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Physico-chemical characterization of commercial Local Alcohol beverages available in South Nations, Nationalities and People's Regional State, Ethiopia

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Abstract : In this present paper the physico-chemical properties of local beverages (Tej, Tella, Areki, Checka and St. George beer) available inSouth Nation, Nationalities and People's Regional State of Ethiopia was evaluated. Samples for the research were collected from the market of Arba Minch town, properties such as pH, total dissolved solids, total suspended solids, total acidity and alcohol content of the local alcohol beverages were analyzed from samples. Tej and Tella with more acidic values of 2.85 and 3.28 than the other local drinks evaluated. The pHof Checka was lower than Araki with values of 3.66 and 3.9, whereas low acidic content was observed in St George with pH of 4.02. Checka had the highest value (0.015) in titratable acidity and the lowest value (0.009) was in Tej. Checka showed significant difference ($p<0.05$) from other drinks while there were no significant difference ($p>0.05$) in the values for Areki, Tellaand St. George. Higher value in titratable acidity of Checka may be attributed to the traditional methods of production which are not standardized in terms of raw materials, equipment and finished products quality and handling. Tella had highest value of 10.39% in total dissolved solid followed by Checka and St.George and also Tella had the highest total suspended solids when compared with the other drinks. Among the local drinks examined, Areki had the highest alcoholic content (24.54%). The high alcoholic content of araki signifies that the product can cause health problems such as liver damage and other organs like kidney in the body.
Key words : Areki, Tej, Tella, Checka, Physico-chemical Properties.

Introduction

In the developed and developing countries, fermentation process is one of the oldest technologies used for food processing and preservation and also millions of people are dependent on this technology for preserving and often enhancing organoleptic and nutritional qualities of their food at costs available to the average consumer (Gotchevaet al., 2001; Tamanget al., 2005; Kaluiet al., 2010).

Fermentation process enhances the nutritional quality of raw ingredient by improving the digestibility of nutrients and inactivating anti-nutritional factors and also improves the acceptability of food by destroying

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undesirable flavor of the raw ingredients (Steinkraus, 1983). Traditional fermented beverages are those that are indigenous to a particular area and have been developed by the local people using age-old techniques and locally available raw materials (Kebede et al., 2002).

The oldest alcoholic drinks were fermented beverages of relatively low alcoholic contents (Rose, 1977). Before the advent of the distillation technique as introduced into Europe by Arabs, the oldest alcoholic drinks were fermented beverages of relatively low alcohol content, such as beers and wines (Desta, 1977).

In Africa, fermented alcoholic beverages are consumed in different occasions such as marriage, naming and rain making ceremonies (Zvauya *et al*., 1997), at festivals and social gatherings, at burial ceremonies and settling disputes (Steinkraus, 1983). They are also used as medicines for fever and other ailments by adding barks or stems of certain plants (Okafor, 1972). Indigenous fermented alcoholic beverages from different parts of the world are described by Steinkraus (1983) and some of the indigenous African fermented alcoholic beverages include Egyptian bouza, Tanzanian Wanzuki, gongo, tembo-mnazi and gara, Nigerian palm-wine, Kenyan muratina and uragua, and South African kaffir beer.

Indigenous Ethiopian fermented beverages include tej (Vogel &Gobezie, 1983; Fite *et al.*, 1991), tella (Sahle&Gashe, 1991), borde and shamita (Ashenafi & Mehari, 1995; Bacha *et al*., 1998, 1999).Tellais made from different cereals. The most popularly used grains are Tefand corn, but in some areas barely, millet or sorghum can be used (Selinus, 1971). The way of preparing telladiffers among the ethnic groups and depends on traditional and the economic situation.Tejis a home-processed, but also commercially available as honey wine. It is a beverage mainly used for great feasts, such as weddings and the breaking of fasting. It is prepared from honey, water and leaves of *Gesho*(*Rhamnus prenoides*).

Arekiis a distilled beverage. It is a colorless, clear and traditional alcoholic beverage which is distilled from fermentation products prepared in almost the same way as *tella*except that the fermentation mass in this case is more concentrated (Fite*etal*., 1991). In cities, areki is most consumed by lower income people and by people who have become dependent on alcohol and cannot afford to buy industrially produced alcohol (WHO, 2004).

