

Physiology and Biochemistry of Indigenous Tribal Liquor Haria: A State of Art



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Submission: August 21, 2017; **Published:** September 20, 2017

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Abstract

Haria, also known as rice beer is an ethnic alcoholic drink that has gained huge approbation among the tribal's of Bengal. The liquor is mostly prepared using the indigenous knowledge of the tribal community. The uniqueness of the liquor lies in the application of Bakhar, an amyolytic starter culture. Although, the preparation of Bakhar differs from community to community but ~42 species of ethno-botanically important plants are mostly used. The microbial consortia are naturally outsourced from rice and herbs used for the preparation of Bakhar. The amyolytic starter culture consistently generates maltooligosaccharides, which is a low calorie ingredient, less sweet and viscous, capable of retaining ample quantity of water within it. Besides, serving the purpose of a beverage, Haria can compensate the loss of water in the human system under extreme high temperature. Together with this, the drink also serves as a remedy for several acute and chronic diseases which may be due to the use of certain medicinal herbs as starter culture.

Keywords: Fermentation; Beverage; Tribe; Haria; Bakhar

Introduction

Preservation of foods through natural fermentation is a widely accepted methodology, practised from the ancient times. The aforesaid process mostly emerged through the indigenous knowledge of the ancestors of the Tribal communities. A huge number of traditional ethnic practices have been neglected and thus no proper documentations are available for scientific analysis. But while analyzing Haria it has been recorded that a huge number of diversified flora and microbial culture have been incorporated during manufacturing of such product which are used traditionally by the tribal communities in their traditional rituals.

In India, till date several tribal communities are widely distributed throughout the geographical extent. The substrates used for the preparation, amyolytic starter culture and its preparation, processing methodology and the environment differs from community to community and are the main decisive factors responsible for the final end product. The topographical location of tribal community is majorly responsible for the substrate and selection of local herbs. The aforesaid selection is crucial in defining the biochemistry of the process and the microbes responsible for carrying out fermentation. The synergistic effect of biochemical composition of the substrate and microbes mostly defines the profile of the product. There

is a firm belief among the Tribals that despite of serving the purpose of beverage, brewed liquors sometimes acts as a remedy to several acute and chronic diseases. Therefore, they are still striving to preserve their indigenous culture and carry their ancestral legacy from generation to generation [1,2]. The present article deals with the processing methodology and preparation of the amyolytic starter culture adopted for the preparation of Haria, a brewed liquor ethnically processed by the Tribals of the lateritic part of West Bengal. The article also emphasizes the nutritional importance of the liquor among the tribals of the region and tries to analyze the biochemistry of Haria and its health impact.

Natural Processing and Preservation

Modern food processing employ several techniques like pasteurization, thermal heat processing, appertization, sterilization to reduce the microbial load in food products to increase the shelf life of the food. Even for preservation chemical additives (nitrites, sulphite) and organic acids (sorbic acid, propionic acid, benzoic acid) are widely used to restrict the growth of microbes. But application of such modern processing techniques reduces the nutritional quality of foods as well as synthetic preservatives enforces to compromise with the organoleptic properties of food. In the recent time, consumer's

negative perception towards synthetic preservatives and growing interest on minimally processed and nutritionally enriched foods drives the researchers to rethink and reinvent procedures to meet the demand [3]. During the research process scientists discovered the antimicrobial activities of essential oils and bioactive present within the flowers, bark, seeds, roots, fruits, leaves of plants and their ability to preserve food naturally. The synergistic effect of these herbs along with the microbes has immense positive health impact on human system by curing diseases like diarrhoea, menstrual cycle, cholera, jaundice, piles, fistula etc. [4].

The interdependent application of plant parts and microorganisms in food processing and preservation technologies associates to the process applied by our lineages and their level of understanding behind the methodology. This method not only keeps intact the nutrition part in the food but also eliminates the use of chemical preservations that in order to retain the desired aroma and scrumptiousness of the product that extremely satisfy to the trades [5]. On the other hand, the potential of microbes including several species of Lactic Acid Bacteria (LAB) to produce organic acids (phenyllactic acid, lactic acid, caproic acid and acetic acid), hydrogen peroxide, reuterin, bacteriocins, reutericyclin enables to create an unfavourable environment for the pathogenic microbes to grow within the food matrix [3]. It also abolishes the unwelcome constituents such as mycotoxin and endotoxins to enrich with malto-oligomers, phenolics, prebiotics, probiotics, antioxidants, antimicrobials and further modifies sensory qualities of the food [6].

