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Process characteristics and nutritional evaluation of *handia* - A cereal based ethnic fermented food from Odisha

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Rice beer, popularly known as *Handia*, is a fashionable drink among the tribals of northern Odisha. It influences their social, cultural and economic life. It is prepared in almost every third house following traditional knowledge. Different parts of 20 plant species are utilized for the preparation of *ranu* or *bakhar* tablets which act as starter cultures for preparing *handia*. De-husked rice after boiling is fermented with required amounts of *bakhar* tablets for a specific period for *handia* production. Lactic acid bacteria and yeasts are predominant microorganisms in the fermentation process. The beverage has acidic *p*H (4.44±0.97). The lower nutrient quality (protein and carbohydrate content) is compensated by the cost factor (Rs. 7/- per L) which matters much for the poor tribals. Its lower alcoholic content (1.21±0.98%) does not make the consumer alcoholic even after repeated consumption. It compensates the water loss of the body during heavy physical labour particularly in summer months.

Keywords: *Handia*, *Bakhar* or *ranu* tablets, Rice beer, Plant ingredients, Traditional processing

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A wide range of cereal based fermented foods exist throughout the Asian and African countries. Since rice is the major cereal in these areas, a global interest in rice and its fermented product is increasing due to their caloric value, unique quality characteristics and high acceptability[1]. In most of the countries, rice is fermented either by using mixed culture(s) into alcoholic beverages, or by natural fermentation into leavened batter formed dough breads which are usually baked or steamed[2]. Rice beer is an integral part of life of several aboriginal communities throughout the world.

In Odisha, from time immemorial, both fermented and distilled beverages have been prepared by fermenting different varieties of rice. These beverages are primarily prepared and used by different tribal communities all over the state. About 62 ethnic tribal communities are reported from the state[3] and they mostly inhabit forest villages. They meet most of their requirements, including food and primary healthcare, from the forest resources. Out of 62, 30 communities (48%), several aboriginals, are found in the district of Mayurbhanj, (largest district of the state; area - 10, 418 sq km forest cover – 4, 392 sq km. population – 25, 13, 895/2011 census). Similipal Biosphere Reserve (SBR, 5569 sq km.) is located at the centre of the district and its rich biodiversity is acknowledged internationally[4]. The district as a whole and SBR in particular, offers unique opportunities to study the indigenous knowledge and their uses prevalent among the local tribes. *Santal, Kolha, Bathudi, Bhumij, Munda* and *Gond* are major tribes whereas *Mankidia, Lodha, Kisan* and *Baiga* are minor tribal groups that inhabit the area. *Santals* constitute the largest tribal group of the district and are scattered throughout. The social, cultural and religious life of aboriginal people is influenced by the nature and natural resources available in and around their habitat that provide food, fodder, medicine, shelter and various other material and cultural needs.

The fermented food, locally known as *handia*, is an inseparable food item in the life of tribals of Mayurbhanj and most other districts of the state. The word *handia* finds its origin from the word *Handi* in *Odia* (local language), means large earthen pot. *Handia* occupies a key position in the social, cultural and economic life of *Santals* and accepted as a traditional drink[5]. It is prepared from rice along with

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some of the locally available plant parts through some indigenous method. Otherwise known as country liquor or poor man's whiskey, it is relished by one and all and in most occasions. Although some reports on processing of rice beverages are available[6-8], to the best of our knowledge, product characterization of *handia* has not been documented. The aim of this paper is to record the indigenous knowledge of the ethnic people of Mayurbhanj district in the preparation of cereal based fermented food, the *handia* including its microbiological and nutritional evaluation.

Methodology

A survey was conducted in 10 selected localities (Palbani, Takatpur, Roxy Road, Chhaupadia, Baghra Road, Tulasichoura, Darogadahi, Station Bazar, Hospital Road and Baripada Hat) of Baripada city in the district of Mayurbhanj where preparation and large scale selling of *handia* is a normal practice, Information was collected on methods of preparation, raw materials used and frequency and timing of consumption through informal personal interview (N = 5 at each sampling point) among various tribal communities. Accuracy of the information was ensured through cross verification. The plant specimens used in *bakhar* preparation were collected, identified and deposited as voucher specimen in Department of Botany, North Orissa University.

