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FLUORIDE LEVELS IN MACRO-AND MICROENVIRONMENT OF CATTLE IN ASSIUT GOVERNORATE

(With 7 Tables)

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مستوي الفلورين في البيئة الصغري والكبري للأبقـــار
بمحافظة أسيـــوط

عادل شحاتـة ، رمضان رفاعـي ، ثابت عبد المنعم ، عبداللطيف شاكـر

إن استخدام اللحوم كغذاء أساسي وهام للاستهلاك الآدمي يرجع في المقام الأول لغنـاه بالعناصر الغذائية المختلفة ولما كان لزيادة أو نقصان أو إختلال معدلات هذه العناصـــر بداخلها أثر كبير في فقد قيمتها الغذائية ولإتساع دائرة التلوث وقلة البحوث الجارية فـي بيئة الأبقار الصغري والكبري في هذا المجال تم اجراء هذا البحث . وقد تم أخذ عينـــات مختلفة من الماء وأنسجة ولحوم الأبقار القاطنة باحدي عشر منطقة بمحافظة أسيوط وذلـــك لتحديد مستويات الفلورين وبعض العناصر الأساسية الهامة الأخري كالكالسيوم والفوسفـــور والصوديوم والبوتاسيوم . وقد أظهرت النتائج وجود ارتفاع بين في معدلات الفلورين في كـل من الماء والعلائق الحيوانية وكذلك لحوم وأعضاء حيوانات كل من مناطق منقباد وأبنـــوب والواسطي . بينما انخفضت نسب الكالسيوم والفوسفور والصوديوم في كبد وعضلات حيوانـــات هذه المناطق الثلاث . وان قلت نسب العناصر في معدلاتها الطبيعية في المناطق المفحوصـة مما سبق يتضح ضرورة توخي الحذر في استخدام لحوم هذه المناطق الثلاث الملوثة (منقبـــاد وأبنوب والواسطي) والتي تزيد من خطورتها تلوث مياهها ونباتاتها مما يزيد من فرصـــة زيادة التسمم بهذه المناطق .

SUMMARY

The present investigation recorded the levels of the industrial pollutant (fluorine) and the related elements (phosphorus, calcium, sodium and potassium) in both macro and microenveronment of cattle in ten areas at Assiut governorate. The results indicated a significant elevation in fluoride levels in water, feedstuffs and meat in three investigated areas (Manqubad, Abnoub and El-Wasta). High levels of calcium and phosphours were recorded in kidney. Also sodium and potassium levels in the kidney showed the same behaviour.

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A lower levels of both calcium and phosphorus were recorded in muscles and liver of cattles in the three affected areas (Manqubad, Abnoub and El-Wasta).

INTRODUCTION

Industerial pollution is considered one of the most important problems in the whole world as it lead to severe dangerous effects on biological systems. Prevention of environmental poisoning requires adequate knowldge of hazardous properties of substances and its levels in both macro and micro environment.

The list of pollutions that are potentially hazardous to human and animal life, has increased rapidly during the last four decades, as a result of spreading of industry over all world such as Aluminum, iron and steel and super-phosphate factories.

Increased quantity of fluorine in tissues (bone, teeth, organs such as liver, heart, muscle, pencreas, thyroid, kidney, tendon and hair) were recorded following the excess addition of fluorine in the normal ration (CHANG, et al. 1934).

Experiments on dairy cows revealed an increase in fluorine content of most soft tissues levels by adding fluorine in ration for 5.5 years (SUTTIE, et al. 1958). Only increase of these levels, two to three-folds, with the exception of the kidney where the higher values recorded. Smaller increases were observed in the corresponding tissues of sheep consuming contaminated water by fluoride (HARVEY, 1952).

The concentration of fluorine in the soft tissues is also increased in fluoretic animals, but only to the extent of two or three times the normal value (CLARKE and CLARKE, 1966).

At Assiut governorate many toxicological studies for fluorine were carried out on sheep and goat (IBRAHIM, 1980), sheep (ABDEL-AAL, 1981), buffaloes (IBRAHIM, 1983), goat (SADDEK, 1988), and camels (SHEHATA, et al. 1989).

Chronic fluorine poisoning occurs when daily feed contains more than 0.003% of its volume as fluorine. Chronic toxic levels of fluorine in human was recorded as 0.1 to 0.16 ppm daily for 6 to 10 years (BOND and STRAUB, 1973).

