

## PRODUCT DEVELOPMENT BY INCORPORATING UNRIPENED AEGLE MARMELOS (BAEL) FOR DIARRHOEA STRICKEN CHILDREN

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### ABSTRACT

Diarrhea among young children accounts for four to five million deaths annually, and is the single most important cause of death amongst them. This study was carried out with the objective of developing a range of antidiarrheal beverages for diarrhea stricken children by incorporating ripened bael fruit pulp, which is known for its individualistic functional quality; at various percentage levels and to conduct sensory and nutritional analysis of the same. The sensory evaluation results revealed that all the products were palatable, but the overall acceptability of 5% bael beverage was very good and its color and appearance was appropriate. Other beverages were moderately liked by the semi-trained panel. Beverages could be stored in refrigerator for 2 weeks. Beverages did not contain fat and negligible amount of protein was present. Ascorbic acid level in the beverage was found to be low, i.e., 0.3–1.1 mg. Therefore, these bael beverages could be considered appropriate for diarrhea stricken children in the acute phase of the disease.

**KEYWORDS:** Bael, Diarrhoea, Bael Beverage

### INTRODUCTION

The progress of the nation is in the hands of its people. The health of the people is consequently essential for the socioeconomic development of the nation. A child is the citizen of tomorrow, the health of the child is the key to the health of an adult.

“Malnutrition continues to be a major health problem in many developing countries. It affects mostly children under 5 years of age, belonging to the underprivileged communities. The condition is particularly serious during the post weaning stage and is often associated with infection. Respiratory infection and diarrhea are the common diseases that precipitate severe PEM and death. Apart from contributing to high mortality, severe malnutrition can lead to permanent sequelae in those who survive. These include stunted growth, poor learning ability and reduced work efficiency. Thus malnutrition has serious repercussions on human development and national productivity” (Reddy 2004).

### Diarrhea

“The acute diarrheal disease has long been recognized as a major public health problem in the developing countries. Diarrhea cases in many areas of the world still account for 50 percent of hospital attendance or admissions, thereby creating a heavy burden for limited national health budgets” (Merson 2000). Subjects with loose watery stools **exceeding 10/24 hours** in number are in danger of developing **dehydration**, particularly if intake is restricted. Diarrhoea ranks among the “three chief killers” of our infants and children. “Almost 10% of preschool mortality and 25% of infant mortality is ascribed to diarrhoea. The magnitude of the morbidity too is considerable” (Gupte 2002). **Death** from acute

diarrhoea is usually caused by loss of large amount of water and salts from the body. This is called **dehydration**. “Early features are difficult to detect but include dryness of mouth and thirst. **Rehydration** is the correction of dehydration” (Grant 1983).

### Oral Rehydration Therapy (ORT)

“Government and international agencies have recognized that oral rehydration therapy (ORT) may be the single most important step in the development of programs to manage the diarrheal disease as well as a key to the reduction of infant and child morbidity and mortality” (WHO 1980). The **major drawback** is that ORT with its present formulation does not reduce the volume, frequency or the duration of diarrhea. This raises the practical problem of its acceptance. Consequently, “there is a persistent desire to use antidiarrheal drugs that they are either harmful or ineffective”. (Mahalanabis 1990; Mehta 1993)

### METHODS AND MATERIALS

An attempt was made to bring into limelight the antidiarrheal property of *Aegle marmelos* (Bael) and therefore to develop beverages by incorporating *Aegle marmelos* (Bael) pulp for children suffering from diarrhea.

The preliminary phase of the study involved the selection of unripened peel fruit and preparation of its pulp and then its incorporation at different percentage level using the ORS composition of salt and anhydrous glucose, viz.,

**Table 1: List of Ingredients of the Products Product: Bael Beverage**

S.No.	Ingredients	Amount (g)		
		A	B	C
1.	Bael pulp	5	10	15
2.	Water	95	90	85
3.	Salt (NaCl)	0.26	0.26	0.26
4.	Anhydrous glucose	1.35	1.35	1.35

In the second phase of study sensory evaluation of prepared beverages were done, by using nine point hedonic scale with the help of fifteen semi-trained panel members, who were selected using triangle difference test and also children aged 3-6 years. The next step involved the estimation of nutrient content. Acidity, total solids, ash content, moisture content, ascorbic acid, fat (Bligh and Dyer), protein (by modifying Biuret method). Mean and standard deviation were calculated for sensory quality.

