Research Article **ISSN: 2393 – 9540**

International Journal of Nutrition and Agriculture Research

Journal home page: www.ijnar.com

ASSESSMENT OF SOME HEAVY METALS IN FOOD PRODUCTS CONSUMED IN KHARTOUM STATE

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ABSTRACT

The aims of this investigation are to assess some heavy metals such as Molybdenum (Mo), Cadmium (Cd), Mercury (Hg), Arsenic (As), Lead (Pb) and Nickel (Ne) in cow milk, egg of white leghorn, banana fruit and anion vegetables in Khartoum State in three location namely: Khartoum, Khartoum north and Omdurman. The molybdenum, cadmium, mercury, arsenic, lead and nickel were determined by using inductively coupled plasma equipment (ICPE). Mean value Mo in banana, anion, cow milk and egg of white leghorn is 0.61, 0.56, 0.16 and 0.5ppm, respectively. Mean value of Cdbanana, anion, cow milk and egg of white leghorn is 0.053, 0.04, 0.045 and o, 1ppm, respectively. Mean value of Hg in banana, anion, cow milk and egg of white leghorn is 0.1, o.1, 0.1o and 0, 1ppm, respectively. Mean value of as in banana, anion, cow milk and egg of white leghorn is 0.90, 0.83, 0.88 and 0.90ppm, respectively. Mean value of Pb in banana, anion, cow milk and egg of white leghorn is 4.19, 0.40, 0.40, 0.40ppm, respectively. Finally, mean value of Ni in banana, anion, cow milk and egg of white leghorn is 0.2, 0.2, 0.2 and 0.2ppm, respectively.

KEYWORDS

Heavy metals, Food and Khartoum.

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INTRODUCTION

Toxic heavy metals are metal elements or elements with metal properties that have a higher density and toxic effects even in low concentrations. They occur naturally in the earth, but can be found in water sources and air as a result of human activity and are toxic for the environment and all life forms because

they accumulate in tissues and cannot be eliminated naturally from the body. The most common toxic heavy metals include arsenic, mercury, lead, cadmium, cobalt, tin and nickel. Other elements like iron, zinc, selenium, copper and chromium are both nutrients in trace amounts and toxic heavy metals when they accumulate in excess amounts in the body (Natureword, 2019)[1]. Lead mineral as leads to hearing loss and tooth decay have been linked to lead exposure, as have cataracts (Park *et al*, 2010)[2]. The maximum residue limit of lead is about 0.25ppm (Natureword, 2019)[1]. Daily intake of Pb for adult and children is 0.1 and 0.1mg day, respectively (UN FAO/WHO, 2011)[3].

Arsenic and Arsenic compounds as a whole are carcinogenic to humans, as occupational exposure to inorganic arsenic, mainly by inhalation, in mining and copper smelting increases the incidents of lung, gastrointestinal and renal cancer and the maximum residue limit is about 1.5ppm (Food Safety Focus, 2007)[4]. Daily intake of As element for adult and children is 0.003 and 0.002mg /day, respectively (UN FAO/WHO, 2011)[3]. Recommended daily allowance of Arsenic is about 0.1ppm (Matthew *et al*, 2017)[5].

Cadmium, as reported by JECFA in 2005, the highest cadmium level found in over 37 000 rice samples from Europe and Far Eastern regions was 0.12ppm, while the average concentration was 0.061ppm (Food Safety Focus, 2007)[4]. The wide range of cadmium levels found in rice may depend on presence of contaminated waters in the farming area, level of cadmium naturally present in soil and the agricultural practices adopted (Food Safety Focus, 2008)[6]. Daily intake of Cd for adult and children is 0.002 and 0.0010mg/day, respectively (UN FAO/WHO, 2011)[3]. Recommended daily allowance of Cadmium is 40.9ppm (Matthew *et al*, 2017)[5].

Mercury is a metal present widely in the environment. Most people are familiar with its use in thermometers as a silver liquid at room temperature. However, this metal may also combine with other elements in nature to form inorganic salts or may bind to organic matters as methyl mercury. Through volcanic eruptions and mining activities, mercury in the earth's crust can be exposed to the environment and get into rivers and oceans. Industrial waste further adds to mercury emissions. Micro-organisms in the aquatic system convert inorganic mercury to methyl mercury. Fish that eat these micro-organisms accumulate methyl mercury which goes up the food chain when larger fish eat smaller fish and the maximum residue limit of mercury is about 16ppm (Matthew *et al*, 2017)[5]. Daily intake of Hg for adult and children is 0.002 and 0.002mg/ day, respectively. The maximum mercury concentration in scallop is 0.033ppm (NMFS, 1978)[7].

