

## Domsiekte or Pregnancy Disease in Sheep—III.

By R. CLARK, Section of Pathology; J. W. GROENEWALD, Section of Nutrition and J. R. MALAN, Section of Chemical Pathology, Onderstepoort.

### INTRODUCTION.

IN a previous communication, Groenewald *et al* (1941) reviewed the literature relating to domsiekte and reported the artificial production of the disease by suddenly reducing the ration of good conditioned ewes. The experiment to be recorded was undertaken to confirm the findings previously reported and to attempt treatment on the cases so produced.

### EXPERIMENTAL PROCEDURE.

Forty 4 to 6 tooth merino ewes were fed a concentrated mixture of yellow maize meal and meat and bone meal, as described by us in a previous publication (Groenewald *et al* 1941). The total consumption of grain and green feed showed no marked deviation from that already recorded. All the sheep put on weight and averaged well over 100 lb. in weight at the time when the experiment started. At the beginning of the fifth month of pregnancy the concentrated ration was removed in all but the control group. The sheep were divided into five different groups in order to supply various supplements in the hope of finding a preventive dietetic factor. The experimental plan is given in Table 1.

TABLE 1.—*Treatment of Different Experimental Groups.*

Group 1.—(Control). To continue to receive a good ration.

Group 2.—To be given poor quality hay only from beginning of fifth month of pregnancy.

Group 3.—As for Group 2 except that  $\frac{1}{2}$  lb. molasses supplemented daily.

Group 4.—As for Group 2 except that 2 oz. of a mixture of 80 per cent. bicarbonate of soda, 10 per cent. bone meal and 10 per cent. salt be supplemented daily.

Group 5.—Non-pregnant ewes treated as Group 2.

An equal number of sheep was not placed in each group as it was not considered necessary to have many controls and any sheep that were found not to be pregnant fell automatically into Group 5. Group 2 was made the largest as cases were required for treatment.

The results of the experiment will be found briefly tabulated in Tables 2 and 3.

TABLE 2.  
*Pregnant Sheep.*

Group.	Sheep No.	Date Ration Cut.	Date of first Symptoms.	Degree of Symptoms.	Blood Chemistry.		Date Lambd or Aborted.	Date Died.	Post Mortem Findings.	Remarks.
					Acetone, Total.	Glucose.				
I CONTROL.	27	—	14/7	Coma .....	High....	Low.....	(L) 14/7	15/7	Typical domsiekte.....	Voluntary starvation from about 8/7 following inter-current temp. of 104°.
	16	—	—	None.....	Normal..	Normal..	(L) 28/7	—	—	Normal.
	41	—	—	None.....	Normal..	Normal..	(L) 27/7	—	—	Non-pregnant.
	1	—	—	None.....	Normal..	Normal..	(L) 27/7	—	—	Normal.
II HAY ONLY.	2	28/7	30/7	Typical spasms.	—	—	(L) 17/8	—	—	Treated, recovered.
	14	17/6	26/6	Nervous, blind.	High....	Low.....	—	7/7	Too decomposed.....	Domsiekte.
	40	18/6	24/6	Unsteady, blind	High....	Low.....	—	26/6	Typical domsiekte.....	Twin pregnancy; voluntarily off feed before ration cut.
	18	24/6	2/7	Nervous, blind.	High....	Low.....	(L) 17/7	—	—	Treated, recovered.
	30	26/6	4/7	Listless.....	High....	Low.....	(A) 19/7	—	—	Domsiekte.
	33	27/6	3/7	Nervous, blind.	—	—	—	—	—	Twin pregnancy; voluntarily off feed before ration cut.
	39	1/7	7/7	Nervous, blind.	—	—	—	—	—	Recovered after abortion.
	4	17/6	24/6	Listless.....	High....	Low.....	—	3/7	Typical domsiekte.....	Treated, recovered.
	38	5/7	10/7	Fits, blind.....	High....	Low.....	—	8/7	Toxaemia, dead foetus....	Recovered after abortion.
	31	17/6	4/7	Nervous.....	High....	Low.....	—	29/7	Dead foetus, septic metritis	Twin pregnancy.
III MOLASSES.	26	17/6	—	None.....	Normal..	Normal..	—	1/7	Pneumonia.....	—
	3	27/6	1/7	Nervous.....	Normal..	Normal..	(L) 5/7	29/7	Domsiekte and metritis....	Lamb died 24 hours old....
	11	27/6	—	None.....	—	—	(L) 20/7	12/7	Toxaemia, dead foetus....	Found <i>in extremis</i> .
	36	1/7	—	None.....	—	—	(L) 21/7	—	—	Ewe had no milk.
IV ALKALI.	25	23/6	—	None.....	Normal..	Normal..	(L) 21/7	—	—	—
	32	16/6	25/6	Dull, blind.....	High....	Low.....	(A) 3/7	—	—	Aborted twins, recovered.
	23	5/7	17/7	Listless.....	High....	Low.....	(A) 9/7	18/7	Typical domsiekte.....	—
	5	18/6	27/6	Nervous, blind.	High....	Low.....	(L) 20/7	10/7	Oedema lungs, fatty liver.	—
V	24	3/7	—	None.....	—	—	(L) 1/8	—	—	—
	17	5/7	—	None.....	—	—	(L) 1/8	—	—	Dystokia, recovered.

