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More Warnings on Baby Formula — Heat-Resistant Bacteria Found Even After Safe Preparation

Analysis by Dr. Joseph Mercola | December 03, 2025

STORY AT-A-GLANCE

- Powdered infant formula isn't sterile, and heat-resistant bacteria like Bacillus cereus and Cronobacter can survive normal prep temperatures, meaning your baby could be exposed even when you think you're doing everything right
- Water needs to be hot at the moment you add the powder — around 165 degrees F (74 degrees C) — to reduce dangerous pathogens, so using a thermometer gives you control instead of guessing based on boiling and waiting
- At-home formula machines often fail to reach safe temperatures, and some even introduce new contamination through internal filters, which means relying on them without checking water temperature increases risk for your child
- Even safely mixed formula becomes unsafe quickly at room temperature, especially once feeding starts, because bacteria from your baby's mouth multiply fast in warm, nutrient-rich milk
- Many formulas contain ingredients like seed oils, heavy metals, and mycotoxins that affect your baby's metabolism, immunity, and brain development, so understanding these risks helps you make safer feeding decisions

Many parents rely on powdered infant formula as the primary source of nourishment for their babies. But despite formula manufacturers touting the convenience and superiority of their product, what they cannot always guarantee is safety.

Case in point: A recent study found that certain bacteria can survive the heat typically used to make baby formula "safe" — raising new concerns about what might still be present in your baby's bottle.

Do Heat-Resistant Bacteria Really Survive Typical 'Safe' Baby Formula Prep?

The demand for infant formula continues to rise, as mainstream health advice continues to tout the advantages of these milk alternatives, saying they're "convenient" and "healthier" for young children. In fact, the global baby formula market is set to rise to $153.26 billion by 2030.[1]

But choosing infant formula over breast milk (which I'll dive into more details below) as your child's first food is one of the most drastic decisions you can make for their well-being. Not only are you choosing to give your child an unnatural, highly processed product during their first years of life, but you're also exposing them to a risk of contamination.

- **Baby formula goes through a rigorous manufacturing process —** The end result is an easily dissolvable powder form that's reconstituted by adding water to the product. However, even if there are stringent safety protocols in place, this extensive manufacturing process still allows multiple opportunities for bacteria like Bacillus and Clostridium to contaminate the product.

  Listeria monocytogenes, in particular, can survive pasteurization.[2] Hence, parents are advised to follow proper formula preparation to minimize the risk.

- **How hot should water be for formula milk?** In order to reduce the risk of bacterial contamination, both the World Health Organization (WHO) and the U.K. National Health Service (NHS) advise using freshly boiled water to reconstitute formula milk. After boiling, the water needs to be cooled to 158 degrees F (70 degrees C) before using it to reconstitute the formula. Afterward, the milk needs to be cooled further to a safe feeding temperature before giving it to the infant.

This recommendation comes from earlier research showing that common environmental bacteria, many of which act as opportunistic pathogens, can be effectively eliminated by moderate heat.

- **However, not all parents abide by this guideline —** In fact only about 44% of parents boil fresh water when preparing formula, with many opting instead for previously boiled, cooled water.

- **Additionally, some people use at-home preparation machines (AHPMs) to prepare baby formula —** These modern conveniences that dispense, mix, and heat formula are becoming popular nowadays, particularly for busy or overwhelmed parents who need help.

  However, studies found that approximately 85% of AHPMs fail to reach the recommended temperature, even though around 52% of parents now rely on them for formula preparation, News-Medical.net reports.[3]

  These oversights in proper preparation further compromise baby formula's safety. Yet, even if the guidelines were followed, it sometimes isn't enough; there's still a high risk for contamination to occur.

Which Bugs Should Parents Be Worried About?

A recent study provides more insight into the risk of contamination in baby formula. In a paper published in the Journal of Applied Microbiology, researchers conducted an investigation into microbial contamination in 21 different brands of baby formula sold in the U.K.[4]

- **Each formula was prepared using three parallel methods —** These include sterile water heated to 70 degrees C, sterile water at room temperature, and using a popular AHPM. To detect microbial growth, the prepared samples were cultured on

Tryptic Soy Agar (TSA) for bacteria and Sabouraud Dextrose Agar (SAB) with chloramphenicol (50 mg/L) for yeasts. The microbial isolates were then identified using advanced mass spectrometry techniques.

