



Safety advice for infant milk preparation: Vacuum flasks, combined formula mixer and bottle insulator and milk preparation machines.

March 2015

This statement offers advice to professionals when asked about making up powdered milks on the move, or using specialist equipment.

1. Vacuum Flasks

The Department of Health recommend that the safest way to make up feeds from powdered infant formula (PIF) when away from home is to make the feed up freshly using a vacuum flask of boiled water. The boiling water should kill any bacteria present in the flask. The feed can then be made up in a sterilised feeding bottle using PIF pre-measured into a small, clean, dry container and the correct amount of boiled water from the vacuum flask. The Department of Health state that vacuum flasks, if full and securely sealed, will keep the water temperature above 70°C for several hours.¹

We have tested several typical vacuum flasks, with two volumes of water, over a period of between 1-3 hours, with the thermos flasks warmed for 1 minute with boiling water before use and stored at an ambient temperature of about 19°C. We found the following average temperatures of water when the procedures were conducted three times, with each time test completed on a freshly stored batch of boiling water:

Amount of water in the bottle	Temperature when boiling water first added to flask °C	Temperature after 30 minutes °C	Temperature after 1 hour °C	Temperature after 2 hours °C	Temperature after 3 hours °C
Full flask: (approx. 17.5oz)	92	90	90	86	76
10oz	92	80	74	72	66
5oz	92	72	70	64	58

The 10oz flask of water was also tested at 2 hours and 30 minutes and the temperature had dropped to an average 68°C. This suggests that a minimum of 10oz of water should be carried in a flask, and that water should be used within 2 hours. Smaller amounts of 5oz will only remain at the correct temperature for about an hour. A full flask of water securely sealed as suggested by The Department of Health remains at >70°C for about 3 hours.

¹ http://www.nhs.uk/start4life/documents/pdfs/start4life_guide_to_bottle_feeding.pdf

2. Combined formula mixer and bottle insulator: 'Myyfeed'



The *Myyfeed* formula mixer and bottle insulator is currently the only one of its' kind available on the UK market, and retails at £24.99 (excluding the infant milk bottle). It is marketed as making the process of preparing a formula feed more convenient when outside the home. The product combines a container for pre-measured amounts of PIF which sits inside a bottle insulator above the feeding bottle of warm water. Placing the PIF container over the neck of the bottle and clicking a button on the container releases the PIF into the bottle, avoiding any spillage of the powder. The bottle must then be shaken to mix the PIF with the warm water.

Provided that the water has been previously boiled before being measured into the bottle and placed in the insulator, and the PIF is added when the water is not below 70°C, the product allows formula milk to be prepared according to current guidance (DH, 2012).

The manufacturers' suggest that the insulator will keep a 9 fluid ounce bottle of water above 70°C for up to two hours but do not caution against smaller amounts which may be commonly measured into the bottle for a feed. There are other factors that will influence the rate at which the water cools including the temperature of the water when it was put in the bottle, the volume of water and the ambient temperature and these factors may reduce the window of opportunity in which the water may be safely used.

We have taken the temperature of the water in the bottle using different amounts of water over different lengths of time, using 9oz of water suggested by the manufacturer and a smaller volume that parents of younger babies may measure into the bottle. We followed the procedures used for the vacuum flask work above and had the following average results:

Amount of water in the bottle	Temperature when boiling water added to bottle °C	Temperature after 30 minutes °C	Temperature after 1 hour °C	Temperature after 2 hours °C	Temperature after 3 hours °C
9oz	92	74	70	66	60
5oz	92	72	68	60	56

We would conclude that this system is less effective than carrying water in a thermos flask, and the time saving of the automatic mixing, compared to using a pre-measured volume of powder in a small container seems minimal. If these flasks are used then a full bottle of boiling water should be used, and then some water discarded before the powder is added, and water should not be held in the container for more than 2 hours. Larger volumes than 9oz are not possible in a bottle held in this flask.

3. Formula Preparation Machines

Formula preparation machines are relatively new to the UK market and are marketed as being a sterile and convenient method of preparing formula feeds at the correct temperature for consumption, within minutes.

In the UK, the only formula preparation machine currently available at high street retailers is the Tommee Tippee Perfect Prep™ Machine. This machine claims to "*prepare a fresh bottle at just the right serving temperature within 2 minutes*". The machine uses a two-step process to prepare the feed. In the first step the machine dispenses a "hot shot" of water directly into the bottle. The user then has two minutes to add the PIF, place the holding cap on the bottle, shake to mix and return the bottle to the machine. In step 2, cold water is added by the machine to make up the selected feed volume to a comfortable temperature to feed immediately.

