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Formulation, nutraceutical profile and storage stability of aloe gel & ginger juice functional beverage blend

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Abstract

Aloe vera gel, well known for its nutraceutical potential, is being explored as a functional ingredient in a wide array of health foods and drinks. Nutraceutical ready-to-serve were prepared by using different proportions of *Aloe vera* gel and ginger juice as 90:10(1), 92:8(2), 94:6(3), 96:4(4) and 98:2(5). Prepared ready-to-serve beverages were filled hot in 200 ml glass bottles and crown corked followed by pasteurized at 90±2°C for 25 minutes and air cooled. The blended ready-to-serve was analyzed for its different sensory quality, evaluated by adopting 9 point hedonic scale. On the basis of overall sensory quality ready-to-serve, sample number (7) blended ratio of 90:10 with 12 per cent total soluble solids and 0.20 per cent acidity was found to be the best. These RTS have a longer shelf life without having any microbial infestation. The data generated during the experiment revealed that TSS, total acidity and total sugar increased, while ascorbic acids content decreased. The developed ready-to-serve could be promoted as a nutraceutical product with multiple benefits to the consumers.

Keywords: *Aloe*, Ginger, Nutraceutical RTS

Introduction

Aloe vera (*Aloe barbadensis* Miller) commonly known as *Ghritkumari* belongs to the family Liliaceae. *Aloe vera* is mainly cultivated for its thick fleshy leaves. *Aloe vera* leaf contains 20 minerals like calcium, copper, selenium, magnesium, manganese, potassium, sodium, zinc, 18 amino acids, 12 vitamins and 92 enzymes. It can be used as the source of vitamins like Retinol, Thiamin, Riboflavine, Niacin, Pyridoxine, Cobalamin, Ascorbic acid, Tocopherol and Folic acid. *Aloe vera* leaf gel contains anthraquinones, particularly barbaloin (aloin), a glucoside of loe-emodin, which appear to be responsible for its bitter taste and cathartic effect [4, 3]. *Aloe vera* is being extensively preferred as a natural product with medicinal and therapeutic properties. The *Aloe vera* juice have wide application in food products like production of ready-to-serve health drink, *Aloe vera* lemon drink, sherbet, diet drink with soluble fiber. Health benefits of aloe vera include its application in wound healing, treating burns, frost bite damage, lung cancer, intestinal problem, increasing high density lipoprotein, reducing low density lipoprotein, reducing blood sugar in diabetics, fighting acquired immune deficiency syndrome, allergies and improving immune system.

Ginger (*Zingiber officinale* Roscoe), is a monocotyledonous, a rhizomatous plant belongs to the family Zingiberaceae. Ginger, a source of valuable phytonutrients is characterized by an aromatic odour and a pungent taste. It shows potential antipyretic, antiallergenic, analgesic, antitussive [6] and chemopreventive activities [14]. Ginger is generally used in different forms such as raw ginger, dry ginger, sliced ginger, ginger candy, ginger oil, ginger oleoresin, ginger beer, ginger wine, ginger flake, ginger based blended beverages.

Blended drinks are good alternative for development of new products to provide taste, nutritional as well as medicinal properties. In recent years *Aloe vera* has become a subject of interest because of its beneficial effects on human health. *Aloe vera* has bitter taste which can be unpleasant in raw state and its palatability could be enhanced with addition of ginger juice. Ginger is known to contain several antioxidant compounds such as gingerol, gingediol and shogaol, which possess antimicrobial activity [15] against food spoilage organism and seems to improve shelf life. There may be great possibility of obtaining an excellent quality drink of *Aloe vera* and ginger which provide benefits of taste and nutrition.

Materials and Methods

Procurement of Raw Materials

Fresh *Aloe vera* mature leaves were harvested in the month of November from the Research.

Farm, College of Horticulture, Mandasaur and ginger rhizomes were procured from local market in the same month.