The synergistic application of plant parts and microbes in food processing and preservation technologies connects to the process applied by our ancestors and their level of understanding behind the methodology. This processing not only include this drink under minimally processed category by keeping intact the nutritional content but also exclude the chemical preservatives needed for prolonging shelf life, which in turn retain the desired aroma and palatability of the product making it highly acceptable to the consumers [7].

Tribal community also known as “adivasi’s” (first settlers) or “vanyajati” (castes of forest) or “adimjati” (primitive people) have evolved throughout the geographical extent because of isolated land parts and forests. They are known to modern society for their linguistic representation, pristine religious practices and grass root culture, which in reality forms their identity. The indigenous knowledge of the communities is for their bonded harmony with the nature. This understanding not only aids in preserving their food but also provide appropriate nutrition and basic remedy for ailments. Beginning from the name of the drink, raw substrate, preparation of starter culture and processing methodology are exceptionally unique and thereby forms the basis of their culture, spiritual rituals and myths. Almost every tribal community consumes traditionally brewed liquor during their festivals, marriage ceremonies

and even in funerals. The preparation methodology virtually transfers from generation to generation and depends mainly on geographical location and the region they belong [8]. Preparation of starter culture that initiates the fermentation process is truly a unique piece of art and knowledge that is to be gained from every tribal community. Although modern food processing and microbiological techniques attempts to mimic the process using defined pure starter cultures but somehow still lack to develop the identical taste and aroma of the drinks. Tribal community enriches the liquor by the addition of additives where mostly different medicinal or “ayurvedic” plant parts are used. These plant parts are responsible for the source of microbes and also as a source of nutrients and bioactive compounds. Another aspect of these beverages is the belief of the communities that the brewed liquor acts as a remedy to several diseases. Scientific autopsy of the methodologies are prerequisite to justify the chemical composition and medicinal benefits of the liquors.

Fermented Beverage of Tribal India

Traditional fermented beverages have always been an integral part of the Tribal culture. It is a well known fact that ethnic liquors emerged from the indigenous knowledge of the ancestral tribal people. Although, each tribal community developed their own in accordance with the availability of substrates and the environment they belong. Handia or Haria or Rice wine is an ethnic, alcoholic, refreshing drink prepared by the indigenous experts of the rural areas. In India, Haria is mostly popular among the Tribal communities of Orissa and West Bengal which includes Santhal, Bonda, Kolha, Bhuinya, Bhumij, Didayi, Paroja, Sabar, Mundari, Bhatoda etc. [9,10]. Nonetheless, the drink gains popularity and draws attention for its simple product processing, comparatively cheap, high medicinal value and unique palatable taste.

