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A study on Apple ber to identify the suitability of new product development

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Abstract
This study emphasis on the physico-chemical properties of a new ber variety (Apple ber) originated in Thailand and slowly emerging in many parts of the world. The analysis is done under two different conditions the one being controlled and second one is blanched. The analysis revealed that the controlled condition is superior in physico-chemical properties than the blanched one. Also, proximate analysis was carried out on the fruit and its powdered form. In this analysis also controlled condition parameters were ahead of blanched. New products were developed with the Apple ber powder.

Keywords: Apple ber; Physico-chemical properties; Proximate Analysis

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Introduction

Humans tend to seek for new things in all the aspects of life which paves the way for the industry to introduce new products. India stands next to china, the global leader in population. This factor attracts many industries to invest in India. Industries in the field of Food and Beverages show a significant growth.

The changes in the climate especially decreased rainfall impacts the productivity of food industry due to fewer yields in cultivation of crops, vegetables and fruits.

Many modern techniques such as drip irrigation, developing hybrid varieties helps to overcome negative impacts of climatic changes. Industries which process fruits face more hurdles due to many factors and the critical factor is the lesser shelf life of many fruits. Hence, effective preservation is essential before and after processing. This lead many fruits underutilized. India has a rich source of underutilized native and exotic fruit trees, which may have a high agro industrial potential and represent an important economic source for the local populations.

Ber is one of the most ancient and underutilized fruits of India. Ber which is also known as “Poor Men’s Apple” since it contains all nutritional benefits of Apple and it is affordable for the poor people. There are many varieties of Ber

fruit available all over the universe. The *Zizyphus mauritiana* Lam is the commonly available Ber variety in India from ancient period. Prunas and Vedas illustrate the existence of Ber fruit before several centuries. It belongs to the genus *Ziziphus* of the family *Rhamnaceae*. This fruit has about 50 species and more than 600 cultivars available mostly in the tropical region of northern hemisphere. India is the origin of *Z. mauritiana* Lam and *Z. jujuba* Mill originated in China (1).

Well known varieties available in southern parts of India are Gola, Umran, Kaithali, Benarasi and Seb. Whereas in China, the common cultivars are Jinsixiaozao, Yazao, Jianzao, Junzao and Sambianhong. A comparison is made on the nutritional composition of these familiar varieties available in India and China. It is concluded that both the varieties are rich in nutritive content. However, Chinese variety is very rich in vitamin C when compared with Indian variety (2).

Though ber fruit contains 81% of moisture, it is rich in essential amino acids such as asparginine, arginine, glycine, glutamic acid and serine (3). It is found that the ber fruit contained more vitamin C and Phosphorus than apple and oranges(4).

Not only the fruits even the leaves, roots and seeds are also having various medicinal properties. The alcohol extracted from the leaves is used to stimulate the cell-mediated immune system (5). It is found that the extracts lower the cholesterol and triglycerides level in serum and liver of rats (6). Also it serves as the anti-microbial agent in preventing the growth of microorganisms such as *E. coli, Staphylococcus niger* and *S. pyogenes*. The anti-diarrheal activity is found in the extracts of root (7). Anti-inflammatory activity retained in the jujube fruit water extract (8). The seven identified and tested compounds from *Zizhypus mauritiana* seed extracts, 3,4-dihydroxybenzoic acid, methyldopa, p-coumaric acid, dihydro-pcoumaric acid, rutin, isoquercetin, and kaempferol 3-O-rutinoside normally increased cell viability, reduced LDH release, and attenuated intracellular oxidative stress in PC-12 cells (9).Utilization of various biological activities of polysaccharides from *Ziziphus jujuba* including anti-oxidant activities, anti-tumor and hepatoprotective activities (10-13).

