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التغيرات فى خلايا الدم والمكونات الكيميائية لدم الأغنام  
المصابة بمرض حمى الوادى المتصدع

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تم دراسة التغيرات فى خلايا الدم والمكونات الكيميائية لدم الأغنام المصابة بمرض حمى الوادى المتصدع وقد ثبت بالفحص أنه قد حدث نقص شديد فى الهيموجلوبين والهيماتوكريت وكذا الكرات الدموية البيضاء هذا بالنسبة للأغنام المصابة كذلك قد حدث زيادة فى عدد خلايا السيروفيل ونقص فى عدد خلايا الليمفوسايت . هذا وقد ظهر زيادة ملحوظة فى أنزيمات التوانس امينيز وكذا كمية كلىسترول الدم . أما بالنسبة لكمية بروتين الدم فقد لوحظ وجود نقص شديد فى تركيزه فى الأغنام المصابة .

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EFFECT OF INDUCED EQUINE PIROPLASMOSIS ON SOME BLOOD CONSTITUENTS  
(With 6 Tables & 10 Figures)

By

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SUMMARY

The present study was designed to investigate the effect of the induced equine piroplasmosis in donkeys and its effect on some blood constituents in Assiut province.

Survey on 54 donkeys revealed negative results by blood smear examination.

Induced infection was tried by splenectomy on 5 donkeys and also by infected blood to another 6 non-splenectomized donkeys, one of each group was kept as control. Parasitaemia reached from 30-100% post-splenectomy. The parasite was diagnosed as *B. equi* and *B. caballi* morphologically. Non-splenectomized infected donkeys showed parasitaemia with lower grade than splenectomized ones.

Haematological findings revealed elevations in white blood cells number which continued till death in both groups. Neutrophils, eosinophils, haematocrit and haemoglobin achieved a prominent decrease in both groups.

Serum values of sodium, potassium were increased in splenectomized group, while calcium, copper and iron values were decreased in both groups.

Smears from organs of dead animals were positive for *Babesia equi* and *B. caballi*.

INTRODUCTION

Identification of equine piroplasmosis depends upon examination of blood smears and also by inoculation of infected blood into susceptible recipient (Manoney, 1962). Detection of carriers by splenectomy was performed by Dennig (1965) and also by brain smear examination (Curnow and Curnow, 1967). However, Callow and Parker (1969) used a new test for the detection of parasites depending on the injection of cortisone derivatives to produce *Babesia argentina* in steers.

Experimental studies carried out by Kirkham *et al.* (1964) reported anaemia, icterus, oedema of limbs, pyrexia and leukopenia. The incubation period stated by Carpio (1972) was 7 days in splenectomized horses and 11 days in non-splenectomized ones.

Decrease in calcium associated with other changes in the electrolytes were also reported in experimentally infected buffaloes (El-Allawy, 1973).

The aim of the present study was designed to investigate the following points:

- 1- A preliminary survey on equine piroplasmosis in Assiut province.
- 2- Experimental infection using infected blood containing *B. equi* and *B. caballi* obtained from splenectomized donkeys proved to harbour the parasite.
- 3- The effect of equine piroplasmosis on some blood parameters.

MATERIALS AND METHODS

a- Materials:

Laboratory examination was carried out on 54 donkeys aged between 3-9 years.

Induction of splenectomy\* was performed on 5 donkeys. Another 4 non-splenectomized donkeys were artificially infected with *Babesia* infected blood, 2 animals received 10 ml i.v. (Exp.A), while the other two received 30 ml i.v. and 10 ml s/c (Exp.B).

For each of the above groups one animal was kept as control.

Blood films were made daily to detect parasitaemia. The body temperature was recorded daily during the whole period of the experiment. Two blood samples were taken before splenectomy, before infection and during parasitaemia, one sample with EDTA for haematological examinations and the other for obtaining serum for sodium, potassium,

\* Kindly performed at the Dept. of surgery, Fac. of Vet. Med. (Fig. A&B)

iron and copper determinations.

The total red blood cells, white blood cells, haemoglobin and packed cell volume were determined according to John (1977).

Serum copper and iron were determined according to Zak (1958), calcium after Gindler and King (1972) and sodium and potassium after Hawk and Oser (1979).

## RESULTS

Examination of blood smears revealed the absence of the parasite in the tested 54 donkeys.

