



Nutritional composition and value-added products of Ber based sattu & digestive powder from Indian Jujube (*Ziziphus Mauritiana* Lam) growing in western region of Maharashtra

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Abstract

This study analyzes the nutritional makeup of Indian Jujube (Ber), a fruit known for its vitamins, minerals, antioxidants, and dietary fibers. The fruit's biofunctional qualities make it an attractive option for developing functional food products. The study explores the production process of Ber Sattu, which maintains the integrity of nutrients. The study also investigates the development of a Digestive Powder with Ber extracts, promoting gastrointestinal health and well-being. The findings show that Ber's functional qualities and high nutritional content make them appealing substitutes for health-conscious customers, potentially fueling the functional food sector in western Maharashtra.

Keywords: *Ziziphus mauritiana* lam, sattu, digestive powder, nutritional composition, Western Maharashtra

Introduction

One of India's most ancient and underutilised fruits is the Ber. Ber are frequently referred to as "poor man's apples" because they are inexpensive and offer all the nutritional advantages of apples. Ber can be found anywhere in the universe. Since ancient times, his Ber variant, *Ziziphus mauritiana* Lam, has been extensively accessible in India. The Vedas and the Puranas both mention the presence of ber fruits in ancient times. It belongs to the Lamniaceae family's *Zyzyphus* genus. About 50 species and 600 cultivars of this fruit can be found primarily in the tropical areas of the Northern Hemisphere. India is the native home of *Z. mauritiana* Lam. (Mathangi S & Prakash Maran J 2020)

Ziziphus mauritiana Lamk is grown in India and many other nations, while certain Middle Eastern nations grow *Ziziphus lotus* L. There is currently more jujube being grown over the world, particularly in Russia, southern Asia, southern Europe, the south western United States, and Australia (Al-Saeedi *et al.*, 2016, Li *et al.*, 2007, Liu *et al.*, 2016) [2, 4, 5]. Jujube has various names depending on where it is consumed or grown. Low rainfall in the desert regions (100-400 mm), frequent droughts, and irregular rain distribution frequently cause whole or partial crop failure. But because it is a fruit tree that is always hardy, it provides some income to resource-poor farmers even during severe droughts. It can be planted even on marginal ground with poor soil, when the majority of other fruit trees fail to thrive or perform extremely poorly. It is the only fruit crop that can thrive even while it is raining. The Ber fruits are full of sugar, vitamin C, and a good number of mineral components. Ber is richer in protein, phosphorus, calcium, carotene, and vitamin C than an apple, and it performs oranges in these nutrients as well as in carbs, calcium, iron, and vitamin C. The FAO/WHO recommends that an adult man's daily diet contain 30 mg of ascorbic acid. Three Ber fruits can be consumed each day to satisfy this requirement. In addition, fruit is used as a dessert. Additionally, it can be processed to

create preserves, jam, dehydrated Ber powder, and drinks that are ready to serve. (Meghwal, P. R., M. A. Khan, and J. C. Tewari.)

The high fibre content of jujubes may aid in better digestion. The fruit contains about 50% fibre, which is known for its advantageous effects on digestion, as its source of carbohydrates (Dreher, M. L. (2018) [7]. Chana Dal (*Cicer Arietinum*), are high in protein which make outstanding replacement meat in vegan diet. Rich source of fiber, vitamins and minerals which help in good digestion system and maintain the weight. (Mahawar, P., Prates). In the past two to three decades, there has been very little analysis of the post-harvest studies on berries, and the knowledge is dispersed among numerous local and regional sources, particularly in India. (M., Gao, Q. H., Shen, J). The limitations of the typical Ber variety make it difficult to maintain the quality of the finished product. To solve the challenges, a cross-breed kind of Ber called "Apple Ber" was recently developed in Thailand and is spreading quickly over the world.

In India, sattu is a common dish. In northern India, especially in rural regions, roasted pulse flour is used as a ready-to-eat (RTE) snack. (Sumedha, D., Bargale,). Sattu is a well-known functional food, therefore meeting customer preferences is crucial to encouraging the use of functional food products. When determining a consumer's preference for food goods, sensory characteristics must come first, followed by nutritional qualities. Therefore, before a created food product is released to the market or to consumers, sensory analysis is a crucial concern (Routray, W., & Mishra, H. N. (2011) [12]. The most important factor in evaluations in any subject is knowledge gathered from personal experience. However, it is very difficult to represent and control the knowledge acquired by experience in the case of sensory evaluation. It is because the process of obtaining information by humans involves ambiguity and imprecision. (Martinez, L. (2007) [13].

