Global Scientific JOURNALS

GSJ: Volume 10, Issue 1, January 2022, Online: ISSN 2320-9186

www.globalscientificjournal.com

Characterization Of Etiopian Commonely Consumed Trdational Home Distilled Alcoholic Beverges.

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ABSTRACT

The Ethiopian traditionall distilled alcohols (‘Wheat Berkrakie Areki, ‘Wheat Sharata Areki’, ‘Dagusa Arefa Areki’, ‘Dagussa Sharata Areki’, ‘Dagim Areki’, ‘Gibto Areki’, ‘Wheat Arefa Areki’, ‘Mixed Areki’, ‘Koso Areki’ and ‘Yemar Areki’) were collected from Addis Ababa, Ethiopia for the mesurment of their ethanol, methanol, solid, salanity contents, acid value, pH value and electrical conductivity. The over all average values of pH value, ethanol% (v/v), acidic content (g/L), solid content (mg/L), conductivity (µS) and salanity (%) found in any of the beverages studied were in the range of 2.80 - 51.2, 0.02 - 105, 0.00 - 20328, 5.87- 8391 and 0.1 - 4.6 respectively. The methanol contents of the beverges were determined using GC-MS. The results showed that the level of methanol in some of the studied traditionall distilled alcoholic beverges were found in the range between 0.867 - 0.979% (v/v). Hence, on the contrary to the general assumtions, the levels of methanol observed in the analyzed drinks do not pose any health threat to the human. However, the normal alcohol health risk associated with high consumption remains a problem.

Key words: distilled alcoholic beverages, Methanol, Ethanol, Acids, GC-MS, Ethiopia

1. INTRODUCTION

Fermented alcoholic beverages around the world are consumed in different occasions. In nearly all areas of the world some type of alcoholic beverages native to its region is prepared and consumed (Wang et al., 2003). Fermented beverages vary considerably in type. Fermented beverages produced from cereals are usually referred to as beers while those produced from fruits are classified as wines (Cabaroglu and Yilmaztekin, 2011). Indigenous fermented alcoholic beverages from different parts of the world are described). 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 (Ashenafi, 2006). Indigenous Ethiopian fermented beverages include Tej (Berza and Wolde, 2014), Tella (Sahle and Gashe, 1991), Bordie and Shameta (Debebe, 2006), Areki (Desta B., 1977; Fite, et al., 1991). Fermented beverages constitute a major part of the diet of traditional African rural homes serving as inebriating drinks and weaning foods in addition to their role in social functions such as marriage, naming and rain making ceremonies (Tafere, 2015). Kenyan muratina and uragua are drunk largely at festivals and social gatherings. Palm wines (toddys) are fermented and consumed under different parts of the world. Palm wine has special place in traditional celebrations and ceremonies such as marriages, burials and settling disputes (Kofi et al., 2017). In West Africa in addition to their use as beverages, toddys are also used as medicines for fever and other ailments by adding barks or stems of certain pants. It has often been observed that alcoholism is a more significant problem than all other forms of drug abuse combined. According to some studies carried out in some African countries there is considerable evidence that home produced alcohol drinks are known to have toxic components (Ellison et al., 2001). A report from Zambia as quoted by (Kebede et al., 2002) indicates that moulds such as mucor could frequently be found on the fermenting source of pectinase the enzyme that breaks down pectinto release methanol. Methanol was shown to be the common contaminants of traditional alcoholic beverages in the studies carried out so far. According to (Cabaroglu and Yilmaztekin, 2011) methanol is highly toxic and can cause blindness insanity and even death depending on the amount consumed. Fusel oil is a collective name of isopentyl alcohol, 2-methyl-1-butanol, isobutyl alcohol, propyl alcohol, esters and aldehydes. It is toxic and has been shown to cause cancer in experimental animals (Ellison et al., 2001). These alcohols are responsible for the severe headache and thirst associated with hangover and also account for taste and flavor of alcoholic drinks. From traditionally fermented beverages in Ethiopia the most popular alcoholic beverages are Tej (honey wine), Tella (a malt beverage like beer), Shameta, Bordie and Areki (distilled liquor). These drinks are widely served on celebrations and at social gatherings. Traditional recipes are handed down through generation and are still used for food processing in many developing countries (Yohannes et al., 2013). 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. In Ethiopia as reported by (Kebede et al., 2002). Villagers prepare a wide range of traditional fermented foods and beverages from different raw materials such as cereals, ensete (false banana), honey, milk, etc. Most of the customs and rituals involving the Ethiopian traditional fermented foods and beverages are still prevailing today in urban areas village communities and rural households. Locally produced and home-brewed alcoholic beverages are predominantly used in the rural areas and by people living in the urban areas who cannot afford factory made drinks. For instance young people (as young as 14 years old and university students) tend to consume local beverages like Areki and Tella as their main source of alcohol since these drinks are easily accessible to them and cannot afford other kinds of factory drinks (Keno and Keskis, 2015). These traditional or locally produced alcohols are also quite significant in economic terms. Many households in the country especially women engage in the production and sales of these beverages as their main source of income to support themselves and their families. Some of the popular locally produced home distilled alcohol beverages in Ethiopia are ('Wheat Berkrakie Areki, 'Wheat Sharata Areki', 'Dagusa Arefa Areki', 'Dagussa Sharata Areki', 'Dagim Areki', 'Gibto Areki', 'Wheat Arefa Areki', 'Mixed Areki', 'Koso Areki' and 'Yemar Areki')