### Experimental work:

A- Clinical findings of all splenectomized donkeys were nearly similar Post-splenectomy, the body temperature showed gradual rise with some fluctuations that ended with sudden rise (41°C) on the 11th day followed by death in most cases (Fig 2).

B- Parasitaemia started to appear from 2-7 days in all animals post-splenectomy and reached 92-100%. Death occurred from the 6th to 11th day in all animals of this group (Fig. 2,3,4,5 and 6).

Successful treatment was recorded only in one donkey of splenectomized group (No. 3, Fig. 4), however, the other splenectomized donkeys died.

Haemoglobinuria was noticed only in the acute stage during the peak of parasitaemia and fever.

In case of non-splenectomized infected group (4 animals), the parasitaemia reached the values of 1-4% then decreased gradually till disappeared from peripheral blood (Fig. 7-10). Clinical signs were nearly similar to the splenectomized cases but there was no haemoglobinuria.

### Haematological findings of splenectomized donkeys:

A slight decrease in total number of erythrocytes, haemoglobin and haematocrit were observed after splenectomy, while there was an increase in leukocytic count that reached up 36.000/cu.mm. at the peak of parasitaemia.

Marked eosinopenia after splenectomy followed by a mild elevation to 2.4% at maximum of parasitaemia was noticed.

Segmented neutrophils increased in some individuals at the peak of parasitaemia, while lymphocytes decreased from 48.2 to 14.7% and the lowest level was noticed before death (table 1)

### Haematological findings of non-splenectomized donkeys:

Red blood cells remained without noticeable changes in number, while blood cells mainly neutrophils increased up to 26.000/cu.mm. Mild decrease in haemoglobin and haematocrit values after infection was noticed (table 2).

### Biochemical findings:

Levels of serum, natrium, kalium, calcium, copper, iron and iron binding capacity are shown in tables 4,5 and 6.

## DISCUSSION

It was noticed that equine piroplasmosis did not receive much attention in Egypt and no reliable data could be traced in this field.

The blood smear examination for the parasite from apparently normal animals were negative. This gives an indication that acute equine piroplasmosis is very rare. The disease may have the mild form that can be overlooked by the clinicians in the field. The disease may also be confused with equine infectious anaemia (Meynard and Goudichaud, 1972)

In the present study, splenectomy was carried out to detect carriers as the injection of cortisone described by Callow and Parker (1969) failed to demonstrate the parasite.

All splenectomized donkeys proved to be acutely infected with both *B. equi* and *B. caballi*, the latter was greater in number. The incubation period varied also from 48 hrs in some animals to 11 days in others. The obtained results denoted with certainty that equines in Egypt are considered to be carriers for *B. equi* and *B. caballi*.

## EQUINE PIROPLASMOSIS

In non-splenectomized animals, the clinical signs developed post-infection were not so severe as those of splenectomized donkeys. The mild clinical signs of the disease in non-splenectomized donkeys may be due to resistance of native Egyptian donkeys created by a previous recurrent exposure, however, the role of the spleen can be ignored here. These results agreed with those obtained by Roberts *et al.* (1962) in horses. Temperature of non-splenectomized infected donkeys varied in the elevation from animal to another, due to individual response of these animals to the amount of infected blood.

Pulse, heart and respiratory rates were greatly increased in splenectomized animals than the non-splenectomized animals than the non-splenectomized donkeys. This agrees with Meynard *et al.* (1977) who attributed such acceleration to the effect of fever.

Parasitaemia:

High levels of parasitaemia were obtained after splenectomy (30-100%), however, mild levels were observed in non-splenectomized animals (1-4%).

Haematological findings:

Leukocytosis was more prominent in non-splenectomized infected donkeys. A shift to the left was noticed just post-splenectomy in the splenectomized group. The same occurred only at the latter stages of the disease in non-splenectomized animals.

Neutrophils decreased in splenectomized group and fluctuated in non-splenectomized ones. These results seem to go parallel with those obtained by Rudolph *et al.* (1975). The eosinophils achieved a marked decrease especially post-splenectomy. Haemoglobin and haematocrit values achieved a tremendous decrease in splenectomized and non-splenectomized donkeys that agreed with Gautam and Dwivedi, (1976).

