



IMPACT OF FOOD PRESERVATIVES ON HUMAN HEALTH:

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Abstract:

Food preservation techniques, including the use of chemical preservatives, play a crucial role in extending the shelf life of perishable food items, ensuring food safety, and maintaining food quality. However, concerns have been raised regarding the potential adverse effects of food preservatives on human health.

This paper reviews the impact of commonly used food preservatives, such as sulphites, nitrates, benzoates, and sorbates, on human health. It examines the physiological effects, including allergic reactions, gastrointestinal disturbances, and potential carcinogenicity associated with the consumption of foods containing these preservatives.

Index Terms - Food Preservation, Food Safety, Chemical Preservatives, Allergic Reactions.

INTRODUCTION:

Food is an essential necessity for all living organisms. Given its limited shelf life, the use of preservatives has become widespread to extend its longevity. Preservatives serve the crucial purpose of prolonging the shelf life of food products, yet their usage is controversial due to associated health risks.

Preservatives in the food industry are a double-edged sword. While they ensure food safety, concerns about their adverse health effects have sparked debates. Sulphites and Benzoates, common preservatives, have been linked to allergic reactions, including bronchitis, asthma, heart ailments, and even cancer.

The consumption of processed foods containing preservatives raises concerns about long-term health effects. Balancing food preservation with consumer health poses a significant challenge for the food industry. Preservatives are substances added to food to prevent microbial growth, oxidation, and spoilage. However, excessive consumption or sensitivity to certain preservatives can lead to allergic reactions or metabolic disruptions.

Some artificial preservatives like BHA and BHT have raised concerns regarding their potential carcinogenic properties, although human studies are inconclusive. Additionally, preservatives like sodium nitrate/nitrite, commonly used in processed meats, can contribute to health issues such as high blood pressure due to their high sodium content.

Furthermore, some preservatives may disrupt the balance of gut microbiota, affecting digestive health and immune function. While regulatory agencies like the FDA and EFSA deem many preservatives safe within specified limits, long-term exposure remains a concern, prompting ongoing research.

It's crucial to acknowledge the role of regulatory agencies in evaluating the safety of food preservatives and setting limits accordingly. Moderation is advised in consuming foods with preservatives, especially for individuals with specific sensitivities or health conditions, who should seek advice from healthcare professionals regarding their dietary choices.

Food preservatives play a vital role in our modern food system. They help extend shelf life, reduce food spoilage, and ensure the safety and availability of a wide variety of foods. However, there has been ongoing debate about the potential negative effects of food preservatives on human health.

Here's a closer look at the two sides of this coin:

Benefits of Food Preservatives:

1. Prevents foodborne illness: Preservatives inhibit the growth of harmful bacteria, Mold, and fungi that can cause food spoilage and foodborne illnesses.
2. Reduces food waste: By extending shelf life, preservatives minimize food waste throughout the supply chain, from farm to fork.
3. Maintains food quality: Preservatives help retain a food's original qualities like colour, flavour, and texture, enhancing consumer appeal.

Potential Concerns: Certain preservatives have been linked to potential health risks, including allergies, digestive issues, and even cancer in some cases. More research is ongoing to fully understand these potential effects. Overreliance on processed foods dependence on preservatives may lead to a decreased intake of fresh, whole foods, which are essential for a balanced diet.

TITLE OF THE STUDY:

The title of our research paper is **“Impact of food preservatives on human health.”**

STATEMENT OF THE PROBLEM:

In recent decades, the consumption of processed foods has become increasingly prevalent in modern diets, owing largely to the convenience they offer in terms of storage, transportation, and shelf-life. However, the widespread use of food preservatives in these processed foods has raised significant concerns regarding their potential impact on human health. While food preservatives serve the crucial purpose of preventing spoilage and extending the shelf-life of food products, there is a growing body of research suggesting that certain preservatives may pose health risks when consumed in excess or over prolonged periods.

The primary problem to be addressed revolves around understanding the potential adverse effects of food preservatives on human health. This includes investigating the mechanisms through which preservatives may exert their effects, identifying specific preservatives of concern, and assessing their impact on various aspects of human health, such as physiological functions, metabolic processes, and the development of chronic diseases. This research endeavour aims to contribute to the development of informed dietary choices, regulatory measures, and public health interventions aimed at safeguarding human health in the face of evolving food production and consumption patterns.

