

Formulation of therapeutic drink to boon human health (guava-lime-ginger RTS beverage)

J. SELVI, P. BANUMATHI, S. KANCHANA AND M. ILAMARAN

The study was conducted to evaluate the formulation of therapeutic drink guava-lime-ginger RTS beverage (GLG RTS) to boon health. The fixed ratio of fruit juices in guava-lime-ginger RTS beverage was 10:3:2. The prepared RTS was bottled in glass bottles and stored at room (R_1) and refrigerated (R_2) temperature. An increasing trend in the acid content of the GLG RTS was observed. The acid content of RTS beverage increased from 0.252 to 0.305 and 0.252 to 0.298 per cent in R_1 and R_2 samples, respectively. The freshly prepared guava-lime-ginger RTS beverages had TSS of 15° brix and slight reduction was noticed during storage. A gradual increase in reducing sugar content of the RTS was observed. The final reducing sugar content of GLG RTS was increased from 5.98 to 8.28 and 5.98-7.98 g per 100 ml in R_1 and R_2 , respectively. The final total sugar content of the RTS beverage decreased from 12.24 to 10.95 in R_1 and 12.24-11.24 g per 100 ml in R_2 samples. A gradual reduction in the ascorbic acid content was observed in all the samples during storage. The initial and final ascorbic acid content was 8.82 to 7.85 and 8.82-7.98 mg per 100 ml (R_1 and R_2 , respectively) in GLG RTS beverage. A slight increase in the microbial load was noted in the formulated value added fruit products during storage. Initially the bacteria, fungal and yeast count was below detectable level (BDL) and at the end of storage period microbial load slightly increased. The formulated value added fruit product secured highly acceptable to acceptable score value during storage. The mean overall acceptability score values noted in storage ranged from 8.55 to 8.30 in R_1 and 8.75 to 8.50 in R_2 samples at the end of 180 days. Comparative economic analysis of value added production showed that the cost of production of RTS per litre was Rs. 29.74. It was found that maximum profit could be obtained per litre of RTS production Rs. 6.26 per kg.

Key Words : Therapeutic drink, RTS beverage

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INTRODUCTION

Guava is one of the famous and well-known fruit grown all over India and many parts of the world. Guava tree bears fruits twice in a year, in summer and winter, but the fruit in winter is considered, superior in quality and taste. The pulp of guava is very useful for human system.

Guava is the most nutritious fruits compared to other types of fruits. It is higher in vitamin C than citrus fruits (the edible rind contains a lot of it) and it contains appreciable

amounts of vitamin A as well. It is also a good source of iron and pectin, an enzyme used in making jams as well as promoting digestion. Guava is digestive, carminative, gives vigour and strength to heart, lungs and the whole body. It is an effective aphrodis, improves blood circulation, heals and dries wound and is an antiseptic. When eaten with seeds it gives roughage to the diet and helps in the normal evacuation of the bowels. The fruit improves overall resistance.

Lime has several uses and products made from it have varied applications. Lime processing utilizes each and every portion of lime fruits for high value products, which have a very high market demand. Lime oil has many uses in cosmetics and pharmaceutical industries. Citric acid has also many applications as food preservative in many food preparations and food processing industries are large consumers. Clarified lime juice is used as health-drink and is mixed in many food preparations. Lime is cultivated in almost all parts of country

MEMBERS OF RESEARCH FORUM

Author for correspondence :

J. SELVI, Department of Food Science and Nutrition, Home Science College and Research Institute (T.N.A.U.), MADURAI (T.N.) INDIA
Email: selvisathi81@gmail.com

Associate Authors' :

P. BANUMATHI, S. KANCHANA AND M. ILAMARAN, Department of Food Science and Nutrition, Home Science College and Research Institute (T.N.A.U.), MADURAI (T.N.) INDIA

and the North-East states are not an exception.

Limes are often grown in abundance in tropical and sub tropical countries. Their seasonal availability gives rise to gluts in the market, which means that growers do not get the full reward for their labours. Fresh limes are perishable items. It is often difficult to get them to the fruit market in a state where they still fetch a good price. Making the limes into lime juice can alleviate these problems. The technology required is simple and due to the very acidic juice of lime, spoilage or food hygiene problems are minimal. Lime juice is popular as it is an important ingredient in many a cuisine or can be made into a drink.

