Bottle nipples: How reliable is the flow rate?

A study of the flow rate and its variability for 25 nipple types that are used in clinics or at home

Pados , B. F., Park, J., & Dodrill, P. (2018). **Know the flow: milk flow rates from bottle nipples used in the hospital and after discharge.** Advances in Neonatal Care, 19(1), 32-41.

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Conclusion

This study shows major differences in the flow rate of bottle nipples. The flow rate ranged from very slow to very fast, with sometimes significant variations between individual bottles of the same type. The MAM nipple was one of the most reliable nipples in the test. The results can help people to select a suitable bottle nipple, especially for premature babies and babies with health problems who do not cope well with a quick milk flow.

Background

An infant must coordinate sucking, swallowing, and breathing when drinking. Whether this works well and safely depends on how quickly the milk flows. Premature babies or children with heart defects often have difficulties when drinking, which may be indicated through breathing interruptions, slowed heart rate, choking, or coughing (see info box). In this study, the flow rates of bottle nipples that are used in clinics or at home were tested.

Methods

Scientists from Boston tested 375 individual bottle nipples in total. Included in the sample were 25 different nipple types (twelve brands): 15 were available in retail stores in the US, including the MAM nipple (0+ months), ten were used in hospitals. For each type, 15 nipples were tested, which were mounted onto bottles attached to the breast shield of an electric milk pump. The amount of milk formula that could be withdrawn in one minute was measured. For every nipple type, the average flow rate and coefficient of variation were calculated. The coefficient of variation is a relative measure of variability and describes the spread of data around its mean value. In addition, nipples with a comparable flow rate were grouped using cluster analysis.

The most important findings

- Among the nipple types that were studied, the average flow rate varied widely, ranging from 0.86 to 37.61 milliliters per minute (**MAM nipple: 13.83 milliliters per minute**).
- Values between 0.03 and 0.35 were calculated as the coefficient of variation. For eight nipple types, the variability was low (coefficient of variation under 0.1), moderate for fourteen (coefficient of variation under 0.1 and 0.2) and high for three (coefficient of variation greater than 0.2; Fig. 1).
- The **MAM nipple** showed a **low measurement variability** (coefficient of variation under 0.05). This means that there were only minor deviations between individual nipples of this type.
- Based on their flow rate, the nipple types could be divided into five groups (Fig. 2).
- The information on the nipple packaging did not always accurately reflect the flow rates.
- In particular, single-use nipples that are used in clinics had a higher flow rate or greater variability in comparison to other products. The safety of these nipples should be reconsidered.

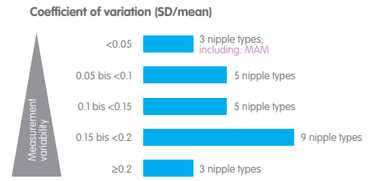

Fig. 1. The number of nipple types and variability of the flow rate (15 nipples were tested per type, the smaller the coefficient of variation, the lower the measurement variability)

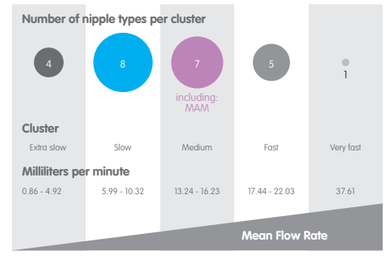

Fig. 2. The number of nipple types and grouping according to the average flow rate (milliliters per minute, result of the cluster analysis)

Learn more about the reliability of the MAM bottle nipple

The full study can be found at:
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More information about the study

Bottle nipples: How reliable is the flow rate? A study of the flow rate and its variability for 25 nipple types that are used in clinics or at home.

This article discusses a study conducted by B. F. Pados et al. on the subject of bottle nipples.

The quicker the milk flows, the more often drinking infants have to interrupt their breathing to swallow. This can have a negative impact on oxygen saturation. While healthy babies can adapt their sucking to high flow rates, premature babies or infants with health problems often have difficulties with this. Bottle nipples with a low flow rate can help these children to drink more safely.

New products regularly come onto the market. Therefore, an update of the literature, which has previously shown large differences in the flow rates of bottle nipples was necessary. In this study, scientists from the Connell School of Nursing and the Brigham and Women's Hospital in Boston, USA, tested 25 nipple types from twelve brands that are frequently used in hospitals or that are offered for purchase after discharge (available in at least three out of six selected US retail chains).

For each type, 15 nipples were tested under standardized conditions (375 individual bottle nipples in total). The nipples, along with their associated baby bottles filled with milk formula, were attached at a 30-degree angle to the breast shield of an electric milk pump (suction rate: 108 cycles per minute). The amount of milk pumped in one minute was weighed and converted to milliliters. This test setup was suitable for a comparative assessment of flow rates; the goal was not to imitate the sucking pattern of a baby. For every nipple type, the mean value and coefficient of variation were calculated. The nipple types were grouped based on their flow rate using cluster analysis.

The average flow rate was between 0.86 and 37.61 milliliters per minute. The **MAM nipple** had an **average flow rate of 13.83 milliliters per minute**. With a coefficient of variation of less than 0.05, it was one of the three nipples with the **lowest measurement variability**. For other nipples, the variability was significantly higher in some cases, with values of up to 0.35.

The packaging did not always provide accurate information on the flow rate. For example, of two products from different brands, which both declared a slow flow rate, one was assigned to the „very slow" category, but the other to the „fast" category.

In some cases, particularly with single-use products, the nipple had no hole. Furthermore, the silicone of some holes stuck together so strongly that the flow was blocked. The authors also pointed out that milk flow might be impaired if the bottle is screwed on too tightly since vent systems cannot work properly. The amount of liquid in the bottle, and thus the hydrostatic pressure, can also affect the flow rate.

The flow rate and its variability are important pieces of information when choosing a suitable nipple, especially for infants with health problems such as premature babies or babies with heart defects. In the future, other factors should be investigated in this context, such as the shape, compression, and elasticity of bottle nipples.

MAM Service
The full study can be found at: **mambaby.com/professionals**

Safety comes before efficiency when drinking
Additional information from: Pados, B. F. (2021). **Milk flow rates from bottle nipples: what we know and why it matters.** Nursing for Women's Health, 25(3), 229-235.

The flow rate of bottle nipples in addition to other factors determine whether babies are able to drink safely. If the milk flow is too fast, this is how infants can react:
1) They stop drinking and turn their head away.
2) They swallow as fast as they need to, but at the expense of breathing, which can lead to breathing interruptions and slowed heart rate.
3) They cannot swallow quick enough and aspirate fluid, choke, or cough.
4) They suck in a way that still allows them to breathe well and let excess milk run out of the mouth.
Attention should be paid to such signals when feeding. There is limited research on the effects of flow rate on infants, with no adverse effects observed with nipples with slow milk flow. When choosing a bottle nipple, safety when drinking should take precedence over efficiency.