Study Radioactivity of Cs^{137} and concentration of Pd^{+} and Cu^{+} in the Iraqi milk in Iraqi markets

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Abstract

Radioactivity of Cs^{137} and concentration of pd^{+2} ion and Cu^{+2} ions were measured by 40 different samples of local milk found in Iraqi markets. All samples were measured by a gamma spectrometry system, using a high purity germanium (HPGe) detector and Flam atomic absorption spectrophotometer. The result shows the presence of radioactivity due to Cs^{137} isotope and concentration of pb^{+2} ion and Cu^{+2} ions in all samples of milk, The maximam radioactive Cs^{137} measured 2.87 Bq/kg, the minimam radioactive measured 0.93 Bq/kg and The concentration of Cu in this study ranges from 0.083-0.971ppm.The lowest concentration of pb was recorded for milk sample (0.282ppm) and the highest concentration for milk sample (1.773ppm).

Key word: Radioactivity, Cs^{137}, Pd^{+} and Cu^{+}, Cow's Milk

دراسه النشاط الاشعاعي لنظير السيزيوم Cs^{137} و تراكيز الرصاص و النحاس في الحليب العراقي في الاسواق العراقيه

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الخلاصة

تم قياس النشاط الإشعاعي لنظير السيزيوم و تراكيز الرصاص و النحاس بحدود 40عينة مختلفة من حليب المحلي المتواجد في الاسواق العراقيه. استخدمت منظومة تحليل أطياف كاما لقياس النشاط الإشعاعي في النماذج. وتتكون المنظومة من كاشف الجرمانيوم ذو نقاوة عالية (HPGe) و جهاز طيف الامتصاص الذري اللهبي. أظهرت نتائج التحليل ألمختبري وجود نشاط إشعاعي لنظير Cs^{137} في جميع النماذج وكذالك وجود تراكيز لعنصري الرصاص و النحاس . حيث كانت اعلى نشاط اشعاعي لنظير Cs^{137} 2.87 Bq/Kg و اقل نشاط 0.93 Bq/Kg . و كان اقل تراكيز النحاس 0.083 ppm و اعلى تركيز 0.971ppm اما بالنسبه لتراكيز الرصاص المسجله لعينات الحليب كانت كالتالي اقل تركيز 0.282ppm و اعلى تركيز هو 1.773 ppm

الكلمات المفتاحية : ،النشاط الاشعاعي، نظير السيزيوم، الرصاص،النحاس، حليب الابقار

Introduction

The World Health Organization defines radiation and chemical contamination in its standards as the presence of a substance or radioactive or chemical substances in another substance, on its surface, on the human body, inside it or anywhere else, leading to harm to the person or organism. In general, food contamination can be defined as the presence of a substance or substances within the nutrient with concentrations that may be harmful to the human being[1, 2]. The indirect way of receiving radiation is through food and water containing radioactive material. Some radioactive isotopes cause soil and plants to enter the human body or animal through the food chain. The radioactive material is transferred from the soil to the plant tissue by root or adsorption by leaves through the metabolic processes carried out in the paper[3].Milk and dairy products are important components of the human diet. Milk has been described as a complete food because it contains vital nutrients including proteins, essential fatty acids, lactose, vitamins and minerals in balanced proportions. However, milk and dairy products can also contain chemical hazards and contaminants, which constitute a technological risk factor for dairy products, for the related commercial image and, above all, for the health of the consumer[4.5,6] Are of particular concern since they are largely consumed by infants and children. Food is the main