METHODOLOGY

Matured, firm fruits like guava, lime and ginger were purchased from local market. Non-perishable items such as sugar, citric acid and potassium metabisulphite (KMS) were purchased in bulk from the local market. Glass bottles (capacity 200 ml) with caps were used for storing the prepared Guava, lime and ginger RTS beverage (GLG RTS beverage).

Guava, lime and ginger were used for the study. The flow chart for the preparation of guava, lime and ginger RTS beverage is given in Fig. 1. The guava pulp (100g) was blended with lime

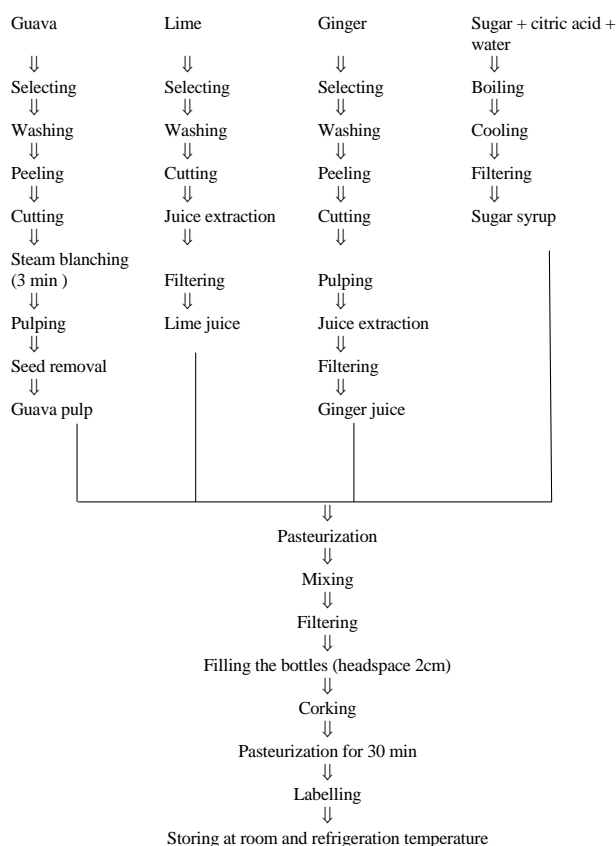


Fig. 1. Flow chart for the preparation of guava, lime and ginger RTS beverage (GLG RTS beverage)

juice and ginger juice (30ml, 20ml, respectively). The fruit pulp was taken in a flat-bottomed vessel and mixed with required amount of water. Sugar was added till 15° brix was reached. Citric acid was added. Heated upto 80°C. Filled in sterilized bottles by leaving head space of 2 cm. Brought down to room temperature crown corked the bottled immediately. The sealed bottles were processed for 30 min under pressure. Labelled and stored at room and refrigeration temperature.

Processing of guava-lime-ginger RTS beverage :

The RTS beverage was prepared by using guava, lime and ginger with FPO specification viz., fruit pulp –10- 15 %, TSS 15°brix, acidity – 0.25- 0.30 % and potassium metabisulphite – a pinch.

Chemical analysis :

The acidity of the sample was estimated by the Ranganna (1995). The pH of the sample was estimated by the method described by Hart and Fischer (1971). The total soluble solid of the fruit was found out by using a hand refractometer. The total and reducing sugar content of the sample was determined by the Shaffer Somogyi micro method described by MC Donald and Foley (1960). Ascorbic acid was estimated following the procedure of Mahadevan and Sridhar (1982). The microbiological load of the stored sample was enumerated at regular intervals by the methods described by Istawankiss (1984).

Organoleptic evaluation :

The developed RTS beverage was evaluated for organoleptic characteristics namely colour, appearance, flavour, texture, taste and overall acceptability by using score card with nine point hedonic rating scale (9-1).

Economic feasibility analysis :

To analyse the economic feasibility of the processing plant project, four criteria were considered, viz., i) internal-rate of return, ii) benefit-cost ratio, iii) pay-back period and (iv) break-even point (Rajan, 1984).

Statistical analysis :

The data obtained from the various experiments were subjected to statistical analysis to find out the impact of storage condition used and storage period. Factorial Completely Randomized Design (FCRD) was applied for the analysis of the study as described by Rangaswamy (1995).

