A STUDY OF SOME CHEMICAL PROPERTIES OF CANNED FISH PRODUCTS IN LOCAL MARKETS IN BASRAH CITY,IRAQ

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ABSTRACT

Concentrations of seven heavy metals (Cadmium, Lead, Zinc, Nickel, Iron, Copper and Manganese) in five canned fish samples found in the local market Basrah city, Iraq were determined after digestion according to the Association of Official Analytical Chemists methods. Concentrations of metals were measured using the Flame Atomic Absorption Spectrophotometer. The results showed that the range obtained for the elements analyzed in mg/kg (dry weight) were as follows, Cd (0.0027 - 0.0078), Pb (0.0048 - 0.0093), Zn (0.0103 - 0.0205), Ni (0.0122 - 0.0128), Fe (0.0149 - 0.0237), Cu (0.0008 - 0.0034) and Mn (0.0014 - 0.0037). The results indicated that canned fish samples in this study have concentrations well below the permissible FAO/WHO levels for these toxic metals.

INTRODUCTION

Fish is a good source of protein rich in essential amino acids, omega - 3 fatty acids, fats that are valuable sources of energy, vitamins, and minerals (٢٧). Fish is one of the most highly perishable food products by growth of microorganisms and autolysis (22). Canning is one of the most important means of fish preservation (9). Canned fish can be spoiled because of heavy metals and chemical reactions as a result of the interaction between food components and can metals causing many undesirable changes or fish may be contaminated by toxic heavy metal elements during its growth, transportation and storage or also during their production, handling and canning processes (16). Fish can accumulate substantial amounts of heavy metals in their tissues especially muscles and this can represent a major dietary source of these

metals for humans causing many deleterious health effects and harmful influences on vital cellular components and interfere with functioning of enzymes, nucleic acids and structural proteins(19). Heavy metals can be divided in to toxic such as (Aluminum, Arsenic, Cadmium, Lead, and Mercury), probably essential such as (Cobalt and Nickel) and essential metals such as (Copper, Iron, Zinc and Selenium), with keeping in mind that toxic elements can be very harmful even at very low concentrations when consumed frequently (29). Information on the metal content in canned fish is important to ensure that the consumed fish is safe for human consumption. This study reports the concentrations of some heavy metals in canned fish samples of different brands which purchased from local markets in Basrah city, Iraq.

MATERIALS AND METHOD

Five different brands of canned fish (Chunk tuna, Solid tuna, Sardine, Mackerel and Shrimp in oil vegetable) were collected from supermarkets in Basrah province center during April 2016, to determine the concentration of heavy metals, (3 lots of each brand) analyzed, After opening, each can content was homogenized thoroughly in a food blender with stainless steel cutters and dried in the oven at 105ºC for 16 hours to dryness and the meat was powdered using mortar and pestle. The heavy metals were evaluated according to (21) then 0.5 gm of the dried sample was taken in a glass digestion tube and digested by using 3 ml mixed of HNO_3 and HOCL at a ratio of 1:1(freshly prepared) and covered with a watch glass. The test tube was then placed at laboratory temperature for 16 hours to complete primary digestion. After then samples were heated in a water path for 30 mint at 70 ºC and added 3 ml H_2O, then the test tube were heated by hot plate. Heating was continued until the solution made clear or volume was reduced to about ٢ ml. The sample was cooled, filtered through No. 0.5 Whatman filter paper and concentrations of centrifuge for 1 mints at 3600 g/m, and transferred into 50 ml volumetric flask and made up to mark with distilled water. Then the heavy metals (Cd, Pb, Zn, Ni, Fe, Cu and Mn) concentrations were evaluated by using Flame Atomic Absorption Spectrophotometer type Pye Unicom Sp 9/ Philips.