Medicinal plants used in the preparation of *ranu* were obtained by interviewing (once only) traditional healers of 14 villages of the district (Table 1). All of them are males with an average age of 40 yrs. Prior informed consent was not taken from the informants as most of them are professionals and reputed in their respective areas and prescribe plant preparations for different ailments. Medicinal properties of the plants used in *ranu* preparation are well documented by several workers[9-18].

Microbiological and nutritional qualities of *handia*

Samples in duplicate were collected during the study period, once in a month (generally on Sundays, maximum sale and consumption) from the above 10 localities in clean, sterilized one liter capacity glass bottles. After a visual sensory evaluation, physico-chemical tests like moisture content (heating at 80^{o}C for 8 hrs in an oven), *p*H (*p*H meter, Systronics, 361), titratable acidity[19], total sugar, protein and alcohol content[20] were estimated following standard procedures.

Enumeration of microbial flora like lactic acid bacteria (LAB) using MRS (Man, Rogosa and Sharpe Agar, *p*H=6.4), yeast using CzapekDox media and pathogenic organisms using XLD and Littman Oxgall media (all Himedia make) was conducted following standard procedures. One milliliter of *handia* sample was homogenized with 9 ml of sterile water. The homogenate was serially diluted to 10^{-6} dilution and 500 µl aliquots of the appropriate dilutions directly inoculated into petriplate containing reference isolation media. The petriplates were incubated at 35^{o}C for 48 hrs for bacteria and at 28^{o}C for 4 days for yeast and fungi in a bacteriological incubator. The purity of the organisms was checked by streaking them in the same media, followed by microscopic examination. Pure cultures were stored on slants at 4°C.

Results

Handia preparation includes two distinct phases: preparation of *ranu* or *bakhar* tablets and making of *handia*.

Preparation of *Bakhar* or *Ranu*

Ranu or *bakhar* tablets act as starter or fermentor and help in fermentation of the beverage. *Ranu* tablets are mixtures of various plant parts (50%) and powdered un-boiled rice (50%). The plant species and parts thereof used for the purpose along with local names, family, parts used and their common medicinal uses are listed in Table 1. Some species, viz. *Asparagus racemosus* Willd., *Cissampelos pareira* var. *hirsuta* (Buch.-Ham. ex DC.) Forman, *Clerodendrum serratum* (L.) Moon, *Coccinia grandis* (L.) Voigt, *Holarrhena pubescens* (Buch.-Ham.) Wall. ex. G. Don, *Madhuca longifolia* (Koenig) MacBride var. *latifolia* Roxb., *Smilax macrophylla* (Roxb.), *Woodfordia fruticosa* (L.) Kurz. and *Rauwolfia serpentina* (L.) Benth. are commonly used by the people of all localities. A total of 20 plant species belonging to 18 families are recorded to be used for *ranu* preparation. Depending on the season and availability in a particular locality, plant parts of one or more species are used. The exact ratio of different plants used for *ranu* preparation could not be ascertained as the informants were reluctant to disclose the same. However, *Cissampelos pareira var. hirsuta* (Buch.-Ham. ex DC.) Forman forms the major part in most of the preparations (70%). Mostly the roots are preferred followed by bark, flower, fruit, young shoot and leaves. Preferred parts and plants

Table 1—Phytotherapeutic uses of plants that are used in preparation of *ranu* tablets