Biochemical changes:

The values of sodium and potassium were increased in splenectomized, however, the value of potassium increased until it reached 11.46m.e q/L and 10.5m.e q/L in splenectomized and non-splenectomized donkeys respectively. These results probably due to the haemolysis ensued during the acute phase of the disease. Calcium and copper values were decreased in both splenectomized and non-splenectomized donkeys. The mechanism by which the parasites affect these findings nearly similar to the results obtained by Wright and Goodger (1977) in a similar study on serum calcium levels in ruminants.

Serum iron and T.I.B.C. levels were decreased at first in both splenectomized and non-splenectomized donkeys, however, they elevated again in haemolytic crisis in splenectomized group.

## REFERENCES

- Callow, D.D. and Parker, R.J. (1969): Cortisone induced relapses in Babesia argentina infection of cattle. Aust. Vet. J. 25, 103-104.
- Carpio, J. (1972): First report (in Peru) of equine Babesiosis due to Babesia equi. Revista de investigaciones pecuarias Peru., 1: 177-183.
- Curnow, J.A. and Curnow, B.A. (1967): Aust. Vet. J. 43, 286-289.
- Dennig, H.K. (1965): Influence of splenectomy on latent piroplasmosis in horses. Berl. Munch. Tierarztl. Wschr. 78, 204-209.
- El-Allawy, T. (1973): Some studies on bovine piroplasmosis in Assiut. M.D.Vet.Thesis. Fac. Vet. Med. Assiut Univ.
- Gautam, O.P. and Dwivedi, S.K. (1976): Equine babesiosis: a severe outbreak in a stud farm at Idissar. Indian Vet. J. 53, 546-551.
- Gindler, E.M. and King, J.D. (1972): Rapid colorimetric determination of calcium in biologic fluids with methylene-thymol blue. Am. J. Clin. Path. 58, 376-382.
- Hawk, P.B. and Oser, B.I. (1979): Hawks physiological. 14th., ed. Tata McGraw-Hill publishing company New Delhi.
- John, B. (1977): Laboratory medicine haematology. 5th., ed. C.V. Mosby Comp. Saint. Louis.
- Kelly, W.R. (1974): Veterinary Clinical Diagnosis. and edition Bailliere Tindall London.
- Kirkham, W.W; Kling, J.M; Edds, G.T. and Neal, F.C. (1964): Clinical signs and drugs studies: Experimental and Spontaneous equine Babesiosis. Sci. Proc. 101, A.V.M.A., 79-85.
- Mahoney, D.F. (1962): Aust. Vet. J. 38, 48.
- Meynard, J.A. and Goudichaud, J.A. (1972): Diagnosis of acute equine piroplasmosis. Proc. 3rd. inter. Conf. on Assiut Vet.Med.J.Vol. 9, No. 17818, 1982.

Equine Infect. Dis. Paris page 462-466.

Roberts, E.D.; Morehouse, L.G.; Gainer, J.R. and Mc Daniel, H.A. (1962): Equine piroplasmosis. J. Amer. Vet. Med. Ass. 141, 1323-1329.

Rudolph, W.W.; Correa, J.; Zurite, L. and Manley, W. (1975): Equine piroplasmosis: Leukocytic response to *B. equi* infection in Chile. British Vet. J., 131, 601-609.

Wright, I.G. and Goodger, B.V. (1977): Acute *Babesia bigemina* infection: Changes in coagulation and kallikrein parameters. Z. Parasitenkunde. 63, 63-73.

Zak, B. (1958): Clin. Chim. Acta. 3, 328-334.

TABLE (1)

Haematological Findings of Splenectomized donkeys. (Mean Values)

