International Research Journal of Natural Sciences
Vol.10, No.2, pp.55-60, 2022
Print ISSN: ISSN 2053-4108(Print)
Online ISSN: ISSN 2053-4116(Online)

# The level of Zinc (Zn) in Yekoso-Areke Ethiopian distilled traditional beverage

**Siyum Shewakena Beshahwored**
Department of Forensic Science, Ethiopian Police University College, P.O. Box 1503, Addis Ababa, Ethiopia

**Citation**: Siyum Shewakena Beshahwored (2022) The level of Zinc (Zn) in Yekoso-Areke Ethiopian distilled traditional beverage, *International Research Journal of Natural Sciences*, Vol.10, No.2, pp.55-60

**ABSTRACT:** *Home-grown fermented and distilled beverages are very popular traditional drinks in Ethiopia. Among these, Arekies, korefe, tej and tella are very common in northern part of Ethiopia. Specifically Yekoso-Arekie which is double distilled and possess unique extra ingredient which is called Yekoso-Kitel the most common beverage in Debre-Birhan town. However, there is no any report on the level of Zinc in this beverage. The purposes of this study were to determine the amounts of Zinc and to compare this parameter of selected Ethiopian traditional alcoholic beverage (Yekoso-Arekie) from Ethiopia in the specific area Debre-Birhanwith other similar beverages. A total of nine bulk samples were collected randomly from vending houses from nine different kebeles. For these purposes, two experimental parts has been implemented sequentially, the firstpart is digestion of the sample with H2O2 and conc. $HNO_3$; the second part is absorbent measurement: the standard, blank and samples were placed in to auto sampler test tube then after placed at sampling area of FAAS in the order of analysis: first the standard solutions in increasing concentration, then the blank and the samples follow.The amount of zinc in yekossoarekie was determined. since this local drink has not standard reference in the nation, the researcher took the standard reference from WHO, Zinc, Zn (mg) Content in distilled Alcoholic beverage, all (gin, rum, vodka, whiskey) is between 0.0283 mg/l and 0.9824mg/l. The researcher concludes that Yekosso-Arekie has remarkable levels of Zinc; as a result the consumers of this beverage can get its vital for activating growth iand physical and neurological development in infants, children and teenagers since Zinc is an essential micronutrient for human health.*

**KEY WORDS:** traditional beverage, Yekosso-Arekie, Zinc, digestion

## INTRODUCTION

In all over the world, some types of alcoholic beverage native to their region are prepared and consumed [1]. 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 [2].Similarly in Ethiopia, some of indigenous fermented beverages include *borde*, *korefe*, *shamita*, *tej* and *tella* which are very popular traditional drinks. *Borde* and *shamita* are mainly prepared in central and southern Ethiopia [3]. Whereas considering popularity, traditional alcoholic beverages namely, '*katikala' (areki*), *korefe* and *tella* are very common in northern part of Ethiopia. Fermented beverages vary considerably in type. Fermented beverages produced from cereals usually referred to as beers while those produced from fruits are classified as wines [4]. Among fermented foods, alcoholic beverages have been widely consumed by people around the world. Fermented products can play an important role, contributing to the livelihoods of rural and perturbing dwellers [5]. In developing countries, traditional fermentation serves many purposes. It can improve the taste of food, enhance the digestibility of food, preserve food from degradation by noxious organisms, and increase nutritional values. Further, it is used for medical reasons, recreational purposes, in marriages, in religious and non-religious ceremonies, at festivals and social gatherings, at burial ceremonies and as food substitutes [6]. *Arakie* is a local distilled beverage, ground *gesho* leaves and water are kept for 3-4 days and after that a *kita* made of *tef* or other cereals and germinated barley or wheat is added. The mixture is allowed to ferment for 5-6 days and then distilled. In the villages distillation is carried out with primitive equipment's made of gourds and wood. The local beer *tella* can also be distilled to produce *Arakie*. This beverage is more expensive than the other drinks and is popularly viewed as very strong and dangerous to consume. *Arakie* is brewed in rural and semi-urban areas and is used more commonly by farmers and semi-urban dwellers than by people who live in the cities. And in cities, people who drink *arakie* are predominantly from lower class or those who have become dependent on alcohol and cannot afford to buy industrially produced alcohol beverages.