Juice Extraction and Preparation of RTS beverages

The gel is extracted from the *Aloe vera* leaves and juice was extracted from the ginger rhizomes. The gel extract and ginger juice were preserved with 700 ppm potassium metabisulfite ($K_2S_2O_5$) and kept till the preparation of final product. At first both the gel and pulp are blended according to the given blending ratio and recipes. Ready-to-serve was prepared by mixing calculated amount of blended pulp, sugar, citric acid and water according to blending ratio and recipes. Sugar syrup was prepared by heating the mixture of sugar, water and citric acid and then it was strained through muslin cloth. Finally blending juice was mixed with syrup. The ready-to-serve thus prepared and presented for organoleptic evaluation so as to find out an ideal recipe.

Biochemical analysis

The total soluble solid in the blended juices were determined by *ERMA* hand refractometer of 0-32% at 20°C and expressed as °Brix. Acidity was determined by titrating a known volume of sample against 0.1 N NaOH solution using phenolphthalein as an indicator. Ascorbic acid content was estimated by diluting a known volume of sample with 3% metaphosphoric acid and titrating with 2, 6-dichloro-phenol indophenols dye solution was used [13]. The titrimetric method of [10] was adopted for the estimation of reducing sugars. Filtrate was taken in a burette and titrated against Fehling's mixture (5 ml

of Fehling's solution A and B each) till brick red colour as the end point. The non-enzymatic browning in the product was assessed by the method as described by [13]. Twenty ml of filtered sample was mixed with 30 ml alcohol (99.9 per cent alcohol strength). This was filtered through Whatman filter paper No. 1. Absorbance of the filtrate was measured at 440 nm using 60 % aqueous alcohol as blank. Non – enzymatic browning was expressed as absorbance of a sample extract at 440 nm. Microbial analysis was done to determine the total plate count (TPC) of the samples on the nutrient agar media for bacterial count by the method recommended by [7].

Statistical analysis

To test the significance of variation in the data obtained, the analysis of variance technique was adopted as suggested by [11]. The critical difference was calculated to assess the significance of difference between treatments, whenever the results were found significant through 'F' test, C.D. at 1 % level of significance was determined. *Sensory evaluation and chemical composition of Aloe vera gel and ginger juice:*

In ready-to-serve beverages sensory evaluation of the product was judged for color, appearances, aroma, taste and overall acceptability on a 9 point hedonic scale [1] were evaluated by a panel of 17 semi-trained judges which comprised scientists and students of Department of PHM. An average score of 5.5 and above was considered as acceptable. The chemical composition of *Aloe vera* gel and ginger juice are presented in Table 1.

Table 1: Chemical composition of *Aloe vera* gel and ginger juice.

Compositions	<i>Aloe vera</i> gel	Ginger juice
Total soluble solids (°Brix)	1.50	2.40
Acidity (%)	0.12	0.25
Ascorbic acid (mg/100ml)	36.00	2.00
Reducing sugar (%)	0.45	2.30
Non reducing sugar (%)	0.30	3.50
Total sugar (%)	0.76	5.80

Evaluation of blending ratio for preparation of ready-to-serve beverages

The following blending ratios were tested for preparation of ready-to-serve are 90 % *Aloe vera* gel + 10 % ginger juice, 92 % *Aloe vera* gel + 8 % ginger juice, 94 % *Aloe vera* gel + 6 % ginger juice, 96 % *Aloe vera* gel + 4 % ginger juice and 98 % *Aloe vera* gel + 2 % ginger juice of 10% juice adjusted to 12 % TSS and 0.30 % acidity were evaluated for organoleptic quality.

Evaluation of recipes for preparation of ready-to-serve beverages

Highest scoring blending ratio of 90% *Aloe vera* gel + 10% ginger juice was selected for preparation of ready-to-serve beverages and evaluated their organoleptic quality after preparation in following recipes are 10 % blended juice adjusted to 10% TSS, 0.20 % acidity, 0.25 % acidity & 0.30 % acidity. 10 % blended juice adjusted to 11% TSS, 0.20 % acidity, 0.25 % acidity & 0.30 % acidity. 10 % blended juice adjusted to 12% TSS, 0.20 % acidity, 0.25 % acidity & 0.30 % acidity.