The mean exposure estimates considering the maximum concentration of Ni assumed from good manufacturing practice in hydrogenated vegetable oils/fats (50 mg Ni/kg) varied between 27µg Ni/kg body weight per day in cats and 255µg Ni/kg body weight per day in rabbits, for the high concentration scenarios, exposures varied between 30µg Ni/kg body weight per day and 307µg Ni/kg body weight per day in the same species. The estimated exposures to Ni are in line with the one reported in the 2015 EFSA opinion, using a worst□case scenario and the maximum limit of Nickel is about 0.28ppm (https://efsa.onlinelibrary.wiley.com)[8]. Daily intake of Ni for adult and children is 0.85 and 0.35mg day, respectively (UNFAO/WHO, 2011)[3]. Nickel in plant is range from 0.5 - 5ppm, while in animal tissue is range 0.1 - 5ppm (Ashimav *et al*, 2013)[9], Nickel in diet is about 1.00ppm (Matthew *et al*, 2017)[5].

Molybdenum is a mineral your body requires to trigger the function of enzymes essential for the synthesis of amino acids and the metabolism of certain compounds. Adults who are at least 19 years old need approximately 4.5ppm of molybdenum each day (Steve, 2008)[10]. Daily intake of Mo for adult and children is 1.0 and 0.7ppm, respectively (UNFAO/WHO, 2011)[3]. Recommended daily allowance of Mo for adults is about 0.45ppm (Raja *et al*, 2014)[11] and also mentions that molybdenum in food is about 2ppm (Tsonga *et al*, 1980)[12].

In fact heavy metals that can be very harmful to your health if found in your drinking water. Severe effects include reduced growth and development, cancer, organ damage, nervous system damage, and in

extreme cases (https://www.freedrinkingwater.com)[13].

High exposure can lead to obstructive lung diseases and has been linked to lung cancer. Cadmium may also cause bone defects in humans and animals. Damage, it can also cause damage to circulatory and nerve tissues (Ashimav *et al*, 2013)[9]. Exposure may occur through the diet, from medications, from the environment, or in the course of work or play. Heavy metals can enter the body through the skin, or by inhalation or ingestion (https://www.freedrinkingwater.com)[13].

Sources of heavy metals in the environment include geogenic, industrial, agricultural, pharmaceutical, domestic effluents, and atmospheric sources. Environmental pollution is very prominent in point source areas such as mining, foundries and smelters, and other metal-based industrial operations. Heavy metal poisoning refers to when excessive exposure to a heavy metal affects the normal function of the body. Examples of heavy metals that can cause toxicity include lead, mercury, arsenic, cadmium, and chromium. Heavy metals can enter the body through the skin, or by inhalation or ingestion. Heavy metal poisoning is the accumulation of various heavy metals in your body. Over exposure can lead to heavy metal poisoning, such as what occurs in Wilson's disease. This can be fatal. Depending on your level of exposure, medications given intravenously under medical supervision can remove these toxins (https://www.freedrinkingwater.com)[13].

Some foods can help you detoxify by getting rid of heavy metals from your body. These food bind to the metals and remove them in the digestive process such as Cilantro, Garlic, Wide blue berries, Lemon water, Spiruline and Chlorella, Barley grass juice powder, Atlantic dulse, curry, Green tea, probiotic and Tomato. Vitamin C has been reported to have chelating effects on iron. In one animal study, B_1 supplements were shown to decrease iron levels (https://www.freedrinkingwater.com)[13].

To minimize the effects of heavy metal poisoning or prevent it altogether, you need to eliminate some foods from your diet such as brown rice (contains arsenic), Large and long living fish (contains mercury), alcohol and non-organic foods (Debra, 2018)[14].

Toxic elements such as mercury, arsenic, cadmium, and lead can diminish mental and central nervous system function include damage to blood composition (kidneys, lungs, and liver) and reduce energy levels. Numerous studies have been performed to examine the effects of common food processing procedures on the levels of toxic elements in food. While some studies have reported negative effects of processing, several have shown that processing practices may have a positive effect on the reduction of toxic elements in foodstuffs. A number of studies have also introduced protocols and suggested chemical agents that reduce the amount of toxic elements in the final food products. In this review, the reported methods employed for the reduction of toxic elements are discussed with particular emphasis on the chemical binding of both the organic and inorganic forms of each element in various foods (https://www.ncbi.nlm.nih.gov)[15].

Generally, accumulations of these metals within the body of human create toxic health because these metals are considered as carcinogenesis problem.

High exposures to inorganic mercury may result in damage to the gastrointestinal tract, the nervous system, and the kidneys. Both inorganic and organic mercury compounds are absorbed through the gastrointestinal tract and affect other systems via this route. However, organic mercury compounds are more readily absorbed via ingestion than inorganic mercury compound. Health effects of mercury. Mercury exposure at high levels can harm the brain, heart, kidneys, lungs, and immune system of people of all ages (Matthew *et al*, 2017)[5].

General Objectives

To monitor by means of analysis the contents of undesirable substances (contaminants) in specific foods.

