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SOME HAEMATO-BIOCHEMICAL AND GROWTH PERFORMANCE CHANGES IN GROWING LAMBS INDUCED BY LEAD AND THEIR MODULATION WITH GINSENG

Abeer I.A. Abou El-Gheit, Nesreen A. Shawky, Halla M. Khalil, and Amal I. A. El-Shorbagy
Biochemestry Department Animal Health Research Institute Zagazig, Sharkia, Egypt

A B S T R A C T

This study briefly summarized the role of ginseng in real amelioration of the growth performance and some haemato-biochemical alterations adverse effects caused by lead in growing lambs. 20 lambs, 4-6 month old, at Sharkia Governorate 10 clinically healthy with 20-22 kg B.Wt., grazing in area faraway main highways and other 10 lambs grazing near main highways with 13-15 kg B.Wt. Lambs were divided into 4 equal groups n=5 /group. 1st group grazed in area faraway main highways healthy control, 2nd group grazed in area faraway main highways and received a daily 200 mg ginseng extract/lamb orally for 30 successive days. 3rd group lambs grazed near main highways left without treatment. 4thgroup lambs grazed near main highways and received 200 mg ginseng extract/lamb same like group 2. Two blood samples were collected from all lambs at 1st day and 15th day post treatment for haemato-biochemical analysis.Clinical signs appeared on lambs grazed near main highways due to excess serum lead concentration inhaled from environment. 2nd group lambs showed significant increase in weight gain, total erythrocytic count, total leukocytic count, hemoglobin content, packed cell volume, total protein, iron, copper as compared to control group. Lambs grazed near main highways showed a significant decrease in live body weight, weight gain, erythrocytic count, hemoglobin content, packed cell volume, total leukocytic count, serum total protein, copper and significant increase in feed conversion rate, serum lead, iron, AST, ALT, alkaline phosphatase and urea,T3,T4 as compared to control group. Lambs of the 4th group showed improvements in body weight gain, feed conversion rate, erythrocytic count, leukocytic count, hemoglobin content, packed cell volume, total protein, AST, ALT, alkaline phosphatase, urea and creatinine. It could be concluded that lead induced many alterations in growth performance and haemato-biochemical parameters in lambs and that could be overcome by daily administration of ginseng.

KEY WORDS. Biochemical, Hematological, Grazing, Lamb, Lead

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1.INTRODUCTION

Lead is a common environmental pollutant [47]. Causes of environmental contamination include industrial use of lead 38. Animals living near facilities that process lead, such as smelters, have been found to have unusually high blood lead levels [53]. Lead exposure can occur from contact with lead in air, dust, soil, water, and commercial products [50].

Animals interact with their environments on a daily basis and as a consequence,are exposed synthesized chemicals present in the food they eat,the air they breath [8]. Heavy metals are persistent contaminant in the environment and come to the forefront dangerous substances causing serious health hazard in animals. Heavy metals are recognized as accumulative toxic

substances due to its low elimination rates from the body [13]. Among these metals lead which cause several clinical problems due to its competition with the essential elements for binding sites and its interference with the sulphahydryl groups and structural protein [12]. Chronic exposure to lead resulted in decrease the activity of kidney and liver enzymes [22]. Lead concentration in animal blood is correlated with the period of exposure and the intensity of lead contamination [3]. Lead is excreted in urine and gastrointestinal secretionurine 76%, gastrointestinal secretion 16%, hair, sweat, nails 8% [10]. Panax ginseng is one of the most valued medicinal plant belonged to family Araliaceae [29]. It is herbal root, has a wide pharmacological actions in the clinical practice [9]. This plant contain many ingredients such as saponins known as panaxosides or ginsengosid, vitamin A, B6, minerals as zinc, antioxidant, peptides, fatty acids, polysaccharide, alcohol and cholesterol ester transfer protein inhibitors [1].The various forms of ginseng appear to be non toxic [25]. Ginseng decreases nitric acid content and nitric oxide synthase activity play a role in accelerating senility in the cerebral cortex in rats [35]. Ginseng improves the survival rate and sperm quality in guinea pigs [33].
Our study was planned to throw light on growth performance and some haemato-biochemical alterations associated with lead toxicity in growing lambs and effect of ginseng on improvement the lead toxicity.

2. MATERIALS AND METHODS

2.1. *Ginseng Drug*
Korean red Ginseng extract capsules (Pharco. Pharmaceutical, Alexandria, Egypt, 100 mg/capsule) was used in current study.

