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Studies on process standardization and storage study of low calorie herbal beverage

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Abstract
In present study the efforts have been made to prepare and standardize the recipe of low calorie herbal RTS beverage by using aonla: Tulsi: Ginger (i.e. 10:5:1) with incorporation of different artificial sweetener. Assessment of energy value was carried out and result obtained was 29.45Kcal/100ml, further the prepared low calorie RTS beverage was studied for storage at refrigerated (4^0C) and ambient temperature ($27\text{-}28^0$C). The sensory evaluation results indicated that herbal beverage stored at refrigeration and ambient temperature upto 60 days the sample stored at refrigeration temperature was found to be highly acceptable compared to ambient storage. A decreasing trend was observed in P^H and ascorbic acid and increasing trend was observed in Total soluble solid and acidity content with increase in storage period at refrigeration and ambient temperature upto 60 days.

Keywords: Aonla, Tulsi, Ginger, Herbal Beverage, Artificial sweetener, Storage study.

Introduction
Aonla is one of the oldest Indian fruits and considered as "*Wonder fruit for health***"** because of its unique qualities**.** It has played an important therapeutic role from time immemorial and is frequently recommended for its synergistic effects in both the ayurvedic and unani systems of medicine. It has a natural balance of tastes (sweet, sour, pungent, bitter and astringent) all in one fruit, it stimulates the brain to rebalance the three main components of all physiological functions, the water, fire and air elements within the body (Bajracharya, 1979) [3].
Clinical *in vivo* and *in vitro* assays have shown that fruit juice extract has antioxidant and anti-inflammatory activities and create positive effects on glycemia, insulin, dyslipidemia, blood pressure and foam cell formation; additionally, some mechanisms of these effects have been reported by Singh *et al.*, (2004) [13]. The fresh fruit of aonla is very rich source of ascorbic acid (454.40 mg/100g) and appreciable source of total sugar (7.53mg/100g), calcium (14.91mg/100g), iron (0.62 mg/100g), phosphorus (11.81 mg/100g) and also has great potential for processing as reported by Khan (2009) [9].
Ocimum sanctum, *Tulsi* belongs to plant family *Lamiaceae*. It has made important contribution to the field of science from ancient times as also to modern research due to its large number of medicinal properties. Tulsi has been described as of two types- vanya (wild) and gramya (grown in homes). Although having identical usage, the former has darker leaves. *Tulsi* is a popular home remedy for many ailments such as wound, bronchitis, liver diseases, catarrhal fever, otalgia, lumbago, hiccough, ophthalmia, gastric disorders, genitourinary disorders, skin diseases, various forms of poisoning and psychosomatic stress disorders (Das *et al.*,2006; Prajapati *et al.*, 2003) [4, 11].
Fresh ginger contains 80.9per cent moisture, 2.3per cent protein, 0.9per cent fat, 1.2per cent minerals, 2.4per cent fibre and 12.3per cent carbohydrates. The minerals present in ginger are iron, calcium and phosphorous. It also contains vitamins such as thiamine, riboflavin, niacin and vitamin C. The composition varies with the type, variety, agronomic conditions, curing methods, drying and storage conditions (Gugnani *et al.*, 1985) [8].
Ginger is arhizomatous plant which is used as a spice and medicine in various countries. Ginger is widely used in ayurvedic medicines and since long time, ginger has been used to treat dyspepsia, gastritis, blood circulation disturbance and inflammatory diseases in many countries.
A variety of artificial sweeteners are available in the market like, aspartame, sucralose, stevia, etc. These are the non-nutritive sweeteners which are not metabolized by the body and do not contribute any energy or calories to the diet. The use of low-calorie sweeteners could improve dietary quality if consumers used energy savings for the consumption of nutrient dense foods (ADA, 2004) [1]. Sucralose is an intense sweetener made by selective substitution of the hydroxyl groups of sucrose with chlorine.