Sl. No.	Name of the plant	Local name	Family	Parts used	Medicinal uses	References
1	*Asparagus racemosus* Willd.	*Gaisiro*	Liliaceae	Root	Nutritive tonic and demulcent, cures fever, sexual debility, leprosy, bronchitis and cough.	Thatoi *et al.*, 2008[9]; Wani *et al.*, 2011[10]
2	*Cissampelos pareira var. hirsuta* (Buch.-Ham. ex DC.) Forman	*Andiakidula*	Menispermaceae	Root, Leaf	Leaves used for cough, urinary troubles, diarrhea, inflammation and colic pain.	Rout & Panda, 2010[11]; Thatoi *et al.*, 2008[9]
3	*Clerodendrum serratum* (L.) Moon	*Samarkand*	Verbenaceae	Root, Leaf	Roots used in fever, snakebite, asthma and cough.	Kirtikar *et al.*, 2005[12]
4	*Coccinia grandis* (L.) Voigt	*Banokunduri*	Cucurbitaceae	Root tuber	Ear pain, jaundice, blood dysentery and diabetes.	Panda *et al.*, 2011[13]; Tamilselva *et al.*, 2011[14]
5	*Dioscorea* sp.	*Sanga*	Dioscoreaceae	Root tuber	Not known.	
6	*Dipteracanthus suffruticosus* (Roxb.) Voigt	*Chaulia*	Acanthaceae	Root	Renal problems.	Nayar *et al.*, 1956[15]
7	*Elephantopus scaber* L.	*Tatmuli*	Asteraceae	Root	Diarrhea, dysentery, colic, vomiting, headache and tooth ache.	Panda *et al.*, 2011[13]
8	*Gardenia gummifera* L.f.	*Bhurudu*	Rubiaceae	Young shoot	Used as a digestive tonic and antiseptic.	Kirtikar *et al.*, 2006[16]
9	*Holarrhena pubescens* (Buch.-Ham.) Wall. ex. G. Don	*Kuruchi*	Apocyanaceae	Bark, Seed	Bark is antihelminthic, antipyretic and used in dysentery. Seeds are astringent, used in cough, cold, fever, scabies, leprosy and malaria.	Kirtikar *et al.*, 2006[16]; Panda *et al.*, 2011[13]; Thatoi *et al.*, 2008[9]
10	*Homalium nepalense* (Wall.) Benth.	*Danmari*	Flacourtiaceae	Bark	Stomach disorder.	Nayar *et al.*, 1956[15]
11	*Lygodium flexuosum* (L.) Sw.	*Mahajal*	Lygodiaceae	Root	Fresh roots used as expectorants and healing wounds.	Panda *et al.*, 2011[13]
12	*Madhuca longifolia* (Koenig) MacBride var. latifolia Roxb.	*Matkam*	Sapotaceae	Seed, Leaf, Bark	Seed oil used in rheumatism. Leaf and bark used for diabetes.	Kirtikar *et al.*, 2006[16]Nayar *et al.*, 1956[15]
13	*Ochna obtusata* DC. var. obtusata	*Otchampa*	Ochnaceae	Root	Used as antidote for snake bite, menstrual complaints and asthma.	Kirtikar *et al.*, 2005[17]
14	*Orthosiphon rubicundus* (D.Don) Benth.	*Chandua*	Lamiaceae	Root tuber	Used to cure stomach disorder.	Nayar *et al.*, 1956[15]
15	*Polygala crotalarioides* Buch.-Ham. ex. DC	*Lilkathi*	Polygalaceae	Bark	Cold decoction of bark for cough. Used as antidote against snake bite.	Nayar *et al.*, 1956[15] Kirtikar *et al.*, 2005[17]
16	*Phoenix acaulis* Roxb. ex. Buch.-Ham.	*Khajuri*	Arecaceae	Root	Used as laxative.	Nayar *et al.*, 1956[15]
17	*Rauwolfia serpentina* (L.) Benth.	*Patal Garuda*	Apocynaceae	Root	Used as antidote for snake bite, malaria.	Nayar *et al.*, 1956[15] Rout & Panda, 2010[11]
18	*Smilax macrophylla* Roxb.	*Ramadantani*	Smilaceae	Root, Stem	Roots used for urinary complaints and dysentery. Stem used in tooth ache.	Panda *et al.*, 2011[13]
19	*Woodfordia fruticosa* (L.) Kurz	*Icheba*	Lythraceae	Flower	Dried flowers used as astringent, leprosy, burning sensation and liver disorders.	Panda *et al.*, 2011[13]; Thatoi *et al.*, 2008[9]
20	*Xantolis tomentosa* (Roxb.) Raf.	*Ghurmur*	Sapotaceae	Fruit	Used as an antiseptic and digestive tonic.	Rout & Panda, 2010[11]

varied at different places. Roots and barks of the collected plants are dried under sun, chopped in to pieces and then powdered by husking paddles. Dried root, stem and other parts used for the purpose, both as such and powdered, are abundantly and openly sold in the local markets (Figs. 1a & b). Powdered plant ingredients are mixed with rice (*Oryza sativa* L.) powder. A suitable amount of water is added to make dough. *Ranu* is prepared in the form of rounded tablets and spread over straw beds in layer over layer with a final thin layer of straw cover. After 3 days, the *ranu* tablets are picked up from straw beds and dried under sun for about 2 days and stored for use in fermentation of rice beverages (Fig. 1c). These tablets are not only used for fermenting rice beverage but also used for treatment of various ailments. A paste of *ranu* tablets with saliva is applied on mumps by the tribes before sleeping to get relief. *Santals* also disinfect tasar silk worm eggs during indigenous rearing.