Studies on storage stability of blended nutraceutical ready-to-serve beverages

Five liters of ready-to-serve of highest scoring ideal blending ratio and recipe as mentioned above were prepared. The

bottled RTS were kept at ambient room temperature for storage studies and observations recorded at monthly intervals for total soluble solid, total acidity, ascorbic acid content, total sugars, reducing sugars, non-reducing sugar, non-enzymatic browning, microbial load, organoleptic attributes etc.

Results and Discussion

Evaluation of blending ratio & recipe for quality nutraceutical ready-to-serve beverages

The data on organoleptic evaluation of different blending ratio & recipe for quality nutraceutical ready-to-serve beverages is depicted on Table 2&3. The results revealed that blending ratio of 90 per cent *Aloe vera* gel + 10 per cent ginger juice was found significantly superior followed by 92 per cent *Aloe vera* gel + 8 per cent ginger juice and RTS prepared from 94 per cent *Aloe vera* gel + 6 per cent ginger juice. Blends containing 90 per cent *Aloe vera* gel + 10 per cent ginger juice was found better. There was significant difference in organoleptic score of ratio (1) and (2) and also between (1) and (3).

Results indicated that the recipe having 10 percent of juice, 12 per cent TSS and 0.20 per cent acidity was recorded the best recipe and significantly superior than all other recipes. There was significant difference in organoleptic score ratio number (7) & (8) and also between (7) & (9).

Table 2: Organoleptic quality of different blending ratio of *Aloe vera* gel and ginger juice blended ready to serve.

S. No	Blending ratio <i>Aloe vera</i> gel: ginger juice	Juice (%)	TSS (%)	Acidity (%)	Organoleptic Quality	
					Score	Rating
1	90:10	10	12	0.30	8.0	LVM
2	92:8	10	12	0.30	7.5	LM
3	94:6	10	12	0.30	7.0	LM
4	96:4	10	12	0.30	6.5	LS
5	98:2	10	12	0.30	6.2	LS
SE(m)					0.131	
CD at 1%					0.54**	
CV					7.407	

** Significant, LS: Like Slightly, NLND: Neither Like Nor Dislike, LVM: Like Very Much, LM: Like Moderately

Table 3: Organoleptic quality of different recipe of ready to serve prepared from blended *Aloe vera* gel 90 per cent and 10 per cent ginger juice.

S. No	Juice blends (%)	TSS (%)	Acidity (%)	Organoleptic evaluation	
				Score	Rating
1	10	10	0.20	6.1	LS
2	10	10	0.25	5.8	NLND
3	10	10	0.30	5.2	NLND
4	10	11	0.20	7.5	LM
5	10	11	0.25	6.3	LS
6	10	11	0.30	6.5	LS
7	10	12	0.20	8.1	LVM
8	10	12	0.25	7.8	LM
9	10	12	0.30	7.3	LM
SE(m)				0.19	
CD at 1%				0.77**	
CV				8.47	

