

From the Department of Reproductive Physiology and Pathology,  
Veterinary College of Norway, Oslo.

## STUDIES ON REPRODUCTION IN THE GOAT

### IV. THE FUNCTIONAL ACTIVITY OF THE UTERINE HORNS OF THE GOAT\*)

By

*Olav Lyngset*

In a previous paper the functional activity of the ovaries of the goat has been discussed (*Lyngset 1968 b*). The present paper deals with the functional activity of the two uterine horns of this animal species.

The frequency with which the foetus is situated in the two uterine horns has been investigated in most uniparous domesticated animals. It has been shown that the foetus may be more frequently localized in the one uterine horn than in the other.

In the cow where the tendency to transuterine migrations of the embryo is small (*Boyd et al. 1944*) the frequent localization of the foetus to the right uterine horn follows the high incidence of ovulations in the right ovary. The great majority of cows will be pregnant in the right uterine horn. *Schmaltz* (quoted by *Clark 1936*) goes so far as to claim that left-sided pregnancy in the cow is abnormal. Out of 704 single pregnancies *Clark*, on clinical examination, found 293 or 42 % of the foetuses in the left horn and 411 or 58 % in the right one. *Schramm* (1937) found among 1213 pregnant cows examined 60.51 % of the foetuses in the right uterine horn.

*Kedrov* (quoted by *Boyd et al.*) by rectal examinations of 574 mares during 804 oestrous cycles found that ovulation occurs

---

\*) This investigation was financially supported by the Agricultural Research Council of Norway.

15—20 % more often in the left ovary. The foetuses, however, were more frequently (25—30 %) observed in the right uterine horn.

In the goat *Taneja* (1959) examined 160 gravid uteri. He found the foetuses in the right horn in 62.9 % of all the pregnancies. *Basu et al.* (1961) found corresponding values in their material. In 59 % of the pregnancies the foetus was situated in the right uterine horn.

### MATERIAL AND METHODS

Genital organs from goats at different stages of pregnancy were collected from various slaughterhouses. The collection has previously been described in detail (*Lyngset* 1968 a). No information regarding the animals before slaughtering was available.

### RESULTS

The placement of the foetus in the uterus is recorded in Table 1. Out of 246 single pregnancies, 125 of the foetuses were localized in the right horn, 119 in the left horn and 1 in the body

Table 1. The localization of the foetuses in the right and left uterine horn.

Single pregnancies	245	
Foetus in right horn	125	51.02 %
Foetus in left horn	119	48.57 %
Foetus in corpus uteri	1	0.41 %
Total number of foetuses	551	
Foetus in right horn	283	51.36 %
Foetus in left horn	267	48.46 %
Foetus in corpus uteri	1	0.18 %

of the uterus. In one case the localization of the foetus could not be verified. A total of 551 foetuses were recorded and of these 283 or 51.36 % were situated in the right uterine horn. In six twin pregnancies the foetuses were situated in the same horn. There were five cases with both foetuses in the right horn and one case with both foetuses in the left horn. In twin pregnancies, in this material, the foetuses were situated in the same horn in 4.1 % of the cases.

Table 2. The sex ratios of the foetuses.

Number of foetuses with verified sex	234	
Number of ♂	139	59.4 %
Number of ♀	91	38.9 %
Number of ♂ ♀	4	1.7 %
Number of foetuses in right uterine horn	120	
Number of ♂	77	64.2 %
Number of ♀	43	35.8 %
Number of foetuses in left uterine horn	110	
Number of ♂	62	56.4 %
Number of ♀	48	43.6 %

The sex ratios of the foetuses are shown in Table 2. Out of 234 foetuses 59.4 % were males, 38.9 % females and 1.7 % hermaphrodites. In the right uterine horn 64.2 % of the foetuses were males in comparison to 56.4 % males in the left uterine horn. In Table 3 is shown the sex of the foetuses in relation to the uterine horn in which they are located. From this table also a more frequent localization of male foetuses in the right uterine horn can be seen.

Table 3. The sex of the foetuses in relation to the uterine horn in which they are located. Hermaphrodites excluded.

		Number of cases with foetuses in right uterine horn			
		♂	♀	2 ♂	♂ ♀
		39	15	1	3
Number of cases with foetuses in left uterine horn	♂	27	16	14	
	♀	21	16	10	
	2 ♂	1	1		
	♂ ♀			1	

The frequency of transuterine migration of the embryo or „cross pregnancies” is shown in Table 4. In 149 single pregnancies where only one ovum had been shed, 61 cases of transuterine migration of the foetus occurred. That means, that in 40.94 % of single pregnancies with single ovulations the embryo will be implanted in the uterine horn which is opposite the ovary from which the ovum is shed. In 37 cases one corpus luteum was found

Table 4. The incidence of cross pregnancies.

