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The Response of Microbes to Physiological Factors and the Importance of Microbial Physiology

Noah Richards*

Department of Food and Information Technology, Pamir University, Kowst, Afghanistan

Commentary

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***For Correspondence:** Noah Richards, Department of Food and Information Technology, Pamir University, Kowst, Afghanistan

E-mail: richardsnoah@outlook.com

ABOUT THE STUDY

Microbial food spoilage costs the food industry millions of dollars each year, which represents a massive waste of a valuable resource. Food losses start on the farm and continue through post-harvest storage, distribution, processing, wholesaling, retailing, and home and catering use. Although well-known technologies such as gamma irradiation make it technically possible to produce food that is completely free of microbial contamination, such a stringent approach runs counter to current consumer demand for foods that are minimally processed and perceived as "fresh". As a consequence, in addition to ensuring food safety, the challenge remains to produce high-quality foods that are simple to prepare, do not necessitate daily trips to the supermarket, and rely less heavily on chemically synthesized food preservatives.

Importance of microbial physiology

Most traditional food preservation methods were developed empirically, with less knowledge of the mechanisms of action of the antimicrobial agents used. However, with the shift away from high concentrations of individual food preservatives towards greater reliance on combinations of sub lethal levels of antimicrobial compounds or processes of fundamentals must be revisited. True novel combination systems can only be developed logically if they are founded on a thorough understanding of the physiology of microorganisms in foods. Unfortunately, knowledge of the physiology of spoilage microorganisms has lagged behind that of microbial genetics and molecular biology in recent years.

Response of microbes to physiological factors

Survival and resistance to food associated stresses: Low or high temperatures, acidity, and modified atmospheres are some of the major stresses those microorganisms in foods. While both spoilage and pathogenic organisms face

similar stresses, spoilage organisms are more adaptable to harsh environmental conditions, often developing resistance to chemical food preservatives, cleaning and sanitizing agents. Furthermore, in terms of both number and type, food spoilage organisms outnumber food pathogens.

Maintaining homeostasis: In general, exposing microbial cells to low water activity via dehydration or the addition of salts or sugars activates constitutive transport systems, resulting in the accumulation of compatible solutes inside the cell. Potassium, proline, glutamate, betaine, and trehalose are examples of small, highly soluble molecules. Notably, accumulation of compatible solutes has been shown to confer increased heat resistance and improved ability to grow at low temperatures in some microorganisms. Cross resistance to different types of stresses has become a recurring theme in microbial physiology research over the last 10-15 years.

Spoilage consortia: Individual food spoilage organisms are being studied in an attempt to provide guidelines for systematic and predictive shelf life determination. Most foods, unfortunately, contain a diverse microbial flora in which strains compete for survival and growth. As a result, poorly understood microbial interactions in foods frequently invalidate drawn from work done with pure cultures.

Future prospects: Despite the technological capabilities of genetic engineering, the introduction of entirely new food preservatives will be slow in the future due to regulatory constraints and the high cost of safety testing now required for all new food additives. It is more likely that a much more sophisticated usage will emerge from a systematic study of microorganism stress responses combined with a detailed assessment of the technological performance of available preservatives and preservation technologies in real food formulations, resulting in new processes and products.