The *arakie* can be redistilled and will then have higher alcohol content (22.0 - 28.0 % Alcohol).*Yekosso-Arekie* is one of the sub classes of *Arekie*, which is familiar around Debre-Birhan /Ethiopia/ is prepared by distillations of *kosso* leaf with a normal *Arekie* which is prepared as stated above. As the researcher mentioned above *Yekosso-Arekie* has many components as a raw material i.e. barley, wheat, water, *gesho* leaves and *kosso* leaves which can be a source of different metal which are potentially hazard or essential to us. So it needs to analyze the presence or absence of potential hazard metals or the content of essential metals. The researcher impressed to determine Zinc, since it is an essential micronutrient for human health.Zincis an essential mineral that is naturally present in some foods, added to others, and available as a dietary supplement. Zinc is also found in many cold lozenges and some over-the-counter drugs sold as cold remedies. Zinc is involved in numerous aspects of cellular metabolism. It is required for the catalytic activity of approximately 100 enzymes [7,8] and it plays a role in immune function [9, 10], protein synthesis [10], wound healing [11], DNA synthesis [8, 10], and cell division [10]. Zinc also supports normal growth and development during pregnancy, childhood, and adolescence [12-13] and is required for proper sense of taste and smell [13]. A daily intake of zinc is required to maintain a steady state because the body has no specialized zinc storage system [14].

The Joint FAO/WHO Export Committee on Food Additives (JECFA) provisional maximal tolerable daily intake of Zn is 1000 µg/kg bw/day [15]. The Expert Group on Vitamins and Minerals safe upper limit (SUL) for Zn is 4.2 mg/day (equivalent to 700 µg/kg bw/day in a 60 kg adult) for total dietary intake [16].

## EXPERIMENTAL

### Reagents and Chemicals

Sample (*Yekosso-Arekie*) was used. Reagents used in the analysis were all analytical grades. $HNO_3$ (69–72%) (Spectrosol, BDH, England) and $H_2O_2$ (30%) (BDH Chemicals Limited, Poole, England) were used for the digestion of this alcoholic beverage sample. Stock standard solutions containing 1000 mg $L^{-1}$ in 2% $HNO_3$ of the metal (Zn) (Buck Scientific Puro-Graphictm) were used for preparation of calibration standards and in the spiking experiments. Working standard solutions were obtained by suitable dilution from stock solution. Distilled-deionized water was used throughout the experiment for sample preparation and dilution, and rinsing of apparatus prior to analysis.

### Apparatus and Instruments

A refrigerator (Samsung Hitachi, Japan) was used to keep the alcoholic beverage samples till the analysis. 250 mL round bottomed flasks fitted with reflux condensers were used on Kjeldahl apparatus hot plate to digest the samples. Flame atomic absorption spectrophotometers (Analytik Jena ZEEnit 700P, Germany) equipped with deuterium arc background connectors and hollow cathode lamps with air-acetylene flame was

Print ISSN: ISSN 2053-4108(Print)
Online ISSN: ISSN 2053-4116(Online)

used for the analysis of the analyte metal (Zn) in the sample. A micropipette (100–1000 µL) was used for the volume measurement of reagents and standards.

**Sampling**

The sample type was selected based on having of unique ingredients that is called *Yekesso* leaf. Similarly sample area was selected due to considerations of widely fermentations and consumptions areas of sampled beverages. Though, Debre-Birhan is the icon source of this beverage (*Yekosso-Areke*).A total of nine bulk samples were collected randomly from vending houses from nine different *kebeles*. 81mL of the beverages were taken from the different sites of the towns. All the samples were collected using glass amber bottles. The prepared bulk samples of the beverages were kept in a refrigerator at 4 ºC until the analysis time.