Sucralose is 600 times sweeter than sugar (sucrose), has taste characteristics very similar to sugar and it is extremely stable to heat and to acid mediaSucralose does not hydrolyse nor does it dechlorinate after ingestion and it is thus nontoxic.
Aspartame was discovered accidentally in the late 1960 as a dipeptide having a pronounced sweet taste. It is a synthetic combination of two amino acids, aspartic acid and phenylalanine. A synthetic sweetener for food and beverages, was given final approval for marketing by (FDA, 1981).

Material and Methodology
The present investigation was carried out in Department of Food Engineering, College of Food Technology, VNMKV, Parbhani during year 2016-17.

Materials
The good quality of raw material such as fresh aonla fruits, basil leaves, and sweeteners were obtained from the local market area of the Parbhani, Maharashtra.

Preparation of aonla juice
Fresh aonla fruits were washed to remove unwanted impurities like mud, dust and dirt particals. Washed fruit were kept in alkali solution (2 percent NaoH solution at 100 ^{0}C) for 4 to 5 min. after that seed and segments were separated and passed through mixer with adding water. Obtained pulp was passed through muslin cloth to get clear aonla juice.

Preparation of basil juice
Basil leaves washed with cleaned water to remove impurities and passed through grinder. Water were added and again passed through grinder. The slurry was passed through muslin cloth to get clear juice.

Preparation of ginger juice
Fresh and sound quality ginger were selected for preparation of juice. Ginger was washed to remove impurities. Then peeling and cutting was carrried out. Cut pieces of ginger were passed through mixer with addition of water. The pulp was passed through muslin cloth to get clear ginger juice.

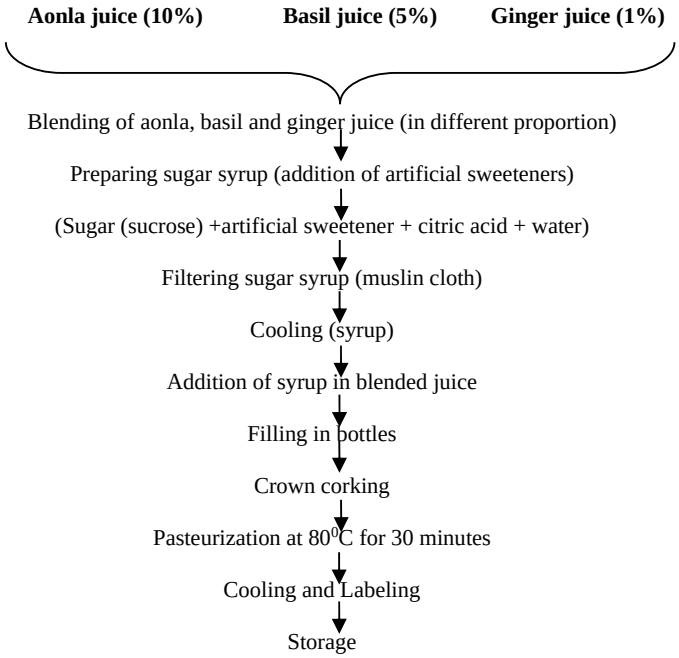
Preparation of low calorie herbal beverage RTS:
The aonla juice 10 per cent, basil leaves juice 5 per cent, ginger juice 1 per cent were blended. However for low calorie beverage sugar substitute (aspartame, sucralose and stevia) were used. The control sample was prepared without addition of artificial sweetener.

