REVIEW ARTICLE

Chemical Analysis of Ginger Rhizomes and Sensory and Microbial Evaluation of Ginger Juice during Storage

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ABSTRACT

Chemical analysis was performed for fresh ginger rhizomes and sensory evaluation of the juice was done. The microbial content of the juice was estimated during storage at 25℃ for three months. Results of chemical composition showed that moisture, protein, lipid, ash, carbohydrate and fibers were 85.29, 1.65, 0.95, 0.98, 11.50 and 2.23%, respectively. Total acidity was 0.12%. Results of sensory evaluation of ginger juice prepared using sugar, citric acid and potassium meta-bisulfate that the degrees given for color, flavor and spicy taste were acceptable. General acceptance values were within the allowances since they were between 5 and 6 according to the acceptable to very good acceptable measurement. Results of microbial analysis of the juice samples indicated that the total count of bacteria was low and within the allowances. Total count of aerobic bacteria and molds were increased during the three months of storage at 25℃.

Keywords: Ginger, Sugar, Ginger juice, Citric acid.

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INTRODUCTION

Ginger (Zingiber officinalis) is a rhizobium plant belonging to the family Zingiberaceae. Its origin is southeast districts of Asia.[1] It is one of the plants that grow under the ground. Ginger is characterized with its good odor and spicy taste because of its content of volatile compounds; therefor it was used in different food products like bread, candies, sauces, carbonated beverages and ginger oil.[2] Some authors[3] showed its potential uses in the biscuit and cake processing. Because of its nutritional components and active compounds, ginger is considered a useful nutritional and preservative item.[4] It is one of the oldest spices used by human as a natural foodstuff with antioxidant and anticancer effects.[5] Its activity against coli cancer was proved.[6] It has important health benefits, since it facilitates liquid transport and catalyzes the blood route.[7] Ginger was used as dried material for cooking,[8] and the oil for odorants and beverages processing[9] because of its special odor and strong flavor.[10] It is also used as a powder in the mayonnaise industry at a concentration between 1 and 1.25 % to improve some organoleptic traits.[11] The emergence of enriched foods, the growth of consumer awareness, and taking care in following health nutrition and strategy in gaining the healthy benefits led to an increase in the functional foods market.[12] World Health Organization (WHO) pointed out that nearly 70 – 80 % of third-world countries depend on non-classic medicine, and that more than 60% directly depend on the plants, especially the herbal extracts for the medical purposes.[13] Ginger contains both volatile and non-volatile materials,[14] the volatile compounds give the snappy taste, whereas the non-volatile components have an important role as an anti-free radical generation,[15] anti-inflammation substances,[16] and decrease muscle pains resulted from sport activities.[17] its content of nutritional components and active compounds, ginger is arbonated beverages and ginger oil.[2] Recently, the interest in natural plant extracts was increased, and the ginger extract had great amount of interest; for example, a group of Simon-Brown, K., et al.[18] developed capsules of ginger extract by spray-drying method to use in many applications. Because of its nutritional and medical importants, the recent study was performed to estimate the chemical composition of ginger and prepare the juice from it and study the microbial and sensory qualities of it during the storage for three months at 25℃.

MATERIALS AND METHODS

Rhizomes of ginger (*Zingiber officinale*) were collected from Iraqi local markets. Sugar, citric acid and potassium meta-bisulfate (KMS) were also purchased from the local markets. According to the established methods, samples of rhizomes were analyzed to assess moisture, ash, lipids, protein,

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carbohydrate, fibers, and perecent of total acidity.[19] Juice from fresh ginger was prepared by washing rhizomes in water and blending tell the complete crushing. The juice was filtered through a cheese cloth and squeezed by hand to extract most juice. Sugar was added in the ratio of (1.2:1) from water and sugar. This ratio was calculated on the basis of primary tests. Materials (Table 1) were mixed, put on direct heat source and the juice was heated at 80–90°C. Then KMS was added to the juice. The juice was distributed in glass containers previously prepared for this purpose and the containers were tightly closed.

Juice samples were subjected to sensory evaluation. Consumer preference was evaluated by some organoleptic tests achieved by a group of specialists in Food Science Department including color, flavor, spicy taste and general acceptance. Microbial tests were performed by measuring total aerobic bacterial count and the total count of yeasts and molds in the juice using suitable methods.[20] Juice samples were kept in storage at 25 ± 2 C for 0, 30, 60 and 90 days in three replicates for each storage period to study the effect of storage on the total aerobic bacterial count and total yeast molds count of the juice. All juice samples were still in good condition tell the third month of storage.

