Composition and Drying Methods for Preservation of Probiotic Bacteria in Food Products

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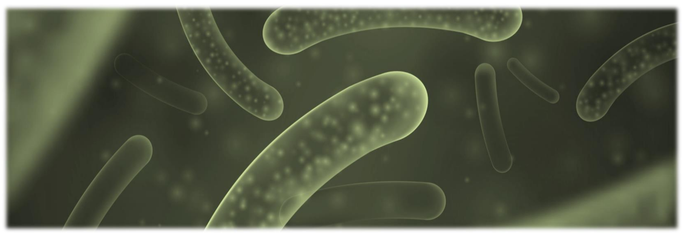
OBJECTIVE

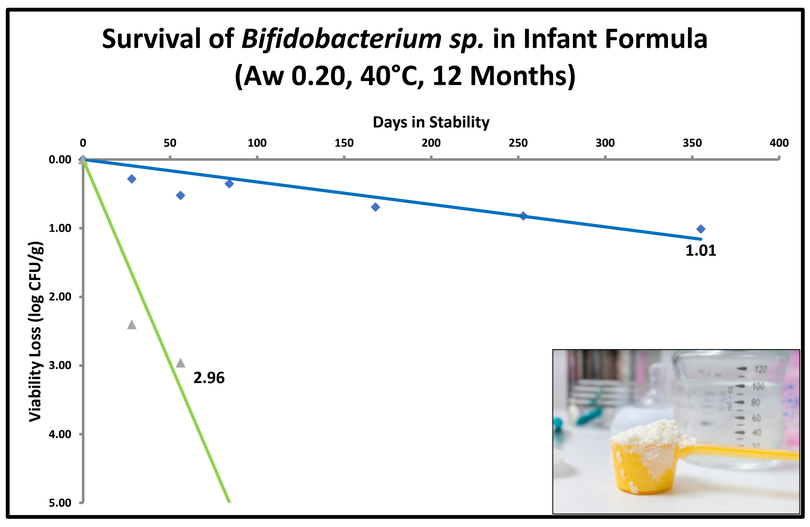
When incorporating probiotic bacteria into food products, it is necessary to maintain probiotic viability during drying and throughout a product's shelf-life. This work describes the effect of different drying methods on probiotic survival and the effectiveness of a stabilizing composition in maintaining probiotic viability in various medium water activity food products.



ABN TECHNOLOGY ATTRIBUTES

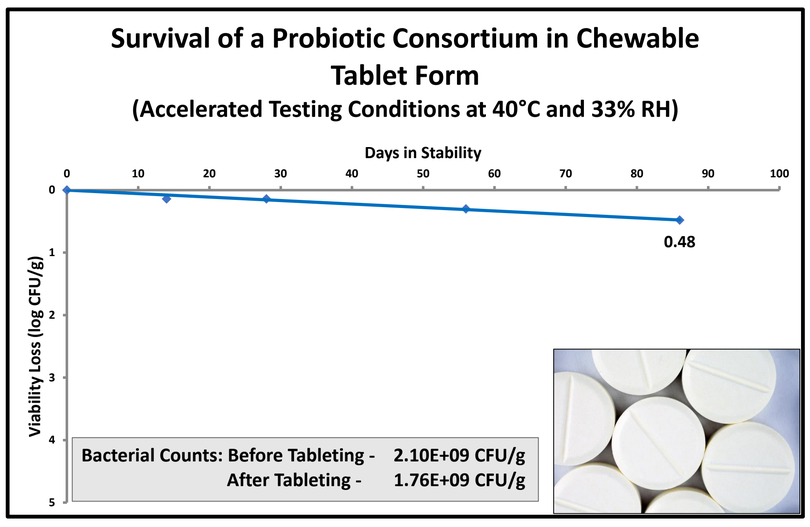
METHODS

Using a proprietary composition (Advanced BioNutrition Corp.(ABN), Columbia, MD, US), individual probiotic strains and a probiotic consortium containing multiple microorganisms were stabilized with the protecting composition and dried by evaporation, spray-drying, or lyophilization. Dry, stable probiotic powders were added to infant formula (A_w=0.20), acidic drink mix (A_w=0.27), chewable supplement tablets (A_w=0.33), and breakfast cereal (A_w=0.40). The packaged probiotic-enriched foods were stored at temperatures ranging from 25 to 40 °C for extended periods of time and probiotic survival demonstrated by microbial plating. Probiotic viability loss is presented in log CFU/g.