N.B.—(L): Lambd. (A): Aborted.

TABLE 3.  
Non-pregnant Ewes.

Sheep No.	Date Ration Cut.	BLOOD CHEMISTRY.		Date Died.	Post-mortem Findings.	Remarks.
		Acetone.	Glucose.			
28	21/6	1/7 Normal 21/8 High.	Low..... Normal...}	26/8	Domsiekte and enteritis	—
9	1/7			—	—	20/8
25	29/10	High.....	Low.....	3/1	Typical domsiekte....	Starved again after lambing.
22	27/6	—	—	—	—	Discharged 28/7.
35	5/7	—	—	—	—	Discharged 28/7.
7	16/9	High.....	Low.....	30/12	Typical domsiekte....	—
8	16/9	High.....	Low.....	7/11	Too decomposed.....	—
12	16/9	High.....	Low.....	23/10	Too decomposed.....	—
19	25/9	High.....	Low.....	12/4	Typical domsiekte....	—
20	25/9	Normal....	Normal....	23/10	Typical domsiekte....	Died suddenly.
21	15/10	Normal....	Normal....	29/1	Typical domsiekte....	Died suddenly.
29	15/10	Normal....	Normal....	27/11	Typical domsiekte....	Died suddenly.
34	17/7	High.....	Normal....	26/8	Typical domsiekte....	Died suddenly.
37	16/10	Normal....	High.....	17/11	Pneumonia.....	—

NOTES.—None of the above sheep showed symptoms of domsiekte. For details of post-mortem findings designated "Typical Domsiekte" see paragraph on this subject.

### RESULTS.

*Controls.*—Of five, two were non-pregnant. One (27) contracted an intercurrent disease when 169 days pregnant and went off her feed. She went into a coma 6 days later and gave birth to a weak lamb, dying soon afterwards. The post-mortem showed typical domsiekte.

The other two lambed normally.

*Group 2.*—These sheep were given dry veld grass only at four months after service. Those that proved to be non-pregnant are dealt with under the non-pregnant group. Of 10 pregnant sheep suddenly reduced in ration as above, all 10 showed symptoms of domsiekte in periods ranging from 2-9 days (average 6 days). Two of these sheep had twin pregnancies, but this did not accelerate the disease as both went down in 6 days. Sheep No. 40 went off feed voluntarily before the ration was cut.

*Group 3.*—Five pregnant ewes were treated as above except that they were dosed with  $\frac{1}{4}$  lb. molasses daily. Only one of these showed slight nervous symptoms on one day. Three lambed but two had very weak lambs and one of the ewes died subsequently of metritis. One died of toxæmia from a dead foetus *in utero* and the fifth died of intercurrent pneumonia.

One sheep of this group requires special mention, namely, sheep No. 25 (see appendix III for full details). This animal was treated as the others in the group and lambed. It was then fed the full ration for three and a half months, the lamb being removed. After this it was again put on to dry veld hay only and, as a non-pregnant animal, showed the typical acetonæmia and hypoglycæmia of domsiekte.



The dosing of molasses, therefore, appears to have had some effect in preventing the symptoms, but the dose given was not enough to cause normal lambing or to maintain weight. It would be impossible to give more as even this dose caused severe diarrhoea. In the three cases where blood analyses were done, the sugar appeared to prevent the formation of ketone bodies.

*Group 4.*—Five pregnant sheep were treated as above, but were also given a mixture consisting of 80 per cent.  $\text{NaHCO}_3$ , 10 per cent. bone meal and 10 per cent. salt. One ounce of this was dosed twice a day. Three of these five sheep showed symptoms. One lambbed normally and the fifth died of toxæmia due to the presence of a retained disintegrating foetus. It is interesting to note that the alkali treatment had no antiketogenic effect and was useless in the prevention of domsiekte.

*Group 5.*—Fourteen non-pregnant ewes were also treated as above. Of these none showed clinical symptoms of domsiekte, but 12 died in periods ranging from 28 days to 199 days (average 69 days). Of the 12 sheep that died, two were too decomposed for diagnosis when brought for post-mortem, but eight showed typical domsiekte lesions. It will, therefore, be seen that non-pregnant ewes are much more resistant than pregnant ewes to a sudden reduction of ration but, provided that they are starved for long enough periods the same pathological changes take place. (For detailed records of individual sheep the reader is referred to appendices I to IV.)

#### *Loss in Weight.*

Adiposity has long been considered an important factor in the aetiology of domsiekte. The sheep in this experiment were fattened for a long period prior to the experiment, and were all in super prime condition.

It was thought that the rate of loss might determine the occurrence of domsiekte. The pregnant ewes lost weight at an average rate of approximately 1.0 lb. per day, but no significant difference could be found between the rate of loss of weight of those showing symptoms and of those which did not.

The average weight of the non-pregnant sheep used in the domsiekte experiment was 122 lb. and their average daily loss was 0.5 lb. These sheep on post-mortem all showed large amounts of fat still present in the depots, although they had been living on poor grass hay for long periods, in one case 199 days (sheep 19). It is, therefore, obvious that, in the absence of a sufficient balanced diet, sheep are incapable of utilizing stored fat.