### RESULTS

The present study was designed and conducted to develop beverages using *a functional food*, i.e., Unripened bael pulp for diarrhea stricken children and to appraise their sensory and nutritional quality. These beverages were conceived to replenish the fluid and electrolyte losses as the functional ingredient is individually superior in its quality and work of action. The result of the analysis of the beverages was as follows:

#### Sensory Tests Using Nine Point Hedonic Test

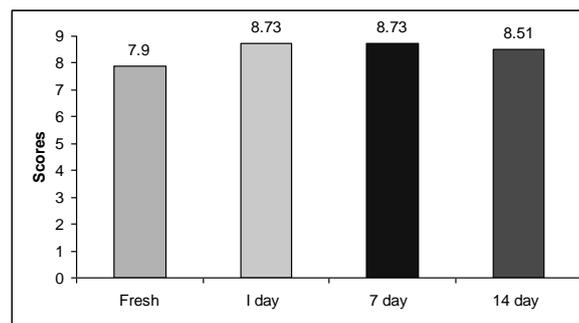
##### Bell Beverages

**Standard Beverage:** The **appearance** of the standard was liked extremely in all storage conditions with a mean above 8. This beverage had an orange color. On storage a change in **color** was observed from orange to reddish maroon.

But then also highest mean was found to be 8.30 for the 14<sup>th</sup> day refrigerated beverage.

The **texture** of the beverage was smooth with easily flowing consistency. **Taste and flavor** were also found to be good under all storage conditions and its acceptability slightly increased on storage with an average of 8.80. Mean for **overall acceptability** was highest among all the fresh beverages (7.90) suggesting that it was liked highly by the majority of the panelists. The mean values of the beverage stored under refrigeration on the 1<sup>st</sup> day and 7<sup>th</sup> day were found to be slightly higher than the fresh and matched each other (Fig 1). The mean of the 14<sup>th</sup> day decreases slightly from the 1<sup>st</sup> and 7<sup>th</sup> day refrigerated in 8.5 but it was still higher than the freshly prepared.

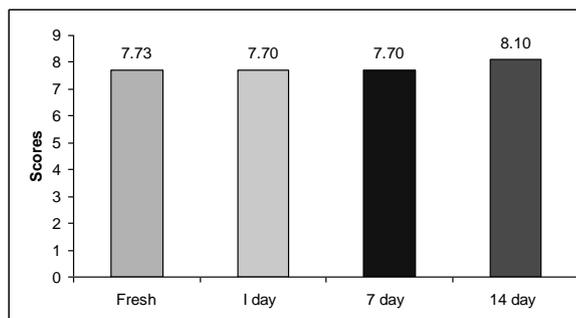
This beverage had a good appearance, color, texture, taste and flavor. After 14 days of storage there was a slight change in color which was liked by the judges and also there was an increase in the overall acceptability of the beverage after storage under refrigeration condition.



**Figure 1: Overall Acceptability (9 Point Hedonic Scale) of Standard Bael Beverage Stored in Refrigerator**

**5% Bael beverage:** The 9 point hedonic test scores of 5% bull beverage presented in Fig. 2 clearly indicated that in **appearance**, there was a quite a difference between freshly prepared and 1<sup>st</sup> day refrigerated beverage. The higher mean value was found to be 8.30 for freshly prepared beverage and it increases to 8.51 for 14<sup>th</sup> day refrigerated.

