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BLOOD SERUM PICTURE OF SOME MINOR AND MAJOR ELEMENTS DURING CHRONIC SULPHUROSIS IN CAMELS

(With 5 Tables and 5 Figures)

By

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صورة بعض العناصر النادرة والرئيسية في حالات التسمم المزمن بالكبريت في الجمال

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أجرى البحث على عدد ١١٤ جمل (ذكور واناث غير حوامل) متقاربة الأعمار وموزعة على ابعاد مختلفة من مصدر التلوث (مصنع سوبر فوسفات أسيوط) . وبالفحص الاكلينيكي والمعملي تبين أن ٩٢ جمل تحمل أعراض التسمم المزمن بالكبريت بينما ٢٢ حيوان كانت سليمة اكلينيكيا ومعمليا أخذت من منطقة بعيدة عن تأثير المصنع واستخدمت كضوابط للبحث . ومن دراسة صورة العناصر النادرة والرئيسية اتضح مايلي: مستوى النحاس سجل انخفاض معنوى كبير في مصل دم الحيوان(ذكور واناث) في المناطق المختلفة حتى مسافة ٤ كم من المصنع عدا منطقة علوان ،وحدثت زيادة طفيفة في مستوى المولبيدنم في أمصال دم جمال المناطق المختلفة وكانت الزيادة معنوية في منطقتي جزيرة الأكراد وجزيرة الطوابية ،ولم يحدث تغير في مستوى الكالسيوم والفسفور الغير عضوى في مصل دم جمال المناطق المتأثرة وكان في حدود المستوى الطبيعي.

SUMMARY

114 camels were chosen from different areas at various distances from Assiut Super-Phosphate Factory. The affected animals showed various clinical signs of chronic sulphur intoxications.

Analysis of camels's blood sera were carried out to determine their sulphur contents, as well as their relations to serum copper, molybdenum, calcium, and inorganic phosphorus.

Blood serum levels of sulphur were significantly elevated in animals at areas less than 2.5 Km far away from the factory while insignificant elevations were recorded in other areas.

Blood serum analysis showed that blood serum copper level was significantly decreased in all the affected camels at areas up to 4 Km. from the factory. Serum molybdenum levels were also elevated in the areas most near to the factory.

Blood serum calcium and inorganic phosphorus levels were not affected and remained within their normal physiological ranges.

INTRODUCTION

Sulphur is considered one of the most important polutants emitted from some industrial plants and induce harmfull effects to the livestock. The major sulphur containing compounds in the atmosphere are sulphur dioxide, sulphur trioxide, hydrogen sulphide, sulphuric acid and sulphate salts (PARKER, 1977). Sulphur dioxide is derived mainly from the combustion of fuels that contain sulphur, and from the smelting of non ferrous metals, in industrial countries. Emission of sulphur dioxide pollutes air and reacts with some substances to form harmfull compounds that precipitate on the soil, affecting plants, animals and human-being (PARKER, 1977).

Sulphur dioxide and sulphur trioxide emitted from the plant of super-phosphate during the process of H_2SO_4 production pollute the surrounding environment arround it at Manquabad, Assiut, Egypt (IBRAHIM, 1983).

Sulphur-Copper and Molybdenum Interaction:

Dietary inorganic sulphate in combination with molybdenum has a profound effect on the uptake of copper in ruminants. (GOODRICH and TILLMAN, 1966 a). Copper deficiency occurs when the dietary intake of copper is considered to be adequate but absorption and utilization of copper are inadequate. This because of the presence of interfering substances in the diet. Molybdenum and sulphate alone or in combination can affect copper metabolism. This effect also operates in the fetus and interferes with copper storage in the fetal liver (BLOOD et al., 1983). SUTTLE and FIELD (1974) reported that molybdenum interfered with the absorption of copper from the gut as there was a response to copper injections and no response to copper administrated oraly to sheep on a high molybdenum intake. KELLEHER and MASON (1979) give an indication for this in such away that molybdate reacts with sulphides to produce thiomolybdate in the rumen which reacts with copper to form biologically unavailable copper thiomolybdate complexes which prevents the formation of copper containing enzyme (Ceruloplasmin). IBRAHIM (1980) recorded that high sulphur level in sheep blood serum was correlated with decreased copper and molybdenum levels in it.

