

Effect of storage on acceptability and nutrient content of iron rich toffee

T.N. Khan and J.P. Nerlekar

Iron rich toffees were prepared from, Rajkeera (*Amaranthus paniculatus*) and Bengal gram leaves (*Cicer arietenum*) powder. The prepared toffees were stored in airtight glass containers at room temperature for a period of six months. The periodical acceptability was evaluated at 0,1,2,3, 4,5 and 6 months of storage period. The nutrient content and microbial count of toffees was determined at 0, 3 and 6 months of storage period. The iron content of toffee R is 31.8 mg/100g and for toffee RB 28.30 mg /100g. The results of mean acceptability scores of organoleptic characteristics of iron rich toffees stored for six months showed that as the period of storage increased all the organoleptic scores decreased. Similarly the nutrient content was highest at initial stage and decreased for 3 and 6 months of storage except moisture. The results of storage study indicated that as the period of storage increased organoleptic characteristics and nutrient content decreased while microbial content increased.

Key Words : Storage, Acceptability, Nutrient content

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INTRODUCTION

Green leafy vegetables supply many nutrients and are rich sources of carotene, iron, calcium, ascorbic acid, riboflavin, folic acid and appreciable amounts of other minerals (Devadas and Saroja, 1980). Indian Council of Medical Research recommendations for leafy vegetables for adult are 100 g but the consumption is found to be only 10-20 g, which is only 20 % of the requirement (Gopalan *et al.*, 1989). Low consumption of green leafy vegetables leads to lower intake of vitamins and minerals, as a result majority of the population suffer from iron and

vitamin A deficiency.

The leafy vegetables are highly perishable and heavy losses occur due to non-availability of sufficient storage, transport and proper processing facilities at the production point (Pande *et al.*, 2000). Preservation of the vegetables can prevent huge wastage as well as make the available in the season. Dehydration is one of the best methods of preservation of leafy vegetables because it reduces the cost of storage and transportation by reducing both the weight and volume of the final product. The drying of leafy vegetables and making them use for future open up new vistas in the field of food technology. Since they are rich in antioxidants and can be added as a natural antioxidant to develop new commercial products (Lahade, 2009). Rajkeera leaves are rich and inexpensive source of dietary fibre, protein, vitamin and wide range of minerals (Shukla *et al.*, 2005). Rajkeera leaves contains higher proportion of insoluble lignin and has low glycemic responses (Srilakshmi, 2007). Addition of dehydrated

MEMBERS OF RESEARCH FORUM

Author for correspondence :

T.N. Khan, Department of Foods and Nutrition, College of Community Science, Vasanttrao Naik Marathwada Krishi Vidyapeeth, Parbhani (M.S.) India

Associate Authors' :

J.P. Nerlekar, Department of Foods and Nutrition, College of Community Science, Vasanttrao Naik Marathwada Krishi Vidyapeeth, Parbhani (M.S.) India

greens increased nutrient density of all formulated products (Gupta and Prakash, 2011). Thus the green leafy vegetables rajkeera leaves and bengal gram leaves rich in iron content were selected for the study with the objectives to study the storage effect on acceptability and nutrient content of iron rich toffee simultaneously to improve the consumption of green leafy vegetables in daily diet.

METHODOLOGY

Iron rich toffees were prepared utilizing two GLV powder *i.e* Rajkeera leaves (*Amaranthus paniculatus*) powder (R) and combination of Rajkeera leaves and Bengal gram leaves (*Cicer arietenum*) powder (RB) with amla jam, sugar, lime and ginger juice. The prepared toffees were stored in airtight glass containers at room temperature for a period of six months. The periodical acceptability was evaluated from 0 to 6 months of storage period and the nutrient content (AOAC, 1975) and microbial count was determined at 0, 3 and 6 month. Acceptability test was carried out using 9 point hedonic scale (Srilakshmi, 2005). The mean acceptability scores were tabulated and analysed statistically (Panse and Sukhatme, 1985).

OBSERVATIONS AND ASSESSMENT

The results of mean acceptability scores of Iron rich toffees stored for six months is presented in Table 1. Acceptability scores were recorded periodically. It was found that toffee (R) scored highest for all the organoleptic characteristics except texture. The scores for texture of RB was 7.7 The toffee RB scored highest for texture may be due to the combination of two green leafy vegetables. It was also observed that as the period of storage increased acceptability for all the organoleptic parameters decreased in toffee R and RB. At the end of four month storage the scores obtained showed that the toffees were slightly liked by the panel members with respect to all organoleptic parameters

The nutrient composition of iron rich toffee at 0, 3 and 6 months of storage period per 100 g dry matter basis is given in Table 2. The protein, ash, fibre, iron, calcium and Vit. C content ranged from 7.9 to 7.45 g, 2.51 to 2.25 g, 0.50 to 0.475 g, 31.8 to 29.5 mg, 280 to 212 mg and 37.53 to 35 mg for toffee R, respectively, whereas (toffee RB) it ranged from 6.14 to 6.12 g, 2.66 to 2.27 g, 0.525 to 0.52 g, 28.30 to 26.0 mg 212 to 176 mg and 26.01 to 24 mg, respectively. The toffee R recorded the highest protein (7.9 g/100g), iron (31.8 mg/100 g) calcium (280 mg/100 g) and Vitamin C (37.53 mg/100 g)