Though ber fruit has more nutrition and medicinal properties, it is highly perishable. Jujube fruit (*Ziziphus jujuba*) has thin peel crisp texture, delicious flesh and high nutritive value. These properties attract more consumers (14). Its shelf life is 2 to 4 days when it is kept at ambient temperature (30 to 36°C). It is considered as a functional food, due to the epidemiological evidence that a high consumption of jujube, and of all its industrial products, is correlated with a reduced risk of some types of cancers. Fruits get accumulated in the local market during the yielding period (15). Harvested jujube fruit has more physiological disorders, such as development of alcoholic fermentation, water loss, and tissue softening. These disorders make the fruit highly perishable and deteriorated easily (16). Since the fruit is of high perishable it is difficult to store and sell it in the market for a longer time. Due to the surplus of fruits in the local markets during peak season, a substantial quantity goes to waste, resulting in heavy post harvest losses (17). The foremost factors in determining the rate of post harvest deterioration of jujube fruit were physiological changes, softening and the loss of firmness these may lead to a poor quality, consumer rejection and economic loss (18).

There are very less analysis done on the post harvest research on ber fruit for last two to three decades and the information is scattered in diverse local and regional sources, especially in India (19).

Typical variety of Ber has several constraints in preserving the quality of product made out of it. To overcome the difficulties, a cross breed variety of Ber “Apple Ber” was originated in Thailand recently and it is spreading across the globe rapidly.

As the name indicates, the new cultivar resembles the shape of an Apple (Fig. 1). Not only the shape, its juiciness and crispy nature also resemble Apple. This cultivar has many advantages over the traditional ber variety.

Fig. 1. Apple ber

The plant starts yielding fruits from the 6th month of plantation. The plant withstands high temperature and drought condition. The plant yields fruits twice and particularly during the December and January. The size of the fruit is large when compared with the traditional variety and it less labour is sufficient for harvesting. This plant variety is best suitable for natural pollination. This variety stays away from various diseases which are common to the traditional ber.

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Materials and Methods

Selection of the Fruits:

A new cultivar Apple ber was collected from the local farmer. Very few cultivars were found in the southern part of India. It was found in the market during October to March. Samples were chosen for the analysis of physical and chemical properties. The samples were completely washed to remove foreign bodies and dried before the analysis was carried out. The dried fruits were ground to a fine powder. The powder was stored in an air tight container and kept at 5°C. Moisture content of the fruit and its powder was measured at 60°C (20).

Physical Parameter of Apple Ber:

Size and weight of the fruit

Ten samples were chosen and the dimensions such as length and diameter were measured with the aid of digital Vernier calliper and screw gauge. The same sample was weighed using an electronic weighing scale and the mean value is registered for the analysis. Weight is measured in different ways based on the requirements for the calculations. Whole fruit weight, weight of flesh and weight of stone was measured to calculate Pulp-Stone Ratio.

Pulp – Stone Ratio (R_{ps})

With the aid of the measured dimension, the pulp-stone ratio was calculated using the following formula.

$$\text{Pulp Stone ratio } (R_{ps}) = \frac{\text{Weight of the Fruit } (W_f) - \text{Weight of the Stone } (W_s)}{\text{Weight of Stone } (W_s)}$$

Pulp-Stone ratio forms the basis for any processing industry to finalize the quantity of fruit required to get targeted volume of fruit juice or weight of flesh for processing.

Specific gravity of fruits

Another important parameter to be calculated is Specific Gravity of the fruit. The weight of the fruit is measured in two states. First being the usual method of weighing and second by keeping the fruit submerged under water. Fruit is pushed into water with the aid of a wire loop which assures proper replacement of water from the container. Specific gravity is measured using the following formula.

$$\text{Specific gravity} = \frac{\text{Weight of fruit in air } (W_{fa})}{\text{Weight of fruit in air } (W_{fa}) - \text{Weight of fruit in water } (W_{fw})}$$

Chemical Parameters of Apple Ber:

Chemical analysis plays a vital role in analyzing the nutritional benefits of the fruit. The common method used for the chemical analysis is derived from the manual of analysis of fruits and vegetable products (21). The properties such as Percentage of Total Soluble Sugar, Acidity, pH, Total sugar, Juice content and Vitamin C were determined under two different conditions. The fruit was analyzed as fresh and in blanched condition.

pH

pH decides whether the fruit is acidic, basic or alkaline. The pH of the fruit was determined by using a digital pH meter. It indicates the pH value with the aid of standard colour code which is compared with the actual colour displayed.

Total soluble solids (TSS)

Juice is extracted from the fruit pulp which was filtered using muslin cloth and a drop is used to calculate the total soluble solids (TSS) using a hand held refractometer. TSS was expressed as °Brix (22).