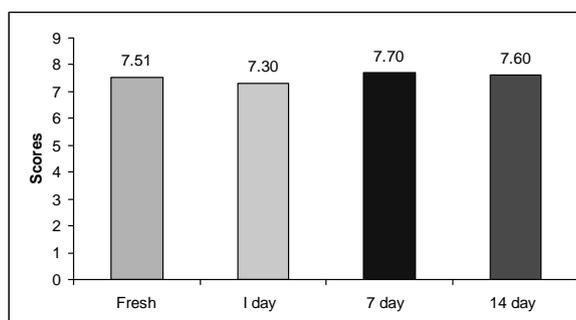
This beverage also had an appealing orange color and its color change was minimal on storage. The mean of **color** was highest (8.40) on the 14<sup>th</sup> day (refrigerated). It was not that smooth in **texture** as standard was but its texture improved on storage, which got an average rating of 8.11. **Taste and flavor** were found to be good under all storage conditions, being highest for the 14<sup>th</sup> day (refrigerated) with a mean of 7.90. The data in the table indicate the superior sensory quality of the product stored under refrigeration, evaluated after 24 hours of storage and fresh as well for **overall acceptability**. There was not much change in the mean scores of freshly prepared and 1<sup>st</sup> day refrigerated beverage, scores averaging to 7.73 and 7.30 respectively. The beverage was highly acceptable even after it was refrigerated for a period of 7 days and 14 days having an average value of 8.10 for the latter. The beverage was good in all attributes and highest mean value was observed for 14<sup>th</sup> day refrigerated beverage



**Figure 2: Overall Acceptability (9 Point Hedonic Scale) of 5% Bael Beverage Stored in Refrigerator**

**10% Bael Beverage:** Gradual rise in the mean value of **appearance** was observed on storage. Highest mean value was 8.21 for 14th day refrigerated beverages. It had a good **color** whose liability increases on storage.

**The texture** of this beverage was good in comparison with 5% bill. There was not a relevant decrease in **taste** in storage as the mean value was highest (6.90) for taste. **The flavor** was found to be good, but not as that of 5% bull beverage. **Overall acceptability**, freshly prepared was 'liked highly' by most of the panelists (n = 10). Beverage (stored in refrigerator) did not show any variation of mean score (7.30) when sensory quality was tested on 1<sup>st</sup>, 7<sup>th</sup> and 14<sup>th</sup> day rather the acceptability increased slightly in storage, i.e., 7.60.



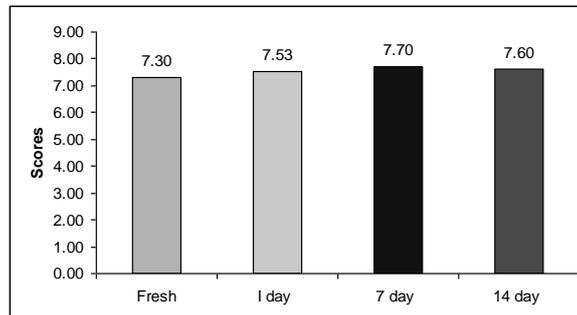
**Figure 3: Overall Acceptability (9 Point Hedonic Scale) of 10% Bael Beverage Stored in Refrigerator**

**15% Bael Beverage:** On storage there was a gradual rise in the mean value of **appearance**. Highest mean value was 8.53 on the 14th day. Slight variation in **color** was observed on storage along with the settlement of particulate matter. But still it did not affect the appearance negatively.

**The texture** was moderately liked by all. There was a static mean value for **test** on 1<sup>st</sup>, 7<sup>th</sup> and 14<sup>th</sup> day (7.10) which was higher than the freshly prepared one. **The flavor** was found to be fair in quality and also there was a decline in mean flavor scores on the 14th day of evaluation.

In comparative terms, this one scored lower in **overall acceptability** than the former two variations but a persistence of trend was observed with mean scores of refrigerated beverages remaining same for 1<sup>st</sup> and 7<sup>th</sup> day with an average of 7.53 and the freshly prepared beverage had a mean score of 7.30 and its acceptability declined as can be seen in fig 4.4 After on the 14th day (7.10). The beverage was liked moderately even after storage of 14 days.

