Effect of some natural preservatives on some homemade fresh fruit juices

Wala’a Sh. Ali, Nibras N. Mahmood, Ali M. Hasan, Rayim S. Abbood

University of Baghdad, Department of Biology, College of Science, Baghdad, Iraq.
Al-Mustansiriyah University, Department of Biology, College of Science, Baghdad, Iraq.
Al-Mustansiriyah University, Department of Biology, College of Science, Baghdad, Iraq.
Al-Mustansiriyah University, Department of Biology, College of Science, Baghdad, Iraq.

Address For Correspondence: Wala’a Sh. Ali, Nibras N. Mahmood, Al-Mustansiriyah University, Department of Biology, College of Science, Baghdad, Iraq.
P.O.box 4022; E-mail: nibras52011@yahoo.com; Phone:009647902330347

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ABSTRACT

In order to determine the effect of some natural and bio-preservatives on shelf life of apple, orange and pomegranate juices, three preservatives include: lactic acid, supernatant of Lactobacillus fermentum and bee honey at three different concentrations and temperatures for four periods of storage were used. The aim of the present study was to examine some substances as natural preservatives including: supernatant of Lactobacillus fermentum, bee honey, and lactic acid to preserve apple, orange, and pomegranate juices with different concentrations at different temperatures and periods of storage. The results showed that bee honey followed by bacterial supernatant at 30% concentration were the best in preservation all three kinds of fruit juices for 21 days of storage at 4°C, since the bee honey and bacterial supernatant reduced the viable count of microorganisms by 4 and 2 log units, respectively in comparison with control. On the other hand, the effect of 30% of lactic acid was clear on orange juice since it decreased the viable count of microorganisms by 3 log units in comparison with the control. These results indicate that the bee honey can be used as natural preservative to enhance the shelf life of homemade fresh fruit juices at refrigerator temperature for three weeks. In conclusion, the natural preservatives such as bee honey and LAB or their metabolites can be used for extend the shelf life of homemade fresh fruit juices instead of consuming the artificial fruit juices which provide with chemical preservatives.

KEYWORDS: natural preservatives, bee honey, Lactobacillus fermentum, lactic acid, fruit juices

INTRODUCTION

Preservatives are natural or synthetic substances that added to the pharmaceutical, cosmetics and food products [1] to maintain and enhance their quality and to increase the shelf life of them [2]. Preservatives can be classified as antioxidants preservatives, antimicrobial preservatives and anti-enzymatic preservatives [1, 3]. The use of the natural preservatives in food increased over the last years because healthy food and drinks without any chemicals additives is the consumer's demand [4].

Bio-preservation or biological preservation has received more attention in the recent years. As a concept it means the use of microorganisms or their metabolites to kill or inhibit unwanted microorganisms in foods and also to extend shelf life of food [5, 6]. Lactic acid bacteria [LAB] that used in food industries for centuries are generally recognized as safe [GRAS] and considered bio-preservatives [7]. Because LAB have ability to produce different antimicrobial and aroma compounds during the fermentation process such as, organic acids, hydrogen peroxide, diacetyl, bacteriocins and others [8], these bacteria or their metabolites are considered good natural preservatives instead of chemical preservatives [9]. Although many studies have recorded the effect of...
LAB or their metabolites on the safety and quality of dairy and meat products [10,11], there is few studies about the effect of these bacteria on fresh food products [7].

Bee honey is a natural product [12] that used as a food, it is super saturated nectar collected from a different kinds of plants by bees [13]. Honey contains at least about 181 substances [14] as well as some ingredients that act as preservatives such as, ascorbic acids, flavonoids, tocopherol, and other phenolics and enzymes like catalase, glucose oxidase, and peroxidase [15]. Bee honey has antioxidant, antimicrobial, and antibrowning preservative properties; it inhibits enzymatic browning in vegetable and fruit processing [3] and has antimicrobial effects on many kinds of microorganisms [16]. Although the natural preservative properties of honey are known, there are few studies about use it in preservation of food [4, 15].

Due to their low toxicity, solubility and flavor [3], organic acids are one of the natural preservatives that used in foods such as, beverages, soft drinks, ice-cream, baked products and others [17]. Lactic acid is the end product of LAB [3], GRAS [18] and it is multifunctional organic acid [19] that used widely in many industries include; cosmetic, chemical, pharmaceutical and food [20].