2.2. *Animals*.
Twenty, 4-6 month old local breed of both sex lambs from Abo Hamad city at Sharkia Governorate. 10 clinically healthy with average body weight of 20-22 kg grazed in area faraway main highways and other 10 lambs grazed near main highways and suffering from loss of appetite, depression, diarrhea, rough coat and poor growth with average body weight of 13-15 kg, All lambs were free from internal and external parasites.

2.3. *Experimental design*.
Lambs were divided into 4 equal groups 5 lambs/group. 1st group: healthy lambs not treated control group. 2nd group: healthy lambs were received 200 mg ginseng extract/ lamb [26] orally in drinking water daily for 30 successive days. 3rd group: lamb grazed near main highway left non treated. 4th group: lambs grazed near main highways and received ginseng extracts same like group 2.

2.4. *Feeding program and body weight*.
Lambs in all groups provided with 500 gm concentrat/lamb/day during treatment period and 600 gm concentrat/lamb/day for 30 day post treatment, hay was provided *ad libitum* along the period of experiment. Fresh clean water was freely available. Concentrate was offered in two equal portions daily along the experimental period. Lambs in all groups were weighted at the beginning of the experiment, 1st day and 30th day post treatment to calculate average weight gain and feed conversion rate.

2.5. *Blood samples*.
Two blood samples were collected from each lamb by Jugular vein puncture at 1stday and 15thday post treatment. The 1stday sample was collected in tube

contain EDTA for hemogram and total leukocytic count according to [27]. 2nd blood samples were collected in clean,dry tubes to obtain clear serum for determina-tion of total protein [14], transaminases enzyemes AST-ALT [48], alkaline phosphatase [28], urea [43], creatinine [24], copper [62], lead [6], iron [15], Triiodothyronine and thyroxin [5] as it was described previously.

2.6. *Statistical analysis*

The obtained data were analysed according to Petrie and Watson [45].

3. RESULTS AND DISCUSSION

Our results revealed that most clinical symptoms (table 1) appeared on lambs grazing near main highways were loss of appetite, depression, diarrhea, rough coat and poor growth these signs may be due to increase lead level in environment near main high ways. Same clinical signs were recorded in sheep [39] and cattle [20, 23]. Chronic lead poisoning induced alimentary tract dysfunction with intestinal atony accompanied by constipation followed by a fetid odor diarrhea, dullness and anorexia [46, 59]. Ginseng supplemented to lambs grazing near main high ways for 30 days induced improvement in clinical symptoms. Ginseng is called the king of herbs possesses multiple unique functions as greatly improving weak constitution, curing diseases and enhancing body weight and improve appetite in rats [30]. Yun [61] stated that ginseng enhances physical performance, promotes vitality and increases resistance to stress.

Present investigation declared that lambs grazing near main highways showed a significant decrease in body weight and increase in feed conversion rate. This finding fitted closely with the data stated previously [42] mentioned that lead poisoning induce significant decrease in weight gain in rats. On other hand, healthy lambs treated with ginseng daily for 30days showed significant increase in weight gain but feed conversion rate was insignificant-ant decrease and these results may be attributed to the high nutritive biological values of the ginseng. Huang [26] declared that ginseng has the ability to stimulate digestion and contains many valuable ingredients as saponins ginsengosid, vitamin A, B_6, minerals as zinc, antioxidant peptides, fatty acids, polysaccharide, alcohol and cholesterol ester transfer protein inhibitors. Our results were agreeable with those reported formerly [16]. Fahim et al. [19] recorded that male rats supplemented with ginseng in their diet caused increase in daily food consumption.

Obtained results in this study revealed that, lambs grazing near main highways showed sever change in blood picture (table 2) as reduction in erythrocytic count, hemoglobin content, packed cell volume and leukocytic count. This observation was previously recorded in cows suffering from lead toxicity [54]. Reduction of erythrogram in our study may be due large affinity of lead for the thiol and phosphate containing ligands, inhibiting the biosynthesis of heme [21] or may be due to failure of bone marrow to produce enough erythrocytes [40]. Healthy lambs treated with ginseng revealed improvement in hemogram represented by significant increase in erythrocytic count, hemoglobin content, packed cell volume and leukocytic count. Similarly, it was found that ginseng induced elevation in total erythrocytic and leukocytic counts, hemoglobin content and packed cell volume in rats [7, 57] that might be attributed to the increase in total leukocytic count to saponin from ginseng which stimulate proliferation of lymphocytes [37].