Whilst research into the safety and efficacy of the Perfect Prep™ Machine has been carried out by the manufacturer, this is not currently in the public domain and the manufacturer has declined to release it for business competition reasons. Mayborn Group Ltd. who produce Tommy Tippee brand products have said:

'Our Perfect Prep product has been tested by an independent laboratory that validated that the 'hot shot' of water addressed the (E.Sakazakii) species of concern. The laboratory used was Intertek Testing Services (UK) Limited. The filter we use is not a standard water filter, such as the ones you might find in a Britta system – it's an antibacterial filter. We have independently validated the removal of bacteria that may be present in water, and we have done this test in extreme circumstances, dosing the water with significantly higher levels of bacteria than typically found in water supplies, so we can be truly confident of the filter efficiency. Validation was carried out by Intertek Testing Services (UK) Limited'.

Unpublished university based research which investigated the efficacy and temperature profile of the Tommee Tippee Perfect Prep™ Machine using PIF inoculated with known amounts of *Cronobacter sakazakii* has suggested that whilst the machine hot shot of water onto a small volume of powder was able to eradicate more than 95% of the bacteria, it failed to reduce their numbers to an undetectable level. Whilst the machine produced water for the "hot shot" at a temperature higher than the 70°C stipulated in current guidelines, the temperature fell to around 60°C after 2 minutes. Furthermore, when PIF was added at 30, 60 and 90 seconds after the "hot shot" - the temperatures in the bottle were only maintained for around five seconds before they fell again to between 52.5 and 55.5°C.

This research showed that dependent on when the PIF is added, the water temperature may be too low to effectively eradicate all bacteria present. The volume of the initial hot shot of water used for a four ounce feed is about one fluid ounce, and it is questionable as to whether this small volume of water can adequately make contact at the right temperature with the amount of PIF added. The research suggests that this volume of water is insufficient to maintain a temperature of greater than 70°C for the duration of the two minute window

recommended for the addition of PIF. This data has not been published in a peer-reviewed journal and therefore can only be considered as contributory evidence at the present time².

The Food Standards agency made the following statement when asked about the safety of these formula machines in 2014:

'The issues we have with it are, although it states it dispenses a 'hot shot' at 70C to kill bacteria that potentially could be in the powder, the reality (if you watch the TT advert) is that this amount of hot water used is very small, and once this is dispensed into a cold bottle/cold powder the heat will be quickly lost (more so than when preparing a full bottle with cooled, boiled water to >70C), so we would be interested to see whether TT have done any validation to see what temperatures the hot shot/powder combo actually reaches (and whether this is enough to destroy any bacteria). The other issue, is that the rest of the bottle is then topped up with cold water, which TT state is filtered to remove impurities. Again we would be interested to know whether it has been validated that the TT filter removes potential bacteria in the tap water (as this won't previously have been boiled). At present the Food Standards Agency would still advocate the use of our Best Practice Guidance, to use cooled, boiled water at >70C to make up infant formula'.

(Email communication between Francesca Entwistle (UNICEF) and Lorna Rowswell at FSA. February 2014)

Department of Health guidance on formula feeding does not cover the use of formula making machines, however in some areas, for example Cambridgeshire Community NHS Trust and Lanarkshire NHS staff have been advised that these machines should not be recommended or promoted by staff since there is insufficient data available about their safety.

Cambridgeshire Community NHS Trust state that:

"Due to the inability to have confidence in all of these machines to correctly prepare a bottle safely, staff must not recommend these and discuss with parents their danger."(Cambridge Community Services NHS Trust, 2014)

The convenience of this type of formula preparation machine is questionable as users are still required to sterilise all feeding equipment and wash surfaces and hands before preparation and accurately measure and add the PIF to the feeds. There are also maintenance issues to address such as changing filters and running de-scaling cycles - which cost both time and money. The only benefit to parents appears to be the time saving associated with not having to wait for water boiled in a kettle to cool before the milk powder can be added.

First Steps Nutrition Trust therefore believes that **there remains insufficient evidence that these machines are safe in the preparation of powdered infant formula**, and recommend that families and carers use cooled, boiled water at >70°C to make up powdered infant formula as currently recommended by the Department of Health.

² Personal communication with First Steps Nutrition Trust