

Microorganism Effect on Ready- To- Eat (RTE) Food & its Shelf-Life

Nikita Rawal
Amity Institute of Microbial Technology
Amity University
Noida, Uttar Pradesh, India, 201301

Abstract:- RTE foods are widely used because they are convenient and readily available. However, these foods are more susceptible to microbial infection and subsequent decomposition, posing health and food quality dangers to consumers. The effects of microorganisms on RTE foods and their shelf life are examined in this review.

Microbial contamination can occur at any point of production, processing, handling, or packaging, posing possible health risks. *Salmonella*, *Listeria monocytogenes*, and *Escherichia coli* are among the pathogenic bacteria that can cause foodborne diseases. Spoilage bacteria, while not always toxic, make RTE foods unappealing and hazardous to consume.

Microorganisms' inherent properties, such as nutritional needs, pH tolerance, water activity, oxygen requirements, temperature sensitivity, and spore production, have an impact on their growth and survival in RTE meals. Extrinsic variables such as temperature, oxygen availability, moisture content, packaging, storage conditions, and manufacturing environments all have an influence on microbial growth and shelf life.

Food manufacturers and regulators use a variety of control techniques to reduce the dangers brought on by microbes. They also involve the use of Good Manufacturing Practices (GMP) and Hazard Analysis and Critical Control Points (HACCP) systems.

To ensure food safety and increase shelf life, it is essential to understand how bacteria and RTE foods interact.

Keywords:- Shelf Life, RTE Snack, Moisture Content, Microbial Analysis, GMP, Spoilage.

I. INTRODUCTION

In today's fast-paced culture, ready-to-eat (RTE) foods have grown in popularity because of their convenience and need for little to no preparation. These meals are created to be eaten without further heating or preparation, providing consumers with quick and simple meal alternatives. However,

microbes can have a negative impact on the safety and shelf life of RTE meals, which can have serious repercussions for both consumers and the food industry.

Microorganisms are present everywhere in nature and can be found in a variety of settings, such as food preparation areas, raw materials, and the natural environment. While many microbes are benign or even helpful, some might seriously threaten your health if they are present in RTE meals. RTE products have been linked to various outbreaks of pathogenic microorganisms, including *Salmonella*, *Listeria monocytogenes*, and *Escherichia coli*. If the right control measures are not put in place, these microorganisms can live and grow in RTE meals.

Microorganisms not only increase the chance of acquiring foodborne diseases but also significantly contribute to the deterioration of RTE meals. Microorganisms that cause spoilage, such as bacteria, Yeasts & Moulds, and viruses, can modify the sensory properties of food, resulting in modifications to its look, flavor, texture, and odour. These modifications not only make the product less desirable and of lower quality, but they also raise questions about its safety.

The presence and growth of microorganisms can have a significant effect on the shelf life of RTE foods, which refers to the time frame during which a food product stays safe and preserves its desirable quality qualities. Both intrinsic and extrinsic variables, such as storage conditions, packing, and processing settings, can affect the proliferation of microorganisms in RTE foods. Intrinsic factors include nutrient availability, pH, water activity, oxygen needs, temperature sensitivity, and spore production.

Determining the way microorganisms affect the shelf life of RTE foods is vital for ensuring their safety and quality. The food business may reduce the dangers posed by microorganisms and lengthen the shelf life of RTE goods by understanding the intrinsic and extrinsic variables that impact microbial growth and putting in place the necessary control measures. This review will look at how microorganisms affect RTE foods and the methods used to increase their safety and shelf life.

Researchers, food producers, and regulators may collaborate to create effective control measures and make sure that RTE meals are secure, pleasurable, and satisfy the needs of modern customers by obtaining knowledge about the interactions between microbes and RTE foods.

The variety of RTE food and its intrinsic qualities should be taken into consideration when choosing particular control techniques. To guarantee the safety and quality of RTE meals, norms and regulations have been put in place by food makers and regulatory organizations.

II. INTRINSIC PARAMETERS

Ready-to-eat (RTE) foods and their shelf life can be significantly impacted by the intrinsic qualities of microorganisms. These features control how microorganisms in food grow and survive, whether they may deteriorate or make people sick, and what conditions encourage their growth. The following are some inherent traits of microorganisms that have an effect on RTE foods:

➤ *Nutrient Requirements*

Microorganisms need specific nutrients in order to develop and reproduce. These nutrients may be found in the RTE meal, such as the carbs, proteins, lipids, vitamins, and minerals. The amount of these nutrients in the meal can have an impact on the population size and growth rate of microorganisms. High-nutrient RTE meals have a lower shelf life and are more susceptible to microbial development.

➤ *pH Tolerance*

Microorganisms may grow and live in a range of pH values known as pH tolerance. While certain microbes favor neutral or alkaline environments, others flourish in acidic ones. The kinds of bacteria that can develop in RTE meals might vary depending on their pH. Examples of bacteria that may thrive in acidic environments include *Listeria monocytogenes*.