RESULTS

Five brands of canned fish were analyzed for Cd, Pb, Zn, Ni, Fe, Cu and Mn. The results showed that the concentration heavy metals varied between the five brands of canned fish analyzed. In present study, concentration of Cd in all samples

analyzed were found in the range 0.0027 - 0.0078 mg/kg in different canned fish shown in (Figure 1). Concentration of Pb in canned fish samples analyzed varied between 0.0048 - 0.0093 mg/kg, the concentration of Pb show in (Figure 2) that was below the prohibited limits for this element. The level of Zn different between all canned fish were found in the range 0.0103 - 0.0205 mg/kg according to result in (Figure 3). Concentration of Ni in the present study was found 0.0122 - 0.0128 mg/kg in canned fish, (Figure 4). Whereas, the comparative levels of Fe in the various varieties of canned fish showed (Figure 5), It can be seen that the average concentrations Fe was found to be 0.0149 - 0.0237 mg/kg. Cu was found in all samples, in the range of 0.0008 - 0.0034 mg/kg (Figure 6). Concentration of Mn in all samples analyzed in the range of 0.0014 - 0.0037 mg/kg in different canned fish was noted in (Figure 7).

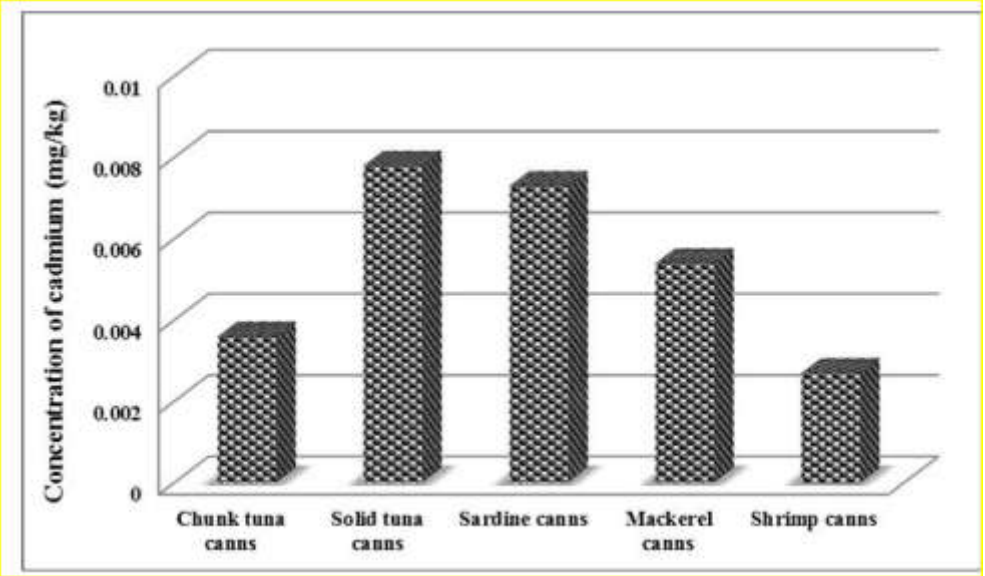

Fig. 1: Concentration of cadmium in canned fish mg/kg

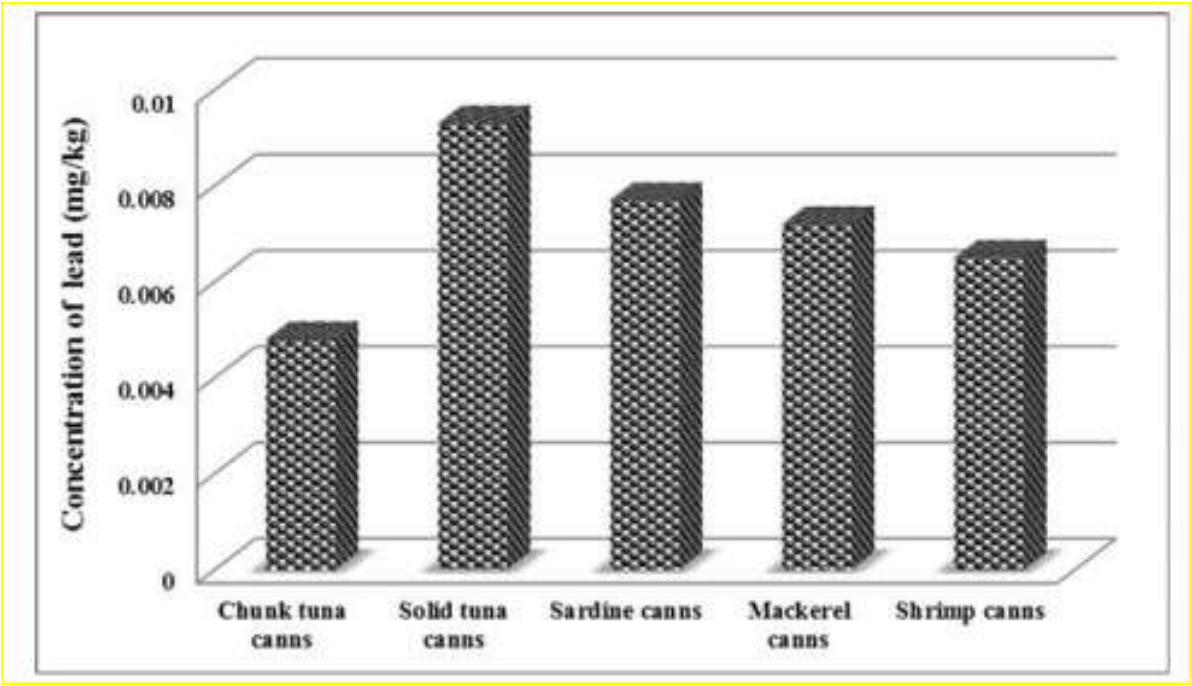

Fig. 2 : Concentration of lead in canned fish mg/kg

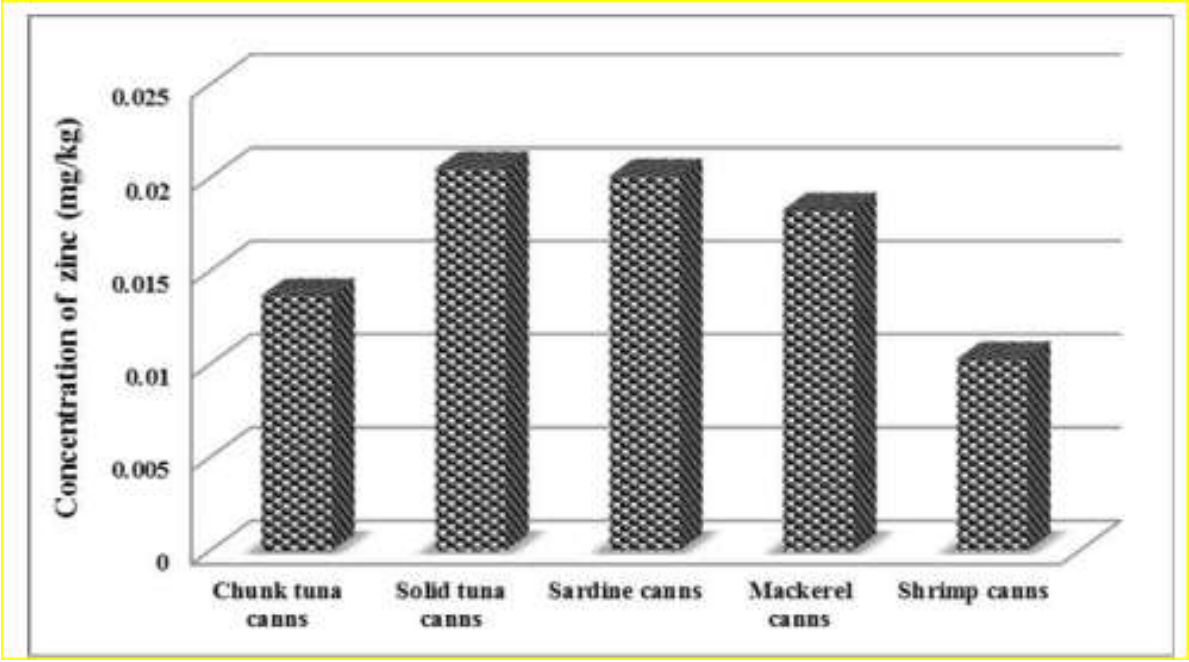

Fig. 3 : Concentration of zinc in canned fish mg/kg

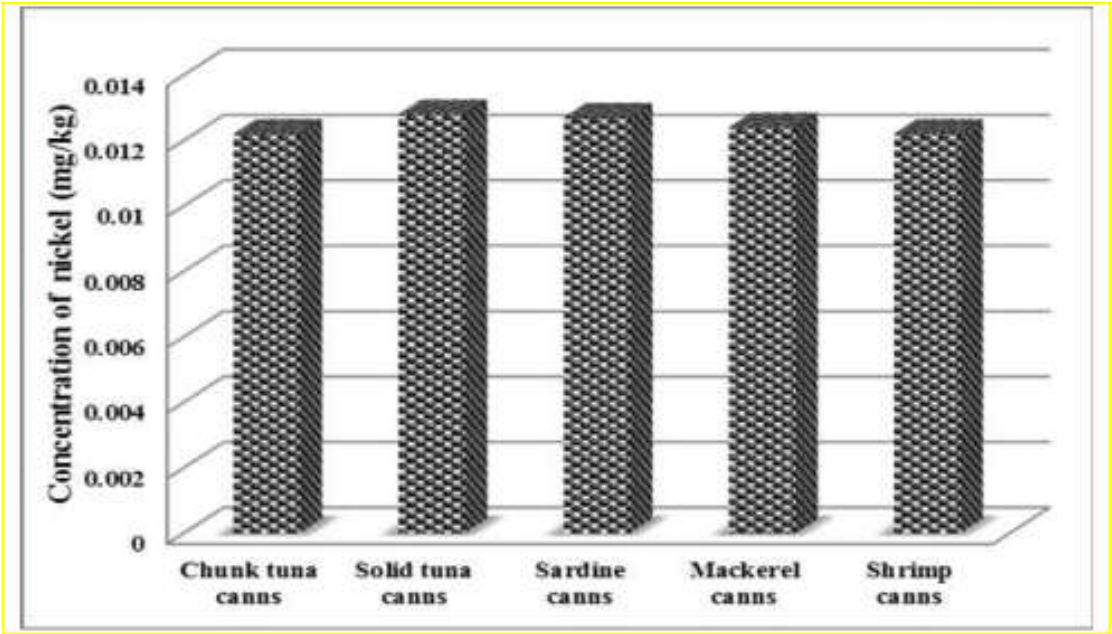

Fig. 4 : Concentration of nickel in canned fish mg/kg

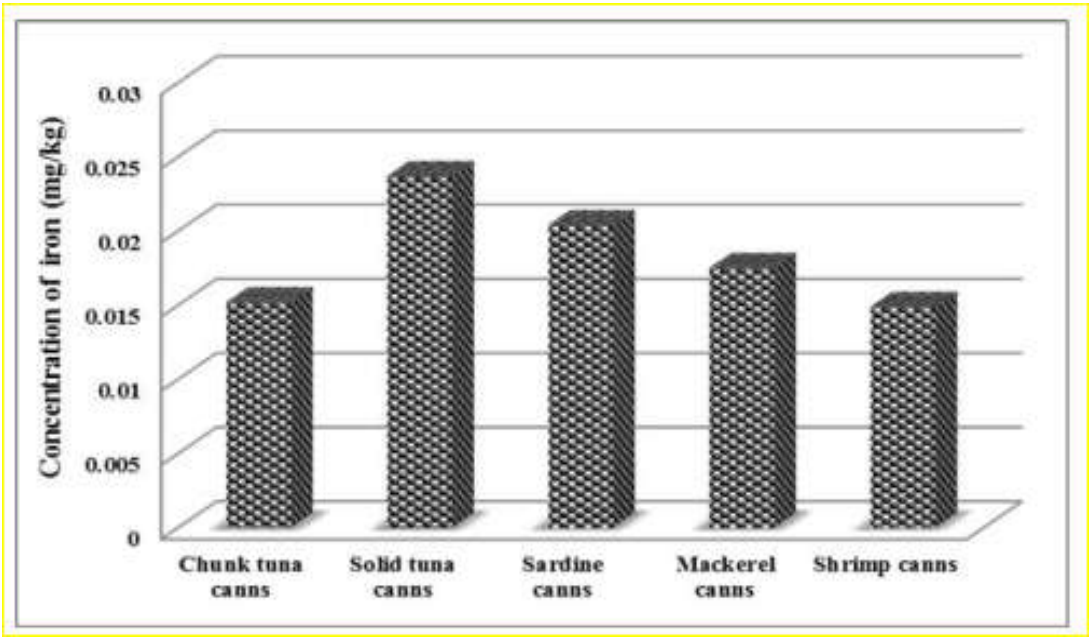

Fig. 5 : Concentration of iron in canned fish mg/kg

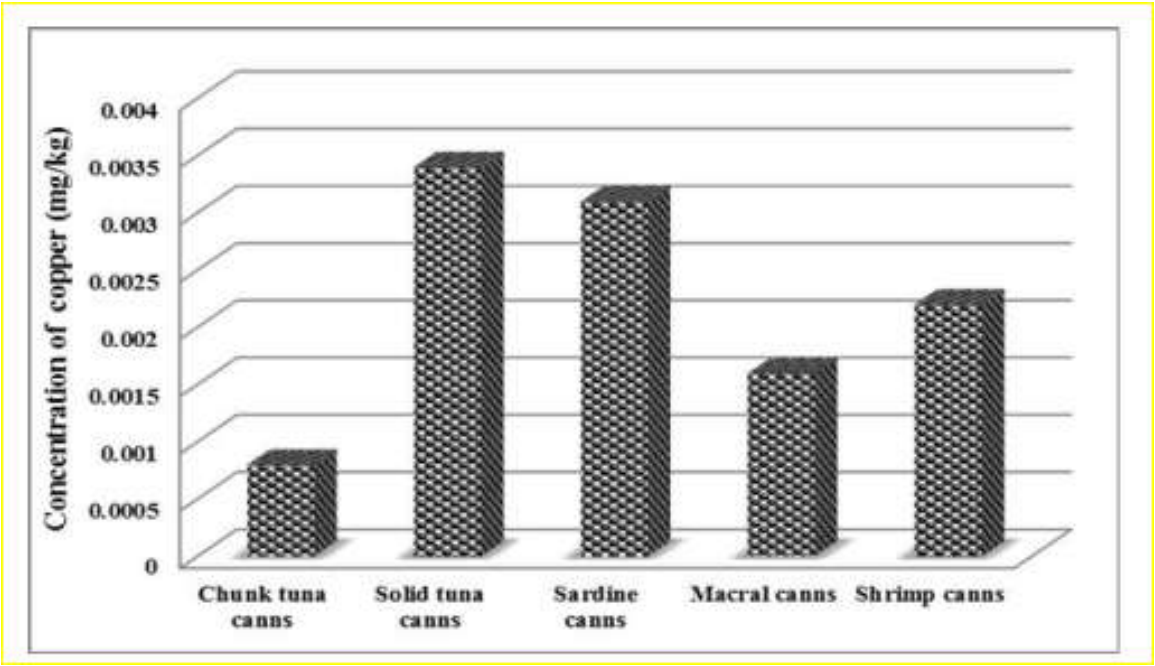

Fig. 6 : Concentration of copper in canned fish mg/kg

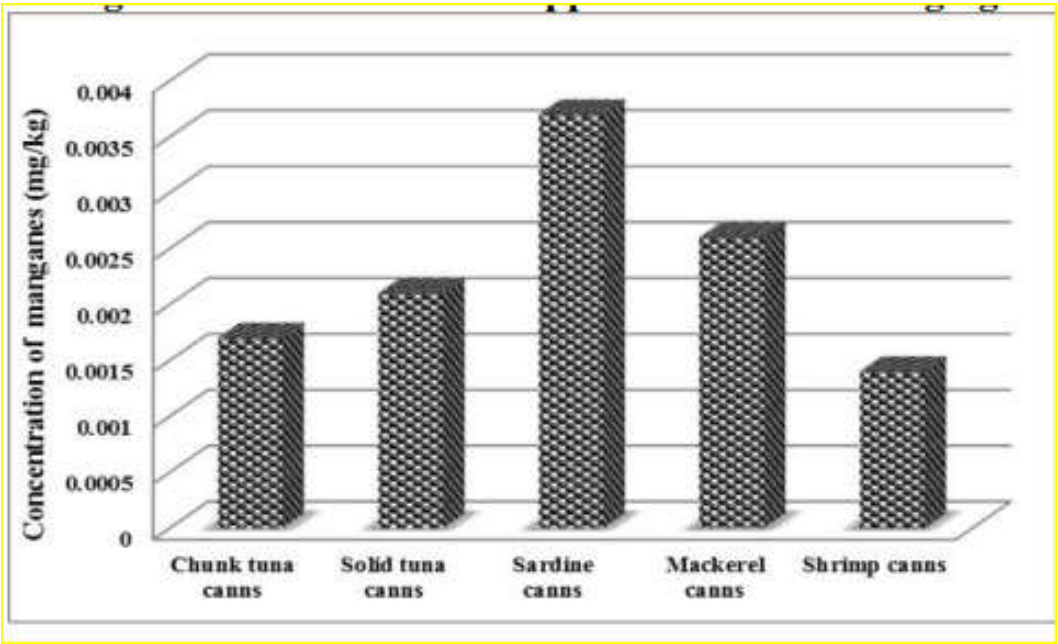