Acidity

Titrable acidity was determined by titrating known quantity of apple ber juice sample (10 mL) against standardized 0.2 N NaOH using a few drops of 1 per cent phenolphthalein solution as indicator to achieve pink colour end point which should persist for 15 seconds.

$$\text{Acidity (\%)} = \frac{\text{Weight of the Fruit } (W_f) - \text{Weight of the Stone } (W_s)}{\text{10 (volume of sample taken)}}$$

Reducing sugars

To 25 g of the sample in a volumetric flask 100 mL of water was added and neutralized with 1N NaOH. 2 mL of 66% lead acetate solution was added and kept for 10 minutes. Excess lead acetate was precipitated by necessary amount of 20% potassium oxalate, made up to the volume with water, filtered and taken in burette. 10 mL of mixed Fehling's solution was taken in 250 mL conical flask. Little quantity of the sample was run into flask and heated to boil moderately for 2 minutes. 3 drops of methylene blue solution was added and completed the titration until the indicator was completely decolourized. Brick red colour of the solution indicates the end point (23).

Total sugars

For total sugars 50 mL of filtered sample was taken in a 200 mL conical flask to which 50 mL water and 5 g of citric acid was added, boiled gently for 10 minutes to complete the inversion of sucrose, transferred to 250 mL volumetric flask and neutralized with 1N NaOH. The volume was made up to the mark and determined the total sugars as invert sugars (24).

Ascorbic acid (mg/100 mL or mg/100 g sample)

Ascorbic acid was estimated by visual titration method. 10 mL of the sample was made up to 100 mL with 3% metaphosphoric acid and filtered. To estimate the interference of sulphur dioxide in the

sample, 10 mL of the filtrate was taken and added with 1 mL of 40% formaldehyde and 0.1 mL of HCl and kept for 10 minutes. The sample was titrated with the standard 2.6-dichlorophenol-indophenol dye to a pink end-point that should persist for at least 15 seconds.

TSS-acid ratio

It was calculated by dividing TSS value with titratable acidity of the juice.

Storage studies:

The fruits harvested needs to be stored until it reaches the processing station**.** Hence, it is essential to study the parameter which impacts the storage life such as decay, skin browning, shrinking change in flavor, taste, etc., at ambient and refrigerator atmosphere. Apart from storage life it is essential to analyze the Physiological loss in weight (PLW) also. It can be calculated using the following formula.

Physiological loss in weight (%):

It was determined by periodic weighing of ber fruits and expressed as percentage of its initial weight by following formula:

$$\% PLW = W_i - W_f / W_i X100$$

Where, PLW = Physiological loss in weight

W_i = Initial weight of ber fruits kept for storage

W_f = Final weight of ber fruits on selected days after harvesting.

Sensory evaluation:

Apart from physical and chemical analysis, sensory evaluation techniques were used to estimate the physico-morphological qualities like texture, taste, odor and skin color. The opinion collected from the panel of experts using 5 point hedonic scale determines the quality of fruits.

Proximate analysis:

Proximate analysis uses neither sophisticated equipments nor chemicals to estimate the main components of a food. It is used to analyse moisture, fibre, ash, proteins and carbohydrates from the fruit and its seed. Difference in the weight is used to determine ash and moisture. The sum of percentages of ash, moisture, extract, crude fibre and crude protein subtracted from 100 gives the presence of carbohydrate. Fibre content was estimated from the loss in weight of the crucible and its content on ignition.

Apple ber powder enriched products

The Apple Ber powder is used to prepare value added products which can be commercial produced and served to the society to improve their health condition. Cake, cookies and chocolates are loved by all age people. Enriching Apple ber powder to these products increases the health benefits. Since the Apple ber has better shelf life, the manufacturers' faces fewer problems in preserving the fruit.

Table 1 depicts the ingredients used to prepare the products enriched with Apple Ber powder.

Table 1. List of ingredients used

Ingredients	Cake	Cookies	Chocolate
Wheat (gm)	20	20	-
Ber fruit powder (gm)	5	5	15
Milk Powder (g)	-	-	35
Cocoa Powder (g)	-	-	30
Jaggery (gm)	25	10	20
Butter (gm)	25	15	-
Egg	1	-	-
Baking powder	a Pinch	a Pinch	-
Vanilla essence	Few drops	Few drops	-

In the commercial product preparation, Maida and sugar is used to prepare cake and cookies. These materials are proved to be very hazards to human health. Hence, the products enriched with Apple ber powder is produced using wheat and Jaggery. These value added products serves as a nutritious food without comprising on the taste and quality of the commercially available food in the market. The preparation methods of apple ber enriched products are given below.

