BIOSCIENCES BIOTECHNOLOGY RESEARCH ASIA, December 2022. Vol. **19**(4), p. 1133-1138

Documentation of Traditional Method of Preparation and Characterization of Judima, a Traditional Rice Beer of Dimasa Tribe of Assam and its Comparison with Old Preserved Judima

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http://dx.doi.org/10.13005/bbra/3062

(Received: 19 July 2022; accepted: 18 October 2022)

Judima is traditionally prepared by the Dimasa community of Assam. This is a rice beer traditionally being used by them generation after generation on various occasions and day-to-day life. As Judima got the Geographical Indication tag commercialization of this beverage increased. Therefore, scientific documentation of its method of preparation and characterization is of utmost need of the hour to maintain quality. The two steps involved in the making of Judima are-making of rice cake and the making of rice beer is involved. The state of Judima is liquid and its colour is yellowish. The pH of both fresh and preserved Judima is near 5. The alcohol percentage of fresh Judima is 20±2 mg/ml and Old Judima is 21.5±2 mg/ml, similarly, the Carbohydrate content of fresh and old Judima is 18±1.8 mg/ml and 19.6±2.7 mg/ml respectively. On the other hand, the protein content and free amino acid of fresh Judima are 3.8±1.8 mg/ml and 0.8±0.5 mg/ml respectively and that of Old Preserved Judima is 3.1±0.98 mg/ml and 1.3±0.77 mg/ml. Although indigenous people prefer old preserved Judima for consumption as they have more belended flavours ans smoother to drink it cannot be clearly stated that it is because of the difference in biochemical parameters as the p-value for all the observations is greater than 0.05 therefore, the difference is not significant.

Keywords: Alcohol; Dimasa; Fermentation; Judima; Rice-Beer.

The preparation and consumption of fermented rice beer is a tradition of different tribal communities residing in the Northeastern part of India. Each tribe has their unique recipes to prepare these brews. Among the ethnic groups of India, the Dimasa is one of the primitive indigenous ethnic groups, they mostly reside in the North Cachar Hills of Assam and Dimapur in Nagaland[1].

Judima is a homemade, ethnic rice beer of the Dimasa tribe hailing from the Dima Hasao district of Assam. It is the first traditional beverage of North-eastern India to get Geogrephical Indication tag in September 2021 under the Geographical Indication of Goods (Registration & Protection) Act, 1999 issued by the Geographical Indications Registry (Chennai)[2]. Judima is an agricultural product whose application for GI tag was filled by Managing Trudte4e, Youth Association for Development & Empowerment (YADEM) on 16th January 2019 and the procuct was certified on 14th September 2021 and the registration is valid upto 15th January 2029. In Dimasa language the meaning of Ju is Beer and Dima means their tribe's name. The colour of this cloudy drink is pale yellow or reddish depending upon the rice used in its preparation. White bora

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(the glutinous sticky variety), non-bora (the everyday non-sticky variety) and Bairing rice which is specially cultivated for Judima preparation are used in preparing this traditional beverage.

Judima is one of the most important parts of Dimasa tribe as it served to show affection and emotions. Judima is served to guests to celebrate different ceremonies like marriages, birth and mourning of death.

Almost all the tribes reside in the North-eastern part of India prepare their own traditional rice beer. But surprisingly all of them tastes different. This is may be due to the difference in preparation of starter cake, variation in time of incubation or using different locally available herbs[3-4]. The rice based fermented foods are considered functional food as they are highly nutritive and has bioactive compounds[5]. In spite of being socio economically as well as nutritively valuable these traditional products are not well documented till now[6]. The recipes of preparation of these beverages passed from generation to generation orally. Therefore, there is no scientific standard protocol maintained[7].

Since Judima got GI tag the commercialization of the beverage increased drastically. Therefore, to maintain the authenticity of the beverage a scientific documentation is very much important. The present investigation was done to evaluate the traditional method of preparation of Judima and to analyse and compare a few biochemical parameters of fresh and Old preserved Judima.

METHODS AND MATERIAL

Study area

The study was conducted in Dima Hasao district of Assam. The district occupies around 4890 km^2 area and the coordinates are 25.18ºN and 93.03ºE.

Field survey

The Dima Hasao district has 695 villages. Out of which culturally rich Dhansiri village was selected to conduct the field survey. The field survey was performed in the month of February 2022 by using semi-structured questionnaires among the local people. Face to face interview was taken in the local language among 100 people out of which 65 were female and 35 were male ageing between 28-67 years. Duly signed proper consent was taken before the interview.

Freshly prepared and old preserved Judima was collected from a family of the same village who is well known for preparing Judima from many generations and renowned for the authenticity.

Preparation of Judima

Total two steps are involved in the preparation of Judima.

