

Production, Optimization and Characterization Of Ethiopian Traditional Fermented Beverage 'Tella' From Barley

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ABSTRACT — This study sought to elucidate the scientific and technological approaches of Ethiopian traditional fermented beverage tella, through optimization and characterization. The aim of this study was to evaluate three different mix ratios for the processing of traditional Ethiopian beverage 'tella', namely small proportion of bikil(malt) to gesho(hop) (1:3), equal ratio of gesho(hop) and bikil(malt) (1:1), and tella with maximum bikil(malt) to gesho(hop) ratio (3:1). Sensory, PH, alcohol content and fermentation time were major criterion for comparison. Optimization conditions were carried by optimizing the mix ratio of raw materials, fermentation time, PH and temperatures. The sensory evaluation was compared the color, aroma, taste, and general acceptability. It was found that the tella production were similar to beer in terms of sugar and acidity. The optimum fermentation temperature ranges from 20-25°C, the average alcohol concentration was 8.24%v/v, the PH value was 4.78, fermentation time 5 to 7 days and malt to hop ratio of 1:3 was optimal for tella production. The sensory evaluation also showed that production of tella with malt to hope ratio of (1:3) had more acceptances, 90% panelists select this ratio.

Keywords- Traditional beverage Tella , Fermentation, optimization.

Introduction:

Fermented beverages produced from cereals usually referred to as beers while those produced from fruits are classified as wines [1]. Indigenous fermented alcoholic beverages from different parts of the world are described [2]. Among these, information on the microbiology and biochemical properties of varieties of the indigenous African fermented alcoholic beverages is available. These include Egyptian bouza, Tanzanian wanzuki, gongo, tembo-mnazi and gara, Nigerian palm-wine, Kenyan muratna and uragela, and South African kaffir beer [3]. Indigenous Ethiopian fermented beverages include tejj, tella [4, 5, 13] borde and shamita [6] areki, traditional liquor [7,13]. Alcohol in traditional beverages serves as source of calories valuable to the calorie deficient villager. Ethanol has gross calorific values of 30 MJ/Kg [8]. The primitive beverages provide not only calories but also vitamins and proteins due to residues of the substrates, the fermenting yeasts and other microorganisms [3,9]. Riboflavin and nicotinic acid are found in kaffir beer due to synthesis of vitamins during malting and fermentation [10]. Mexican pulque is consumed as a nutritional supplement because of its vitamin content and protein.

The traditionally fermented beverages are low-cost product in all aspect as they are usually manufactured using only rudimentary equipment. Because of their cheapness, low-income groups mostly consume them. Thus, their handling and consumption often takes place under conditions of poor hygiene [11].

Ethiopia is one of the countries where a wide variety of traditional fermented beverages are prepared and consumed. The various traditional fermented beverages consumed in Ethiopia consists of high alcoholic beers such as tella; low alcoholic beers such as keribo, buqri, shameta, borde, wine such as tejj made from honey and distilled spirits such as katikala or areki [12]. Tella is one of the Ethiopian traditional beverages, which is prepared from different ingredients. It is, by far, the most commonly consumed alcoholic beverage in Ethiopia

It is assumed that over two million hectoliters of tella to be brewed annually in households and drinking houses [6]. Depending on the type of cereal ingredients used to make, tella has different names Amhara tella, Oromo tella, and Gurage tella [13]. Amhara

tella has gesho (rhamnus prinoides) and concentrated. Gurage tella is delicately aromatized with a variety of spices. Oromo tella has no gesho (rhamnus prinoides), and it is thick and sweet [5]. Tella is made from different cereals teff and corns are the most popular, but in some areas barely, millet or sorghum can be used [14]. The way of preparing tella differs among the ethnic groups and depends on traditional and the economic situation.

There are several recipes for making tella and it appears as if every house wife has her own version of the recipe [6]. The fermenting organisms of tella are composed of s.cervisea and lactobacillus species. Increase in ethanol content (2.2 to 5% (v/v)) is directly associated with increase in the population of yeasts and decrease in reducing sugar and total carbohydrate. The PH of tella is in the range of 4.5 to 4.8 [15]. For tella considered a good quality, the final ethanol content is in the range of 2-8% (v/v) and PH is 4-5 [6]. But the ratios still different from region to region and even different from one house hold to the next households in the same region due to absence of well-organized procedures as well as lack of consideration to scientific scholars on the development of this well-known beverage. This paper addresses some issues on the development of this beverage.

MATERIALS AND METHODS:

1. Material and sample preparation

The basic raw materials were barley, barley malt, gesho(hop) and water. These raw materials were obtained from the local market in Bahir Dar .The experiment on fermentation and physicochemical analysis were carried out in the school of chemical and Food engineering laboratories, Institute of Technology, in Bahir Dar University.

General experimental procedure for the production of Tella

- 1. Soaking of barley:** barley was soaked for three days in water. This is for three main reasons; the first is to reduce the energy/wood consumption during cooking, secondly; preparing the sugar present in barley for enzymatic or microbial action and thirdly, to get equal distribution of heat during roasting.