2. MATERIALS AND METHODS

2.1 Alcoholic beverage samples

For this study ten traditionall distilled (Yemar Areki, Dagim Areki, Wheat Arefa Areki, Wheat Sharata Areki, Dagusa Arefa Areki, Dagussa Sharata Areki, Wheat Berkrakie Areki, Koso Areki, Mixed Areki and Gibto Areki) alcoholic beverages were collected from Addis Abaeba (Kality and Kotibe). All the samples were collected based on universality of consumption from adolescents to the elderly and were widely available at both the local market and the household levels. From each sampling area theree samples each of 500 mL were collected from different vending houses which were selected randomly to prepare a bulk sample to get represenative sample. Thus, analysing of the mixing of samples instead of analyzing single sample can reduces the variance and resource consumption. The most widly used raw matertials are cereals, fruits and selected herbs. A one single sample was prepared in the laboratory with equal volume ratios from the mixture of traditionally distilled alcohols which includs Wheat Berkrakie, Wheat Sharta, Wheat Arfa and Dagim Arekies. This is because most of the women who sell different types of mixed Arekies. Such type of action is done intentionally to get more profit from it. For instance, Dagim Arekie which is good and high cost and Wheat Shrata and Wheat Berkrakie which were low

quality and cheap. Triplicate analysis was performed for each sample. All the samples were collected using polyethylene plastic bottles and the bulk samples were kept in refrigerator at 4 ºC until the analysis was done.

2.2 Chemicals

Methanol (99.9%, Sigma-Aldrich, France), ethanol (99.9%, Fisher Scientific, UK), anhydrous ethyl acetate (99.8%) and sodium sulfate (99%) were utilized to prepare standard solutions. Sodium hydroxide pellets (98%, Sigma-Aldrich, France), hydrochloric acid (37%, Sigma-Aldrich, France and phenolphthalein indicator (98 - 102%, Sigma-Aldrich, France) were used for the determination of acidic content of alcohols. Distilled water was used for dilution of samples.

2.3 Quality parameters of trdational home distilled alcholoc beverages

Methanol content of traditional distilled alcoholic beverages was determined using GC-MS according to the method (Pinu and Boas, 2017). pH of traditional distilled alcoholic beverages were determined using the method (Yücesoy, 2011). Rajković et al.; 2007). Acids of trdational distilled alcoholic beverages were determined by using titration with indicator phenolphthalein (Rajković et al.; 2007). Total solids were determined according to the method set by AOAC Official Method (920.47, 940.09, 950.27, 17th Ed, 2010)**.** Determination of Electrical conductivity and salinity of alcoholic beverages. The conductivity of collected traditional distilled beverages were determined using the method using (Alejandra et al.; 2016). The ethanol level of collected samples was determined by fractional distillation method (AOAC Official Method (920.47, 942.06, 945.07, 982.10, 983.12 17th Ed); ASBCofficial method Beer-4; 27 CFR part 30, 2010).

3. RESULTS AND DISCUSSION

Several analytical parameters of various beverage samples produced in Ethiopia were measured in this study. Having different crop varieties as the raw material, distillation process and alcohol content lead to different chemical properties (Yücesoy, 2011). All the results with regard to the determination of pH, electrical conductivity, salinity, solid, acid, methanol and ethanol content of beverage samples are listed with mean values and standard deviations in Table 2 - 5 and in Table 9. In the study Mixed Areki are the mixure of Wheat Berkrakie, Wheat Sharta, Wheat Arfa and Dagim Arekies.

3.1 Methanol content in alcoholic beverages

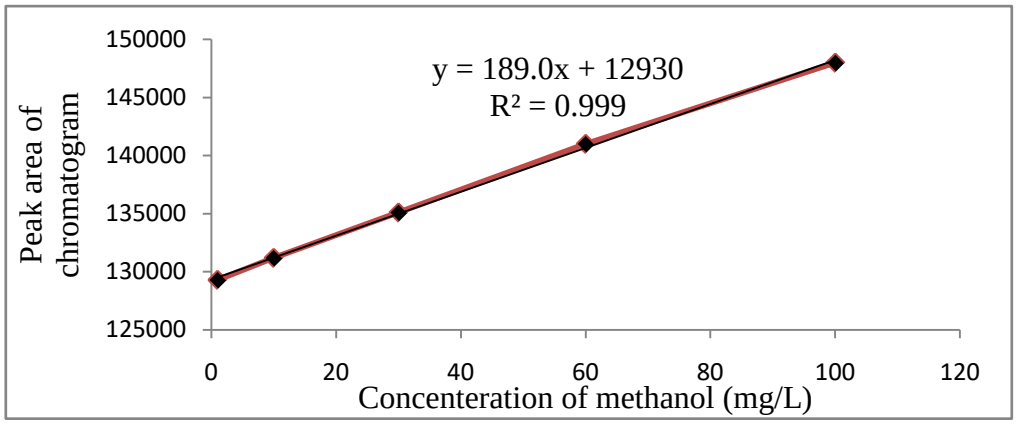

Figure 1. Calibrationcurve of methanol standard for GC-MS

Table 1. Methanol content of traditional distilled alcoholic beverages

No	Beverage types	Peak area	Methanol concentration (mg/L)
1	Daussa Shrata	1301618	6872 ± 53.2
2	Ouzo	1321681	6930 ± 50.5
3	Mixed	1325426	6944 ± 57.9
4	Wheat Sharata	1330075	6936 ± 29.1
5	Koso	1385390	7244 ± 75.4
6	Dagim	1431145	7525 ± 81.7
7	Yemar	1433920	7504 ± 29.2
8	Wheat Arefa	1458666	7667± 86.3
9	Dagussa Arefa	1301031	7654 ± 35.2
10	Wheat Berkrakie	1301618	7735 ± 45
11	Gibto	-	ND