LITERATURE REVIEW:

1. (Ritu Gupta, Rakesh Kumar Yadav, 2021) The Food Has Limited Shelf Life, In Order to Increase the Shelf Life and Maintain the Quality Certain Preservatives Are Used, These Preservatives May Have Some Harmful Effect So If Possible, And Food Without Preservatives May Be Used. This Additive Is a Sodium Salt Which Is Commonly Used as Chemical Preservative in Foods and It Is Found Mainly in Industrialized Drinks. Sodium Benzoate Is Considered Safe by Measurability Agencies but There Is Still Controversy Over Its Effect on Human Health.
2. (Subhashish Dey, Bommu Hema Nagababu, 2022) Colour is a key component to increase the ultimate appetizing value and consumer acceptance towards foods and beverages. Synthetic food colours have been increasingly used than natural food colours by food manufacturers to attain certain properties such as low cost, improved appearance, high colour intensity, more colour stability and uniformity.

3. (E Quattrucci, V Masci,1992) Despite the benefits attributed to food preservatives, some concern still remains regarding their safety and possible influence on nutrients. Surprisingly, there is quite a lack of scientific knowledge in this field. In order to describe a few examples, the effects of the extensively used sulphite on thiamine, folates, pyridoxal and other nutrients have been reported.
4. (Syed Mohammad Nabavi, Syed Fazel Nabavi, Monica Rosa Loizzo, 2020) This reference is a detailed guide to the world of food additives commonly used in the food processing and manufacturing industry. Chapters provide readers with knowledge on a broad range of food additives (anti-browning agents, essential oils, flavour enhancers, preservatives, stabilizers, sweeteners, among others), their safe use and a summary of their effects on human health.
5. (Yu Cao, Hongli Liu, Ningbo Qin, Xiaomeng Ren, 2020) This review summarizes the current findings on the impact of common food additives on gut microbiota structure and function. The food additives discussed include artificial sweeteners, emulsifiers, preservatives, colorants and acidity regulators.
6. (Moreno Bondi, Andrea Lauková, Simona de Niederhausern,2017) Food products can be contaminated by a variety of pathogenic and spoilage microbiota, the former causing foodborne diseases and the latter causing significant economic losses for the food industry due to undesirable effects on the food properties.
7. (Hubert Antolak, Dorota Kregiel,2017) It has long been shown that phytochemicals protect plants against viruses, bacteria, fungi and herbivores, but only relatively recently we have learnt that they are also critical in protecting humans against diseases. A significant number of medicinal plants is consumed by humans. As food-related products, they additionally improve human health and general well-being. This chapter deals with plant-derived food preservatives.
8. (Hamid A Abdulmumeen, Ahmed N Risikat, Agboola R Sururah,2012) Foods are substances or mixture of substances both solid and/or liquid, which are intended for human consumption or ingestion for their nutritional of pleasurable benefits. The classification of food, its storage and chemistry were treated in this study.

A literature review on the impact of food preservatives on human health calls for a deep dive into the analysis of various studies, theories, and findings that examine the effects of preservatives on a person's well-being. The following literature review aims to synthesize and analyse existing research to understand the implications of food preservatives on human health.

RESEARCH METHODOLOGY:

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Scientists rely on state-of-the-art methods to carry out Chemicals in food analysis, both in laboratories and on site in ingredients processing plants, production factories and supermarket storerooms.

Mass spectrometry (MS) stands out as a prevalent analytical technique extensively employed in food analysis laboratories. It frequently collaborates with liquid chromatography (LC) or gas chromatography (GC) to amplify outcomes. Depending on the context, MS can also merge with capillary electrophoresis (CE) and infrared spectroscopy (IR).

Nuclear magnetic resonance (NMR) spectroscopy, on the other hand, leverages the magnetic traits of atomic nuclei, typically hydrogen, carbon-13, phosphorus-31, and deuterium, to scrutinize liquid and solid samples. Renowned for its non-destructive nature, NMR proves invaluable in scrutinizing intricate food samples, enabling simultaneous detection and quantification of various compounds. Its adaptability and high reproducibility further enhance its appeal to scientists.

Polymerase chain reaction (PCR), while now prominently associated with COVID-19 testing, has been a staple in food analysis for years. This technique dissects specific DNA sequences and has been pivotal in identifying animal species within meat products, thus combating food fraud like the notorious 2013 horsemeat scandal. PCR also detects harmful pathogens, microorganisms, and genetically modified organisms (GMO).

Enzyme-linked immunosorbent assay (ELISA) emerges as a ubiquitous method across the food industry, employed by manufacturers and quality control agencies alike. It detects hidden allergenic proteins, hormones, antibodies, and peptides with remarkable sensitivity. ELISA also serves to detect peanut traces in various food forms.

Lateral flow device (LFD) testing, popularized during the pandemic, offers swift gluten detection in food products through an antigen-antibody reaction. Compact and user-friendly LFD kits facilitate on-site testing.