** Significant, LS: Like Slightly, NLND: Neither Like Nor Dislike, LVM: Like Very Much, LM: Like Moderately

Juice blending is one of the best methods to improve the nutritional and medicinal quality of ready-to-serve beverages. This type of improvement in visual and organoleptic quality of blended beverage has been reported by several workers i.e. blended RTS of 90% *Aloe vera* gel + 10% aonla pulp Kumar [8], blended RTS of 90% of mango pulp + 10% ginger juice Deen and Kumar [5], blended RTS of 70% *Aloe vera* gel + 15% aonla pulp + 15% ginger juice Kumar *et al.* [9], Blended RTS of 90% papaya juice + 10% *Aloe vera* gel Boghani *et al.* [2], blended RTS of 80% *Aloe vera* gel + 10% mint extract + 10% ginger extract Yadav *et al.* [17], blended RTS of 80% *Aloe vera* gel + 15% papaya pulp + 5% spice extract Ramachandran and Nagarajan [12], blended RTS of 25% aonla pulp + 75% mango pulp Singh *et al.* [16]. Kumar *et al.* [9] prepared a recipe of blended RTS of *aloe vera* + aonla+ ginger with 15 per cent of TSS and 0.30 per cent acidity. Boghani *et al.* [2] formulated a recipe of blended ready-to-serve beverages from papaya + *Aloe vera* juice, containing 10 per cent juice, 12 per cent total soluble solids and 0.30 per cent acidity. Deen and Kumar [5] prepared mango

+ ginger RTS beverage with 12 per cent blended juice, 13 per cent TSS and 0.25 per cent acidity.

Changes during storage of blended nutraceutical ready-to-serve of *Aloe vera* gel and ginger juice (Table 4)

Total soluble solids of ready-to-serve do not alter up to two months of storage and it increases slightly with the progression of storage period. Acidity of ready-to-serve did not change up to one month of storage and there after it increased slightly. Ascorbic acid content of ready-to-serve declined continuously during storage. Total sugar, reducing and non-reducing sugar increased continuously during entire period of storage. Non-enzymic browning in ready-to-serve beverages increased continuously during storage. Microbial load was not found during the entire period of storage in ready-to-serve beverages. The organoleptic score of ready-to-serve decreased gradually with the storage period. The quality of ready-to-serve was found acceptable up to five months of storage.

Table 4: Changes in total soluble solids, acidity, ascorbic acid, total sugar, reducing and non-reducing sugar, non-enzymic browning, microbial load and organoleptic quality of blended nutraceutical ready-to-serve of *Aloe vera* gel and ginger juice during storage at ambient room temperature.

Storage period in months	TSS (^o Brix)	Acidity (%)	Ascorbic acid (mg/100g)	Total sugar	Reducing sugar	Non-reducing sugar	Microbial load (cfu/ml)	Non-enzymic browning (O.D.)	Organoleptic quality
0	12.00	0.20	3.1	8.60	1.64	6.84	0.0	0.02	8.1
1	12.00	0.20	3.0	8.7	1.65	6.91	0.0	0.03	8.0
2	12.00	0.21	2.7	9.0	1.69	7.15	0.0	0.05	7.8
3	12.20	0.23	2.3	9.6	1.80	7.65	0.0	0.07	7.5
4	12.40	0.24	1.8	10.6	2.02	8.43	0.0	0.09	7.3
5	12.60	0.26	1.2	12.1	2.34	9.60	0.0	0.14	7.1
CD at 1%	0.85	0.01	0.06	0.23	0.04	0.18	0.0	0.005	0.19
SE(m)	0.20	0.03	0.27 **	0.98**	0.19 **	0.78**	0.0	0.022	0.77
CV	4.81	8.16	8	6.99	7.09	7.02	0.0	17.37	8.47

