

Detection of heavy elements in plant supplements that are dealt with in the Iraqi market

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ABSTRACT

Heavy metals were measured in plant supplements including spirulina, mycophigi, lion's mane, reishi mushroom, Lingzhi tea, Cordyceps mushroom and coffee. Aluminium and chlorine were measured using X-ray fluorescent technology, whereas copper and cadmium using the atomic absorption spectrometry. According to the results, aluminium exhibited the highest concentration in Lingzhi tea: 618,263 ppm (part per million), while Cordyceps mushroom the lowest (105.781 ppm). In the case of chlorine, the highest concentration was recorded in spirulina (21502.5 ppm), whereas in the reishi mushrooms the lowest (921.2 ppm). Lingzhi tea recorded the highest copper concentration of 7.17 ppm, while the lion's mane the lowest (0.39 ppm). In the case of cadmium, its concentration was zero in all samples.

Keyword: Heavy metals, Plant supplements.

Article type: Short communication.

INTRODUCTION

Well-known nutritional supplements are foodstuffs, readily available to people, increasingly being chosen as an easy way to enrich the daily diet with vitamins and minerals (Cwielag-Drabek *et al.* 2020). As a result, they can be classified as a special category of foods subjected to food law and not to pharmaceutical regulations. Therefore, nutritional supplements are much less restrictive than drugs (EFSA 2019). As the nutritional supplement market is growing, by an increased number of individuals interested in using these products for different purposes in America, Europe and Asia. Furthermore, there is a special interest in targeting those products that rely on ingredients of natural origin (Rzymiski *et al.* 2019) such as spirulina, which is an undifferentiated filamentous blue colour, spiral-shaped, multicellular cyanobacteria, naturally growing in warm climates (Sanchez *et al.* 2003). However, reishi is a medicinal mushroom that has great effect in combating oxidative stress and free radicals (Fu *et al.* 2002). Despite the global use of plant products and the increase in their popularity, the World Health Organization found that out of 191 countries listed, only 25 had a national policy regarding weeds (Avigan *et al.* 2016). The use of nutritional supplements in special circumstances may be necessary. Nevertheless, excessive consumption of these products can cause toxicity and pose serious health threats (Korfali *et al.* 2013). Therefore, it should be noted that the cultivation of algae for scientific purposes differs from cultivation for commercial purposes, since the quality of the botanical supplements in commerce are in doubt due to the detection of cyanotoxin and neurotoxicity (Manali *et al.* 2017). The aim of the study was to detect heavy metals in botanical supplements.

MATERIALS AND METHODS

Sample collection

Samples were taken from the special centres for the sale of nutritional supplements in Diyala, which are spirulina, mycofiji, lion's mane, reishi mushroom, Lingzhi tea, cordyceps mushroom and coffee. All products were from the Malaysian DXN Company. Samples were collected on February 15, 2021, then the samples were sent to the Ministry of Science and Technology for the purpose of examination.

Sample preparation

Aluminium and chlorine were measured using fluorescent X-ray technique. The samples were dried in the oven to get rid of moisture, then crushed. Afterwards, 8 g of each sample was weighed and 2 g Spectro certified binder was added to it. The sample was placed in a pressing device for pressing purposes to obtain a hard disk, finally placed in the XRF device. As for the elements of copper and cadmium, they were measured using the Atomic Absorption Spectrometry device, whereby 2 g of the dry and milled sample was weighed, then placed in the Baker and 40 mL of concentrated HNO₃ acid was added to it. The baker was covered with the watch bottle and left for a period of overnight, and then the baker was placed with the watch bottle at a temperature of 105 °C until the appearance of vapours. Then, the model was cooled and 3-mL concentrated HClO₄ acid were added, the baker was placed back on the heater without the watch bottle and heating was done carefully until the form dried and adding 2 mL concentrated HCL acid along with 3 mL distilled water. Thereafter, it was placed on the heater at a low temperature of 75 °C, then left to be cooled and filtered into a 25-mL volumetric bottle, finally the volume was completed with distilled water to the mark.

RESULTS AND DISCUSSION

Aluminium

According to Fig. 1, aluminium exhibited the highest concentration in the Lingzhi tea (618,263 ppm), whereas the Cordyceps mushroom displayed the lowest (105.781 ppm). The aluminium was not recorded in each of the samples of Lion's mane, reishi mushroom and coffee. The increased aluminium in the Lingzhi tea may be due to the equipment used in the manufacture.