Sulphate-Calcium-Inorganic phosphorus interaction:

SHIRLEY et al. (1950) reported that losses of inorganic phosphorus from the body of steers were increased up to two or three times of the normal when the diet contains a high level of molybdenum and low level of copper.

Feeding sulphate ration containing 100 p.p.m of copper elevates urinary calcium level, which leads to lower body calcium with an increased phosphorus retention (GOODRICH and TILLMAN, 1966 b).

The aim of our work is to clear the blood serum picture of some minor and major elements during chronic sulphurosis in camels.

A total number of 114 camels (c. dromedorius) were examined. Of them 92

MATERIALS and METHODS

Materials :

A total number of 114 camels (c. dromedorius) were examined. Of them 92 were selected from different areas around Assiut Superphosphate Factory. The chosed lacalities were Gaziret El-Akrad, Ezbet Mohamed, Gaziret-Tawabia, Manqubad, Ilwan and El-Walidyia (Fig. 1). By clinical and laboratory aids the animals in the previous areas showed the clinical signs of chronic sulphur intoxication. Control group (22) proved to be healthy clinically and laboratory as they were chosen from area far away from the factory (Manfalut). Animals included in this work were of both sexes, and of 4 to 6 years old. The female animals were non-pregnant. Each group of animals at eah selected area either diseased or control would was 8 individuals at least. Blood samples were collected from the jugular vein in a clean sterile centrifuge tubes. Serum was separated from the clot after centrifugation at 3000 r.p.m. for 30 minutes (COLES, 1980) Clear, non haemolysed sera were kept into clean, sterile glass vials.

Laboratory methods :

Blood serum sulphur was estimated according to the method of STOCKHOLM and KOCH (1923).

Blood serum copper was determined colorimetrically using test kits supplied by Behringer Mannhim GmpH Diagnostica, W-Germany (ZAK, 1958).

Blood serum molybdem was estimated colorimetrically according to Sendele's method (1944) using digital ultraviolet spectrophotometer, CE 292.

Blood serum calcium and inorganic phosphorus (mg %) were determined colorimetrically using test kits of Biomerieux, Bain/France (GINDLER and KING, 1972) and (MORINAL and PROX, 1973).

The obtained data were estatisticlly analysed according to the method of SNEDECOR and COCHRAN (1974).

RESULTS

Biochemical analysis for the determination of blood serum sulphur, copper, molybdenum, calcium and inorganic phosphorus in camels grazing at the vicinity of Assiut Super Phosphate Factory and the control group were presented in tables 1,2,3,4 & 5 and Figures 2,3,4 & 5.

DISCUSSION

The relationship between sulphur and copper was sufficiently decumented in the literature. their intoxication in ruminants was recorded and impairment of copper utilization was also discussed (MYLREA, 1958; GOODRICH and TILLMAN, 1966 a).

Blood serum copper levels of camels which had higher levels of sulphur were significantly decreased (P/ 0.01) (Table 1, 2 and Fig. 2) in all examined localities except at Ilwan where the decrease was marked but not statistically significant. Regarding Gaziret El Akrad, Ezbet Mohamed, Gaziret El-Tawabyia and Manquabad the lwoered blood serum copper levels of animals at these areas could be attributed to the higher blood serum sulphate levels. This is because sulphate impaired the utilization of copper by bacteria in the gut by the formation of insoluble cupric sulphide that leads to decrease copper absorption causing secondary copper deficiency. The same observations were recorded by HILL and WALK (1969); SUTTLE (1974) and IBRAHIM (1980 & 1983) in cattle, sheep and goats where secondary copper deficiency occured when the dietary intake of copper was considered to be adequate but absorption and utilization of copper were inadequate due to presence of sulphate in the diet.

A significant increase (P/ 0.01) in blood serum molybdenum levels (Table 3 and Fig. 3) was recorded in the examined camels of both sexes at Gaziret El-Akrad and the females at Gaziret El Tawabyia. Howver, a slight non-significant elevation of this element was observed in animals at the other areas.

Animals present at the areas in close proximity to the factory have higher levels of serum sulphate and molybdate associated with a low level of serum copper. This indicates that sulphate and molybdate firstly decrease the availability of copper in the rumen by the formation of cupric sulphate, cupric molybdate or cupric thiomolybdate or by inhibition of copper intake by the tissue and prevention of transportation of copper both into and out of the liver. These findings come in agreement with those recorded by SUTTLE & FIELD (1974); HUISINGH & MATRONE (1976); KELLEHER and MASON (1979) and RYSSEN and STIELAU (1980) in their studies on cattle, sheep and goats.