Table 2 shows the variations in the concentrations of methanol of the various beverage samples analyzed. Methanol concentration of the beverage samples ranged from “not detectable” to 7735 mg/L. From Table 2, it was also observed that one traditional distilled beverages (Gibto Areki) recorded no content of methanol concentration where as nine of traditional distilled beverages (Dagussa Sharata, Ouzo, Mixed, Wheat Sharata, Vodka, Koso, Dagim, Yemar, Wheat Arefa, Dagussa Arefa and Wheat Berkrakie) showed traces of methanol at different concentrations. Among the samples that tested positive for methanol content Wheat Berkrakie Areki (traditional distilled Areki) showed the highest methanol concentration (7735 mg/L). The oral lethal dose of methanol between 0.3–1 g/kg (20 to 60 g or 25–75 ml/person in a 60 kg adult) (Tulashie eta al.; 2017). A 7735 mg/L methanol level as seen in the analysis implies that 7.74g methanol may be realized in 1 L of the alcoholic drink (Wheat Berkrakie) and hence possesses no

potential health threat when consumed. However, it has a health problem in 60 kg adult when drinks continuously 3.2 L- 9.7 L Wheat Berkrakie areki.

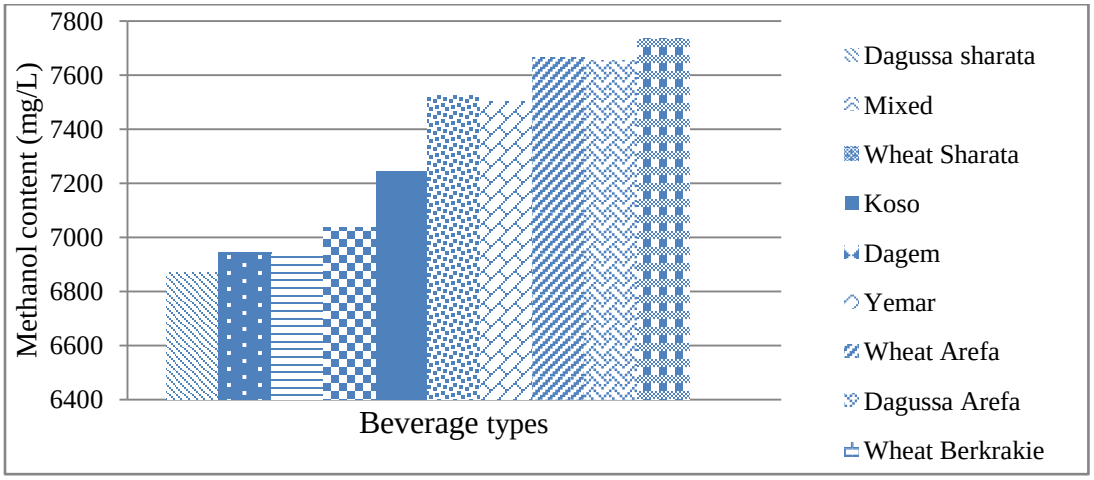

Figure 2. Methanol content of traditionall distilled alcoholic beverages of Ethiopia.

As it cab be seen in figure 5, generally the content of methanol across the beverage types were decreased in order of Daussa Shrata > Wheat Sharata > Mixed > Koso > Dagim >Yemar >Wheat Arefa > Dagussa Arefa > Wheat Berkrakie.

3.2 Determination of pH, conductivity, salinity, acidity and solid contents in traditionall distilled alcoholic beverages

Table 2. Contents of selected quality parameters in traditionall distilled alcoholic beverage drinks.

Beverage types	Quality parameters in different traditional distilled alcoholic beverages								
	pH	Conductivity (µS)	Salinity (%)	TDS (mg/L)	TSS (mg/L)	TS (mg/L)	Fixed acidity (g/L)	Volatile acidity (g/L)	Total acidity (g/L)
Yemar	4.60 ± 0.01	116 ± 1	0.100 ± 0.001	56.0 ± 0.1	7156 ± 2.08	7211 ± 1.2	0.163 ± 0.005	0.188 ± 0.01	0.350 ± 0.005
Gibto	4.40 ± 0.01	48.0 ± 0.5	0.000	21.9 ± 0.1	699 ± 1	720 ± 1.5	0.146 ± 0.004	0.205 ± 0.008	0.351 ± 0.004
Dagim	4.20 ± 0.01	19.0 ± 0.25	0.000	9.03 ± 0.1	1.00 ± 0.03	10.0 ± 0.2	0.018 ± 0.004	0.160 ± 0.006	0.178 ± 0.002
Wheat Arefa Areki	4.00 ± 0.01	24.0 ± 0.1	0.000	10.0 ± 0.1	0.000	10.0 ± 0.3	0.039 ± 0.004	0.214 ± 0.013	0.253 ± 0.009
Wheat sharata	4.00 ± 0.01	24.0 ± 0.15	0.000	0.000	0.000	0.000	0.026 ± 0.005	0.311 ± 0.007	0.337 ± 0.002
Dagussa Arefa	4.10 ± 0.01	26.0 ± 0.2	0.000	9.87 ± 0.2	0.000	10.0 ± 0.3	0.027 ± 0.004	0.177 ± 0.012	0.204 ± 0.016
Dagusa Sharata	4.10 ± 0.01	19.0 ± 0.21	0.000	100 ± 0.1	0.000	10.0 ± 0.3	0.023 ± 0.005	0.234 ± 0.003	0.257 ± 0.002