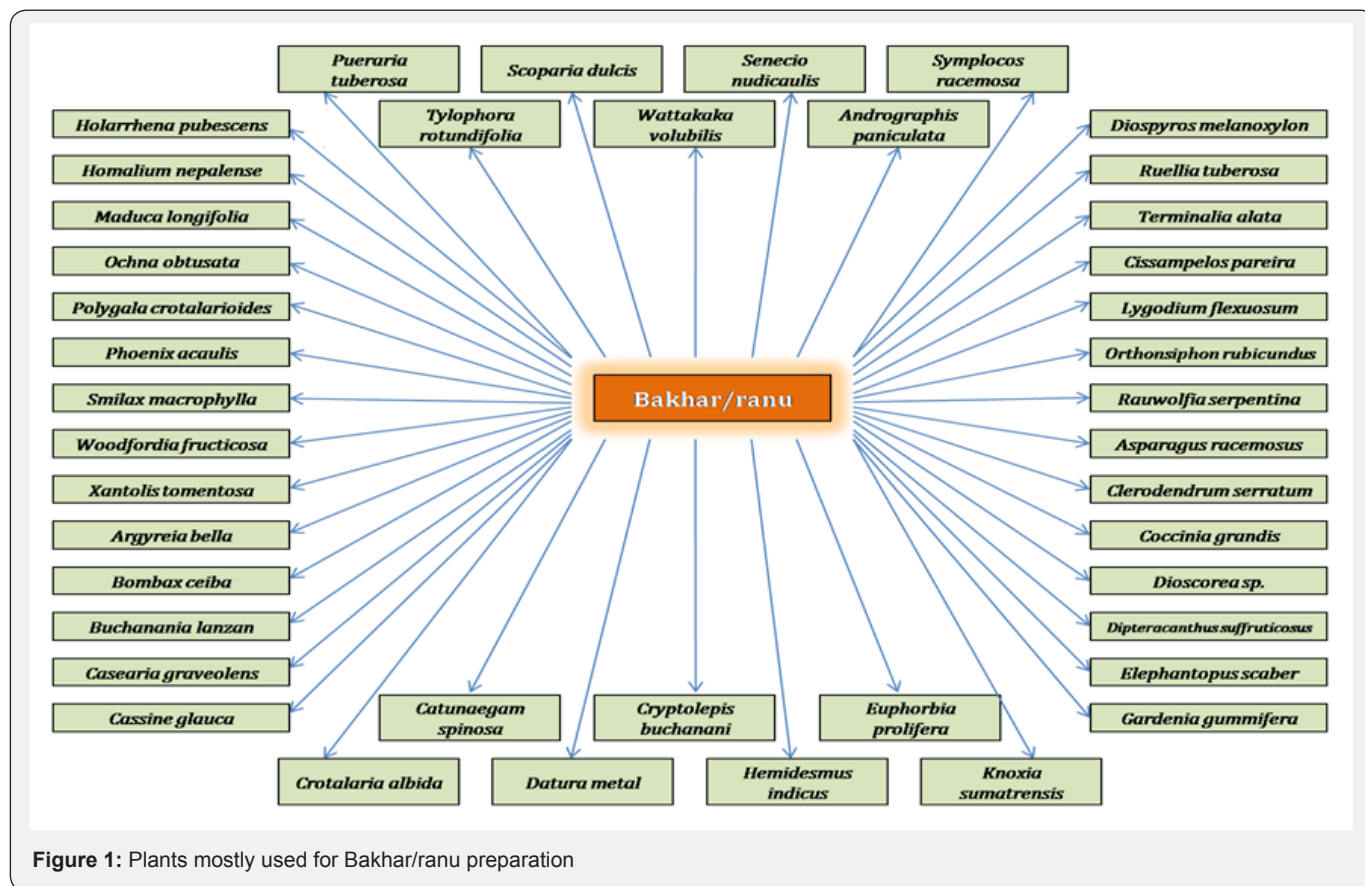
Methodology of haria production

The methodology for Haria preparation is described by two phases- (i) Making of Bakhar or ranu tablets, (ii) Processing of rice for microbial fermentation.

Making of bakhar/ ranu tablets: Bakhar acts as an inoculum or source of microorganisms added to initiate the fermentation process. Conventionally, the tablets are composed of raw rice powder and a powdered mixture of distinct phyto-therapeutic plant parts. In Bakhar, permutation and combination of plant parts from ~42 species (Figure 1) are used for the composite formulation [1,10-12]. Although, the ratio used remains a trade secret but there exists a disparity in the composition of plant parts among distinct tribal communities which depends on the season and availability of the plant. Mostly, the parts of the plants are collected from local areas or markets, diced into pieces, sun dried and then grounded under husking paddles or “dheki”. The composite is then mixed with raw rice powder in the ratio 1:1 and sufficient amount of water is added to prepare tough dough. The dough is then used to make tablets which is then spreaded

over straw beds and covered by a thin layer of straw followed by sun drying for 2 days. The above process possibly confers that

microflora employed for the fermentation is solely from natural source [1].



Processing of rice for microbial fermentation: Initially, the process begins by de-husking of rice. Rice is then boiled to disrupt the starch granules so as to favor the fermentation process. The boiling process is followed by draining of excess water and drying of rice under sun by spreading over bamboo mat. Rice is then mixed with bakhar tablets (approximately 1 tablet per 100 grams of rice) in an earthen pot in presence of excess of water. The pot is kept untouched for 3-4 days for saccharification and fermentation process. After incubation, a clear whitish layer forms, known as “rashi” which contains 8-10% of alcohol. This layer containing alcohol (called “rashi”) is decanted. Rest of the fermented liquid is then screened through a bamboo sieve and get ready for consumption. On an average about 10 litre of haria is produced from 1 kilogram of rice [1].

