

# Studies on the development and storage stability of bitter gourd-lemon function RTS beverage

■ SUMAN SINGH AND KIRTIRAJ K. GAIKWAD

**SUMMARY :** A blend of beverage from bitter gourd (*Momordica charantia*) and lemon (*Citrus limon*) was formulated and evaluated for its storage stability in Deptt. of Agriculture Engineering process of food engineering (Sam Higginbottom Institute of Agriculture, Technology and Sciences, Allahabad), in the year 2010-11. Addition of bitter gourd to lemon juice increases the nutritional value of the drink and also provides various health benefits to consumers. These ready-to-use functional beverages were prepared by blending different ratios of lemon and bitter gourd (100:0, 75:25, and 50:50). The physico-chemical parameters and sensory characteristics of blended beverage were evaluated for 2 months at 15 days of storage interval. It was observed that TSS mean values decreased (3.5-2.086%) during storage. Decrease in acidity (5.03-4.167%) and increased in pH (2.6-3.6) was also observed. Regarding sensory attributes, maximum scores (9) for overall acceptability was observed in lemon and bitter gourd ratio of 50:50 followed by ratio of 100:0 (7). Drink prepared at 50:50 was also found as the most acceptable in maintaining the physico-chemical and organoleptic characteristics as compared to other treatments.

**KEY WORDS :** Bitter gourd, Lemon, Blend

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The functional beverages can play an important role in health promotion and disease prevention. These reduce increasing burden on health care system by a continuous preventive mechanism. Beverages are considered to be an excellent medium for the supplementation of nutraceutical components for enrichment such as soluble fiber or herbal extract. Bitter gourd is botanically called *Momordica charantia* Linn. The genus *Momordica* belongs to family Cucurbitaceae. Bitter gourd also known as bitter cucumber, bitter lemon caraille, alligator pear, maiden apple coucouli, balsam pear or karela. It has good nutritional value with 2.1 g of protein, 4.2 g of carbohydrates 1.8 mg iron, 20 mg of calcium, 55 mg of

phosphorus, 210 IU of vitamin A and 88 mg of vitamin C per 100 gram of edible portion (Akryod, 1963). Usefulness of bitter gourd as food and medicine has long been known to people (El-Bartan *et al.*, 2006). Bitter gourd (*Momordica charantia* L.) is a popular vegetable in Asia and is used to prepare several dishes. They are highly nutritive and are relatively high in proteins, minerals and vitamins. Bitter gourd has already been reported as a good source of phenolic compounds, which possessed potent antioxidant activity (Budrat and Shotipruk, 2008; Aminah and Anna, 2011). It has some medicinal properties and is recommended for curing blood diseases, rheumatism, diabetes and asthma. It is very effective in inhibiting the growth of HL60 human leukaemia cells and this effect probably contribute in cancer prevention (Kobori, 2003). The aqueous juice of bitter gourd fruit has been shown to possess hypoglycemic activity (Sitasawad *et al.*, 2000). Lemon (*Citrus limon*) belongs to the family of Rutaceae. Lemon juice is very rich in vitamin C, a vitamin responsible for a series of health benefits.

Blending could lead to the production of delightful and delicious beverages with improve organoleptic quality and high nutritive value. Blending increases taste and flavour of fruit

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juices. The blending of juice may also improve aroma, taste and nutrients of the beverages. Bitter gourd-lemon drink is not available commercially and research has not been carried out on preservation of such blended drink. Research on preservation and storage studies were mostly confined to carrot, pumpkin, tomato, spinach and beetroot juice. All parts of bitter gourd, including the fruit, taste was bitter and as such consumption is quite difficult so in present study blended functional RTS beverage were developed and evaluated for storage statistically to provide more nutritive beverage to the consumers.

## EXPERIMENTAL METHODS

This study was conducted in Deptt. of Agriculture Engineering process of food engineering (Sam Higginbottom Institute of Agriculture, Technology and Sciences (Deemed University), Allahabad) in 2010-11. Fresh and sound fruits of bitter gourd (*Momordica charantia*) and lemon (*Citrus limon*) were purchased from local market and were washed with clean water to remove dust, dirt and outer material. Fruits were cut into desired pieces for further processing. Common salt was added at the rate of 8 per cent with small amount of citric acid and kept overnight to reduce bitterness and for softening and firmness. Then, it was washed with water. Blanching was done for time and temperature 100 °C for 3 min and immediate cooling was done in cold water to prevent further cooking. After completion of pretreatments, It was difficult to extract the juice from it so that pieces were crushed in mixture after that placing in muslin cloth and carry out squeezing with pressing to extract the juice then it was filtered to get clear strained juice.