Wheat berkrakie	4.30 ± 0.01	25.0 ± 0.25	0.000	0.000	0.000	0.000	0.032 ± 0.005	0.283 ± 0.01	0.315 ± 0.003
Mixed Areki	4.10 ± 0.01	23.0 ± 0.15	0.000	11.2 ± 0.2	0.000	11.0 ± 0.4	0.114 ± 0.005	0.055 ± 0.00	0.169 ± 0.005
koso	3.80 ± 0.01	38.0 ± 0.12	0.000	17.8 ± 0.3	233 ± 1.53	249 ± 2.1	0.063 ± 0.002	0.067 ± 0.00	0.130 ± 0.004

* = Values are mean ± SD of triplicate readings of triplicate analysis

Total acid results of traditional distilled beverage samples ranged from 0.130 - 0.351 g tartaric acid/L. The mean total acid values of Yemar, Gibto, Dagim, Wheat Arefa, Wheat Sharata, Dagussa Arefa, Dagussa Sharata, Wheat Berkrakie, Mixed and Koso beverages were 0.350, 0.351, 0.178, 0.253, 0.337, 0.204, 0.257, 0.315, 0.169 and 0.130 g tartaric acid/L, respectively. Gibto Areki had highest total acid value compared to others traditional distilled beverages. On the other hand Koso Areki had lowest total acid value compared to others traditional distilled beverages.

Volatile acid results of traditional distilled beverage samples ranged from 0.05 - 0.310 g tartaric acid/L, respectively. The mean volatile acid values of Yemar, Gibto, Dagim, Wheat Arefa, Wheat Sharata, Dagussa Arefa, Dagussa Sharata, Wheat Berkrakie, Mixed, Koso beverages were 0.19, 0.21, 0.31, 0.18, 0.23, 0.28, 0.05, 0.07g tartaric acid/L, respectively. Wheat Sharata Areki had highest volatile acid value compared to others traditional distilled beverages. On the other hand Mixed Areki had lowest total acid value compared to others traditional distilled beverages. Fixed acid results of factory traditional distilled beverage samples ranged from 0.018 - 0.146 g tartaric acid/L respectively. Fixed acid values of Dagim had the lowest fixed acid value of 0.018 g tartaric acid/L.Yemar Areki had highest fixed acid value compared to others traditional distilled beverages. On the other hand Dagim Areki had lowest total acid value compared to others traditional distilled beverages. The acid content plays an important role in alcoholic beverages for the preservation and sensory characteristics of beverages. The acid amount in distilled beverages can vary in wide ranges depending on crop variety, harvesting time of crops, climatic conditions during harvesting, type of the soil, phyto-sanitary condition of crops, way of malt processing, conditions which alcohol fermentation was done, beverage storage time, volatile compounds and additives (Rajković, 2007). Preferred total acidity levels of beverages are 6 – 8 g tartaric acid/L (Jahagirdar et al., 2015. There fore the acid content of all analyzed distilled alcoholic beverages were within the recomended ranges.

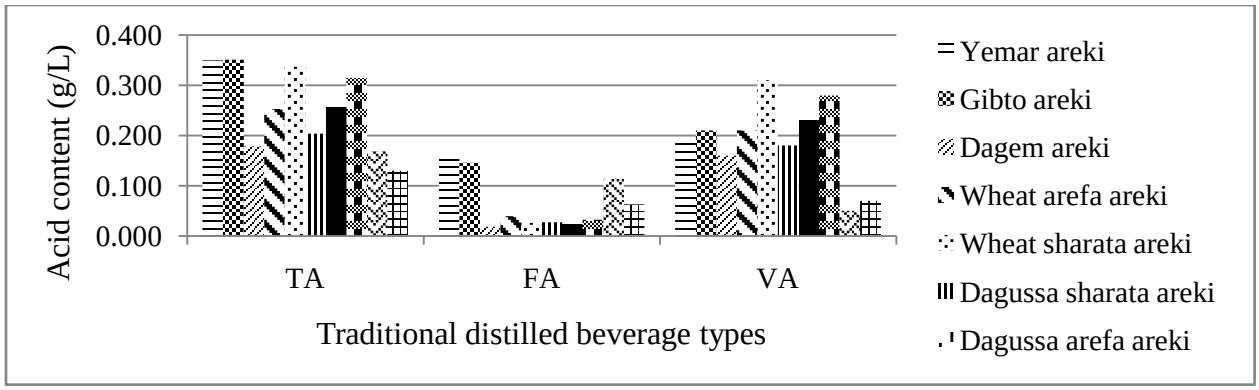

Figure 3. The comparison of total acidity, fixed acidity and volatile acidity contents in g/L between traditionally distilledalcoholic beverages.

As it cab be seen in figure 8, generally the content of total acid across the traditional distilled beverage types were decreased in order of Gibto > Yemar > Wheat sharata > Wheat Berkrakie > Dagussa Sharata > Wheat Arefa > Dagussa Arefa > Dagim > Mixed > Koso Whereas, the volatile acid of Wheat Sharata > Wheat Berkrakie > Dagussa Shrata > Wheat Arefa > Gibto > Yemar > Dagussa Arefa > Dagim > Koso > Mixed and fixed acid of Yemar > Gibto > Mixed > Koso > Wheat Arefa > Wheat Berkrakie > Dagussa Arefa > Wheat Sharata > Dagussa Sharata > Dagim. Total dissolved solid results of traditional distilled beverage samples ranged from 0.000 - 100 mg/L respectively. TDS values of Dagussa Sharata Areki had highest compared to others traditional distilled beverages. On the other hand TDS values of Wheat Sharata and Wheat Berkarkie beverages had lowest TDS value compared to others traditional distilled beverages. No dissolved solids were present in Wheat Sharata and Wheat Berkarkie beverages. Differences in the raw materials (crop varieties), process conditions, volatile compounds and additives can cause the differences among the TDS values. Total suspended solid results of traditional distilled beverage samples ranged from 0.000 - 7156 mg/L, respectively. TSS values of Yemar Areki had highest TSS value compared to others traditional distilled beverages. On the other hand, TSS values of Wheat Arefa, Wheat Sharata, Dagussa Arefa, Dagussa Sharata, Wheat Berkrakie and Mixed beverages had lowest TSS value compared to others traditional distilled beverages. From the result of traditional distilled beverages no TSS was observed in Wheat Arefa, Wheat Sharata, Dagussa Arefa, Dagussa Sharata, Wheat Berkrakie and Mixed beverages, where as Gibto Areki, Yemar Areki, Koso Areki and Dagim Areki had low content of suspended solids. The wide variation in TSS of different beverage type is apparently related to the difference in sources raw materials (crop varieties), process conditions, volatile compounds, additives, initial TSS as well as the difference in ferment ability behavior of the beverages (Yücesoy, 2011).

