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ASSESSMENT OF SOME HEAVY METALS IN FOOD PRODUCTS (BANANA, ANION, MILK AND EGG) CONSUMED IN KHARTOUM STATE (KHARTOUM NORTH, KHARTOUM AND OMDURMAN)

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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 milk, egg, banana and anion in Khartoum State in three location namely: Khartoum north, Khartoum and Omdurman. Mo in foods consumed in Khartoum State ranged 0.012 - 0.06mg/100mg, Cd in foods consumed in Khartoum State ranged 0.0038 - 0.0060mg/100mg, Hg in foods consumed in Khartoum State ranged 0.0076 - 0.0100mg/ 100mg, As in foods consumed in Khartoum State ranged 0.080 - 0.091mg/ 100mg, Pb in foods consumed in Khartoum State ranged 0.038 - 0.427mg/ 100mg and Ne in foods consumed in Khartoum State ranged 0.020 - 0.037mg/100mg.

KEYWORDS
Mo, Cd, Hg, As, Pb, Ne, 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[1]. Lead. As leads to hearing loss and tooth decay have been linked to lead exposure, as have cataracts[2]. The maximum residue limit of lead is about 0.25mg/100mg[1].

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 0.15mg/100mg[3].

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 0.012mg/100mg, while the average concentration was 0.0061mg/100mg. 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[4].

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 0.016mg/mg[5].

Nickel, The mean exposure estimates considering the maximum concentration of Ni assumed from good manufacturing practice in hydrogenated vegetable oils/fats (50mg Ni/kg) varied between 27µg Ni/kg bw per day in cats and 255µg Ni/kg bw per day in rabbits; for the high concentration scenarios, exposures varied between 30µg Ni/kg bw per day and 307µg Ni/kg bw 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 0.028mg/100m[6].

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 0.45mg/100mg of molybdenum each day[7].

General Objectives

1. To monitor by means of analysis the contents of undesirable substances (contaminants) in specific foods.
2. To compare the results of the present study with the maximum limit allowed by National and international authorities.
3. To study the particular implications (risk assessment) of targeted food consumed by individual or family per day using a cross-sectional population survey.

Specific objectives

1. 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, Milk; Egg, Onion and Banana were collected from different locations (Khartoum, Omdurman and Bahri) in Khartoum State.

Determination of total Mineral concentration

Total mineral concentration was determined for all samples by Nitric acid, perchloric acid decomposition method described by Atomic Absorption spectrophotometry cookbook section 6, foodstuffs analysis fertilizer and feed analysis, Shimadzu Corporations Kyoto Japan, used Inductively Coupled plasma Atomic Emission spectrometer (ICPE), motel = 9000, Shimaedzu, Japan.

Condition of ICPE - 9000: Argon Gas (Ar) P (K Pa) = 533.50, Plasma = 10.00, Vacuum Level (Pa) = 7.2,

Direction = Axial, Auxiliary = 0.60 and Nozzle Dest = Ro

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 AND DISCUSSION

Banana product

Table No.1 indicated that calculate value of Mo in Khartoum North, Khartoum and Omdurman for Banana was 0.057±0.006, 0.058±0.005 and 0.067±0.002mg/100gm, respectively. Dietary reference intake of Mo for adult and children was 0.10 and 0.07mg/100gm[8], respectively. The calculate value for Mo in three locations (Khartoum North, Khartoum and Omdurman) is lower than thus value reported by[8], in adult and children and it is still lower than thus value obtained by[1].

Calculate value of Cd in Khartoum North, Khartoum and Omdurman for Banana was 0.005±0.00, 0.0048±0.00 and 0.006±0.00mg/100gm, respectively. Dietary reference intake of Cd for adult and children was 0.002 and 0.001mg/100gm[8], respectively. The calculate value for Cd in adult and children in three locations (Khartoum North, Khartoum and Omdurman) is higher than thus value reported by WHO (2004)[8], but it is lower than value illustrated by[4]. Therefore, Banana in three locations in Khartoum state contains high amount of Cd.

