

Short communication

Food preservatives and their uses: A short report

Abstract

Packaged foods and beverages are consumed all over the world for their nutritional value, longer durability, thirst quenching properties, stimulating effect or for their medicinal values. With changing lifestyle and requirements, people now often prefers packaged food products over homemade products. Although, various food products including the beverages pass through several, quality, safety and regulatory mandates, consumers are concern about food preservatives as in some cases allergic reaction to generally recognized as safe (GRAS) has been reported. The study represents the usages of different forms of preservatives in packaged food industry along with their beneficial and adverse effects and also highlights their antioxidant and antimicrobial potential to serve the consumer's needs.

Keywords: Beverages, Preservatives, Health, Shelf-life, Antimicrobial, Antioxidant

Comment [L1]: not bold font

Introduction

Packaged food industry has been serving as one of the fastest growing network in the present era. Numerous forms of preservation techniques such as pasteurization, freezing, drying and application of chemicals have been designed to extend the shelf-life of the food products, not only by reducing the microbial growth, but also to maintain the antioxidant potential to serve the consumers' needs [1, 2]. To make the packaged food quality stable for a reasonable time period, preservatives are often used in different quantity and concentrations. Traditionally, food preservation has three goals; the preservation of appearance, the preservation of nutritional characteristics, and a prolongation of the time that the food can be stored. Hence, food preservatives can be defined as the "food additives used to inhibit the growth of micro-organisms like yeast, molds and bacteria and prevent the spoilage by different anti-oxidative reactions in order to maintain the quality, texture, consistency, taste, colour, alkalinity or acidity" [3, 4]. Several forms of chemical preservatives are being currently in use in food and beverages industries such as benzoate, Sorbates, Vitamins, fruit extracts, Sodium salts etc. as listed in Fig 1.

Comment [L2]: word of the first letter should be written in small letters

33 [5,6]. Preservatives can mainly divide into two groups based on their purpose of usages *i.e.*
34 preservatives as antimicrobial and preservatives as antioxidants (Fig. 1).

35

36 Antimicrobial

37 Antimicrobial preservatives reduce the microbial spoilage of foods by inhibiting the
38 growth and proliferation of bacteria, yeasts and molds. Benzoates (E210 -E219), Sorbates (E200
39 – E209), Nitrates (E240 – E259), and Sulfites (E220 – E229) are categorized under the group of
40 antimicrobial preservatives [7]. Sodium Benzoate (Produce Benzoic Acid when dissolved in
41 water) and Benzoic Acids are the most common used preservative and widely used in acidic food
42 products like fruit juice, carbonated drinks, pickles and jams [8]. The maximum concentration
43 level of benzoates approved by FDA is 0.2% and when used along with Ascorbic acid is 0.1%.
44 Sulfites like Sodium bisulfite and Potassium meta-bisulfites are used in food by dissolving in
45 cold water. Upon dissolving they produce Sulfurous Acid that inhibits the growth of bacteria and
46 molds and to some extent yeast such as *Oospora lactis*. Sorbates like Potassium Sorbate, Sodium
47 Sorbate are use as the preservatives in products having high pH value up to 6.5 [9]. Nitrites are
48 mostly use to prevent the growth of yeast and molds in food products. The maximum
49 concentration level allowed is 0.1%. Nisin peptide is an alternate food preservative which is
50 prepared during the food fermentation by *Lactococcus lactis* bacteria. Nisin is a polypeptides
51 containing about 34 numbers of amino acids [10]. It is highly effective on the gram positive
52 bacteria and their spores through interfering in biosynthesis of bacterial cell wall [10]. Though it
53 is less effective on gram negative micro-organisms and fungi, the FDA and WHO recommend
54 this to use because of its non-toxicity and less adverse reaction [11].

55

56 Antioxidants

57 Chemicals that prevent oxidation in other molecule are known as antioxidants.
58 Ascorbates (E300 – E305), Tocopherols (E306 – E309), Erythorbates (E310 – E319), Lactates
59 (E320 – E329), Phosphates (E340 – E349), Succinates (E360 – E369) are all effectively used as
60 antioxidants for food and beverages. Ascorbic Acid (E301) is a common antioxidant beverages
61 and pickles. Foods containing unsaturated fats are easily attacked by oxidation. Oxidation causes
62 them to turn rancid in order to discoloring and unpleasant tastes like metallic or sulfurous [12].
63 Hence, the Tocopherols (Normally Vitamin E) are used in rich fat foods for preservation.