Blood serum calcium levels (Table 4 and Fig. 4) and serum inorganic phosphorus levels (Table 5 and Fig. 5) of the examined camels showed no significant alterations at all areas.

SHIRLEY et al. (1950), GOODRISH and TILLMAN (1966 b) and IBRAHIM (1980) recorded that feeding cattle or sheep on diets containing a high level of molybdenum and low level of copper or diets high in sulphate causes decrease in blood serum phosphorus and calcium levels sometimes hypophosphataemia could be induced by lowering of copper levels. In the present study blood serum levels of calcium and inorganic phosphorus in camels with high levels of serum sulphur, molybdenum and low level of serum copper were not affected and remained within the physiological range. This may be attributed to the highly efficient renal function in camel that allows salts, water to be utilized at enterohepatic shunt facilitating nitrogen retention and small urine out put (HIGGINS and KOCK, 1984).

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Table(1): Serum sulphur levels (mg%) of the examined camels at the studied areas.

Localities	Distance from the factory (km.)	Animals	
		Males	Females
Gaz.El-Akrad	adj. to the factory	2085.5±295.8** 1090-3847	1882.1±261.76** 1360-3122
Ezb. Mohamed	1.50-2.50	1703.7±279.2** 1090-2885	2011.3±218.10** 1450-2473
Gaz. El-Tawabyia	0.50-1.00	1926.6±527.6** 1090-2900	2273.8±448.4** 1687-3847
Manquabad	1.00-2.00	1771.8±254.1** 1136-2880	1732.8±293.5** 937-2363
Ilwan	2	981.3±159.9 687-1237	928.0±163.9 714-1250
El-Walidyia	4	886.3± 45.93 687-1094	736.0± 96.043 1020-612
Manfalut	25	449.2±51.9 220-1090	503.4± 67.8 274-820

** LSD (t 0.01).
* LSD (t 0.05).
± Standard error.

ANOVA of serum sulphur levels (mg%)

S V.	D.F.	S.S.	M.S.S.	F.
Areas	6	48760337.7	8126722.95	23.499**
Sex	1	266835.7	266835.7	0.772 N.S.
Interaction	6	530329.7	88388.28	0.256 N.S.
Error	93	32162573.2	345834.12	
Total	106	81720074.0		

** Highly significant (P 0.01)
* Significant (P< 0.05)
N.S.:Non significant.

Table(2) : Serum copper level (ug) of the examined camels at the studied areas.

Localities	Distance from the factory (Km.)	Animals	
		Males	Females
Gaz. El-Akrad	Adj. to the factory	90.00±09.5** 50-133	111.20±07.8** 67-138
Ezb.Mohamed	1.50-2.50	110.00±10.3** 76-138	106.30±11.33* 111-125
Gaz.El-Tawabyia	0.50-1.00	86.70±11.7** 65-105	92.00±06.3** 67-111
Manquabad	1.00-2.00	122.20±07.9* 89-148	106.30±12.3* 83-130
Ilwan	2	118.30±07.3 111-133	108.70±04.5 100-115
El-Walidyia	4	102.14±06.8** 78-133	98.75±05.6* 84-111
Manfalut	25	165.80±09.84 100-244	150.60±06.99 105-228

**: LSD (t 0.01)
*: LSD (t 0.05)
±: Standard error.

ANOVA of serum copper levels (ug%).

S.V.	D.F.	S.S.	M.S.S	F.
Areas	6	71537.87	11922.98	7.071**
Sex	1	168.772	168.772	0.1 N.S.
Interaction	6	5057.284	842.9	0.4998 N.S
Error	98	165246.04	1686.2	
Total	111	242009.96		

**: Highly significant ($P \leq 0.01$)
N.S.: Non significant.

Table(3): Serum molybdenum levels (ug%) of the examined camels at the studied areas.

