The diagnosis in this outbreak was based on clinical signs, slight or no necropsy changes and on identification of *Cl. botulinum* type-C toxin in sera of sick birds. The source of the toxin was not identified as neither the feed nor the litter or water was assayed for it. But the failure to isolate *Cl. botulinum* in the organs of the sick birds appears to indicate that the outbreak could be due to ingested pre-formed toxin. It was difficult to attribute the disease to the commercial feed newly introduced in the farm, as similar outbreak was not observed in other farms using the same feed which has a nation-wide distribution. Mildly affected birds which were sleepy and turning their necks sideways could be confused with cases of Newcastle disease which may also show slight or no gross necropsy changes.

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OKOYE (J. O. A.). An outbreak of type-C botulism in broiler chickens in Nigeria. *Revue Elev. Méd. vét. Pays trop.*, 1988, **41** (1) : 51-52.

A flock of 8 weeks old broilers suddenly developed signs of coma, paralysis of the legs with neck dropped and extended. Only mild enteritis was noticed at necropsy. Mice inoculated with serum of affected birds died overnight while those given *Clostridium botulinum* type-C antitoxin remained apparently healthy. A diagnosis of type-C botulism was consequently made. Reports of outbreak of this disease appear to be rare in Nigeria and other African countries. *Key words* : Chicken - Type-C botulism - Diagnosis - Nigeria.

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Clinico-pathological aspects of naturally-occurring contagious caprine pleuropneumonia in the Sudan

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ABDELSALAM (E. B.), GORAISH (I. A.), TARTOUR (G.). Aspects clinico-pathologiques d'une pleuropneumonie contagieuse caprine naturelle au Soudan. *Revue Elev. Méd. vét. Pays trop.*, 1988, **41** (1) : 52-54.

Les altérations des constituants hématologiques et du plasma dues à une pleuropneumonie contagieuse caprine naturelle ont été analysées. Les résultats révèlent une réduction significative de la concentration d'hémoglobuline, du volume cellulaire, du taux de globules rouges et de la concentration moyenne globulaire de l'hémoglobine. Le nombre total de globules blancs a augmenté alors qu'aucun changement n'est apparu dans le volume globulaire moyen ou le taux de sédimentation des érythrocytes. La protéine totale du plasma a montré une légère baisse avec une réduction significative de l'albumine et une hausse des concentrations de globulines et de fibrinogènes. L'activité du plasma de l'aspartate amino tranférase a aussi baissé en comparaison aux valeurs normales. *Mots clés* : Caprin - Pleuropneumonie contagieuse de la chèvre - Soudan.

Contagious caprine pleuropneumonia (CCPP) is one of the most serious diseases of goats in the Sudan which causes considerable economic losses amongst farmers and back-yard goat keepers. Although the disease has long been recognized in the country (3) but most investigations were mainly directed toward the isolation, identification, characterization and pathogenicity of the causative mycoplasma (1, 6, 7). However, the principal lesions are now well established (2) and the present report describes some of the heamatological and plasma constituent alterations associated with the naturally-occurring disease.

Heparinized blood samples were collected from 50 adult Nubian goats brought for treatment at the University Veterinary Hospital during the winter outbreak of 1985-86. All animals were showing typical signs including high fever, dullness, anorexia, increased respiration, occasional coughing, dyspnoea and moaning. Control samples were also obtained from apparently healthy goats in the neighbouring farms. The haematological investigations including haemoglobin (Hb) concentration, packed-cell volume (PCV), erythrocyte sedimentation rate (ESR), red and white blood cell (RBC & WBC) counts and differential leucocytic count were performed by standard techniques (4). The plasma activity of aspartate amino transferase (AST) was measured by the method of REITMAN and FRANKEL (9) and expressed as I.U./l.

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The biuret method was used for the determination of total plasma proteins and fibrinogen (11). Albumin was measured by the bromocresol green (BCG) reaction (8) and globulins were calculated by substraction. All the results were then converted into S.I. units.

The haematological results (Table I) showed a significant decrease ($P < 0.05 - 0.01$) in Hb concentration, PCV and RBC count as compared to control values. The MCHC was also decreased but there was no change in MCV or ESR. The total WBC count was, on the other hand, increased and the differential leucocytic count showed a significant increase ($P < 0.05$) in the percentage of circulating neutrophils, decrease in lymphocytes and no change in eosinophils and monocytes. The plasma analysis (Table II) showed a slight reduction of total proteins. However, albumin was significantly ($P < 0.05$) decreased and there was a concomitant increase in globulins and fibrinogens concentrations. In addition, there was a considerable rise in the plasma AST activity in the diseased animals.