Table 1 : Acceptability scores of iron rich toffees stored for 6 months

Storage period	Colour		Taste		Flavour		Texture		Overall acceptability	
	Toffee R	Toffee RB	Toffee R	Toffee RB	Toffee R	Toffee RB	Toffee R	Toffee RB	Toffee R	Toffee RB
	Mean \pm SD	Mean \pm SD	Mean \pm SD	Mean \pm SD	Mean \pm SD	Mean \pm SD	Mean \pm SD	Mean \pm SD	Mean \pm SD	Mean \pm SD
0 month	7.4 \pm 0.6	7.2 \pm 0.4	7.5 \pm 0.5	7.4 \pm 0.8	7.2 \pm 0.4	7.2 \pm 0.7	7.5 \pm 0.5	7.7 \pm 0.8	7.5 \pm 0.5	7.1 \pm 0.7
1 month	6.7 \pm 0.6	6.9 \pm 0.9	7.4 \pm 0.9	7.4 \pm 0.5	7.1 \pm 0.7	7.2 \pm 0.9	7.5 \pm 0.5	7.6 \pm 0.5	7.4 \pm 0.8	7 \pm 0.9
2 month	6.3 \pm 0.6	6.5 \pm 0.8	7.2 \pm 0.6	7.3 \pm 0.4	6.8 \pm 0.7	7 \pm 0.8	7.4 \pm 0.5	7.6 \pm 0.5	7.2 \pm 0.7	6.9 \pm 0.7
3 month	6.3 \pm 0.6	6.4 \pm 0.4	7.1 \pm 0.9	7.2 \pm 0.7	6.6 \pm 0.8	7 \pm 0.6	7 \pm 0.7	7.3 \pm 0.4	6.9 \pm 0.9	6.7 \pm 0.7
4 month	6 \pm 0.6	6.2 \pm 0.4	6.7 \pm 1.0	6.9 \pm 0.8	6.2 \pm 0.4	6.7 \pm 0.4	6.3 \pm 0.8	6.7 \pm 0.4	6.4 \pm 0.5	6.4 \pm 0.5
5 month	5.6 \pm 0.4	5.4 \pm 0.6	5.7 \pm 0.6	5.8 \pm 0.9	5.5 \pm 0.7	5.9 \pm 0.5	5.7 \pm 0.6	5.9 \pm 0.5	5.8 \pm 0.4	5.9 \pm 0.5
6 month	4.9 \pm 0.5	5.2 \pm 0.7	4.9 \pm 0.5	5.1 \pm 0.5	5.1 \pm 0.8	5.6 \pm 0.8	4.9 \pm 0.7	5.1 \pm 0.8	4.9 \pm 0.7	5 \pm 0.8

Table 2: Nutrient composition of the iron rich toffee (dry weight basis / 100 g) at 0, 3 and 6 months of storage period

Nutrients	Toffee R			Toffee RB		
	0 months	3 months	6 months	Initial	3 months	6 months
Moisture (g)	12.0	13.2	13.8	12.0	13.8	14.84
Protein (g)	7.9	7.65	7.45	6.14	6.12	6.12
Fat (g)	0.92	0.92	0.92	0.86	0.87	0.87
Ash (g)	2.51	2.42	2.25	2.66	2.42	2.27
Fibre (g)	0.50	0.50	0.475	0.525	0.52	0.52
Iron (mg)	31.8	30.8	29.5	28.30	26.9	26.0
Calcium (mg)	280	252	212	212	188	176
Vit. C (mg)	37.53	35.87	35	26.01	26.7	24

Table 3 : Microbial count of iron rich toffees

Storage period	Bacterial count		Fungi count	
	Toffee R	Toffee RB	Toffee R	Toffee RB
0 month	1 x 10 ¹	2 x 10 ¹	2 x 10 ¹	1 x 10 ¹
1 month	2 x 10 ¹	1 x 10 ¹	2 x 10 ¹	1 x 10 ¹
2 month	2 x 10 ¹	Nil	2 x 10 ¹	1 x 10 ¹
3 month	2 x 10 ¹	2 x 10 ¹	3 x 10 ²	2 x 10 ²
4 month	4 x 10 ¹	3 x 10 ¹	5 x 10 ²	3 x 10 ²

content as compared to toffee RB. The nutrient content was highest in initial sample which was followed by 3 and 6 months of storage except moisture.

Microbial content of selected Iron rich toffees (toffee R and toffee RB) stored for six months recorded periodically and given in Table 3. The groups of microorganisms identified were bacteria and fungi. In both the products, initial bacterial count was (1 cfu x 10¹), (2 cfu x 10¹) and fungi count was (2 cfu x 10¹) and (1 cfu x 10¹), respectively. In the fresh state of the product the count of bacteria and fungi was very less as compared to the stored samples. It was found that as the period of storage increased microbial count was increased in both the variations. At the end of four month mould growth was observed in both the variations.

Conclusion :

The results of mean acceptability scores of organoleptic characteristics of Iron rich toffees stored for six months showed that as the period of storage increased organoleptic characteristics and nutrient content decreased while microbial content increased. Thus the suitable storage period for acceptability of toffee was four months.

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