- **Microbes were detected —** The researchers found microbial contamination in five sterile room-temperature samples and four from samples using 70 degrees C water. What's astounding, however, was the results from AHPMs — the majority of samples prepared using these devices exhibited contamination — 16 samples on TSA and 18 on SAB.

> *"Interestingly, the formula prepared using an AHPM had distinct microbial patterns. Even sterile water run through the appliance showed microbial growth, indicating the problem may lie in the filters,"* News-Medical.net reported.

Based on bacterial recovery counts, the researchers estimated that a three-month-old infant consuming formula prepared under these conditions could ingest approximately 10^6 CFU (colony-forming units) of bacteria per day. While this number is lower than the microbial exposure from exclusive breastfeeding, it involves different microbial species, some of which may be less beneficial.

- **One of the potential pathogens isolated in infant formula was Bacillus cereus —** These spore-forming bacteria have been associated with food poisoning and other more serious health issues.[5] B. cereus spores can survive drying, heat, and even brief boiling, and once the spores encounter moisture and nutrients, like those in formula milk, they can become active again.

- **When milk was heated to 65 degrees C or above, B. cereus levels dropped significantly —** However, viable B. cereus cells were still detected even at 100 degrees C, though in much lower numbers. Some pathogens found in AHPM-prepared formula were temperature-resistant strains of B. cereus.

- **In contrast, yeasts such as Candida albicans were eliminated at 70 degrees C —** However, not all yeast species may have been destroyed under typical preparation conditions.

  > *"Current preparation guidance may not remove all microbial contaminants of PIFs, including the opportunistic pathogens identified in this work. These appear to be primarily environmental contaminants, and which may present a currently underappreciated concern with regards to infant microbiome development,"* the researchers concluded.[6]

- **A separate study also highlights Cronobacter as a cause of infections from baby formula —** Published in the Journal of Food Protection, researchers from Cornell University highlight how Cronobacter can be lethal to infants below 2 months old, preemies, and those who are immunocompromised.

  "When the bacteria contaminate powdered formulas, they can cause septicemia, meningitis and death. Cronobacter cases are rare, with an estimated 18 cases occurring annually in the U.S.," the researchers reported. However, they said that meeting the recommended temperature can help reduce the risk.

What Temperatures and Timings Actually Reduce Risk

The Cornell University study provided recommendations on how to teach baby formula safety to parents. They noted that simply following current label instructions — "boil water, cool for several minutes, add powder" — isn't enough to guarantee bacterial destruction as they provide ambiguous guidelines.

> *"Some of the guidance just says boil and wait five minutes, which is not a temperature at all,"* Abigail Snyder, PhD., an associate professor of microbial food safety in the Cornell College of Agriculture and Life Sciences and one of the study authors, said. *"All of these different practices change the thermal history of that water."*

- **The key problem isn't just the temperature you start with —** Rather, it's the exact timing of when that hot water meets the powder and how long it stays hot afterward. That said, the researchers recommend a more precise approach that eliminates confusion and reduces the survival of dangerous pathogens like Cronobacter:

    1. Boil water and pour it into the bottle.
    2. Use a thermometer to check when it cools slightly to around 165 degrees F (74 degrees C) — a safe yet effective temperature.
    3. Add the baby formula at that point.
    4. Wait for one minute before starting any cooling (for example, running the bottle under cold water).

Using a food-grade thermometer helps confirm that the water truly hits the right range before mixing. It removes any guesswork from a process where precision matters.

In short, safe preparation isn't about boiling and waiting — it's about timing, sequence, and sustained heat contact. A few seconds' difference can determine whether your baby's bottle is free from heat-resistant bacteria or quietly harboring them.

Hygiene That Actually Matters

Baby formula safety doesn't stop at boiling water at the right temperature — it extends to every tool that you use to prepare and give the formula to your child. Each piece of feeding equipment can become a reservoir for bacteria if not cleaned properly. Follow these tips when preparing baby formula. Bacteria growth is reduced when proper precautions are taken.

- **Wash your hands thoroughly before handling bottles or powder —** Clean bottles, nipples, and rings with hot soapy water, using a dedicated brush to scrub crevices.