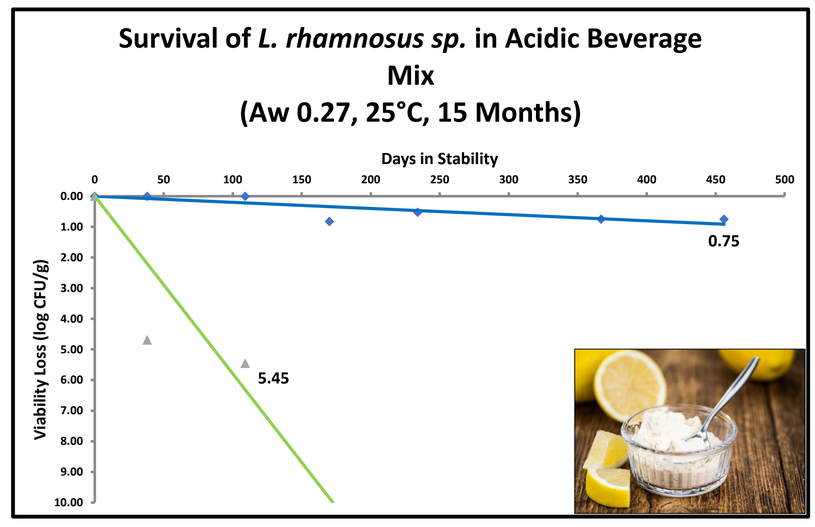
Infant Formula

Storage shelf-life at 40°C of infant formula containing *Bifidobacterium* sp. (Aw = 0.20) was extended for 1 year with a viability loss of only 1.01 log CFU/g, while the non-stabilized probiotics lost 2.96 log CFU/g in 56 days.



Chewable Dietary Supplement Tablets

A stabilized probiotic consortium was blended with excipients and formed into chewable tablets using a tablet press at 1 ton of pressure. The ABN technology was effective in stabilizing an entire consortium of bacteria species and not only protected the probiotics during the mechanical stress of tableting but imparted significant stability in aggressive accelerated testing environmental conditions. The tablets were stored in open containers exposed to 40°C and 33% relative humidity and lost only 0.48 log CFU/g in about 3 months.



Acidic Drink Mix

Storage shelf-life at 25°C of acidic powdered beverage mix containing stabilized *L. rhamnosus* sp. (Aw= 0.27) was extended to 15 months with a loss of only 0.75 log CFU/g, while the non-stabilized probiotics lost 5.45 log CFU/g in less than 4 months.

The Effect of Drying Methods on *L. acidophilus* Survival

Drying Technique	Calculated Viable Cell Concentration (log CFU/g)	Measured Viable Cell Concentration (log CFU/g)	Viable Cell Loss (log CFU/g)
Drying by Evaporation*	11.64	11.50	0.14
Drying by Sublimation*	10.98	10.76	0.22
Spray Drying	10.98	10.91	0.07

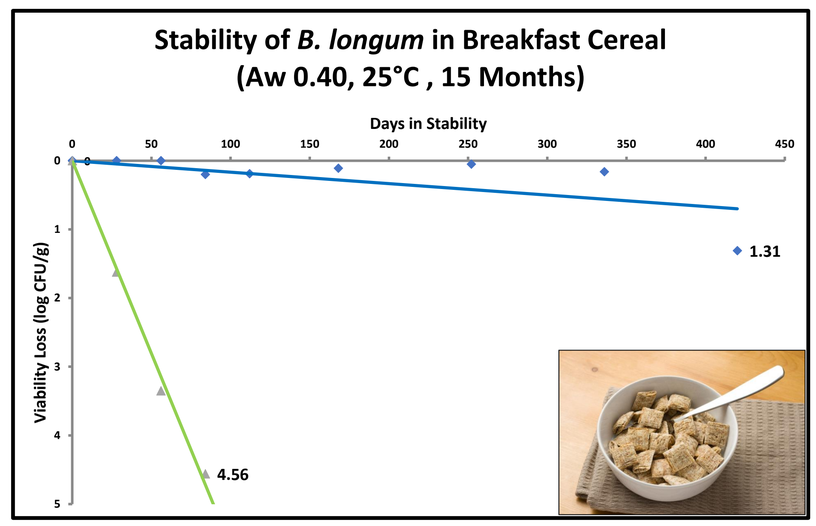
*Drying performed using a commercial freeze dryer

Drying Methods and Survival

Drying of probiotic bacteria is commonly done by freeze drying or spray drying. Most commercial probiotic strains retain sufficient activity after drying, but that does not ensure their viability in food and supplement applications over the product's shelf-life. To achieve viability retention over time a form of protection must be used. Typical controls include moisture-resistant capsules, specially engineered packaging, and the reduction of the end product's moisture to ≤0.1Aw. Here *L. acidophilus* was dried using three methods. All samples demonstrate good retention of viable cells after drying. ABN's stabilization technology, which combines unique formulations and drying by evaporation, allows probiotic strains to be added to foods and supplements with moderate water activity while providing excellent stability over the product's shelf life, and reducing the need for significant over formulation.

Results and Conclusions

These results demonstrate the excellent survival of probiotics across various drying methods. Good long-term probiotic survival is achieved in food and tablet applications after being formulated with ABN's stabilization technologies. Robust stabilization platforms reduce the need for over-formulation to achieve end of product shelf-life requirements. This creates opportunities for economic savings, allows for the development of new probiotic products, and increases consumer confidence and regulatory compliance.



Breakfast Cereal

Storage shelf-life at 25°C of breakfast cereal containing stabilized *B. Longum* (Aw 0.40) was tested for 15 months with a viability loss of only 1.31 log CFU/g, while the non-stabilized probiotics lost 4.56 log CFU/g in 3 months.

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