Calculate value of Hg in Khartoum North, Khartoum and Omdurman for Banana was 0.01±0.00, 0.0095±0.00 and 0.0107±0.002mg/100gm, respectively. Dietary reference intake of Hg for adult and children was 0.002 and 0.001mg/100g[8], respectively. The calculate value for Hg in three locations (Khartoum North, Khartoum and Omdurman) is higher than thus value reported by WHO (2004)[8], but it is still lower than thus value reported by[5]. Therefore, Banana in Khartoum north, Omdurman contains high amount of Hg, but Khartoum contains less amount of Hg.

Calculate value of As in Khartoum North, Khartoum and Omdurman for Banana was 0.08±0.004, 0.081±0.001 and 0.0807±0.004mg100 gm, respectively. Dietary reference intake of as for adult and children was 0.003 and 0.002mg/100gm[8], respectively. The calculate value for as in three locations (Khartoum North, Khartoum and Omdurman) is higher than thus value reported by[8], but it is lower than value reported by[3]. Therefore, Banana in Khartoum north, Khartoum and Omdurman contains high amount of As.

Calculate value of Pb in Khartoum North, Khartoum and Omdurman for Banana was 0.42±0.005, 0.41±0.004 and0.427±0.006 mg/100gm, respectively. Dietary reference intake of Pb for adult and children was 0.10 and 0.10 mg/100gm[8], respectively. The calculate value for Pb in three locations (Khartoum North, Khartoum and Omdurman) is higher than thus value reported by[8], but it is higher than value obtained by[1]. Therefore, Banana in Khartoum north, Khartoum and Omdurman contains high amount of Pb.

Calculate value of Ni in Khartoum North, Khartoum and Omdurman for Banana was similar (0.02±0.003mg/100gm). Dietary reference intake of Ni for adult and children was 0.85 and 0.35mg/day[8], respectively. The calculate value for Ni in three locations (Khartoum North, Khartoum and Omdurman) is lower than thus value reported by[8], but it is agreement with value reported by[6]. Therefore, Banana in Khartoum north, Khartoum and Omdurman contains low amount of Ni.

Anion product

Table No.2 indicated that calculate value of Mo in Khartoum North, Khartoum and Omdurman for Anion was 0.056±0.002, 0.057±0.002 and 0.056±0.006mg/100gm, respectively. Dietary reference intake of Mo for adult and children was 0.10 and 0.07 mg/100gm[8], respectively. The calculate value for Mo in three locations (Khartoum North, Khartoum and Omdurman) is lower than thus value reported by[8], but it is lower than value obtained by[7].

Calculate value of Cd in Khartoum North, Khartoum and Omdurman for Anion was 0.004±0.00, 0.004±0.00 and 0.004±0.00mg/100gm, respectively. Dietary reference intake of Cd for adult and children was 0.002 and 0.001mg/100gm[8], respectively. The calculate value for Cd in three locations (Khartoum

North, Khartoum and Omdurman) is higher than thus value reported by[8], but it is lower than value reported by[4]. Therefore, Anion in three locations in Khartoum state contains high amount of Cd.

Calculate value of Hg in Khartoum North, Khartoum and Omdurman for Anion was 0.0096±0.001, 0.010±0.00 and 0.010±0.00mg/100gm, respectively. Dietary reference intake of Hg for adult and children was 0.002 and 0.001mg/100gm[8], respectively. The calculate value for Hg in three locations (Khartoum North, Khartoum and Omdurman) is higher than thus value reported by[8], but it is lower than value obtained by[5]. Therefore, Anion in Khartoum north, Omdurman contains high amount of Hg.