A completely different picture was seen in another similar experiment where three non-pregnant ewes in moderate condition were also put on to the same grass hay only. At the commencement of this experiment the ewes averaged 86 lb. in weight. As the ewes used in these two experiments were of exactly the same type and were in fact all picked from the available ewes on the station it can be fairly assumed that the difference in initial weight between the two groups was almost entirely due to fat. When the lower conditioned ewes were put on to the grass diet they only lost an average of three pounds per sheep in six months. One was actually alive ten months after going on to the grass hay only and was discharged, having lost 11 lb. in weight. The other two died of cachexia and on post-mortem showed no fat in the body, there being only a gelatinous atrophy of the fatty tissues.



It is, therefore, obvious that the amount of adipose tissue in the body has a very marked effect on the reaction to a sudden drop in nutritional intake.

#### *Clinical Symptoms.*

The symptoms seen in the pregnant ewes were typical of domsiekte, namely, dullness, twitching of the ears and spasms of the body, blindness, usually of one eye, and comâ as described in our previous publication. (Groenewald *et al* 1941.) A point of interest is the frequency of apparent death of the foetus with partial recovery of the ewe but without abortion. It can be said that when a ewe shows symptoms of domsiekte and then lingers on without either lambing or aborting, it can be assumed that the foetus is dead and the ewe will eventually die of toxaemia. Reference to the prevalence of abortion among domsiekte sheep was made in the last article. Further reference to the death of the foetus will be made under the discussion of the chemical findings in the blood.

#### *The Blood Chemistry.*

(For details of analyses see appendices I to IV.) As will be seen from table 2, all the pregnant sheep showed the usual blood chemical changes when the symptoms developed, i.e. a rise in ketone bodies and a fall in blood sugar with the N.P.N. not affected.

A peculiar phenomenon appeared in pregnant sheep 4, 14 and 31 and in several of the non-pregnant animals, namely that after a period of hypoglycaemia and ketonaemia the blood-sugar shot up well above normal figures with a simultaneous drop in the ketone bodies and rise in the N.P.N.

In the case of the pregnant sheep this can be explained by assuming that the foetus died at this point but was not expelled. Evidence of this was found at post-mortem. The sudden drop in metabolic requirements subsequent to the death of the foetus would explain the rise in blood sugar and consequent drop in ketone bodies, while the rise in N.P.N. would be due to absorption of break-down products from the foetus aggravated by the gradually mounting disfunction of the kidneys following on degenerative changes. It must be remembered, however, that non-pregnant sheep also showed the same phenomenon. An alternative explanation is that at a certain point there is a sudden large scale catabolism of protein for the production of the much needed carbohydrates. It is probable that both factors come into play.

#### *Pathological Findings.*

The macroscopical pathological findings were as described in Number II of this series, being briefly: gross fatty changes in the liver and adrenal cortex, obesity with marked fat necrosis especially of the perirenal fat and atrophy of the lymphatic tissue. The alimentary tract usually shows atrophy of the ruminal wall, small intestines empty and the presence of hard mucous covered faeces in the large intestine.

#### *Histopathology.*

The histological changes noted were as previously reported (Groenewald *et al*, 1941). The only additional lesion noted was in the lymph nodes.



As previously reported the drop in circulating lymphocytes was associated with an atrophy of the lymph-nodes, affecting especially the germ centres, and a shrinking of the malpighian bodies of the spleen. From all cases of the present series which died, specimens were taken of the prescapular, precrucial, mediastinal and mesenteric lymph glands. All these were very much smaller than normal but the most marked decrease was noted in the external glands, i.e. prescapular and precrucial.

On histological examination of these nodes it was found that the germ centres were markedly decreased in size and density. Islands of typical foam cells were noted in the cortex, occupying the positions of the disappearing germ centres and obviously consisting of swollen and hypertrophied cells derived from the reticulum of the centres. The cytoplasm of these foam cells showed typical vacuolation with the nuclei often pressed to one side. Often no division could be noted between several adjacent cells, giving the appearance of multinuclear giant cells. The vacuoles of the cytoplasm did not stain with routine sudan III methods but when the new acetic-carbol-sudan III technique of Jackson was applied, the vacuoles took on a bright red colour. There was also a marked hypertrophy and desquamation of the littoral cells of the sinuses resulting in these channels being packed with macrophages also exhibiting foamy cytoplasm. With routine Sudan III methods many of these vacuoles were refractory but with Jackson's technique the cytoplasm was seen to be packed with red-stained globules of varying sizes.

The exterior lymph nodes showed the alteration of the follicles to a greater degree than did the interior ones, but the latter showed isolated foam centres in the cortex and marked desquamation of the littoral cells of the sinuses, together with a varying degree of hyperaemia.

The changes noted are, therefore, an atrophy of lymphoid tissue together with a typical reticulo-endothelial reaction of lymph nodes associated with phagocytosis of fats. Curiously enough the latter reaction was not noted in the spleen. In view of the known abnormality of fat catabolism in domsiekte, this lesion may be of great significance and its study may help to elucidate the question of normal fat catabolism in sheep. Identical lesions have been noted in the lymph nodes of sheep dead of domsiekte in naturally occurring outbreaks from the field.