The preparation of value-added Ber based goods and an evaluation of the products' sensory evaluation were the two main goals of the current study, "Nutritional composition and value-added products of Ber based Sattu & Digestive powder from Indian jujube (*Ziziphus mauritiana* Lam) growing in western region of Maharashtra." and to developed economy of villagers and improve the sustainable goals.

Methods and material

1. Selection of the Fruits

A fresh variety the local farmer was where the Indian jujube was gathered. The Eastern region of Maharashtra contained a very small number of cultivars (Figure 1.). From October through March, it was available on the market. For the investigation of physical and chemical attributes, samples were chosen. Prior to examination; the samples were thoroughly cleaned to get rid of extraneous objects and dried. A fine powder was made from the dried fruits. The powder was kept at 50°C and kept in an airtight container. At 60°C, the fruit's and its powder's moisture content were tested (Pareek, S., & Yahia, E. M. (2013) [10]. Mature raw fruits of Indian jujube were collected from local additional forest areas, homesteads, and local markets in Wardha, Maharashtra, during October - March 2021. The fruits were washed and cleaned with water before being separated into outer and inner parts. The raw outer part of the ber fruit was utilised for the preparation of products like Ber Based Sttu and Ber based digestive powder at Bioprocessing and Herbal Division of the Mahatma Gandhi Institute for Rural Indutrilization wardha.



Fig 1: Fruits of Indian jujube cultivars

2. Preparation of Ber based digestive (BBD) powder and Ber based Sattu(BBS) powder

We grabbed 500 grammes of fresh Ber fruit at the Wardha market. The Ber fruits were carefully cleaned, and any seeds or debris were taken out. Following that, the Ber fruits were divided into tiny pieces and placed on a baking sheet. The Ber fruit segments were dried for eight to ten hours at 60 degrees Celsius in an oven. The dried Ber fruit pieces were then processed in a food mixer or grinder to create a fine powder. The black salt, rock salt, black pepper, roasted cumin powder, small cardamom, and black cardamom (table 1) were completely combined in a clean, dry mixing bowl. The combination was then supplemented with ammonium chloride and sugar, which were both thoroughly combined.

Table 1: List of ingredients used BBD powder

Ingredients	Quantity (in gm)
Ber Powder	100
Black salt	10
Rock salt	6
Black pepper	6
Cumin powder Roasted	30
Small cardamom	6
Black Cardamom	6
Sugar	100
Ammonium Chloride	1

The purpose of this study procedure was to develop Ber-based sattu products by following a predetermined path. First, market-fresh Ber fruits were purchased and meticulously cleansed. The Ber fruit chunks were then divided into smaller pieces and baked in an oven to finish drying. The roasted chickpea powder, Jav powder, (table 2) and dried Ber fruit pieces were all mixed to make the sattu mixture after being ground into a fine powder. The mixture was then kept in a cool, dry environment in an airtight receptacle. The sattu mixture can be used to prepare a number of dishes and is a healthy and nourishing food choice.

Table 2: List of ingredients used BBS powder

Ingredients	Quantity (in gm)
Ber Powder	50
Roasted chickpeas powder	30
Jav Powder	20



Fig 2: Ber Based digestive product and Ber based Sattu Powder

a. Sensory evaluation

The term "sensory," "subjective," or "organoleptic" refers to an evaluation of food product quality made using human sensory organs. Every time food is consumed, a decision is made. A group of judges grade the food's quality using sensory evaluation. The 9-point Hedonic scale (Lawless and Klein, 1991) was used to evaluate the various characteristics for this study. Eight members of the Five Scientific staff, including the head of the Basic Principles Department, the department of the Bioprocessing & Herbal division, MGIRI Wardha, and three Project Assistants, were chosen at random to serve on the panel of assessors. Based on the assessors' ratings, the preparations' acceptability and organoleptic quality were scored. The dishes were made on the college's grounds. The dishes were assessed

- Appearance
- Color
- Odour
- Flavor
- Consistency
- Mouth-feel (palatability)
- Adhesiveness

- The preparation area was off-limits to the assessors because they may learn something that might affect their judgement.
- They were requested to provide an unbiased view but were not permitted to consult one another.
- For oral rechecking in between the samples, each assessor received a glass of water.
- The time gaps between samples were maintained constant.