Comment [L3]: word of the first letter should be written in small letters

Comment [L4]: word of the first letter should be written in small letters

Comment [L5]: word of the first letter should be written in small letters

64

65 **Adverse effects of preservatives**

66 Though preservatives are a beneficial to packaged food, they do have some negative
67 effect on human health. All preservatives cause hyper activity on regular usage. Some of the
68 common preservatives and their harmful effects on human health are listed below;

69

70 a) **Nitrates and Nitrites:** For curing of meat products these additives are used. But
71 sometimes it reacts to cause urticarial, itching and anaphylaxis in human beings. Sodium
72 Nitrite is used in meat product during cooking to prevent botulism, but during high heat it
73 reacts with the proteins to produce carcinogenic N-Nitrosamines which are linked to
74 different forms of cancers like liver, intestinal and oesophageal cancer [13, 14].

75 b) **Benzoates:** Benzoate contained foods are strictly abandoned for asthma patients because
76 it worsening the condition. Benzoates are also reported to cause rhinitis, chronic urticarial
77 and flushing in some cases [6]. Sodium Benzoate which is used to enhance the self-life
78 for a long time is found to form carcinogenic benzene while use with vitamin C or
79 Ascorbic acid. Though the amount of benzene form is low but it is a risk factor to cause
80 cancer [15]. It is also reported that Benzoates can cause brain damage [16].

81 c) **Sorbates:** Sorbates can cause urticarial and contact dermatitis in some cases [17].

82 d) **Sulphates:** Copper sulphate is generally used in coloring of peas and other vegetables. It
83 is found that the copper, when added to the vegetables, forms a compound which is not
84 easily soluble in the human body [18].

85

86 **Conclusion:**

87 Food preservation presents an opportunity to move alternative food practices away from
88 an individualistic, consumer-oriented politicsto a politics based upon relationships to self, others,
89 and the earth, enabling activist's to connect more deeply to the goals of food movements.
90 Although there are certain risk in use of preservatives but its importance and contributions to
91 packaged food industry can't be overlooked. A lot of researches are needed to be done to find out
92 the natural and harmless preservatives like Nisin Peptide. The food manufacturer should give
93 special attention during their formulation for healthy preservatives as combination of different

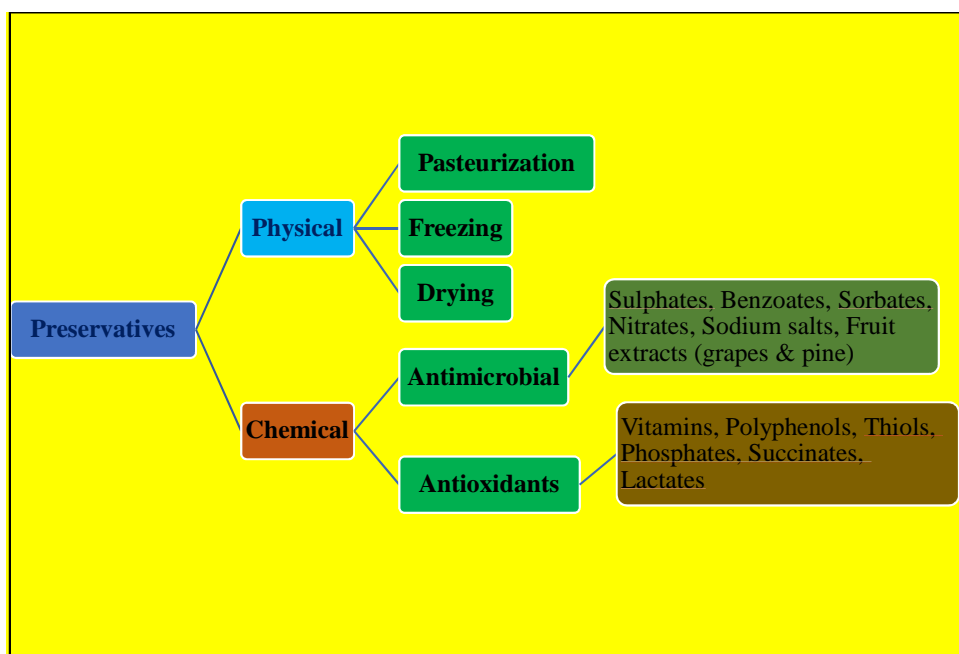
Comment [L6]: word of the first letter should be written in small letters

Comment [L7]: word of the first letter should be written in small letters

Comment [L8]: word of the first letter should be written in small letters

94 preservatives has been known to improve not only the shelf life of the product but also enhance
95 the quality and health benefits.