In addition, Payne [44] explained that ginseng contain many ingredients such as saponins vitamin B12, minerals as zinc in which help in the formation of hemoglobin and erythrocytes.

It is evident from the present study that, lambs grazing near main highways showed a significant increase in serum AST, ALT, alkaline phosphatas, urea and significant decrease in total protein but creatinine showed insignificant increase (table 3). These results came in the same line with that noticed formerly [21] who concluded that in lead toxicity induce elevation in AST, ALT, urea and insignificant increase in creatinine .Also, Swarupa et al. [58] stated that lead toxicity induce significant increase in AST, ALT and alkaline phosphatase in cows. The above mentioned results could be due to increase cellular basal metabolic rate, irritability and the destructive changes of liver and skeletal muscle cells [2]. Moreover, Sakurai wt al. [52] mentioned that elevation in urea may be due to toxic effect of lead on kindney causing renal dysfunction and decreasing renal clearance of blood from urea. Abd El-Salam et al. [4] found significant reduction in total serum protein of lead exposed cattle and this may be due to reduced appetite and a state of inappetence.

Table 1 Live body weight (B.W), weight gain (W.G), feed consumption (F.C) and feed Conversion rate (FCR) of healthy and diseased lambs (N=5)

Parameters	G1	G2	G3	G4
Initial Body weight (kg)	22.12±0.89	21.22±0.91	14.31±0.74	14.62±0.91
	---------- At 1 day ----------			
B. Wt. (Kg)	30.94±1.95	31.47±0.33	19.62±1.35**	24.08±2.49
W.G (Kg)	8.82 ± 0.62	10.25±0.20*	5.31±0.63**	9.46 ± 0.51
F.C (Kg)	15	15	15	15
FCR	1.70± 0.39	1.46± 0.22	2.84± 0.27*	1.59± 0.17
	---------- At 15 days ----------			
B. Wt. (Kg)	40.38±2.78	42.06±0.82	26.31±1.97**	34.11±0.98
W.G (Kg)	9.44 ± 0.38	10.59±0.14*	6.69 ± 0.99*	10.03±0.28
F.C (Kg)	18	18	18	18
FCR	1.91± 0.15	1.70± 0.12	2.69± 0.24*	1.79± 0.12

* P < 0.05 and ** P < 0.01

Table 2 Hemogram and total leukocytic count of healthy and diseased lambs (N=5)

Groups	RBCs($\times10^6$mm^3)		Hb (gm %)		PCV (%)		WBCs ($\times10^3$/mm^3)	
	1st day	15th day	1st day	15th day	1st day	15th day	1st day	15th day
G1	8.12±0.30	8.20±0.31	11.23±0.45	11.10±0.37	36.51±0.62	36.07±1.58	9.08±0.22	9.13±0.17
G2	10.18±0.41**	9.35±0.74	14.49±0.85**	12.16±0.38	41.17±0.92**	37.20±0.89	12.36±00.89**	10.03±0.18**
G3	6.28±0.38**	6.73±0.27**	8.94±0.21**	9.09±0.18**	31.83±0.87**	30.28±0.65**	7.04±0.49**	7.17±0.51**
G4	8.17±0.8	8.22±0.41	10.69±0.38	11.06±0.32	34.17±1.38	36.04±0.53	8.79±0.48	8.97±0.72

** P < 0.01

Table 3 Liver function tests of healthy and diseased lambs (N=5)

Groups	T.protein (gm/dl)		AST(IU/L)		ALT(IU/L)		AlK.Ph.(IU/L)	
	1st day	15th day	1st day	15th day	1st day	15th day	1st day	15th day
G1	8.55±0.15	8.09±0.25	46.14±2.83	46.27±2.37	27.2±2.19	27.92±1.68	26.08±1.12	26.46±1.19
G2	11.98±0.87**	9.15±0.39	47.04±0.83	46.36±0.93	29.14±1.92	28.16±1.46	29.20±1.32	28.53±1.82
G3	6.09±0.61**	6.16±0.37**	57.03±0.99**	59.21±1.07**	35.83±0.52**	34.47±0.46**	32.94±1.03**	33.35±1.14**
G4	7.58±0.59	8.04±0.87	47.02±0.89	46.89±0.93	27.24±0.99	28.24±0.92	27.03±1.55	26.52±1.92