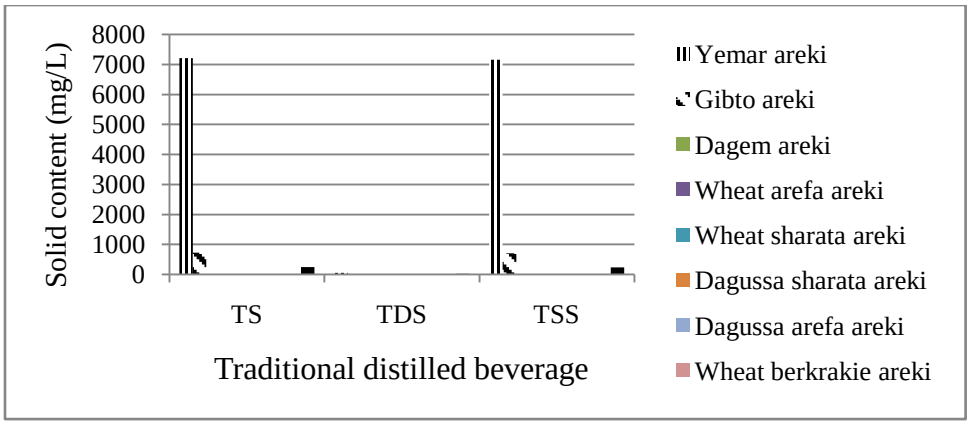

Figure 4. The comparison of TS, TDS and TSS contents in g/L between traditionally distilled alcoholic beverages.

As it cab be seen in figure 10, generally the content of total solid across the traditional distilled beverage types were decreased in order of Yemar > Gibto > Koso > Mixed > Dagim = Wheat Aarefa = Dagussa Arefa > Wheat Sharata = Wheat Berkrakie. Whereas, the total dissolved solid of Dagusa Sharata > Yemar > Gibto > Koso > Mixed > Wheat Arefa > Dagussa Arefa > Dagim > Wheat Berkrakie = Wheat Sharata and total suspended solid of Yemar > Gibto > Koso > Dagim > Wheat Shrata = Dagussa Arefa = Dagussa Sharata = Wheat Berkrakie.

3.3 Ethanol content of alcoholic beverages

Table 3. The mean ± SD, % (v/v) (n = 3) of ethanol in traditionall distilled alcoholic beverage samples.

No.	Beverage type	Loaction	Ethanol content % (v/v)	Litreature report % (v/v)	Reference
1	Yemar Areki	Kotebie	37.5 ± 0.5	-	-
		Kality	38.5 ± 0.5		
2	Gibto Areki	Kotebie	46.0 ± 0.5	46.8 - 50.3	Debebe et al.; 2016
		Kality	48.6 ± 0.6		
3	Dagim areki	Kotebie	51.5 ± 0.5	51.1 - 54.0	Desta, 1977; Debebe et al.; 2016
		Kality	51.0 ± 0.5		
4	Wheat arfa areki	Kotebie	43.9 ± 0.4	34.0 - 40.0	(Desta, 1977)
		Kality	42.0 ± 0.5		
5	Wheat Sharata Areki	Kotebie	35.9 ± 0.4	34.0 - 40.0	Yohanes etal,; 2012
		Kality	37.0 ± 0.3		
6	Dagusa arfa areki	Kotebie	48.0 ± 0.5	-	-
		Kality	47.5 ± 0.5		
7	Dagusa Sharata Areki	Kotebie	39.9 ± 0.4	-	-
		Kality	40.9 ± 0.3	8.94 - 13.2	Bahiru et al., 2001;

8	Tej	Kotebie	11.9 ± 0.4		Yohanes etal, 2012
		Kality	13.3 ± 0.3		
		Kality	2.60 ± 0.4		
11	Wheat Berkraki areki	Kotebie	42.0 ± 0.6	34.0 - 40.0	Debebe, 2016
		Kality	39.2 ± 0.8		
12	Mixed Areki	Kotebie	40.6 ± 0.6	34.0 - 40.0	Debebe, 2016
		Kality	40.7 ± 1		
13	Koso Areki	Kotebie	41.4± 0.5	42.8 - 56.0	Debebe et al., 2017
		Kality	42.1 ± 0.4		
		Kality	4.50 ± 0.5		

Table 9 shows the variations in the mean concentrations of ethanol of the various samples analyzed. Among the samples that tested Dagim Areki (traditional distilled Areki) showed the highest ethanol content 51.2% (v/v). Ethanol content of traditional distilled beverage samples ranged from 36.5% (v/v) - 51.2% (v/v. Wheat sharata Areki had lowest ethanol content compared to others traditional distilled beverages. The oral lethal dose of ethanol had been reported in the range 5 to 8 g/kg. Thus, for a 60 kg adult, 300 g (384 ml) of ethanol can be fatal (Tulashie eta al.; 2017). Therefore, ethanol concentrations of 39.0% (v/v) and above as seen in 8 of the analyzed drinks (Gibto Areki, Dagim Areki, Wheat Arefa Areki, Dagussa Arefa Areki, Dagussa Sharata Areki, Wheat Berkrakie Areki, Mixed Areki, Koso Areki) implies that at least 390 ml of ethanol is contained in 1 L of the alcoholic drink and may all the same cause higher health risks when consumed excessively or without care. The wide variation in ethanol of different beverage type is apparently related to the difference in sources raw materials (crop varieties), limit of standard procedures to produce traditional alcohols, alcohols process conditions and the difference in ferment ability behavior of the beverages (Tulashie et al.; 2017).

