ESTIMATION OF CONTAMINATION WITH SOME METALLIC ELEMENTS IN CANNED PROCESSED MEAT PRODUCTS AVAILABLE IN LOCAL MARKETS.

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ABSTRACT

This study was conducted to estimate the contamination with some heavy metals (lead, iron, copper, tin, and cadmium) in samples of canned processed meat available in the local markets. A sample were collected from three regions at Baghdad (Al-jamaa district S1, Al-Amel district S2 ,Al-Bayaa S3) with five samples, which included canned beef sausage, canned beef luncheon meat, and canned beef minced meat, which represented (45) samples as a total number. the atomic absorption spectrometer was used to estimate the contamination . The study results showed the presence of chemical contamination with heavy elements in concentrations higher than the permissible concentrations In most of the samples under study It has exceeded the permissible limits in the Iraqi standard, and thus it is not suitable for human consumption because it does not conform to the Iraqi standard, by exceeding the limits of concentrations of heavy elements from the limits allowed by the World Health Organization (WHO) and the World Food and Agriculture Organization (FAO) in the United Nations. The highest concentration Each of lead, iron and cadmium in beef sausage samples in treatment S3 (1.451, 2.342, 1.681) p.p.m compared to S2, which amounted to (0.684, 2.1131.380) p.p.m, respectively, and the lowest concentration of S1, which amounted to (0.068, 1.188, 1.07) p.p.m, respectively. The results also showed that the ratio of the copper and tin elements in most samples is within the permissible limits of the Iraqi standard.

Keywords: heavy metal, canned meat, baghdad markets, good health

تقدير التلوث ببعض العناصر المعدنية في منتجات اللحوم المصنعة المعلبة المتوفرة في الأسواق المحلية.

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المستخلص

أجريت هذه الدراسة لتقدير التلوث بالمعادن الثقيلة (الرصاص ،الحديد ،النحاس ،القصدير ،والكادميوم) في عينات اللحوم المصنعة المعلبة المتوافرة في الأسواق المحلية، اذ تم جمع العينات من ثلاث مناطق في بغداد(حي الجامعة، حي العامل، البياع) بواقع 5 نماذج لكل عينة والتي شملت نقانق اللحم البقري المعلب، اللانشون اللحم البقري المعلب، واللحم المثروم البقري المعلب، والتي تمثلت في 45 عينة كعدد كلي، وتم استعمال جهاز مطياف الامتصاص الذري . بينت النتائج وجود تلوث كيميائي بالعناصر الثقيلة بتراكيز اعلى من التراكيز المسموح بها في معظم العينات قيد الدراسة، فقد تجاوزت الحدود المسموح في المواصفة القياسية العراقية وبالتالي عدم صلاحيتها للاستهلاك البشري لعدم مطابقتها للمواصفة القياسية العراقية ، من خلال التجاوز الكبير لحدود التراكيز العناصر الثقيلة عن الحدود المسموح بها من قبل منظمة الصحة العالمية WHO ومنظمة الأغذية والزراعة العالمية FAO في الأمم المتحدة ، فقد بلغ اعلى تركيز كل من الرصاص والحديد والكادميوم في عينات نقانق اللحم البقري في المعاملة S3 (1.451، 2.342، 1.681).p.p.m مقارنة ب S2 والتي بلغت(0.684، 2.113، 1.380) p.p.mعلى التوالي .

الكلمات المفتاحية: المعادن الثقيلة، اللحوم المعلبة، اسواق بغداد، صحة جيدة.