Bitter gourd RTS beverage was standardized by using and mixing different ingredient (bitter gourd juice, salt, citric acid, sodium benzoate, lemon juice etc.) which were used at different quantity. All the ingredients were dissolved through homogenizer. Beverage was prepared by blending bitter gourd and lemon juice at different ratios (C = 100:0, B = 75:25, A = 50:50). Beverage was heated below boiling point for a few minutes and sodium benzoate was added into it. The beverage were filled in glass bottles at 85°C, sealed and stored at ambient temperature of 28+ 5°C. The prepared beverage was analyzed for total soluble solids (TSS) by refractometer (Abbe Refractometer Model 2WAJ) for two months storage at 15 days intervals. A few drops of well homogenized sample were taken

on prism of refractometer and direct reading was taken by reading the scale in meter as described in AOAC. The pH of each sample was determined with digital pH meter (InoLab 720, Germany). A sufficient quantity (50ml) of bitter gourd-lemon drink was taken in 100ml beaker and pH meter was used to record pH according to method explained in AOAC. The acidity in each sample was determined according to standard procedure given in AOAC. 10ml of bitter gourd-lemon drink along with 100ml water was taken and then titrated with 0.1 N NaOH using phenolphthalein as an indicator (1-2 drops) till light pink colour was achieved. Sensory evaluation was made through panel of 10 semi-trained judges. The panel evaluated the acceptance level of beverage for colour, flavour, taste and overall acceptability. A 9-point hedonic scale was used for this purpose. The data obtained were subjected to statistical analysis using analysis of variance technique and comparison of means by LSD test.

## EXPERIMENTAL FINDINGS AND ANALYSIS

The experimental findings obtained from the present study have been discussed in following heads:

### TSS (%) :

The mean values of TSS (Table 1) revealed significant difference (4.62-4.06%) among sample and significant decrease (5.033-4.166%) during storage period. The TSS increased gradually which might be due to hydrolysis of polysaccharides into monosaccharide and oligosaccharides. At zero day storage TSS of all drinks was in the range of 4.5-5.6 per cent.

### Titerable acidity (%) :

Titerable acidity is directly proportional and is a measure of shelf life of the product and guard against the attack of micro-organisms. It also helps to ensure some chemical changes during preparation and storage. The statistical analysis of data (Table 2) showed that acidity varied significantly due to substitution of bitter gourd in lemon. Dhaliwal and Hira reported that there were minor changes in acidity *i.e.* from 0.39 to 0.42 per cent in carrot-spinach and carrot-pineapple juices during storage. Similarly, Majumdar *et al.* (2008). reported that acidity increased from 0.25-0.36g/100ml during storage of cucumber-basil juice. Krishnaveni *et al.*(2001). also reported marginal

**Table 1: Effect of different sample and storage on TSS of bitter gourd- lemon RTS beverage**

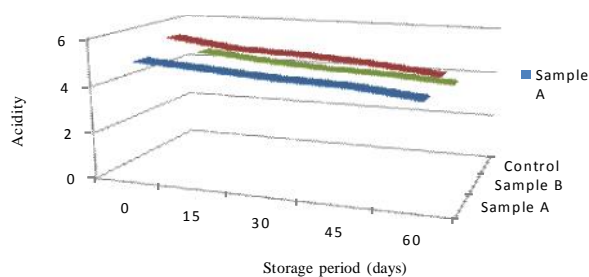
Sample	Storage period (days)					mean
	0	15	30	45	60	
a	5	4.8	4.6	4.5	4.2	4.62
b	5.6	5.2	5.1	4.9	4.6	5.08
c	4.5	4.2	4	3.9	3.7	4.06
Mean	5.033333	4.733333	4.566667	4.433333	4.166667	

The values in column and row followed by different letters are significantly different (p<0.05)

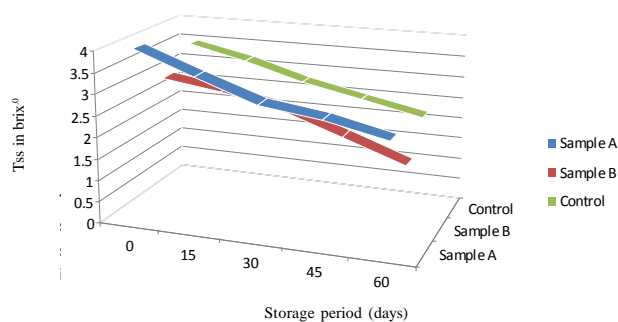
changes in acidity in jack-fruit RTS beverage (0.25-0.27%). The decrease in pH and increase in acidity during storage might be due to degradation of carbohydrates present in bitter gourd lemon drink by the action of microorganisms which cause production of acids in drink.