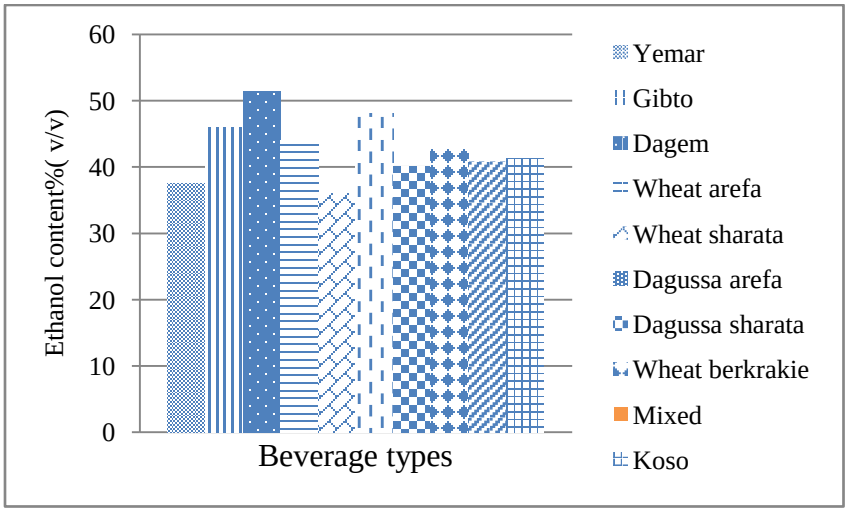

Figure 5. The comparison of the ethanol content of traditionall distilledalcoholic beverges.

As it cab be seen in figure 12, generally the ethanol content across the traditional distilled types were decreased in order of Dagim > Dagussa Arefa > Gibto > Wheat Arefa > Koso > Mixed > Wheat berkrakie > Dagussa Sharata > Yemar >Wheat Sharata.

Annalysis of variance

Table 4. Analysis of variance (ANOVA) for the ethanol concentrations between distilled alcoholic beverages at the 95% confidence level.

Source of variations	Df*	SS	MS	F calcuated	F critical	Remark
Area	1	0	0	0	4.2	No signficance difference in ethanol content between areas of beverages
Varieties	14	24766	2752	19655	4.1	Signficant difference in ethanol content between varieties of beverages
Area x Variety	14	22.56	2.51	17.93	4.1	Signficant difference in ethanol content between intraction varieties and area
MS within	60	5.47	0.14	-	-	-
Total	89	24793	2754	19673	12.4	-

4. CONCLUSION AND RECOMMENDATIONS

Quantification of methanol concentration in alcoholic drinks showed that some amounts of methanol between the ranges of “not detectable” to 7735 mg/L, however below the minimum oral lethal dose 0.3 – 1.0 g/kg (20 to 60 g or 25 – 75 mL/person in a 60 kg adult). The results indicated that the content of ethanol in beverage samples was ranged from 2.80% (v/v) - 51.2 % (v/v) and there was no significant difference in the ethanol content obtained from the two areas where as there was significant difference in different types of beverages. The study indicated that the alcoholic content of Ethiopian traditional beverages vary considerably. The alcoholic content variability of local beverages could be attributed to the spontaneous fermentation, raw materials used and method of producing (Debebe, 2006). pH value of alcoholic beverage samples ranged from 3.50 - 7.50 but most samples have pH values around 4. Electrical conductivity results of beverage samples ranged from 5.87 - 8391 μS cm^{-1}. Salinity content results of beverage samples were between 0.000 and 4.60%. Total dissolved solid values of tested beverage samples differed between 0.000 mg/L and 4520 mg/L. Total suspended solid results of beverage samples ranged from 0.000 - 16498 mg/L. Total solid values of tested beverage samples differed between 0.000 mg/L and 20328 mg/L. Total acid values of tested beverage samples differed between 0.024 to 105 g tartaric acid/L. The results of volatile acid content (in terms of tartaric acid) of beverage samples ranged from 0.000 to 85.2 g tartaric acid/L. Fixed acid results of beverage samples ranged from 0.018 - 55.9 g tartaric acid/L. This research work suggests that despite the fact that methanol was found to be present in most of the

analyzed alcoholic drinks, the levels observed do not pose any health threat to the human health when consumed, contrary to the general assumptions that it does. However, the normal alcohol health risk associated with high consumption remains a problem. In Ethiopia, the government has no control over the production and quality of traditional beverages. There is however wide spreading and serious alcohol related problems (Ellison et al., 2001). Thus control in the production and supervision with the development of comprehensive national alcohol policy is recommended. It is not difficult to imagine that large number of population in the most parts of the country consumes the local beverages. As the process of fermentation is spontaneous high amount and variability of toxic substances is inevitable. Hence, from the point of view of public health investigation on the mechanism of production and means to avoid predominance of harmful contents are necessary. Further researches need to be conducted toward the determination of all quality parameters of beverages.