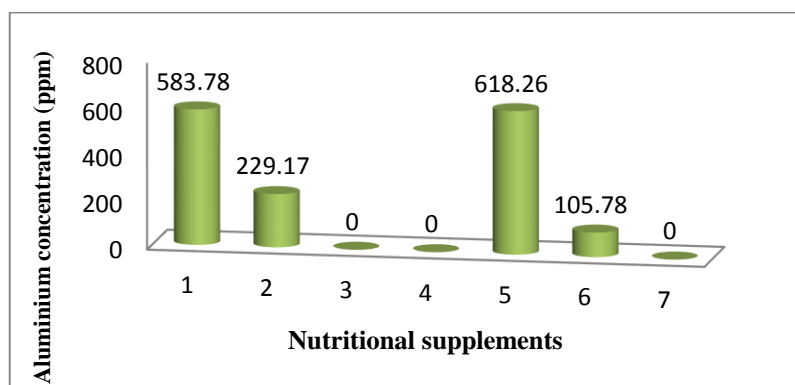


Fig. 1. The aluminium concentration (parts per million = ppm), in nutritional supplements (1: spirulina, 2: mycophigi, 3: lion's mane, 4: reishi mushroom, 5: Lingzhi tea, 6: Cordyceps mushroom and 7: coffee).

Chlorine

Based on Fig. 2, chlorine exhibited the highest concentration in spirulina (21502.5 ppm), while the reishi mushroom displayed the lowest (921.2 ppm). The reason for the increased chlorine in spirulina may be due to the environment in which it grows.

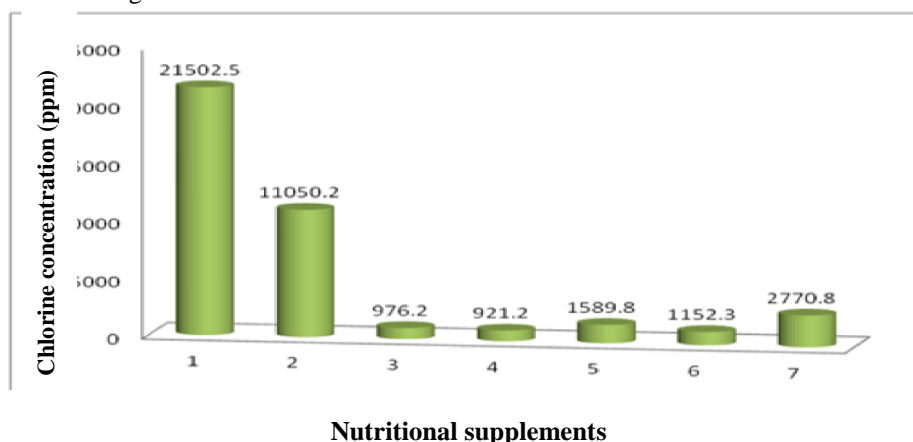


Fig. 2. The chlorine concentration (ppm) in the nutritional supplements (1: spirulina, 2: mycophigi, 3: lion's mane, 4: reishi mushroom, 5: Lingzhi tea, 6: Cordyceps mushroom and 7: coffee).

Copper

According to Fig. 3, Lingzhi tea exhibited the highest copper concentration (7.17 ppm), whereas the lion's mane displayed the lowest (0.39 ppm). The copper was not recorded in the coffee samples.

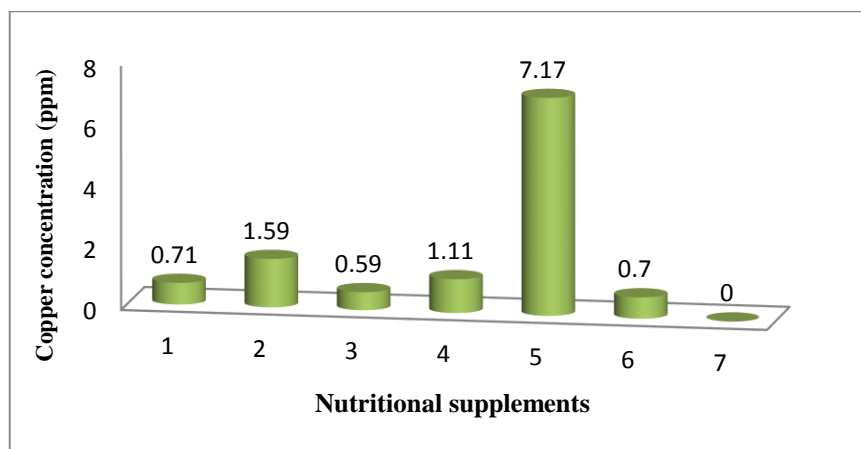


Fig. 3. The copper concentration (ppm) in nutritional supplements (1: spirulina, 2: mycophigi, 3: lion's mane, 4: reishi mushroom, 5: Lingzhi tea, 6: Cordyceps mushroom and 7: coffee).

Cadmium

Cadmium was not found in each of spirulina, mycophigi, lion's mane, reishi mushroom, lingzhi tea, cordyceps mushroom and coffee samples.

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