#### *The Blood.*

The drop in circulating lymphocytes and rise in neutrophiles which was described in our last article was again noted. The average differential count for sheep showing symptoms was:—neutrophiles 56%, lymphocytes 39% with no significant change in the leucocyte total.

#### CORRELATION BETWEEN ACETONAEMIA ON THE ONE HAND AND CLINICAL SYMPTOMS ON THE OTHER.

Among the pregnant ewes in all cases where symptoms were noted the blood showed a fall in glucose and a rise in ketone bodies. Of the eleven non-pregnant ewes on which chemical data is available, however, six showed identical and equally severe changes without showing clinical symptoms.



The symptoms of domsiekte cannot therefore be attributed to the aceto-naemia or hypoglycaemia alone. From this experiment it would appear that pregnancy is necessary for the development of the clinical picture of domsiekte but, as previously reported (Groenewald, *et al* 1941), typical symptoms have been seen in non-pregnant ewes.

#### THE CORRELATION OF CHEMICAL FINDINGS TO PATHOLOGICAL CHANGES.

All the pregnant sheep which showed hypoglycaemia and aceto-naemia were found on post-mortem to have extensive fatty changes in the liver and other typical changes associated with domsiekte.

Turning again to the non-pregnant ewes, however, we find that these same changes appeared in sheep that had never shown typical chemical changes. The anatomical pathological findings recorded to date, therefore, cannot be directly correlated with the chemical pathology.

#### CORRELATION BETWEEN SYMPTOMS AND PATHOLOGICAL FINDINGS.

Once again we find among the non-pregnant ewes that typical pathological changes did not always produce clinical symptoms.

#### TREATMENT.

Three pregnant sheep were treated with intravenous injections of 10 gm. glucose, 3333 i.u. Thiamin hydrochloride (Abbott) and 1 mgm. lentin subcut. All three showed improvement but one died subsequently of toxemia from a dead fetus. Particular reference may be made to the history of sheep 18. (See appendix II.) This animal showed typical symptoms of domsiekte 10 days after the cut in ration and was treated on the twelfth day when in coma. This sheep ate grain offered the following day and in three days the blood chemistry was normal. The ewe lambled normally.

Similar treatment has been used by the authors in a naturally occurring outbreak with some success. It is considered that the main object to be attained in any treatment is to get purgation. It has been noted that ruminal atony and constipation of the large intestine is an almost constant finding in cases of domsiekte and no permanent improvement can be expected till this is relieved. Lentin acts well but 120 c.c. of raw linseed oil has also been found effective. Rapidly absorbable carbohydrate such as glucose or sugar is also obviously indicated.

#### SUMMARY.

(1) It has been confirmed that a sudden and drastic reduction in diet of fat ewes in the fourth month of pregnancy causes typical domsiekte or pregnancy disease. The condition was evinced clinically, chemically and pathologically.

(2) Similar treatment of fat, non-pregnant ewes caused the same changes in blood chemistry as seen in pregnancy disease in some, and post-mortem findings typical of the disease in others. No clinical symptoms were observed in non-pregnant ewes.

DOMSIEKTE OR PREGNANCY DISEASE IN SHEEP III.

(3) In the non-pregnant group no correlation could be found between chemical changes, post-mortem findings and clinical symptoms.

(4) The non-pregnant ewes survived for a very much longer period than the pregnant ewes.

(5) A hitherto undescribed pathological finding, namely hypertrophy of the retico-endothelial system of the lymph nodes is recorded.

(6) Indications are given that the use of alkaline dosing has no effect on the formation of acetonaemia.

(7) Treatment by means of rapidly active purgatives and sugars is indicated.

LITERATURE.

As a full review and list of literature relating to domsiekte has been given in a previous publication (Groenewald *et al* 1941), it is not considered necessary to repeat it here. The reader is, therefore, referred to the following:—

CLARK, R., AND GROENEWALD, J. W. (1941). Pregnancy Disease or Domsiekte in Ewes. *Jour. South Afric. Med. Vet. Assoc.*, Vol. 12, No. 4, pp. 97-102.

GROENEWALD, J. W., GRAF, H., AND CLARK, R. (1941). Domsiekte or Pregnancy Disease in Sheep I.—A review of the Literature. *Onderstepoort Jl.*, Vol 17 (1 and 2), pp. 225-244.

GROENEWALD, J. W., GRAF, H., BEKKER, P. M., MALAN, J. R., AND CLARK, R. (1941). Domsiekte or Pregnancy Disease in Sheep II. *Onderstepoort Jl.*, Vol. 17 (1 and 2), pp. 245-296.



