NEW ERA AGRICULTURE MAGAZINE

Postbiotics in Meat Products: The Next Generation of Natural Preservation

Dr. Kusuma Niharika

Abstract: -

Growing consumer interest in safe, minimally processed and clean-label foods has increased the search for natural alternatives to conventional meat preservatives. Postbiotics, derived from non-viable microorganisms or their components, are emerging as promising agents for improving the safety and quality of meat products. They may contain organic acids, short-chain fatty acids, bacteriocins, enzymes, peptides and other bioactive compounds with antimicrobial and antioxidant properties. Recent studies have demonstrated their potential to inhibit foodborne microorganisms, reduce oxidative deterioration and extend the refrigerated storage life of meat. Postbiotics can also be incorporated into edible coatings and other food systems, providing practical opportunities for their application. Despite their potential, differences in production methods, composition, characterization and regulatory requirements remain challenges. Continued research may establish postbiotics as useful natural tools for safe and sustainable meat preservation.

Keywords: Postbiotics, Meat preservation, Natural preservatives, Anti-microbial activity, Meat quality.

Introduction:

Meat is highly nutritious but is also susceptible to microbial growth and oxidation during storage. These changes can affect safety, colour, flavour, texture and overall acceptability. At the same time, consumers are increasingly interested in foods with fewer synthetic additives, encouraging the development of naturally derived preservation strategies.

One emerging approach is the use of postbiotics, which provide beneficial biological activities without the presence of living microorganisms. Their antimicrobial

Dr. Kusuma Niharika,
M.V.Sc, Department of Livestock Products Technology,
NTR College of Veterinary Science, Gannavaram, Andhra Pradesh, 521102.

and antioxidant properties have attracted increasing attention for application in meat and meat products.

What are Postbiotics?

Postbiotics are preparations derived from inactivated microorganisms and their components that exert beneficial biological effects. Unlike probiotics, which contain live microorganisms, postbiotics do not depend on viable cells for their activity.

They may contain bioactive substances such as organic acids, short-chain fatty acids, bacteriocins, enzymes, peptides and other microbial metabolites or cellular components. *Lactobacillus* and *Bifidobacterium* are among the most commonly investigated sources. However, postbiotics originating from *Streptococcus* and *Faecalibacterium* species have also been documented (Gurunathan *et al*., 2023; Prajapati *et al*., 2023).

An important advantage of postbiotics is their greater stability compared with live microorganisms. Their non-viable nature can also facilitate their incorporation into food processing and preservation systems (Trymers *et al*., 2026).

How are Postbiotics Prepared?

Postbiotics can be prepared through controlled fermentation or by inactivating selected microorganisms. In fermentation-based production, microorganisms are grown under controlled conditions to produce beneficial metabolites. The cells can then be separated by centrifugation or filtration, producing a cell-free fraction containing bioactive compounds.

Another approach involves controlled physical or thermal inactivation of microorganisms while attempting to retain their beneficial components. Freeze-drying, spray drying and other stabilization methods may subsequently be used to improve storage stability and handling.

The processing method is important because heat important, drying and other conditions can alter the composition and activity of postbiotic preparations. Therefore, the source microorganism, inactivation conditions, stabilization method and characteristics of the final preparation should be properly defined and reported (Taspinar *et al*., 2026).

Importance of Postbiotics in Meat Preservation

The major interest in postbiotics for meat preservation is their antimicrobial and antioxidant activity.

Antimicrobial activity

Postbiotic compounds may inhibit or suppress important foodborne microorganisms such as *Listeria monocytogenes, Staphylococcus aureus, Escherichia coli* and *Salmonella spp*., thereby contributing to microbiological safety and shelf-life extension.

Antioxidant activity

Oxidation of meat lipids can result in rancid flavours, undesirable odours, colour deterioration and reduced nutritional quality. The antioxidant properties of some postbiotic preparations may help slow these oxidative changes and maintain meat quality during refrigerated storage.

