleeping soundly. He gained weight rapidly and continued to thrive.

Discussion

'Windy' babies who progress to this degree of dehydration

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and misery are fortunately rare, but lesser degrees of this syndrome are common and, although the baby may thrive in spite of much difficulty and discomfort, the mother may suffer considerably from frustration and lack of sleep.

Upright feeding bottles are now in general use, in fact it is difficult to purchase a boat-shaped bottle, yet all babies fed from them do not suffer from windy distension. In order to understand the problem many hours were spent watching babies being fed. From these observations it appears that the presence or absence of air-swallowing depends on the method adopted by the baby to overcome the negative pressure created in the bottle as milk is withdrawn.

Some babies soon learn the trick, when the flow of milk lessens, of opening the mouth without releasing the teat. A stream of bubbles passes up through the milk and when the bubbles cease the baby resumes its sucking. This process is repeated until the feed has been consumed, without effort and without air-swallowing.

Other babies, when the effort of feeding against the negative pressure becomes too difficult, spit out the teat and howl. By the time they have been persuaded to take the teat again the pressures have equalized and feeding proceeds normally until the negative pressure rises again, when the cycle is repeated. Such babies are troublesome to feed but do not suffer from ' wind '.

Two robust babies had a further interesting method of feeding without air-swallowing. These babies continued sucking until the teats were completely flattened by the negative pressure; they then stopped sucking but retained their grip on the teats. When this stage was reached, one of the mothers removed the bottle and held it upright whilst air hissed in through the teat until its shape was restored. The other mother adopted the surprising technique of pulling off the teat and replacing it by another. This observation prompted experiments to determine the negative pressure necessary to flatten a teat. Two types of teat in common use were tested in two ways (figure 1).

In the first method a boat-shaped bottle with a teat at one end was connected via a pressure gauge to an exhaust pump, the hole in the teat being sealed by a plastic film. In the second method suction was applied to a needle inserted through the hole in the teat and fixed in position with plastic. Both methods gave substantially the same results, which are recorded in tabular form (figure 2).

The surprising result is that there exist a few babies who can suck

powerfully enough to create a negative pressure of as much as one-tenth of an atmosphere.

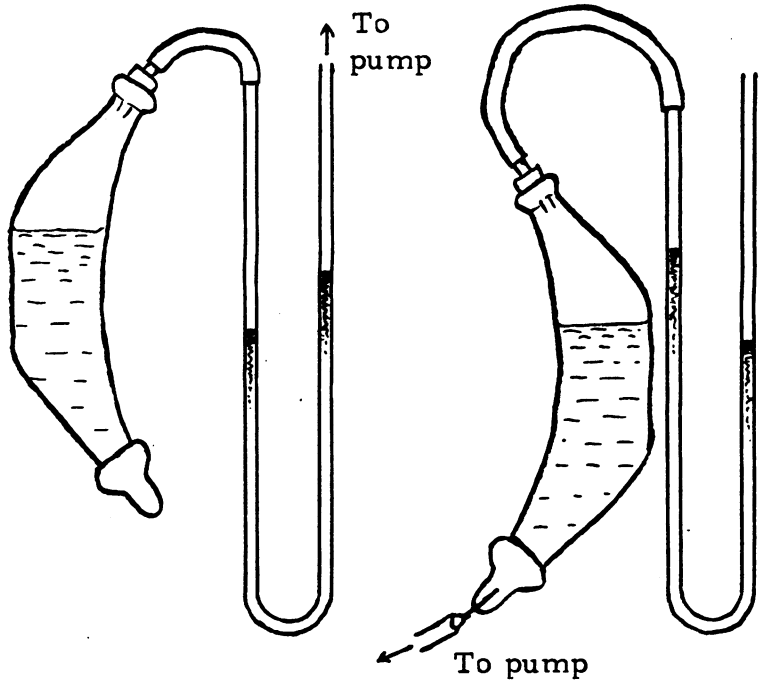

Figure 1. Negative pressure experiments

'Windy' babies seem to have a feeding technique of their own. The baby sucks normally until the increasing negative pressure makes this difficult; he then separates the lips slightly without releasing the teat. A few bubbles of air are seen to rise through the milk but the baby resumes sucking before there has been much reduction in the negative pressure. The whole feed is taken in this way, against a partial vacuum and with the expenditure of much effort and time. In the process, air is swallowed. Occasionally, as in the instance cited, the situation may deteriorate until the baby is driven by pain, frustration and exhaustion to give up the struggle and refuse to feed.