Calculate value of As in Khartoum North, Khartoum and Omdurman for Anion was 0.0818±0.003, 0.083±0.003 and 0.081±0.003mg100gm, respectively. Dietary reference intake of as for adult and children was 0.003 and0.002mg/100gm[8], respectively. The calculate value for as in three locations (Khartoum North, Khartoum and Omdurman) is higher than thus value reported by[8], but it is lower than finding obtained by[2]. Therefore, Anion in Khartoum north, Khartoum and Omdurman contains high amount of As.

Calculate value of Pb in Khartoum North, Khartoum and Omdurman for Anion was 0.0401±0.002, 0.0402±0.006 and 0.040±0.004mg/100gm, respectively. Dietary reference intake of Pb for adult and children was 0.10 and 0.10mg/100gm[8], respectively. The calculate value for Pb in three locations (Khartoum North, Khartoum and Omdurman) is lower than thus value reported by[8], but it is lower than finding reported by[1]. Therefore, Anion in Khartoum north, Khartoum and Omdurman contains low amount of Pb.

Calculate value of Ni in Khartoum North, Khartoum and Omdurman for Anion was similar (0.02±0.003mg/100gm). Dietary reference intake of Ni for adult and children was 0.85 and 0.35mg/day[8], respectively. The calculate value for Ni in three locations (Khartoum North, Khartoum and Omdurman) is lower than thus value reported by [8], but it is agreement with[6]. Therefore, Anion in Khartoum north, Khartoum and Omdurman contains low amount of Ni.

Milk product

Table No.3 indicated that calculate value of Mo in Khartoum North, Khartoum and Omdurman for milk was 0.023±0.001, 0.012±0.001 and 0.013±0.006mg/100gm, respectively. Dietary reference intake of Mo for adult and children was 0.10 and 0.07mg/100gm[8], respectively. The calculate value for Mo in three locations (Khartoum North, Khartoum and Omdurman) is lower than thus value reported by[8], but it is than value obtained by[7].

Calculate value of Cd in Khartoum North, Khartoum and Omdurman for milk was 0.0038±0.00, 0.0038±0.00 and 0.013±0.006mg/100gm, respectively. Dietary reference intake of Cd for adult and children was 0.002 and 0.001mg/100gm[8], respectively. The calculate value for Cd in three locations (Khartoum North, Khartoum and Omdurman) is higher than thus value reported by[8], but is lower than finding reported by[4]. Therefore, milk in three locations in Khartoum state contains high amount of Cd.

Calculate value of Hg in Khartoum North, Khartoum and Omdurman for milk was 0.0096±0.001, 0.010±0.00 and 0.010±0.00mg/100gm, respectively. Dietary reference intake of Hg for adult and children was 0.002 and 0.001 mg/100gm[8], respectively. The calculate value for Hg in three locations (Khartoum North, Khartoum and Omdurman) is higher than thus value reported by WHO (2004)[8], but it is lower than value reported by[5]. Therefore, milk in Khartoum north, Omdurman contains high amount of Hg.

Calculate value of As in Khartoum North, Khartoum and Omdurman for milk was 0.0099±0.00, 0.0099±0.00 and 0.011±0.002mg100gm, respectively. Dietary reference intake of as for adult and children was 0.003 and 0.002 mg/100gm[8], respectively. The calculate value for as in three locations (Khartoum North, Khartoum and Omdurman) is higher than thus value reported by[8], but is lower than value reported by[3]. Therefore, milk in Khartoum north, Khartoum and Omdurman contains high amount of As.

Calculate value of Pb in Khartoum North, Khartoum and Omdurman for milk was 0.038±0.002, 0.038±0.001 and 0.043±0.005mg/100gm, respectively. Dietary reference intake of Pb for adult

and children was 0.10 and 0.10mg/100gm[8], respectively. The calculate value for Pb in three locations (Khartoum North, Khartoum and Omdurman) is lower than thus value reported by[8], but it is lower than finding reported by[1]. Therefore, milk in Khartoum north, Khartoum and Omdurman contains low amount of Pb.