Procedure for Cake preparation

1. Sieve flour with baking powder twice
2. Beat the egg white light and frothy
3. Beat the egg yolk and butter together
4. Add jaggery little by little and cream well
5. Add sieved flour little by little and mix well
6. Add the egg white and fold gently
7. Pour it on the greased mold
8. Bake at 200°C for 20 minutes

Procedure for Cookies preparation

1. Creaming the butter and sieve the dry ingredients and mix well with jaggery
2. Mixing (creamed butter +dry ingredients)
3. To make the dough
4. Sheeting and cutting
5. Bake at 150°C for 15 minutes

Procedure for Chocolate preparation

1. Sieve all the dry ingredients
2. Prepare the jaggery syrup
3. Add the dry ingredients into the jaggery syrup
4. Stir it well
5. Pour it into greased plate and cool it
6. Cut into desired shape
7. packed it in the aluminium foil and store it

Microbial analysis of ber fruit powder incorporated products:

Microbial count was carried out in Ber fruit (*Zizyphus mauritiana*) powder enriched products at 15 days interval. The polythene covered products were stored at room temperature and refrigeration. For this study, the proportion of products were homogenized, serially diluted in appropriate dilutes, plated in a suitable agar medium, incubated at an appropriate temperature for a given time, after which all visible colonies were counted by the use of electronic counter. The number of microbes was tested by SPC (standard plate count) method. The agar agar was used for fungal counts. The incubation time for nutrient agar plate was 24 hours.

Statistical Analysis:

The data were analyzed using SPSS. All results are expressed as the mean ±standard deviation (SD) of three replicates. t-test was used to evaluate difference between samples. All of the statistical differences were carried out at a significance level 0f $\alpha < 0.05$.

Results and Discussion

Physical characteristics of apple ber

Table 2 depicts the comparison of physical parameters of blanched and controlled fruits. Each value in the table was obtained by calculating the average of ten experiments and the data are presented as Mean ± Standard Deviation. The mean fruit and stone weight, height, diameter and pulp stone ratio were 65.5±5.4g, 4.98±0.22cm, 4.42±0.16cm, 7.1±2.7g, 1.2±0.1cm, 2.26±0.11cm and 7.3±2.44 for normal control fruit.

Table 2. Physical Characteristics of Apple Ber

Physical Properties	Control	Blanched	Significant Difference *P<0.05*
Fruit Weight (gm)	65.5±5.4	62.3±6.3	0.421
Fruit Height (cm)	4.98±0.22	3.98±0.34	0.008
Fruit Diameter (cm)	4.42±0.16	4.26±0.23	0.222
Stone Weight (gm)	7.1±2.7	6.8±2.1	0.690
Stone Height (cm)	1.2±0.1	1.2±0.1	1.00
Stone Diameter (cm)	2.26±0.11	2.24±0.1	0.841
Pulp Stone Ratio	7.3±2.44	7.0±2.7	0.670

**Statistically significant differences between the control and blanched sample ofphysical characteristics of Apple ber fruit.*

In blanched environment the mean fruit and stones weight, height, diameter and pulp stone ratio were 62.3±6.3g, 3.98±0.34mm, 4.26±0.23mm, 6.8±2.1g, 1.2±0.1mm, 2.2±0.1mm and 7±2.7. There was decrease in all the physical parameters of fruit and stone after the process of blanching, whereas the stone height remained the same even after blanching. Significant differences between the controlled and blanched are shown in Table 2.

Chemical characteristics of apple ber

The chemical properties of blanched fruit was compared with control and assessed as in Table 3. Each value in the table was obtained by calculating the average of three experiments and the data are presented as Mean ± Standard Deviation. The TSS, Acidity, pH, TSS/Acid ratio, Juice content, Reducing sugar, Vitamin C and specific gravity values were determined. Significant reduction has been found in chemical parameters such as TSS, Acidity, pH, TSS/Acid ration, reducing sugar and specific gravity after blanching process. Whereas there was increase in the TSS/Acid ration, Juice content of the fruit after blanching. Significant differences between the controlled and blanched are shown in Table 3. From the statistical analysis, it is found that the control ber fruit is suitable for the experimental study.