NTRODUCTION

Meat and its products are among the most consumed food stuffs in the world, should be great value due to they contain proteins, vitamins and essential amino acids which is necessary for the body growth (7, 14, 15, 19) The consumption of canned food is one of the most common consumption patterns in the world, (8, 20, 24, 28). Researchers have been interested in studying and analyzing minerals pollutants and determining their quantities and the damages resulting from them, the most important of which are mercury, arsenic, cadmium and lead that may reach canned food through air, water, or through soil, as well as from manufacturing processes **(**1). Lead and cadmium represent a serious threat to the health of the consumer because of their ability to cause severe damage to the tissues and organs of the human body due to their ease of absorption through digestive system and their transfer to the blood stream and their association with red blood cells (6), while the remaining quantities of lead appear in the form of free lead in the plasma and then distributed It gets on the tissues quickly as it accumulates in the soft tissues such as the lung tissues, spleen, liver and kidneys, which serve as deposits for lead in the body (17). Also, low doses of it negatively affect the nervous and reproductive systems, the heart, and the circulatory system. Continuous exposure to low levels of it leads to its accumulation in bone formation. Due to the wide openness of the local markets to import various and large quantities of canned food from different origins, this has led to the availability of a large number of foods. Canned food in violation of legal and health conditions, which negatively affected the health of the consumer in two ways (5). The first was directly through eating canned food containing toxins and pathological pollutants (13), while the second was indirectly through the cumulative effect of consuming these foods containing far-reaching pollutants such as toxic metals that exist. In these foods through the raw materials used in the manufacture of cans that contain foodstuffs (21).

MATERIALS AND METHIODS

The laboratory test was carried out in the Market Research and Consumer Protection Center / University of Baghdad.

Collection

Five samples were collected for each product (canned beef sausages meat, canned beef luncheon meat, canned beef minced meat) from each region which included (Al-jamaa district S1, Al-Amel district S2 ,Al-Bayaa S3) with forty five samples as a total number was shown in (Table 1).

Table 1. Samples of processed canned meat under study

N	Regions	code	Canned beef sausage meat	Canned beef luncheon meat	Canned minced beef meat
	Al-Jamaa district	S1	5	5	5
	Al-Amel district	S2	5	5	5
	Al-Bayaa	S3	5	5	5

Preparation of samples

Five grams sample were taken and then dried in a drying oven at a temperature of 105 $^{\circ}_{C}$, until the weight stabilized then placed in a burning oven at a temperature of 500$^{\circ}_{C}$ for 5 hours and after incineration and obtaining white ash, the samples were prepared using HNO_3 and concentrated HCl, then filter the prepared samples using filter paper, then complete the volume with distilled water and obtain a volume of incineration solution of 50 ml. Standard concentrations of heavy elements to be estimated were prpared using the company's standard solutions, the concentration of which is (500) p.p.m, and the elements were estimated. Heavy elements (pb, Cd, fe, Cu, Zn) were using to estimate by atomic absorption spectrophotometer. Determined of heavy elements was based on the reference method (12).

STATISTICAL ANALYSIS

The Statistical analysis - SAS (23) was used to analyze the data to study the effect of different coefficients on the studied traits according to a complete random design (CRD), and the significant differences between the means were compared using (Least Significant Difference-LSD/0.05).

RESULTS AND DISCUSSION

Through the results of the current study of canned beef samples, there were significant differences at the level of 0.05 ≥P in the