OBSERVATIONS AND ASSESSMENT

The result obtained from the present investigation are presented below :

Changes in the chemical constituents of the guava-lime-ginger RTS beverage :

The chemical constituents such as acid content, pH, TSS, reducing sugar, total sugar, ascorbic acid, microbial load and organoleptic characteristics of the guava-lime-ginger RTS were analysed at regular intervals (once in 30 days) during the study period of 180 days in room temperature (R₁) and refrigerated temperature (R₂).

Acid and pH :

The changes noted in the acid content of the guava-lime-ginger RTS beverages are presented in Table 1. An increasing trend was observed in the acid content of the RTS throughout the storage period for both R₁ and R₂ temperature samples. From the data it could be seen that the initial acid content of

the RTS beverages was 0.252 per cent and was increased to 0.305 per cent in R₁ and 0.298g per cent in R₂ after 180 days of storage. The acidity of the prepared RTS beverages was within FPO standards (0.25%).

The statistical analysis showed that a significant difference in the acid content of the guava-lime ginger RTS beverages during storage period and storage condition. An increase in acidity (0.28 to 0.34%) of mango RTS beverages was noted by Beerth *et al.* (1989).

As the acid content of the RTS beverage increased, the pH decreased during storage. The initial pH was 3.95. At the end of the storage period the pH decreased from 3.95 to 3.58 in R₁ and 3.95 to 3.59 in R₂, respectively. The statistical analysis of the data revealed that there existed a significant difference among the RTS beverage, storage period and storage

Table 1. Changes in the acidity, pH and TSS (°Bx) content of the guava, lime and ginger RTS beverage during storage

Storage period (S) (days)	Acidity (g/100ml)		pH		TSS (°Bx)	
	Storage condition (R)		Storage condition (R)		Storage condition (R)	
	R ₁	R ₂	R ₁	R ₂	R ₁	R ₂
0	0.252	0.252	3.95	3.95	15.50	15.50
30	0.265	0.248	3.90	3.92	15.50	15.50
60	0.272	0.265	3.84	3.87	15.45	15.48
90	0.279	0.270	3.78	3.80	15.38	15.40
120	0.285	0.279	3.71	3.72	15.30	15.35
150	0.297	0.285	3.62	3.61	15.22	15.30
180	0.305	0.298	3.58	3.59	15.10	15.24
	Acidity (g/100ml)		pH		TSS (°Bx)	
	SED	CD (0.05)	SED	CD (0.05)	SED	CD (0.05)
S	0.00054	0.00111**	S	0.00054	0.00111**	0.00111**
R	0.00029	0.00059**	R	0.00029	0.00059**	0.00059**
SR	0.00077	0.00157**	SR	0.00077	0.00157**	0.00157**

R₁- Room temperature R₂- Refrigeration temperature

Table 2. Changes in the total and reducing sugar (g/100 ml) content of the guava, lime and ginger RTS beverage during storage

Storage period (S) (days)	Total sugar (g/100 ml)		Reducing sugar (g/100 ml)	
	Storage condition (R)		Storage condition (R)	
	R ₁	R ₂	R ₁	R ₂
0	12.24	12.24	5.98	5.98
30	12.10	12.18	6.85	6.25
60	12.00	12.05	7.12	6.89
90	11.86	11.92	7.45	7.05
120	11.45	11.75	7.86	7.28
150	11.18	11.52	7.99	7.45
180	10.95	11.24	8.28	7.98
	Total sugar (g/100 ml)		Reducing sugar (g/100 ml)	
	SED	CD (0.05)	SED	CD (0.05)
S	0.01225	0.02509**	S	0.01990
R	0.00659	0.01341**	R	0.01064
SR	0.01732	0.03548**	SR	0.02814

R₁ - Room temperature R₂ - Refrigeration temperature

conditions. Similarly Kumar and Manimegalai (2001) reported that a slight reduction in pH of the mixed fruit RTS beverages stored at room and refrigeration condition during storage. The initial values of pH of RTS ranged from 3.95 to 3.84 which changed to 3.66 to 3.70 and 3.63 to 3.69 at room and in the refrigerated temperature, respectively after 150 days of storage.

