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# Estimation of heavy metals in fresh camel meat in Samawah city as a human food hygiene

Mussa M. Alkhatib [1,*], Entesar Hussain madi [2] and Mohammed Khadim Wali [3]

[1] *Department of Vet. Public Health, College of Veterinary Medicine, University of Al Muthanna, Iraq.*
[2] *Zoonoses Research Unit, College of Veterinary Medicine, University of Baghdad, Iraq.*
[3] *Department of Vet. Public Health, College of Veterinary Medicine, Al-Qasim Green University. Iraq.*

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## Abstract

**Background:** Meat is considered a good source of animal vitamins, minerals, and proteins in some parts of the world, such as the Arabian Peninsula, India, and the Middle East. Measuring metal concentrations in camel meat is therefore essential for preventing food safety threats, which in turn protect consumers. Camel meat can be contaminated with heavy metals that may pose problems for human health and food safety.

**Methods:** In this study, a determination of the concentrations of heavy or toxic metals that may be harmful to human health was made in camel meat obtained from different sources and butcher shops over a period of time in Samawah city. A total of 100 samples from different locations in Samawah city were collected for measurement each week using an atomic absorption spectrometer.

**Results:** This was a positive sign for ensuring human health since camel meat was not polluted in any of the tested samples.

**Keywords:** Heavy metal; Pollution; Camel meat; Proteins

## 1. Introduction

Camel meat, especially that of young animals, is low in fat besides cholesterol and is also a good source of amino acids and minerals [1]. Camel meat and meat products are an essential component of the human diet because they include a range of nutrients, but they may also contain harmful substances. Furthermore, while the concentration of these harmful chemicals in muscle tissue is normally low, it appears to have a higher concentration than most other diets [2]. A toxic metal is one that is neither required nor useful but instead causes severe toxicological effects at low concentrations. Metals are entering the environment at an increasing rate as industrialization progresses. Because they cannot be degraded by the environment, these metals remain indefinitely. They get into the diet, and from the diet, they finally make their way into the muscles [3]. Contamination by heavy metals in meat and other edible muscles is a major concern for food security and human health. These metals are toxic and can cause harm even at low concentrations [4]. Heavy metals have just a long half-life and are non-biodegradable, allowing them to accumulate in the human body. Exposure to these metals can result in a variety of health issues, including blood pressure changes, liver, lung, and kidney dysfunction, and immune system defects [5]. Cadmium, chromium, and lead play no physiological roles in the human body and have been linked to liver, kidney, and nervous system disorders [6]. Heavy metals are classified into two types and are not biodegradable in the natural environment. Toxic metals (such as Pb, Cd, and As) fall into the first category

* Corresponding author: Mussa M. Alkhatib
Department of Vet. Public Health, College of Veterinary Medicine, University of Al Muthanna.

because they are unappealing, provide no biological benefits to human health, and are toxic at any concentration. The second group consists of essential metals (such as Cu, Zn, Mn, Fe, Ni, and Cr), which are desirable and beneficial to human health at low concentrations but become toxic at high concentrations [7]. Estimating heavy metals in animal muscle and offal is necessary to increase food safety and maintain human health. As reported by [8], the levels of metals in meat depended on the animal's age. Chromium metal enters animals through pastures. The normal range of chromium requirements for livestock is about 0.3-1.6 mg/kg, but toxic levels can impair the reproductive potential of animals. Stress also increases the animal's urinary excretion of chromium, thereby increasing the need for chromium in grazing animals. It is a bioaccumulative toxin that affects grazing animals [9]. The present study aims to determine the presence of lead (Pb), cadmium (Cd), and chromium (Cr) in samples taken from the muscle of slaughtered camels at Samawah city.

## 2. Material and methods

### 2.1. Sample collection

A total of 100 fresh camel meat samples (n = 100) were collected. Samples were randomly drawn from the slaughterhouse. All samples collected are placed in clean polyethylene bags suitable for their nature and sent to the laboratory for processing and analysis.