To compare the results of the present study with the maximum limit allowed by National and international authorities.

Specific objectives

Determination some heavy metals in the target food (animal and plant) by using inductively coupled plasma (ICPE).

MATERIAL AND METHODS

Materials

Seventy two samples (4 Foods X 3 locations X 6 samples) namely, Cow Milk; Egg (white leghorn laying hen), Onion and Banana were collected from different locations (Khartoum, Omdurman and Bahri) in Khartoum State.

Preparation of samples

The samples *were* cleaned from dust and foreign materials by hand and separately freed from other parts of plant and crushed by electricity machine into coarsely powdered (AOAC, 1990)[16].

The minerals (Mo, Cd, As, Pb, Hg and Ni) of samples were extracted according to Pearson's method (1970) and were measured in a filtered 50 ml extraction solution by using Atomic absorption equipment.

Determination of total Mineral concentration

The minerals of samples were extracted according to Pearson's method (Pearson, 1970)[17].

Procedure

About 5grams of each sample were transferred into amacro-kjeldahl digestion flask and 20ml concentrated nitric acid and up to 20ml water (depending on the water content of samples) were added. The content of the flask was boiled to reduce the volume to 20ml.

The solution was cooled and added 10ml of conic sulphuric Acid and boiled again. Further small quantities of nitric acid was added whenever the contents begin to blacken was continued when the addition of nitric acid was no longer necessary (i.e. when the liquid no longer blackens was continued heating till white fames were evolved). At this stage, was cooled the solution and added 10ml of saturated ammonium oxalate solution and again was boiled until copious white fumes were again produced. The oxalate treatment assists in removing yellow coloration due to nitro compounds, fat etc., so that the final solution was colorless, every trace of nitric acid must be removed be for proceeding for assayed of metals. A blank should be prepared at the same time the digested sample was injected into ICPE using the condition below.

The ICPE. 9000 conditions used were Argon Gas (Ar), P (K Pa) = 533.50, plasma = 10.00, vacuum level (Pa) = 7.2, Direction = Axial, Auxiliary = 0.60, Nozzle Dest = Ro. The identification and quantification of each mineral was determined using a standard solution of each mineral.

Statistical analysis

Statistical analysis was performed using SPSS package for windows version 21.0 Data are expressed as Mean ± SD, one way ANOVA and T - test were used to analyze differences among groups

RESULTS

Banana fruit

The calculate value of Mo in Khartoum, Khartoum north and Omdurman for Banana was0.57, 0.58 and 0.67ppm, respectively (Figure No.1). Mean value of Mo for three locations is 0.61ppm. The calculate value of Cd in Khartoum, Khartoum north and Omdurman for Banana was 0.05, 0.048 and0.06ppm, respectively while mean value of Cd for three locations is 0.053ppm (Table No.1). Calculate value of Hg in Khartoum, Khartoum north and Omdurman for Banana was 0.01, 0.095 and 0.107ppm, respectively, but the mean value of Hg for three locations is 0.1ppm (Table No.1). Calculate value of As in Khartoum, Khartoum north and Omdurman for Banana was 0.8, 0.81 and 0.807ppm, respectively (Figure No.2). Mean value of As for three locations is 0.81ppm Calculate value of Pb in Khartoum, Khartoum north and Omdurman for Banana was 4.2, 4.1 and 4.27ppm, respectively, while mean value of Pb for three locations is 4.19 (Table No.1). Calculate value of Ni in Khartoum, Khartoum north and Omdurman for Banana was similar (0.2ppm), but mean value of Ni for three locations is still 0.2ppm (Table No.1).

Anion vegetable

The calculate value of Mo in Khartoum, Khartoum north and Omdurman for Anion was 0.56, 0.56 and0.56ppm, respectively, while mean value of Mo for three locations is 0.56ppm (Table No.2). The calculate value of Cd in Khartoum, Khartoum north and Omdurman for Anion was 0.04, 0.04 and 0.04ppm, respectively, but mean value of Cd for three locations is 0.04ppm (Table No.2). The calculate value of Hg in Khartoum, Khartoum north and Omdurman for Anion was 0.096, 0.10 and

0.10ppm (Figure No.3). Mean value of Hg for three locations is 0.099ppm. The calculate value of As in Khartoum, Khartoum north and Omdurman for Anion was 0.818, 0.83 and 0.81ppm, respectively, but mean value of As for three locations is 0.83ppm (Table No.2). The calculate value of Pb in Khartoum, Khartoum north and Omdurman for Anion was 0.401, 0.402 and 0.40ppm, respectively (Figure No.4). Mean value of Pb for three locations is 0.401ppm. The calculate value of Ni in Khartoum North, Khartoum and Omdurman for Anion was similar (0.2ppm), while mean value of Ni for three locations is 0.2ppm (Table No.2).