1. Making of rice cakes
2. Preparation of rice beer.

Making of Rice Cakes

Rice and bark plant of Thempra (*Acacia pennata*) which belong to Mimosaceae family is used to make the starter cake which is known as Humao. Dimasa tribe believe in a folk tale that one of their ancestors went for farming carrying rice for his lunch wrapped in banana leaves and hung his lunch in a tree. When he returned after few hours, he saw some liquid flowing from the packet, and it was sweet in taste. They believe that the bark of Thembra turned it into sweet. Since then, they are using this plant in preparing this beverage.

The bark of Acacia pennata is sun-dried and cut into small pieces. Then the barks are crushed into powder. Water-soaked rice is grinded using their traditional mortar pastel known as Rimin. The Thembra powder is then mixed with the grinded rice along with little water to make a dough. Then cakes of appropriate size of radius: 5-7 cm; weight: 80-100 g are made. 15-20 gm of old rice is sprinkled over the new cake. The prepared cakes are then sun-dried for 4-5 days and after that, it is stored in a cool place to minimize fermentation and can be stored for many months.

The most preferred rice for making beer is Bairing or Bora rice. The rice is boiled and for cooling it is spread on bamboo mats. Then a large size cake (humao) is crushed in the rice which is sufficient for about 5 kg of rice and then the mixer is kept in earthen or bamboo vessels known as khulu covered with jute gunny bags. After 5-7days of keeping slightly yellowish liquid started to come up indicating fermentation. The time for fermentation usually depends upon the season as in the summer season it takes lesser time. The liquid which comes out is collected in an empty vessel or hundy and can be further strained, and diluted to make it suitable

for consumption. The taste usually depends upon the time it is preserved and they believe that the longer the time tastier it becomes.

Estimation of Ethanol Content

At first, for 45 minutes the Judima was centrifuged at 4000 rpm at 4ºC and for ethanol estimation the supernatant was taken. Ethanol content was estimated by the colorimetric method as described by Sambhate et al. 2012[8]. For standard 1.6 mg/mL ethanol stock solution was prepared freshly prior to use. To an aliquot of standard stock solution, 5 mL of sodium dichromate solution, 5 mL of acetate buffer pH 4.3 and 25 mL of 1N sulfuric acid was added. The mixture was shaken gently and allowed to incubate at room temperature for 120 min this resulted in formation of green colored reaction product. Following incubation period, the absorbance at 578 nm was read on spectrophotometer. This procedure was followed for each sample prepared in triplicates.

Estimation of Carbohydrates, Proteins, Amino acids, pH

Carbohydrate was estimated by Anthrone reagent method[9]. 2g of Anthrone dissolved in 1 litre of concentrated H_2SO_4 was used prepared freshly prior to use. Glucose stock solution of concentration 200µg/mL was taken for preparation of standard curve. Optical density was measured in 620nm.

The total protein content was determined by the Folin-phenol method as described by Lowry et al, 1951[10]. 1 mg/ mL BSA standard solution was prepared to determine the standard curve and measurement was taken in 660nm on spectrophotometer.

The free amino acid was estimated by microdiffusion technique[11]. 0.1 N hydrochloric acid was taken for the standard. pH was measured by a digital pH meter.

Statistical Analysis

All values in this study indicate mean ± standard deviation (S.D.), and all determinations were repeated three times. The one-way analysis of variance (ANOVA) was used to evaluate the difference among groups. Statistical significance was taken at a 95% confidence limit. All the statistical analysis was done by using SPSS software version 28.0.1.

RESULTS AND DISCUSSION

Different ethnic tribe of North eastern region of India use variety of traditional alcoholic beverages from since time immemorial[1]. As one of the primitive tribes of Assam the Dimasa believed that their traditional rice beer has medicinal values and it is good for health and act as a remedy for various ailments. This may be because of the uses of various herbs and plants used during the preparation of starter cake. During the field study it was revealed that females are more involve in preparation and selling of Judima for the betterment of their socio-economic conditions. The Dimasa women plays important role in socio-cultural and spiritual occasions as they have a diverse knowledge system to prepare the nutritionally rich foods and fermented beverages. During the field study, it was found that different plant parts (leaves and twigs) are used for the preparation of Judima which includes *Piper betle*, *Acacia pennata*, *Buddleja asiatica* and *Hedyotis scandens* as common growth supplements during the preparation of fermentation starter cultures. The most frequently used species were *Buddleja*

Table 1. Biochemical analyses of Judima

Characteristics	Fresh Judima	Old Preserved Judima
State	Liquid	Liquid
Color	Yellowish	Yellowish
Opacity	Clear	Clear
Ph	4.7±0.3	4.9±0.2 (p= 0.056)
Alcohol percentage	20±2 (v/v)	21.5±2 (v/v) (p=0.06)
Carbohydrate content	18±1.8 mg/ml	19.6±2.7 mg/ml (p=0.05)
Protein Content	3.8±1.8 mg/ml	3.1±0.98 mg/ml (p=0.054)
Free Amino Acid	0.8±0.5 mg/ml	1.3±0.77 mg/ml (p=0.051)

Fig. 1. Map showing the Dima Hasao District

asiatica (leaves), *Hedyotis scandens* (leaves and twigs) and *Acacia pennata* (leaves and barks).

