



EFFECT OF ENVIRONMENTAL POLLUTION BY LEAD ON HEMOGRAM PICTURE AND SOME MACRO AND MICRO ELEMENTS IN MULES IN ASSIUT GOVERNORATE

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ABSTRACT:

A total number of twenty mules belonged to Assiut Governorate, their ages ranged from 5–8 years constituted the materials of this investigation. Animals have been divided into two equal groups (exposed to air pollution with lead and non exposed mules) each of them contain ten mules. Clinical signs of exposed mules showed poor performance, nervous signs, dyspnea as well as stiffness and enlargement of joints and some of them showed signs of gastroenteritis. Hemogram picture of exposed mules showed oligocythemia, decreased in hemoglobin content and packed cell volume when compared with non-exposed group. Also leucopenia was evident in exposed group. Biochemical analysis revealed a significant elevation in blood and hair lead level and decrease in blood serum copper, iron and phosphorus levels in exposed mules when compared with non exposed ones. Non-significant fluctuation in blood serum levels of zinc, calcium and magnesium was evident in lead exposed group.

INTRODUCTION:

Upper Egypt nowadays shows numerous and growing industrialization which did not exist before 40 years ago. Moreover, in Assiut Governorate the motor vehicles increased 800% in the same time the roads still remained narrow consequently pollution came to all areas especially that around the main roads of this Governorate. Lead is a common cause of poisoning of domestic animals throughout the world. Lead is considered to be the one of the major environmental pollutants which has been incriminated as a cause of accidental poisoning

in domestic animals more than any other elements especially in cattle, sheep and horses (Liu, 2003). Sharon, (2003) mentioned that Gasoline additive represent the current chief source of lead air pollution especially in cities and near high ways. Interaction between lead and essential nutrients is biologically of more significance in horses owing to their sensitivity and affects the absorption and availability of such nutrients as calcium, iron, zinc and copper (Saeni, 2000).

The level of lead in the air depends on wind velocity; rain, highly raise buildings, narrow

roads and traffic congestion. Lead particles fumes if inhaled through respiration eventually will affect health. Small lead particles if inhaled in the lung will flow in the blood stream. The amount of metals in hair correlated with the amount of metals absorbed by the body, therefore the hair may be used as a biopsy material. Hair analysis was used to monitor the occupational and lifestyle exposed subjects (Saeni, 2000).

Derangement of calcium absorption and metabolism results from interference with vitamin D metabolism. Lead may also alternate zinc dependent enzyme processes and interfere with gamma aminobutyric acid (GABA) production or activity in CNS (Gwaltney-Brant, 2002).

Anemia that occurs in lead poisoning results from two basic defects shortened erythrocyte life-span and impairment of heme synthesis and due to increase the mechanical fragility of the cell membrane, it is accompanied by inhibition of sodium and potassium dependent adenosine triphosphatase and lead inhibits enzymes at several steps in heme formation pathway (Herrnberg *et al.*, 1967).

Hematological studies in experimental lead toxicity showed normocytic norm chromic anemia and leukocytosis followed by leucopenia (Benkova *et al.*, 1993).

The clinical symptoms in lead toxicity in equine appeared as marked loss of weight, stiffness of joint, progressive arching of the back and anemia. The syndrome characterized by dysfunction of peripheral motor, with relative sparing of sensory nerve function, weight loss, depression, ataxia, dysphagia, laryngeal paralysis, facial nerve deficits, seizures and death (George, 1996 and Schmitz, 1998).

Copper is involved in bone collagen, elastic synthesis, mobilization of body iron stores and synthesis of the body pigment melanin. Impairment of copper causes anemia and loss of hair (Lewis, 1996). The author also found a correlation between the occurrence of diseases and reduced concentrations of calcium, phosphorus, zinc and copper.

The present investigation carried out to throw the light on the effect of lead pollution on hemogram picture and some biochemical constituent includes macro and micro-elements.

MATERIALS AND METHODS:

Materials:

1-Animals:

A total number of 20 mules in different localities at Assiut Governorate (the studied animal included 10 working mules are exposing daily to lead air pollution of motor vehicles and 10 mules non exposed localities far away from the main roads were used as control groups).