Cow milk

The calculate value of Mo in Khartoum, Khartoum north and Omdurman for milk was 0.23, 0.12 and 0.13ppm, respectively, while mean value of Mo for three locations is 0.16ppm (Table No.3) Calculate value of Cd in Khartoum, Khartoum north and Omdurman for milk was 0.038, 0.038 and 0.06ppm, respectively (Figure No.5). Mean value of Cd for three locations is 0.45ppm. The calculate value of Hg in Khartoum, Khartoum north and Omdurman for milk was 0.099, 0.o99 and 0.11ppm, respectively, while mean value of Hg for three locations is 0.103ppm (Table No.3). The calculate value of As in Khartoum, Khartoum north and Omdurman for milk was 0.91, 0.91 and 0.81ppm, respectively, but mean value of As for three locations is 0.88ppm (Table No.3). Calculate value of Pb in Khartoum North, Khartoum and Omdurman for milk was 0.38±0.002, 0.38±0.001 and 0.43±0.005ppm, respectively (Figure No.6). Mean value of Pb for three locations is 0.40ppm. The calculate value of Ni in Khartoum, Khartoum north and Omdurman for milk was similar (0.2ppm), while mean value of Ni for three locations is 0.2ppm (Table No.3).

Egg of white leghorn

The calculate value of Mo in Khartoum, Khartoum north and Omdurman for egg was 0. 5, 0.5 and 0.5ppm, respectively, but mean value of Mo for three locations is 0.5ppm (Table No.4). Calculate value of Cd in Khartoum, Khartoum north and Omdurman for egg was 0.04, 0.04 and 0.04ppm, respectively while mean value of Cd for three locations is 0.04ppm (Table No.4). The calculate value of Hg in Khartoum, Khartoum north and Omdurman for egg was 0.1, 0.1 and 0.1ppm, respectively, where mean value of Hg for three locations is 0.1ppm (Table No.4). The calculate value of As in Khartoum, Khartoum north and Omdurman for egg was 0.91, 0.90 and 0.90ppm, respectively while mean value of As for three locations is 0.90ppm (Table No.4). The calculate value of Pb in Khartoum, Khartoum north and Omdurman for egg was 0.4, 0.4 and 0.4ppm, respectively (Figure No.7). Mean value of Pb for three locations is 0.4ppm. The calculate value of Ni in Khartoum, Khartoum north and Omdurman for egg was 0.2, 0.37 and 0.2ppm (Figure No.8). Mean value of Nin for three locations is 0.25ppm.

DISCUSSION

Banana fruits

Molybdenum

The mean value of Mo of banana for three locations in banana in Khartoum State is lower than value reported by (Steve, 2008)[10]. In adult for daily intake, mean value of Mo in banana is low than value obtained by (UN FAO/WHO)[3], but in children for daily intake, it is high than value found by (UN FAO/WHO)[3]. The mean value of Mo for banana is high than value reported by (Raja *et al*, 2014)[11]. The variation in Mo content in diet might concert with the source and types of foods. The mean value of Cd for three locations in Khartoum State is low than value of Cd obtained by, but for both adult and children the mean value of Cd is high than value reported by (UN FAO/WHO, 2011)[3]. In addition, it is low than value found by (https://www.freedrinkingwater.com)[13]. The variation in Cd content is due to source and types of foods. The mean value of Hg of banana in three locations in Khartoum State is high than value of both adult and children reported by (UN FAO/WHO, 2011)[3]. It is low than finding obtained by (Matthew *et al*, 2017)[5], but it is high than finding reported by (NMFS, 1978)[7]. The results indicated mean value of Hg is high than values mentioned for daily intake of Hg by international organization recommended for adult and children. The mean value of as in banana for three location is low than value obtained by. It is high than value recommended for Adult and children

(UN FAO/WHO, 2011)[3]. Whereas; it is high than value reported by (https://www.freedrinkingwater.com)[13]. The results are indicated that mean value of as is high than daily intake of As. Also there was variation in as content in banana. These might be due to source and types of food. The mean value of Pb in banana for three locations in Khartoum State is high than those values reported by (https://www.freedrinkingwater.com)[13]. The results are indicated that level of Pb in banana for three locations is high than value recommended by international organization. The mean value of Ni of banana for three locations in Khartoum State is high than value found by (https://efsa.onlinelibrary.wiley.com[8] and UN FAO/WHO, 2011)[3], but it is within the range reported by (Ashimav *et al*, 2013)[9]. Where it is low than value reported by (https://www.freedrinkingwater.com)[13]. The results are indicated there was variation in Ni content according to source and types of food.