Preparation of *Handia*

Mechanically de-husked rice is soaked and boiled in water. The cooked rice is dried on a bamboo mat under sun (Fig. 1d). After drying, the rice is mixed with required amount of powdered *ranu* tablets (approximately 10 tablet per kg rice), kept in a large earthen pot or *handi* (hence the name of the product) followed by addition of required amount of water. The mixture is kept untouched for 3-4 days for fermentation. After proper fermentation a white supernatant was present at the upper layer containing 8-10% alcohol called *rashi*, which fetches higher price. After 2-3 days the fermented liquid is allowed to trickle down through a bamboo sieve, collected in earthen pots and is ready for consumption (Figs. 1e & f). The taste of *handia* depends on the plants used for *ranu*/*bakhar* preparation. About 8-10 *bakhar* tablets are used for 1 kg of rice, which together produce about 10 L of *handia*. The quality gets lowered on dilution.

On an average, some 30% of families prepare *handia* for their own consumption. Per capita consumption amounts to be about 1 L/day. Consumption is much higher during summer and hence, it is essentially a summer drink (Figs. 1g & h). It keeps the stomach cool, protects from extreme heat and is also intoxicating. *Handia* preparation and selling is a secondary source of livelihood for tribals and some accept it as a primary occupation. It is used in all social, cultural and religious purposes and no social occasion is considered complete without it. The *Santals* believe it to possess medicinal value, i.e. use it in the cure of jaundice, colic disorders and dysentery.

Mcrobiological analyses

Samples collected for the present study are prepared in varied lots, at different times and by different individuals. Samples of different preparation lots recorded wide variation in their microbial content and physico-chemical characteristics (Table 2). Lactic acid bacteria (LAB) count/mL was lowest ($1.08x10^3$) at Darogadahi and highest ($9.84x10^3$) at Takatpur. LAB presence in different samples belonged to one of the three categories: higher bacterial count (more than $8.0x10^3$), medium count ($5.0\text{-}8x10^3$) and lower count (less than $5.0x10^3$). There was not much variation in the microbial content of *handia* at any given point during the study period. This suggests standardization of the procedure. Analysis revealed that bacteria were always more abundant than yeast.

Moisture content (6.11 % to 7.62%) and *p*H (4.28 - 4.67) of all the samples was nearly uniform. Alcohol content of the samples was also uniform except at one point (0.78%) which might be due to dilution of the product for more benefit. There was not much variation in the average titratable acidity (0.702 gm/L) content of the samples. Some variation was observed in the total sugar content and protein content which was the result of rice and plant ingredients used for preparation.

Discussion

Preparation and consumption of cereal based beverages is a common practice in many Mid-Asian, Middle East and African countries[21,22]. These are known by different names at different places: *saki* in Japan, *lao-chao* in China, *tape ketan* in Indonesia, *khao-mak* in Thailand and *jhara*, *daru*, *kali*, *pachwai*, *apong*, *bunkchung*, *chi*, *laopani*, *jumai*, *suze*, *morpo*, *jou*, *zu*, *mod*, *harhia* and *handia* in India. These products have many advantages like superior digestibility and nutritive value compared to their unfermented counterparts. *Handia* preparation and consumption is a very common practice among the tribals of Mayurbhanj district specifically *Santals* and is prepared in almost every third house. Almost all tribals are fond of drinks and consume

Fig. 1—(a & b) Powdered mixture of different plants and parts thereof ; (c) readymade *ranu* tablets in the local weekly markets to be used for *ranu* preparation; (d) Drying of boiled rice in bamboo mat to be used for *handia* preparation; (e & f) Processed *handia* in earthen pots; (g) Selling and consumption of the beverage

during every ceremony, festivals, marriages, funeral feasts, and offer it to their, guests, gods and deities[7]. In marriages, the amount of *handia* to be given to the girl side is decided well in advance.