Localities	Distance from the factory (km.)	Animals	
		Males	Females
Gaz.El-Akrad	Adj. to the factory	41.70±02.8** 29-50	36.50±03 7** 18-52
Ezb. Mohamed	1.50-2.50	30.90±05.9 13-54	32.50±08.01 17-50
Gaz.El-Tawabyia	0.50-1.00	28.30±09.3 11-43	36.70±02.21* 13-43
Manquabad	1-2	26.50±03.75 17-43	33.25±02.9 30-41
Ilwan	2	36.70±03.8 30-43	31.70±02.7 28-37
El-Walidyia	4	33.70±05.3 8-55	25.25±08.7 8-43
Manfalut	25	23.40±02.9 6-32	25.50±02.15 6-50

** : LSD (t 0.01)
* : LSD (t 0.05)
± : Standard error.

ANOVA of serum molybdenum levels (ug%)

S.V.	D.F.	S.S.	M.S.S.	F.
Areas	6	3096.768	516.128	3.84**
Sex	1	1.0611	1.0611	0.008 N.S.
Interaction	6	684.573	114.1	0.849 N.S.
Error	98	13175.28	134.44	
Total	111	16957.683		

**: Highly significant ($P < 0.01$)
N.S.: Non significant.

Table(4): Serum calcium level (mg%) of the examined camels at the studied areas.

Localities	Distance from the factory (Km.)	Animals	
		Males	Females
Gaz.El-Akrad	Adj.to the factory	12.50±01.4 9.8-19.1	10.74±01.42 8.2-19.1
Ezb.Mohamed	1.50-2.50	13.80±01.8 8.8-18.2	9.53±00.3 8.8-10.1
Gaz El-Tawabyia	0.51-0	13.13±03.02 8.7-18.9	14.70±01.9 10.4-19.1
Manquabad	1-2	13.50±01.2 9.1-19.6	14.90±02.6 10.1-15.3
Ilwan	2	10.30±01.04 8.8-12.3	9.90±00.15 9.6-10.1
El-Walidyia	4	12.40±00.6 11.2-15.3	13.20±00.4 12.5-14.3
Manfalut	25	12.15±00.8 9.6-19.1	11.90±00.37 8.9-14.8

**: LSD(t 0.01)
*: LSD(t 0.05)
± Standard error.

ANOVA of serum calcium levels (mg %)

S.V.	D.F.	S.S.	M.S.S.	F.
Areas	6	114.064	19.011	1.59 N.S.
Sex	1	12.569	12.57	1.0517 N.S.
Interaction	6	64.604	10.77	0.9012 N.S.
Error	98	1171.23	11.951	
Total	111	1392 427		

N.S.: Non significant.

Table(5): Serum inorganic phosphorus levels(mg%) of the examined camels at the studied areas.

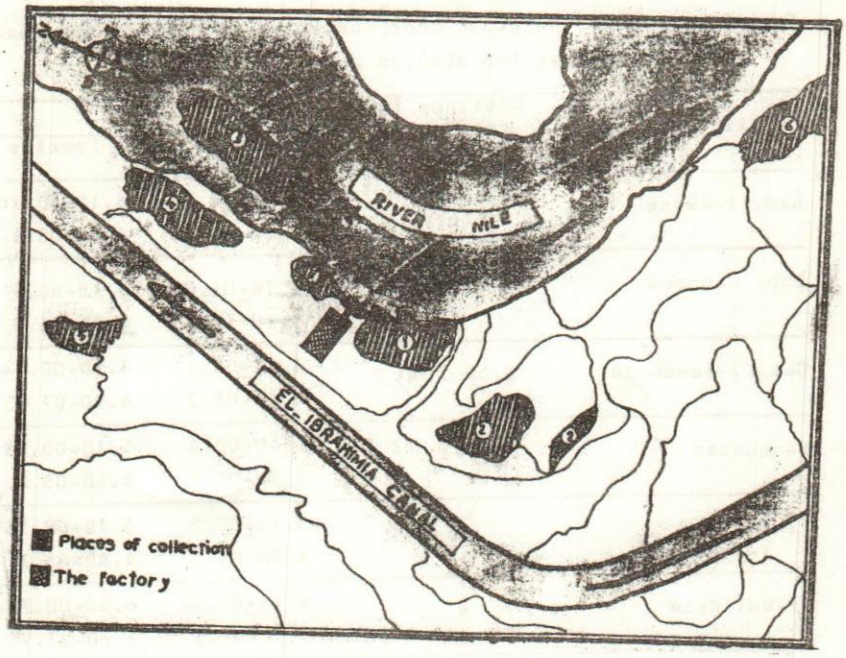
Localities	Distance from the factory (km.)	Animals	
		Males	Females
Gaz.El-Akrad	Adj. to the factory	5.97±01.16 4.60-08.1	6.10±00.26 4.60-08.1
Ezb. Mohamed	1.50 2.50	6.70±01.03 5.10-12.5	5.10±00.5 4.00-06.0
Gaz.El-Tawabyia	0.50-1.00	4.73±00.33 4.10-05.2	5.90±00.44 4.90-07.6
Manquabad	1-2	6.30±00.4 3.80-07.7	5.10±00.18 4.60-05.4
Ilwan	2	5.10±00.2 4.80-05.5	5.10±00.15 4.80-05.3
El-Walidyia	4	6.16±00.27 5.30-07.1	6.00±00.7 4.30-07.9
Manfalut	25	5.97±00.32 4.60-08.6	6.30±00.22 4.30-07.9

