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Original article

Uniqueness of Ethiopian traditional alcoholic beverage of plant origin, *tella*

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ABSTRACT

There are many kinds of traditional fermented beverages in Ethiopia, not only of animal origin, but also of plant origin. In everyday life people enjoy fermented beverages and particularly when having guests, they like to treat them to traditional alcoholic beverages. *Tella*, *tej*, *areki*, *borde*, and *shamita* are drinks that each household brews to treat guests. Substrates for their production are from locally available raw materials. Therefore, the basic production method is the same, but the tastes may vary. One of the most consumed fermented alcoholic beverages is *tella*, which is made mostly with barley but wheat, maize, sorghum, and *teff* are utilized depending on the region. Its production process shows the similarity to beer: addition of malt and *gesho* which has the same function as hops in beer. The main fermentation yeast is *Saccharomyces cerevisiae* and saccharification of cereal starch seems to depend on malt. However, the degree of alcoholic fermentation is low and alcohol content varies between 2 and 6%. Lactic acid bacteria are very active in *tella* so pH ranges 4–5 give typical tastes such as sourness, sweetness, and bitterness. As the Ethiopian economy improves, more people drink western style beers. *Tella* has not been commercialized yet, so the process has not been standardized and modernized. Considering the case of Korean *makgeolli* and the Ethiopian creativity of utilizing *gesho* in *tella*, Ethiopia should pay more attention to *tella* for globalization.

1. Introduction

Alcoholic beverages are a part of human dietary culture and have an inseparable relationship with the life of mankind in history. The making and drinking of alcoholic beverages are ways of enhancing the nutritional significance as well as social relationships for human beings. Exactly when mankind started to produce and consume alcoholic beverages is not known but beer is known to have been produced by the Sumerians before 7,000 BC [1], while wine has an unequivocally recorded history stretching back nearly 6,000 years, with the earliest evidence dating between 5,400 and 5,000 BC [2].

Almost all countries and regions all over the world have traditional alcoholic beverages, which utilize indigenous agricultural produce. Alcoholic beverages of plant origin represent a vast diversity of products (Table 1) [3]. However, in general, alcoholic beverages can be classified into three main categories: wines, beers, and spirits [4]. This classification is based on production methods: (1) by mono-fermentation; (2) by malting and fermentation; and (3) by distillation after fermentation. Yeasts are able to produce ethanol primarily through metabolism of the low-molecular-weight sugars that can be transported into the cell cytoplasm. Thus, fruits with sugars can be utilized to produce alcoholic beverages such as wine and ciders by direct fermentation [5]. However, in production processes utilizing cereals or tubers, fermentations must be preceded by depolymerization of storage polysaccharides and proteins yielding the sugars and amino acids that can be utilized by the microorganisms [6]. This explains the process for producing beers. To produce spirits such as brandy, whiskey, and vodka, the alcoholic beverages are produced by either the mono-fermentation or fermentation after starch hydrolysis by amylolytic enzymes, and are distilled.

2. Ethiopian alcoholic beverages of plant origin and their production

In Ethiopia, very popular traditional fermented alcoholic drinks include *tella* [7], *tej* [8], *areki* [9], *borde* [10], and *shamita* [11]. *Tej* is mead which is prepared from honey, water, and leaves of *gesho*

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Table 1
Some of the traditional alcoholic beverages of plant origin in the world.

Country	Beverage	Substrate
Andes regions	*Chicha*	Maize
Bhutan	*Aarak*	Barley
China	*Tien-chiu-niang*	Rice
Egypt	*Bouza*	Wheat
Himalayan regions	*Raksi*	Cereals
India	*Aarak/Buza*	Barley
	Bhang-chyang	Maize
	Chulli	Apricot
	Duizou	Red rice
	Ennog/kiad lieh	Rice
	Kanji	Carrot
Japan	*Sake*	Rice
Korea	*Makgeolli*	Rice
Mexico	*Pulque*	Cactus
Mongolia	*Darassun*	Millet
Nepal	*Kodo ko jaanr*	Finger millet
Nigeria	*Pito*	Sorghum
Philippines	*Basi*	Sugar cane
Russia	*Bagni*	Millet
South Africa	*Bantu/kaffir*	Sorghum
Sudan	*Merrisa*	Millet
Tanzania	*Mbege*	Millet
Thailand	*Sato/krachae/nam khao*	Rice
Tibet	*Aarak/lugri*	Barley
Uganda	*Kwete*	Maize
Vietnam	*Ruou de/ruou nep*	Rice
Zimbabwe	*Mangisi*	Maize

Note. From "Fermented foods and beverages of the world", Tamang JP, 2010, p. 85–125. Copyright 2010, *CRC Press*. Adapted with permission.