Table 1: Formulation of herbal beverage by using different artificial sweeteners

Sample	Aonla Juice (%)	Ginger (%)	Basil juice (%)	Citric acid (%)	Sugar	Sweeteners (%)
Control	10	1	5	0.2	7	-
T_1	10	1	5	0.2	7	0.2 Aspartame
T_2	10	1	5	0.2	7	0.15 Sucralose
T_3	10	1	5	0.2	7	0.1 Stevia

Preparation of low calorie herbal beverage RTS
The aonla juice 10 per cent, basil leaves juice 5 per cent, ginger juice 1 per cent were blended. However for low calorie beverage sugar substitute (Aspartame, sucralose and stevia) were used. The control sample was prepared without addition of artificial sweetener. The treatments were given as,

Control: Without addition of sweetener
T_1: Sucrose 50% + Aspartame 0.2%
T_2: Sucrose 50% + Sucralose 0.15%
T_3: Sucrose 50% + Stevia 0.1%



Flow chart: Preparation of low calorie herbal beverage (RTS)

Measurement of theoretical energy value

Energy value is determined by using values of crude protein, crude fat and total sugar content of sample and considering that 1 g of protein yields 4 kcal energy, 1 g of fat yields 9 Kcal energy and 1 g carbohydrates yields 4 kcal energy. Total energy value in Kcal is calculated by adding above three energy values which gives energy value per 100 ml of sample (Saniah and Samsiah, 2012) [12].

Result

Total energy value of low calorie herbal RTS beverage

The theoretical energy value of low calorie herbal RTS beverage is presented in Table 2. Results revealed that energy provided by 100 ml of beverage was calculated theoretically by multiplying carbohydrates and protein with 4 Kcal and fat with 9 Kcal respectively (Saniah and Samsiah, 2012) [12]. The energy value of low calorie herbal RTS beverage (T_2) was 29.45 Kcal/100 ml beverage, while the energy value of the prepared control sample by using sugar as sweetener was 58.35 Kcal /100ml.

Results obtained by energy value calculation showed that there was the higher energy value for control sample beverage prepared by addition of sugar than that of selected sample with artificial sweetener. Thus due to its low calories it is beneficial to cut the calories in RTS beverage.

Table 2: Total energy value of low calorie herbal RTS beverage

Sample	Carbohydrate (Kcal)	Protein (Kcal)	Fat (Kcal)	Total energy (Kcal/100 ml)
Control	58.6	0.02	0.13	58.35
Selected (T_2)	29.3	0.02	0.13	29.45

It can be concluded from the Table 2 that 100 ml of low calorie herbal RTS beverage (29.45 Kcal/100ml) which was almost half than that provided by control sample.

Effect of storage temperature on quality of low calorie herbal RTS beverage

The prepared RTS beverage was analyzed for storage study at refrigerated temperature and ambient temperature.

The changes occurred in physic-chemical parameters of prepared RTS beverage during storage at different temperatures and founded result were tabulated in Table 3. The physicochemical parameters such as TSS, acidity, pH and ascorbic acid content were observed.

Table 3: Effect of storage temperature on quality of low calorie herbal RTS beverage

Parameter	Fresh RTS	Storage after 60 Days	
		Refrigeration temperature (4-5^{0}C)	Ambient temperature (27-28^{0}C)
TSS (^{0}Brix)	7.5	8.5	9.5
Acidity (%)	3.7	3.8	3.9
pH	3.93	3.90	3.83
Ascorbic acid (mg/300ml)	108.5	103	98

The change was observed in TSS content of the samples during storage, 7.5^{0}BX TSS was observed for fresh RTS beverage and 8.5^{0}BX and 9.5^{0}BX for ambient and refrigerated stored samples respectively. The significant increase in TSS with passage of storage time it may be due to the hydrolysis of polysaccharides into monosaccharides and oligosaccharides (Deka and Sethi, 2001) [6] in juice blends and found an increasing trend in total soluble solids during storage at ambient and low temperature in lime - aonla and mango-pineapple spiced RTS beverages. Similarly (Awsi and Dorcus, 2012) [2] also found an increasing trend in total soluble solids during storage at ambient and low temperature in pineapple juice blend with carrot and orange juice. It was observed that significant variation occurred in acidity and PH as compared to fresh RTS sample. Moreover, the TSS of sample stored under ambient temperature was found to have increased more than sample stored under refrigeration temperature.