➤ *Water Activity (aw)*

A measure of the quantity of water that is readily available in a food product is called water activity (aw). Different levels of water activity are necessary for different microorganisms to thrive and survive. The degree of water activity in RTE meals can have an impact on microbial development and deterioration. Compared to high-moisture RTE foods, foods with minimal water activity, such dry snacks, have a lower risk of microbial contamination and a longer shelf life.

➤ *Oxygen Requirements*

Microorganisms can be categorized according to their oxygen needs into three groups: aerobes (which require oxygen), anaerobes (which cannot tolerate oxygen), and facultative anaerobes (which can thrive with or without oxygen). The kinds of bacteria that can flourish in RTE meals can vary depending on whether oxygen is present or not. RTE meals that have been vacuum-sealed or packaged in a modified

atmosphere can inhibit the growth of some spoilage germs by reducing the oxygen in the environment.

➤ *Temperature Sensitivity*

Microorganisms can grow best in a variety of temperatures. The microbial growth and deterioration of RTE foods can be affected by the temperature at which they are produced and kept. Most bacteria may be slowed down or prevented from growing by freezing or refrigeration, increasing the shelf life of RTE foods. RTE goods, however, may be at danger from some psychrotrophic microbes that can grow at refrigerator temperatures.

➤ *Spore Formation*

In unfavorable environments, certain bacteria have the capacity to develop dormant formations known as spores. Spores have a strong tolerance for harsh elements like heat and chemicals. Spores that are present in RTE meals may survive and subsequently germinate if they are not adequately processed or kept, resulting in microbial development and food spoiling.

Understanding the inherent characteristics of microorganisms aids in the development of control measures by food producers and regulators to avoid or reduce microbial contamination, increase the shelf life of RTE foods, and guarantee their safety and quality.

III. EXTRINSIC PARAMETER

The environmental elements that affect microorganisms' growth, survival, and effects on foods that are ready-to-eat (RTE) and their shelf life are referred to as extrinsic attributes of microorganisms. These elements are vital in evaluating the safety and quality of RTE goods since they have the potential to either suppress or stimulate microbial multiplication. Extrinsic characteristics of microorganisms that impact RTE meals include the following;

➤ *Temperature*

A major factor influencing microbial proliferation is temperature. There are particular temperature ranges where different bacteria may flourish best. To stop or sluggish microbiological development, RTE meals should be refrigerated at the proper temperatures. Heat treatments (such as cooking or pasteurization) can be used to kill or reduce the microbial burden in RTE goods, whilst refrigeration or freezing can be used to prevent the development of most microorganisms.

➤ *Oxygen Availability*

Another environmental aspect that affects the proliferation of microorganisms is the availability of oxygen. While certain microbes (aerobes) demand oxygen, others (anaerobes) cannot withstand it. To regulate oxygen availability, RTE foods' packaging and storage settings can be changed. Packaging that

is anaerobically sealed or oxygen-reduced can inhibit the growth of some spoiling germs.

➤ *Moisture Content*

Microbial growth is significantly influenced by the moisture level in RTE meals. Because microorganisms need water to flourish, foods with a high moisture content are more likely to become contaminated by microbes and become spoiled. Controlling the RTE meals' water activity (aw) and moisture content can help make them last longer. Dehydration, desiccants, or drying can lower the amount of water present and prevent microbial development.

➤ *Packaging*

The method RTE food are packaged might affect microbial development and shelf life. Materials and methods used for packaging should act as a barrier against microbial contamination and keep moisture and oxygen out. By reducing the amount of time that germs are exposed to the outside environment, proper packaging can help maintain the quality and safety of RTE food.

➤ *Storage Conditions*

The microbiological growth and shelf life of RTE foods can be strongly impacted by the storage conditions, which include temperature, humidity, light exposure, and cross-contamination hazards. To avoid microbial contamination, growth, and spoiling, RTE items should be kept in the proper conditions. To preserve the quality and safety of RTE meals, it is crucial to keep them refrigerated, minimize temperature changes, and keep them apart from raw or contaminated foods.

➤ *Processing Environment*

To minimize microbiological contamination of RTE meals, the cleanliness and hygienic conditions of the processing environment are essential. If individuals, surfaces, utensils, or processing equipment come into touch with pathogens or spoilage microorganisms, cross-contamination may result. The extrinsic microbiological hazards related to RTE foods must be minimized by following good manufacturing practices (GMP) and putting in place appropriate sanitation standards.

Ensuring food safety and increasing shelf life, it is crucial to recognize and manage the extrinsic factors that affect microbial growth and survival in RTE meals. To reduce extrinsic variables that may affect the quality and safety of RTE goods, food makers employ a variety of measures, including adequate packaging, storage conditions, and sanitation practices.

IV. EFFECTS OF MICROBES ON RTE FOOD

Microorganisms can significantly affect the shelf life of Ready-to-Eat (RTE) food products. RTE foods are those that have been processed or prepared for consumption without further cooking or heating. These goods are frequently eaten

straight out of the packaging, which leaves them open to microbial contamination and deterioration.