**: LSD (t 0.01)
*: LSD (t 0 05)
±: Standard error.

ANOVA of serum inorganic phosphorus level (mg%)

S.V	D.F.	S.S.	M.S.S.	F.
Areas	6	8.6024	1.434	0.9397 N.S.
Sex	1	0.163	0.163	0.1068 N.S.
Interaction	6	14.073	2.35	1.539 N.S.
Error	98	149.5486	1.526	
Total	111	172.387		

N.S.: Non significant.



(1) Gazerat El-Akrad.
(2) Ezbat Mohamed
(3) Gazerat El-Tawabyia
(4) Manquabad
(5) Ilwan
(6) El-Walidyia

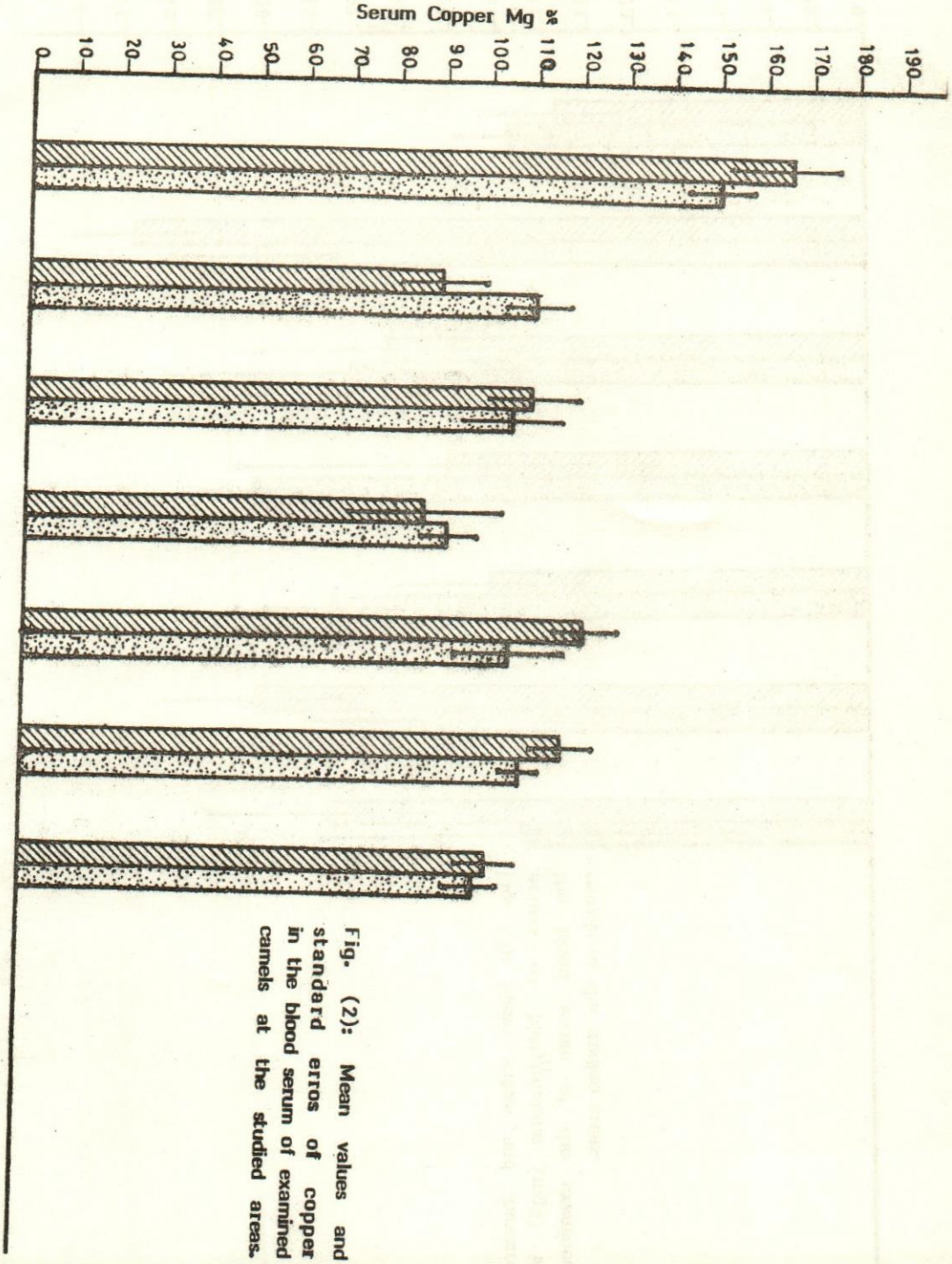


Fig. (2): Mean values and standard erros of copper in the blood serum of examined camels at the studied areas.

