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INDUSTRIAL SULPHROSIS IN GOATS

(With 4 Tables)

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التلوث الصناعي بالكبريت في الماعز

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يمثل التسمم بالكبريت خطرا داهما بحيوانات المناطق الصناعية التي تستخدم الكبريت في التصنيع ومن أهم هذه المصانع السوبر فوسفات بمنقباد ـ أسيوط والذى ينتج كميات هائلة من الكبريت في صور شتى غازيه كثاني وثالث أكسيد الكبريت أو سائله من الغسيل والتبريد ومايترتب عليه من تلوث المياه بالاضافة الى تطاير ذراته بتأثير الرياح ليتسبب عنها تلفيات بالنباتات وحيوانات المنطقة. ولدراسة الآثار السميه أجريت هذه الدراسة على الماعز البلدى المتواجد بمنطقة الأكراد والمتاخمة لمصنع السوبر فوسفات بنحو نصف كيلومتر. باختبار عدد ٢٣ من الماعز بمنطقة التلوث والتي ظهرت عليها أعراض الهزال وسهولة تساقط الشعر مقارنة بحيوانات سليمه اكلينيكيا ومن منطقة النخيلة التى تبعد ٣٥ (خمسة وثلاثون) كيلومترا جنوب المصنع. وتم تحديد معدلات الكبريت كملوث أساسي بالاضافة الى عنصرى النحاس والحديد في الأوساط الأساسية والتي من خلالها تتعرض هذه الكائنات الحيه للتلوث (الماء والنباتات الزراعية والعلائق) مع تقدير هذه العناصر في أمصال وبول وأنسجة الحيوانات المتعرضة للتلوث. وقد أظهرت النتائج ارتفاع معنوى لمستوى الكبريت والحديد في المياه والمزروعات الزراعية بمنطقة التلوث بينما تناقصت معدلات النحاس معنويا ـ كما أظهرت نتائج الفحوص المختلفة. أما في الأمصال وبول وأنسجة الحيوانات فحدث ارتفاع معدل الكبريت مع انخفاض معنوى في معدل النحاس ولم يتأثر مستوى الحديد معنويا في أمصال هذه الحيوانات نظرا لارتفاع معدلاته في العلائق . ويتضح من نتائج هذه الدراسة مدى التعرض المزمن لهذه الحيوانات باحد الملوثات الصناعية الهامة وهو الكبريت مما يؤدى الى اضطراب في معدلات العناصر المرتبطة به.

SUMMARY

The present study investigated the levels of sulphur in both macro and microenvironment of goats in El Akrad village near the superphosphate factory at Assiut Governorate. The analytical levels indicated a significant increase in sulphur in macro-environment (feedstuffs and water) correlated with the microenvironment (serum, urine, kidney and liver). The related element copper and iron showed a variable levels in both macro and microenviroment.

INTRODUCTION

Recently, poisoning of animals with sulphur from environmental pollution has been reported. Garzing animals exposed to industrial emissions may become poisoned by sulphur dioxide. In addition, sudden exposure to hydrogen sulphide emitted from a slurry tank, especially when the tank is agitated, may be fatal (BUCK, et al. 1973). Animals confined to industrial areas, near smelters, may become poisoned by sulphur dioxide as may animals confined near power plants or factories burning large amounts of coal. Exposure of grazing animals to a sulphur dioxide concentration of 500 ppm for 1 hr, is dangerous (HATCH, 1977). He also found that sudden exposure to 400 ppm may be quickly fatal. JANOWSKI and CHMIELOWIEG (1981) reported cases of poisoning of cattle with sulphur from environmental pollution. Cattle within 1 km of a sulphur mine were exposed to sulphur dusts, sulphur dioxide, and hydrogen sulphide. The author added that, poisoning was associated with lesions of respiratory and digestive symptoms. Sulphur poisoning manifested by depression of animals, colicy pain, unwilling to stand. Fast and shallow breathing beside smell of hydrogen sulphide. Apparent diarrhoea was characterised by blackish colouration (IBRAHIM, 1983).

From the available litrature research on contineous chronic toxicity by sulphur oxides gasses are very scanty in both man and animals.