ACKNOWLEDGEMENTS

First, thanks to my almighty 'GOD' for giving me spiritual strength, health, encouragement and guidance to complete this study. I am deeply thankful to Ethiopian Agricultural Research Institute for giving me the fund to do this research. My heartfelt thanks also go to my son Bisrat Seferu, daughter Eldana Seferu, my wife, father and mother for their love, care and help that enabled me to realize my long-term dream.

5. REFERENCES

Abegaz, K.; Beyene, F; Langsrud, T.; Narvhus, J. (2002). Indigenous processing methods and raw materials of Bordie, an Ethiopian traditional fermented beverage. *The Journal of Food Technology in Africa* 7, 59-64.

Alejandra, C.A.; Amaury, S.G.; Florentina, Z.; Sergio, G.S. (2016). Assessment of physicochemical properties of Tequila brands:authentication and quality. *Journal of Chemistry* 2016, 1-13.

AOAC Official Methods of Aanalysis 920.47, 942.06, 945.07, 982.10, 983.12 (17th Ed); ASBC official method Beer-4; 27 CFR part 30 (2010). List of methods of analysis for beverage Alcohol http:// www.ttb.gov/ssd/pdf/list_of_beverage_methods. pdf (Accessed October, 2018).

AOAC Official Methods of Aanalysis 945.08, 950.15, 962.12 (17th Ed) (2010). List of methods of analysis for beverage Alcohol http:// www.ttb.gov/ssd/pdf/list of beverage methods. pdf (Accessed October, 2018).

AOAC Official Methods of Analysis 920.47, 940.09, 950.27 (17th Ed) (2010). List of methods of analysis for beverage Alcohol http://www.ttb.gov/ssd/pdf/list_of_beverage methods. pdf (Accessed October, 2018).

Ashenafi, M. (2006). A review on the microbiology of indigenous fermented foods and beverages of Ethiopia. *Ethiopia Journal of Biological Science* 5(2), 189-245.

Bacha, K.; Mehari, T.; Ashenafi, M. (2003). Microbiology of the fermentation of shamita, a traditional Ethiopian fermented beverage. SINET: *Ethiopian Journal of Science* 22, 113- 126.

Bahiru, B.; Mehari, T.; Ashenafi, M. (2001). Chemical and nutritional properties of '*Tej*' an indigenous Ethiopian honey wine variations within and between production unit. *Journal of Food Technology in Africa* 6, 104-108.

Bekele, D.; Chandravanshi, B.S. (2012). Levels of essential and non-essential metals in Ethiopian Ouzo. *SINET: Ethiopian Journal Science* 35(1), 19–28.

Belete, Y.; Chandravanshi, B.S.; Zewge, F. (2017). Levels of the fluoride ion in six traditional alcoholic fermented beverages commonly consumed in Ethiopia. *Fluoride* 50(1), 79-96.

Berhanu, A. (2014). Microbial profile of Tella and the role of gesho (*Rhamnus prinoides*) as bittering and antimicrobial agent in traditional Tella (Beer) production. *International Food Research Journal* 21(1), 357-365.

Berza, B.; Wolde, A. (2014). Fermenter technology modification changes microbiological and physicochemical parameters, improves sensory characteristics in the fermentation of Tella :an Ethiopian Traditional fermented alcoholic beverage. *Journal of Food Processing and Technology* 5(4), 2-7.

Brereton, P.; Hasnip, S.; Bertrand, A.; Wittkowski, R.; Guillou, C. (2003). Analytical methods for the determination of spirit drinks. *Trends in* Analytical Chemi*stry* 22(1), 19- 25.

Brill, S.; Wagner, M. (2012). Alcohol determination in beverages using polar capillary gas chromatography-mass spectroscopy and an acetonitrile internal standard. *Journal of Analytical Chemistry* 3(2012), 6-12.

Cabaroglu, T.; Yilmaztekin, M. (2011). Methanol and major volatile compounds of turkish raki and effect of distillate source. *Journal of the Institute of Brewing* 117(1), 98–105.

Debebe, A.; Anberbir, A.; Redi, M.; Chandravanshi, B.S.; Asfaw, A.; Asfaw, N.; Retta, N. (2017). Alcohol determination in distilled alcoholic beverages by liquid phase fourier transform mid-infrared and near-infrared spectrophotometries. *Food Analytical Methods* 2017 9 (10), 172–179.

Debebe, A.; Redi, M.; Chandravansh, BS. (2017). Non-destructive determination of ethanol levels in fermented alcoholic beverages using Fourier transform mid-infrared spectroscopy. *Chemistry Central Journal* 11(27), 1-8.

Debebe, G. (2006). Determination of ethanol level in beverages. MSc Thesis, Addis Ababa University, Addis Ababa, Ethiopia.

Desta, B. (1977). A survey of the alcoholic contents of traditional beverages. *Ethiopia Medical Journal* 15, 65-68.

Dudley, R. (2004). Ethanol, fruit ripening and the historical origins of human alcoholism in primate frugivory. *Integrative and Comparative Biology* 44(4), 315–23.

Ellison, C.; Zhang, Y.; Lennan, c.; Rothman, K. (2001). Exploring the relation of alcohol consumption to risk of breast cancer. *American Journal of Epidemiology* 154(8), 740- 747.

Fite, A.; Tadesse, A.; Urga, K.; Seyoum, E. (1991). Methanol, fuel oil and ethanol contents of some Ethiopian traditional alcoholic beverages. SINET: *Ethiopian Journal of Science* 14, 19-27.