96



97

98

99 **Fig 1: Diagrammatic representation of usages of preservatives**

100

101 **Acknowledgements:** Authors are grateful to respective organization for support.

102 References

103

104 [1] Yadav P, Garg N, Kumar S. Improved shelf stability of Mulberry juice by combination of
105 preservatives. Indian J Natural Prod Resources. 2014;5(1):62-66.

106 [2] Sarkar S, Saha S, Rai C, Bhattacharyya S. Effect of storage and preservatives on antioxidant
107 status of some refrigerated fruit juices. Int J Curr Microbiol App Sci. 2014;3(7):1007-1013.

108 [3] World Health Organization (WHO). Principles for the safety assessment of food additives
109 and contaminants in food. Env Health Criteria. 1987;70.

Comment [L9]: the page number of the journal is incorrect

- 110 [4] Tuormaa TE. The adverse effects of food additives on health: A review of the literature with
111 special emphasis on childhood hyperactivity. J Orthomol Med. 1994;9(4):225-243.
- 112 [5] Doughari JH, Alabi G, Elmahmood AM. Effect of some chemical preservatives on the shelf-
113 life of Sobo drink. Afr J Microbio Res. 2007;2:037-041.
- 114 [6] Sharma S. Food Preservatives and their harmful effects. Int J Sci Res Pub. 2015;5(4):1-2.
- 115 [7] Abdulmumeen HA, Risikat AN, Sururah AR. Food: Its preservatives, additives and
116 applications. Int J Chem Biochem Sci. 2012;1:36-47.
- 117 [8] Mirza SK, Asema UK, Kasim SS. To study the harmful effects of food preservatives on
118 human health. J Med Chem Drug Discovery. 2017;2(2):610-616.
- 119 [9] Hwang C, Huang L. The effect of potassium Sorbate and pH on the growth of *Listeria*
120 *monocytogenes* in ham salad. J Food Proc Preser. 2014;38:1511–1516.
- 121 [10] Alexander JH, Judicael P, Adam M, Boyan BB. Nisin-induced changes in *Bacillus*
122 morphology suggest a paradigm of antibiotic action. Proce Nat Acad Sci. 2006;103(52):
123 18896-901.
- 124 [11] Carlo DM, Sacchetti G, Mattia CD, Compagnone D, Mastrocola D, Liberatore L, Cichelli
125 A. Contribution of the phenolic fraction to the antioxidant activity and oxidative stability of
126 olive oil. J Agric Food Chem. 2004;52(13):4072–79.
- 127 [12] Toaima W, Trak J, Alkowwatly KA. Nisin peptide as promising natural food preservative
128 for food. J Chem Pharma Res. 2015;7(4):11-14.
- 129 [13] Anon MI. Food Irradiation – A technique for preserving and improving the safety of
130 Food. WHO, Geneva. 1991.
- 131 [14] Theron MM, Lues JF. Organic acids and meat preservation: A review”. Food Rev Int.
132 2007;23: 141-158.
- 133 [15] Jha KH, Taneja A, Kabra KK, Sadiq HM. A study on consumer awareness, safety
134 perceptions and practices about food preservatives and flavoring agents used in
135 packed/canned foods from South India. National J Community Med. 2013;4(3):402-406.
- 136 [16] McCann D, Barrett A, Cooper A, Crumpler D, Dalen L, Grimshaw K, Kitchin E, Lok K,
137 Porteous L, Prince E, Sonuga-Barke E, Warner JO, Stevenson J. Food additives and
138 hyperactive behaviour in 3-year-old and 8/9-year-old children in the community: A
139 randomised, double-blinded, placebo-controlled trial. The Lancet. 2007;370(9598):1560-67.

Comment [L10]: word of the first letter
should be written in small letters

- 140 [17] Kinderlerer JL, Hatton P. Fungal metabolites of sorbic acid. Food Addit Contam.
141 1990;7(5):657-69.
- 142 [18] Elhkim MO, Heraud F, Bemrah N, Tanaka T, Ogata A. New consideration regarding the
143 risk assessment, intolerance reactions and maximum theoretical daily intake in France.
144 Regulatory Toxicol Pharma. 2007;43(3):308-16.
145