تحديد تركيز بعض العناصر الثقيلة في الأجبان المتوفرة بالسوق الليبي

أ .أبوبكر عامر الطروق ، د . أبوراوي محمد الجرنازي ، أ خالد الصغير حريبة
قسم الكيمياء - كلية التربية طرابلس جامعة طرابلس
د. حسين علي الزائدي / قسم الكيمياء / كلية الآداب والعلوم / جامعة المرقب

الملخص:

تعتبر منتجات الألبان من الأطعمة المهمة في النظام الغذائي للإنسان وتهدف هذه الدراسة إلى تحديد تركيز بعض من العناصر الثقيلة مثل النحاس ،الزنك ،الرصاص ،الكادميوم والحديد في منتجات الأجبان المتوفرة بالسوق الليبي وتقييم المخاطر الصحية المحتملة لهذه العناصر على صحة الإنسان . ولتحقيق أهداف هذه الدراسة تم جمع 20 عينة من عدة أنواع من الأجبان المتوفرة بالسوق الليبي لإجراء الدراسة المعملية لتلك العينات . ومن خلال هذه الدراسة اتضح بأن نسب التراكيز في العناصر الزنك ، النحاس و الحديد كانت على النحو التالي :
3-2 ، 3-1 و 16-1 جزء في المليون على التوالي . أما فيما يتعلق بالعنصرين الأخرين الرصاص والكادميوم فكانت نسب التراكيز في هذه العناصر أقل من 0.002 و 0.003 جزء في المليون على التوالي . وتجدر الإشارة هنا أن نسب التراكيز في أخر عنصرين (الرصاص والكادميوم) كانت مطابقة للمواصفة الليبية والتي تتلخص في أن تركيب العنصرين لايتجاوز 0.25 جزء في المليون للرصاص و 0.05 جزء في المليون للكادميوم .

Determination of some Heavy Metals in Consumed Cheese Products in The Libyan local Market .

Abubaker a bashir Atrrog* [1], Hussein El-Zaeddi[2] and Aborawi Elgornazi[1], khaled Asagheer Hreeba[1]
Chemistry Department, Faculty of Education, University of Tripoli, Libya[1]
Chemistry Department, Faculty of Art and scinece, University of elmergib , Libya[2]
*Email address: A.ATRROG@UOT.EDU.LY

Abstract

dairy products are an important food in the human diet-. the aim of study is to determine the concentration of lead - cadmium - zinc - copper and iron in cheese products and evaluate the potential health risks of these metals to human could be caused the via consumption of dairy products-. Total of 20

samples of cheese types were collected from a number of grossary shops in the city of Tripoli, Libya, the study results reveales that -Zn - Cu - and Fe concentration in cheese samples was ranged at 2-33 , 1-3 and 1-16 ppm respectively. While for Pb and Cd, the concentration was less than 0.002 and 0.003 ppm respectively.it's worth mentioning that the last two chemical as rizedmaelements applied with the libyan specification which can be sum ppm 0.05 = and Cd 0.25 = follow Pb

Key words: ICP-AES, heavy metals, cheese, nutritio

1. Introduction

The mineral elements in the composition of milk products can be classified into essential minerals such as iron; manganese, copper, zinc, cobalt, chromium and non-essential minerals such as Hg, Cd, and Pb. however, the presence of non-essential metals, even in low concentration, leads to metabolic disturbances. It is also important to note that for both classes of mineral elements, an increase in their concentrations above the permissible limits can role a toxic effects on the consumers of milk and milk products [1]. The exisistance of heavy metals in milk and dairy products at impermissible level can cause many diseases at the human body such as kidney failure, infertility, many kinds of cancers, weakened in immune system and nervous system disorders [2]. It is worth noting that heavy metals can be transferred directly from animals to milk and dairy products, as well as through equipment used during milk storage and processing when producing different types of cheese. Moreover , heavy metals can be resulted from the corrosion which caused by milk fermentation, the method used in the production of cheese, and the amount of milk used [3]. Therefore , it must be taken into account that elements such as iron, copper and zinc play an important role as vital elements needed for the proper functioning of the human body, while elements such as lead, mercury, arsenic and cadmium are considered harmful to the human body [4]. Air pollution with lead and cadmium resulting from various industrial activities and thus contaminating soil, water, food and plants with such toxic elements and their incorporation into the food chain, which causes a great danger to human and animal health [5]. The aim of this study is to verify the quantity of some essential and non-essential heavy metals in various types of cheese consumed in the markets in Tripoli, Libya, and to compare the obtained results with Libyan and international standards.

2. Materials and methods

2.1.Chemicals

All chemicals used in this study were analytical grade (sigma aldrch) and deionized water was used for the preparation off all solutions.

2.2. Sample collection

20 different type of cheese samples were randomly selected from different supermarkets in Tripoli. Table (1) shows the types and identifications of cheese samples. All samples were kept in their original packing, and then transferred to the laboratory for investigation.