## APPENDIX I.

*Details of Control Group.*

No.	Datè.	Body Weight. (lb.).	BLOOD ANALYSES.					Remarks.
			Biochemical, mgm. Per cent.			Counts.		
			N.P.N.	Sugar.	Total Acetone.	Total Leuc. per c.mm.	Per cent. L.	
27	18/6	—	34.1	43.9	3.9	—	—	—
	24/6	121	—	—	—	—	—	—
	3/7	—	30.0	41.3	18.2	—	—	—
	8/7	—	27.3	22.2	31.7	—	47	Ill, voluntary starvation, temperature 104°.
	11/7	—	27.2	21.3	42.6	—	—	High acetone, low sugar.
	14/7	—	—	—	—	—	—	Lambèd.
	15/7	—	—	—	—	—	—	Died, typical domsiekte P.M.
16	24/6	117	—	—	—	—	—	—
	3/7	—	30.2	43.9	3.9	—	—	—
	9/7	—	35.6	50.0	3.9	—	49	—
	15/7	—	33.6	48.1	3.5	6,300	48	—
	18/7	—	—	—	—	5,600	41	Normal acetone and sugar.
	24/7	—	35.1	37.6	6.6	—	—	—
	28/7	—	—	—	—	—	—	Lambèd.
	30/7	—	31.6	52.6	4.6	—	—	—
	20/8	—	30.0	52.9	2.9	—	—	—
1	24/6	149	—	—	—	4,600	63	—
	2/7	—	33.3	55.6	3.9	4,500	64	—
	8/7	—	33.6	60.2	2.9	—	68	Normal acetone and sugar.
	14/7	—	30.0	50.0	2.7	5,200	59	—
	18/7	—	—	—	—	5,200	50	—
	22/7	—	—	—	—	—	—	Lambèd.
	24/7	—	33.3	46.5	3.5	—	—	—
30/7	144	35.3	64.5	4.5	—	—	—	
41	24/6	118	—	—	—	7,000	62	—
	4/7	—	45.4	51.0	4.1	7,800	51	—
	10/7	—	49.6	49.5	2.7	4,900	61	—
	15/7	—	40.0	39.2	2.3	6,500	54	—
	17/7	—	36.1	45.5	2.5	—	—	Normal acetone and sugar.
	24/7	—	40.8	49.5	3.9	—	—	—
	30/7	—	42.9	54.1	4.3	—	—	Non-pregnant.
6	24/6	130	—	—	—	4,300	72	—
	2/7	—	—	—	—	6,900	73	—
	10/7	—	—	—	—	—	63	—
	15/7	—	—	—	—	5,700	71	—
	28/7	140	—	—	—	—	—	Non-pregnant.

APPENDIX II.  
Detailed History of Individual Pregnant Sheep.

No.	Date.	Body Weight. (lb.)	BIOCHEMICAL BLOOD.			Symptoms.	BLOOD.		Remarks.
			N.P.N.	Sugar.	Total Acetone.		Total Leuc. per c.mm.	Per cent. L.	
2 Gr. 2	28/7	132	—	—	—	—	—	—	Put off ration. Treated Lentin, glucose and Vitamin B. Refuses food, force fed.
	30/7 1/8	128	—	—	—	Spasms..... Recovered.....	—	—	
4 Gr. 2	16/6	—	31.3	47.2	3.3	—	—	—	Ration cut. Sugar low, acetone high. Foetus dead? N.P.N. and sugar high. N.P.N. and sugar high; acetone low. Died. Toxaemia decomposing foetus.
	17/6	163	—	—	17.0	—	—	—	
	24/6	151	26.1	29.4	24.8	Dull, blind..... Improved.....	7,800	19	
	25/6	—	24.8	28.5	—	—	4,000	40	
	26/6	—	28.6	34.5	42.4	As before.....	7,600	26	
	27/6	—	41.6	51.0	38.7	As before.....	—	—	
	30/6	—	102.7	100.0	24.0	As before.....	8,500	14	
	1/7 2/7 3/7 4/7 7/7 9/7	142 — 136 131 —	146.4 193.6	100.0 72.5	5.8 9.3	As before.....	—	19	
14 Gr. 2	16/6	—	30.0	46.7	4.6	—	—	—	Ration cut. Sugar low, acetone high. N.P.N. and sugar rising with high acetone Foetus dead? Died. Too decomposed for post-mortem.
	17/6	115	—	—	—	—	—	—	
	24/6	110	27.1	29.2	22.0	—	—	—	
	25/6	—	25.0	19.2	34.6	—	6,000	41	
	26/6	106	25.6	31.8	37.3	Listless, blind..... Listless, blind.....	6,700	43	
	27/6	—	30.0	23.2	54.2	As above.....	—	—	
	30/6 1/7	— 98	33.3	31.7	68.0	—	16,200	10	
4/7 7/7	98 —	39.8	49.5	70.0	—	—	—		
18 Gr. 2	24/6	142	30.9	50.0	4.8	—	—	—	Ration cut. Sugar low, acetone high. Treated glucose and B <sub>1</sub> . Sugar and acetone normal. Lambled normally.
	1/7	132	30.5	21.7	24.8	—	5,400	55	
	2/7	132	—	—	—	Nervous..... Blind, dull..... Coma..... Eating.....	—	—	
	3/7	—	—	—	—	—	—	—	
	4/7	—	27.9	25.7	39.5	—	—	—	
	5/7	—	—	—	—	—	—	—	
	8/7 11/7 17/7	— — —	25.8	55.0	6.2	—	7,600	64 61	