	Cases with one foetus in right uterine horn	Cases with one foetus in left uterine horn	Cases with one foetus in each uterine horn
1 c. l. in right ovary		37	3
2 c. l. in right ovary		15	32
3 c. l. in right ovary		1	2
1 c. l. in left ovary	24		2
2 c. l. in left ovary	7		30

in the right ovary while the foetus lay in the left horn. The opposite had occurred in 24 cases. Where two ova had been shed from the right ovary and one had been lost, the foetus was placed in the left horn in 15 out of 33 cases; while in seven of 19 cases the foetus had migrated to the right horn with ovulation of two follicles in the left ovary and loss of one ovum. Where two follicles had ovulated in the same ovary and both had been the origin of foetuses, one of the foetuses had migrated, in 32 cases, from the right to the left, and in 30 cases, from the left to the right. In one case the eruption of two follicles from the left ovary was recorded, while both foetuses were situated in the right uterine horn.

#### DISCUSSION

Of the 397 pregnant organs which were examined in this material 246 or 61.96 % were single pregnancies, 147 or 37.03 % were twin pregnancies and four or 1.01 % triple pregnancies. These values agree well with results previously published (*Lyngset* 1966). The number of twin pregnancies in the goat in Norway is low compared to what is reported from other countries. *Honeker* (1950) quotes *Richter & Machens* who report that on the average there are 27 % single kids, 57 % twins, 13.5 % triplets, 2 % quadruplets and 0.3 % quintuplets born. *Richter & Machens'* material apparently also includes young goats. The frequency of twin pregnancy is lower in the goat in the first two to three pregnancies than later. A material including only adult goats that have had two or three kids will give other results than a material that includes all goats. *Hinterthür* (1938) reports that out of 391 pregnancies 28.4 % were single, 59.8 % twin, 11.3 triplet and 0.5 quadruplet pregnancies. For the total goat population the frequency of twin pregnancy lies 10—15 % lower

for the goats in Norway than for the breeds of goats from which the above mentioned authors have collected their material.

The ratio between male and female is somewhat higher than previously found (*Lyngset* 1966). This material includes foetuses of different ages. The proportions of males is higher than that recorded at birth (54.7 %). It might well be, however, that at the time of conception a larger number of males than females are conceived and that in the foetal period a larger number of males will disappear so that the ratio between the sexes will approach 50:50.

It has been demonstrated in other animal species that the primary sex ratio is different from the secondary. In the guinea-pig, for instance, the sex ratio at birth is 50.6 % males. Among foetuses of various ages 55.9 % are males (*Asdell* 1964).

Out of 230 foetuses of verified sex 120 or 52.2 % were localized in the right uterine horn and 110 or 47.8 % in the left. A significantly greater number of male than female foetuses were localized in the right uterine horn. It was not possible to demonstrate a similar difference in the left horn.

Judging from this material there does not seem to be any essential difference in the functional activity of the two uterine horns. There is no statistically significant difference between the right and the left horn. These results are not in agreement with those given by *Taneja* (1959) and *Basu et al.* (1961). The authors mentioned found 62.9 and 59 % respectively of the foetuses localized in the right horn. It has not been possible to find other information about these conditions in the goat.

There must be a great racial difference between the breed of goat from which this material stems and the breeds from which the above-mentioned authors have collected their material. The tendency to intrauterine migration of the ova is also considerably greater in the present material.

As mentioned previously, the ova or ovum, in a relatively large percentage, will be shed from the ovary opposite to the uterine horn in which the foetus develops. This phenomenon is termed "cross pregnancy", "intrauterine", "internal" or "trans-uterine" migration of the ovum. According to *Boyd et al.* (1944) the terms transuterine and transperitoneal migration is used. At some time or another before implantation, the ovum will migrate through the one uterine horn and out into the other via the body of the uterus.

Transuterine migration of the ova occurs in all domesticated animals, but relatively seldom in the cow (*Boyd et al.*). In this material a frequency of transuterine migration of the foetus of 40.94 % has been found in the single pregnancies. This frequency is considerably higher than what has been reported earlier for the goat.

*Tsukaguchi* (quoted by *Boyd et al.*) found one case at least in 14 organs examined. *Taneja* reports a percentage of "cross pregnancies" of 18, while *Basu et al.* report 22.3 %.

*Casida et al.* (1966) in sheep found a marked tendency to migration of the ovum in twin pregnancies when both corpora lutea were found in the same ovary. In single pregnancies, however, they found that migration of the ova was unusual. In the goat too it is usual in twin pregnancies, also in cases where both ova are shed from the same ovary, that one of the embryos migrates into the other uterine horn. In the single pregnancies there appears to be a great tendency for the ova to migrate towards the left uterine horn. This tendency of migration to the left will reduce the effect of a higher incidence of ovulations in the right ovary so that this is not followed by equally frequent localization of the foetuses in the right uterine horn.

The possibility is, of course, also present that in some of the cases here recorded as transuterine migration of the ovum, a transperitoneal migration of the ovum can have occurred. Transperitoneal migration of the ovum has been described particularly in rodents and man (for ref. see *Boyd et al.*), but its occurrence is rare. To our knowledge no conclusive evidence of this phenomenon in our domesticated mammals is to be found.