In standard food physicochemical testing processes, emphasis should be placed on three key facets: sample collection, sample pre-treatment, and inspection/determination of extracted samples. Sample collection lays the foundation for subsequent procedures, necessitating utmost attention to representativeness and avoidance of contamination. Pre-treatment methods must be meticulously chosen to ensure adequate recovery rates and minimal contamination. Shielding agents may be employed to mitigate interference during analysis. Inorganic pre-treatment methods encompass wet digestion and dry aching, each tailored to extract non-volatile inorganic compounds for analysis. Dilute sulphuric acid lacks oxidizing properties, while hot concentrated sulphuric acid boasts strong oxidizing abilities. Addition of catalysts like copper sulphate or mercury sulphate can expedite digestion processes.

Chemicals can find their way into our food through various pathways:

- During the production, transportation, or storage of food, certain substances like pesticides, preservatives, colorants, veterinary drugs, and elements from packaging materials may be utilized.
- Illicit use of chemicals in food production processes is another avenue through which contaminants can enter the food chain.
- Some chemicals occur naturally in food ingredients or the environment, such as heavy metals like lead and cadmium in soil, or mycotoxins produced by fungi.
- Certain substances, like acrylamide from baking starchy foods at high temperatures or polycyclic aromatic hydrocarbons (PAHs) released during meat barbecuing, can be formed during food production or preparation.

Instances of undesirable chemicals in food could lead to health issues like allergic reactions or adverse effects on health, though these are rare due to strict regulations governing chemical levels in food. Allergic reactions may affect those particularly sensitive to specific substances, hence labeling requirements to indicate potential allergens in food products. Toxic effects such as gastrointestinal symptoms, kidney damage, liver disease, nervous system impairment, or even cancer due to DNA damage, could occur but are generally mitigated by adherence to safety standards.

Excessive concentrations of chemicals in food are usually isolated incidents or temporary breaches of safety thresholds. While minor violations may not necessarily pose immediate health risks due to safety margins incorporated into standards, some chemicals could have significant long-term impacts, accumulating in the body or manifesting health effects gradually over time.

The WHO Collaborating Centre on Chemical Food Safety, designated by the World Health Organization, collaborates in research, guideline development, and training related to chemical safety in food.

Risk assessment of food safety involves identifying, characterizing, and assessing hazards associated with food, considering exposure levels and potential health effects. Foodborne illnesses, often caused by pathogens like *Salmonella*, *E. coli*, and *Listeria*, can lead to various symptoms and serious health implications, necessitating proper food hygiene practices and regulatory oversight to prevent outbreaks and ensure consumer safety.

Efficient reporting and surveillance systems are crucial for health authorities to monitor and respond effectively to foodborne outbreaks, aiding in source identification and prevention efforts.

OBJECTIVES OF THE STUDY:

1. **To Assess the Health Effects of Food Preservatives:** Conduct a systematic review of existing literature to evaluate the potential adverse health effects associated with the consumption of various types of food preservatives.
2. **To Investigate Mechanisms of Action:** Explore the mechanisms through which food preservatives may exert their effects on human health, including metabolic pathways, cellular interactions, and physiological responses.
3. **To Identify Specific Preservatives of Concern:** Identify and prioritize food preservatives that have been associated with higher risks of adverse health effects, considering factors such as frequency of use, toxicity profiles, and available scientific evidence.
4. **To Examine Population Vulnerabilities:** Investigate whether certain demographic groups, such as children, pregnant women, or individuals with specific health conditions, are more susceptible to the adverse effects of food preservatives and elucidate underlying reasons for these vulnerabilities.
5. **To Evaluate Cumulative Exposure and Long-Term Health Outcomes:** Assess the cumulative exposure to food preservatives through dietary intake over time and investigate potential associations with the development of chronic diseases, such as cancer, cardiovascular disorders, and metabolic syndromes.
6. **To Provide Recommendations for Risk Management and Regulation:** Based on the findings, formulate evidence-based recommendations for policymakers, regulatory agencies, and food manufacturers to mitigate potential risks associated with the use of food preservatives while ensuring food safety and quality standards are upheld.
7. **To Raise Awareness and Promote Informed Dietary Choices:** Disseminate research findings to the general public, healthcare professionals, and stakeholders in the food industry to raise awareness about the potential health implications of food preservatives and empower individuals to make informed dietary choices.

FINDINGS OF THE STUDY:

Preserving food is vital to prevent spoilage from bacteria, fungi, and oxidation. Preservatives, whether natural or artificial, are grouped by their function. Here's an overview of common types:

1. **Antimicrobial Preservatives:**

- Examples include sodium/potassium benzoate, potassium sorbate, calcium/sodium propionate.