2. **Roasting of barley:** After three to four days soak, the maize directly roasted by fire wood using bired mitad (metallic material used for roasting) until the color medially dark then flesh off the seed easily. The main advantage of roasting is for colorant that can attract customers/to have customers' quality standard. Over darkening of the roast may lead to loss of the sugar content of the barley and may cause the final product tella over dark.
3. **Grinding of ingredients:** grinding roasted barley, malt and hop to appropriate fraction for better hydrolysis and enzymatic action
4. **Preparation of Enkuro:** prepared by adding water to grounded roasted barley and heat treatment up to color change to near black for ease to fermentation
5. **Yetela kitta:** this can be used the same reason as enkuro but the preparation is different. Only the raw powdered barley was well mixed with small proportion of water and can be agitated well. Then after 1 to 3 hours waiting, it can be baked. The baked bread was then dried and grounded in to pieces to make the sugar ready for s.cervisea for conversion to alcohol [6].
6. **Preparation of fermenter tank:** The fermenter tank was washed with Grawa leave (cleaning material) and after cleaning with Grawa leave the tank should be sterilized with weyra wood smoke for 45 minute for better aroma and to prevent external microorganisms.



Figure 4 : Fermentation of three different mix ratios

Result and Discussion

Sensory analysis

Sensory quality is the ultimate measure of product quality and success. Sensory analysis comprises a variety of powerful and sensitive tools to measure human responses to foods and other products. In this research ten people were selected those who knows well enough about the flavor, odor and color of tella. Since temperature has effect on nutritional value, color, taste and flavor sensory evaluation was conducted on the product produced at 20 °C. According to the sensory analysis results above 90% of the panelist preferred the sample of tella with more hop i.e hop to malt ratio 3:1 . The reason behind the excellence in quality of tella is because of gesho can give good aroma ,flavor and in addition to its aroma and flavor it can strongly act as a buffer which can adjust the media of fermentation then finally use as a filter media during filtration and also formation of haze is removed.

PH: The PH was measured from the time of making 'difdif' up to the time of good tella PH range obtained in the literatures. In the literature above, good tella is ranging from PH value of 4 to 5 [3, 15]. From the figure 5, all tella samples are in the literature of good tella ranges.



Figure 1: Enkuro



Figure 2: Yetela kitta



Figure 3: Fermenter Tank preparation for smoke with grawa

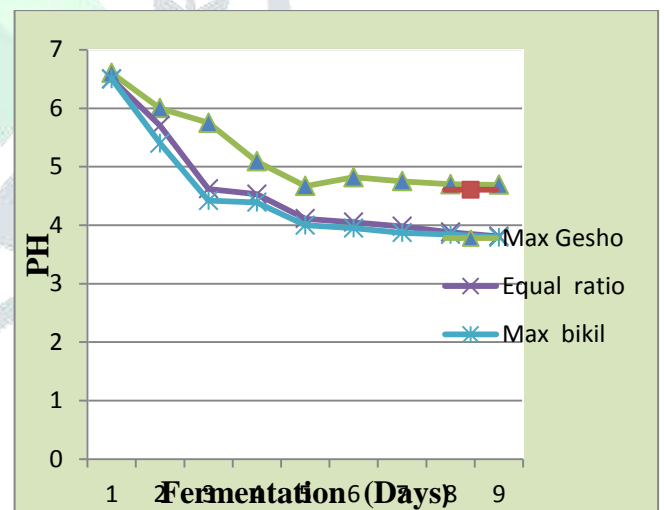


Figure 5: PH Versus fermentation days

But for samples with maximum malt and equal ratio in the figure 5 , the PH shows rapid decrease and went to more acidic medium, the rapid conversion of this product out of the specified day in the literature leads to more undesired product because secondary fermentation starts to occur. This will expire the product easily and the shelf life becomes too short.

Table 1: physicochemical properties of samples with malt to hop ratio

Samples	PH	Speci-fic gravity	Refractive index	Alcohol (%v/v)
1:3	4.78	1.00761	44.65	8.24
1:1	4.63	1.0075	43.15	7.71
3:1	4.14	1.0093	44.02	7.40

Table 2: Alcohol content,PH and fermentation rate of samples with malt to hop mix ratio

Mix ratio	1:3	1:1	3:1
Alcohol cont (%v/v)	8.24	7.71	7.40
PH	4.78	4.63	4.14
Fermentation rate	0.84	1.03	1.08

The average alcohol content of filtered tella for this paper was 8.24(%v/v) for malt to hop ratio of 1:3. And this is with the range of 8.1 to 14.59(%v/v). So from the result obtained from table 1 and table 2 the alcohol content of tella with more gesho satisfies the range of alcohol content of tella.

In the studies[12,15] the best tella takes retention time from time of didfid making up to addition of enough water for a drink is from 5 to 7 days and PH of best tella is between 4.65 to 5. The tella with more gesho from this experiment was in the range of best tella within this day and PH specified in different studies. Therefore, the tella with more gesho is optimum mix ratio for tella preparation process for a drink.

Conclusion and Recommend

A study aimed at development of production, optimization and characterization of local beverages tella with three different mix ratios. The results showed that mix ratio of malt and hop affects the physicochemical properties of the product significantly. The ratio of malt to hop was 3:1, 1:1 and 1:3 taken for the study. In the study the malt to hop ratio of 1:3 was the optimum condition for tella production and to have good test, for better shelf life, for more alcohol content and for minimum fermentation rate. The optimum fermentation temperature ranges from 20-25°C, the average alcohol concentration was 8.24%v/v, the PH value was 4.78, fermentation time 5 to 7 days and gesho to bikil ratio of 3:1 was optimal for tella production. The sensory evaluation also showed that production of tella with maximum gesho had more acceptance than the comparative ratio.

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