**Digestion of Samples**

Required equipment was prepared on the laboratory desk, and then the round bottom flasks were sacked in acid and then washed with distilled water. After drying of them, the digestion procedures were optimized by varying: the ratio and amount of $HNO_3$ and $H_2O_2$ added to the sample, the digestion time and the temperature required for the digestion. The procedures which consumed least amount of the reagents and lower time and temperature for the digestion, giving clear solution with no precipitate were considered as the optimum procedure. Smaller amounts of reagents and lower temperature and time than the optimum parameters resulted in incomplete digestion of samples which were indicated by colored and unclear digest with precipitates. The optimized digestion procedure: 10ml *Yekosso-Arekie* were measured with pipette by sacking with pipette filler and placed in to separate flasks. For the round bottom flasks (for blank, samples), 1ml of $H_2O_2$ & 1ml conc. $HNO_3$ of were added for each by measuring with pipette step by step respectively for replicate analysis and to take the average of absorbance for reducing of systematic error).Then the flasks were feet to kjeldahi setup by closing their aperture with the condensers, after that the kjeldahi has been turn on at $120^0$c for 5/2 hours at the end clear solutions were obtained. Then the kjeldahi has been turn off and cooled for a while. After cooling, filtration was done by using filter paper, beaker (50ml) and separators funnel. The filtered solutions were placed in sample beakers separately and filled up(diluted) to the mark of 25 ml by using distilled water finally the beakers were labeled and placed in to the fridge until the absorbance measurement.

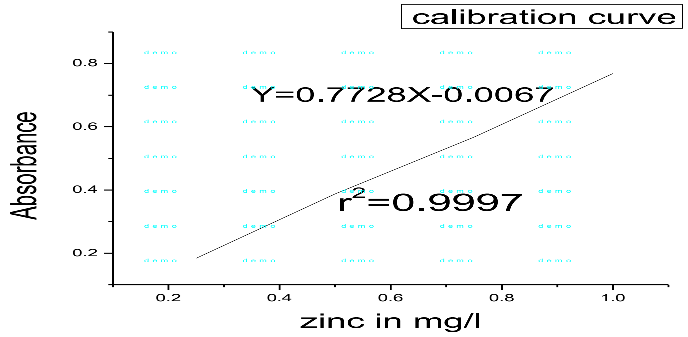
**Determination of the Metal in the Sample by Faas**

Stock standard solutions containing 1000 mg $L^{-1}$ in 2% $HNO_3$ of the metal, Zn, was used for the preparation of calibration standards and in the spiking experiments. All the analyses were carried out using flame atomic absorption spectrophotometer at the wavelength of 213.9 nm of the metal. For the preparation of calibration curve, a series of four working standards were prepared for the metal. The working standards were prepared from the intermediate standards, that were earlier prepared from the stock solutions (1000 mg $L^{-1}$). The standard solutions which have concentrations of 0.25ppm, 0.5ppm, 0.75ppm and 1ppm in 50ml from 1000ppm standard solution were prepared by diluting with de-ionized water. (To prepare standard solutions use the so called dilution equation: $C_1 \cdot V_1 = C_2 \cdot V_2$,where $C_1$ is the concentration of the stock solution, $V_1$ is the volume of the stock solution needed, $C_2$ is the concentration of the desired standard solution, $V_2$ is the volume of the desired standard solution).The standard, blank & samples were placed in to auto sampler test tube and placed at sampling area of FAAS in the order of analysis: first the standard solutions in increasing concentration, then the blank and the samples follow. The FAAS was turned on, then absorbance versus concentration were measured for the standard and calibration curve has been plotted, finally the absorbance of blank and two samples were measured and the data was recorded.

## RESULT AND DISCUSSIONS

Table1: standard solutions Absorbance

| Number | Concentrations in mg/l | Absorbance at 213.9 nm wave length |
|---|---|---|
| 1 | 0.25 | 0.18384 |
| 2 | 0.5 | 0.38766 |
| 3 | 0.75 | 0.56718 |
| 4 | 1.0 | 0.76882 |