The observed hazardout effect of fluorine on animal health were inconstant appetite, poor inflection of joints, dental changes, bony exostoses and lower milk yeild (IBRAHIM, 1983).

Cattle is the most important animal used for meat production in Assiut governorate. Considering the scanty toxicological studies on cattle, the aim of our research is the investigation of the main industrial pollutant (fluorine) in both macro- (water and feedstuffs) and microenvironment (muscle, liver, lung and kidney) of cattle slaughtered in Assiut abattoirs. Also related elements (calcium, phosphorus, sodium and potassium) were investigated in all meat samples.

MATERIAL and METHODS

Eleven areas were investigated in this study (Manquabad, Assiut, Mousha, El-Moteaa, Abu-Tig, Sedfa, El-Wasta, Abnoub, Sahel-Seleem, Manfalout and El-Qussiea). Manquabad was considered the most polluted area, oppositely Manfalout was used as control.

Sampling:

Ten cattle feedstuff samples (5 tibn and 5 barseem) were collected from each examined area. Ten samples of the offered drinking water to cattle were collected from every area. Meat and organs (liver, lung and kidney) samples were collected from 10 animal in every investigated area.

Methodology:

Fluoride was estimated by mean of fluoride electrode 94-09 attached to single junction reference electrode model 90-01 fitted to expandable ion analyser EA 920, Orine research incorporated, Cambridge, U.S.A. according to the method of FRY and TAVES (1970).

Calcium and phosphorus were determined after BETT and FRASER (1959); MORINL and PROX (1973) respectively. For potassium and sodium estimation, the flame photometer (corning 400) was used.

RESULTS

Results obtained were recorded in tables 2, 3, 4 and 5.

DISCUSSION

Environmental pollution is one of the most hazardous agents to animal and human bieng's health status. Industrization added more hazards to environment. In Assiut governorate the fertlizer manfacturing operation is one of the main sources contributed to environmental pollution.

Macroenvironmental studies are considered the first necessary step for evaluating the toxic hazards to animal and human beings. Analysis of water samples from the studied areas revealed a highly significant fluoride levels in Manquabad (4.77 ± 0.44 ppm), Abnoub (4.20 ± 0.52 ppm) and El-Wasta (2.98 ± 0.12 ppm) in comparison with the control area (Manfalout 1.95 ± 0.2 ppm) and the international standard for drinking water is from 1-1.5 ppm (BOND and STRAUB, 1973).

The results indicated that the higest degree of feedstuff bollution with fluoride occurred at Manquabad, Abnoub for both tibn and barseem, and at El-Wasta for barseem only. As fluoride is hydrophilic element this may explain the low finding in tibn in comparison with barseem. Feedstuff pollution by industrial effluents containing fluoride was previously reported by many authers (SHUPE, et al. 1963 and SUTTIE, 1964).

It is obvious from the previous results of macroenvironmental analysis that pollution is inversely related to the distance from the source of industrial pollution. The results of fluoride level in cattle's meat indicated a highly singificant elevation in Manquabad, Abnoub and El-Wasta in comparison with control area. A similar results were recorded by IBRAHIM (1983) for buffaloe's meat at Manquabad. On the other hand, the levels of calcium and phosphorus in cattle's meat revealed a significant decrease in carrellation with the high fluorine level.

The calcium inbalance associated with fluoride pollution may be taken as a major mechanism cantsibuting for fluoride intoxication. Moreover, the previous finding recorded by IBRAHIM (1983) that blood phosphorus levels associated with fluoride pollution may indicate that the disturbance not only confined to calcium, but also extended to include phosphorus. This interrelationship has been recorded by SHEARER, et al. (1978). Also, the present study revealed a significant increase of both sodium and potassium levels in kidney especially at areas of Manquabad, Abnoub and El-Wasta. This result my be attributed to the increase excreation of these elements through the kidney as a results of fluoride exposure. The same result was observed by SEDDEK (1983) who stated that the two elements were highly excreated in urine of fluorosed goats. Our findings may prove a direct relationship between the level of fluoride in macro-and microenvironment of cattle. In agreement, SUTTIE, et al. (1958) reported that quantity of fluorine in meat followed the same excess of fluorine in the normal ration.

In spite of the previous records that organs of intoxicated animals with safe for human use (SUTTIE, et al. 1958). It is worthy to state here the possible dengerous effects of using these organs which constitute a hazared of additional fluorine toxicity to potential human consumers or those living within the area of pollution.