Table 1 Identification of cheese samples

No.	Product name	Country	No.	Product name	Country
1.	Abu alwalad	Egypt	**11.**	Kalb alhlib	Libya
2.	Al bakara aldaheka	France	**12.**	Cheesy	Tunisia
3.	Al rabee	Libya	**13.**	Al waha	Libya
4.	Delice	Tunisia	**14.**	Al waled aldki	Egypt
5.	Kiry	France	**15.**	Recota	Libya
6.	Al nasim	Libya	**16.**	Almtfok	Tunisia
7.	Al raihan	Libya	**17.**	Albtrik	Libya
8.	Al bakara alsaheda	Austria	**18.**	Kapten fromy	Tunisia
9.	Chedar	Austria	**19.**	Mozeralla	Ireland
10.	Al jayad	Libya	**20.**	Frico idam	Holland

2.3. Samples treatment

Adiquate amount of each sample was homogenized by using a stainless steel blender, 2 g of each sample was transferred to a pre – burned, cooled and weighed porcelain crucible The crucible with its contents was heated first on hotplate to around 300 ^{0}C for 30 min until dryness. The dry sample was then introduced into furnace at 550 ^{0}C for 16 h in order to obtain white ash. The ash was treated with 1ml nitric acid 1N and filtered through whatman filter paper No.41 and diluted to 200 ml with 1N nitric acid. The analysis of the metal contents in these solutions was carried out by ICP – AES (Agilent

– expert pro). The ICP- ASE was accompanied with a cross – flow nebulizer and elements were measured at the parameters shown in table 2.

Table (2) the ICP-AES calibration parameters .

Label(wavelength nm)	Minimum concentration	Maximum concentration	Calibration error	Detection lemet
Cd(214.439)	**0ppm**	**8.8ppm**	**5%**	**<0.002**
Pb(220.353)	**0ppm**	**8.8ppm**	**5%**	**<0.003**
Fe(238.204)	**0ppm**	**8.8ppm**	**5%**	**<0.002**
Zn(213.857)	**0ppm**	**8.8ppm**	**5%**	**<0.001**
Cu(327.395)	**0ppm**	**8.8ppm**	**5%**	**<0.002**

3. Results and discussion

Essential minerals such as zinc (Zn) and iron (Fe) were analyzed in 20 cheese samples by ICP and the results were given in Table 3. The concentration of zinc in the samples was varied, and the values ranged between 2.00 and 33.00 ppm. Samples REC, DAH, CHE, MOZ and FRC had the highest values at concentrations of 22, 23, 28, 28 and 33 ppm, respectively and these results are somewhat consistent with *Teixeira et al*. [6] The zinc concentration in samples of cow cheese was 24.0 ppm and goat cheese was 23.0 ppm. In addition to this, another study by *Manzi et al*. [7] reported that cow cheese had the highest zinc content (18.3–77.5 ppm cheese), followed by sheep cheese (13.4–36.9 ppm), and cheese from mixed milk (3.9–45.4 ppm). Zinc content in the cheese samples is the result of the effect of different factors, such as the feeding system, the species (cow, sheep, goat, and buffalo), and the cheese-making [7]. The results of the analysis showed that the iron content was lower than that of zinc, as the values ranged from 1.00 ppm to 16.00 ppm, and the samples with the highest concentration were WLD, DAH, FRC , BAK and REC, which recorded 16.00, 12.00, 11.00 ,09.00 and 09.00 ppm, respectively. *Shaimaa et al*. [8] recorded the results of iron concentration using ICP-OES and tabulated data showed values close to the values in this study, where the iron concentration in the pizza cheese sample was 18.35 ppm and for the soft cheese sample was 16.3 ppm. Also, in previous study, the lowest concentration of iron was recorded as 1.76 ppm, and the highest concentration was 14.74 ppm in 20 Karish cheese samples from dairy shops in Beni-Suef, Egypt [9]. The results of the analysis for the copper element in all samples were close to each other and ranged from 1.00 ppm to 3.00 ppm. Content of copper in cheese from various regions of Poland was ranged

between 0.082 ppm to 4.940 ppm [4]. Morefurther, Halloumi cheese, Kashar cheese, White cheese and Lor cheese were analyzed by *Dağcilar and Gezer* [3] to detect the concentration of copper and the results for the four samples were (0.466-0.738 ppm), (0.235-0.289 ppm), (0.182-0.443 ppm) and (0.212-0.300 ppm), respectively. As for the elements Cadmium and Lead, the analysis showed an absence (not detectable) in all samples analyzed in this study and these results are consistent with those recorded by *Dağcilar and Gezer* [3] In Kashar, White, and Lor cheese, where the results of the analysis of cadmium and lead were free in the three types of cheese Also lead was not detectable in white cheese samples [10].