samples of canned beef sausages within the geographical locations of the samples under study, as it was noted that S3 was more affected by the high levels of metal elements (Lead, Iron, and Cadmium). Which amounted to 1.457, 2.342 and 1.681 p.p.m, respectively. It is higher than the permissible limits of the Iraqi standard and the World Health Organization (WHO) and the World Agricultural Food Organization (FAO) in the United Nations and Cadmium (10,11) ,0.068, 1.188 and 1.071 p.p.m, respectively, these results were agreement with those reported by (26). It is also noted from the results obtained for the Copper element that S3 amounted to (1.090) p.p.m, which is a percentage was accepted in the Iraqi standard specification and the world health organization. As for the tin element, the results of the examination in S1, S2, and S3 reached to (0.025, 0.190, 0.552) p.p.m, respectively, which are Within the permissible percentages within the Iraqi standard and the World Health Organization, and the results was agreement with what was shown by(27,6) when investigating and detecting contamination with heavy elements in some canned foods in the local market of the city of Hilla, as the rate of Cadmium concentration in canned beef samples was (0.23). p.p.m, and the Lead concentration was (0.34) p.p.m, a study conducted by in the investigation of canned meat (9), the percentage of Cadmium concentration was recorded in all studied samples that were analyzed from (1.35-0.83) p.p.m, and the percentage of Cadmium concentration reached Cadmium in beef sausage has the highest value as it reached (1.71) p.p.m compared to the rest of the samples It was noted that concentration of mineral elements of the canned luncheon samples in Table (3) showed similarities between Table (2) and Table (3) within the geographical locations referred to in the sample, despite the difference in the type of sample, as it was noted that S3 was characterized by a high percentage of elements (Lead, Iron, and Cadmium). 1.062, 3.172, 1.432 p.p.m, respectively, and these results are consistent with the results of Roy et al. (2016) in estimating the concentration of lead, iron and cadmium, as they amounted to (1.120, 2.210, 1.310) p.p.m, respectively, and this is not consistent with the results that It was obtained by (16). when the percentage of lead was 0.018 p.p.m in canned beef luncheon meat. As for the percentage of copper, it ranged between (1.465 -0.152) p.p.m, which is close to the results reached by (13). The percentage of copper ranged from (0.15-0.3) p.p.m in the processed beef luncheon samples, and this increase in the percentage of minerals may be due to Contamination of canned meat as a result of poor manufacturing process, packaging process, type of metal, environmental storage conditions and method of presentation, or the negative effect of the preservative due to its chemical composition or interaction with the metal of the can. These results are consistent with what was indicated by(22,4**).** when examining luncheon samples, as for the tin element, its percentage was in S3 (0.237) p.p.m, and in S2 it was (0.151) p.p.m, while in S1 (0.021) p.p.m, respectively, which is within the permissible limits in the Iraqi standard and the World Health Organization.

Table 2. Concentration of mineral elements of canned beef sausage meat samples in (p.p.m)

Sample	Pb	Fe	Cu	Cd	Sn
S1	0.068	1.188	0.995	1.071	0.025
S2	0.684	2.113	0.039	1.380	0.190
S3	1.451	2.342	1.090	1.681	0.552
LSD	* 0.372	* 0.407	* 0.395	* 0.318	* 0.266

.(P≤0.05) *

Table3. Concentration of mineral elements of canned beef luncheon samples in (p.p.m)

Sample	Pb	Fe	Cu	Cd	Sn
S1	1 0.02	1.150	0.152	1.001	0.021
S2	0.331	2.024	1.307	1.218	0.151
S3	1.062	3.172	1.465	1.432	0.237
LSD	*0.398	*0.602	*0.469	*0.307	*0.118

.(P≤0.05) *

The results of Table (4) showed that the concentration of mineral elements in canned minced beef, as S3 reached 1.120 p.p.m, the highest concentration of lead, while S1

reached 0.012 p.p.m, which is the lowest concentration, then followed by S2, which reached 0.030 p.p.m, while the percentage of iron reached 0.030 p.p.m. S3 1.551 p.p.m, S2 reached 1.213 p.p.m, S3 reached 0.062 p.p.m, and this difference in the percentages of concentrations of mineral elements is due to poor storage and preservation conditions such as high temperature, expiration date, or the use of preservatives, or it may occur as a result of physical defects that accompany the mechanical transport process or Storage for canned products, and these results agree with(2,18) the study he conducted on minced beef samples, which showed the results of the examination of the samples studied with a high percentage of heavy elements, as the percentage of each of lead, iron and cadmium reached (1.220, 1.681،1.421 (.p.p.m) in order, as well as the study conducted by (3) on canned minced beef, as the concentration of the lead element was (1.8) p.p.m and the cadmium element was (0.2) p.p.m, while the cadmium element ranged from (0.122-0.034) p.p.m and the concentration of tin from (0.206-0.051) p.p.m which is within the permissible limits in the Iraqi standard and the World Health Organization.