The following factors were taken into account

a. Scoring scales for different sensory parameter.

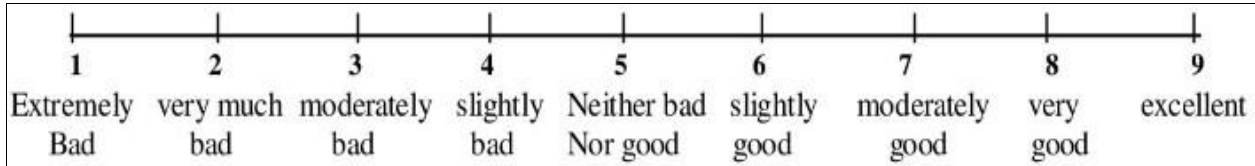


Image 1: Appearance

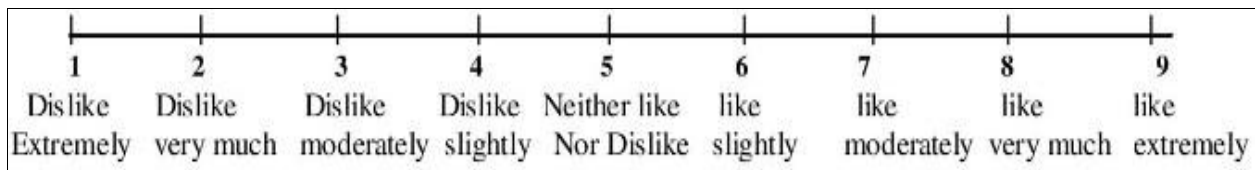


Image 2: Color

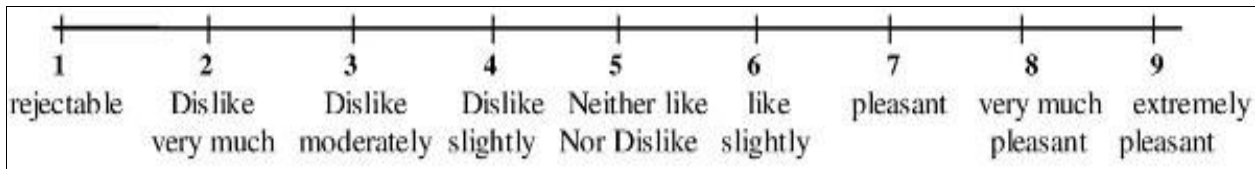


Image 3: Odor

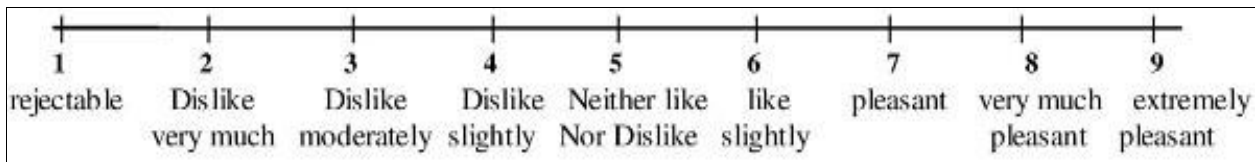


Image 4: Flavour

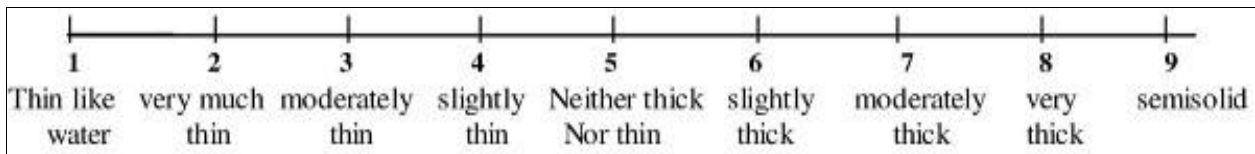


Image 5: Consistency

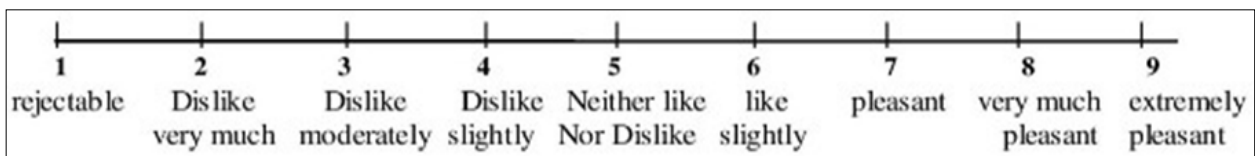


Image 6: Mouth-feel (Palatability)