route of lead and cadmium exposure in the general population (representing 90 % of the total Cd intake in non-smokers), although inhalation can play an important role in very contaminated areas[7]. Lead and cadmium are considered potential carcinogens and are associated with etiology of a number of diseases in the cardiovascular system, kidneys, nervous system, blood and skeletal system[8]. When a nuclear explosion or a nuclear accident releases radioactive sources in the atmosphere and their depositions above the surface of the earth called "precipitation". The most important fission products are the Sr^{90}, 28.8years and Cs^{137}, 30 years old. They have relatively long half-lengths, and their chemical composition is similar to that of the basic elements of the body. Sr^{90} is similar to calcium; (Cs^{137}) is the potassium, which belongs to the second group of the periodic table. Potassium is the main element in the cellular structure of the muscle cells [2,9] ,Chemically similar elements can compete with each other as they move from soil to plant and thus to humans. Lead poisoning leads to increased blood pressure, anemia, liver failure, kidney, brain, central and peripheral nervous system[8,10] ,Especially in children. They have a rapid absorption of lead, replacing calcium in their bodies, storing in bone structures and nerve endings, causing obstruction in different neural transmission systems, as well as its toxic effect on fetal health, as found in the fetal mother's blood and breast milk[11-12].The increased level of copper in milk leads to vitamin C damage and is a factor in the occurrence of oxidation and give the taste of lipid milk[9,12,13,14].It is the lattices used by radioactive elements and heavy chemical elements to reach the human body are cattle and cattle polluted plants radically and chemically, these substances are concentrated in the body of cows and other animals and then treated by the human and transmitted to his body with water that he drinks if contaminated Table (1) Shows the quantity of foods consumed by humans annually and by age stages in units (kg / year) [15].

Table (1) the quantity of foods consumed by humans annually and by age stages in units (kg / year)

Food	Baby(1-6)	Kid(7-13)	Adult
Dairy products	120	110	105
Meat products	15	35	50
Cereal products	45	90	140
Vegetables	20	40	60
Fruits	60	110	170
Fish	5	10	150

It is also easy to obtain the concentration of radioactive materials and heavy chemicals in foodstuffs by calculating the percentage of human ingestion of food. Table (2) shows the percentage of people consumed during the year by radioactive materials and heavy chemical substances in milk products [16].

Table (2) the percentage of people consumed during the year by radioactive materials and heavy chemical substances in milk products

Element	Baby(1-6)	Kid(7-13)	Adult
Radioactive materials	0.38 Bq/Kg	0.67 Bq/Kg	2.01 Bq/Kg
Chemical elements Heavy	0.5 ml/Kg	0.7ml/kg	1.8ml/kg

The presence of heavy metals and trace elements in milk and dairy products has been reported in different countries and regions [17, 18]. However, to our knowledge, very little is currently known about the levels of heavy metal and trace element in milk and dairy products in Upper Egypt.

Moreover, an additional insight into metal uptake and assessment of human risks associated with the

The purpose of this research is to study levels of radiation activity and heavy chemical elements in the local milk found in Iraqi markets.

Method and material

In this study two methods were used to obtain the radioactivity of the Cs^{137} and concentration of pb^{+2} ion and Cu^{+2} ions. All samples were measured by a gamma spectrometry system, using a high purity germanium (HPGe) detector. The detector was shielded by 10 cm lead on all sides with cadmium copper in the inner sides. The selected characteristic gamma peaks for the detection of different ware 661kev for Cs-137 and 1460kev for K-40. The energy calibration was performed using a set of standard gamma ray calibration sources Eu-152 to measure radioactivity of the standard source and milk samples. A temperature oven of 100C was used to dry our samples. The time to measure each sample within the system used was 750 Sec to get the best result. Also been measured concentration of pd^{+2} ion and Cu^{+2} ions by using Flam atomic absorption spectrophotometer, Where the technique is used to estimate the small quantities of elements. The method depends on the irritation of the atoms of the element using the gases calcatin and converted into a state of steam to radiate light energy directly proportional to the concentration of the element in the sample, The standard solutions were present with concentrations (4% and 2% microgram/ml) The concentration of these heavy elements was measured at wavelength 270 and 296 nm. The local market for sampling was used. Table 3 shows the radioactivity of Cs^{137} and concentration of pb^{+2} ion and Cu^{+2} ions concentrations of the studied samples

Result and Discussion

Table 3 shows the radioactivity of Cs^{137} and concentration of pd^{+} ion and Cu^{+} ions concentrations of the studied samples

Samples	Radioactive of Cs^{137} Bq/Kg	Concentration of pd ions ml/kg	Concentration of Cu ions ml/kg
S1	1.64	0.282	0.778
S2	2.87	1.057	0.541
S3	D.B.L	1.139	0.971
S4	2.42	0.159	0.822
S5	0.93	0.671	0.653
S6	1.59	1.002	0.247
S7	0.98	1.773	0.083
S8	1.12	0.819	0.612
Error		±0.021	±0.027