Calculate value of Ni in Khartoum North, Khartoum and Omdurman for milk was similar (0.02±0.003mg/100gm). Dietary reference intake of Ni for adult and children was 0.85 and 0.35mg/day (WHO, 2004)[8], respectively. The calculate value for Ni in three locations (Khartoum North, Khartoum and Omdurman) is lower than thus value reported by[8], but is lower than value reported by[6]. Therefore, milk in Khartoum north, Khartoum and Omdurman contains low amount of Ni.

Egg product

Table No.4 indicated that calculate value of Mo in Khartoum North, Khartoum and Omdurman for egg was 0.05±0.006, 0.05±0.004 and 0.05±0.003mg/100gm, respectively. Dietary reference intake of Mo for adult and children was 0.10 and 0.07mg/100gm[8], respectively. The calculate value for Mo in three locations (Khartoum North, Khartoum and Omdurman) is lower than thus value reported by WHO (2004)[8], but it is lower than finding reported by[7].

Calculate value of Cd in Khartoum North, Khartoum and Omdurman for egg was 0.004±0.001, 0.004±0.00 and 0.004±0.00mg/100gm, respectively. Dietary reference intake of Cd for adult and children was 0.002 and 0.001mg/100gm[8], respectively. The calculate value for Cd in three locations (Khartoum North, Khartoum and Omdurman) is higher than thus value reported by[8], but it is lower than value reported by[4]. Therefore, milk in three locations in Khartoum state contains high amount of Cd.

Calculate value of Hg in Khartoum North, Khartoum and Omdurman for egg was 0.01±0.004, 0.01±0.00 and 0.01±0.001mg/100gm, respectively. Dietary reference intake of Hg for adult and children was 0.002 and 0.001mg/100gm[8], respectively. The calculate value for Hg in three locations (Khartoum North, Khartoum and Omdurman) is higher than thus value reported by[8], but it is low than value reported by[5]. Therefore, milk in Khartoum north, Omdurman contains high amount of Hg.

Calculate value of As in Khartoum North, Khartoum and Omdurman for egg was 0.091±0.002, 0.09±0.01 and 0.09±0.001mg100gm, respectively. Dietary reference intake of as for adult and children was 0.003 and 0.002mg/100gm[8], respectively. The calculate value for as in three locations (Khartoum North, Khartoum and Omdurman) is higher than thus value reported by[8], but it is low than finding obtained by[3]. Therefore, milk in Khartoum north, Khartoum and Omdurman contains high amount of As.

Calculate value of Pb in Khartoum North, Khartoum and Omdurman for egg was 0.04±0.001, 0.04±0.00 and 0.04±0.003mg/100gm, respectively. Dietary reference intake of Pb for adult and children was 0.10 and 0.10mg/100gm[8], respectively. The calculate value for Pb in three locations (Khartoum North, Khartoum and Omdurman) is lower than thus value reported by[8], but it is low than value reported by[1]. Therefore, milk in Khartoum north, Khartoum and Omdurman contains low amount of Pb.

Calculate value of Ni in Khartoum North, Khartoum and Omdurman for egg was similar (0.02±0.003, 0.02±0.0030.037±0.005 and 0.02±0.003mg/100gm). Dietary reference intake of Ni for adult and children was 0.85 and 0.35mg/day[8], respectively. The calculate value for Ni in three locations (Khartoum North, Khartoum and Omdurman) is lower than thus value reported by WHO (2004)[8], but is low than finding obtained by[7]. Therefore, milk in Khartoum north, Khartoum and Omdurman contains low amount of Ni.

CONCLUSION

Foods that consumed by people life in Khartoum State namely: Khartoum north, Khartoum and Omdurman contain small amount of heavy metal. Accumulations of these metals within the body of human create toxic health because these metals are considered as carcinogenesis problem.

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CONFLICT OF INTEREST

We declare that we have no conflict of interest.

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