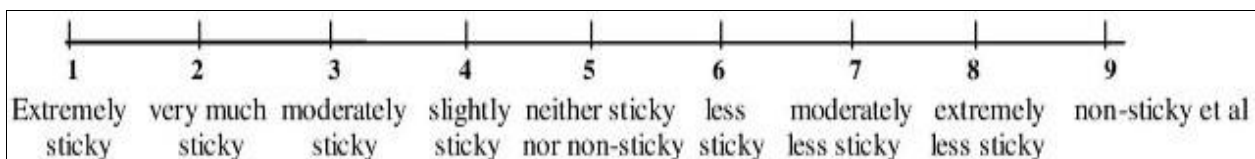


Image 7: Adhesiveness

b. Proximate analysis

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.

Moisture content (%): The moisture content of powder was found using moisture determining apparatus (Stortus).

Total Ash % (AOAC, 1990): Place about 3g of the ground air-dried BBD & BBS powder, accurately weighed, in a previously ignited and tared crucible (usually of platinum or silica). Spread the material in an even layer and ignite it by gradually increasing the heat to 600°C until it is white, indicating the absence of carbon. Cool in desiccators and weigh. If carbon-free ash cannot be obtained in this manner, cool the crucible and moisten the residue with about 2 ml of water or a saturated solution of ammonium nitrate R. Dry on a water-bath, then on a hot-plate and ignite to constant weight. Allow the residue to cool in a suitable desiccator for 30 minutes, and then weigh without delay. Calculate the content of total ash in mg per g of air-dried material.

$$\text{Ash (\%)} = \frac{\text{Weight of ash (g)}}{\text{Weight of sample (g)}} \times 100$$

Insoluble Ash (AOAC, 1990): To the ash contained in the dish, add 25 ml of dilute hydrochloric acid, cover with a watchglass, and heat on a water-bath for 10 minutes. Allow the dish to cool, then filter the contents of the dish through a Whatman filter paper No. 42 or its equivalent. Wash the filter paper with water until the washings are free from the acid, and return them to the dish. Keep it in an oven maintained at 100 ± 2°C for about 3 hours. Ignite in a muffle furnace at 550±10°C for one hour. Cool the dish in a desiccator and weigh it. Heat the dish again at 550 ± 10°C for 30 minutes, cool in a desiccator, and weigh. Repeat this process of heating for 30 minutes, cooling, and weighing until the difference between two successive weighings is less than one milligram. Record the lowest weight.

Calculation

$$\text{Acid insoluble ash, percent by weight} = \frac{100(W_2 - W)}{W_1 - W}$$

Where

W_2 = weight in g of the dish with the acid insoluble ash,

W = weight in g of the empty dish, and

W_1 = weight in g of the dish with the material taken for the test

Fat (AOAC, 1990): Weighed samples of 5.0 g each in triplicate were extracted with petroleum ether in Soxhlet extraction apparatus for 18 hours. The ether extract was filtered through a sintered funnel in a pre-weighed beaker and was washed with small volume of petroleum ether 2-3 times. The petroleum ether was completely evaporated and the beakers were weighed.

$$\text{Fat (\%)} = \frac{\text{Amount of ether extract (g)}}{\text{Weight of sample (g)}} \times 100$$