- **Allow everything to air dry completely on a clean rack —** Towels can trap moisture and encourage microbial growth.
- **Make sure the baby formula is properly sealed and the container, along with the other equipment, is placed in a clean, closed space —** Keep the scoop inside the can; it needs to be kept dry at all times.
- **Sterilizing bottles at least once a day during early infancy helps eliminate biofilms —** This refers to a community of microorganisms that can thrive on these containers. Biofilms can resist soap and water, so sterilization is vital. Once your baby is older and healthy, daily thorough cleaning may suffice, but inspect nipples regularly for buildup or residue.

These steps matter because contamination doesn't just happen during mixing — it often occurs after, when bacteria find a warm, moist environment to grow.

Baby infant formula hygiene checklist

1. Wash bottles and nipples immediately after each use.
2. Use separate brushes for bottle and nipple cleaning.
3. Air dry, never wipe.
4. Sterilize bottles daily to prevent biofilm formation.
5. Store equipment and formula milk in a clean, closed space.
6. Keep scoops inside powder cans dry at all times.

Baby Formula Safety Has Always Been Uncertain

These recent findings just add to the growing evidence on the risks of contamination in powdered formula milk. Over the years, there have actually been multiple recalls on various infant formula brands, after they've been found to contain pathogenic bacteria.

- **Crecelac infant formula recalled over Cronobacter contamination —** In 2024, the U.S. Food and Drug Administration (FDA) raised the alarm on this formula milk brand after they found that aside from failing to meet regulations, its products also tested positive for Cronobacter bacterium.[7]

  Although no illnesses were reported with the recall, the FDA still advised guardians to seek immediate care if their child exhibits symptoms like poor feeding, grunting breaths, and temperature changes[8] after consuming these infant formulas, as these are signs of Cronobacter infection.

- **What's even more alarming is that independent studies have also found heavy metals in baby formulas —** For example, a review published in the Science of the Total Environment journal found that infant formulas sold in Asia, Europe and Africa contain high levels of heavy metals, like lead, cadmium, arsenic, and manganese.[9]

  Meanwhile, an independent study spearheaded by two nonprofit foundations, GMOScience and Moms Across America, found five toxic heavy metals in 20 infant formulas from well-known local and international brands, including Similac, Enfamil, and Gerber.[10,11]

  > *"Chronic exposure to these metals, even at low levels, can have cumulative effects on infants, potentially leading to developmental and neurological issues, carcinogenic, as well as initiating the development of chronic diseases later in life,"* the researchers said. *"Given the [crucial] growth period in infants, even small amounts of toxic metals can have disproportionately large impacts as compared to adults."*

- **Mycotoxins are another threat to baby formula safety —** Produced by molds or fungi, these secondary metabolites may have various detrimental effects, as they are carcinogenic, neurotoxic, hepatotoxic, dermatotoxic, estrogenic and immunosuppressive.[12]

- **Finally, baby formula is loaded with seed oils —** These highly processed oils are loaded with linoleic acid (LA), which is among the most damaging ingredients you can have in your diet. Excessive amounts of LA has been associated with obesity, inflammation, and metabolic dysfunction — and yet the FDA requires infant formulas to have at least 2.7% of their calories (300 mg per 100 kcal) to come from this problematic omega-6 fat.

  Meanwhile, the fats that are essential for developing infants are largely absent from formula. You can read more about this in "The War Against Breastfeeding and the Dangers of Infant Formula."

Breast Is Always Best

What's unfortunate about this baby formula issue is that it is mostly unnecessary, as Mother Nature has provided mothers with the best food to nourish their children — breast milk. However, not all mothers can provide their infants with sufficient breast milk, and this led to the creation of infant milk substitutes that hope to match the safety and efficacy of human breast milk.

But despite these attempts, food manufacturers are unable to replicate nutritional profile of breast milk. It is indeed the perfect food for any child, which is why breastfeeding remains the most natural and powerful way to nourish babies.