**pH:**

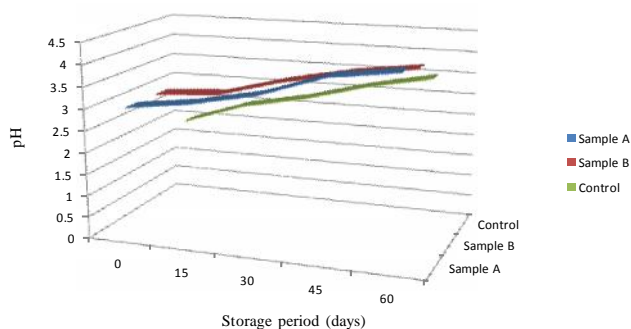
pH is inversely proportional to the acidity of any medium. The results of present study also showed significant effect of storage period and different sample on pH of all drink samples with decrease in acidity and increase in pH. Mean values (Table 3) ranged from(3.58-2.8). It revealed significant decrease in pH among samples and significant increase (2.66-3.66) during



**Fig. 1: Acidity of blended bitter guard- lemon RTS beverage during storage period**



**Fig. 2: TSS of blended bitter guard- lemon RTS beverage during storage period**



**Fig. 3: pH of blended bitter guard- lemon RTS beverage during storage period**

**Table 2 : Effect of different sample and storage on titratable acidity (%) of bitter gourd- lemon RTS beverage**

Sample	Storage period (days)					Mean
	0	15	30	45	60	
A	5	4.8	4.6	4.5	4.2	4.62
b	5.6	5.2	5.1	4.9	4.6	5.08
c	4.5	4.2	4	3.9	3.7	4.06
Mean	5.033333	4.733333	4.566667	4.433333	4.166667	

The values in column and row followed by different letters are significantly different (p<0.05)

**Table 3: Effect of different sample and storage on pH of bitter gourd- lemon RTS beverage**

Sample	Storage period (days)					Mean
	0	15	30	45	60	
a	3	3.2	3.5	4	4.2	3.58
b	3	3.1	3.5	3.8	4	3.48
c	2	2.5	2.8	3.2	3.5	2.8
Mean	2.666667	2.933333	3.266667	3.666667	3.9	

**Table 4 : Sensory evaluation of low calorie bitter gourd RTS beverage**

Sample	Colour	Taste	Aroma	Flavour	Overall acceptability	Mean
A	9	8	8	8	8	8.2
B	9	9	9	8	9	8.8
Control(C)	8	7	7	8	7	7.4
Mean	8.67	8	8	8	8	

The values in column and row followed by different letters are significantly different (p<0.05)

storage period of two months.

#### Sensory evaluation :

The statistical analysis of sensory scores showed significant difference for overall acceptability of drinks during the storage of two months (Table 4). Maximum mean score was attained by sample B (8.8) followed by sample A (8.2) while minimum score was recorded in sample C (7.4) The judges concluded that decreased in level of substitution of lemon juice decreased the overall acceptability for the drinks. (Din *et al.* 2011). Also reported a decrease in overall acceptability of beverages prepared from different ratios of bitter gourd during storage.

#### Conclusion :

Bitter gourds are well accepted and can be one possibility

to increase the consumption of bitter gourd as anti- diabetic vegetable. The bitter gourd fruit has to be given salt treatment to remove bitterness and blanching followed by fast cooling to remove the further cooking. Then juice was extracted with the help of mixture and then further different ingredients like lemon juice, black pepper and black salt were added as per requirement. To increase the overall acceptability of product lemon juice was added in different ratio for better taste. The study concludes that bitter gourd-lemon functional drink prepared at 50:150 was the most acceptable for minimum changes in TSS, acidity and pH. Sensory evaluation score was also higher for this drink followed by ratio of 100:0. The data further revealed that all blended drinks remained acceptable during the storage period of 60 days.

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