Table 4. Concentration of mineral elements of samples of canned minced beef in (p.p.m)

Sample	Pb	Fe	Cu	Cd	Sn
S1	0.012	0.062	0.221	0.034	0.051
S2	0.030	1.213	1.167	0.061	0.158
S3	1.120	1.551	1.282	0.122	0.206
LSD	* 0.547	* 0.563	* 0.482	NS 0.098	* 0.115

.(P≤0.05) *

Conclusions

It was observed through the results that there were significant differences in the proportions of the heavy metal elements studied according to the different types of samples and the areas of their sale, and these elements reach the food as a result of environmental pollution and pollution occurring in the manufacturing process, as well as not good storage conditions such as high temperature or deformation in the can sheets as a result of transportation operations It may lead to damage to the inner surface of the package, which leads to interaction with the internal components of the package with the food. It was found that lead, iron and cadmium in some studied samples of all kinds were higher than the permissible limit in the Iraqi and international standards, and this requires continuous monitoring. The levels of heavy metal elements for fresh and canned food to ensure food safety and the quality of processed food by following healthy manufacturing practices, starting from the water used, the raw materials used, packaging materials, the transportation process, and attention to storage methods and storage conditions, because a large proportion of the canned meat available in the local market and imported from abroad and the factory In different countries, they must be subjected to careful chemical analysis to know their A content Heavy metal elements and their harmful effect on the health of the consumer, and not to allow the entry of products that do not conform to the Iraqi standard specification, especially its content of lead and cadmium because of its high toxicity and its harmful effect on the health of the consumer for the long term.

REFERENCE

1. Adil T. Al- Musawi, 2019. Efficiency study of spent black and green tealeaves in removing lead and copper ions in water. plant archives. 19 (2)4089-4094

2. Alzurfi, S.K.L., A.Y. Alisaw and G. A..Al –shafai , 2018.Bioaccumula of some heavy by the aquatic plant lemnagibba in vitro . research Journal of pharmacy and Technology. 11(10) 4229-4236

3. Ashraf S., Ali, Z.A.Zahir and H. N. Asghar 2019. Phytoremediation environmentally sustainable way for reclamation of heavy metal bpolluted soils. Ecotox. Environ. Safe. 174, 714-727

4. Aydin Turkyilmaz, Mehmet cetin Hakan Sevik Kaan Isinkaralar , A.Elnajy and Ahmaid Saleh, 2018. Variation of heavy metal accumulation in certain laaandscaping plants due to traffic density. Environment, Development and Sustainability. (22)2385-2398