At refrigerated temperature and at ambient temperature decreasing trend was observed in ascorbic acid content. The ascorbic acid content of fresh RTS was 108.5 mg/300ml while at refrigerated it was 103mg/300ml and at ambient temperature it was 98mg/300ml.

Table 4: Organoleptic evaluation of low calorie herbal RTS beverage stored at ambient temperature (27-28^{0}C)

T_2 Samples Days	low calorie Herbal RTS beverage			
	Color	Flavor	Taste	Overall acceptability
0	8.8	8.6	8.7	8.7
15	8.5	8.4	8.1	8.4
30	8.3	8.1	8.2	8.3
45	7.9	8.0	8.0	8.0
60	7.7	7.5	7.3	7.5
S.E±	0.0689	0.0689	0.0122	0.0272
CD at 5@%	0.2073	0.2073	0.0366	0.0819

The data in the table 4 revealed that there was slight change in sensorial parameters of sample stored at ambient temperature (27-28ºC) in 60days. Changes in organoleptic qualities were observed at 15 days interval. It was observed that fresh beverage scored the highest score (8.7) as compared to stored beverage. From the Table 4 it was clear that there was slight change in taste of the beverage (8.7 to 7.5) during the storage period of 60 days.

During storage of beverage from 0 to 30 days there was decrease in sensory score for overall acceptability (8.3) which was found to be at par with fresh sample. On 60 day of storage there was significant decrease in sensory score for flavor, taste and overall acceptability (7.5).

It can be concluded from the score that low calorie herbal RTS beverage can be stored for 60 days at ambient temperature without affecting sensorial parameters. However its acceptability score was slightly decreased. Similar results were reported during storage of low calorie beverage by Gaikwad *et al.* (2013) [7].

Table 5: Organoleptic evaluation of low calorie herbal RTS beverage stored at refrigeration temperature (4°C)

Sample T_2	Low calorie Herbal RTS beverage			
Storage days	Color and appearance	Flavor	Taste	Overall acceptability
0	8.8	8.6	8.7	8.7
15	8.4	8.3	8.3	8.5
30	8.4	8.3	8.2	8.4
45	8.4	8.2	8.1	8.4
60	8.3	8.2	8.1	8.3
SE ±	0.037	0.040	0.050	0.05
CD @ 5%	0.112	0.123	0.153	0.150

The data in the above Table revealed that there was slight change in sensorial parameters of sample stored at refrigeration temperature (4ºC) in 60 days. Changes in

organoleptic qualities were observed at 15 days interval. It was observed that fresh beverage scored the highest score (8.7) as compared to stored beverage. From the Table 5 it was clear that there was slight change in taste of the beverage (8.3 to 8.1) during the storage period of 60 days.

During storage of beverage from 0 to 30 days there was decrease in sensory score for overall acceptability (8.4) which was found to be at par with fresh sample. On 60 day of storage there was significant decrease in sensory score for flavor, taste and overall acceptability (8.3) but liked moderately by the panel members. There was no evidence of microbial spoilage.

It can be concluded from the score that low calorie herbal RTS beverage can be stored for 60 days at refrigerated temperature without affecting sensorial parameters. However its acceptability score was slightly decreased and liked moderately.

The rate of changing in sensorial properties like color, flavour, taste and overall acceptability was lower at refrigeration temperature as compare to sample stored at ambient temperature. Similar results were reported by Khurdiya and Anand (1981) [10]; Deka (2000) [5].

Conclusion

It may be concluded from the present investigation that the aonla, tulsi and ginger can well utilized in development of low calorie herbal beverage with its potential health benefits. It was observed that the energy value of beverage was lower (29.45 kcal/100g) than that of control sample (58.35 kcal). Sensory evaluation with respects to storage shown that low calorie herbal beverage stored at refrigeration was found to be highly acceptable. Finally it could be suggested that low calorie herbal beverage can be explored for commercial utilization.

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