

## **Studies in Sex Physiology, No. 17.**

# **The Extent of the Gravid Merino Uterus in Relation to the Vertebral Column in the Dorsal Recumbent Position and the Weights of the Gravid Uterus and Foetus in Relation to the General Body Weight.**

By H. H. CURSON and A. P. MALAN, Sections of Statistics and  
Anatomy, Onderstepoort.

### INTRODUCTION.

THE observations made in connection with the relationship of the gravid uterus to the vertebral column are of academic interest, in that during life the uterus, which occupies a ventral abdominal position is separated from the vertebral column by the stomach and intestines. It is nevertheless instructive to note the increasing area "covered" (\*) by the uterus of the various intervals of pregnancy, particularly the cranial limit of the developing organ.

Of greater interest is the ratio not only between the weight of the gravid uterus to the general body weight (minus the weight of the unopened uterus); but also the relationship between the foetal weight and the general body weight of the mother (also minus the weight of the unopened uterus).

### LITERATURE.

Works on obstetrics, *e.g.* Craig (1930) and Wyman (1901), naturally refer to the usual relations of the enlarging uterus. Craig (p. 104) states that "in ruminants the gravid uterus passes into the abdomen and extends between the right sac of the rumen and the abdominal wall". Wyman adds (p. 7) that "the anterior free end not supported by the broad ligaments is covered by the great omentum".

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\* i.e. When the ewe is in the dorsal recumbent position.

The photographs accompanying our Study unfortunately illustrate only the increase of size of the uterus in relation to the lumbar and thoracic vertebrae. Hammond (1932), while not concerned with the position of the uterus in the abdominal cavity, gives useful information regarding the lumbar region of sheep. He indicates (*a*) in Table LVII (p. 216) that the lumbar formula of his animals was usually 6, and mentions (*b*) that "the variability which exists in the lumbar and also of the thoracic vertebrae . . . shows the possibility of increasing the comparative length of this part by selection". He adds (*c*) that "it appears probable . . . that the seat of greatest post-natal growth occurred at the end of the thoracic and beginning of the lumbar region". Nathusius (quoted by Hammond, p. 219) states that the actual length of the lumbar region is independent of the number of lumbar vertebrae, but as Hammond points out, he does not give the relative length of lumbar region to other parts in the sheep under consideration.

In regard to growth in foetal weight there is but little information available. In fact, Needham (1931) states that "Colin is the only investigator who has ever determined" this factor. The figure he reproduces (Fig. 39, p. 379, Vol. 1) shows the weight as a percentage of the system occupied by the embryo, foetal membranes and foetal fluids and not as a percentage of the weight of the ewe.

#### OUR OBSERVATIONS.

(*a*) Sisson (1917, p. 156) gives the vertebral formula of the sheep as C7, T13, L6-7, S4 and Cy 16-18, but our experience with the Merino shows that L 7 is more common than L6. Also in the adult, owing to the practice of docking lambs, the number of coccygeal segments remaining is less than half the normal number.

The details bearing on the relationship referred to in the title are summarised in Table I.

The increase in volume of the uterus may be judged by perusal of Figs. 1, 3, 5, 8, 11, and 13; but it may be added that whereas the greatest depth of the non-gravid uterus is approximately 3 cm., and 10 cm. after one month's pregnancy, this figure has increased to 15 cm. at full term.

It must be emphasised that the body of the uterus is exceedingly short (about 2-3 cm.) but owing to the posterior part of the horns being united by connective tissue and having a common peritoneal lining, a false idea may be obtained as to the extent of the body.

(*b*) From columns (2) and (4) have been calculated the percentage weight of the intact or gravid uterus to the general body weight.

The weights of the unopened uterus, expressed as a percentage of the weight of the ewe (less weight of unopened uterus) [Table I, column (6)], are represented graphically on the accompanying chart. It is to be noted that the values in Table I, columns (4) and (6), marked with an asterisk, are approximately double the value to be expected from a comparison of the whole series.