5. Al-ghanimi, G. M. M., and A. M. Alrubeii. 2024. Effect of elastin hydrolysate on bacteria and some sensory traits of chilled ground beef. Iraqi Journal of Agricultural Sciences, 55(1):422-431.
https://doi.org/10.36103/8w3frt36
6.Al-Falluji, A.L.A. 2016. Determination of lead, cadmium and copper in food cans in the city of Hilla. Iraq. Al Furat Journal of Agricultural Sciences 8 (3) 197- 203
7.Al-Saleh, I., R. Al-Rouqi, R. Elchaig, M. Abduljabbar, and T. Al-Rajudi, 2017. Risk assessment of environmental exposure to heavy metals in mothers and their respective infants. International Journal of Hygiene and Environmental Health, 220(8), 1252-1278
8. Al-Sarraj, E., M. H Janker, and M S. Al-Rawi, 2014. Bioaccumulation study of some heavy metals in tissues and organs of three collected fish species in tigris river within mosul city. rafidain Journal of Science, 25(4), 43-55
9.Badis, B., Z. Rachid, and B. Esma, 2014. Levels of selected heavy metals in fresh meat from cattle, sheep, chicken and camel produced in Algeria. Annual Research & Review in Biology, 1260-1267
10. Codex Alimentarins Commission (FAO / WHO) 2001. Food Addititives and Contaminates.joint FAO/WHO food Standars Program. Allnorm 01/12A.1-289
11.FAO/WHO. joint FAO/WHO Food standers program codes Alimentarins commission coniamination CAC/Vol xvll. FAO Roma، 1984
12. FURR، K. and ED.، CRC 1990, Handbook of laboratory Safcty 3rd cd..The chemical Rubber Co. ، 222-229. press.، Florida، USA
13. Hamasalim H.J. and H. N Mohammed 2013. Determination of heavy metals in exposed corned beef and chichen luncheon that sold in Sulaymaniah markets. African Journal of food Science. 7(7): 178-182.
14. Hassan, S.A., K. M. Hassan, and A. Al-Rubeii. 2010. Carcass characteristics of Karadi lambs as affect by different levels of dietary supplement of rumen degradable nitrogen fed with *Nigella sativa*. African Journal of Biotechnology, 9(27): 4295–4299
15. Hassan, S.A., Khasraw Hassan, and A. Al-Rubeii, 2011. Carcass yield and characteristics of karadi lambs as affected by dietary supplement of rumen undegradable nitrogen fed with *Nigella sativa.* African Journal of Biotechnology, 10(8):1491–1495
16.Korfalii S. and W Hamdan 2013. Essentail and toxic meatls in lebanese marketedcanned food lmpact of Metal Cans. Journal of Food Research .2: 20-30
17.Li, F., Z. Qiu, J Zhang., W., Liu, C., Liu, and G.Zeng, 2017. investigation, pollution mapping and simulative leakage health risk assessment for heavy metals and metalloids in groundwater from a typical brownfield, middle China. International Journal of Environmental Research and Public Health, 14(7), 768
18.Mahdi. R.S. and F.K. Omran, 2021. Determination of heavy metals concentration of local and Im ported wheat grains storage and wheat flourin some silos of Baghdad city. Iraqi Journal of Agrecultural Sciences. 52(5) 1139- 1149
19. Mula, N. S. A., and A.M. S. Alrubeii. 2024. The role of nisin, potassium sorbate and sodium lactate as additive in improving the chemical and qualitative characteristics of chilled ground beef. Iraqi Journal of Agricultural Sciences, :55(Special Issue):195-205.
https://doi.org/10.36103/ijas.v55iSpecial.1898
20. Raafat A. Abu-Almaaly. 2019.Estimate the contamination by some heavy metals in sesame seeds and rashi product that availablnocal markets. Plant Archives. 19.(2) 3217-3222
21.Rajeshkumar, S., and X.Li, 2018. Bioaccumulation of heavy metals in fish species from the meiliang bay, taihu lake, china. Toxicology Reports, 5, 288-295
22.Roy, M. N., Roy, A., and, S. Saha. 2016. Probing inclusion complexes of cyclodextrins with amino acids by physicochemical approach. Carbohydrate polymers, 151, 458-466
23.SAS. 2018. Statistical Analysis System, User's Guide. Statistical. Version 9.1 ed. SAS. Inst. Inc. Cary. N.C. USA
24. salmany, A.S.M., and A. M. S. AL-Rubeii. 2020. Effect of cinnamon and turmeric nanoparticles extract in quality characteristics of fresh ground beef during cold storage. Annals of Tropical Medicine and Public Health, 23(2): 200–213

25.The Central Agency for Standardization and Quality Control. Standard Specification. Luncheon meat. Issue 20061341

26. Yakupa, N. Y., Sabowa, A. B., S. J. Saleh, and G. R. Mohammed. 2018. Assessment of heavy metal in imported red meat available in the markets of Erbil city. Journal of University of Babylon, 26(6), 177-183

27. Zahrana, D. A., and B. Hendy, 2015. Heavy metals and trace elements composition in certain meat and meat products sold in Egyptian markets. International Journal of Sciences: Basic and Applied Research, 20, 282-293

28. Zainy, Z. I., and A. M. S. Alrubeii, 2023. Eeffect of replacement nitrite by beetroot and silybum marianum powder in physical characteristics and lipid oxidation for pasterrma. Iraqi Journal of Agricultural Sciences, 54(4), 1131-1136. https://doi.org/10.36103/ijas.v54i4.1806