Role of edible coatings

Postbiotics can also be incorporated into edible coatings, allowing bioactive compounds to be applied directly to the surface of meat. Such coatings may provide an additional protective barrier while delivering antimicrobial and antioxidant components during storage.

Applications of Postbiotics in Meat Products

Recent studies have demonstrated the potential of postbiotics in different meat products. Behbahani *et al*., (2025) developed an edible coating containing a cell-free supernatant from *Lactobacillus acidophilus* for refrigerated lamb meat. The postbiotic-enriched coating reduced microbial growth and oxidative deterioration while maintaining better sensory quality during storage.

Similarly, Kaynakci *et al*., (2025) incorporated postbiotics derived from *Bifidobacterium bifidum* into alginate-based edible coatings for fresh turkey breast. The treatment reduced *L. monocytogenes* counts and helped maintain the physicochemical quality of the meat during refrigerated storage.

These studies demonstrate that postbiotics may be useful not only as direct preservation agents but also as functional ingredients in edible coating systems. Their incorporation into coating materials such as alginate and other food-grade matrices may provide a practical method for delivering bioactive compounds to meat surfaces.

Advantages and Challenges

Postbiotics offer several advantages, including antimicrobial and antioxidant activity, good stability and compatibility with clean-label approaches. Their non-viable nature also makes them attractive for food applications where the survival of live microorganisms may be difficult.

However, their wider application is limited by differences in microorganisms, production methods, processing conditions and composition. These factors can influence the activity of the final preparation. Further research is needed to establish standardized production and characterization methods, safety, regulatory requirements, storage stability and effectiveness under real food conditions.

Conclusion

Postbiotics represent an emerging natural approach for improving the safety, quality and shelf life of meat products. Their

antimicrobial and antioxidant properties, along with their stability and potential use in edible coatings, make them promising alternatives to conventional preservatives. Recent studies in lamb and turkey meat have shown encouraging results. Further standardization and real-food validation will be important for their successful application in the meat industry.

References

1. Behbahani, B. A., Jooyandeh, H., Taki, M., & Vasiee, A. (2025). Innovative eco-friendly approaches to fresh lamb preservation with postbiotics from Lactobacillus acidophilus VBFDP771 and Shirazi balangu mucilage. *Applied Food Research*, 101638. https://doi.org/10.1016/j.afres.2025.101638
2. Gurunathan, S., Thangaraj, P., & Kim, J. H. (2023). Postbiotics: functional food materials and therapeutic agents for cancer, diabetes, and inflammatory diseases. *Foods*, *13*(1), 89. https://doi.org/10.3390/foods13010089
3. Kaynakci, E. C. (2025). Evaluation of alginate-based coatings enriched with postbiotics from Bifidobacterium spp. on the quality and safety of Turkey meat. *Scientific Reports*, *15*(1), 23634. https://doi.org/10.1038/s41598-025-09913-z
4. Prajapati, N., Patel, J., Singh, S., Yadav, V. K., Joshi, C., Patani, A., ... & Patel, A. (2023). Postbiotic production: harnessing the power of microbial metabolites for health applications. *Frontiers in Microbiology*, *14*, 1306192. https://doi.org/10.3389/fmicb.2023.1306192
5. Taspinar, T., & Güzeler, N. (2026). Postbiotics in Food Systems: Components, Production Methods, Food Applications, Functional Properties, and Technological Challenges. *Food Science & Nutrition*, *14*(8), e72173. https://doi.org/10.1002/fsn3.72173
6. Trymers, M., Wiśniewski, P., Tkacz, K., & Zakrzewski, A. (2026). From production to application: postbiotics in meat, meat products, other food matrices, and bioactive packaging. *Foods*, *15*(3), 501. https://doi.org/10.3390/foods15030501
7. Wei, L., Wang, B., Bai, J., Zhang, Y., Liu, C., Suo, H., & Wang, C. (2024). Postbiotics are a candidate for new functional foods. *Food chemistry: X*, *23*, 101650. https://doi.org/10.1016/j.fochx.2024.101650