Three types of fruits (apple, orange, and pomegranate) were collected from the local market in Baghdad, Iraq. Fruits were washed gently with clean water and the juices were extracted from them separately.

Lactic acid (Sigma, USA), supernatant of Lactobacillus fermentum (Department of Biology, College of Science, Al-Mustansiriya University), and bee honey (local market in Baghdad) were used as preservatives.

Each one of lactic acid, bacterial supernatant and bee honey was added with concentrations 10, 20, and 30% separately to each one of the fresh juices of apple, orange and pomegranate separately and incubated at 4, 25 and 37°C for 7, 14, 21 and 28 days, fresh juices of apple, orange and pomegranate without any preservatives served as control. After every incubation period at every incubation temperature, serial tenfold dilutions was made and 0.1 ml of the last three dilutions spread on nutrient agar plates separately and then incubated at 37°C for 24 hours. Colonies were enumerated and the colony forming unit (CFU)/ml was counted.

RESULTS AND DISCUSSION

The results showed that there is antimicrobial effect of the preservatives on the three juices with all their concentrations that used in this study at 4°C and this effect was increased with increasing of concentration of preservatives, while there is no effect of them at 25 and 37°C for all storage periods. No microbial growth was observed after one week of storage at 4°C for all three fruit juices at all concentrations that used, while no antimicrobial effect of all preservatives at all concentrations was observed after 4 weeks of storage at 4°C. Also the results showed that there are differences among bee honey, bacterial supernatant and lactic acid as inhibitors for microbial growth. The bee honey with concentration 30% was the best, it was able to reduce the viable count of microorganisms by 4 log units for 21 days, whereas, the bacterial supernatant decreased the viable count of them by 2 log units at the same concentration (30%) in comparison with the control. On the other hand, lactic acid at 30% concentration reduced the viable count of microorganisms in orange, pomegranate and apple juices by 3, 1 and 1 log units, respectively with comparison with control (Figures 1, 2, and 3).

Many studies reported the antimicrobial activity of honey against Gram positive and Gram negative bacteria, molds and yeasts [24, 25, 26] but only several studies reported the use of honey as natural preservative in foods and beverages [4, 15].

The antimicrobial activity of bee honey is related to many agents and components in it such as, high osmolarity due to the large amounts and high concentrations of carbohydrates [16] which reached approximately to 95% of the dry weight of it [27] that cause shrinkage disruption of the microbial cell wall [28], its low pH because of the presence organic acids especially gluconic acid [29], hydrogen peroxide and non-hydrogen peroxide activities [26] as well as lysozyme, inhibit [28] and other aromatic and volatile compounds [16].

Depending on the concentration of bee honey that used, the effect might be static or cidal [26] and this explain the fact that the antimicrobial activity of bee honey is increased with increasing of its concentration, also components of honey are differed based on the type of honey, so there is variation in its quality and ability to preserve food and thus the long of storage period of food.
The effect of honey at its three concentrations was more strong on orange juice in comparison with apple and pomegranate juices, it is could be because the honey is more activity in acidic environments and media[30].

The antimicrobial activity of supernatant of *L. fermentum* is attributed to the synergistic action of many antimicrobial metabolites that produced by this bacteria such as organic acids, bacteriocins and others. Organic acids provide acidic conditions unfavourable for the growth of many microorganisms [31]. The organic acids like lactic acid neutralized the electrochemical potential of cell membrane, increasing its permeability, decrease cytoplasmic pH, stop metabolic functions and as a result cause death of sensitive microorganisms [32].

**Fig. 1:** Effect of lactic acid, bacterial supernatant of *Lactobacillus fermentum* and bee honey at different concentrations on microbial growth in pomegranate juice after 14 and 21 days of storage at 4°C

**Fig. 2:** Effect of lactic acid, bacterial supernatant of *Lactobacillus fermentum* and bee honey at different concentrations on microbial growth in apple juice after 14 and 21 days of storage at 4°C

**Fig. 3:** Effect of lactic acid, bacterial supernatant of *Lactobacillus fermentum* and bee honey at different concentrations on microbial growth in orange juice after 14 and 21 days of storage at 4°C.
REFERENCES