** Significant

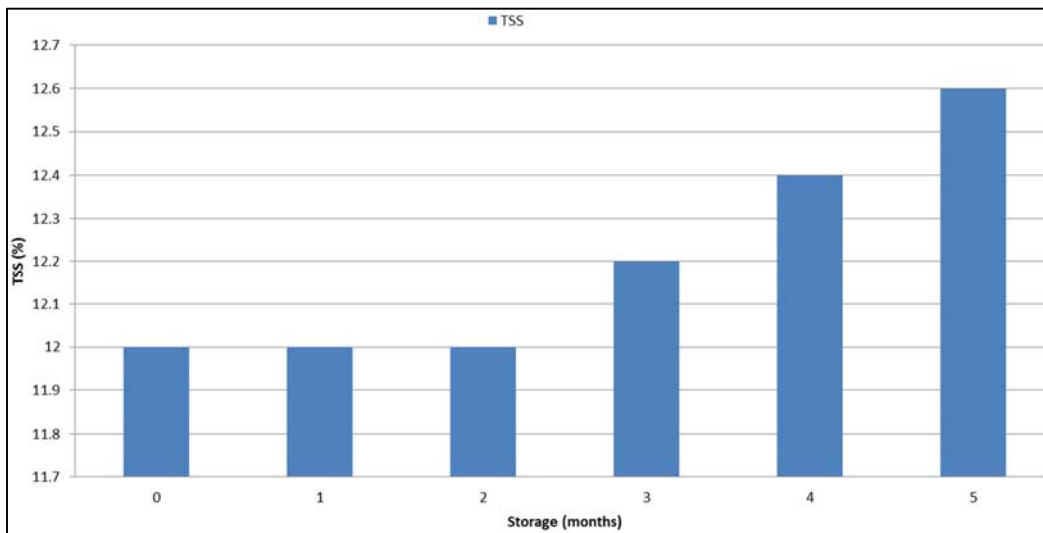


Fig 1: Change in total soluble solids (%) in RTS during storage at ambient temperature



Fig 2: Change in total acidity (%) in RTS during storage at ambient temperature

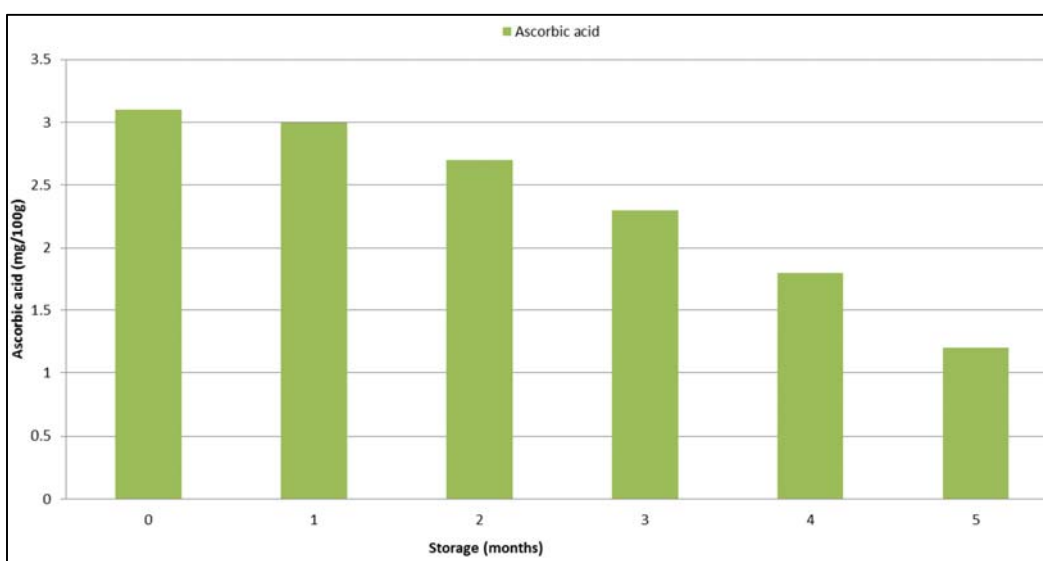


Fig 3: Change in ascorbic acid (mg/100ml) in RTS during storage at ambient temperature