Table 3. Chemical Characteristics of Apple Ber

Chemical Properties	Control	Blanched	Significant Difference *P<0.05*
TSS (°Brix)	8.4±0.32	6.4±0.16	0.008
Acidity (%)	0.21±0.05	0.23±0.2	0.690
pH	4.9±0.1	4.2±0.2	0.008
TSS/Acid Ratio	30.1±1.7	34.5±0.42	0.008
Juice Content (%)	52.4±1.4	33.8±4.6	0.320
Reducing Sugar (%)	1.82±.05	1.52±1.6	0.008
Non-Reducing Sugar (%)	5.2±0.3	4.4±0.43	0.032
Total Sugar (%)	7.2±0.3	6.12±0.42	0.008
Vitamin C (mg)	64.6±2.8	52.8±4.1	0.008
Specific Gravity	0.34±0.9	0.12±0.4	0.008

**Statistically significant differences between control and blanched sample of chemical characteristics of Apple ber fruit.*

Proximate Analysis of Ber Fruit Seed

The result of the proximate composition of ber fruit seed was shown (Table 4) to be the moisture (11.62%), ash (5.10%). Fibre (10.30%), Carbohydrate (37.51%), Protein (24.65%) and fat (22.44%). This study reveals that apple ber fruit seed have low moisture, high fat and protein content.

Table 4. Proximate analysis of Apple ber seed

S. No	Analysis	Results
1	Moisture content (%)	11.62
2	Total Ash (%)	5.10
3	Fiber (%)	10.30
4	Carbohydrates (%)	37.51
5	Protein (%)	24.65
6	Fat (%)	22.44

Physiological Loss in Weight (PLW) of Fruit

Physiological weight loss evaluation before and after refrigeration and room conditions are showed in Table 5. Whereas there was no weight

loss was measured till the 2nd day of storage at normal RT. But on 8th day, the maximum weight loss recorded was 42% in room temperature and only 6% of weight loss was recorded in refrigerator temperature. Development of dark brown spot on the pericarp of fruit skin within 5-8 days stored at ambient condition was seen.

Table 5. Physiological Loss in Weight (PLW) of Fruit

Storage Conditions	PLW (%)			
	Storage period days			
	0 day	3rd day	6th day	8th day
Room Condition	0	35	38	42
Refrigerator Condition	0	4	5	6

Subjective Maturity Parameter and Quality Attributes (Ambient condition)

Quality and freshness of the fruit can be partially judged using the color of the fruit. Skin color, Pulp Texture, Taste and attractiveness of the fruit is rated using sensory evaluation as depicted in Table 6.

Table 6. Subjective Maturity Parameter and Quality Attributes (Ambient condition)

	Maturity Parameter		Quality Attributes	
Storage Days	Skin Colour	Pulp Texture	Taste	Attractiveness of Fruits
3rd day	Dark Green	Crispy	Very Good	Attractive
6th day	Yellowish Green	Crispy	Good	Very much Attractive
8th day	yellowish Green with Shriveling and brown spots	Crispy	Fair	Less Attractive

The fruit is exposed in two different conditions. Fruit is kept under ambient condition and the changes in the parameters based on the number of days were recorded as shown in the table. Also the fruit is kept in the refrigerator and the parameters were recorded. The analysis shows that there is change in the color with respect in increase in storage period however no significant changes occurred in the pulp texture. Slow Deterioration is witnessed in the taste and attractiveness of the fruit over a period of time.

Refrigerated condition:

Fig. 2 depicts the level decomposition of the fruit under refrigerated under ambient condition. Till the 8th day, the fruit didn't decompose in the refrigerated condition. Almost the freshness of the fruit is maintained hence the fruit can be used to manufacture many value added products which can be stored for a longer time under preserved condition.