The superphosphate plant constitutes an important source of sulphur oxides. A matter which appeared from the litratures to be a real danger of all biological systems in the locality. That is why the present work was planned in order to elucidate the effect of the emitted pollutants on the goats which are the main animals rearing this area.

This work dealed with the toxicological effects on the foetal or premature animals rearing the same area. The work aimed also to deal with the interaction of sulphur with other related elements present in animal tissues.

MATERIAL and METHODS

The animal material used in this work were taken from Ezbet El Akrad. This a rural area 0.5 km away at the south of the superphosphate plant and in the wind direction. Most of the fumes that emitted from the factory were carried out to this area directly.

Thirty five goats were used in the investigation. Twenty three animals were selected from the area of study according to their symptoms of cachexia and loss of hair.

10 adult non pregnant (1.5-3 years).
5 pregnant at the 4th month of pregnancy.
8 young goats (8-12 weeks old).

The control animals were taken randomly from El Nokhaila village 32 km to the south of the source of emmision.

5 adult non pregnant (1.5-3 years).
3 pregnant at the 4th month of gestation.
4 youngs at the 8-12 weeks old.

All selected goats reared the same locality exclusively and never get cotact at any period to the area of the study. There were no other sources of pollution near around.

Four feed stuff samples (barseem, tibn, wheat and grass) were collected during the growing season from the examined area. Sulphur, copper and iron were estimated in the fresh homogenised substances. Twenty ground and surface water samples were taken from different localities in the examined area for sulphur estimation. Serum samples were analysed for S, Cu, and Fe. Voided urine samples were examined for estimation of the elemental status that estimated in serum. Sulphur, copper and iron were estimated after SEINFELD (1975) and FRANGENBERG (1986) respectively.

RESULTS

Results obtained were recorded in table (1) for sulphur, copper and iron in feed-stuffs and water. Tables 2, 3 and 4 for sulphur, copper and iron respectively in serum, urine and tissues.

DISCUSSION

Environmental polutionis one of the most hazardous agents to animals and man health status. Industrialization added more hazards to the environment.

In Assiut Governorate the fertliser manufacturing operation is one of the main sources contributed to air pollution, which takes place from the emitted sulphur oxides. The deleterios effects of the emitted gasses on animal health could be recognised from the clinical point of view as a rather retardation of the general health status.

Macroenvironmental studies considered the first necessary step for evaluating the toxic hazards to animals and man. Analysis of water samples from the studied

area revealed a sulphur levels of (75.73±6.34 and 64.20±9.4 mg%) in surface and deep water respectively which are higher than the control water samples (36.20±5.2 and 32.15±8.2 mg%) respectively. The recorded sulphur levels in water were higher than the recommended maximum limits 25 mg% according to TWORT, et al. (1974).

Plants absorb sulphur dioxide mainly be gasseous diffusion through the stomata (MANSFIELD and MAJERNIK, 1970). Upon diffusion through the stomata gasseous SO_2 dissolves in water on the moist cellular surfaces to form sulphite $(SO_3)^2$, bisulphite (HSO_3) and other ionic species. Plant can overcome these phytotoxic effects by converting culphites to sulphates to a less toxic forms, (THOMAS, et al. 1943). Analysis of sulphur in plants showed an increased levels in all vegetations discussed indicating an atmospheric exposure and absorption of the plant components to the gasseous SO_2 and their accumulations into the plant tissues. The sulphur levels reached 0.15% in Wheat, 0.137% in Barseem, 0.074% in Grass and 0.107% in Tibn.

The results of feedstuffs showed a significant increase in iron, while on the other hand copper levels were significantly decreased.

Sulphur analysis revealed that both serum and urine levels in exposed animals recorded significant higher amounts than control goats.