Anion vegetables

The mean value of Mo in anion in three locations in Khartoum State is low than value reported by (Steve, 2008[10] and Tsonga *et al*, 1980)[12]. It is high than value reported for children (UN FAO/WHO, 2011)[3] and low than value reported for adult (UN FAO/WHO, 2011)[3]. The results illustrated that level of Mo in anion is low than value recommended by international organization. The mean value of Cd of anion for three locations in Khartoum State is low than value obtained by[4]. The daily intake Cd of adult and children is low than value reported by author. Where mean value is still low than value found by (https://www.freedrinkingwater.com)[13]. The results are indicated that mean value of Cd of anion is low than recommended value reported by international. The mean value of Hg of anion for three locations in Khartoum State is high than values reported by (UN FAO/WHO, 2011[3] and NMFS, 1978)[7]. Where it is low than value found by (Matthew *et al*, 2017)[5]. The results are indicated there was varied in Hg content. It might be due to different in source and types of food. The mean value of as of anion in three locations in Khartoum State is low than value reported by[4]. It is high than value reported by (UN FAO/WHO, 2011[3] and https://www.freedrinkingwater.com)[13]. The results indicated that mean value of As for anion is high than value of daily intake recommended by international organization. The mean value of Pb of anion in three locations in Khartoum State is high than value reported by (https://www.freedrinkingwater.com)[13], that means there as variation in Pb content in anion. These might due to type and source of food. The mean value of Ni of anion in Khartoum State is lo than value reported by (https://efsa.onlinelibrary.wiley.com[8], UNFAO/WHO, 2011[3] and https://www.freedrinkingwater.com)[13], it is within the range obtained by (Ashimav *et al*, 2013)[9]. The results are indicated that mean value of Ni is low than daily intake recommended by international organization.

Cow milk

The mean value of Mo of cow milk in three locations in Khartoum State is low than value reported by (Raja *et al*, 2014[11] and Tsonga *et al*, 1980)[12]. For daily intake of Mo, mean value of Mo of cow milk is low for adult [UN FAO/WHO[3], but it is high for children (UN FAO/WHO, 2011)[3]. The results are indicated that mean value of Mo of cow milk is agreed with value thus recommended by international organization. The mean value of Cd of cow milk in three locations in Khartoum State is high than value reported by (Food Safety Focus, 2007)[4] and low that value reported by (https://www.freedrinkingwater.com)[13]. It is high than value for adult and children (UN FAO/WHO)[3]. Therefore, mean value of Cd of cow milk is high than value recommended by international value. The mean value Of Hg of cow milk in three locations in Khartoum State is low than value reported by (Matthew *et al*, 2017)[5], but it is high than value recommended for adult and children (UN FAO/WHO, 2011)[3]. It is still is high than value obtained by (NMFS, 1978)[7]. For daily intake the mean value is high than international value, the mean value of As of cow milk is low than values reported by (UN FAO/WHO[3] and Food Safety Focus, 2007)[4], but it is high than value obtained by (Ashimav *et al*,

2013)[9]. The results are lower than the international value of As. The mean value of Pb of cow milk in three locations in Khartoum State is high than value reported by (Natureword, 2019)[1]. It is still high than value reported by (UN FAO/WHO, 2011)[3]. For daily intake of Pb of cow milk is higher than international value of Pb recommended b international organization. The mean value of Ni of cow milk in three locations in Khartoum State is low than value reported by (UN FAO/WHO, 2011[3], https://efsa.onlinelibrary.wiley.com[8] and https://www.freedrinkingwater.com)[13], but it is within the range recommended by (Ashimav *et al*, 2013)[9]. For daily intake of Ni for cow milk is low than vale recommended by international organization.

Egg of white leghorn

The mean value of Mo of egg of white leghorn in three locations in Khartoum State is low than value reported by (Steve, 2008[10] and Tsonga *et al*, 1980)[12], but is high than value obtained by (Raja *et al*, 2014)[11]. It is low than value for adult (UN FAO/WHO)[3], but it is high than value for children [UN FAO/WHO, 2011)[3]. The variation in Mo content depends on type and source of food. The mean value of Cd of egg of white leghorn in three locations in Khartoum State is high than value found by (UN FAO/WHO, 2011[3] and Food Safety Focus, 2007)[4] but is low than value obtained by (https://www.freedrinkingwater.com)[13]. For daily intake of Cd for egg is high than the international organization. The mean value of Hg of egg of white leghorn in three locations in Khartoum State is low than value reported by (Matthew *et al*, 2017)[5], but it is high for adult and children that found by (UN FAO/WHO, 2011)[3].

It is still high than value recommended by (Ashimav *et al*, 2013)[9]. For daily intake of Hg is high than value recommended by international organization. The mean value of As of egg of white leghorn in three locations in Khartoum State is high than value reported by (UN FAO/WHO, 2011)[3], but it is low than value reported by (Food Safety Focus, 2007)[4]. For daily intake of as high than value reported by international organization. The mean value of Pb of egg of white leghorn in three locations in Khartoum State is high than value found by (https://www.freedrinkingwater.com)[13]. The indicated that Pb content in egg of white leghorn is high than value recommended internationally. The mean value of Ni content of egg of white leghorn in three locations in Khartoum State is high than value obtained by (https://www.freedrinkingwater.com)[13], but it is high (https://efsa.onlinelibrary.wiley.com)[8]. For daily intake of adult and children, it is low (UN FAO/WHO, 2011)[3]. The results for Ni level in diet are low than value recommended internationally.