### 2.2. Sample Analysis

The samples are digested and prepared as a clear solution to be measured by the atomic absorption spectrophotometer (England origin), which depends on changing the metals from atoms to ionic form by flaming to measure with light from lumps for each metal. We prepared samples with wet digestion by adding 10 ml of nitric acid and 5 ml of boric acid to 1 gm of the well-granted sample for 24 hours until we obtained a clear solution complete with demonized water. Standard solutions were presented at 10 ppm, 20 ppm, and 30 ppm for (Pb, Cd, and Cr) to allow calibration of the apparatus, the wavelength of each metal as determined by the device [10].

### 2.3. Statistical analysis

Statistical analysis of the data was performed using SAS (Statistical Analysis System-version 9.1). Two- and one-way ANOVA and Least significant differences (LSD) post hoc tests were performed to assess significant differences among means. Also, an independent t-test was used to assess the difference between the two means. $P < 0.05$ is considered statistically significant [11].

## 3. Results and discussion

**Table 1** Concentrations (mg/kg) of the three elements measured in camel meat

| Metal | Muscle (Mean± SE mg\kg) |
|---|---|
| Cadmium Ca | 0.032± 0.05 |
| Lead Pb | 0.033± 0.01 |
| Chromium Cr | 0.014± 0.09 |

The present study showed the estimation of heavy metals (Pb, Ca, and Cr) in fresh camel meat in Samawah city. The static analysis demonstrates that the overall mean concentrations of heavy metals of Pb, Ca, and Cr in camel meat were 0.033± 0.01, 0.032± 0.05, and 0.014± 0.09 mg/kg, respectively, as shown in Table 1) [12] and accepted according to the maximum permissible level (MPL) shown in Table 2. In the present study, all metals in the meat of camels were recorded at the levels of toxic metals (Pb, Ca, and Cr) limits of safety standards as recommended by [13]. The concentration of heavy metals in the meat of different animals depends on factors like environmental conditions, type of feed, and industrialization development [14]. Sources of contamination by this element result from human activities; car and generator exhaust; and human activities in large factories, which cause high air pollution with Pb. In addition, bad fertilizers reach crops, animals, and human tissues as mentioned [15]. The presence of these metals can create worries due to accumulative effects on the consumers' organs and can lead to metal toxicity as referred to by [16]. The slightly high levels resulted from grazing and watering from artesian wells, which have high concentration levels of heavy metals this agrees with [17]. Consumption of camel meat is a source of exposure to Pb, which could have adverse health

effects on humans. Lead (Pb) is a well-known toxic element to humans, especially for neurodevelopment in children. Moreover, it was reported by the World Health Organization (WHO) that Pb exposure (4.4%) to children between 0-4 years may lead to minor mental retardation in Europe [18]. The compounds containing lead are added to cars' fuel as anti-knock agents, which have lipophilic properties [19]. Therefore, we could notice an accumulation of Pb in camel hump, as we observed in our study, could be due to intensive car traffic in Saudi Arabia [20]. Toxic heavy metals are regarded as dangerous to consumer health because they don't break during cooking processing and have bioaccumulation features in human and animal bodies, which cause health hazards, as also concluded by [21] and [22].

**Table 2** Maximum permissible level (MPL) in mg/kg according to WHO & FAO, 2011

| Metal | Maximum permissible level (MPL) in mg/kg | Reference |
|---|---|---|
| Cadmium (Cd) | 0.5 | FAO (1983) |
| Lead (Pb) | 0.1 | FAO (1983) |
| Chromium (Cr) | 0.05 | Codex alimentarius commissions, 1994 |

Source: [WHO & FAO, 2011]

## 4. Conclusion

The levels of toxic metals (Cd, Pb, and Cr) in meat camels in Samawah Province were within the limits of safety standards as recommended by (NRC). We recommended that the detection of pollution in camel meat decreases at these sources with the continuous examination of feedstuff for detected levels of toxic metals.

## Compliance with ethical standards

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*Disclosure of conflict of interest*

The authors declared that there was no conflict of interest.

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