2. **Antioxidants:**

- Like tocopherols, tocotrienols, ascorbic acid, sodium ascorbate, BHA, BHT, TBHQ.

3. **Chelating Agents:**

- Such as EDTA, citric acid.

4. **Natural Preservatives:**

- Salt, sugars (sucrose, glucose, fructose), vinegar, honey.

5. **Natural Extracts:**

- Rosemary, grapefruit seed, green tea extracts.

6. **Nitrates and Nitrites:**

- Sodium nitrate, sodium nitrite.

7. **Sulphur Compounds:**

- Sulphur dioxide, sodium sulphite.

8. **Acids:**

- Lactic acid, acetic acid.

9. **Enzymes:**

- Lactoperoxidase system, lysozyme.

10. **Microbial-derived Preservatives:**

- Nisin.

11. **Essential Oils:**

- Oregano, thyme, cinnamon oils.

Regulations govern the use of preservatives, dictating levels, labeling, and safety. It's crucial for consumers with dietary restrictions or allergies to check labels and consult authorities for the latest guidelines.

Various chemicals are commonly included in food items to enhance their shelf life. Here are some examples:

1. Sodium benzoate: Used in acidic foods like sodas, fruit juices, and pickles to prolong their freshness.
2. Potassium sorbate: Prevents the growth of molds and yeasts, often added to cheeses, baked goods, and dried fruits.
3. Sodium nitrite: Preserves the appearance and taste of processed meats like bacon, hot dogs, and deli meats.
4. Sulfur dioxide: Halts the growth of bacteria and fungi, commonly employed in dried fruits and wine production.

5. Calcium propionate: Extends the lifespan of bread and other baked goods by inhibiting mold growth.
6. BHA (butylated hydroxy anisole) and BHT (butylated hydroxytoluene): Antioxidants utilized to prevent fats and oils from turning rancid, frequently found in cereals, chewing gum, and processed foods.
7. Ascorbic acid (Vitamin C): Added as an antioxidant to prevent discoloration in fruits and vegetables.
8. Tocopherols (Vitamin E): Another antioxidant employed to prevent the oxidation of oils and fats.

It's crucial to understand that although these substances are generally deemed safe when used appropriately, excessive intake may have adverse health implications. Hence, their usage is monitored and regulated by food safety authorities.

EXAMPLES ON THE STUDY:

1. **Allergic Reactions:** Some people may be allergic to certain preservatives like sulfites, commonly found in dried fruits and wine, leading to symptoms such as hives, difficulty breathing, or even anaphylaxis.
2. **Asthma Trigger:** Sulfites, often used in processed foods and restaurant dishes, can trigger asthma attacks in individuals with asthma, causing wheezing, chest tightness, and difficulty breathing.
3. **Headaches and Nausea:** Monosodium glutamate (MSG), used to enhance flavor in savory foods like soups and snacks, may cause symptoms such as headaches, flushing, sweating, and nausea in sensitive individuals.
4. **Cancer Risk:** Sodium nitrite, used in cured meats like bacon and hot dogs, has been linked to an increased risk of certain cancers, particularly colorectal cancer, when consumed in large amounts over time.
5. **Disruption of Gut Microbiota:** Artificial sweeteners like aspartame and saccharin, commonly found in diet foods and beverages, may disrupt the balance of gut bacteria, potentially leading to digestive issues and metabolic imbalances.
6. **Endocrine Disruption:** Butylated compounds like BHA (Butylated Hydroxyanisole) and BHT (Butylated Hydroxytoluene), used to prevent rancidity in processed foods, have been associated with potential negative effects on the endocrine system, which regulates hormones in the body.

CONCLUSION:

In conclusion, while food preservatives serve a critical function in food preservation, their impact on human health cannot be overlooked. By adopting a comprehensive approach that prioritizes safety, innovation, and consumer empowerment, we can mitigate the risks associated with food preservatives and ensure a healthier and more sustainable food system for future generations.

The impact of food preservatives on human health is a multifaceted issue that warrants careful consideration from various stakeholders, including consumers, policymakers, and the food industry. While food preservation techniques are essential for ensuring food safety, extending shelf life, and maintaining quality, the use of chemical preservatives has raised concerns about their potential adverse effects on human health.

Addressing the challenges posed by food preservatives requires a multi-faceted approach. First and foremost, regulatory agencies must prioritize the safety of consumers by establishing stringent guidelines for the use of preservatives and conducting thorough risk assessments. Additionally, the food industry should explore alternative preservation methods, such as natural preservatives or innovative packaging techniques, to reduce reliance on chemical additives.

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