Period	Group	R.B.Cs. $\times 10^6/\text{mm}^3$	W.B.Cs. $\times 10^3/\text{mm}^3$	Hb gm%	PCV %	Differential Leukocytic Count					
						Band %	Seg. %	Eos. %	Bas. %	Lymph. %	Mono. %
Before-	Splen.	5.418	14.170	13.9	31.8	6.7	39.5	4.9	0.4	48.2	2.0
	On-I	+0.272	+1.928	+0.8	+3.5	+2.6	+13.7	+1.9	+0.7	+9.5	+1.5
	Control	4.910	19.100	14.2	25.0	15.0	44.0	6.5	0.5	30.5	3.5
After	Splen.	4.935	12.345	12.2	29.3	8.5	73.6	0.0	0.1	14.75	2.8
	On-I	+0.472	+3.447	+0.4	+6.4	+5.3	+0.9	+0.0	+0.3	+6.3	+1.8
	Control	4.450	18.800	13.8	28.0	14.5	42.5	8.5	0.5	33.0	1.0
Paras. W. hae- molysis	Splen.	4.778	23.726	11.2	33.6	18.2	53.4	2.4	0.0	24.0	2.1
	On-i	+0.648	+8.443	+0.9	+3.1	+13.4	+30.1	+3.0	+0.0	+14.8	+1.8
	Cont.	4.620	15.800	13.5	26.6	15.5	43.0	3.5	0.5	34.5	3.0
Paras. W. hae- molysis	Splen.	2.358	21.283	9.3	14.0	23.6	57.1	0.8	0.2	17.7	0.5
	On-I	+0.483	+10.20	+1.7	+5.5	+19.5	30.6	+1.1	+0.4	+12.9	+0.9
	Cont.	4.920	13.100	13.7	25.0	15.0	44.0	6.5	0.5	30.5	3.5

W<sup>⊖</sup> = Without

W<sup>⊕</sup> = With.

TABLE (2)

Haematological Findings of Non-splenectomized Infected Donkeys (Exp. No A)  
(Mean Values)

Period	Group	T.R.B.Cs. $\times 10^6/\text{mm}^3$	T.W.B.Cs. $\times 10^3/\text{c.mm}$	Haemo- globin. gm%	Haemato- crit. %	Differential Leukocytic Count					
						Band %	Seg. %	Eosino- %	Baso- %	Lympho- %	Mono- %
Pre inf- ection.	I-Infec- ted Gr.	4.845	17.675	14.8	39.5	24	32.5	7.0	0.0	34	1.5
	On-I	+0.601	+6116.5	+0.3	+2.1	+10.6	+3.5	+1.4	+1.4	+9.9	+3.5
	2-Control.	5.160	13.550	13.7	25	15.5	20	6.5	0.5	52.5	5
5 days Post inf- ection.	I-Infec- ted.	5.010	19.000	13.7	27	6.3	43.5	4.5	1.4	44.0	0.5
	On-I	+1.159	+6576.1	+0.2	+4.2	+3.9	+13.4	+5.3	+0.7	+3.5	+0.0
	2-Control.	5.55	12.000	13.1	25	15.0	36	0.5	0.0	46.5	2
10 days Post inf- ection.	I-Infected.	4.500	15.875	13.3	25	24.5	24.8	6.8	1.0	41.75	1.3
	On-I	+1.344	+10.500	+0.8	+1.4	+11.3	+5.3	+1.1	+0.7	+6.0	+0.3
	2-Control.	4.68	13.600	12.7	26	15.0	32.5	4.0	0.0	47.0	1.5
15 days Post inf- ection.	I-Infected.	4.615	17.000	12	30	8	62.3	3.5	0.0	21.8	4.5
	On-I	+0.233	+11313.7	+0.7	+8.5	+7.8	+7.4	+4.9	0.0	+10.3	+0.0
	2-Control.	4.36	17.200	13.3	24	16.5	40.5	3.0	0.5	39.5	0.0

## EQUINE PIROPLASMOSIS

TABLE (3)

Haematological findings of cortisone injected donkeys  
(Mean values)

Period	Group	T.R.B.Cs. $\times 10^6/\text{mm}^3$	T.W.B.Cs. Th./ $\text{mm}^3$	Haemoglobin gm/dl	Haematocrit %	Differential leukocytic count %					
						Band cells	Seg. neutro-	Eosino	Basoph	Lymph	Monocytes
Before injec- tion	(1)	5.665 (+0.00614)	14,537.5 (+3267.6)	14.11 (+0.4)	30.8 (+1.3)	11.45 (+9.8)	30.5 (+7.1)	7.4 (+3.1)	0.5 (+0.5)	48.6 (+12.6)	1.0 (+ 7)
	(2)	6.28	15.600	13.81	30.0	11.0	31.5	2.0	0.0	51.5	4.0
Post 5 days	(1)	6.0275 (+1.293)	9,237.5 (+352.7)	14.9 (+1.7)	30.3 (+3.5)	7.75 (+1.9)	40.4 (+10.5)	0.0 (+0.0)	0.8 (+0.6)	46.3 (+11.8)	4.9 (+2.2)
	(2)	5.14	15.150	14.8	31.0	8.0	37.5	7.0	0.0	44.0	3.5
Post 10 days	(1)	6.342 (+7.209)	14,812.5 (+3,859)	14 (+1.3)	31.8 (+2.6)	5.0 (+1.9)	42.1 (+6.9)	5.0 (+1.9)	0.8 (+0.6)	45.0 (+7.9)	2.1 (+0.8)
	(2)	6.490	21,350	15.4	35	8.0	35.0	2.5	0.0	53.5	0.8
Post 15 days	(1)	5.921 (+3.227)	13,707 (+4478)	14.9 (+0.6)	33.8 (+1.5)	9.6 (+3.5)	39.1 (+3.6)	4.9 (+2.1)	0.1 (+0.3)	41.9 (+5.8)	4.4 (+2.6)
	(2)	5.530	19,780	14.2	33.0	8.0	35.0	2.5	0.0	53.5	1.0