**Results**

Triplicate analysis, Absorbance of the blank ($A_o$) =0.10247

Table2: absorbance, concentration of zinc in the sample, A1, A2…. Implies kebele1, kebele2 …..Respectively

| Sample | Average absorbance | Net absorbance | Concentration in the sample | Conc. of Zinc in *Yekosso-Arekie* (mg/l) |
|---|---|---|---|---|
| A1 | 0.2983 | 0.1959 | 0.2621 | 0.6552 |
| A2 | 0.3158 | 0.2133 | 0.2847 | 0.7118 |
| A3 | 0.3071 | 0.2046 | 0.2734 | 0.6835 |
| A4 | 0.3027 | 0.2002 | 0.2678 | 0.6694 |
| A5 | 0.3056 | 0.2031 | 0.2715 | 0.6788 |
| A6 | 0.3059 | 0.2034 | 0.2719 | 0.6798 |
| A7 | 0.3053 | 0.2028 | 0.2711 | 0.6779 |
| A8 | 0.3058 | 0.2033 | 0.2718 | 0.6795 |
| A9 | 0.3063 | 0.2038 | 0.2724 | 0.6809 |

## CALCULATIONS AND DISCUSSIONS

The standard solutions which have 50ml volume for each of four standards from 1000 ppm standard stock solution were prepare with $C_1V_1 = C_2V_2$relation formula. V1=50µl; V2=37.5µl;V3=25µl ; V4= 12.5µl. The equation of regression line (calibration curve) was determined from standard sample concentrations(X) & absorbance(Y):Y=0.7728X-0.0067.

$Y_{intercept}$(-0.0067), this shows that the regression line starts approximately from 0:0 (from the joint of concentration &absorbance lines. The slope (b) = 0.7728, this shows that concentration and absorbance has positive relationships.

The concentration(X) of Zinc in the sample=0.7728X-0.0067;X= (Y+0.0067)/0.7728.But Y = (A-$A_o$) /2) where A is absorbance of each sample, $A_o$ absorbance of the blank solution, Y is the absorbance of Zinc (analyte) in the sample that gave the concentration of Zinc in the sample. The milligram of Zinc to liter of *Yekosso-Arekie*, Zinc weight in 1000ml sample =0.27342 mg; in 25ml sample=A; A= (25ml samplex0.27342 mg)/1000ml sample=0.00684 mg zinc in 25ml. Sample or in10ml *Yekosso-Arekie*, so 10ml *Yekosso-Arekie*=0.00684 mg zinc, 1000ml *Yekosso-Arekie*=X, X= (1000ml yekossoarekiex0.00684mg zinc)/10ml *Yekosso-Arekie* is between 0.6552 and0.7118mgof Zinc per liter of *Yekosso-Arekie.*

The concentrations of Zn varied from 0.12 mg/l in ogogoro to 3.86 mg/l in raphia palm wine, Burukutu and raphia palm wine generally contained higher concentrations of Zn than the oil palm wine, pito, and ogogoro[17]. The permissible limit of Zn in alcohol is set at 5.0 mg/l[18]. The concentrations of Zn in fresh and bottled palm wine in Benin City, Nigeria were found to be in the range of 0.98–8.88 mg/l[19]. The low concentrations of Zn found in ogogoro (local gin) were similar to 0.126– 0.137 mg/l range that was reported for Brazilian cachaca (sugar-cane spirit). Zinc concentrations in the range of 0.2–1.3 mg/l have been reported in wines from Brazil, Portugal, and Chile [20].In Ethiopian wines Znconcentrations is in the range of 1.82–2.70 mg/L [21]. The concentrations of Zn reported in this study were similar to concentrations of Zn reported in the literatures for wines, ogogoro and cachaca.The concentrations of Zn recorded in this study were below the permissible limit for Zn in wines; as a result it hasn’t over dose effect for the consumers with respect to Zinc contents.

## CONCLUSIONS

Traditional distilled alcoholic beverage of Ethiopia namely *Yekossoarekie* was investigated for its essential metal content. The result confirmed that Zincconcentrations in Ethiopian distilled beverages differ among samples of different kebeles because metals in beverages are derived from various raw materials, equipment and brewing processes. In terms of metallic content, the Ethiopian *Yekossoarekie* was found comparable with wine and African traditional beverages. The metal in this beverage was below the WHO limits. The researcher concludes that *Yekosso-Arekie* has remarkable levels of Zinc; as a result the consumers of this beverage can get it’s vital for activating growth and physical and neurological development in infants, children and teenagers since Zinc is an essential micronutrient for human health.