Also, it was mentioned that the reduction in the serum total protein concentration indicate the impaired protein synthesis in the liver [32]. Healthy lamb supplemented with ginseng extract for 30 days showed insignificant elevation in liver enzymes activityAST, ALT and alkaline phosphatase, urea, creatinine, and significant increase in total protein (table 5). Our results were confirmed formerly in male rats treated with ginseng [60]. It was stated that ginseng have antioxidant effect by enhancing the activity of the antioxidant enzymes, and also have a protective effect on liver and kidney functions [17]. Increase the total protein might be attributed to the saponins ginsenosid which stimulate serum protein biosynthesis or to direct act of ginseng on the body cells promotting DNA and protein synthesis protection [51].

In the present study, our results revealed significant elevation in serum lead, iron and decrease copper in lambs grazing near main highways (table 5). Our results were in agreement with El-Shereif [18] in cattle intoxicated with lead. Earlier studies [37, 58] stated that serum lead was increased in sheep and cows suffering from lead toxicity. Elevation of serum iron in lead toxicity may be due to the indirect inhibitory effects of lead to the heme biosynthesis by inhibition of deltaaminolevulinic acid dehydrase enzyme activity leading to accumulating iron in the blood [55]. On the other hand, lead level remain high in lambs grazing near main highways and supplemented with ginseng and healthy lambs and lambs grazing near main highway supplemented with ginseng showed improvement in trace elementsiron and copper, in diseased lambs this improvement in trace elements may be due to improve intestinal absorption of some nutrients such as copper.Same explaination was recorded previously [26] mentioned that ginseng contain many ingredients such as minerals.

Table 4 Kidney function tests of healthy and diseased lambs (N=5)

Parameters		G1(Control)	G2	G3	G4
Urea (mg/dl)	1st day	19.28±1.13	20.13±0.82	27.19±1.39**	20.17±0.48
	15th day	19.58±1.25	19.63±0.92	28.05±1.57**	21.904±0.83
Creatinine (mg/dl)	1st day	4.12±0.29	4.30±0.39	4.73±0.40	4.17±0.94
	15th day	4.29±0.40	4.42±0.38	4.38±0.31	4.23±0.25

** P < 0.01

Table 5 Trace elements of healthy and diseased lambs (N=5)

Groups	Lead (Ug/ml)		Copper(Ug/dl)		Iron (Ug/dl)	
	1st day	15th day	1st day	15th day	1st day	15th day
G1	0.010±0.003	0.009±0.006	109.18±2.71	112.06±3.39	101.16±2.13	105.03±1.32
G2	0.012±0.004	0.008±0.002	121.28±1.91**	115.14±1.32	110.18±1.21**	107.39±1.87
G3	0.83±0.09***	0.93±0.10***	99.21±1.65**	89.21±2.59***	115.19±1.40***	120.27±1.47***
G4	0.90±0.08**	0.88±0.19**	100.28±1.92*	107.28±1.47	114.37±1.9 7**	108.29±1.42

* P < 0.05, ** P < 0.01, ***p <0.001

Obtained data revealed significant elevation of T3 and T4 in lambs grazing near main highways (table 6).Our results agreed with those recorded previously [58] mentioned that plasma T3 and T4 were elevated in cows suffering from lead toxicity. Also, same results were recorded formerly [31] in buffalo and cows. These changes in this hormone may be related to high dose and long

duration of exposure to lead [54]. Treatment healthy lambs and lambs grazing near main highways with ginseng for 30 days showed insignificant elevation in thyroid hormone. Similar findings were reported in earlier study [49]. Elevation in thyroid hormone might be due to direct action of ginseng on the anterior pituitary gland [41].

From the previously mentioned points we could be concluded that lead toxicity induced many alterations in growth performance and haemato-biochemical parameters. Treatment diseased lambs by ginseng induce important role as protective agent against lead toxicity.