TABLE I.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Number of ewe.	Live weight of ewe. (Kg.)	Stage of gestation. (Days.)	Weight of unopened uterus (Gm.) <sup>(1)</sup>	Weight of ewe less weight of uterus unopened. (Kg.)	Weight of unopened uterus as a percentage of the weight of the ewe <sup>(11)</sup> . (%)	Weight of foetus as a percentage of the weight of the ewe <sup>(11)</sup> . (%)	Number of lumbar vertebrae.	Pre-sacral vertebrae 'covered' by uterus.
38584.....	38.56	Non-gravid.	158	—	—	—	7	2 (see fig. 2).
25924.....	38.56	3	163	38.39	0.4	0.00	7	2 (see fig. 4).
35712.....	27.44	31	165	27.82	0.6	0.00	7	2
38510.....	38.78	55	870	37.91	2.3	0.11	—	—
35659.....	34.13	61	2,000*	32.13	6.2*	0.22	6	7 (see fig. 6).
35592.....	31.75	64	1,440*	29.93	4.8*	0.27	7	7 (see fig. 7).
33131.....	33.57	92	2,090	31.47	6.6	1.96	7	11 (see fig. 9).
39904.....	39.46	94	2,155	37.31	5.8	1.82	7	9½ (see fig. 10).
32969.....	38.10	107	2,982	35.12	8.5	3.76	—	—
35976.....	35.38	122	3,380	32.00	10.6	6.97	7	12 (see fig. 12).
45023.....	42.86	±149	3,700	37.16	15.3	10.09	7	12

<sup>(1)</sup> This includes vulva vagina, fallopian tubes and ovaries. In Study 12, column 4, the heading obviously should read "Approximate total weight of unopened uterus." There the weight included the oviducts and ovaries.

<sup>(11)</sup> Less weight of unopened or gravid uterus.

From earlier observations (Sex Physiology, Study 10) it appears that the weight of the unopened uterus (Ewe 180) at a gestation age of 64 days is 1,000 gm.,\* in which case the weight of the unopened uterus is approximately 3.25 per cent. of the weight of the ewe. This value, 3.25 per cent., is also shown on the chart by a square dot and evidently lies very near the expected value.

Ignoring the values for 61 and 64 days, given in Table I, column (6) and marked with an asterisk, a smooth curve has been drawn through the data, its equation being:—

$$y = 0.00131 x^{1.875},$$

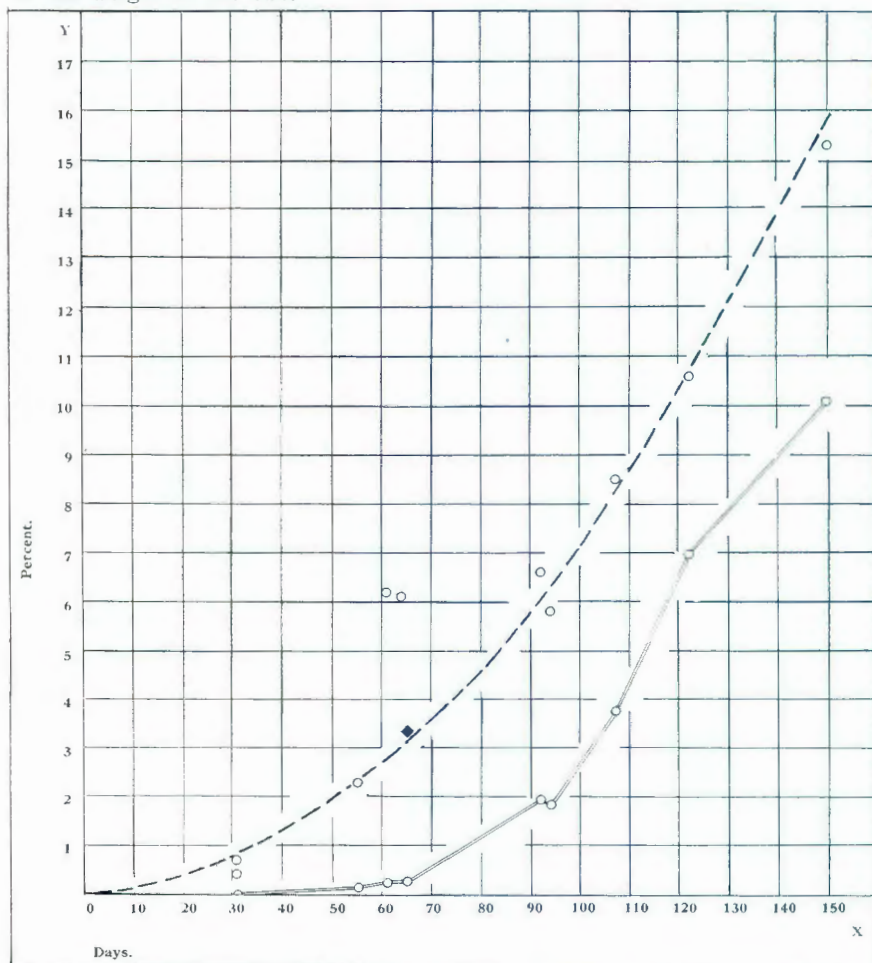
where  $x$  = gestation period in days,

$$y = 100 \times \frac{\text{weight of unopened uterus,}}{\text{weight of the ewe-wt. of the unopened uterus.}}$$

\* Subsequently (3.2.36) ewe 30169 was killed on 61st day of pregnancy and the weight of the unopened uterus was 1,192 gm.

