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Assessment of Blood Lead and Cadmium Levels in Sheep Grazing on Street Trash in West Zawia Municipality, Libya

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Abstract

The goal of the present study is to evaluate blood lead and cadmium status in sheep grazing on street garbage. A total number of 50 ewes (2 – 4 years old) were subjected to study. Animals were classified into two groups, the first group (No.= 30) included animals grazed on street garbage in West Zawia Municipality, the second group (No.= 20) were selected from sheep lived indoor at the privet farms in the same Municipality, Libya.

Blood lead concentration was 1.50 ± 0.19 (ppm) in the street garbage group and was 0.32 ± 0.14 (ppm) in the Indoor group. Blood cadmium concentration was 0.17 ± 0.01 (ppm) in the street Garbage group and was 0.009 ± 0.005 (ppm) in the Indoor group.

The street garbage group had greater blood lead and cadmium contents than the indoor group, according to a statistical comparison of the two groups.

In conclusion, the elevated blood levels of lead and cadmium in sheep grazing on street trash suggested ongoing exposure to the two elements, which pose a serious risk to both human and animal health.

Key words: cadmium, lead, sheep, garbage, street, farm sheep.

تقييم مستويات الرصاص والكاديوم في دم الأغنام التي ترعى على نفايات الشوارع في بلدية الزاوية الغربية، ليبيا

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تهدف هذه الدراسة إلى تقييم مستويات الرصاص والكاديوم في دم الأغنام التي ترعى على نفايات الشوارع. شملت الدراسة 50 نعجة (تتراوح أعمارها بين سنتين وأربع سنوات). قُسّمت الحيوانات إلى مجموعتين: المجموعة الأولى (عددها 30) ضمت الأغنام التي ترعى على نفايات الشوارع في بلدية الزاوية الغربية، والمجموعة الثانية (عددها 20) ضمت الأغنام التي تعيش داخل الحظائر في المزارع الخاصة في نفس البلدية، ليبيا.

بلغ تركيز الرصاص في الدم 1.50 ± 0.19 جزء في المليون في مجموعة نفايات الشوارع، و0.32 ± 0.14 جزء في المليون في مجموعة الحظائر. أما تركيز الكاديوم في الدم فبلغ 0.17 ± 0.01 جزء في المليون في مجموعة نفايات الشوارع، و0.009 ± 0.005 جزء في المليون في مجموعة الحظائر.

أظهرت مقارنة إحصائية بين مجموعتي الأغنام التي ترعى نفايات الشوارع مستويات أعلى من الرصاص والكادميوم في الدم مقارنةً بمجموعة الأغنام التي تربي في المنازل.

وخلصت الدراسة إلى أن ارتفاع مستويات الرصاص والكادميوم في دم الأغنام التي ترعى نفايات الشوارع يشير إلى تعرضها المستمر لهذين العنصرين، مما يشكل خطراً جسيماً على صحة الإنسان والحيوان.

الكلمات المفتاحية: الكادميوم، الرصاص، الأغنام، القمامة، الشارع، أغنام المزارع.

Introduction

Industrial and agricultural activities have released numerous toxic metals into the environment, though relatively high concentrations can also occur naturally. Cadmium, lead, arsenic, and mercury are the elements that have raised the most concern. This occurs because they are easily transferred through food chains and can pose a potential health risk to animals and humans (Fowler et al., 2007). Lead is recognized as a significant environmental pollutant and has been implicated as a leading cause of accidental poisoning in domestic animals, especially in cattle, sheep, and horses (Liu, 2003).

One of the elements that is most harmful to both humans and animals is cadmium. The environment, including fresh and marine water, soils, sediment, and air, naturally contains this metal (Roberts et al., 1994). It is utilized in several industrial processes and contaminates certain fertilizers, particularly partly acidulated phosphate fertilizers (McLaughlin et al., 1997), and urban sewage sludge used to fertilize crops or pastures (Hutton, 1983), (Godin et al., 1985).

The widespread distribution and industrial fallout have resulted in all food being exposed to and containing cadmium (Miranda et al., 2001). Sheep grazing on street garbage are exposed to a wide variety of health hazards, stemming from environmental pollutants and the ingestion of toxicants hidden within the waste. This study aims to evaluate the blood lead and cadmium levels in sheep that naturally graze on street garbage.

A total number of 50 ewes (2 – 4 years old) were subjected to study. Animals were classified into two groups, the first group (No.= 30) included animals grazed on street garbage in West Zawia Municipality, the second group (No.= 20) were selected from sheep lived indoor at the privet farms in the same Municipality, Libya.