Checka is a traditional fermented beverage of Ethiopia, a common meal replacement in Southern Ethiopia around Konso areas and some parts of Arba Minch town. Checkais prepared from unmalted maize (*Zea mays*), barley (*Hordeum vuldare*), wheat (*Triticum sativum*), finger millet (*Eleusine coracana*), sorghum (*Sorghum bicolor*) and/or tef(*Eragrostistef*) and their malt, except sorghum and tef(Kebede *et al*., 2002). According to Mogessie and Tetemke(1995), it is consumed while actively fermenting and has a short fermentation period, usually overnight. Since they are fermented at homes and they are not labeled the content presents in beverages and lack of information about the physic-chemical properties of those alcoholic beverages. The objective of this project was to determine the physical and chemical properties of local alcoholic beverages available South Nation, Nationalities and People's Regional State.

Methods and Materials

Analytical Assay and sample collection

Sample of local alcoholic beverages tella, cheaka ‚araki' tej were collected from the different markets of Arba Minch. A sample of commercial beer from St George Beverage Company was taken as reference to traditionally prepared local beverages. All the samples were collected in screw-capped sterile glass bottles and kept in a refrigerator until the physic-chemical characterization by using the appropriate instrumentation.

pH Determination:

The pH was measured according to modified eletrometric method of Dornier *et al*. (1993). The pH meter was standardized with buffer solution.Then the buffer solution was prepared with pH buffer powder of pH 4.0 at 25^{o}Cdissolved in 250 ml distributed water.Finally, the electrode of the pH meter was immersed in a glass beaker containing the samples and reading were obtained from photo detector of the pH meter.

Determination of Total Dissolved Solids (TDS):

The total soluble solid content in the juice was determined using refractometric method, measured with an Abbe refractometer (Atago, Japan). The refractometer was standardised with distilled water at 20 ^{0}C. Two drops of juice at 20 ^{0}C was dropped on the lens (sensitive surface) of the refractometer and measured (AOAC, 2004).

Give the references…. A crucible was dried in the oven at 105^{o}C for one hour. Then it was placed in desiccator after one hour and allowed to cool.The crucible was weighed. 20 ml of the sample was filtered by using filter paper.The filtration was measured and poured into a weighted crucible. The crucible containing the filter was dried in the oven for one hour.After an hour the crucible was placed in desiccators and allowed to cool for one hour.Finally, the crucible containing the dried sample was weight again and total dissolved solids were calculated.

Determination of the total suspended solids (TSS):

The filter paper was dried in the oven at 105 ^{o}C for one hour and placed in clean desiccators for one hour. Next the filter paper was weighed.Then the filter paper was placed in the filter paper holder and soaked with clean distilled water free of solids.Five milliliter of sample was flowed through filter paper, finally,the used membrane filter paper was dried in the drying oven at 105^{o}C for one hour and it placed in clean desiccators for one hour and weighed again.

Titrable acidity (TA):

The titrable acidity was appreciated by titrimetry using the modified method of De Clerck (1963), Navarre and Collette (1986), Oyeyiola (1991), Ugboaja*et al*. (1991), Jong *et al*. (1999) and Diakabana *et al*. (2007). Distilled water and about 200 mL boiled and added to 500 mL Erlenmever flask and then 1 mL of 1% phenolphthalein indictor was added.The solution was titrated with 0.1M sodium hydroxide solution to a faint but definite pink color; 5ml of sample was titrated to a pink color with 0.1M NaoH, using 3 drops of 1% phenolphthalein as indicator .

Alcoholcontent:

The refractometre method was used in determining of the alcoholic content. A clean dry applicator was used to place 2 drops of the sample (must i.e. before fermentation) on the prism of the refractometer and the value (original gravity) of the refractive index was taken. Also, after fermentation, 2 drops of the sample was applied on the prism of the refractometer and the value of totalgravity was taken.(Gena 1 with prism L1). Finally, the percentage alcohol content was calculated.The alcoholic content of the samples were calculated using (Miller, 1988).