Table 6 Thyroid hormones of healthy and diseased lambs (N=5)

Parameters		G1(Control)	G2	G3	G4
T3 (ng/dl)	1st day	134.15±4.18	136.84±7.94	151.05±3.12**	137.30±2.39
	15t day	135.08±3.2	136.03±8.05	150.43±3.11**	136.52±3.26
T4 (ng/dl)	1st day	3.21±0.23	3.50±0.39	4.49±0.19**	3.88±0.63
	15th day	3.25±0.21	3.28±0.72	4.52±0.23**	3.35±0.61

** P < 0.01

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BENHA UNIVERSITY
FACULTY OF VETERINARY MEDICINE

بعض التغيرات الدموية، الكيمياء حيوية، وكفاءه معدل النمو فى الحملان الناميه المحدثه بالرصاص ومعالجتها باستخدام الجنسنج

عبير ابراهيم عبد الرحمن ابو الغيط , نسرين أحمد شوقى,هاله محمد محمد خليل وامل ابراهيم عبد الحميد الشوربجى

معهد بحوث صحة الحيوان– فرع الزقازيق– قسم الكيمياء والنقص الغذائي والسموم

الملخص العربى

استهدف العمل فى هذا البحث دراسة تأثير الرصاص على معدل النمو, التحويل الغذائي, صورة الدم, بعض التغيرات البيوكيميائية وبعض المعادن النادرة فى الحملان النامية وكيفية تلافى تلك هذه الأخطار باستخدام الجنسنج. شملت هذه الدراسة عدد عشرين حمل نامي تتراوح أعمارهم من4–6 شهر تنتمى إلى أماكن مختلفة بمحافظة الشرقية قسمت الحملان إلي أربع مجموعات متساوية. المجموعة الأولي حملان تتمتع بصحة جيدة ولم يتم علاجها (مجموعة ضابطه)، المجموعة الثانيه حملان تتمتع بصحة جيدة تم تجريعها مستخلص الجنسنج عن طريق الفم بجرعه مقدارها 200 مليجرام يوميا فى مياه الشرب لمدة شهر والمجموعة الثالثة حملان مريضة لم يتم علاجها أما المجموعة الرابعة حملان مريضة تم إعطائها مستخلص الجنسنج بنفس جرعة ، والمدة المستخدمة للمجموعة الثانية. تم أخذ عينتين دم من كل حيوان عند اليوم الاول والخامس عشر بعد نهاية العلاج لدراسة تأثير المرض والجنسنج على صورة الدم والأخرى لفصل السيرم وذلك لقياس مستوى بعض المعادن النادرة والتغيرات البيوكيميائية. كذلك عند اليوم الأول من بداية التجربة يتم وزن الحملان وعند اليوم الأول والخامس عشر بعد الانتهاء من العلاج بالجنسنج ويتم حساب كمية الأعلاف المركزة التى تم استخدامها وذلك لحساب معدل التحويل الغذائي. ظهر على الحملان التى ترعى بجوار الطريق الرئيسى والمعرضة لعوادم السيارات أعراض فقدان في الشهية، وهزال شديد، ضعف عام، و إسهال. أوضحت النتائج أن حملان المجموعة الثانية اظهرت زيادة معنوية فى وزن الجسم المكتسب، العدد الكلى لكرات الدم الحمراء والبيضاء، تركيز الهيموجلوبين، حجم خلايا الدم المرصوصة، البروتين الكلى,الحديد والنحاس وزيادة غير معنوية فى وزن الجسم، الترانس أمينيزيسAST–ALT) الفوسفاتيز القاعدى اليوريا و الكرياتينين T3 و T4. كما اشارت النتائج الى أن حملان المجموعة الثالثة عانت من وجود نقص معنوي فى وزن الجسم, وزن الجسم المكتسب، العدد الكلى لكرات الدم الحمراء والبيضاء تركيز الهيموجلوبين، حجم خلايا الدم المرصوصة، البروتين الكلى والنحاس وزيادة معنوية فى معدل التحويل الغذائي، الترانس أمينيزيس (AST –ALT) الفوسفاتيز القاعدى اليوريا T3وT4. حملان المجموعة الرابعة اظهرت تحسن فى وزن الجسم، وزن الجسم المكتسب، معدل التحويل الغذائي، صورة الدم، مستوى البروتين، الحديد والنحاس، الترانس أمينيزيسAST –ALT) الفوسفاتيز القاعدى اليوريا و الكرياتينين T3 و T4. من مجموع ما تقدم من نتائج نستخلص أن الرصاص لة تأثير سمي ويؤدى إلى تغيرات كبيرة فى معدل النمو، صورة الدم وبعض الوظائف البيوكيميائية ونوصى بإضافة الجنسنج لمياة الشرب حيث أنة له تأثير مفيد علي وزن الجسم ومعدل التحويل الغذائي, صورة الدم وبعض الوظائف البيوكيميائية.

(مجلة بنها للعلوم الطبية البيطرية. عدد 22(2)، ديسمبر 2011: 127–135)