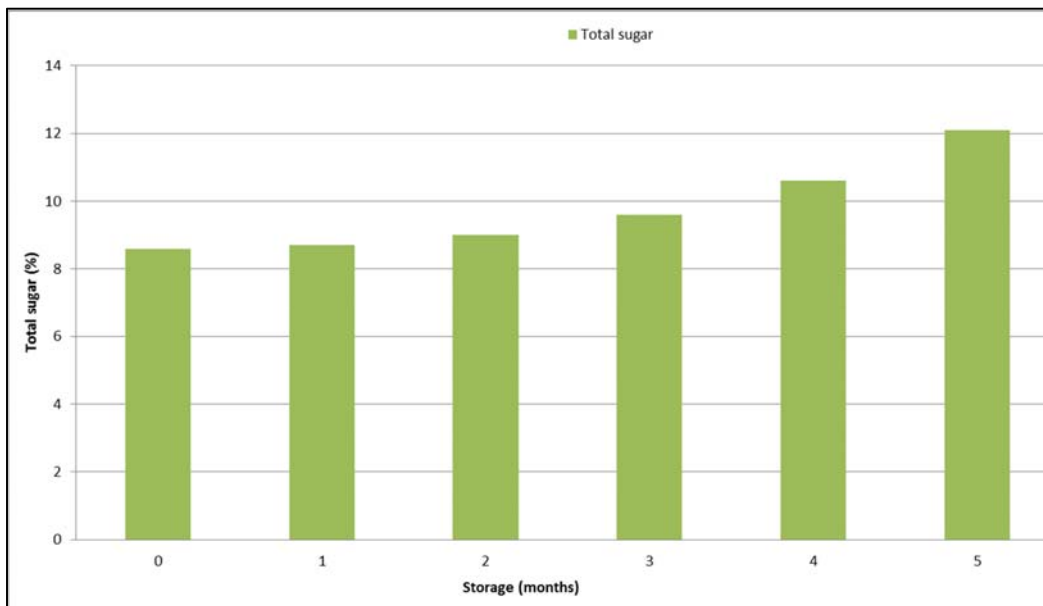


Fig 4.1: Change in total sugar (%) in RTS during storage at ambient temperature

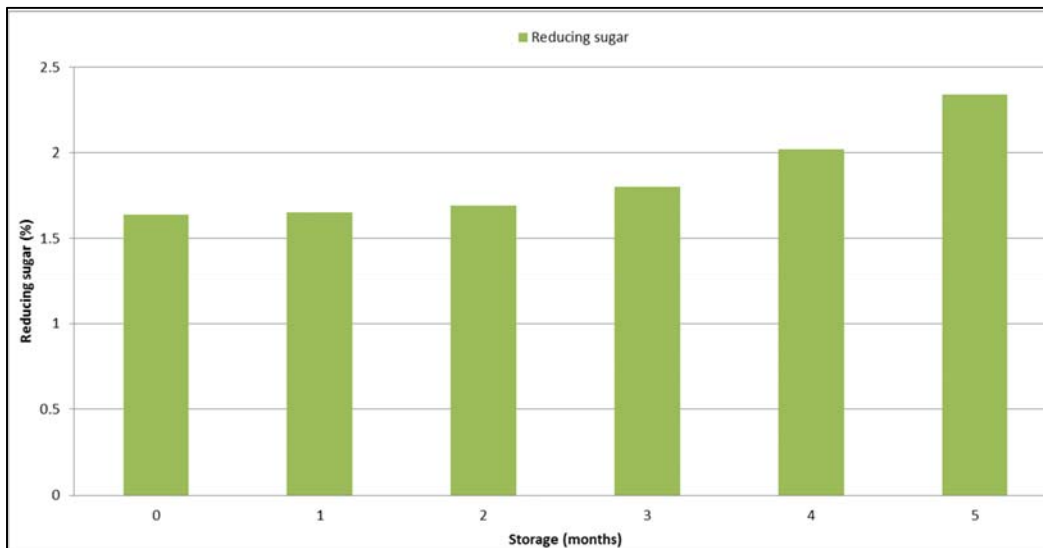


Fig 4.2: Change in reducing sugar (%) in RTS during storage at ambient temperature