Sensory quality of these three unrefrigerated beverages on the 7<sup>th</sup> and 14<sup>th</sup> day was not checked as room temperature storage resulted in rapid deterioration of quality, giving foul smell and off flavor, hence these beverages could not be analyzed for acceptability and were discarded.



**Figure 4: Overall Acceptability (9 Point Hedonic Scale) of 15% Bael Beverage Stored in Refrigerator**

### Nutrient Analysis

The four balls based beverages made as a part of this endeavor were analyzed for acidity, total solids, protein, fat, ascorbic acid and ash. Tannin content was also checked for unripened bagel pulp.

### Bell Beverages Acidity

The acidity value of beverages varies with the concentration of pulp. A fairly large amount of difference was seen in the acidity value of beverage and the increasing percentage of pulp in beverage resulted in the increased acidity. The highest value was 0.07% for both standard and 15% beverage and lowest value was observed in 5% ball, i.e., 0.02%, which is depicted in the table and also with a medium value of 0.05% in 10% beverage.

### Total Solids

Total solid is a representative of presence of mass after removal of water and volatile substances. The total solid scores of the four beverages variation in the percentage of bagel pulp incorporated are being discussed here.

The highest value was 18.92% for standard and among the three variations, with the increasing proportion of pulp, an increase in value was noticed. 15% bull beverage had the highest value, i.e., 4.85% and the lowest value was seen in 5% beverage, which was 2.91%. There was a slight difference between 10% and 15% beverage as the value of 10% beverage was found to be 4.32%.

The results of the present investigation differ with the variation in concentration, i.e., With 5% bull beverage being low on TS but 15% had comparatively higher value and higher being for standard. Out of these 15% bull beverage had a lower acceptability.

### Protein

As bail is not a very good source of protein and these beverages were made purely from bill so there was negligible amount of protein present in them, i.e., 0.09 to 0.27 g%, according to the increasing concentration of pulp and very little difference was found in the protein concentration of standard and 15% pale beverage.

## Fat

The basic ingredients of these beverages, i.e., Unripened bael fruit pulp is inherently low in fat, which is only about 0.3g%. The fat content was found out to be NIL in all the beverages.

## Ascorbic Acid

The ascorbic acid values vary with the varying percentage of pulp. It was found to be in negligible amount. The highest value was 1.1 mg% for 15% bull beverage and standard. The difference was seen in the two different percentage beverages with the lowest value being for 5% bull beverage, i.e., 0.3 mg % and moderate for 10 %, i.e., 0.7 mg %

## Ash

Ash content is an indication of its mineral status. The higher the mineral content, higher would be the ash content of the product. The values are illustrated in the table 4.3. Ash content was found to be highest in the standard beverage, i.e., 0.51% and the percentage of ash increases with the increment in the concentration of pulp, i.e., 0.08%, 0.17%, and 0.25% of ash found in 5%, 10% and 15% beverage respectively.

## Tannin

“Of the numerous phytochemicals present in active extracts, one of the phytochemicals, *tannin* is thought to be responsible for *antidiarrheal activity* by increasing colonic water and electrolyte absorption this will in turn control diarrhea” (Palombo 2006).

The tannin content of bagel pulp was found to be 71µg%.

The chemical/nutrient analysis revealed that beverage did not contain fat and negligible amount of protein was present. Ascorbic acid level in the beverage was found to be low.

Summing up the results, it could be inferred that the beverages are poor sources of ascorbic acid, protein and fat but fairly acceptable.

## CONCLUSIONS

- Overall acceptability of 5% bull beverage was very good. Its appearance, color and texture are appropriate.
- Beverages could be stored in refrigerator for 2 weeks.
- Beverages did not contain fat and negligible amount of protein was present.
- Ascorbic acid level in the beverages was found to be low

It was interpreted that all these products were of appropriate nutritional composition according to the varied requirements of diarrhea and could be recommended for diarrhea stricken children.

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