1 = Injected group

2 = Control Donkey

TABLE (4)

Biochemical Findings of Splenectomized Donkeys  
(Mean Values)

Period	Group	Sodium m. eq/L	Kalium m. eq/L	Calcium mg/dl	Iron mg/dl	T.I.B.C. mg/dl	Copper mg/dl
Before	Splenect- omy.	162.4	7.7	13.46	107.5	322	106.7
	On-I	+32.5	+2.1	+2.6	+23	+69.0	+43.5
	Control	169	6.8	15.7	78.3	234.8	93.8
After	Splenectomy.	179.3	6.4	11.9	97.6	312.9	85.5
	On-I	+85.1	+1.9	+1.3	+18.9	+46.5	+24.5
	Control.	174	7.8	15.7	78.3	234.8	76.3
Parasitaemia without haem- olysis.	Splenect.	160.2	7.64	11.7	155.4	477.1	129.1
	On-I	+46.5	+1.6	+1.6	+51.8	+162.1	+33.2
	Control.	164	6.8	11.4	78.3	234.8	76.3
Parasitaemia with haemolysis.	Splenect.	172	11.64	14.3	244.9	741.1	102.1
	On-I	+58.8	+7.7	+2.6	+64	+185.7	+16.8

TABLE (5)

Biochemical Findings of Non-Splenectomized infected Donkeys (Exp. No. A; Mean Values)

Period	Group	Sodium M. eq/L	Potassium M.eq/L	Calcium mg/dl	Iron mg/dl	TIBC mg/dL	Copper mg/dl
Pre-Infec- ion		149.0	8.85	12.9	93.5	280.5	100.0
	On-I	+7.1	+0.2	+2.1	+21.5	+64.6	+17.7
	Cont.	134.0	6.6	14.1	78.3	234.8	118.8
5 days Post-Inf.	I-Infected.	167.0	10.5	10.5	121.8	365.3	68.8
	On-I	+24.0	+2.1	+0.9	+12.2	+36.8	+26.5
	2-Cont.	132.0	7.2	14.3	100.0	313.3	75.0
10 days Post-Inf.	I-Infected.	168.0	8.2	19.3	75.7	286.9	75.1
	On-I	+48.0	+2.8	+0.9	+28.3	+ 0.0	+8.8
	2-Cont.	134.0	7.2	15.1	91.3	273.9	75.5
15 days Post-Inf.	I-Infected.	220.0	7.6	12.9	102.2	313.1	84.4
	On-I	+107.5	+1.6	+0.0	+ 3.1	+ 0.0	+22.1
	2-Cont.	133	8.6	15.1	86.9	200.9	75.5

TABLE (6)

Biochemical findings of non splenectomized infected donkeys (Exp. No.B)  
(Mean Values)