CHART I.

Weight of (a) the unopened uterus and (b) the foetus as a percentage of the weight of the ewe.



The weight of the foetus, expressed as a percentage of the ewe weight [Table I column (7)] is also represented on the chart. These points are joined by a series of *straight* lines. It is to be observed that the foetus weights for 61 and 64 days show no such irregularity as was observed in the weights of the unopened uterus. This strengthens the conclusion that the discrepancies mentioned are more likely due to an error than to individual variation.

## SUMMARY.

The increasing extent of the gravid uterus is well illustrated in the Figs. 1, 3, 5, 8, 11, and 13, and the relationship [see column (9) of Table I] to the vertebral axis in Figs. 2, 4, 6, 7, 9, 10 and 12.

The weights of the unopened uterus and of the foetus alone are expressed as percentages of the ewe weight (minus unopened uterus). Details are set down in columns (6) and (7) of Table I and a diagrammatic representation is given in the chart.

## REFERENCES.

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## ADDENDUM.

Further to the data recorded above, subsequent observations have been made as follows:—

(a) The extent of the vertebral axis "covered" by the gravid uterus (the ewe being in the dorsal recumbent position) at the various stages of pregnancy is shown in the following tabulated summary:—

No. of Ewe.	Stage of Gestation.	Presacral vertebrae "covered" by uterus.
35894.....	32 days	4
44803.....	33 "	4
45082.....	60 "	6
44849.....	60 "	6
15337.....	90 "	11
21665.....	90 "	9
44679.....	121 "	14
38521.....	121 "	14
44397.....	145 "	13
30514.....	146 "	14

In these observations, as in the former series, the cranial limit of the uterus was determined *after* the stomach and intestines had been removed. Obviously if determined *before* removal of the viscera, the cranial limit in advanced pregnancies would not have been so far anterior owing to the influence of the interposing organs.

As would be expected there is a general agreement between the observations recorded here and in the former series.

(b) In regard to the relationship between the (i) gravid uterus and (ii) foetus, and the ewe weight less weight of gravid uterus expressed as a percentage, the additional data, *i.e.* obtained from the ewes above, will be included in a further discussion on the subject in Sex Physiology Study 18.



Fig. 1.—Ewe 38548, non-pregnant. Ventral view of uterus.  
( $\pm \frac{1}{4}$  of original.)



Fig. 2.—Bony pelvis of Ewe 38548, non-pregnant.  
The uterus extends over 2 presacral vertebrae.  
( $\pm \frac{1}{4}$  of original.)



Fig. 3.—Ewe 25924, pregnant 31 days. Ventral view of gravid uterus, right horn pregnant. ( $\pm \frac{1}{4}$  of original.)



Fig. 4.—Ewe 25924. The 31 days pregnant uterus extends over 2 presacral vertebrae. ( $\pm \frac{1}{4}$  of original.)



Fig. 5.—Ewe 35659, pregnant 61 days. Ventral view of gravid uterus, left horn pregnant. ( $\pm \frac{1}{4}$  of original.)





Fig. 6.



Fig. 7.

Fig. 6.—Ewe 35659. The 61 days pregnant uterus extends over 7 presacral vertebrae. ( $\pm \frac{1}{4}$  of original.)

Fig. 7.—Ewe 35592. The 2 months (64 days) pregnant uterus extends over 7 presacral vertebrae. ( $\pm \frac{1}{4}$  of original.)



Fig. 8.—Ewe 33131, pregnant 92 days. Ventral view of gravid uterus, right horn pregnant. ( $\pm\frac{1}{4}$  of original.)



Fig. 9.



Fig. 10.

Fig. 9.—Ewe 33131. The 92 days pregnant uterus extends over 11 presacral vertebrae. ( $\pm \frac{1}{4}$  of original.)

Fig. 10.—Ewe 39904. The 3 months pregnant uterus extends over  $9\frac{1}{2}$  presacral vertebrae. ( $\pm \frac{1}{4}$  of original.)



Fig. 11.—Ewe 35976, pregnant 122 days.  
Ventral view of gravid uterus, left horn pregnant.  
( $\pm\frac{1}{4}$  of original.)



Fig. 12.—Ewe 35976. The four months pregnant uterus extends over 12 presacral vertebrae. ( $\pm\frac{1}{4}$  of original.)



Fig. 13.—Ewe 45023, pregnant about 149 days.  
Ventral view of gravid uterus, left horn pregnant.