## REFERENCES

1. Steinkraus, K.H. Fermented foods, feeds and beverages. *Biotechnology Adv*ances, **1986**, 1, 219-243.
2. Steinkraus, K.H. (Ed.). *Handbook of Indigenous Fermented Foods*. Marcel Dekker, Inc.:New York; **1983**,pp. 1-58.
3. Alemu, F.; Amha-Selassie, T.; Kelbessa, U.; Elias, S. Methanol, fuel oil and ethanol contents of some Ethiopian traditional alcoholic beverages. *SINET: Ethiopian Journal of Science*, **1991**, 14, 19-27.
4. Pederson, S.C. *Microbiology of Fermentation*. 2nd Ed. AVI Publishing Co. Inc.: West Port, Connecticut; **1979**, pp.288-293.
5. Gadaga, T.H.; Mutukumira, A.N.; Narvhus, J.A.; Feresu, S.B. A review of traditional fermented foods and beverages of Zimbabwe. *International Journal of Food and Microbiology*, **1999**, 53, 1-11.

6. Anteneh, T.; Tetemke, M.; Mogessie, A. Antagonism of lactic acid bacteria against foodborne pathogens during fermentation and storage of *borde* and *shamita*, traditional Ethiopian fermented beverages. *International Food Research Journal*, **2011**, 18(3), 1189-1194.
7. Sandstead HH. Understanding zinc: recent observations and interpretations. *J Lab ClinMed*,**1994**; 124, 322-7.
8. Institute of Medicine, Food and Nutrition Board. Dietary Reference Intakes for Vitamin A, Vitamin K, Arsenic, Boron, Chromium, Copper, Iodine,Iron, Manganese, Molybdenum, Nickel, Silicon, Vanadium, and Zinc. Washington, DC: National Academy Press, **2001**.
9. Solomons NW. Mild human zinc deficiency produces an imbalance between cell-mediated and humoral immunity. *NutrRev*, **1998**; 56, 27-8.
10. Heyneman CA. Zinc deficiency and taste disorders. *Ann Pharmacother*,**1996**; 30,186-7.
11. Simmer K, Thompson RP. Zinc in the fetus and newborn. *ActaPaediatrScandSuppl*,**1985**, 319,158-63.
12. Maret W, Sandstead HH. Zinc requirements and the risks and benefits of zinc supplementation. *J Trace Elem Med Biol*, **2006**, 20, 3-18.
13. Prasad AS, Beck FW, Grabowski SM, Kaplan J, Mathog RH. Zinc deficiency: changes in cytokine production and T-cell subpopulations in patients with head and neck cancer and in noncancer subjects. *Proc Assoc Am Physicians*,**1997**, 109, 68-77.
14. Rink L, Gabriel P. Zinc and the immune system. *ProcNutrSoc*, **2000**, 59, 541-52.
15. World Health Organization (WHO). 1982. Safety evaluation of certain food additives and contaminants: Zinc, WHO additives series No 17. World Health Organization, Geneva.
16. Expert Group on Vitamins and Minerals (evm). Safe upper levels for vitamins and mineral. *Food Standards Agency*, May **2003**.
17. Chukwujindu M. A. Iwegbue,Anwuli L. Ojelum1 & Francisca I. Bassey.A survey of metal profiles in some traditional alcoholic beverages in Nigeria.*Food Science & Nutrition***2014**, 2(6), 724– 733.
18. OIV-OrganisationInternationale de la Vigueet du VIN.Compendium of International methods of wine andMust Analysis. Edition **2007**, Vol. 2, 1-3.
19. Ukhun, M. E., N. P. Okolie, and A. O. Onyerinde. Some mineral profile of fresh and bottled palm wine– a comparative study. *Afr. J. Biotechnol*, **2005**, 4, 829–832.
20. Anjos, M. J., R. T. Lopes, E. F. O. de Jesus, S. Moreira, R. C. Barroso, and C. R. F. Castro. Trace elements determination in red and white wines using total reflection x-ray fluorescence. *Spectrochemi. Acta*,**2003**, Part B 58:2227– 2232.
21. Woldemariam,D.M. and B.S.Chandravanshi.Concentration levels of essential and non-essential elements in selected Ethiopian wines. *Bull. Chem. Soc. Ethiopia*,**2011**, 25,169–180.