Table 3: Concentration of heavy metals in different cheese samples (ppm)

Sample name	Sample code	Zn	Fe	Cu	Cd	Pb
Abu alwalad	WLD	16.00	16.00	2.00	<0.002	<0.003
Al bakara alsaheda	DAH	23.00	12.00	2.00	<0.002	<0.003
Al rabee	RAB	9.00	4.00	2.00	<0.002	<0.003
Delice	DEL	7.00	1.00	3.00	<0.002	<0.003
Kiry	KRY	2.00	1.00	2.00	<0.002	<0.003
Al nasim	NAS	8.00	1.00	1.00	<0.002	<0.003
Al raihan	RAH	8.00	5.00	2.00	<0.002	<0.003
Al bakara aldaheka	BAK	10.00	9.00	2.00	<0.002	<0.003
Chedar	Che	28.00	1.00	2.00	<0.002	<0.003
Al jayad	JAD	19.00	1.00	1.00	<0.002	<0.003
Kalb alhlib	HLB	8.00	4.00	1.00	<0.002	<0.003
Cheesy	CHS	5.00	1.00	2.00	<0.002	<0.003
Al waha	WAH	14.00	5.00	1.00	<0.002	<0.003
Al waled aldki	WAL	7.00	6.00	3.00	<0.002	<0.003
Recota	REC	22.00	9.00	2.00	<0.002	<0.003
Almtfok	ALM	7.00	3.00	3.00	<0.002	<0.003
Albtrik	ALB	5.00	6.00	2.00	<0.002	<0.003
Kapten fromy	KAP	8.00	4.00	2.00	<0.002	<0.003
Mozeralla	MOZ	28.00	1.00	1.00	<0.002	6.00
Frico idam	FRC	33.00	11.00	1.00	<0.002	<0.003

Conclusion:

As seen from the results and the table above the study results revealed that (Zn , Cd , Fe , Cu and Pb) in 20 kind of cheese from deffrent market in Tripoli . the method was fast , easy and accurate to moniter heavy metals in cheese where we used ICP- AES .

No doubt that human nutrition is crucial . The main objective of this study was to determine the concentration of Zn , Cd, Fe , Cu , and Pb in various kinds of cheese made from sheep , goats , cows and buffaloes milk provided by the Libyan market in Tripoli .

References

1. I. Gogoasă, I. Gergen, M. Rada, D. Pârvu, C. Ciobanu, D. Bordean, C. Mărutoiu, D. Moigrădean, AAS detection of heavy metal in sheep cheese (The Banat area, Romania), *Buletinul USAMV-CN*, **2006**, 62, 240-245.
2. R.A. Sidawi, G. Ghambashidze, T. Urushadze, A. Ploeger, Heavy Metal Levels in Milk and Cheese Produced in the Kvemo Kartli Region, *Georgia. Foods*, **2021**, 10, 2234.
3. K. Dağcilar, C. Gezer, Heavy metal residues in milk and dairy products produced in Northern Cyprus, *Progress in Nutrition*, **2021**, 23, 1.
4. M. Sujka, U. Pankiewicz, R. Kowalski, A. Mazurek, K. Ślepecka, M. Góral, Determination of the content of Pb, Cd, Cu, Zn in dairy products from various regions of Poland, *Open Chem*., **2019**, 17, 694–702.
5. A.M.S. Meshref, W.A. Moselhy, N. E.Y. Hassan, Heavy metals and trace elements levels in milk and milk products, *Food Measure*, **2014**, 8, 381–388.
6. J.L.P. Teixeira, D.P. Baptista, E.A. Orlando, M.L. Gigante, J.A.L. Pallone, Effect of processing on the bioaccessibility of essential minerals in goat and cow milk and dairy products assessed by different static in vitro digestion models, *Food* Chemistry, **2022,** 374, 131739.
7. P. Manzi, M.G.D. Costanzo, M. Ritota, Content and Nutritional Evaluation of Zinc in PDO and Traditional Italian Cheeses, *Molecules*, **2021,** 26, 6300.
8. S.A. QAISAR and R.A. MUSTAFA, Evaluation of Concentrations of Macro and Trace Minerals in Consumed Milk, Milk Products, and Their Biological Functions in Human Life, *Pakistan Journal of Medical and Health Sciences*, **2021**, Vol 14, NO. 4.
9. A.M.S. Meshref, W.A. Moselhy, N.E.Y. Hassan, Heavy metals and trace elements levels in milk and milk products, *Food Measure*, **2014** 8, 381–388.
10. A. Abdulkhaliq, K.M. Swaileh, R.M. Hussein, M. Matani, Levels of metals (Cd, Pb, Cu and Fe) in cow's milk, dairy products and hen's eggs from the West Bank, Palestine, *International Food Research Journal*, **2012**, 19, 3, 1089-1094.