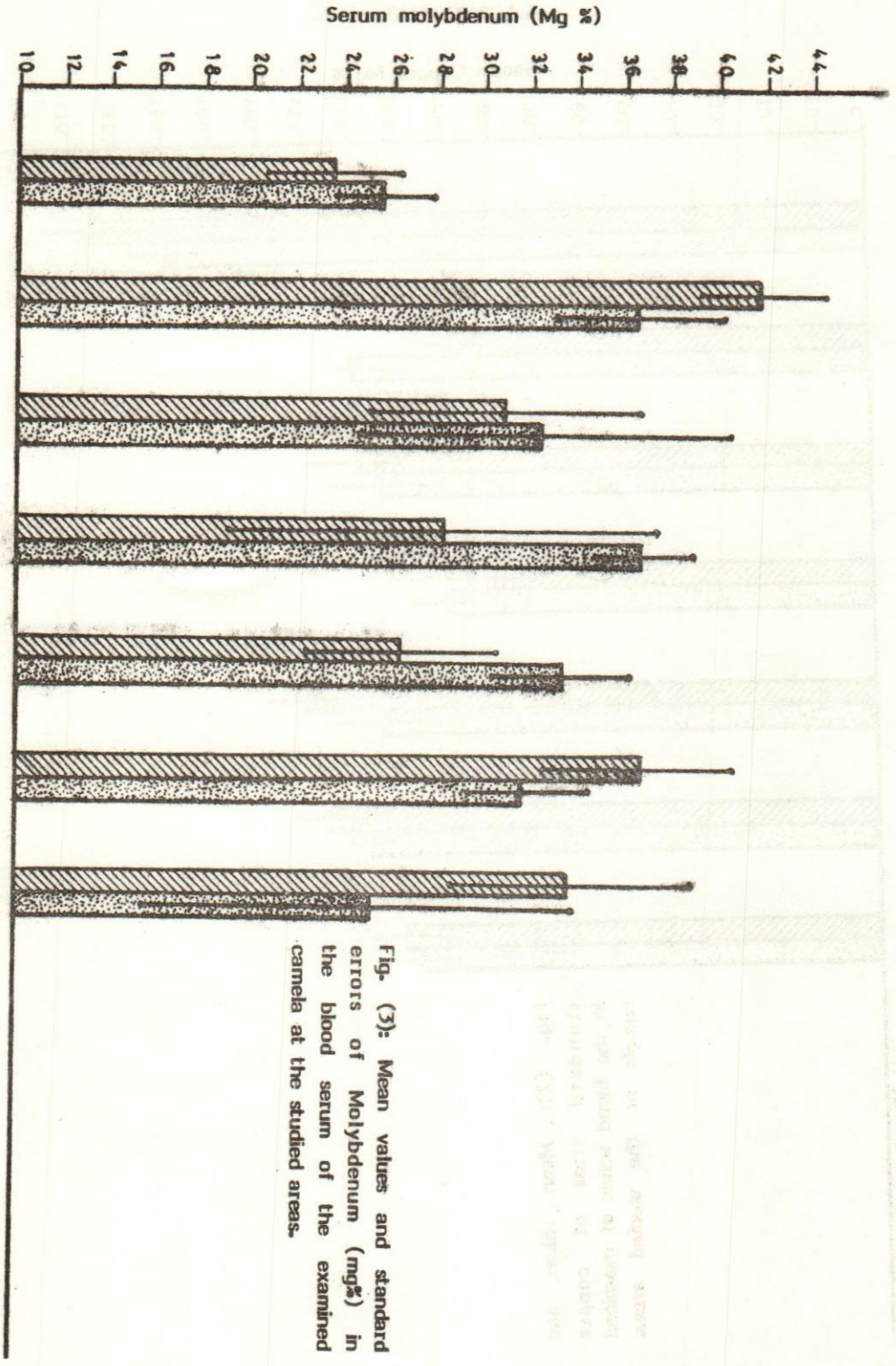


Fig. (3): Mean values and standard errors of Molybdenum (mg%) in the blood serum of the examined camels at the studied areas.