Fig. 7 : Concentration of manganese in canned fish mg/kg

DISCUSSION

The levels of heavy metals in fish could depend on many factors like the duration of exposure to contaminants, feeding habits of each fish species, the concentration of contaminants in aquatic system, water chemistry, fish sex, weight, season and any contamination of fish during handling processing (3). Cadmium is one of the toxic heavy metals to human tissues even at very low concentrations. The maximum level of Cd permitted by (7) is 0.5 mg/kg. Thus, all present samples had Cd content well below this limit and the present results showed the safe status for consumption regarding Cd in canned fish. It was reported that, in anchovy, Cd content was 5.77 mg/kg (wet weight) (5). On the other hand, the metal content in canned tuna fish reported by (15) varied between 0.0046 – 0.0720 mg/g. In addition, (11) showed that cadmium content was 0.05mg/kg in fish samples from Egypt. The current results confirmed that mean concentration of Pb in canned fish is lower than the maximum recommended level for canned fishes which is 0.2 - 0.3 mg/kg according to (7). Pb contents have been reported in the range of 0.076 - 0.314 mg/g in canned fish from Turkey (4) and 0.011 - 0.89 mg/g in canned tuna fish from Iran (17). Zn is one of the major essential elements because it plays several roles in the human body (8 , 23). The maximum level of Zn in fishes was 50 mg/kg (1). These set levels of heavy metals, however, are higher in comparison to the levels reported in the current study which were closer to the results of (18) and (3). Reported levels of zinc in canned fish marketed in Turkey were in the range of 0.90 - 2.50 mg/g (25). Ni is one of the trace heavy metals found in the environment. The maximum level of Ni permitted by (7) is 18 mg/kg. In the literature, Ni levels in fish meat were in the range of 0.01 - 2.04 mg/g for fish from the Black Sea coast (24) and 0.66 - 1.59 mg/g for fish from Iskenderun Bay (26). In addition, (13) showed Ni content in the range of 0.0011 - 0.0018 mg/kg in canned mackerel fish samples. A range of 0.02 - 4.22 mg/g was recorded in fish from the coastal waters of the Turkish seas (26). Fe is an essential element for humans and other organisms and dose not cause any type of nutritional loss in the product. However, it may alter the sensory properties of the food where its concentration can increases respectively with increase of storage period due internal erosion (6). The maximum level of Fe permitted by (7) is 50 mg/kg. Levels of Fe in canned fish show a wide variation around the world, ranging between 2.95 - 64.1 mg/g. However, it is also known that when the intake of Fe is more than 15.0 mg/g, it