The mechanism behind the transuterine migration of the ovum is little understood. It is assumed that the peristaltic and antiperistaltic movements in the uterus play a part, but this is by no means the whole explanation (*Boyd et al.*).

#### REFERENCES

- Asdell, S. A.*: Patterns of mammalian reproduction. Publishing Inc., Ithaca 1964.
- Basu, S., S. K. Goswami & S. K. De*: Studies on the genitalia of the she-goat. Indian vet. J. 1961, 38, 302—304.
- Boyd, J. D., W. J. Hamilton & J. Hammond jr.*: Transuterine ("internal") migration of the ovum in sheep and other mammals. J. Anat. (Lond.) 1944, 78, 5—14.

- Casida, L. E., C. O. Woody & A. L. Pope:* Inequality in function of the right and left ovaries and uterine horns of the ewe. *J. Animal Sci.* 1966, 25, 1169—1171
- Clark, C. F.:* Does the right ovary of the bovine function more frequently than the left. *J. Amer. vet. med. Ass.* 1936, 88, 62—65.
- Hinterthür, E.:* Die Tragzeit der Ziegen. *Züchtungsk.* 1938, 8, 55—62.
- Honeker, A.:* Die Krankheiten der Ziege. Verlag für Kleintierzucht. H. Welkershaus, Dortmund 1950.
- Lyngset, O.:* Fruktbarhet hos geit. *Medlemsbl. norske Vet.-foren.* 1966, 3, 68—72.
- Lyngset, O.:* Studies on reproduction in the goat. I. The normal genital organs of the non-pregnant goat. *Acta vet. scand.* 1968 a, 9, 208—222.
- Lyngset, O.:* Studies on reproduction in the goat. III. The functional activity of the ovaries of the goat. *Acta vet. scand.* 1968 b, 9, 268—276.
- Schramm, W.:* Untersuchungen über Links- und Rechtsträchtigkeit beim Rinde. *Dtsch. tierärztl. Wschr.* 1937, 45, 387—389.
- Taneja, G. C.:* Observations on foetal losses in goat. *Indian vet. J.* 1959, 36, 439—441.

#### SUMMARY

1. A study of a total of 397 genital organs from goats in various stages of pregnancy was undertaken.
2. Totals of 61.96 % single pregnancies, 37.03 % twin pregnancies, and 1.01 % triplet pregnancies were observed.
3. Among 234 foetuses 59.4 % were males, 38.9 % females and 1.7 % hermaphrodites.
4. A significantly greater number of male than female foetuses are localized in the right uterine horn.
5. In single pregnancies where only one ovum has been shed a frequency of transuterine migration of the ovum of 40.94 % is found.
6. There appears to be a great tendency for the ovum to migrate towards the left uterine horn.

#### ZUSAMMENFASSUNG

##### *Untersuchungen über die Reproduktion bei Ziegen.*

#### *IV. Die funktionelle Aktivität in den beiden Gebärmutterhörnern der Ziege.*

1. Eine Untersuchung von insgesamt 397 Geschlechtsorganen von Ziegen an verschiedenen Entwicklungsstufen in der Trächtigkeit ist vorgenommen worden.
2. Es wurden 61,96 % Einzelträchtigkeiten, 37,03 % Zwillingträchtigkeiten und 1,01 % Drillingträchtigkeiten registriert.
3. Unter 234 Früchten waren 59,4 % männlichen Geschlechts, 38,9 % weiblichen Geschlechts und 1,7 % Hermaphroditen.

4. Im rechten Gebärmutterhorn wurden statistisch gesichert mehr Früchte männlichen Geschlechts als weiblichen Geschlechts lokalisiert.
5. Die Frequenz der transuterinen Migration der Früchte war 40,94 %.
6. Es scheint eine deutliche Tendenz dazu zu sein, dass die Früchte gegen das linke Gebärmutterhorn wandern.

#### SAMMENDRAG

##### *Undersøkelser over reproduksjonen hos geit.*

##### *IV. Den funksjonelle aktiviteten i de to uterushorn hos geit.*

1. Det er foretatt en undersøkelse av i alt 397 kjønnsorganer fra geit på forskjellige stadier i drektigheten.
2. Det er registrert 61,96 % enkeltdrektigheter, 37,03 % tvillingdrektigheter og 1,01 % trillingdrektigheter.
3. Blant 234 foster var 59,4 % hannkjønn, 38,9 % hunnkjønn og 1,7 % hermafroditter.
4. Det er signifikant flere foster av hannkjønn enn av hunnkjønn lokalisert i høyre uterushorn.
5. Det er funnet en frekvens av transuterin migration av embryo på 40,94 %.
6. Det synes å være en markert tendens for embryo å vandre mot det venstre uterushorn.

*(Received May 22, 1968).*