Results and Discussion

The important physicochemical characteristics are obtained from different indigenous traditional alcoholic beverages compared to commercial beer is shown in Table 1. Tej and Tella with more acidic values of 2.85 and 3.28 respectively than the other local drinks evaluated. Areki had pH value of 3.91 which was acidic than the values 4.20 reported (Desta, 1977). The pH of Checka was lower than Araki with values of 3.66 and 3.9, whereas low acidic content was observed in St George with pH of 4.02. Similar results were obtainedwas much higher than that of Korean honey wine (Rhim *et al.,* 1997) and slightly higher than African mango juice wine (Akubor, 1996), Nigerian oil-palm wine (Eze & Uzoechi, 1988) and Korean fruit-honey wine (Rhim *et al.,* 1997). Over 25% of our *'tej'* samples had higher pH values than various commercial honey wines (Steinkraus & Morse, 1973). But this value was much lower than that for Tanzanian honey wine and pine apple wine (Tiisekwa *et al.,* 2000).

Checka had the highest value (0.015) in titratable acidity and the lowest value (0.009) was in Tej. Checka was significant difference ($p<0.05$) different from other drinks while there were no significant difference ($p>0.05$) in the values for Areki, Tella and St.Georg. Higher value in titratable acidity of Checka may be due to the traditional methods of production which are non standardized in terms of raw materials, equipment and finished products quality and handling (Desta B., 1977). The amount of acid present in Checka

was higher than those present in the other drinks since total titratable acidity gives a measure of the amount of acid present in a particular product.

Most of our *'tej'* samples had titratable acidity values similar to Korean honey wine (Rhim *et al.,* 1997) and these values fall within the range for different commercial honey wines (Steinkraus & Morse, 1973). They were, however, slightly less acidic than Korean fruit-honey wine (Rhim *et al,* 1997) and African mango juice wine (Akubor, 1996) and much less acidic than cashew juice wine (Akinwale, 1999).

Tella had highest value of 10.39% in total disolved solid followed by Checka and St.Georg. There was no significant difference ($p>0.05$) in the values of Checka and St.Georg. Areki had the lowest total dissolved solid (0.1137%).Tella had the highest Total suspended solids when compared with the other drinks. Out of the five local drinks examined, Areki had the highest alcoholic content (24.54%).

The alcoholic content of Ethiopian local beverage varies from report to report. Desta, 1977, in his survey of alcoholic content of some traditional(local) beverages of Ethiopian, reported that the alcohol content tella is 3.5 to 6.65%(v/v), and that of tej from 4 to11.5%(v/v).The report also indicates the alcoholic content of areki ranges from 20.56 to 30.83%(v/v) and that of beer (St.George) is from 4.25 to 6%(v/v).The variation in alcohol content of the beverages is due to differences in preparation and fermentation [Fite,et al.1991].

Table 1: Physico-chemical analysis of local beverage

Products	**P^H**	**Titratable acidity**	**Total acidity(g/ml) in terms of lactic acid**	**Total dissolved solids (%)**	**Total suspended solids(ppm)**	**Alcohol content %(v/v)**
Tej	2.85	0.009	9.49×10^{-3}	2.98	4.675×10^{4}	7.85
Araki	3.9	0.012	9.99×10^{-3}	0.1137	4.12×10^{3}	24.54
Tella	3.28	0.0102	8.49×10^{-3}	10.39	7.69×10^{4}	4.80
Checka	3.66	0.015	1.249×10^{-2}	6.62	2.27×10^{5}	3.66
St.George Beer	4.02	0.0108	8.99×10^{-3}	5.92	2.6×10^{4}	4.02

Conclusion

This study showed the physico-chemical properties of commercial local beverages in South nations, nationalities and peoples regional state, Ethiopia.. According to the project result significant in the P^H values of samples indicate that tej is more acidic than other samples. Areki has the highest alcoholic content. Consumption of Areki should be avoided because Areki had higher alcoholic content which can be absorbed into the blood stream and affect the nervous system. Checka, Tella and St.George beer could be taken in small quantities while Teji could be taken in large quantities but the sugar content must be reduced especially for diabetic patient.

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