Biochemistry and microbiology of haria

Scientific research reports unfolds that Haria is a combined product of liquefaction, saccharification and fermentation processes. Mostly, aerobic bacteria, yeast, mould, LAB, Bifidobacteria work synergistically to complete the biochemical processes [13]. At the beginning, an aerobic bacterium initiates the fermentation process and dominates over other

microorganisms. The hydrolytic activity of aerobic microbes sets the environment for the growth of the yeast and mold. Although, the count of yeast and mold are maximum on the 2nd day of the fermentation but the production of amylase and glucoamylase are found to be optimum on the 3rd day [14,15]. In fact, LAB and Bifidobacteria were dominant throughout the fermentation process with respect to the 0th day, which is evident and reflect the fact that the microorganisms are outsourced from the medicinal herbs used for the fermentation. It is apparent to decipher that amylase and glucoamylase are the enzymes responsible for the saccharification and liquefaction of the rice, where amylase converts complex polymers of amylose and amylopectin into limit dextrin and thereafter glucose is produced by the action of glucoamylase [16,17]. This glucose is then utilized by yeasts for the production of alcohol. The synergistic enzymatic activity also leads to the formation of malto-oligomers including maltotriose, maltotetraose and maltopentaose. And these malto-oligomers are highly water soluble and thereby responsible for the production of clear solutions, leading to the formation of the final product [2]. It has been reported that, amylolytic yeast *Saccharomycopsis fibuligera* in fermented rice are also responsible for the production of oligosaccharides [18].

Nutritional importance

In Haria, lactic acid (1.42%) production by LAB exerts beneficial effects on human health as they restricts the growth of pathogens as well as provide anti-allergic, immuno-stimulatory, anti-tumor and anti-ulcer effects. Production of malto-oligomers makes it an ultimate product for human consumption as it prevents the growth of pathogenic gastrointestinal microflora, have low calorific value, low viscosity, low water activity, and high moisture retaining capacity. During the fermentation of haribial metabolism process, many sugar derivatives are produced such as β -d-manopyranose pentaacetate; 1,2,3,6-tetra-O-acetyl-4-O-formyl-d-glucopyranose; 2,3,4,5-tetra-O-acetyl-1-deoxy- β -d-glucopyranose. These sachharides derivatives can conjugate with different components, like proteins and also various receptors of glycosylate present on the membrane of pathogenic bacteria and digestive tract wall of animal [19] to promote their activities. For instance, some conjugates are involved with immune system like alpha-d-mannan/protein that enhances the activity of immune system [20,21].

Presence of phenolics and flavonoids can be correlated with free radical scavenging and anti-mutagenic property of the product that prevents several degenerative disorders and risk of heart diseases [2]. Due to its low alcoholic content (0.78-1.38%) compared to other alcoholic drinks (8-60%), consumers can intake sufficient amount of this drink as it compensate the loss of water from the body during heavy labor work in summer season. Although, there is a tribal practice of using Bakhar tablets in ailing mumps but there is a belief that Haria cures diseases like jaundice, dysentery etc. Maria tribe of Baster district also use this tablet as a mild painkiller. While ranu tablets are used for treating cholera by Gond tribe of Surguja district. The product is non-toxic, cheap and thus acts as a food supplement [1]. In addition, it is also used as a remedy for skin, eye and hair and heart protective agent [22].

Conclusion

Among all the fermented products alcoholic beverages has been found to be one of the most important and widely acceptable popular drink in the world. The native knowledge behind the processing and preparation of local liquors by the tribal's are unique and praiseworthy. Modern food technologists although made several attempts in mimicking the traditional processes but their failures advocates to carry interdisciplinary research on fermentation technology for maintaining the authenticity of the process. The rationalized application of microbes in tailor-made media and their preponderant role in fermentation for defining the composition of the product need considerably promising microbiological research. Application of advance/emerging scientific research in traditionally prepared indigenous fermented beverages makes it more nutritional, safe and potential therapeutics. Identification and confirmation of health benefits of fermented beverages could

be a great inspiration for future beverages industry. The lactic acid content in Haria has numerous beneficial health effects like immune-stimulation, reducing cholesterol, endocrine secretion stimulation as well as shows protective roles for intestinal mucosa and overall intestinal function. Thus, the health promoting effect of lactic acid, probiotic organisms and bioactive substances from microbes and plant materials likely make Haria, a healthy nutritive drink. Hence, evolution and evaluation of fermented beverages is more promising as they are found to be trendy and widely admired among modern as well as tribal communities throughout the world. The current review emphasizes on the scientific evaluation, upgradation and commercialization of non-popular tribal drinks like Haria that carries considerable potential for its nutritional and medicinal value.

Conflict of Interest

There is no conflict of interest among the authors.

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DOI: [10.19080/AIBM.2017.06.555683](https://doi.org/10.19080/AIBM.2017.06.555683)

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