Period	Group	Sodium m. eq/L	Potassium m.eq/L	Calcium mg/dl	Iron mg/dl	TIBC mg/dl	Copper mg/dl
Preinfe- ction	1-Infected	194	7.1	10.0	154.2	462.5	175.0
	On - 1 (+)	+0.0	+0.6	+0.0	+64.8	+194.5	+35.4
	2-Control	134	6.6	14.1	78.3	234.8	118.8
5 days Post- infection	1-Infected	193	9.7	11.5	162.5	487.5	250.0
	On - 1 (+)	+55.2	+2.1	+2.9	+88.3	+17.7	+23.6
	2-Control	132	7.2	14.2	100.0	313.1	75.0
10 days Post- infection	1-Infected	154	6.1	7.5	179.2	537.4	258.4
	On - 1 (+)	+28.3	+0.9	+1.1	+53.0	+159	+35.3
	2-Control	164	7.7	14.1	86.9	260.9	77.5
15 days Post- infection	1-Infected	142	9.5	10.0	183.4	549.9	191.9
	On - 1 (+)	+42.3	+1.3	+2.4	+58.9	+176.8	+11.8
	2-Control	160	7.0	14.3	78.3	234.8	75.5



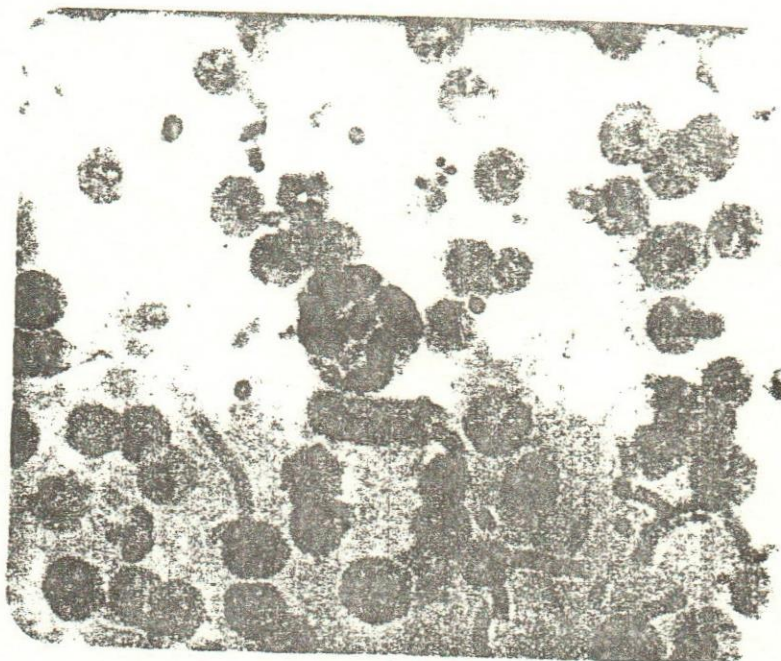


Fig. ( A ) : *Babesia caballi* in blood smear within RBCs and neutrophil leukocyte ( x 60 ).

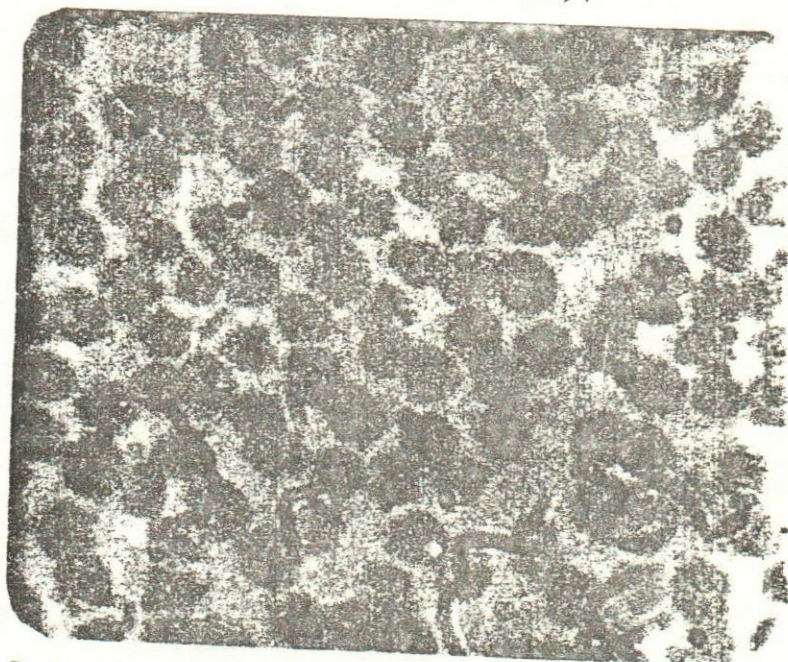


Fig. ( B ) : *Babesia equi* in blood smear ( x 60 ).



