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Article

Microbiological Quality of Raisin Dried by Different Methods

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Abstract: Raisins are one of the dried fruit products made from grapes. In this study, microbial quality of raisin samples produced by shade drying and solar drying methods has investigated. The results indicate that Salmonella and *E.coli* were not detected in both samples but *Coliforms* significantly have observed. Molds and yeasts were in higher levels in raisin samples. Also, fungi counts in shade drying method found in lower level (mold 2.59 Mean Log Cfu/g, yeast 2.05 Mean Log Cfu/g) in compared with solar drying method (mold 2.88 Mean Log Cfu/g, yeast 2.48 Mean Log Cfu/g) because of SO_2 treatment, without exposure to environment contamination and lower process time in shade drying method. Shade drying method is suggested as a better system to produce raisin but harmful effects of residues of sulphur after shade drying process cannot be forgotten.

Keywords: Raisin, Drying methods, Microbial quality

1. Introduction

Raisins are one of the important products that are made from grapes. Because of importance of our country in Raisin export, the use of the best ways to preparation and production and also observance the factors affecting quality of products have particular importance (Pahlavanzadeh *et al.*, 2001). Until Twenty-five years ago, Iran was one of the most important countries in the supply of world's Raisin. But because of the lag in technology and processing, low quality of produced Raisins and disobedience of international standards lead to decrease in export of products (Vagenas and Kouris, 1991). Drying is one of the oldest methods for keeping human food. This method is based on the reduction in food water, or in other words the reduction of water activity in foods which leads to reduction in microbial, chemical, biochemical processes and increases the shelf life of products. Although the solar drying method has a long history, yet this style of food drying is scientific and practical method used in most developed countries. Because this method is simple and inexpensive (Pangavhane and Sawhney, 2002). However, these methods have disadvantages Including the possibility of product contamination due to direct exposure to environmental factors, insects, birds and rodents attacking and long drying time which has a negative effect on the economic aspects (Kostaropoulos and Saravacos, 1995). Therefore, to increase quality and reduce drying time and drying methods have recently been proposed. In This study, we compared microbial count including *Salmonella, coliform, E. coli* and fungi of Raisins which dried by shade and solar drying methods.

2. Material and Methods

2.1. Drying Methods of Raisin

2.1.1. Solar drying

In this way, the grapes were picked in the mesh trays and placed in the open environment exposed to direct sunlight. During the drying, the temperature range was 18- 39 °C (Pangavhane and Sawhney, 2002).

2.1.2. Shade drying

In this method, after putting grapes in mesh trays, they put in an enclosed room and left to dry in the shade. The temperature used in this method was 20- 35 °C (Pangavhane and Sawhney, 2002).

2.2. Microbial Count

2.2.1. Coliform

Total *coliforms* were estimated on violet red bile agar (VRBA) (Microbial) incubated for 24–36 h at 37°C and 44°C respectively. Isolates were examined for colony morphology, lactose fermentation on VRBA, Gram stain, oxidase test and triple sugar iron fermentation test (Pisano *et al.*, 2006).

2.2.2. E.coli

E.coli strains were isolated on Eosin Methylene Blue agar (EMB: Difco, Detroit, Michigan). Five lactose fermenting colonies were selected from each plate and examined by physiological tests (Clermont *et al.*, 2000).

2.2.3. Salmonella

For detection of *Salmonella spp*., 25 g of each samples were homogenized in 225 mL of buffered peptone water (Microbial) and incubated for 24 h at 37 ºC, then 0.1 mL was sub-cultured in 10 mL of selenite cystine (SC) broth (Microbial) and Rappaport Vassiliadis (RV) broth (Microbial) and incubated for 24 h at 37°C and 42°C, respectively. Then a loopful of SC broth and RV broth was streaked on Hektoen agar (HA) (Microbial) and brilliant green modified agar (Microbial) and plates were incubated for 24-48 h at 37°C. Suspected colonies were further screened biochemically and serologically (Clermont *et al.*, 2000).

2.2.4. Yeasts and *moulds*

Yeasts and *moulds* were enumerated using potato dextrose agar (Microbial) with chloramphenicol (0.01%), and incubated at 25°C for 5 days. The isolates were identified using the tests reported by Kurtzman and Fell (Kurtzman *et al.*, 2011).

3. Results and Discussion

The result of research showed that there is no *E. coli* and *salmonella* in Raisin in both condition of drying. The occurrence of Molds and Yeasts contamination in Raisin in solar drying method was more than shade drying method. The result of raisin contamination to bacteria and fungi in different methods of drying is shown in tables 1 and 2.

According to Tables 1 and 2, bacterial count including *E. coli* and *Salmonella* have not detected in both solar drying and shade drying samples, also *Coliforms* were not different drying treatments. Eight compounds in raisin make antibacterial effects including oleanolic acid, oleanolic aldehyde, linoleic acid, linolenic acid, betulin, betulinic acid, 5-(hydroxymethyle)-2-furfural and sitosterol that antibacterial activity of oleanolic acid is more than other compounds. Antimicrobial activity of mentioned compounds leads to limit the growth of some bacteria such as *Coliforms* (Rivero-cruz *et al.*, 2008).

Table 1. Microbial properties of Raisin in Shade drying method (Mean Log Cfu/g)

	Microorganism	**count**
Bacteria	*E. coli*	0.00
	Coliforms	2.00
	Salmonella	0.00
Fungi	*Molds*	2.59
	Yeasts	2.05

Table 2. Microbial properties of Raisin in solar drying method (Mean Log Cfu/g)

	Microorganisms	**count**
Bacteria	*E. coli*	0.00
	Coliforms	2.00
	Salmonella	0.00
Fungi	*Molds*	2.88
	Yeasts	2.48

Low moisture of raisin contributes to stimulate the growth of molds and yeasts (Hakobyan *et al.*, 2010). Askari *et al.* (2012) also found high levels of fungi in raisin samples. As it has shown in tables 1 and 2, there are higher counts of molds and yeas than bacteria. Raisin samples produced by shade drying method were in lower counts of fungi in compared with solar drying according to tables 1 and 2. Witthuhn *et al.* (2005) indicated that the unsulphured (solar drying method) raisins have been the cause of higher levels of yeasts and molds contamination and sulphured (shade drying method) raisin were in lower counts of fungi. In this study we also observed higher levels of fungi in raisin samples produced by solar drying method. SO_2 decrease the fungi levels in dried fruits such as raisin (Witthuhn *et al.*, 2005) also it has known as an important anti-fungi compound (Askari *et al.*, 2012). Exposure of raisin to environment and higher drying time in solar drying method in compared with shade drying method also leads to higher levels of fungi (Witthuhn *et al.*, 2005). Shade drying method is suggested as a better system to produce raisin but harmful effects of residues of sulphur after shade drying process cannot be forgotten.

4. Conclusion

Microbial quality of raisin samples produced by shade drying and solar drying methods has investigated in this study. Because of anti-bacterial compounds such as oleanolic acid bacterial counts

including *Salmonella* and *E. Coli* were not detected in both samples but *Coliforms* significantly have observed. Molds and yeasts were in higher levels in raisin samples. Also, fungi counts in shade drying method found in lower level in compared with solar drying method because of SO_2 treatment, without exposure to environment contamination and lower process time in shade drying method. Finally, shade drying process can be suggested as better process for raisin production but residues of sulphur after shade drying process are not safe absolutely.

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