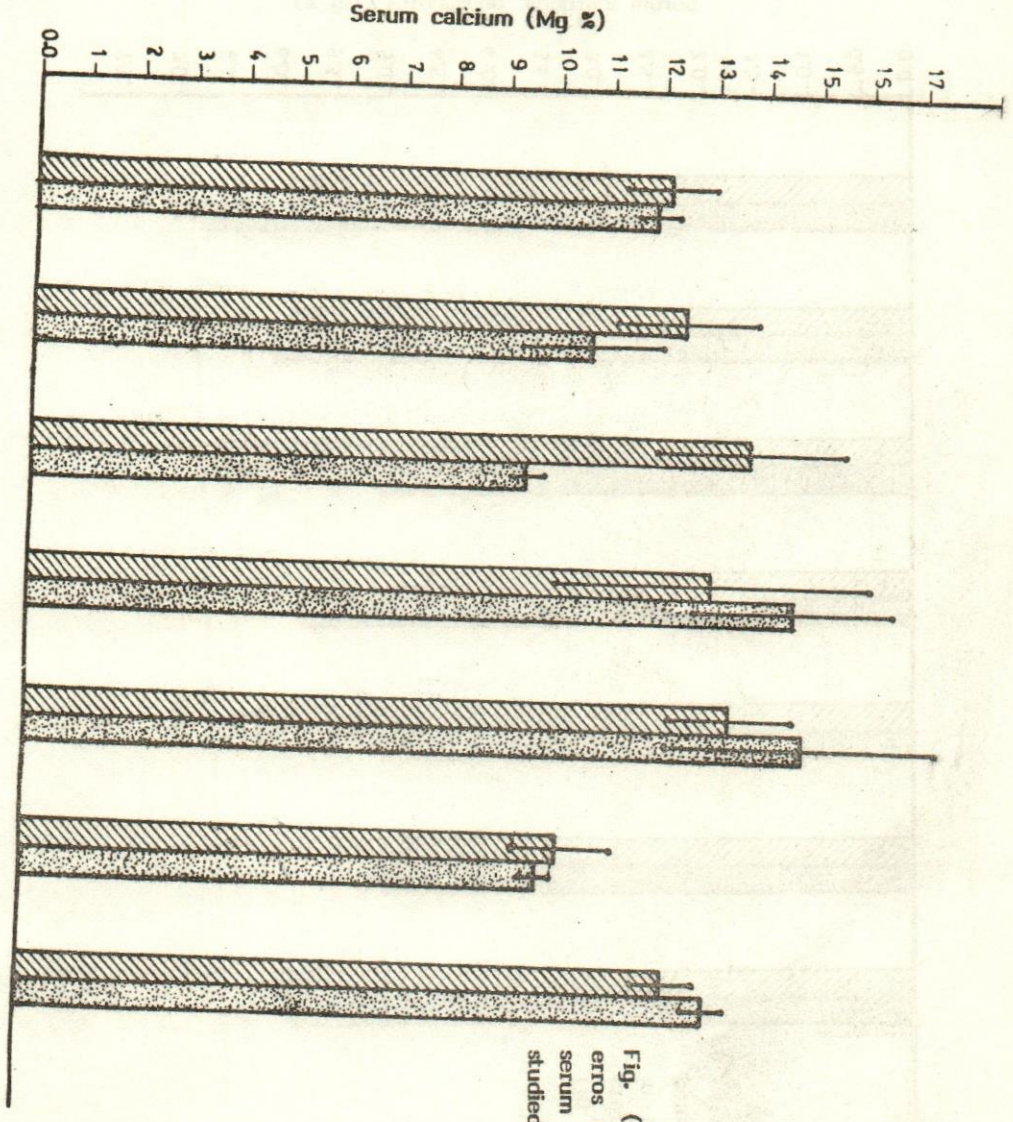


Fig. (4): Mean values and standard erros of calcum (mg%) in the blood serum of examined camels at the studied areas.