2-Blood samples:

Two blood samples were collected through jugular vein puncture; one with EDTA as anticoagulant for hemogram picture and the second without anticoagulant for obtained clear non-hemolysed sera for estimation of Ca, P, Mg, Cu, Fe, and Zn.

3-Hair samples:

About 1 gm from the main hair from nape area near the skin for estimation of lead levels after digestion and preparing the samples for analysis.

Methods:

1-Clinical examination:

All animals have been subjected to careful clinical and laboratory methods of examination according to Spires and Wrigley (2001) and Coles (1986) to ensure their healthy status.

2-Hematological picture:

Blood samples with EDTA from all animal were used for manual hemogram determination including total erythrocytic count (TRBc-T/L), packed cell volume (PCV%), hemoglobin concentration (Hb g/L) and total leucocytic counts (TWBcs-G/L) according the method previously described by Coles (1986).

3-Biochemical analysis:

Blood serum calcium, inorganic phosphorus and magnesium levels were determined with spectrophotometer using standard test kits after the methods described by Biggs and Moorhead (1974), Goodwin (1970) and Jacob (1986) respectively. Meanwhile, blood serum copper, iron, zinc and lead levels were estimated using atomic absorption spectrophotometer (GBC 906 AA).

Statistical analysis:

The obtained results were analyzed statistically according to Selvin (1996).

RESULTS:

Table (1): Mean Values and standard deviation of lead in healthy and lead exposed mules

Condition	Units	Pb level in blood	Pb level in hair
Healthy (N=10)	PPm	0.37 ± 0.12	1.95 ± 0.35
Exposed (N=10)	PPm	1.58 ± 0.31**	4.50 ± 1.6**

Table (2): Hemogram picture in healthy and lead exposed mules

Condition	Items	Units	Means ± S. D.
Healthy N = 10	TRBCS	T/L	12.2± 0.5
	Hb	gm/L	165 ± 0.8
	Pcv	%	41.6 ± 2.5
	WBCS	G/L	15.5 ± 1.7
Exposed N = 10	TRBCS	T/L	5.0 ± 0.5**
	Hb	gm/L	132 ± 0.8**
	Pcv	%	36.3 ± 1.9*
	WBCS	G/L	7.8 ± 1.7**

Clinical symptoms of lead-exposed mules were summarized in poor performance nervous signs including convulsion, roaring, laryngeal paralysis with dyspnea, as well as enlarged joints, stiffness, muscular weakness and anorexia and some of them revealed gastro-enteritis signs.

Lead levels of blood and hair showed a highly significant elevation in exposed mules when compared with the non-exposed animals (Table 1).

Hematological picture in exposed mules revealed a highly significant oligocythemia, decrease in hemoglobin concentration and hematocrit values when compared with the control mules. A highly significant leucopenia was recorded in exposed mules when compared with controlled one (Table 2).

Biochemical analysis of blood sera revealed a highly significant decreased in levels of copper and iron, significant decrease in phosphorus levels in exposed group when compared with the non-exposed ones. Meanwhile blood serum zinc, calcium and magnesium were fluctuated in exposed group when compared with control group (Table 3).

* : Significant (P< 0.05).

**:= Highly Significant (P< 0.01).

Table (3): Macro and microelements in healthy and lead exposed mules

Elements	Units	Healthy	Exposed
Copper	µg/dl	130.9± 11.5	105.5± 13.1**
Iron	µg/dl	172.3± 16.1	135.5 ± 18.9**
Zinc	µg/dl	153.6± 15.1	154.9 ± 11.5
Calcium	mg/dl	10.8± 1.2	8.5 ± 1.5
Phosphorus	mg/dl	5.7± 0.7	3.9± 0.9*
Magnesium	mg/dl	2.7± 0.6	2.1 ± 0.1

* : Significant (P< 0.05).

**:= Highly Significant (P< 0.01).

DESCUSSION:

Estimation of lead in blood and hair are generally useful for determining the lead exposure of the animal and used most frequently to insure a clinical diagnosis of lead poisoning. Lead levels of both blood and hair were highly significant increased in exposed mules than non-exposed ones (Table 2). These results agreement with those previously obtained by Sharkawy and Rateb (2000) and Abd-El-Salam *et al.*, (2002). Such elevation may be due to contamination of foodstuffs and drinking water with lead or air pollution of the environmental with heavy metals especially that of major health effects like lead.