Protein (%): Weighed sample (1 g) was digested with concentrated sulphuric acid (25 ml) and digestion mixture in Kjeldahl digestion flask. The content were cooled and transferred to 250 ml volumetric flask. The volume was made upto the mark with distilled water and mixed. Measured aliquot was taken in a distillation flask followed by 40.0 per cent Sodium hydroxide and ammonium borate was collected through a condenser in a flask containing (35 ml) of 4.0 per cent boric acid solution. The distillate was titrated with 0.1 N sulphuric acids. A blank sample was also run along with the sample

$$\text{Nitrogen \%} = \frac{(\text{Titre value} - \text{blank}) \times 1.4007 \times \text{N of H}_2\text{SO}_4 \text{ solution}}{\text{Sample weight}}$$

$$\text{Protein \%} = 6.25 \times \text{Nitrogen\% value}$$

Crude fibre (AOAC, 1990): Weighed defatted samples (5.0 g) each in triplicate were digested with 200 ml of 1.25 per cent sulphuric acid by gentle boiling for half an hour. The contents were filtered and the residue was washed free of acid using hot distilled water. Acid free residue was then transferred to the same flask to which 200 ml of 1.25 per cent sodium hydroxide was added. The contents were digested again for half an hour, filtered and again washed free of alkali using hot distilled water. The residue was dried in an oven overnight at 105°C, weighed and then placed in the muffle furnace at 600°C for 4 hours. The loss in weight after ignition represented the crude fibre in the sample.

$$\text{Crude fibre (\%)} = \frac{\text{Wt. of sample (before ignition - after ignition)}}{\text{Weight of sample (g)}} \times 100$$

Total carbohydrates (NIN, 1983): The content of the percent available carbohydrates was determined by difference, by subtracting from 100, the sum of percent values of moisture, crude protein, crude fat, crude ash and crude fibre. The values were expressed as total carbohydrates (%) in the samples.

c. Microbial analysis of Ber fruit powder incorporated products

1 gram of powder is dissolved in lactose broth, and the volume is adjusted to 100 ml using the same medium. The next step is to add 10 ml of the powder-lactose broth mixture to 100 ml of Macconkey broth. The Macconkey broth is then incubated at a temperature of 43–45 °C for 18–24 hours. A subculture is created by placing a sample from the Macconkey broth onto a plate with Macconkey agar after incubation. The plate is incubated once again for 18–24 hours at 43–45 °C. E. coli is present in the churna sample because red, typically non-mucoid colonies of gram-negative rods with reddish zones are growing there. On the other hand, the lack of such colonies implies the absence of E. coli.

The minerals contents of jujube powder were determined by Unit Atomic Absorption Spectrophotometer (AA240 Varian K, Australia) on an acetylene air flame and flame photometer by following the protocols discovered by the Association of Official Analytical Chemists (AOAC, 2010) method No. 3.014-016.

Results: The results of the physical parameter evaluation such as heavy metals, pH, moisture content, Total ash value, Fat, Protein, Crude fibre, Total carbohydrates were given in

table 3. detection of heavy metals such as Potassium g/100g, Phosphorus mg/100g, Sodium mg/100g, Calcium mg/100, Iron mg/100g, Magnesium mg/100 in table 4. Finally, the result of microbial detection was given in table 5

Table 3: Evaluation of Physical Parameters of Bds & Bbs

Sr. No.	Physical Parameter	BDS Value	BBS Value
1	pH	4.45	4.00
2	Moisture	9.39%L	14.31%L
3	Ash Value	8.95%	14.31%
4	Insoluble ash in dil. Hydrochloric acid	2.62%	7.15%
5	Fat	4.27%	5.48%
6	Protein	4.99%	8.78%
7	Crude fibre		
8	Total carbohydrates	42.4%	39.7%

Table 5: Detection of Microbes in Bds & Bbs

Sr. No.	Microorganism	BDS Values Present/ Absent	BBS Values Present/Absent
1	<i>Escherichia coli</i>	Absent	Absent

Table 6: Mineral Analysis of Ber fruit powder BBS and BDS

Minerals (ppm)	BDS	BBS
Ca	327.5	325.6
Fe	27.91	127.25
Mg	119.62	119.46
Na	135.07	92.452
K	406	368
P	142.1	161.9

Conclusion

Exploring wild fruits like Indian jujube, which can be easily accessed and gathered without putting a lot of strain on the species, is obviously necessary. This will give the region's customary management and protection of its rich plant diversity a new perspective. Utilizing wild edible plants will be a successful strategy for reviving indigenous people ingrained traditional knowledge. The results of such investigations and analyses will be helpful in filling in the gaps in impoverished people's nutritional deficiencies and the requirement for cultivating additional foods as a diet.

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