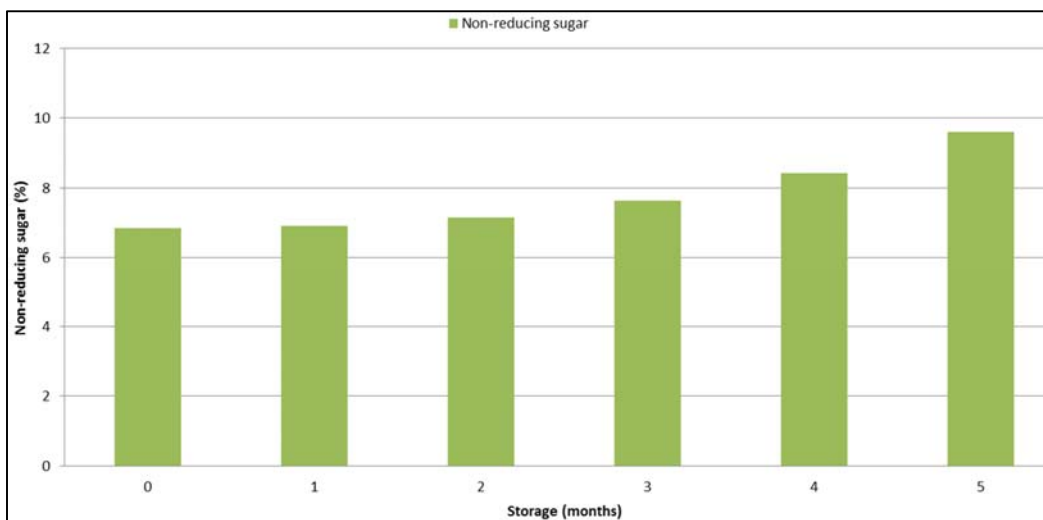


Fig 4.3: Change in non-reducing sugar (%) in RTS during storage at ambient temperature