Normal serum iron levels indicated minor effect of sulphur on iron metabolism. The relatively higher sulphur levels in serum and urine in the exposed goats indicated some sort of correlation between the two fluids, a fact which was previously stated by IBRAHIM (1980). Kidney and liver sulphur levels in exposed animals showed a highly significant increase than control goats. Copper analysis revealed no deleterious effect of sulphur oxides on Cu levels in blood serum. Urine analysis revealed lower Cu levels in exposed goats than in control except for youngs. Liver copper concentrations revealed a normal levels however the pregnant exposed animals showed the lowest mean levels which could be attributed to the active mobilisation of Cu from the maternal to the foetal side. The residues of Cu in exposed pregnant goats was also lower than respective control levels. This could threw a light on sulphates counteraction.

The correlation between our evidence of sulphur levels in water and feedstuffs, with that obtained in goats serum, urine, kidney and liver, support the obtained results. The previous studies by IBRAHIM (1983) in buffaloes and SHEHATA, et al. (1989) also ensured the direction of the present findings.

The high levels of sulphur in animal feed affect the mucous membranes, gastrointestinal tract, and central nervous system. Moreover, the effect of animal requirements may contribute through disturbing the levels of copper which reflected clinically in the form of cachexia, aneamia and loss of hair.

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Table (1): **Feedstuff and water analysis in exposed area.**

Element	Sulphur		Copper		Iron	
	Exposed	Control	Exposed	Control	Exposed	Control
Wheat	151.6±12.3*	62.2±03.9	3.81±.003*	4.46±.056	80± 2.99*	44± 1.1
Barseem	137.0±09.5	127.0±13.2	10.15±.190	10.71±.360	1920±14.95*	1011±12.1
Grass	74.2± 3.1*	49.3± 2.6	10.42±.042*	16.77±.049	3236±95.00	2326±91.2
Tibn	107.1± 5.7*	54.0± 3.9	2.67±.016*	3.63±.007	912±14.6	820± 7.7
Surface Water	75.7± 6.3*	36.2± 5.2	-	-	-	-
Deep Water	64.2± 9.4*	32.2± 8.2	-	-	-	-

* : Significant at $p < 0.05$

** : " at $p < 0.001$

Table (2): Sulphur leveles in serum, urine, liver and kidneys of goats

animal	group	serum(mg%)	urine(mg%)	liver(mg%)	kidney(mg%)
adult non pregnants	Exposed	0.720 .,/ 1.48*	0.600 .,/ 2.76*	4.06±1.67*	7.41±1.22*
	Control	0.008 .,/ 1.48	0.008 .,/ 1.63	0.30±0.20	0.50±0.40
pregnant	Exposed	0.730 .,/ 1.24*	0.690 .,/ 1.40*	5.04±1.90$	5.05±1.99$
	Control	0.013 .,/ 1.09	0.011 .,/ 1.16	1.30±0.10	0.20±0.01
youngs	Exposed	0.900 .,/ 1.22*	0.890 .,/ 1.20*	4.60±1.80$	4.59±1.79$
	Control	0.007 .,/ 1.7	0.009 .,/ 1.61	0.40±0.30	0.40±0.04
foetuses	Exposed			0.30±0.10	0.62±0.1
	Control			0.17±0.06	0.40±0.0

$: Significant at p < 0.05
* : " at p < 0.01
• : " at p < 0.001

Table (3): Copper conc.in serum, urine and liver of goats [ppm]

animal	group	serum u mol/L	urine u mol/L	liver ppm
adult non pregnants	Exposed	15.5+1.06	1.00 .,/ 1.15	58.36±35.30
	Control	12.4±1.95	2.20 .,/ 0.84	49.12±47.69
pregnant	Exposed	13.2±4.80	0.40 .,/ 0.90	28.38±25.20
	Control	13.0±1.73	0.30 .,/ 0.57	78.30±25.36
youngs	Exposed	12.5±2.20	0.57 .,/ 0.53	52.91±16.50
	Control	11.8±1.26	0.50 .,/ 1.00	47.23±11.14
foetuses	Exposed			56.72± 9.20
	Control			65.10± 2.36

Table (4): Iron conc.in serum of goats (umol/L)

animals	group	serum
adult non pregnants	Exposed	13.31±1.83$
	Control	18.06±1.20
pregnant	Exposed	18.20±1.03
	Control	16.97±1.90
youngs	Exposed	17.41±3.28
	Control	14.65±2.60

$: Significant at p < 0.05