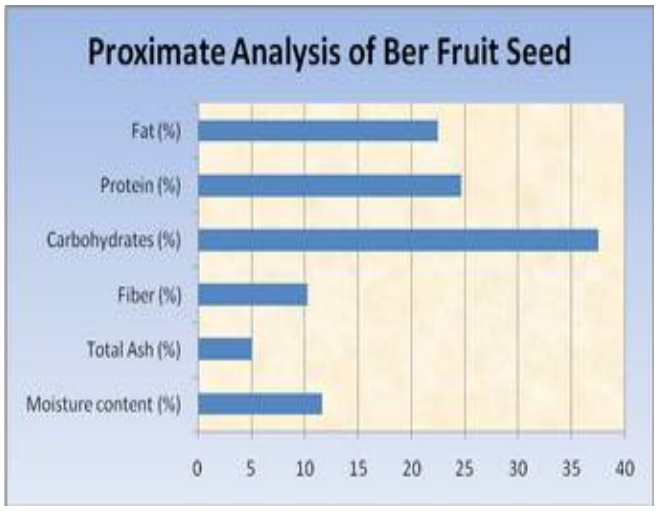

Fig. 2. Proximate Analysis of Ber Fruit Seed

Progress of decomposition in the ambient condition is depicted in Fig. 3. Each and every day the fruit is analyzed for the change of color and texture. Until day 8, the quality of fruit is acceptable and from day 10 the process of decomposition is at higher rate.

Fig. 3. Apple Ber under refrigerated condition

Table 7. Sensory Evaluation of Apple Ber fruit during storage

	3rd day		6th day		8th day	
Characters	AT	RT	AT	RT	AT	RT
Colour	4.3±0.3	4.8±0.1	3.7±0.2	4.9±0.1	3.4±0.29	4.72±0.09
Flavour	4.5±0.31	4.9±0.1	3.9±0.24	4.74±0.10	3.5±0.15	4.74±0.09
Texture	4.3 ±0.3	4.7±0.2	3.7±0.12	4.78±0.11	3.76±0.40	4.56±0.16
Appearance	4.3±0.3	4.8±0.09	3.94±0.26	4.7±0.12	3.7±0.33	4.66±0.99
Overall acceptability	4.5±0.3	4.9±0.1	3.9±0.29	4.8±0.12	3.7±0.33	4.7±0.12

Sensory evaluation:

The colour, flavor, texture and appearance of the apple ber fruit during storage is estimated using sensory evaluation. 5 point hedonic scale is depicted in Table 7.

Overall acceptability of the fruit in the ambient condition diminishes day by day from 4.5±0.3 in 3rd day to 3.7±0.33 on 8th day. Similarly in the refrigerated condition the overall acceptability reduces at a lower rate when compared with the ambient condition. It reduces from 4.9±0.1 to 4.7±0.12 which is very close to the fresh condition. Thus, the fruit undergoes less deterioration under refrigerated condition.

Proximate Analysis of Apple ber:

Table 8 shows that the proximate analysis of the apple ber on wet basis. It compares the controlled sample with the blanched one.

Table 8. Proximate Analysis of Apple ber in Wet Basis

	Wet Basis	
	Control	Blanched
Energy (Kcal/100g)	36.4	34.8
Moisture (%)	90.2	90.9
Protein (g)	1.7	1.0
Fat (g)	<0.1	<0.1
Fiber (g)	6.4	4.4
Ash (%)	0.7	0.4
Total Sugar (g)	1.60	1.25
Calcium (mg)	32	28.4
Ascorbic acid (mg)	67	59

The energy per 100 grams is 1.6 gm higher in control than the blanched. Moisture content is approximately equal in both the cases. 0.7 grams higher protein is available in control than the blanched. Fat is almost the same however there is a significant difference in the presence of fiber. Fiber in the control is 5 gms higher than the blanched is witnessed in the analysis. Very less percentage of ash is present in the blanched when compared with the control. Around 0.3 % difference is found in the Ash content. Higher values of Calcium and Ascorbic acid were present in the controlled condition.

Table 9 depicts the proximate analysis of the Apple ber on Dry basis. Apple ber is dried using micro wave oven in 4 different temperatures.