Handia is generally prepared throughout the year, but most common during the summer months (March to June). Women and children are also fond of these beverages but consume in small quantity and preferably during festivals, ceremonies and on Sundays. Tribals get 5-10% of their daily nutrient requirements that plays a supplementary role in the nutrition of the people[23]. In small quantity, these beverages are also used as medicine for treating different ailments or diseases. It cures jaundice, colic, and dysentery. It protects from sun stroke and maintains the motility and tone of the gastro-intestinal

Table 2-Physico-chemical and microbiological characteristics of *handia* (N = 20)

Sampling location	Moisture (%)	*p*H	Alcohol (%)	Titratable Acidity (gm/L)	Total sugar (gm/L)	Protein (gm/L)	LAB (MRS)	Fungi (Czapekdox)
Palbani	6.28±0.85	4.24±0.03	1.38±.0.02	0.698±0.096	1.337±0.278	0.443±0.211	5.33 x10^3	4.39 x10^3
Takatpur	7.62±0.36	4.46±0.04	1.33±0.02	0.677±0.138	1.233±0.351	0.503±0.275	9.84 x10^3	7.37 x10^3
Roxy Road	6.91±0.94	4.50±0.08	0.78±0.09	0.776±0.078	1.192±0.385	0.422±0.297	1.21 x10^3	1.01 x10^3
Chhaupadia	6.11±1.02	4.34±0.07	1.22±0.04	0.688±0.101	1.502±0.277	0.862±0.164	3.82 x10^3	2.65 x10^3
Baghra Road	7.45±0.78	4.52±0.05	1.20±0.06	0.715±0.065	1.383±0.186	0.661±0.184	5.33 x10^3	4.13 x10^3
Tulasichoura	6.76±0.92	4.67±0.03	1.32±0.03	0.685±0.124	1.247±0.303	0.634±0.278	2.10 x10^3	1.74 x10^3
Darogadahi	7.02±0.89	4.62±0.06	1.13±0.07	0.795±0.086	1.700±0.158	0.900±00.73	1.08 x10^3	0.68 x10^3
Station Bazar	6.22±1.24	4.36±0.11	1.36±0,05	0.655±0.133	1.337±0.342	0.842±0.126	4.25 x10^3	3.78 x10^3
Hospital Road	6.53±1.32	4.43±0.07	1.29±0.08	0.678±0.162	1.278±0.387	0.765±0.237	8.00 x10^3	4.89 x10^3
Baripada Hat	6.98±1.41	4.28±0.06	1.08±0,05	0.659±0.089	1.382±0.227	0.721±0.270	5.81 x10^3	2.82 x10^3
Average	6.97±0.97	4.44±0.06	1.29±0.05	0.702±0.097	1.359±0.289	0.675±0.211	4.677 x10^3	3.346 x10^3

system. It is taken as a light tranquillizer by *Maria* tribe of Baster[24]. It is also given to treat fever, dysentery, diarrhea and gynecological complaints[25]. *Mahua* is given to treat dysentery by *Baiga, Gond,* and *Kol* tribes of Surguja district[26]. *Ranu* tablets are also used in treating cholera by *Gond* tribe of Surguja district[26].

Plant ingredients are used in preparation of starter culture (*ranu* or *bakhar*) universally that are essential for fermentation of rice to prepare beverages. After surveying 12 districts of Odisha including Mayurbhanj, Dhal *et al.*,[8] recorded the use of bark and root of 6 plant species in the preparation of *bakhar* by the tribals. However, our study in Mayurbhanj district alone listed as many as 20 plants that are used in the preparation of *ranu or Bakhar* (Table 1). We have recorded the use of almost all parts of different plants, such as root, stem, shoot, bark, leaf, flower, fruit and seed for the purpose. However, not all these parts from a single plant are used. Singh[27] has reported the use of several plant species in the preparation of drinks in North-eastern states of India. *Canna edulis* (Ker Gawl.) and *Zea mays* (L.) are used in the preparation of *rokshi,* a local drink of Sikkim. Mature leaves of *Allophylus cobbe* (L.) Blume, *Antidesma roxburghii* Wall. ex Tul. and tender leaves of *Artocarpus heterophyllus* (Lam.), in equal proportions together with few chili, are used in the preparation of *Choarak*, a local wine of Tripura state[27]. For preparation of *Yu,* four plants, *Albizia myriophylla* (Benth.), *Tectona grandis* (L. f.), *Ficus hispida* (L. f.) and *Alocasia indica* (Roxb.) Schott are used. Tribal inhabitants of tea gardens in Terai region of west Bengal use 12 plants, specific parts for particular purpose, for preparation of rice beer *jhara* or *haria*[6]. Sweetness of the liquor is developed by the use of tuberous roots of *Coccinia grandis* L. (Voigt), whole plant including fleshy roots of *Veronia cinerea* L. (Lessing) and leafy twigs of *Scoparia dulcis* (L.). Similarly, young and soft leaves of *Clerodendrum viscosum* (Ventinat), bark of *Oroxylum indicum* (L.) Benth. ex. Kurz, root bark of *Rauwolfia serpentina* (L.) Benth., and bark of *Wattakaka volubilis* (L. f.) Staph., produce a bitter taste. Leafy branches of *Plumbago zeylanica* (L.) act as a process enhancer. Roots of *Stephania japonica* (Thumb.) Miers and *Stephania glabra* (Roxb.) Miers are used for long storing. Roots of *Mussaenda roxburghii* (Hook. f.) and leaves of *Artocarpus heterophyllus* (Lam.) impart sweetness and yellowish tint to the liquor[6]. *Baiga and Gond* tribes of Central India use roots, barks, rhizomes, leaves and seeds of some 21 plants for making *ranu*[7]. *Rabha* tribe of Assam uses some 10 plants for the purpose. Recognition of proper combination and use of alternatives are the result of their testing through trial and error and of prolonged analytical observation. The total amount of each plant used and the amount of starter culture (*ranu*) provides material for further research. The tribals get the phytotherapeutic value of these plants through the drink. The use of specific plants and parts thereof is a tradition and passed through generations. However, due to the loss of biodiversity and fragmentation of habitat, all the plants are not available in the vicinity of a particular village.