For Cs^{137}

The transmission of radioactive elements to dairy products depends on the surface contamination of plants and water bodies and the concentration rate in plants and grass fed to the animal. In some rare cases, the contamination of the milk may be contaminated in the Aleppo milking process or milk transfer[15] .Table (3) shows the radiation activity of the cesium equivalent. The average values for all samples are 1.45Bq / kg. After testing on soil and plant samples, we found that the milk yield is less than the radiation activity in the soil and plants by about 3.5%, it is important to note that high-cesium-containing sites are present in the soil and may be due to direct contamination of the plant. Some parts of the plant act as a trap for the

minutes that fall on them, increasing pollution as well as root absorption. The radioactive elements may enter the tissues of the leaves of the plants after colliding with the drops of rain falling on the paper and the absorption of these materials depends on the continuity of water from the surface of the paper to the protoplasm of the prophecy, also depended on area of peppers, ages and type. In other words, contamination of milk can occur as a result of environmental sources such as the contents of the preservative case[11] . Therefore, countries concerned with the environmental control of food imports to ensure that they are free from any radiation activity and set standards that control the radioactive contaminants that accompany some foodstuffs so that the dose is exposed within the recommended limits and the special standards that comply with the requirements of the International Atomic Energy Agency and bound Global health without hindering the movement of world trade and food trade among the countries of the world. Table (4) shows the limits for food contamination by radioisotopes in some countries depending on socio-economic conditions in units (Bq / kg) [15].

Table (4) the limits for food contamination by radioisotopes in some countries depending on socio-economic conditions in units (Bq / kg).

Subject	Syria	Egypt	Europe	USA	Iraq
Baby milk	15	370	370	370	30
Baby food	15	370	600	370	30
Other food	150	600	600	370	370

Where studies were conducted in Iran, Saudi Arabia and India on many types of food for different adults and children and found 42% It contained a Cs^{137} equivalent and a concentration of 0.1-1.02Bq / Kg in Saudi Arabia [6]. It was found 67% of which contained Cs^{137} and a concentration of 0.1-2.08Bq / Kg in Iran [19]. 13% which contained C^{137} and a concentration of 0.1-0.442Bq / kg in India[20].

For pb^{+} ion and Cu^{+}ion

Lead is till now recognized as potentially harmful. Actually essential element may also be toxic in animals and humans if ingested at sufficiently high level and for a long enough period [21]. The results of elemental analysis of local Ir of paqi milk powder samples and the range of their average concentrations of Pb in the samples are presented in Appendix Table 3. The concentration of Lead in this study ranges from 0.159-1.773ppm.The highest concentration of lead was recorded for milk sample (1.773ppm) and the lowest concentration for milk sample (0.159ppm).

The mean elemental concentrations of Lead in this study were higher than those reported in previous studies [22]. Are agreed with the present study where these studies were showed increasing in Cu concentration in milk [23].

Conclusions

The purpose of our study was to focus radioactivity in Cs^{137} and concentration of selected metals (Pd^{+} and Cu^{+}) in raw milk. The results of this study showed radiation in Cs^{137} and higher concentration of copper and lead in raw milk. However, the number of analyzed heavy metals and sample size were limited in our study and further studies are necessary to evaluate the contents of ,,,,essential"""" and ,,,,toxic"""" heavy metals on a greater number of milk samples from various region of Iraq and to confirm the absence of possible toxicological risks.