No.	Date.	Body Weight: (lb.)	BIOCHEMICAL BLOOD.			Symptoms.	BLOOD.		Remarks.
			N.P.N.	Sugar.	Total Acetone.		Total Leuc. per c.mm.	Per cent. L.	
30 Gr. 2	26/6	127	32.2	44.6	3.7	—	7,100	53	Put off ration.
	30/6	121	26.1	25.9	18.6	—	4,400	58	Sugar low, acetone high.
	4/7	118	—	—	—	Dull and listless.....	—	54	—
	5/7	115	—	—	—	—	6,500	—	—
	7/7	—	—	—	—	—	5,100	71	—
31 Gr. 2	10/7	—	—	—	—	—	5,700	55	—
	16/7	—	—	—	—	—	7,800	63	—
	19/7	—	—	—	—	—	—	—	Aborted and recovered.
	25/6	126	25.4	46.7	3.7	—	—	—	—
	27/6	120	—	—	—	—	4,100	50	Put off ration.
	28/6	120	27.6	25.3	12.4	—	6,700	44	—
	1/7	116	—	—	—	Slight nervous.....	2,800	43	—
	4/7	—	31.6	27.2	41.8	Dull and listless.....	—	—	Sugar low, acetone high.
	7/7	—	40.8	43.5	61.5	Nervous.....	5,500	19	Acetone high, sugar and N.P.N. rising, foetus dead?
	9/7	—	57.2	74.6	77.0	—	—	—	—
10/7	—	100.5	111.1	38.7	—	12,900	10	N.P.N. and sugar high, acetone low.	
33 Gr. 2	12/7	105	87.0	87.7	7.4	—	—	—	Died. Typical domsiekte P.M. Foetus dead and disintegrating.
	15/7	—	—	—	—	—	—	—	—
	16/7	—	—	—	—	—	—	—	—
	17/7	—	—	—	—	—	—	—	—
38 Gr. 2	20/7	—	—	—	—	—	—	—	—
	27/6	139	—	—	—	—	7,100	43	Put off ration.
39 Gr. 2	1/7	134	—	—	—	—	6,200	38	Died. Typical domsiekte P.M. Twin pregnancy.
	3/7	130	—	—	—	Marked nervous.....	—	—	—
	5/7	117	—	—	—	—	—	36	Put off ration.
	8/7	115	—	—	—	Sudden fit.....	—	—	—
	10/7	—	—	—	—	Nervous, blind right eye..	—	—	—
	13/7	—	—	—	—	Nervous.....	—	38	Glucose, B <sub>1</sub> and Lentin.
	14/7	—	—	—	—	Calm, drinks, does not feed	—	—	Dosed, ½ lb. molasses.
	15/7	—	—	—	—	Passing soft faeces.....	—	—	Dosed meatmeal.
	16/7	—	—	—	—	Stiff.....	5,700	27	Died. Dead foetus and Toxaemia.
	17/7	—	—	—	—	—	—	—	—
29/7	—	—	—	—	—	—	—	—	
39 Gr. 2	1/7	139	—	—	—	—	8,000	47	Put off ration.
	3/7	129	—	—	—	—	5,100	37	—
	7/7	—	—	—	—	Loss of balance and blind.	7,000	25	Died. Typical domsiekte P.M.

## DOMSIEKTE OR PREGNANCY DISEASE IN SHEEP III.

## APPENDIX II—(continued).

No.	Date.	Body Weight. (lb.)	BIOCHEMICAL BLOOD.			Symptoms.	BLOOD.		Remarks.	
			N.P.N.	Sugar.	Total Acetone.		Total Leuc. per c.mm.	Per cent. L.		
40 Gr. 2	18/6	112	33.0	28.4	42.9	—	—	—	Voluntarily off feed before ration cut.	
	20/6	—	25.2	23.5	46.4	—	—	63	—	
	24/6	—	—	—	—	Unbalanced.....	5,000	—	—	
	25/6	—	29.4	18.4	42.9	Blind, unsteady.....	8,800	42	—	
26/6	—	—	—	—	—	—	—	—	Died. Typical domsiekte P.M. Twin pregnancy.	
3 Gr. 3	27/7	131	22.7	46.3	4.3	—	—	—	Put off ration, plus $\frac{1}{4}$ lb. molasses.	
	1/7	128	21.6	40.3	7.4	—	—	—	—	
	2/7	—	—	—	—	Nervous.....	—	—	—	
	3/7	—	—	—	—	Improved.....	—	—	—	
	7/7	—	—	—	—	—	5,800	24	—	
	8/7	122	29.7	44.6	6.8	—	4,400	25	—	
	11/7	—	27.5	46.9	4.6	—	5,900	37	—	
	12/7	—	—	—	—	—	—	—	—	Acetone, sugar and N.P.N. Normal.
	14/7	—	22.5	41.0	6.2	—	—	—	—	
	15/7	—	—	—	—	—	5,100	26	—	
	16/7	112	26.8	76.9	3.9	—	—	—	—	
17/7	—	—	—	—	—	—	—	—	Metritis.	
21/7	—	—	—	—	—	—	—	—	Died. Fatty liver and metritis.	
29/7	—	—	—	—	—	—	—	—	—	
11 Gr. 3	27/6	115	—	—	—	—	4,200	41	Put off ration, plus $\frac{1}{4}$ lb. molasses.	
	2/7	111	—	—	—	—	—	—	Died. Dead foetus. Toxaemia, no domsiekte.	
26 Gr. 3	17/6	97	32.3	38.5	6.6	—	—	—	Ration cut plus $\frac{1}{4}$ lb. molasses.	
	24/6	95	20.5	30.9	5.6	—	—	—	Died suddenly. Pregnant, pleuro-pneumonia, no domsiekte.	
36 Gr. 3	1/7	—	—	—	—	—	—	—	Put off ration, plus $\frac{1}{4}$ lb. molasses.	
	4/7	122	—	—	—	—	5,400	21	Molasses stopped.	
24 Gr. 4	12/7	108	—	—	—	—	8,200	21	Normal lamb, no milk.	
	14/7	—	—	—	—	—	—	—	Put off ration and alkali dosed.	
	20/7	—	—	—	—	—	—	—	Alkali stopped.	
	3/7	111	—	—	—	—	6,100	75	Lambled normally.	
7/7	110	—	—	—	—	3,900	76	Put on full ration.		
11/7	—	—	—	—	—	7,000	45	Died. Decomposed at P.M. but no domsiekte.		
12/7	—	—	—	—	—	—	—	—		
16/7	101	—	—	—	—	—	—	—		
20/7	—	—	—	—	—	—	—	—		
29/7	92	—	—	—	—	—	—	—		
7/8	—	—	—	—	—	—	5,400	44	—	