It may be concluded from the previous evidence that cattle's meat from polluted areas (Manquabad, Abnoub and El-Wasta), constitute a hazard to human consumer without realizing it. Thus a vetrinary medically orinted practitiones must do carful evaluation of the location of the source of contaminants. periodic evaluation of the health status of animals at the polluted areas is needed for signs of warsening the organ's failure.

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Table 1: Locations (distance, direction and angle of direction) of investigated areas.

AREA	Distance from the factory (Km)	Angle of Direction	Direction from the factory
Manquabad	1	22°	North - Western
Abnoub	4	32°	South - Estern
El-Wasta	8	28°	South - Estern
Assiut	9	18°	South - Western
Mousha	18	25°	South - Western
El-Moteaa	18	8°	South - Estern
Abu-Tig	36	30°	South - Estern
Sahel-Sleem	38	15°	South-Estern
Sedfa	45	10°	South - Western
El-Qussiea	38	10°	North - Estern
Manfalout	18	0°	North

Table (2)

Fluoride content of feed-stuffs and available drinking water in various areas at Assiut province

AREA	(ppm)		
	Tibn	Barseem	Water
Manquabad	6.95±0.38***	17.90±0.99***	4.77±0.44***
Abnoub	6.10±0.70*	16.75±1.65**	4.20±0.52***
El-Wasta	4.38±0.61	13.60±1.07*	2.98±0.12***
Assiut	5.15±0.60	12.35±1.35	2.60±0.22
Mousha	4.45±0.48	10.88±1.25	1.99±0.42
El-Moteaa	3.99±0.37	11.42±1.15	2.04±0.32
Abu-Tig	4.98±0.52	10.35±1.88	2.44±0.33
Sahel-Sleem	4.88±0.46	10.60±1.20	2.32±0.23
Sedfa	4.71±0.24	6.70±1.27	1.78±0.20
El-Qussiea	4.47±0.45	8.20±0.83	1.88±0.18
Manfalout	4.42±0.34	9.98±1.02	1.95±0.20

Table (3)

Fluoride content (ppm) of cattle organs in various areas at Assiut province

AREA	Muscle	Liver	Lung	Kidney
Manquabad	6.22±0.40***	6.80±0.86***	5.22±0.42***	10.22±1.01***
Abnoub	2.82±0.12**	3.03±0.21**	3.40±0.20***	7.98±0.65***
El-Wasta	2.05±0.13	2.52±0.16*	2.85±0.09*	4.70±0.12***
Assiut	2.35±0.18	2.14±0.19	3.01±0.29	3.61±0.42
Mousha	2.14±0.19	2.30±0.11	2.42±0.27	2.75±0.22
El-Moteaa	2.40±0.33	2.33±0.17	2.75±0.16*	3.20±0.33
Abu-Tig	2.04±0.21	2.33±0.20	2.75±0.29	3.02±0.28
Sahel-Sleem	2.13±0.31	1.97±0.18	2.80±0.32	3.03±0.32
Sedfa	1.90±0.22	1.55±0.14	1.80±0.30	2.10±0.16
El-Qussiea	1.66±0.28	1.75±0.28	2.20±0.13	2.45±0.18
Manfalout	1.98±0.24	1.88±0.22	2.22±0.19	2.43±0.26

S.E. = Standard

* = Significant at P/ 0.05

** = Significant at P/ 0.01

*** = Significant at P/ 0.001

Table (4)

Inorganic phosphorous levels (mg/gram) of cattle organs at Assiut province

AREA	Muscle	Liver	Lung	Kidney
Manquabad	4.22±0.41	4.22±0.54**	5.56±0.72	6.99±0.78
Abnoub	4.20±0.39	4.39±0.55**	6.21±0.67	8.90±0.32
El-Wasta	4.01±0.52	4.60±0.62**	6.33±0.55	6.77±0.21
Assiut	5.01±0.09	6.72±0.44	6.52±0.42	7.90±0.58
Mousha	4.45±0.32	5.60±0.52	6.65±0.72	8.45±0.82
El-Moteaa	4.46±0.22	5.95±0.50	6.90±0.26	7.35±0.81
Abu-Tig	4.99±0.18	7.20±0.61	7.45±0.85	8.20±0.26
Sahel-Sleem	5.12±0.61	7.14±0.72	7.31±0.72	7.76±0.82
Sedfa	5.02±0.24	7.40±0.62	7.12±0.62	7.86±0.46
El-Qussiea	4.75±0.35	6.82±0.74	6.55±0.61	6.86±0.71
Manfalout	4.95±0.25	6.95±0.42	7.10±0.33	8.05±0.78