(*Rhamnus prinoides*) [8]. Mix one part honey to three parts water, put in some stems and branches of *gesho*, and let it ferment for 5–6 weeks, removing the *gesho* after 2 weeks. *Areki* is a colorless distilled alcoholic beverage from fermentation products prepared in the same way as *tella*. The preparation of *borde* [12] is as follows: it is made from maize or wheat. A thick coarse paste of wheat or maize flour is roasted on a hot flat metal pan and cooled for 1 hour. Then it is thoroughly mixed with ground malt. The whole mixture is put into a jar and further blended with water and allowed to ferment at ambient temperature for 24 hours. *Shamita* is prepared as follows [11]: (1) dehulled barley is roasted on a flat metal pan until it turned light brown and ground finely; (2) barley flour, salt, ground linseed, and assorted spices are mixed together; (3) this mixture is mixed with water in a jar and then the jar is sealed tightly and allowed to ferment overnight at ambient temperature. Pepper is optionally added depending on the consumer's preference.

Borde and *shamita* are mainly consumed in central and southern parts of the country, while *tella* and *areki* are very popular in northern parts of Ethiopia. *Tej* is a honey wine and consumed in Ethiopia as well as Eritrea. However, *borde* and *shamita* are not exactly alcoholic beverages but fermented low alcoholic beverages with a thick consistency consumed as a meal replacement in some districts [9,13].

Among various Ethiopian fermented alcoholic beverages, *tella* has many varieties in the various regions and is made with diverse cereals such as barley, wheat, maize, millet, sorghum, and *teff*. It is, by far, the most commonly consumed alcoholic beverage in Ethiopia [13]. How the *tella* is produced differs among ethnic groups, and their tradition and economic situation affect the kind of cereals they utilize. The basic processing steps are similar.

How to prepare the barley *tella*: (1) a clay container (jar) is washed with water and cleaned with leaves of *grawa* (*Vernonia amygdalina*); (2) then the jar is fumigated by the smoke of burning chips of *weyra* (*Olea europea*) or *tinjute* (*Otostegia integrifolia*). This will eliminate some adverse microorganisms present in the inside of the jar and contribute to unique *tella* flavor; (3) malt (*bikil*) is prepared by grinding the dried germinated barley, maize, or wheat. For preparation of malt, cereals were moistened in a container and left to be germinated for about 3 days, and then sundried; (4) *gesho* plant (*Rhamnus prinoides*) is prepared to make a powder of leaves or shreds of stem. *Gesho* has some antibacterial effects against some groups of bacteria while imparting the typical bitter taste to *tella*; (5) flour of barley is made into dough and baked to make a unleavened bread (*kita*); (6) *kita* is broken into small pieces; (7) barley is ground to flour and roasted (*enkuro*). The extent of baking or roasting determines the color of *tella* to be from light yellow to dark brown.

The fermentation process has four phases [7]. At the first phase, dried *gesho* leaves (Fig. 1) are soaked in water for 4–5 d. The second stage starts by mixing malt (*bikil*) and unleavened bread pieces (*kita*) into the *gesho* leaf-soaked water with additional powders of *gesho* leaves and stem. In some areas, herbs are added at this stage. This is left to ferment for 2 days or more. At the third stage, powder of the *gesho* leaves and pounded stem and barley flour are mixed into a thick slurry and left to ferment for 2 days or more. At the final phase, the container is filled with water to the brim and the slurry is mixed thoroughly. The container is then sealed with mud to create an anaerobic condition and left for 2 days or more (Fig. 2). *Tella* is consumed directly or after filtration. To prepare *tella*, in general, 1 kg of *gesho*, 0.5 kg of malt (*bikil*), 5 kg of unleavened bread (*kita*), 10 kg of flour (*enkuro*), 30 L of water are needed. The final alcohol content of *tella* is 2–4%, while that of the filtered drink is 5–6% (Fig. 3 and 4).

3. Comparison of characteristics of Ethiopian *tella* with Western beer

Tella is called Ethiopian traditional beer. Its production process is similar to beer making in that the grain starch is converted into sugars by malting. However, there is no yeast inoculation stage for fermentation but it utilizes the natural yeast present on the cereals. The dominant microorganism after the end of the first stage until the completion of *tella* fermentation was reported to be *Saccharomyces cerevisiae* and *Lactobacillus pastorianumi* [7]. *Saccharomyces cerevisiae* is known to be the top fermentation yeast for ale production, while *S. pastorianus* or *S. carlsbergensis* are the bottom fermentation yeasts used for lager beer production [14]. Alcohol is a by-product of yeast metabolism and is toxic to the yeast; typical brewing yeast cannot survive at alcohol concentrations above 12%

Fig. 1. From the left, powdered leaves, leaves, and stem shreds of *gesho*.