RESULTS AND DISCUSSIONS

Results of chemical analysis (Table 2) showed that ginger rhizomes contents were as follows: moisture 85.29%, protein 1.65%, ash 0.98%, lipids 0.95%, carbohydrate 11.5% and fibers 2.23%. The total acidity of the ginger juice was 0.12%. These results are with agreement with what other authors[21] found in the research on ginger in India. But our results for some components were slightly different from[22] who mentioned that the percent of moisture, protein, lipids, carbohydrate, ash and fibers were 80.9, 2.3, 0.9, 12.3, 1.2, and 2.4 %, respectively. These differences in the percent of the components may be due to the differnces in cultivars and the variability of the agricultural conditions.

Table 3 illustrates the results of sensory evaluation of ginger juice made according to three different combinations (treatments) with variable ratios of components used in juice preparation. The table revealed that the sensory traits were in acceptable levels. Color had degree between 6.2 and 7. The degrees for flavor and spicy taste were 6.7–6.8 and 5.9–6, respectively. All the treatments were of general acceptance between 5.9 and 6.2. In spite of non-significant differences ($P \leq 0.01$), it can be noted that the second treatment was the best in the sensory evaluation. This is because the spicy taste level was low. This decrease may be due to increase juice content of sugar in treatment[2] as compared with tretments 1 and 3.These results were in consistent with that of other authors[23] who found that the beverage prepared from ginger and lemon was characterized with acceptable degrees for each of flavor, color and spicy taste, and the general acceptability was fairly good.

Results of microbial study (Table 4) pointed out the good microbial quality of the juice at the end of preparation. Number of bacteria was less than 10 cfu/mL. This may be due to the heat treatment which was enough to kill the vegetative cells. All treatments were free from yeasts and molds. After 30, 60, and 90 days of storage at 25°C the total count of bacteria was increased and some molds have appeared in the juice. By the end of the storage period, aerobic bacteria's ginger juice content was between 3.92–4.94 log cfu/mL. This increase in bacterial count with the period of storage may be due to that the heat treatment killed the vegetative cells only and some spores may resist this treatment and begin to grow when the conditions became suitable. These results agree with Ural R, *et al*.[24] about the decrease of the microbial content of some products processed from ginger, and with Arifan F, *et al*. [25] who found that ginger juice samples were still low in the microbial count and valid for human consumption for at least 6 months.

From this study it may be concluded that ginger juice prepared by crushing plant rhizomes with adding sugar, citric acid and KMS had acceptable levels of sensory traits and the general acceptance was within moderate ranges. The juice can be stored at room temperature (25°C) for three months. Storage period may be increased using cool conditions to pay more attention to filling steps and heat treatment. The processing of ginger-containing products needs more study because of the important features, which may make it a very useful nutritional and medical item.[26] There are many herbs that represent good

Table 1: Percent of materials added to obtain the ginger juice

Componenet	*Sample 1*	*Sample 2*	*Samle 3*
Juice (ml)	60	70	80
Water (ml)	120	140	160
Sugar (g)	12	22	32
Citric acid (ml)	1.3	1.3	1.3
KMS (mg)*	20	30	40

*KMS: Potassium metabisulfate

Table 2: Chemical composition of fresh ginger

Components	*%*
Moisture	85.29
Protein	1.65
Lipids	0.95
Ash	0.98
Carbohydrate	11.50
Fibers	2.23
Total acidity	0.12

Table 3: Sensory evaluation of ginger juice

Sample No.	*Color*	*Flavour*	*Spicy taste*	*General acceptance*
1	6.2	6.8	6.1	5.9
2	7.0	6.7	5.1	6.2
3	6.4	6.7	5.9	6.1

Table 4: Total aerobic bacterial and molds counts (log cfu/mL) of ginger juice stored for 3 months at 25 C

	Sample No.	*Day 0*	*Day 30*	*Day 60*	*Day 90*
Bacteria	1	≤1	2.98	3.56	4.94
	2	≤1	2.84	4.10	4.30
	3	≤1	1.92	3.74	3.92
Molds	1	-	≤1	1.67	2.35
	2	-	≤1	1.60	2.40
	3	-	≤1	≤1	2.35

sources of nutritional and medical substances for use in such studies. For example, rosemary may be used as it is known for the rich antioxidant contents.[27]

CONCLUSION

This study indicated that ginger is suitable for juice production by addition of sugar, citric acid, and KMS. This juice is fairly acceptable and it keeps its good quality up to three months of storage in room temperature. More studies are necessary to improve the quality of this product.

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