Table No.1: Minerals concentration (ppm) of banana collected from different sites in Khartoum State

S.No	Location / Mean value / Minerals	Khartoum Calculate value (ppm)	Khartoum north Calculate value (ppm)	Omdurman Calculate value (ppm)	Mean value
1	Cd	0.05±0.000	0.048±0.00	0.06±0.0010	0.053±0.006
2	Hg	0.1±0.0000	0.095±0.00	0.107±0.002	0.100±0.0060
3	Pb	4.2±0.0050	4.1±0.0040	4.27±0.0060	4.19±0.0850
4	Ni	0.2±0.0030	0.2±0.0030	0.2±0.00300	0.20±0.0000

Table No.2: Minerals concentration (ppm) of Anion collected from different sites in Khartoum State

S.No	Location / Mean value / Minerals	Khartoum Calculate value (ppm)	Khartoum north Calculate value (ppm)	Omdurman Calculate value (ppm)	Mean value
1	Mo	0.56±0.0020	0.57±0.002	0.56±0.006	0.56±0.0060
2	Cd	0.04±0.0000	0.04±0.000	0.04±0.000	0.04±0.000
3	As	0.818±0.003	0.83±0.003	0.81±0.003	0.83±0.0100
4	Ni	0.2±0.00300	0.2±0.0030	0.2±0.0030	0.20±0.0000

Table No.3: Minerals concentration (ppm) of Cow milk collected from different sites in Khartoum State

S.No	Minerals	Khartoum Calculate value (ppm)	Khartoum north Calculate value (ppm)	Omdurman Calculate value (ppm)	Mean value
1	Mo	0.23±0.001	0.12±0.001	0.13±0.006	0.16±0.04800
2	Hg	0.099±0.00	0.099±0.00	0.11±0.002	.0.103±0..055
3	As	0.91±0.004	0.91±0.003	0.81±0.006	0.88±0.05800
4	Ni	0.2±0.0030	0.2±0.0030	0.2±0.0030	0.20±0.00000

Table No.4: Minerals concentration (ppm) of egg of white leghorn collected from different sites in Khartoum State

S.No	Minerals	Khartoum Calculate value (ppm)	Khartoum north Calculate value (ppm)	Omdurman Calculate value (ppm)	Mean value
1	Mo	0.5±0.0060	0.5±0.0040	0.5±0.003	0.5±0.0000
2	Cd	0.04±0.001	0.04±0.000	0.04±0.00	0.1±0.0000
3	Hg	0.1±0.0040	0.1±0.0000	0.1±0.001	0.1±0.0000
4	As	0.91±0.002	0.9±0.0100	0.9±0.001	0.90±0.006

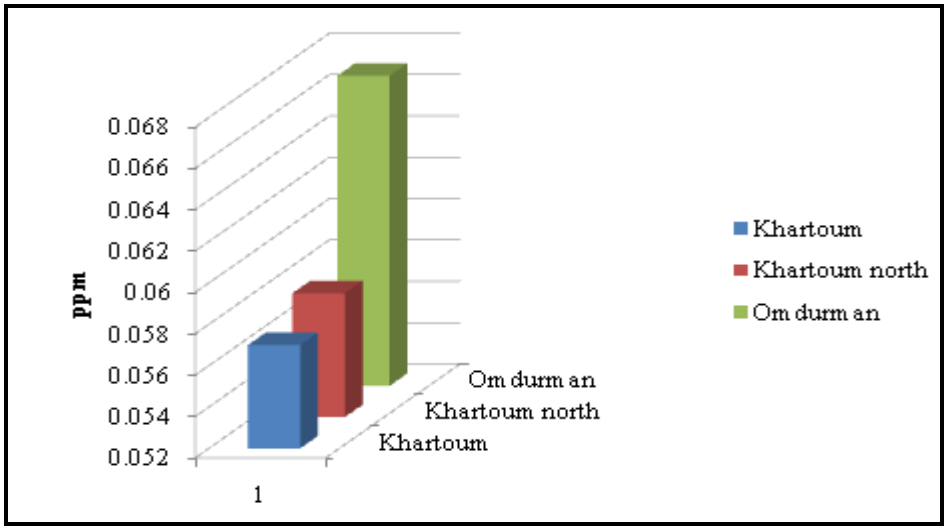

Figure No.1: Shows Molybdenum concentration (ppm) in Banana fruit selected from three locations in Khartoum State