References

1- WHO, Nations Scientific Healthy (Effects of Radiation in food and water), Brlien ,Germany 2005.
2- UNSCEAR, United Nations Scientific Committee on the Effects of Atomic Radiation (Sources and effects of Ionizing Radiation) Report to the General Assembly, with Scientific Annexes, New York 2011.
3- Marouf B.A., Toma N., and Mahmood J.A., radionuclide contamination of food imported into Iraq following the Chernobyl nuclear reactor accident" , Science of the total Environment Vol, 106/3, pp. 191-194 ,1991
4- P. Licata, D. Trombetta, M. Cristani, F. Giofre, D. Martino, M. Calo, F. Naccari, Levels of ‘‘toxic’’ and ‘‘essential’’ metals in samples of bovine milk from various dairy farms in Calabria, Italy. Environ. Int. 30, 1–6 ,2004
5- Cruz, G.C.; Din, Z.; Feri, C.D.; Balaoing, A.M, Gonzales, E.M.; Navidad, H.M, Schiaaff, M.F.; Winter, J. Analysis of toxic heavy metals (arsenic, Lead, and mercury) in selected infant Formula milk Commercially available in the Philippines by aas. *E- Interna. Sci. Res. J.*, **1**, 40-50,2009.
6- Abdul-Fattah A.F, and Abdul-Majid S., "Cs-137 and K-40 radioactivity levels I foodstuffs in Jeddah and Riyadh local markets", the fourth Saudi engineering conference, vol V , pp 329-337, Nov 1995.
7- WHO ‘‘World Health Organization’’, Health risks of heavy metals from long-range transboundary air pollution,2007
8- K.D. Cashman, Trace elements, nutritional significance. In Encyclopedia of dairy science, 2nd edition, (Academic press), Vol. 3, pp. 933-940 , 2011.
9- La Brecque, J., Rosales, PA. and Cordoves, PR., Anomalously high values of Cs-137 in soil on the peninsula de paraguana, (Venezuela) J. Radioanal. nucl. chem.Vol. 247, No. 3, pp. 563-566. 2001.
10- Characterization of the Eu-152 milk powder reference material for radioactivity with assigned values traceable to the SI unit", Altzitzoglou T. and Bohnstedt A. , Applied radiation and isotopes , vol 66 issue 11, pp 1702-1705, 2008.
11- United Nation Scientific Committee on the Effect of Atomic Radiation, source and effects of ionizing radiation in food new york ,United Nation publication , , vol 1, 2000.
12- Chary, N.S.; Kamala, C.T.; Raj, D.S. Assessing risk of heavy metal.s from consuming food grown on sewage irrigated Soils and food Chain transfer. *Ecotoxic Environ. Safety*, **69**, 513-524,2008.
13- Radioactivity and annual effective dose in some types of dru ,Ali Dawoud Salloum, Nisreen Kh. Abdalameer, Sara Talal Muhamad Murad, Iraqi Journal of Physics, Vol.15, No.34, PP. 81-86, 2017
14- FAO, (effect radiation in food and baby food)UN publication ,vol 4,2014
15- Natural Radioactivity in Foods Consumed in Turkey, E. Kam, G. Karahan, H. Aslıyuksek, A. Bozkurt, World Academy of Science, Engineering and Technology International Journal of Nutrition and Food Engineering Vol:10, No:6, pp389-394,2016
16- WHO," *food supply* problems in the world" *Indian* National Institute for Nutrition, Hyderabad, *India*,2014
17- Trace metals in raw cow’s milk and assessment of transfer to Comte´ cheese. S. Maas, E. Lucot, F. Gimbert, N. Crini, P-M. Badot, Food Chem. 129, 7–12 ,2011.
18- Trace element levels in raw milk from northern and southern regions of Croatia. N. Bilandzic, M. Dokic, M. Sedak et al., Food Chem. 127, 63–66 ,2011.
19- Assessment of radionuclides in imported foodstuff in Iran, Hosseini T., Fathivand A.A., Karimi M., Journal radiat Ras Iran, Vol 4(3), pp 149-153, 2006.

20- Natural and fallout radioactivity in milk and diet samples in Bombay and population dose rate estimates. V.K.ShuklaM. R.MenonT. V.Ramachandran A.P.Sathe S.B.Hingorani, Journal of Environmental Radioactivity, Volume 25, Issue 3, pp 229-237,2006
21- Macro and Micro-Element Levels in Cereals Grown in lower Austria.Sanger, M., J. Hoesch, . Central European Agriculture, 6: 461-467,2005.
22- Evaluation of some heavy metals residue in whole milk powder used at confectionary plant regarding the public health significance. Abdallah M. I. M., Animal research institute, agricultural research center, Giza Egypt,2011
23- A. Enb, M. A. Abou-Donia, N. S. Abd-Rabou, A. A. K. Abou-Arab, M. H. El-Senaity, Global Veterinaria 3(3) 268-275, 2009.