APPENDIX II—(continued).

No.	Date.	Body Weight. (lb.).	BIOCHEMICAL BLOOD.			Symptoms.	Blood.		Remarks.
			N.P.N.	Sugar.	Total Acetone.		Total Leuc. per c.mm.	Per cent. L.	
32 Gr. 4	17/6	140	31.9	45.5	3.5	—	—	—	Ration cut and alkali dosed.
	24/6	130	30.3	29.9	19.9	—	—	64	—
	25/6	—	—	—	—	Dull, blind left eye.....	6,300	—	—
	26/6	—	25.0	22.0	36.4	Dull, blind left eye.....	5,900	49	Sugar low, acetone high.
	30/6	—	41.6	28.4	50.3	—	—	—	—
	1/7	121	—	—	—	Still as above.....	—	—	—
	2/7	—	26.6	27.5	53.8	—	—	—	—
	3/7	—	—	—	—	—	—	—	—
	4/7	—	24.0	55.5	46.8	Improved.....	—	—	—
	9/7	—	20.2	49.8	14.7	—	—	—	—
12/7	—	—	23.8	49.8	—	—	—	—	
15/7	95	—	22.2	43.1	—	—	—	—	
16/7	—	—	—	—	—	9,700	58	—	Discharged.
28/7	104	—	—	—	—	—	—	—	—
5 Gr. 4	18/6	108	25.6	42.0	4.3	—	—	—	—
	24/6	107	23.6	18.2	21.9	—	—	—	—
	27/6	102	19.5	25.4	28.6	Nervous, blind left eye....	—	—	—
	30/6	—	24.6	19.8	39.8	—	—	—	—
	1/7	100	23.1	18.6	44.9	—	7,400	25	—
	4/7	—	25.8	24.3	39.5	—	—	—	—
	7/7	—	25.2	22.4	44.5	—	—	—	—
	8/7	97	—	—	—	—	—	—	—
	9/7	—	30.0	46.9	19.3	—	—	18	—
	12/7	—	—	—	—	—	—	—	—
16/7	—	—	—	—	—	—	—	—	
17 Gr. 4	5/7	119	—	—	—	—	—	68	—
	8/7	121	—	—	—	—	—	—	—
	12/7	—	—	—	—	—	—	—	—
	15/7	106	—	—	—	—	8,000	39	—
	18/7	—	—	—	—	—	—	—	—
	29/7	98	—	—	—	—	—	—	—
1/8	—	—	—	—	—	—	—	—	
23 Gr. 4	5/7	137	—	—	7	—	—	—	—
	9/7	138	—	—	—	—	—	56	—
	12/7	—	—	—	—	—	—	—	—
	17/7	—	—	—	—	Listless.....	—	—	—
	18/7	—	—	—	—	—	—	—	—

## APPENDIX III.

*Details Sheep No. 25.*

Date.	Body Weight. (lb.).	BLOOD ANALYSES, mgm. (Per Cent.).			Remarks.
		N.P.N.	Sugar.	Total Acetone.	
20/6	—	26.1	46.9	5.0	A pregnant ewe in group 3.
23/6	99	—	—	—	Put off ration and $\frac{1}{2}$ lb. molasses dosed daily.
24/6	100	—	—	—	—
26/6	—	20.1	50.3	2.9	—
2/7	92	20.3	47.6	3.9	—
8/7	91	21.1	41.0	3.1	—
15/7	87	23.2	34.3	6.8	—
21/7	—	23.8	45.5	6.8	Lambd, showing normal blood picture.
28/7	81	—	—	—	Molasses stopped and given full ration, for 3½ months.
30/7	—	28.6	51.3	2.9	—
20/8	—	25.4	49.5	2.5	—
29/9	—	27.3	52.6	1.2	—
29/10	—	32.9	48.5	1.7	Ration changed to veldhay only.
17/11	—	33.6	39.4	10.4	—
3/12	—	33.3	47.6	11.6	—
12/12	—	29.7	35.7	38.3	—
17/12	—	33.3	19.6	54.9	High acetone and low sugar after 7 weeks.
19/12	—	35.3	22.2	56.8	—
22/12	—	40.0	47.6	15.5	N.P.N. and sugar rising, acetone dropping.
29/12	—	53.6	61.7	4.7	—
2/1	—	60.0	61.7	5.4	N.P.N. and sugar high, acetone normal.
3/1	—	—	—	—	Died, typical domsiekte P.M.