Historical

The early history of the development of the artificial feeding bottle and rubber teat is one of sustained battle against vacuum. The first rubber teats appeared on the market soon after Charles Goodyear discovered how to vulcanize rubber in 1850, and the earliest feeding

bottles consisted of a teat fitted to a beer or sauce bottle.* An early attempt to counter the negative pressure created in the bottle was to place a piece of string across the mouth of the bottle before attaching the teat. A little air could then enter along the string. Equally, a little milk could escape along the same track and the method was apt to be messy.

Method	*Type of teat*	*Flattening (mm. Hg)*		
		Began	*Complete*	*Mean*
Retrograde suction		64	78	71
Direct suction		70	82	76
Retrograde suction		35	67	51
Direct suction		35	67	51

Figure 2. Negative pressure experiments

In the late nineteenth century an elaborate bottle was invented which seemed, at first, to fulfil all requirements. It was a narrow, round, flask-shaped bottle (figure 3), closed at the neck by a screw-in stopper through a hole in which ran a narrow rubber tube. This was attached, within the bottle, to a glass tube of like width which extended to the bottom of the flask. The rubber tube was about nine inches long, and attached to it distally was a glass fitment which carried the rubber teat. In use, the bottle was loaded with milk and the stopper, with its attached tubes, was screwed into place. Next the bottle was tilted until milk filled both tube and teat and, when the baby had taken a firm hold of the teat, the bottle was turned

*Feeding bottles with teats simulated by flannel or by the " cured " nipples of sheep were used for at least a hundred years prior to the invention of the rubber teat. (Editor).

upright. The screw stopper could be loosened so that air could enter along its thread and the baby could feed easily and comfortably.

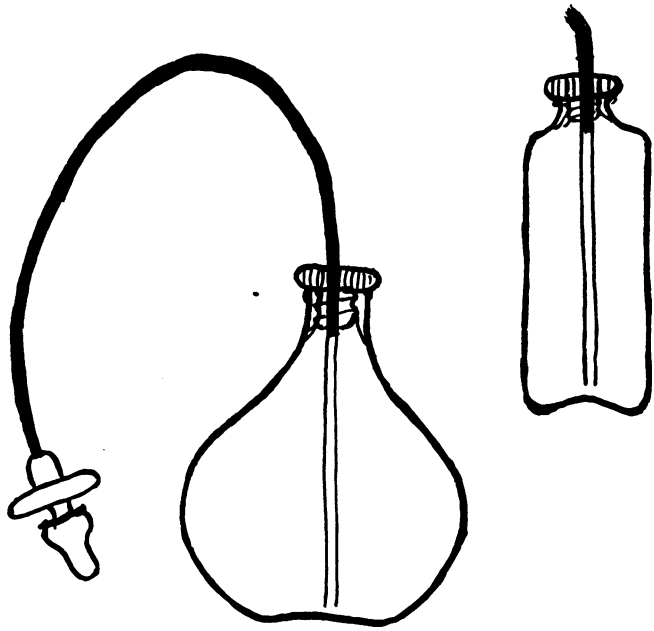

Figure 3. Feeding bottle (late 19th century)

This bottle was made and sold in very large numbers but it had two major drawbacks. In the first place it required a modicum of intelligence to carry out this complicated series of manoeuvres and secondly it was difficult to clean the tubes and the flask-shaped bottle.

Another bottle produced in the early twentieth century was designed to be much simpler in use. It was a flat-sided bottle with a long, angled neck which carried the teat (figure 4). Near the blunt end was a round, depressed area, in the centre of which was a tiny hole. In use, a thumb was placed over this hole whilst the bottle was filled, and removed as soon as the bottle had been tilted into the feeding position. Air entered through the hole as milk was sucked out of the bottle.