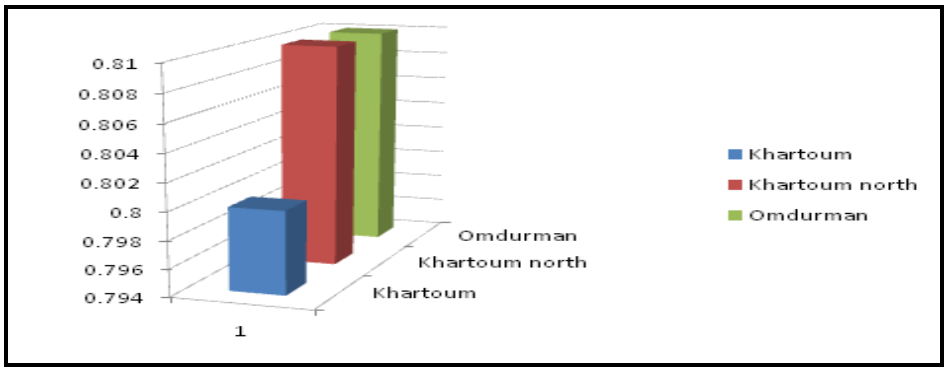

Figure No.2: Shows Arsenic (As) concentration (ppm) in Banana fruit selected from three locations in Khartoum State

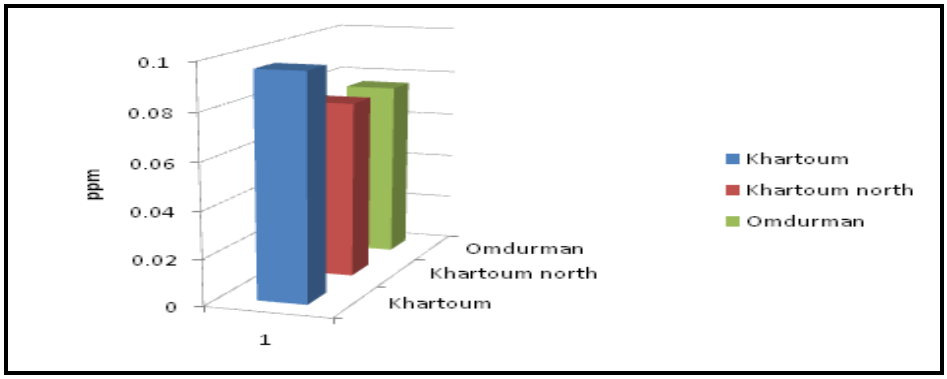

Figure No.3: Shows Mercury (Hg) concentration (ppm) in Anion vegetable selected from three locations in Khartoum State

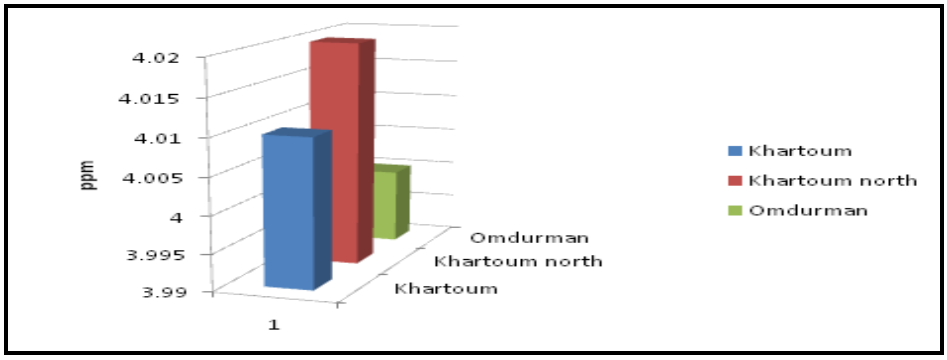

Figure No.4: Shows lead (Pb) concentration (ppm) in anion vegetable selected from three locations in Khartoum State

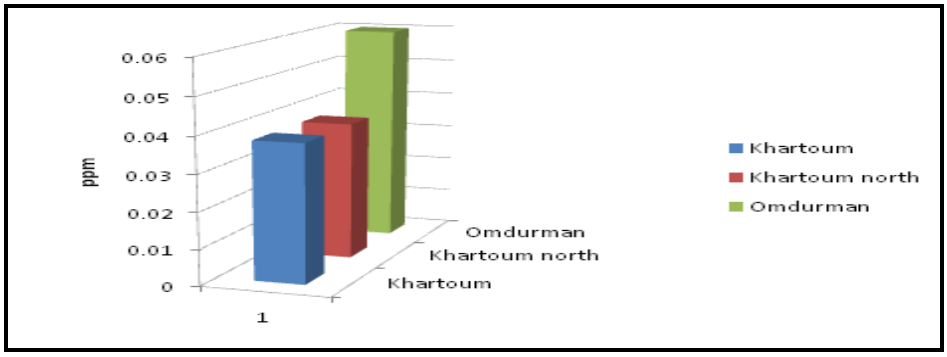

Figure No.5: Shows Cadmium (Cd) concentration (ppm) in cow milk fruit selected from three locations in Khartoum State