The colour of both fresh and old Judima is Yellowish though the old Judima is slightly opaque therefore it looks a little bit darker. The observations were made purely on the basis of visual examination. Therefore, scientific analysis of color difference through CILAB (Chroma) is suggested.

The pH of fresh and preserved Judima is 4.7±0.3 and 4.9±0.2 respectively. The ideal pH of any alcoholic beverage is 4-7. This is because during fermentation not only ethanol is produced by the yeast. They produce organic acids (acetic acid, succinic acid) and other metabolites like glycerol esters, higher alcohols, ketones as well. Therefore, it can be assumed that both fresh and preserved Judima lies within the ideal pH range.

On the other hand, the alcoholic percentage of Fresh Judima is 20±2 (v/v) and preserved Judima is 21.5±2 (v/v). The difference between the pH and alcoholic percentage of old and preserved Judima is not significant as the p-value is greater than 0.05 at 95% confidence level. This difference may be due to the preparation of the drink in different batches. As the alcoholic percentage of preserved Judima is slightly higher this shows high pH as well because of the presence of OH ion in ethanol. Fortified wines range from 15.5% to 25% ABV, with an average of 18%. Therefore, it can be said that Judima belongs to the category of wine on the basis of its alcoholic content.

The carbohydrate content of fresh Judima is 18±1.8 mg/ml and that of old preserved Judima is 19.6±2.7 mg/ml. The presence high amount of carbohydrate content in comparison to foreign beverages can be considered a good source of energy for cell [12]. The amounts of carbs in popular alcoholic beverages vary based on several factors, such as ingredients and procedure of processing. In general, commercially available alcoholic drinks contain less carbs than the Judima, this is because Judima is a raw drink prepared from high carbohydrate containing glutinous rice. During domestic alcohol fermentation the biochemical conversion of starch to alcohol occurs in two phases, viz. saccharification of rice to simple mono and disaccharification through hydrolysis of starch and conversion of monosaccharide to alcohol. á-amylase and â-glucosidase enzyme helps in the saccharification process[13].

The protein content of fresh Judima is 3.8±1.8 mg/ml and old preserved Judima is 3.1±0.98 mg/ml. It seems that the protein content of freshly prepared Judima is slightly higher but it is not significant. The difference in preparation methods and fermentation time plays a significant role in the nutritional status of Judima or other traditional alcoholic beverages. The protein content act as metabolizable and energy providing

content[12]. The protein percentage of commercially available wine is only 0.14 gm per serving which is less than the Judima. Therefore, the Judima is one of the most nutritionally valuable drink. The free amino acid is found to be 0.8±0.5 mg/ml in fresh Judima and 1.3±0.77 mg/ml in old preserved Judima. As the drink is high in nutritional components it can be used as a refreshing drink. The evidence of presence of such presence of these metabolites and energy processing substances in Judima have potential to change the status of the drink from refreshment drink to energy drink.

The local people prefer preserved and old Judima for consumption. Though we haven't found any significant difference in their biochemical properties the people prefer old Judima because aging reduces the harsher flavours that are associated with raw alcohol and it gets smoother, while introducing flavours that are found in the wood of the barrel, which adds a distinct taste.

CONCLUSION

Because of the variation in preparation procedure and raw material the biochemical property of the beverage varies with batch. Depending upon the plant used in preparation of these beverages the medicinal properties also change. Further research in this direction will help to reach the deeper level of utility and preparatory process of the liquor in a cost effective but highly nutritive product. Judima is rich in nutritional supplements and can be good for health. These tribal alcoholic beverages are not only popular locally but they are now famous in other parts of the country. As the processes of preparing these beverages are passing down orally generation after generation there is a lack of standard procedure. Because of the absence of suitable preservation method tribal fermented foods and beverages are unsteady and spoiled in very less time. With the development of science and technology conservation of traditional knowledges are declining. Therefore, there is need of systematic documentation of their preparation methods and method of preservation to increase the self-life and value. This will ensure that the right amounts of ingredients are used and that the medicinal properties of the ingredients are preserved. There is great opportunity for development of various food industries associated with fermented product and various new product, quality assurance and increased promotion on a large scale. Commercialization of the drink could result in revenue that could be used for society's overall development as well as provides employment for the community's youth.

ACKNOWLEDGEMENTS

We are grateful to the Department of Zoology Madhabdev University for providing me with the laboratory facility. I am thankful to the local Dimasa people for their cooperation during the field survey.

Conflict of Interest

The author declares that there are no conflicts of interest.

Funding sources

There is no funding source

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