can produce toxic effects (2). In another study, (13) showed iron content in the range of 0.0379 - 0.0302 mg/kg in canned mackerel. Cu is an essential element for good health but a very high intake can result in adverse health problems such as liver and kidney damage (13). The maximum level of Cu is 30 mg/kg as given by (28). For canned yellowfin tuna, the concentration of Cu has been reported as 0.53 - 1.83 mg/g by (10). For canned fish marketed in Nigeria, Cu contents have been reported to be between 0.0022 - 0.0033 mg/kg (13), while a concentration of 1.96 mg/g was found in canned sardines in Turkey (2).

All these findings are similar to the current results and show that Cu in canned fish is well below the recommended limits. Mn is one of the heavy metals needed by biological systems. Mn plays essential roles in different organisms, including humans, such as oxidative phosphorylation, fatty acid and cholesterol metabolism, mucopolysaccharide metabolism, and activation of some enzymes (20 , 14). United States National Research Council has recommended safe and adequate daily intake levels for Mn that range from 0.3 to 1 mg/day for children up to 1 year, 1–2 mg/day for children up to age 10, and 2–5 mg/day for children 10 and older (12). The results obtained for Mn in the present study were comparable with those obtained by (13) at 0.0016 - 0.0028 mg/kg, but it were lower than that reported in canned fish by (3). This indicated that both brands contained minimum Mn levels and as such, supplements through other consumed foods may be needed. It should be known that manganese levels in foods may also be affected by food processing. In conclusion, it was obvious that for the selected metals, Cd, Pb, Zn, Ni, Fe, Cu, and Mn, current recorded concentrations in mg/kg were below the levels set by FAO/WHO and other standard bodies. However, it is imperative to perform routine monitoring on the levels of heavy metals in these well-patronized canned fish brands so as to avert encountering any metal toxicity due to their consumption in the future.

دراسة بعض الجوانب الكيميائية للمنتجات السمكية المعلبة المتداولة في الأسواق المحلية لمدينه البصرة

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الخلاصة

أجريت الدراسة على خمسة أنواع من الأسماك المعلبة المتوفرة في محافظة البصرة / العراق لغرض تحديد نسبة تركيز العناصر المعدنية الثقيلة حيث تم الكشف عن سبعة معادن ثقيلة (الكادميوم والرصاص والزنك والنيكل والحديد والنحاس والمنغنيز)، قيس تركيز العناصر بأستخدام مقياس الطيف الذري للامتصاص الذري. أظهرت النتائج أن المدى الذي تم الحصول عليه للعناصر المدروسة محسوبة بالملغم/كغم (الوزن الجاف) كان كالتالي : الكادميوم (٠.٠٠٢٧ - ٠.٠٠٧٨)، الرصاص (٠.٠٠٤٨ - ٠.٠٠٩٣)، الزنك (٠.٠١٠٣ - ٠.٠٢٠٥)، النيكل (٠.٠١٢٢ - ٠.٠١٢٨) ، الحديد (٠.٠١٤٩ - ٠.٠٢٣٧)، النحاس (٠.٠٠٠٨ - ٠.٠٠٣٤) والمنغنيز (٠.٠٠١٤ - ٠.٠٠٣٧). وأظهرت النتائج أن عينات الأسماك المعلبة في هذه الدراسة لها تراكيز أقل بكثير من المستويات المسموح بها بين منظمة الأغذية والزراعة ومنظمة الصحة العالمية لهذه المعادن السامة.

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