Gerchman, Y.; Schnitzer, A.; Gal, R.; Mirsky, N.; Chinkov, N. (2012). Simple rapid gas-chromatography flame-ionization-detector (GC-FID) method for the determination of ethanol from fermentation processes. *African Journal of Biotechnology* 11(15), 3612- 3616.

Getnet, B.; Berhanu, A. (2016). Microbial dynamics, roles and physico-chemical properties of Korefe, a traditional fermented Ethiopian beverage. *Biotechnology International* 9(7), 156-175.

Jahagirdar, S.S.; Patki, V.K.; Thavare, R.M. (2015). Comparative study of water quality parameters of different brands of soft drinks. *Journal of Mechanical and Civil Engineering* 2(1), 142-149.

Keno, S.; Keskis, W. (2015). Assessment of causes, prevalence and consequences of alcohol and drug abuse among Mekelle University. *American Journal of Applied Psychology* 3(3), 47-56.

Kofi, S.; Preko, A.; Dzidefo, G.; Yaw, A.; Wiredu, A. (2017). Determination of methanol and ethanol concentrations in local and foreign alcoholic drinks and food products (Banku, Gakenkey, Fantekenkey and Hausakoko) in Ghana. *International Journal of Food Contamination* 4(14), 1-5.

Lachenmeier, D.W. (2007). Rapid quality control of spirit drinks and beer using multivariate data analysis of fourier transform infrared spectra. *Food Chemistry* 101, 825–832.

Lachenmeier, D.W.; Schmidt, B.; Bretschneider, T. (2008). Rapid and mobile brand authentication of vodka using conductivity measurement. *Microchim Acta* 160, 283–289.

Mulaw, G.; Tesfaye, A. (2017). Technology and microbiology of traditionally fermented food and beverage products of Ethiopia. *African Journal of Microbiology Research* 11(21), 825-844.

Nagarajan, R.; Gupta, A.; Mehrotra, R.; Bajaj, M.M. (2006). Quantitative analysis of alcohol, sugar and tartaric acid in alcoholic beverages using attenuated total reflectance spectroscopy. *Journal of Automated Methods and Management in Chemistry* 2006, 1-5.

Oladeinde, F.O.; Nwankwo, E.I; Moronkola, O.A; Amosu, M.A., Farayola, B. (2002). Determination of indigenous and foreign alcoholic beverages levels in urine by quantitative infrared spectroscopy.*African Journal of Biomedical Research* 5, 73-76.

Paine, A.; Dayan, A. (2001). Defining a tolerable concentration of methanol in alcoholic drinks. *Human and Experimental Toxicology* 20, 563 –568.

Pinu, F.; Villas-Boas, S. (2017). Rapid quantification of major volatile metabolites in fermented food and beverages using gas chromatography-mass spectrometry. *Journal of Molecular Diversity Preservation International and Multidisciplinary Digital Publishing Institute* 7(37), 1-13.

Pontes, H.; Guedes, P.; Casal, S.; Carmo, H.; Santos, A.; Magalhães, T.; Remião, F. (2009). GC determination of acetone, acetaldehyde, ethanol and methanol in biological matrices and cell culture. *Journal of Chromatographic Science* 47, 272-278.

Rajković, M.; Ivana D. Novaković, I.; Petrović, A. (2007). Determination of titratable acidity in white wine. *Journal of Agricultural Sciences* 52(2), 169-184.

Sahle, S.; Gashe, BA. (1991). The microbiology of Tella fermentation. S*INET: Ethiopian Journal of Science* 14, 81-92.

Sanni, A. I. (1992). The need for process optimization of African fermented foods and beverages. *International Journal of Food Microbiol*gy 18, 85-95.

Shyam, G.; Datt, K.; Kumar, S. (2015). Effect of initial total soluble solids on physico- chemical, antioxidant and sensory properties of mulberry wine. *Journal on Processing and Energy in Agriculture* 19(5), 228-232.

Tafere, G. (2015). A review on traditional fermented beverages of Ethiopia. *Journal of Natural Sciences Research* 5(15), 94 - 102.

Tekluu, B.; Gebremariam, G.; Aregai, T.; Saripalli, H. (2015). Determination of alcoholic content and other parameters of local alcoholic beverage (Tella) at different stages in Gondar, Ethiopia. *International Journal of It, Engineering and Applied Sciences Research* 4(6), 2319-4413.

Tiscione, N.; Alford, I.; Tate, D.; Shan, X. (2011). Ethanol analysis by headspace gas chromatography with simultaneous flame-ionization and mass spectrometry detection. *Journal of Analytical Toxicology* 35, 501-511.

Tulashie, S.K.; Appiah, A.P.; Torku, G.D.; Darko, A.Y.; Wiredu, A. (2017). Determination of methanol and ethanol concentrations in local and foreign alcoholic drinks and food products (Banku, Ga Kenkey, Fante Kenkey And Hausa Koko) in Ghana. *International Journal of Food Contamination* 4(14), 1-5.

WANG, M.L.; CHOONG, Y.M.; SU, N.W.; LEE, M.H. (2003). A rapid method for determination of ethanol in alcoholic beverage s using capillary gas chromatography. *Journal of Food and Drug Analysis* 11(2), 133-140.

WHO (2014). Global status report on alcohol and health. Available at: http://apps.who.int/iris/bitstream/10665/112736/1/9789240692763_eng. pdf (Accessed November, 2018).

Yohannes, T.; Melak, F.; Siraj, K. (2013). Preparation and physicochemical analysis of some Ethiopian traditional alcoholic beverages. *African Journal of Food Science* 7(11), 399- 403.

Yücesoy, D. (2011). Authentication and prediction of some quality parameters of alcoholic beverage raki with infrared spectroscopy. MSc Thesis, İzmir University, İzmir, Turkey.