The samples collected for the present study represented various preparation lots by different people at different times. In spite of this, the products recorded almost uniform values in parameters like

*p*H, alcohol content, titratable acidity, total sugar and protein content. This indicates that the people of the region follow a standard practice for manufacturing *handia*. The observed variation in total sugar and protein concentration was due to the quality of raw materials (plant parts and rice variety) used by various manufactures. Because of the lower alcohol content (0.78 - 1.38%) in comparison to other commercial alcoholic products (8 - 60% alcohol), the consumers seldom get alcoholic even after repeated consumption. It compensates the water loss of the body during heavy physical labour particularly in summer months. It has comparatively lower nutrient quality (protein and carbohydrate content), but this is compensated by the cost factor (Rs. 7/- per L) which matters much for the poor tribals. Besides, it is non-toxic as it does not contain any pathogenic bacteria. Hence, it is used as a cheap alternative food by the tribals.

The results revealed the predominance of LAB and yeasts. The dominance and association of LAB and yeasts are common in several traditional cereal based fermented food and beverages[28-33]. Enumeration of these organisms, however, varied in different reports. Fermented preparations have higher antimicrobial properties than unfermented ones due to the lowering of *p*H and the production of other antimicrobial compounds during the fermentation process[34,35]. The pathogenic bacteria remained undetected in all the samples of the present study. Samples of the millet dough had very low to undetectable numbers of enterobacteriaceae at *p*H values of less than 4.5. Nout[36] and Mensah *et al.*[37] also reported their disappearance as *p*H comes below 4.5, although the later suggested that the antimicrobial effect of fermented maize dough *porridge* was not due to *p*H per se but probably due to the presence of other antimicrobial compounds. Kingamkono *et al.,*[38] also reported on the antimicrobial effect of *togwa* on several enteropathogens. Besides, cooking of the rice at a higher temperature further reduces the microbial count.

Traditional significance of the study

The study establishes the deep knowledge of tribal people in terms of selection of plants for preparation of *handia* and the processing technique. The lower alcohol content does not make the consumer alcoholic and it is cheap which very much suits to their economy. The fermentation of the product increases the antimicrobial potential along with the growth of probiotic LAB and yeast. Besides, both the *ranu* tablets and *handia* are used in the treatment of several ailments. Probably, this is central theme in the preparation of rice beverages by the tribals across the world.

Conclusion

It is possible that the traditional knowledge of beverage preparation along with various parts of different plant species used will be a useful lead for phytochemists and pharmacologists for further study. Once the efficacy of these indigenous drinks is scientifically established, the popularization of these remedies can be recommended in conventional healthcare systems for wider applications. The present work is a humble effort to document the indigenous knowledge on uses of plants by tribal people which will contribute towards further study and lead to drug discovery in future. Further work is required to fully characterize the predominant microorganisms and to establish their technological roles and contribution to product quality and safety.

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