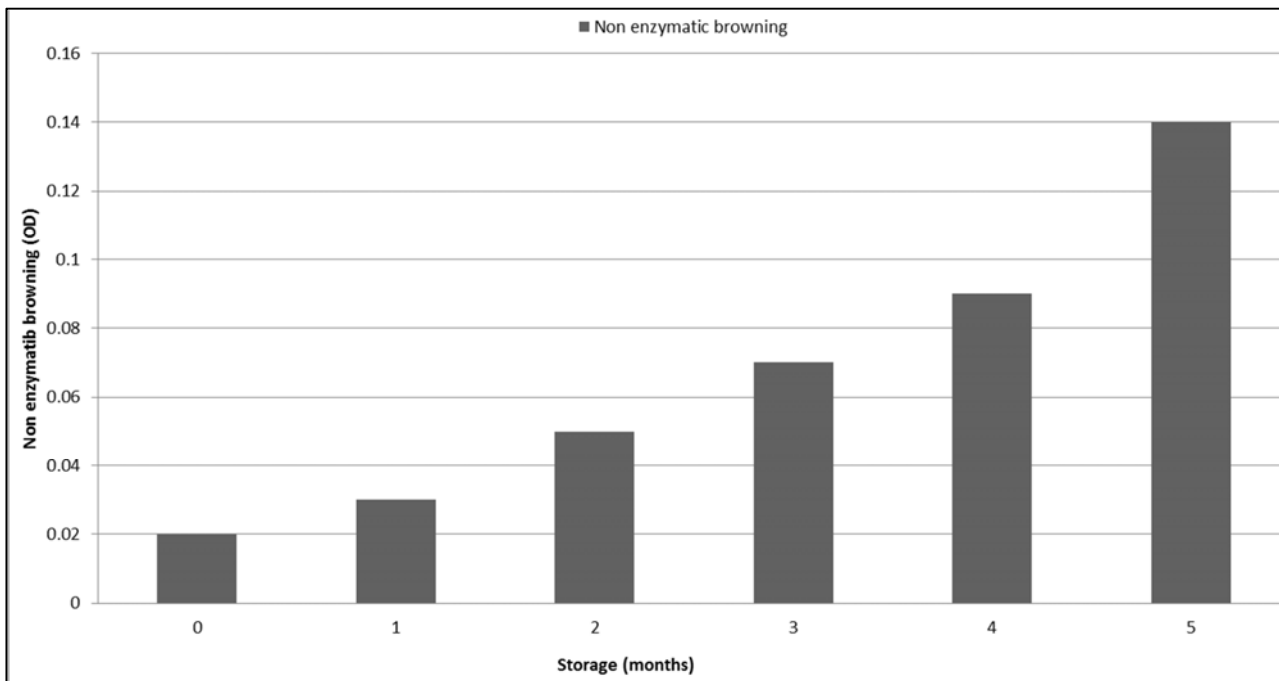


Fig 5: Change in non-enzymatic browning (OD) in RTS during storage at ambient temperature

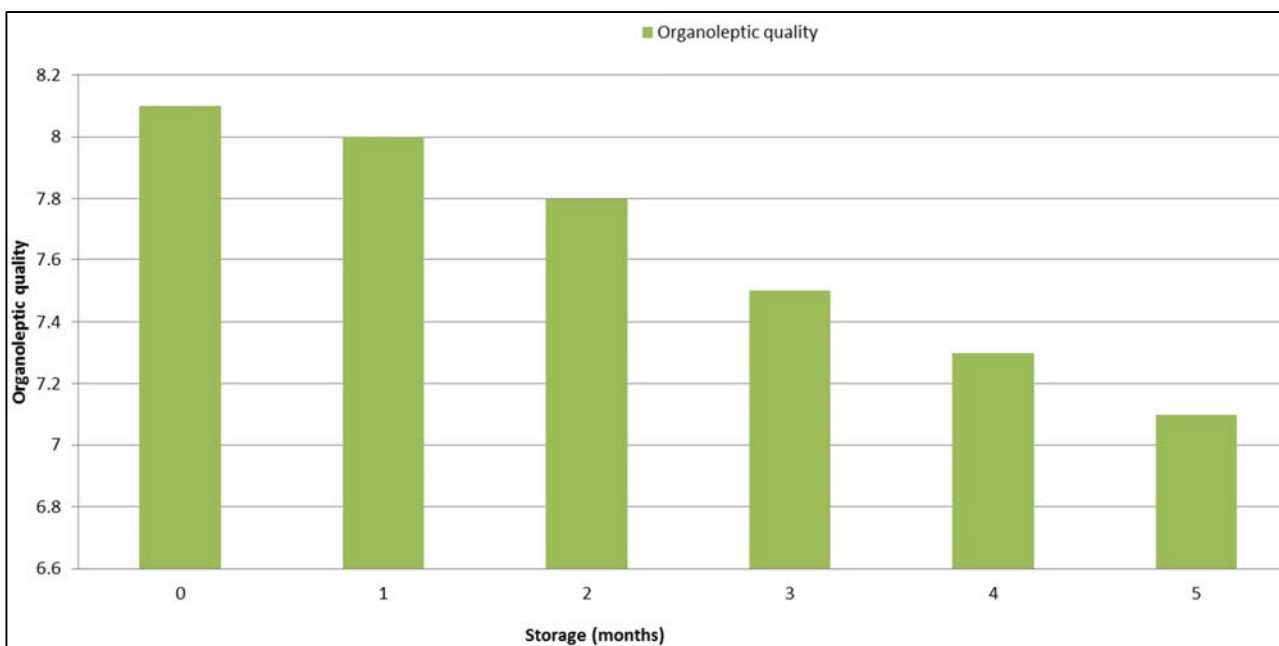


Fig 6: Change in organoleptic quality in RTS during storage at ambient temperature



Plate 1.(a):- Showing chemical appearance of *Aloe vera* gel.
 (b):-Showing chemical appearance of ginger juice.



A) At the time of storage



B) After five months of storage

Plate 2. :- Showing colour difference in blended Aonla pulp + *Aloe vera* gel ready to serve.

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