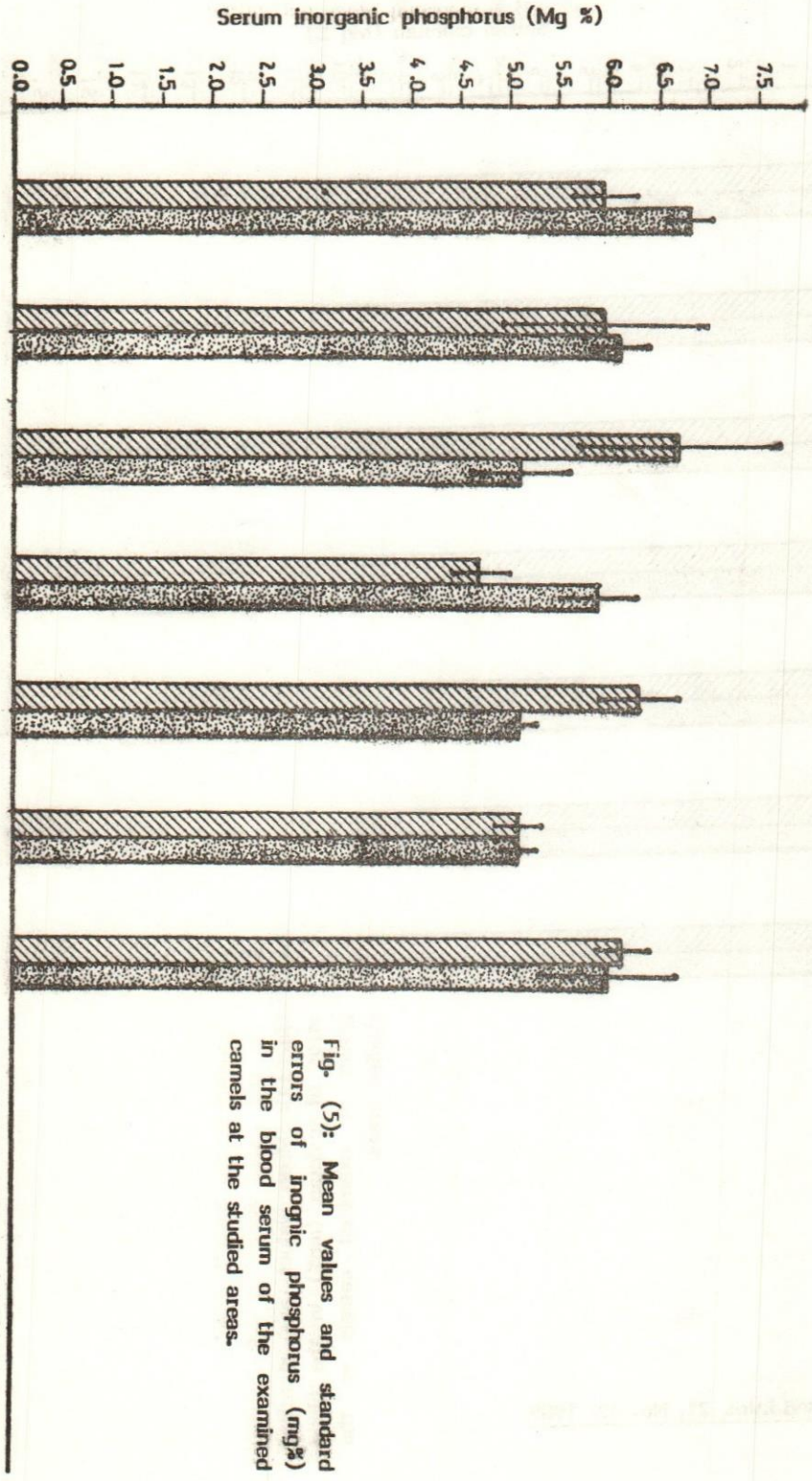


Fig. (5): Mean values and standard errors of inognic phosphorus (mg%) in the blood serum of the examined camels at the studied areas.