➤ *Microbial Contamination*

During manufacturing, handling, or packing, RTE foods may pick up a variety of microbes. Bacteria (including *Salmonella*, *Listeria monocytogenes*, and *Escherichia coli*), yeasts, moulds, and viruses are examples of common microbiological pollutants. These impurities may be introduced through equipment, environmental factors, or raw materials.

➤ *Spoilage*

Microorganisms can cause RTE foods to spoil, which can change the way they look, taste, feel, and smell. Off flavors, sliminess, discoloration, gas production, or the growth of visible moulds are all signs of microbial deterioration. Although spoilage bacteria typically do not pose a threat to human health, they can make food unpalatable and dangerous for consumption.

➤ *Pathogenic microorganisms*

When consumed, pathogenic bacteria can cause foodborne diseases. RTE foods are particularly susceptible to contamination. If appropriate control measures are not in place, pathogens including *Salmonella*, *Listeria monocytogenes*, and specific strains of *Escherichia coli* can survive or grow in RTE foods. These bacteria offer a major risk to health, particularly to people who already have compromised immune systems, young children, and the elderly.

➤ *Reduced Shelf Life*

Microbial proliferation can cause RTE foods to have a shorter shelf life. As bacteria grow, they absorb nutrients, create metabolic waste products, and alter the physical properties of the meal, lowering its quality. This process can speed up if spoilage or pathogenic microbes thrive, which reduces the product's shelf life.

V. TECHNIQUES USED FOR REDUCE THE IMPACT OF MICROBES ACTIVITY

Several techniques are used in the food business to reduce the impact of microbes on RTE meals and lengthen their shelf life. These comprise:

➤ *Good Manufacturing Practices (GMP)*

According to stringent hygiene standards while manufacturing food, including routinely sanitizing and maintaining facilities, staff, and equipment.

➤ *Hazard Analysis and Critical Control Points (HACCP)*

Following a systematic method to recognize, assess, and manage potential threats to food safety, including microbiological risks, at crucial production stages.

➤ *Use of Preservatives*

To suppress microbial development and increase shelf life, add antimicrobial preservatives such organic acids (like citric acid or acetic acid) or their salts.

➤ *Packaging and Storage*

Using the proper packaging supplies and methods to keep RTE meals free from microbial deterioration and to preserve their quality while being stored.

➤ *Cold Chain Management*

Maintaining the supply chain's temperature under control, whether by freezing or refrigeration, helps prevent microbial development and maintain the quality of RTE foods.

➤ *High-Pressure Processing (HPP)*

This technique uses high hydrostatic pressure to get rid of or suppress pathogenic and spoilage bacteria without using a lot of heat, prolonging the shelf life of RTE items.

VI. CONCLUSION

Microorganisms significantly affect the shelf life of Ready-to-Eat (RTE) foods. While spoiling microorganisms can cause quality to deteriorate and unpleasant sensory qualities, the presence of pathogenic bacteria in RTE items can offer substantial health hazards to consumers. In order to ensure the safety of RTE foods and increase their shelf life, it is essential to understand the internal and extrinsic variables that affect microbial growth and survival in such foods.

The food sector may reduce the risk of microbiological contamination during processing, handling, and packing by putting control mechanisms including Good Manufacturing Practices (GMP), Hazard Analysis and Critical Control Points (HACCP) systems, and appropriate sanitation practices into place. The shelf life of RTE meals can be increased by the use of preservatives, suitable packing materials, and storage conditions, including temperature control.

It's essential for regulators and food makers to keep up with new developments in microbial control trends and technology. RTE foods' safety and shelf life may be enhanced by improvements in high-pressure processing (HPP), creative packaging, and quick microbiological testing techniques. To improve these technologies and make sure they can be used in the food sector, further research and development must be done.

To assure the safety and quality of RTE meals, it is crucial for researchers, food producers, regulatory bodies, and consumers to work together. We can continue to fulfil the rising need for quick, secure, and pleasant food alternatives in our contemporary culture by cooperating to comprehend and mitigate the effects of microbes on RTE goods.

REFERENCES

- [1]. Kate T., Gauri S. (2023) GMP vs HACCP
- [2]. Swanson, K. M. J., Buchanan, R. L., Cole, M. B., Cordier, J. L., Flowers, R. S., Gorris, L. G. M., Taniwaki, M. H., Tompkin, R. B., & Zwietering, M. H. (2011). *Microorganisms in Foods 8: Use of Data for Assessing Process Control and Product Acceptance*.
- [3]. jay, j.m., loessner, m.j., & golden, d.a. (2005). *Modern food microbiology*.
- [4]. Juneja, V.K., Sofos, J.N., & Schmidt, K.A. (Eds.). (2012). *Pathogens and Toxins in Foods*
- [5]. Todd, Motarjemi, Moy, (Ed.). (2017). *Encyclopedia of Food Safety*.
- [6]. Adams, M.R., & Moss M.O. (2008). *Food Microbiology*