Clinical symptoms of lead-exposed mules were summarized in nervous signs including convulsion, roaring, laryngeal paralysis with dyspnea as well as enlarged joints, stiffness, muscular weakness and anorexia and some of them revealed gastro-enteritis signs. Such results coincided with those previously obtained by Sharkawy and Rateb (2000); Abd-El-Salam *et al.*, (2002); Gwaltney-Brant, (2002) and Shima (2007) in similar condition in horses, donkeys and mules.

Hematological picture in exposed mules revealed a highly significant oligocythaemia, decrease in hemoglobin concentration and hematocrit values when compared with the healthy mules. A highly significant leucopenia

was recorded in exposed mules when compared with the non-exposed ones. Anemia in exposed mules coincided with those previously obtained by Ibrahim (1983) who reported that the decrease in circulatory erythrocytes was attributed to indirect inhibitory effects of lead to hemobiosynthesis. Also Radostatis *et al.*, (2003) reported that increase lead level in the blood incorporation of glycin into globin reduction of hemoglobin concentration. A highly significant leucopenia was recorded in exposed mules when compared with the controlled ones. Such decreased in total leucocytic count can be attributed to suppression effect of lead on bone marrow leading to such decrease (Radostatis *et al.*, 2003). The obtained anemic can be explained also to decrease of iron, zinc and copper levels in exposed mules when compared with the non-exposed animals and such results similar to those previously obtained by Sharkawy and Rateb (2000) and Abd-El-Salam *et al.*, (2002).

Biochemical analysis of blood sera of studied mules revealed a highly significant decreased in levels of copper and iron, significant decrease in phosphorus levels meanwhile zinc, calcium and magnesium were fluctuated these obtained results were in accordance with Pounds (1985) and Shima (2007) whose stated that lead intoxication leads to such changes in iron, zinc and copper.

Niklowitz and Yeager (1973) reported that lead displace zinc or prevent its uptake by the brain. The obtained results in this study revealed a positive correlation between lead and iron in sera of draft mules; these results are agreement with by Sharkawy and Rateb (2000); Gwaltney-Brant, (2002) and Shimaa (2007).

Finally we could be concluded that periodical monitoring of the lead level in examined animals and using lead level in hair as an easily biological samples which reflect the state of toxicity and minimize the hazard effect by supplementation the animals by hemotonic minerals such as copper, iron, phosphorus and calcium in ration and transporting such animals faraway from the main roads to minimized the source of pollution.

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تأثير التلوث البيئي بالرصاص علي الصورة الدموية وبعض العناصر الكبرى والصغرى في البغال بمحافظة أسيوط

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اشتملت هذه الدراسة على عدد 20 من بغال الجر والتي يتراوح أعمارها بين 5-8 سنوات بمحافظة أسيوط. تم تقسيم الحيوانات إلى مجموعتين متساويتين (كلا منها عشرة بغال) حسب تعرضها أو عدم تعرضها للرصاص. أوضحت الدراسة ظهور الأعراض الإكلينيكية للبغال التي تعرضت للتلوث متمثلة في حدوث تشنجات عصبية وصعوبة في الخطي وضيق في التنفس وتضخم في المفاصل وقد عانت بعض منها بالنزلات المعوية. أوضحت الصورة الدموية حدوث أنيميا متمثلة في نقص معنوي في عدد كريات الدم الحمراء ونسبة الهيموجلوبين ونسبة الكريات المصمتة. كذلك حدوث نقص معنوي في عدد كريات الدم البيضاء في البغال المعرضة للتلوث بالمقارنة بتلك الغير معرضة. سجلت الصورة البيوكيميائية عن حدوث ارتفاع معنوي في معدل الرصاص في الدم والشعر في البغال المعرضة للتلوث، وكذلك حدوث انخفاض معنوي في معدلات كلا من عنصر الحديد والنحاس والفسفور بالمقارنة بتلك الغير معرضة للتلوث. فيما كانت معدلات الزنك والكالسيوم والماغنسيوم متمثلة في تارجح غير معنوي بالمقارنة بتلك الغير معرضة للتلوث بالرصاص.