The results presented in this report indicate that the disease is generally associated with the development of normocytic hypochromic anaemia, leucocytosis with neutrophilia and elevated plasma ACT activity. The plasma proteins were also affected and showed similar changes to those previously reported for the

TABLE I Haematological changes in goats naturally infected with contagious caprine pleuropneumonia.

Erythrocytic series						
	Hb (g/dl)	PVC (l/l)	ESR (mm/24 h)	RBC ($\times 10^{12}$/l)	MCHC (g/dl)	MCV (FL)
Infected (n = 50)	6.85 ± 1.08 (5.1 – 8.2)	0.25 ± 0.05 (0.18 – 0.30)	7.40 ± 2.90 (4.0 – 10.0)	6.40 ± 1.2 (5.65 – 9.30)	23.90 ± 2.65 (20.5 ± 29.8)	30.15 ± 4.10 (26.6 – 34.5)
Control (n = 50)	9.65 ± 0.95 (8.4 – 12.0)	0.34 ± 0.07 (0.27 – 0.45)	6.50 ± 2.10 (3.50 – 10.0)	12.50 ± 1.50 (8.8 – 14.6)	38.40 ± 3.05 (27.9 ± 42.5)	28.60 ± 5.20 (25.5 – 32.4)
Level significance	$P < 0.01$	$P < 0.05$	NS	$P < 0.01$	$P < 0.05$	NS
Leucocytic series						
	WBC ($\times 10^9$/l)	Neutrophils (p. 100)	Lymphocytes (p. 100)	Eosinophils (p. 100)	Monocytes (p. 100)	
Infected	22.5 ± 5.7 (13.8 – 32.4)	68.70 ± 9.10 (49 – 80)	36.5 ± 6.29 (30 – 40)	5.2 ± 0.5 (2 – 5)	4.40 ± 0.60 (2 – 5)	
Control	7.75 ± 1.2 (6.3 – 10.5)	34.80 ± 5.60 (22 – 40)	62.40 ± 10.30 (46 – 75)	4.8 ± 0.4 (1 – 6)	5.6 ± 0.50 (2 – 6)	
Level of significance	$P < 0.01$	$P < 0.05$	$P < 0.05$	NS	NS	

Values are given as means ± standard deviations. Ranges are written in parenthesis. NS : not significant.

TABLE II Plasma constituents in goats naturally infected with contagious caprine pleuropneumonia.

	Total proteins (g/dl)	Albumin (g/dl)	Globulins (g/dl)	Fibrinogen (mg/dl)	AST IU/l
Infected (n = 50)	5.9 ± 0.6 (5.2 – 6.9)	2.75 ± 0.5 (2.1 – 3.2)	4.8 ± 0.6 (3.1 – 4.8)	750.5 ± 20 (450 – 900)	180.5 ± 25 (25 – 250)
Control (n = 50)	6.7 ± 0.4 (5.8 – 7.5)	3.9 ± 0.7 (3.4 – 4.8)	2.8 ± 0.5 (2.4 – 3.7)	275 ± 25 (250 – 400)	57.4 ± 13.8 (40.6 – 68.5)
Level of significance	NS	$P < 0.05$	$P < 0.01$	$P < 0.01$	$P < 0.05$

Values are given as means ± standard deviations. Ranges are written in parenthesis. NS : not significant.

experimental (2) and naturally-occurring disease (5). However, the increased levels of plasma fibrinogen concentration observed here was not evident by the previous reports. On the other hand, a diphasic pattern of fibrinogen level alterations has occasionally been observed in a number of goats naturally infected with the disease (GAMEEL, unpublished data). That was characterized by a transient rise at the beginning, followed by consistent reduction or total disappearance, particularly at the terminal stages of the disease. As the disease is mainly characterized by fibrinous pneumonia (2, 5), the level of plasma fibrinogen in various stages of infection would probably deserve further attention. A similar rise in the plasma AST activity and fibrinogen level concentration was also observed in experimentally-produced fibrinous pneumonias in calves (10) in which the clinical and pathological changes were similar to those produced by contagious caprine pleuropneumonia.

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The haematological and plasma constituent alterations associated with naturally-occurring contagious caprine pleuropneumonia were investigated. The results showed a significant reduction in haemoglobin (Hb) concentration, packed-cell volume (PCV), red blood cell (RBC) count and mean corpuscular haemoglobin concentration (MCHC). The total white blood cell count (WBC) was increased and there was no change in the mean corpuscular volume (MCV) or erythrocyte sedimentation rate (ESR). The total plasma protein was slightly reduced with a significant decrease in albumin and increase in globulins and fibrinogene concentration. The plasma activity of aspartate amino transferase (AST) was also increased as compared to control values. *Key words* : Goat - Contagious caprine pleuropneumonia - Sudan.

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