TSS :

The freshly prepared RTS beverages had 15.50° brix of TSS and it was observed that the stored RTS beverage did not show much changes in TSS till 30 days of storage in R₁ and R₂. At the end of storage period TSS content of RTS beverage was reduced to 15.10 in R₁ and 15.24 in R₂. The statistical analysis of the data revealed that there existed a significant

Table 3. Changes in the ascorbic acid (mg/100 ml) and β-carotene (µg/100 ml) content of the guava, lime and ginger RTS beverage during storage

Storage period (S) (days)	Ascorbic acid (mg/100 ml)	
	Storage condition (R)	
	R ₁	R ₂
0	8.82	8.82
30	8.68	8.75
60	8.55	8.60
90	8.40	8.49
120	8.25	8.32
150	8.05	8.18
180	7.85	7.98
	Ascorbic acid (mg/100 ml)	
	SED	
S	0.01254	0.02568**
R	0.00670	0.01373**
SR	0.01773	0.03632*

R₁ - Room temperature R₂ - Refrigeration temperature

Table 4. Changes in the microbial population of guava, lime and ginger RTS beverage during storage

Storage period (S) (days)	Bacteria (x10 ⁵ /g)		Fungi (x 10 ⁴ /g)		Yeast (x 10 ³ /g)	
	R ₁	R ₂	R ₁	R ₂	R ₁	R ₂
0	BDL	BDL	BDL	BDL	BDL	BDL
30	2	1	2	1	2	1
60	2	2	2	1	2	1
90	3	3	3	2	3	2
120	4	3	3	3	4	2
150	4	4	4	3	4	3
180	5	4	5	3	5	3

* BDL – Below Detectable Level

R₁- Room temperature R₂- Refrigeration temperature

Table 5. Organoleptic characteristics of guava, lime and ginger RTS beverage

Storage period (S) (days)	Quality attributes							
	Room temperature (R ₁)				Refrigeration temperature (R ₂)			
	Colour and appearance	Flavour	Taste	Overall acceptability	Colour and appearance	Flavour	Taste	Overall acceptability
0	8.6	9.0	8.6	8.55	8.7	9.0	8.7	8.75
30	8.6	9.0	8.6	8.55	8.7	9.0	8.7	8.75
60	8.6	9.0	8.4	8.50	8.7	9.0	8.6	8.75
90	8.5	8.6	8.4	8.45	8.6	9.0	8.5	8.65
120	8.5	8.5	8.4	8.45	8.6	8.9	8.5	8.60
150	8.4	8.5	8.3	8.35	8.5	8.8	8.4	8.55
180	8.4	8.4	8.2	8.30	8.5	8.6	8.4	8.50

R₁- Room temperature R₂- Refrigeration temperature

difference in TSS of the RTS beverage of, storage condition and during storage period. Sindhumathi (2002) stated that the prepared papaya based blended RTS beverages had initial TSS of 15° brix and it was maintained throughout the storage period.

Total and reducing sugar :

As the storage period increased, the total sugar content was reduced (Table 2). The initial total sugar content of the samples was 12.24 g / 100 ml. The retention of total sugar in the R₂ samples was found to be higher than R₁ during the study period. At the end of storage period the total sugar content was decreased to 10.95 and 11.24 g per cent in R₁ and R₂, respectively. The decrease in total sugar was due to hydrolysis into simple sugars. The statistical analysis of the data showed a highly significant reduction in the total sugar content of the guava-lime-ginger RTS beverage during storage period and storage condition.

The conversion of total sugar into simple sugar might have increased the reducing sugar content of RTS beverage. As the storage period increased, the reducing sugar content increased in the RTS beverages irrespective of storage conditions. The initial reducing sugar content of the RTS beverage was 5.98 g per 100 ml. The reducing sugar contents of stored samples after 180 days were 8.28 g (R₁) and 7.98 g (R₂), respectively. At the end of the storage period reducing sugar content was slightly increased in R₁ when compared to R₂. The statistical analysis showed that a significant difference in the reducing sugar content of the guava-lime-ginger RTS beverage during storage period and storage conditions.

Ascorbic acid :

Table 3 represents the changes in the ascorbic acid content of the RTS beverages during storage. A higher quantum of ascorbic acid loss was noted in all the RTS beverages throughout the storage period. Initially the ascorbic acid content was 8.82 mg / 100 ml. After 180 days of storage, the ascorbic acid content was 7.85 mg / 100 ml (R₁) and 7.98 mg / ml (R₂). At the end of storage period the loss of ascorbic acid content was slightly reduced in R₂ when compared to R₁ samples. Such reduction may be due to the oxidation of vitamin C by light and heat. Significant difference in ascorbic acid was observed in guava-lime-ginger RTS beverage with respect to storage condition and storage period. Kumar and Manimegalai (2001) reported that there was a higher quantum of ascorbic acid loss (2.60 to 1.61 mg / 100 ml) in the pineapple: pear: pomegranate (1:1:1), blended RTS throughout the storage period.