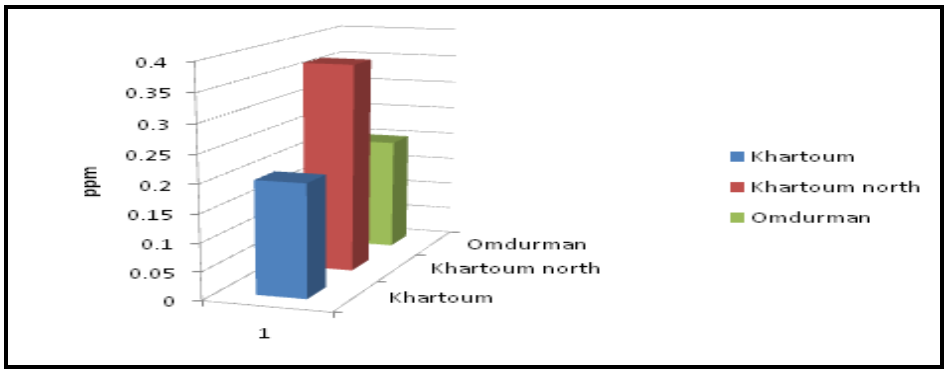

Figure No.6: Shows Lead (Pb) concentration (ppm) in cow milk selected from three locations in Khartoum State

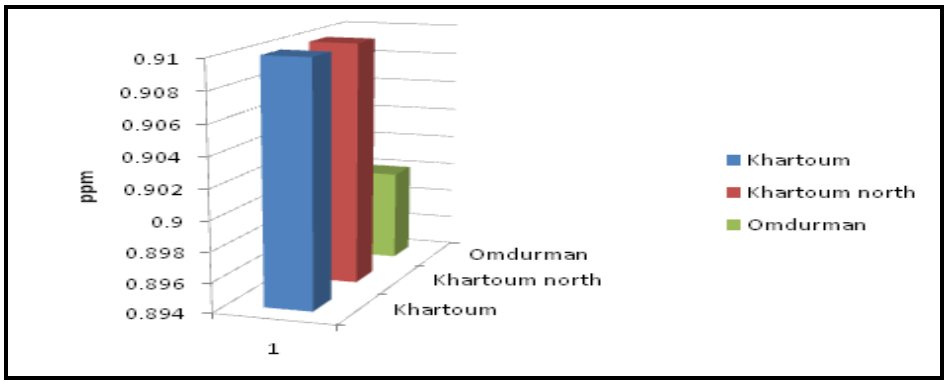

Figure No.7: Shows lead (Pb) concentration (ppm) in egg of white leghorn selected from three locations in Khartoum State

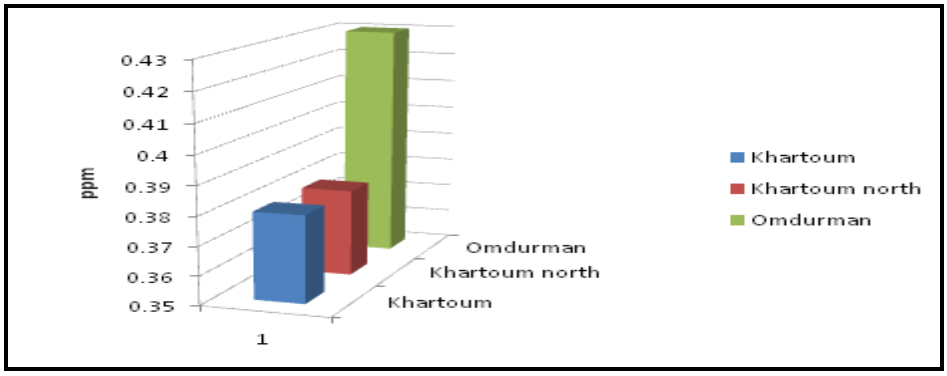

Figure No.8: Shows Nickel (Ni) concentration (ppm) in egg of white leg horn selected from three locations in Khartoum State

CONCLUSION

The food that consumed by people life in Khartoum contain heavy metals such as Mo, Cd, Hg, As, Pb and Ni. Some of these metals are within value recommended internationally, while others are without value recommended internationally. In addition, there was variation in these heavy metals according to types, sources and locations in Khartoum State.

ACKNOWLEDGEMENT

The authors wish to express their sincere gratitude to Department of Biochemistry and Molecular Biology, Al-Neelain University, Faculty of Science and Technology, Khartoum, Sudan for providing necessary facilities to carry out this research work.

CONFLICT OF INTEREST

We declare that we have no conflict of interest.

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Please cite this article in press as: Sabahelkhier M K *et al.* Assessment of some heavy metals in food products consumed in Khartoum State, *International Journal of Nutrition and Agriculture Research*, 6(2), 2019, 53-63.