Table 9. Proximate Analysis of Apple ber in Dry Basis

	Dry Basis	
	Control	Blanched
Energy (Kcal/100g)	86.23	82.37
Moisture (%)	10.4	11.7
Protein (g)	0.36	0.32
Fat (g)	1.20	1.08
Fiber (g)	8.40	6.24
Ash (%)	4.65	4.32
Total Sugars (g)	48.65	36.43
Calcium (mg)	12.4	10.18
Ascorbic acid (mg)	72	68

Analysis of Apple Ber in Dry Basis four chosen temperatures were 50° C, 55° C, 60° C and 65° C which little higher than the room temperature. Among these four temperatures 60° C is chosen for the study. High yield of fruit powder is obtained from apple ber at 60° C. Since there is no significant losses occurred in the nutritional values. The Table 9 shows the controlled condition tops in all the aspects when compared to the blanched. Though the difference is very meager in many parameters, significant difference is witnessed in total sugar.

Nutritional Comparison between Apple ber with Traditional ber

Table 10 depicts the comparison of nutritional analysis of the Apple ber with traditional variety. It shows that the Apple ber variety shows a significant difference in various aspects. Energy level is 36.4 kcal/100 gms which is double the value of traditional variety. This will be a major factor to be considered in developing a nutritive new product with more calorific value. Similarly Protein, fibre, ash content, calcium and ascorbic acid were found higher in apple ber compared with traditional variety. However, fat and total sugar found to be lesser that the traditional ber fruit. Apple ber fruits are rich in vitamins and minerals; hence consumption of one apple ber in a day would meet the nutritional requirements of an adult to stay healthy.

Table 10. Nutritional Comparison between Apple ber with Traditional ber

	Wet Basis	
	Apple Ber	Traditional Ber Variety
Energy (Kcal/100g)	36.4	17
Moisture (%)	90.2	81 - 83
Protein (g)	1.7	0.8
Fat (g)	<0.1	0.07
Fiber (g)	6.4	0.60
Ash (%)	0.7	0.3 – 0.59
Total Sugar (g)	1.60	5.4
Calcium (mg)	32	25.6
Ascorbic acid (mg)	67	65
Reducing Sugar (%)	1.82	1.4
Non-Reducing Sugar (%)	5.2	3.2

Sensory Evaluation of Apple ber powder Enriched Products

Table 11 depicts the sensory evaluation of the products enriched with Apple ber powder. Cake, cookies and chocolates produced were analyzed for its color, flavor, texture, taste and overall acceptance.

In all the aspects, cookies top the other products. It is followed by cake and chocolate stands the last. Cookies were found to have natural aroma and taste which was liked by many people.

Table 11. Sensory Evaluation of the Enriched Products

Characters	Cake	Cookies	Chocolate
Color	4.3±0.2	4.9±0.1	4.2±0.2
Flavor	3.5±0.15	4.74±0.10	4.3±0.2
Texture	3.8±0.12	4.78±0.11	4.2±0.2
Taste	3.8±0.31	4.7±0.12	4.4±0.24
Over all acceptability	4.46±0.25	4.7±0.12	4.37±0.23

Microbial Analysis of Apple ber Fruit Powder

In microbial analysis, the above Table 12 depicts the result of the microbial load of control and blanched ber fruit powder was kept in room temperature and refrigeration temperature. During the analysis, it was found that the powders had too few to count microorganisms at refrigeration temperature where the samples had too numerous to count microorganisms at room temperature. Since the microbial count is very less, it is suitable for edible purpose.

Table 12. Microbial Analysis of Ber Fruit Powder

Sample Ber Fruit Powder	Microbes	Microbial load at room temperature			Microbial load at Refrigeration temperature		
		Initial	15th day	30th day	Initial	15th day	30th day
Control	Bacteria	-	TFTC	TFTC	-	TFTC	TFTC
Blanched	Bacteria	-	TFTC	TNTC	-	TFTC	TFTC

Conclusion

The new variety is analyzed from the physico-chemical perspectives and found that the controlled condition sample is superior in all the aspects. Many products can be produced using this new cultivar since it has a very good storage and shelf life which is essential to preserve the food for a longer time. Out of the three products produced using the Apple ber powder, Cookies is liked by many people because of its natural flavor and taste. These kinds of products are essential to human kind to stay healthy and live long.

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Conflict of Interest

We hereby declare that we have no conflict of interest.

Authors' contribution

We declare that we have contributed equally to the work presented in the research article.

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