## APPENDIX IV.

*Details of Non-pregnant Ewes.*

Sheep No.	Date.	Body Weight. (lb.).	BLOOD ANALYSES, mgm. (Per Cent.).			Remarks.
			N.P.N.	Sugar.	Total Acetone.	
7	15/9	—	38.0	49.5	2.5	Ration cut.
	25/9	96	33.3	37.3	3.7	—
	7/10	—	24.6	41.3	2.9	—
	27/10	87	27.3	43.5	3.3	—
	17/11	—	33.3	39.7	6.9	—
	9/12	—	40.0	28.4	24.4	Sugar low, acetone high.
	17/12	—	20.3	32.3	23.3	—
	24/12	—	23.1	34.4	25.5	—
	29/12	58	26.3	34.0	21.6	Died suddenly. Typical domsiekte lesions.
8	16/9	—	34.5	44.5	4.1	Ration cut.
	25/9	123	31.9	37.0	5.9	—
	7/10	—	24.0	34.5	6.6	—
	20/10	—	25.6	25.6	33.2	Sugar low, acetone high.
	31/10	111	25.0	41.3	22.4	—
	3/11	—	61.8	50.0	2.6	N.P.N. and sugar high, acetone low.
	7/11	—	—	—	—	Died suddenly. No P.M.
12.	16/9	—	35.3	51.3	1.6	Ration cut.
	29/9	97	33.3	39.4	8.1	—
	13/10	—	24.0	31.3	13.2	Sugar low, acetone above normal.
	20/10	—	73.2	52.6	7.0	N.P.N. and sugar high.
	23/10	—	—	—	—	Died suddenly. No P.M.
19	25/9	148	38.9	48.0	2.0	Put off ration.
	16/10	—	24.8	45.5	4.1	—
	31/10	131	27.8	41.7	4.5	—
	12/11	—	17.5	41.7	3.5	—
	3/12	—	19.1	47.2	5.1	—
	23/12	—	21.0	43.5	2.7	—
	13/1	—	20.7	48.8	3.0	—
	3/2	—	14.7	42.6	5.3	—
	24/2	97	24.0	43.3	5.1	—
	9/3	—	13.6	48.8	4.7	—
	31/3	—	20.0	27.5	20.4	High acetone, low sugar, after 187 days.
	7/4	—	21.4	37.9	27.5	—
	10/4	—	30.0	62.5	7.4	High sugar, normal acetone.
	12/4	—	—	—	—	Died after 199 days. Typical domsiekte. P.M.
20	25/9	139	30.9	42.9	2.3	Put off ration.
	9/10	—	23.1	38.5	4.1	—
	23/10	—	35.3	30.7	5.0	Died suddenly, typical domsiekte lesions.
21	15/10	142	28.0	46.7	1.9	Put off ration.
	31/10	134	30.0	41.7	4.3	—
	6/11	—	20.0	45.5	4.3	—
	24/11	124	18.6	40.7	6.2	—
	3/12	—	20.7	50.3	5.4	—
	23/12	106	29.2	46.5	5.1	—
	13/1	—	20.0	48.1	4.7	—
	27/1	88	23.3	53.7	4.7	—
	29/1	—	—	—	—	Died. Typical domsiekte lesions.

## APPENDIX IV—(continued).

Sheep No.	Date.	Body Weight (lb.).	BLOOD ANALYSES, mgm. (Per Cent.).			Remarks.
			N.P.N.	Sugar.	Total Acetone.	
28	18/6	—	30.9	55.0	3.5	—
	21/6	134	—	—	—	Put off ration.
	24/6	132	33.3	37.6	3.9	—
	1/7	128	25.2	20.8	3.5	Low sugar, normal acetone.
	15/7	120	—	—	—	—
	28/7	113	—	—	—	—
	21/8	—	25.4	44.3	43.7	Normal sugar, high acetone.
	26/8	—	—	—	—	Died, domsiekte lesions and enteritis at P.M.
29	15/10	131	30.0	47.6	2.5	Put off ration.
	31/10	125	37.0	43.1	8.1	—
	6/11	—	21.2	40.5	2.3	—
	26/11	—	60.0	40.3	3.0	—
	27/11	—	—	—	—	Died. Typical domsiekte lesions.
34	24/6	108	—	—	—	—
	17/7	—	31.4	44.3	3.5	Put off ration.
	21/7	—	45.4	32.7	4.5	—
	28/7	103	36.0	33.1	5.0	—
	21/8	—	60.0	59.5	31.5	High acetone with N.P.N. and sugar rising.
	26/8	—	—	—	—	Died, typical domsiekte P.M.
37	15/10	149	46.2	49.0	1.9	Put off ration.
	30/10	131	31.6	45.4	4.3	—
	12/11	—	120.0	69.0	2.9	—
	15/11	—	324.0	130.0	2.3	—
	17/11	—	—	—	—	Died pneumonia.