Microbial changes of the mixed fruit squash :

An increasing trend in microbial population was noted in the guava, lime and ginger RTS beverage during storage but was highly in an acceptable link (Table 4). Initially bacterial,

fungi and yeast count was below detectable level (BDL) and at the end of storage period bacterial count of guava, lime and ginger RTS beverage was increased from 2 to 5 x 10⁵cfu/g in R₁ and 1 to 4 x 10⁵cfu/g in R₂ samples, 2 to 5 x 10⁴cfu/g in R₁ and 1 to 3 x 10⁴cfu/g in R₂ samples in fungi and yeast count was 2 to 5 x 10³cfu/g in R₁ and 1 to 3 x 10³cfu/g in R₂ samples during the storage period.

Organoleptic characteristics of guava-lime-ginger RTS beverage during storage :

Guava, lime and ginger RTS beverage secured highly acceptable to acceptable score values during the storage (Table 5). The mean overall acceptability score values were 8.30 and 8.50 in R₁ and R₂ samples at the end of 180 days, respectively. In general, overall acceptability of guava-lime-ginger RTS beverages was highly acceptable for R₂ samples when compared to R₁ samples.

Economics of guava-lime-ginger RTS beverage production :

Economics of guava-lime-ginger RTS production @ 100 litres / day production capacity and operating season of 300 days in a year revealed a fixed cost (operation and maintenance cost) of Rs. 30,050 for the processing plant. The total variable cost (production cost) was worked out to be Rs. 8, 62 lakhs. It was found that annual total cost of production was Rs. 8.92 lakhs and gross return estimated to be 30 tonnes of guava-lime-ginger RTS produced was Rs. 10.80 lakhs by using prevailing product market price. In nutshell, it was found that the cost of production of guava-lime-ginger RTS /litre was Rs. 29.74. Also profit per litre of guava-lime-ginger RTS was estimated to be Rs. 6.26.

Economic feasibility analysis (Table 6) :

It could be seen from the Table 6 that the internal rate of return was 89.43 per cent which was more than current bank rate indicating that the proposal of setting a plant producing 100 litres / day for 300 days of operating capacity can be

Table 6. Economic analysis of value added guava, lime and ginger RTS beverage productions

S.No.	Analysis particulars	Mixed fruit squash production (in litres)
Economics of production		
1	Cost of production/unit (Rs/unit)	29.74
2	Production/year (litres/kgs)	30,000
3	Price /unit (Rs/unit)	36.00
4	Profit/Year (Rs)	1.87 lakhs
5	Profit/unit (Rs/ litres)	6.26
Economic feasibility analysis		
1	Internal rate of return (%)	89.43
2	Benefit -cost ratio	1.16
3	Break-even point (litres/kgs/year)	4,137

commercially viable. The benefit cost ratio was worked out to be 1.16 for this processing plant. A project can be accepted, if the benefit cost ratio was more than unity. Hence, the proposal for setting up this plant was found to be economically feasible.

For determining breakeven point, the total fixed cost was found to be Rs. 30,050. The variable cost per litre was Rs. 28.74 and the unit contribution to fixed cost was analysed as Rs 2.87/ litre. The analysis showed that breakeven point for the above said processing plant was 4,137 litres/year. It was the minimum production required for successful operation of the plant.

The payback period was worked out to be within one year. Hence, this analysis showed that greater benefit could be accrued as profit from second year onwards.

Conclusion :

It could be possible to process value added fruit product of guava, lime and ginger RTS beverage. Storage condition and packaging the value added products in suitable packaging materials (Glass bottles- capacity 200 ml) could extend the shelf life of the product with minimum changes in the chemical composition. Value added fruit products of guava, lime and ginger RTS beverage showed an increasing trend in acidity and reducing sugar whereas a decreasing trend in pH, TSS, total sugar and ascorbic acid contents were noticed during storage. A slight increase in the microbial population was observed in the product. Among the value added fruit product of guava, lime and ginger RTS beverage had secured higher sensory score values. So that the market structure for fruits might be more competitive and the benefits could be proportionally shared by fruit growers in the study area.

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