- **Breast milk contains sugars that promote gut and brain development in infants —** A systematic review and meta-analysis in Frontiers in Pediatrics found that human milk oligosaccharides (HMOs), complex sugars that pass undigested to your baby's colon, are abundant in breast milk. HMOs feed beneficial bacteria, strengthen defenses, and support healthy brain and immune development not just during infancy but even into toddlerhood as well.[13]

- **HMOs also influence long-term metabolic health —** Their ability to positively influence gut bacteria and regulate immune activity contributes to healthier energy balance and reduced inflammation. Additional research even suggests that HMOs

offer protection against Type 2 diabetes, obesity, and allergic disease.[14]

- **Myo-inositol, also found in breast milk, boosts brain function as well —** This small cyclic sugar molecule significantly increases synapse abundance. Synapse formation reaches its highest rate during the first months of life, laying the groundwork for sensory processing, learning, and memory. Myo-inositol further enhanced neuronal connectivity, helping brain regions integrate more efficiently into functional networks that support learning, memory, and overall information processing.
- **The benefits of breast milk go beyond brain, immunity, and gut health —** Multiple studies have provided clear evidence on how breastfeeding influences infants' overall health, by protecting and reducing the risk of conditions like:
    - Allergies[15]
    - Sudden infant death syndrome (SIDS)[16]
    - Blindness in preemies[17]
    - Autism and attention deficit hyperactivity disorder (ADHD)[18]
    - Cancer, including leukemia[19]
- **Breastfeeding also benefits mothers, too —** For example, breastfeeding helps the uterus return to a normal size and reduces postpartum bleeding, which means moms who breastfeed their child recover quicker from childbirth.[20] Other maternal benefits include:
    - Reduced rates of breast and ovarian cancer[21,22]
    - Lower risk of postpartum depression[23]
    - Reduced risk of cardiovascular disease[24]
    - Lower mortality risk[25]

What to Do if Breast Milk Isn't an Option

Even though breastfeeding offers numerous well-documented health benefits, fewer than half of infants worldwide are breastfed according to WHO recommendations — leading to an estimated $350 billion in global economic losses each year.[26]

While many mothers choose infant formula because of convenience, there are some who cannot breastfeed due to health reasons or because their milk production is not just sufficient to maintain their child's needs. In this case, my recommendation is to forgo commercially available baby formula and instead make your own homemade baby formula using raw milk.

In my article "**US Pushed Countries to Weaken Infant Formula Regulations, Documents Show**," Sarah Pope, also known as The Healthy Home Economist, explains the differences between different kinds of milk, such as cow's milk and goat's milk, and why cow's milk is actually preferable. She also provides a guide on how to make your own baby formula. If your child has a milk allergy and is unable to tolerate milk proteins, you can check out her **hypoallergenic milk formula recipe** as well.

Frequently Asked Questions (FAQs) About Baby Formula Safety

Q: Can bacteria survive boiling in baby formula?

A: Yes. Heat-resistant bacteria species like Bacillus cereus can survive drying, heat, and even brief boiling. According to the study published in Journal of Applied Microbiology, viable B. cereus cells were still detected even at 100 degrees C, although in lower numbers. Spores are the reason — they remain dormant through boiling and reactivate when mixed with warm formula.

Q: What temperature should water be to reduce Cronobacter risk?

A: The WHO and NHS recommend using freshly boiled water cooled to 158 degrees F (70 degrees C) before mixing formula. Cornell University researchers refine this further, advising parents to use a thermometer and mix powder when the water reaches 165 degrees F (74 degrees C), then let it sit for one minute before cooling. This destroys Cronobacter more effectively.

Q: Are at-home formula machines safe?

A: Not reliably. According to the research findings, approximately 85% of at-home preparation machines (AHPMs) fail to reach the recommended 70 degrees C needed for safe preparation, even though more than half of parents now depend on them. Some machines even showed microbial contamination when researchers ran sterile water through the device, suggesting the filters themselves may harbor bacteria.

Q: How long can mixed formula sit out?

A: Bacteria multiply rapidly once baby formula is mixed. While exact times vary by agency, the file states that contamination happens quickly whenever baby formula sits warm. Once feeding begins, leftovers should be discarded, because bacteria from the baby's mouth enter the bottle and grow rapidly in the nutrient-rich formula.

Q: Should I worry about sugars or other ingredients in formula?

A: Yes. Beyond bacteria, baby formula carries other additives and contaminants that can pose long-term developmental and neurological risks, especially during infancy. These include:

- High levels of seed oils, which are rich in linoleic acid and linked to inflammation and metabolic dysfunction

- Heavy metals such as lead, cadmium, arsenic, and manganese, found in multiple formula brands
- Mycotoxins, which can be carcinogenic and immunosuppressive

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