Table (5)

Calcium content (mg/gram) of cattle organs at Assiut province

AREA	Muscle	Liver	Lung	Kidney
Manquabad	1.35±0.21***	1.50±0.21*	1.32±0.09*	1.95±0.11**
Abnoub	1.68±0.28**	1.61±0.09**	1.44±0.07*	1.81±0.08*
El-Wasta	2.11±0.19*	1.62±0.07**	1.58±0.09	1.73±0.04
Assiut	2.30±0.18	2.37±0.21	2.04±0.13	1.62±0.10
Mousha	3.02±0.33	2.24±0.18	2.10±0.11	1.59±0.07
El-Moteaa	1.95±0.24*	2.36±0.22	2.22±0.19	1.64±0.12
Abu-Tig	3.72±0.42	2.18±0.17	2.07±0.22	1.72±0.16
Sahel-Sleem	2.15±0.35	2.54±0.33	2.18±0.18	1.61±0.11
Sedfa	2.62±0.30	2.44±0.24	2.42±0.31	1.49±0.12
El-Qussiea	2.92±0.15	2.11±0.09	1.98±0.23	1.48±0.13
Manfalout (Control)	2.82±0.20	2.14±0.16	1.86±0.22	1.55±0.09

S.E. = Standard errous

** = Significant at P/ 0.01

* = Significant at P/ 0.05

*** = Significant at P/ 0.001

Table (6)

Sodium levels (mmol/g) of cattle organs in varius areas at Assiut province

AREA	Muscle	Liver	Lung	Kidney
Manquabad	31.02±2.85***	50.88±4.88	108.20±8.50***	118.68±6.50**
Abnoub	35.12±4.25**	60.12±5.25	99.125±5.22***	103.62±6.50***
El-Wasta	36.12±1.94**	36.12±3.50*	103.37±7.91***	114.00±4.62***
Assiut	70.25±9.50	51.50±4.20	69.10±4.41	65.50±4.20
Mousha	50.75±3.13	48.87±4.66	93.87±8.65**	51.50±4.99
El-Moteaa	43.12±3.23	42.75±4.05	86.37±7.85**	51.22±5.05
Abu-Tig	50.37±3.10	53.00±4.25	107.50±9.33***	68.60±5.26
Sahel-Sleem	47.75±2.25	34.50±3.22*	51.37±3.45	62.00±4.22
Sedfa	51.37±4.25	39.87±4.02	62.37±7.20	57.87±3.22
El-Qussiea	49.62±2.17	44.37±2.39	57.21±3.65	67.33±5.45
Manfalout	53.75±4.55	48.37±4.20	56.37±5.20	61.62±2.40

Table (7)

Potassium levels (mmol/g) of cattle organs in various areas of Assiut province

AREA	Muscle	Liver	Lung	Kidney
Manquabad	1.22±0.11	1.33±0.06	1.91±0.21	4.67±0.21***
Abnoub	1.57±0.14	1.53±0.09	1.58±0.23	4.13±0.36***
El-Wasta	1.57±0.1	0.93±0.12	1.82±0.06	1.99±0.22
Assiut	1.53±0.21	1.68±0.12	1.31±0.13	1.85±0.16
Mousha	1.38±0.14	0.93±0.14	1.36±0.21	1.67±0.22
El-Moteaa	0.96±0.12**	0.99±0.06	1.57±0.10	1.69±0.30
Abu-Tig	1.30±0.06	1.43±0.11	1.85±0.13	1.94±0.23
Sahel-Sleem	1.37±0.04	1.23±0.01	1.51±0.15	1.88±0.33
Sedfa	1.43±0.06	1.29±0.01	1.89±0.11	2.02±0.23
El-Qussiea	1.63±0.24	1.24±0.11	1.62±0.08	1.918±0.25
Manfalout	1.34±0.03	1.23±0.13	1.69±0.15	2.37±0.21

S.E. = Standard errous

** = Significant at P/ 0.01

* = Significant at P/ 0.05

*** = Significant at P/ 0.001