At about the same time the teat manufacturers designed an 'anti-vacuum' teat, which had a small inlet valve near its base

through which air bubbled in as milk was withdrawn. These teats worked very well for a short time but the small valve soon became clogged by curds and ceased to function.

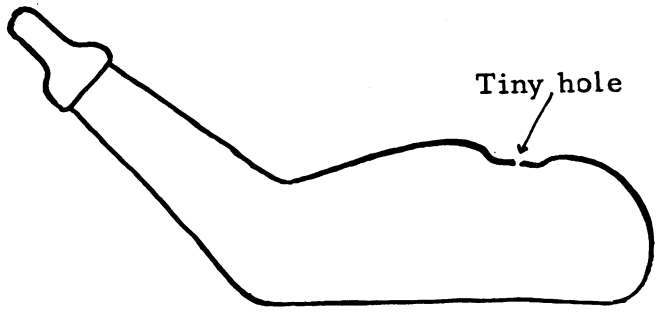

Figure 4. Feeding bottle (early 20th century)

Such bottles and teats fell into disuse overnight with the advent of the brilliantly conceived boat-shaped bottle which allowed free entry of air at one end whilst milk was withdrawn from the other.

Conclusions

In recent years, for no obvious reason, there has been a reversion to what is virtually the old beer-bottle with a teat on it—the upright feeding bottle, with no air inlet other than the hole in the teat. The fashion is set by hospitals and clinic doctors and midwives, in whose hands the upright bottle gives rise to little difficulty because they are experienced and skilled in its use. The average young mother, however, has no idea what a vacuum is and may find it difficult to comprehend that milk cannot be withdrawn from a closed bottle unless air is allowed to enter.

In an inquiry amongst midwives the only advantage claimed for the upright bottle was greater ease of sterilization.

The manufacturers appear to be more alive to the difficulties of infant feeding than do the medical and nursing professions and are amazed at the success of the upright bottle after all the efforts made in the past to overcome its deficiencies. There are signs that the cycle is being repeated, for already the teat with a small valve at its base is back in use. The sooner the boat-shaped bottle is back in favour the better, particularly for the youngest infants.

Summary

The history is recorded of an infant who suffered severely from

air-swallowing due to feeding from an upright bottle. Observations are made on bottle-feeding habits and their relationship to air-swallowing. The history of the development of bottles and teats for infant feeding is outlined and a plea is made for a return to the boat-shaped bottle.

Acknowledgements

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Breast Feeding

" . . . That milke is good, that is whyte and sweete, and when yet droppe it on your nayle, and do moue your finger, neither fleteth abrode at euery stering nor will hange faste vpon your nayle, whē ye turne it downeward, but that which is betwene both is best.

Sometime is chaunceth that the milke wasteth, so that ye nource can not haue sufficient to susteine the child, for the whiche I wil declare the remedies leauig out the causes for breuity of time.

Remedies appropriate to the encreasing of milke in the brestes.

Pasneppe rotes, and fenelle rotes, sodden in broth of chickens, & afterwarde eaten with a little fresh butter, maketh encrease of milke within the brestes.

An other.

The pouder of earth wormes dried and dronken in the brothe of a neates tongue, is a singuler experiment for ye same intent.

Also the broth of an olde cocke, with myntes, cynamome and maces.

Ryce also sodden in cowes milke, with the crūmes of white bread, fenell seede in pouder, and a little suger is exceading good.

An other good medicine for ye same.

Take Christall, and make it in fine pouder, and myxe it with asmuche fenell seede and suger, and vse to drinke it warme with a litle wyne.

A plaister for the encrease of milke.

Take fenell and hoorehounde, of euery one two handfulles, anys seede foure drammes, Saffron a scruple in pouder, swete butter thre oūces, seeth them in water, and make a playster to be layde vpon the nurces brestes.

Thomas Phaire — *The Boke of Chyldren*, 1593