Blood lead concentration was 1.50 ± 0.19 (ppm) in the street garbage group and was 0.32 ± 0.14 (ppm) in the Indoor group. Blood cadmium concentration was 0.17 ± 0.01 (ppm) in the street Garbage group and was 0.009 ± 0.005 (ppm) in the Indoor group.

Materials and Methods

Study area

The study was conducted in the district, of West Zawia, State of Libya. The region is located 59 km west of Tripoli capital of Libya. The area of the study is located at 32.694163°N, 12.625615°E. The district comprises many farms.

Sources of samples:

A total number of 50 ewes (2–4 years old) were subjected to study. Animals were classified into two groups, the first group (n = 30) included animals naturally grazed on street garbage in West Zawia Municipality, Libya. The second group (No.=20) were selected from sheep live indoor at the privet farms in the same Municipality, Libya.

Ethical approval:

The present experimental work was carried out at the Research Laboratory belonging to the Faculty of Veterinary Medicine and Agriculture (Al-Ajeelat), University of Zawia, on the 5th of Mars 2025.

Samples: blood samples (4 ml) were collected from the jugular vein in vacutainer tubes containing heparin, and kept in deep freeze (-15 ºC) for chemical analysis.

Digestion of samples: blood samples were digested according to Zilva (1973).Briefly, to each 1 mL whole blood sample, 2 mL of digestion mixture (equal volume of concentrated nitric acid and 72% per chloric acid) was added in a 50 mL Teflon beaker and left to react for 24 hours at room temperature. The mixture was then heated on a hot plate at 100ºC until the sample became colorless. The samples were then diluted with distilled water up to 20 mL.

Analytical methods: Lead and cadmium concentrations were determined in digested whole blood using Atomic Absorption Spectrophotometry (Atomic absorption 906, GBC, Australia). Certified standard solutions of the elements were used for the preparation of the elements working standard solutions.

Statistical analysis: Statistical analysis was conducted using SPSS 27.0 for windows (SPSS, Chicago, USA) and were carried out using one way ANOVA. Data were expressed as Mean ± SD.

Results and discussion

Blood lead concentration was 1.50 ± 0.19(ppm) in the street Garbage group and was 0.32 ± 0.14 (ppm) in the Indoor group. Blood cadmium concentration was 0.17 ± 0.01 (ppm) in the street Garbage group and was 0.009 ± 0.005 (ppm) in the Indoor group. Statistical comparison of the two groups revealed that street garbage group had a higher blood lead and cadmium concentrations than the indoor group shown in table 1.

Table 1. Blood lead and cadmium concentrations in sheep.

	Street garbage group (No.=20)	Indoor group (No.=10)
Lead (ppm)	1.50 ± 0.19**	0.32 ± 0.14
Cadmium (ppm)	0.009 ± 0.005	0.17 ± 0.01**

** significant at $p<0.01$

The growing interest in minerals has prompted the development of reliable methods to measure trace elements and toxic metals within the body. Several studies have examined specific aspects of lead toxicity in humans (Ye, 2001), and animals (Huang & Liu, 2001), (Abdou et al., 2004).

Element status in humans and animals may be evaluated using a variety of specimens, including blood (Melton et al., 1990), (Forrer et al., 2001).

In some areas of West Zawia City (Libya), sheep are grazing on street garbage, which may carry health hazard. Significant increase in blood lead concentration ($p<0.01$) was observed in sheep grazing on street garbage (1.50 ± 0.19 ppm) when compared with the indoor group (0.32 ± 0.14 ppm).

Every day, sheep grazing on the street are exposed to lead, which comes from a variety of industrial processes and vehicle emissions (Chandra, 1980).

Following combustion, the tetraethyl lead found in gasoline settles on the plants along roadsides as lead oxide or chloride (Bartik & Piskač, 1981).

The amount of blood lead found in the current study is more than what is allowed in ruminant blood. According to a previous study normal ruminants typically have whole blood lead levels between 0.05 and 0.25 ppm (Radostits et al., 2000).

Blood cadmium concentration was significantly higher in street grazing group (0.17 ± 0.01 ppm) than the indoor group (0.009 ± 0.005 ppm).

The grazing group's elevated cadmium levels might be caused by ingesting burned solid waste when grazing on trash (Ambasht & Ambasht, 1992), or by consuming meals tainted with cadmium from artificial sources (Bjorland & Norheim, 1981).

In conclusion, the increased blood lead and cadmium in sheep grazing on street garbage indicated the continuous exposure to the two elements, which may affect the reproduction and production of the animals and bear significant health hazard to human. Further studies are recommended from Libya to assess the level and types of pollutants in the country's various cities and on different types of animals.

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