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DEVELOPMENTAL DYNAMICS OF THE CAPRINE *(Capra aegagrus* f. *hircus)* FORESTOMACH IN THE POSTNATAL PERIOD

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Abstract

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Basic morphometric data characterizing the developmental dynamics of the forestomach compartments were investigated in 52 male goats (*Capra aegagrus* f. *hircus*) between post partum (pp) days (d) 2 and 232. The parameters under study included ruminal, reticular and omasal volumes, circumferences and empty mass. Attention was also paid to the development of the mucosal structures. Ruminal volume increased between pp days 30 and 90 at a rate exceeding that of live body mass gains. The ratio between the rates of the ruminal and the overall body growth reverted only from pp d 108. The variability of the increase of the empty ruminal mass and maximal volume was very high from pp d 90; this was due to differences in the change from milk to roughage feeding. Ruminal papillae, which differentiated between pp d 7 and 10, assumed their flat and tongue-like shape after pp d 30. Their growth is stimulated by the absorption of volatile fatty acids and the height depends on the localization, varying from 5 - 7 mm in the ventral part of the ruminal atrium to 1 - 3.5 mm in other ruminal parts and to zero or 0.5 mm on the ruminal pillars and in the dorsal part of the dorsal sac. Reticular mass and volume followed those of the rumen. The volumes increased markedly from pp d 180.

Empty mass of the reticulum increased rapidly only from pp d 90 and its volume between pp d 40 and 90 and after pp d 210. The mucosal reliefs of the rumen and reticulum differentiated along with the development of their functions.

Goat, forestomach, morphometry, rumen, reticulum, omasum, development of mucosal relief, ontogenesis.

The current growth of interest in goat husbandry has been motivated by the particular characteristics in the choice and intake of food, milk composition and the mode of its production, and the alleged therapeutic effect in some human diseases. Also important is the growing demand for certain goat milk products. These facts have led us to investigations aimed at the completion of basic morphometric data of the forestomach in the local goat breed. Compared with the abundance and relative completeness of data on the anatomy of the bovine and ovine forestomachs, those concerning the caprine forestomach, particularly is morphological characteristics in the early postnatal, milk nutrition and weaning periods and at the time of the change to feeding with roughage, are unsatisfactory.

Most of textbooks of morphology quote early data on the capacity and morphologic development of the caprine forestomach published along with the data on the ovine forestomach under the common heading of "small ruminants", although species and breed differences are evident (Lambert 1948).

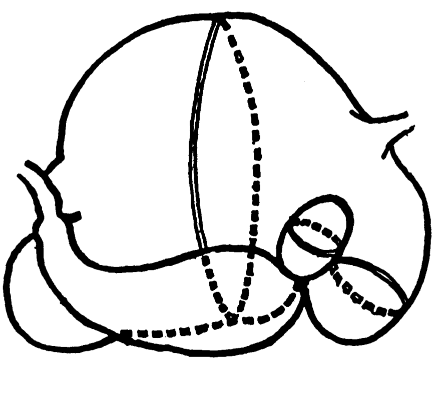
Earlier publications (Auernheimer 1909; Lagerlöf 1930; Friedrich 1942, as quoted by Ellenberger and Baum 1974) usually describe ruminal volumes in adult goats. Moreover, the data were obtained by different methods and reflect rather the distention of the forestomach ensuing immediately after exenteration than the actual physiological condition. Wilkens (1956) described the topography of the caprine digestive organs, but did not investigate the relative sizes of the forestomach compartments, nor the development of the mucosal relief. Textbooks of veterinary anatomy (Ellenberger and Baum 1934, 1974; Church 1972; Nickel et al.1960, 1973;

N a j b r t et al. 1973) contain only a very brief data on the postnatal ontogenesis of the caprine forestomach.

The current interest in the ruminal absorption has incited a series of studies pointed to the microscopic and submicroscopic structure of the ruminal, reticular and omasal mucosae, primarily in cattle and sheep. The reliefs of the bovine and caprine ruminal mucosae were described, among others, by S c h n o r r and V o l l m e r h a u s (1967), while H o f m a n n (1969) chose several species of tropical ruminants for similar studies. Although a large number of papers on functional morphology of the ruminal epithelium has been published, most of them are irrelevant to the topic dealt with here, because they omit the basic macroscopic characteristics of the forestomach and pertain only to cattle and sheep. The links between the anatomical and functional characteristics were investigated by T a m a t e (1957) in domestic goats and by B e r g et al. (1986a, b) in dwarf goats. However, T a m a t e (1957, as quoted by C h u r c h 1972) measured only the volumes of the ruminoreticulum and omasoabomasum and his investigations covered only the period between pp days 1 and 72. On the basis of own results and data published by other authors, C h u r c h (1972) postulated that the development of the caprine forestomach was finished at the age of 7 to 9 months (210 - 270 days) - a period which was practically identical with that covered by our morphometric studies. Our choice of the male goats and the age limit resulted from the availability of the animals; older male goats are sold at auctions and included into breeding. The aim of the measurements presented here was to obtain, in a defined goat breed, the basic morphologic data reflecting the dynamics of the functional development of the forestomachal compartments and mucosal structures from birth up to and including the period of change to nutrition with forages.

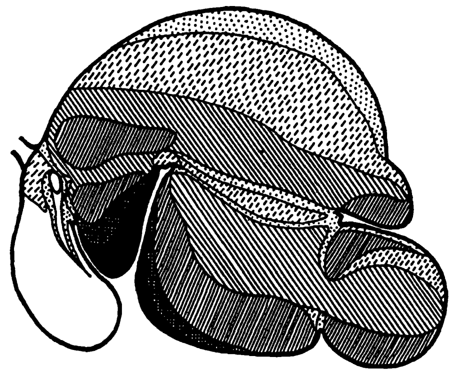
Materials and Methods

Morphometric values of the caprine forestomach compartments and the macroscopic development of the mucosal relief were investigated in 52 male goats (*Capra aegagrus f. hircus*) of the White Shorthaired Hornless breed aged 2 to 230 days. Standard individuals were selected and slaughtered at two-day intervals during the first two weeks of age and the intervals were prolonged to 5 - 7 days for the period covering pp days 15 - 60 and to approximately 30 d from pp d 90 up to the end of the experiment. All the animals were weighed before slaughter and volumes of the forestomach and its compartments were measured immediately after exenteration of the forestomach, abomasum and intestines and ligation of the cardia. The contents of the forestomach and abomasum were fixed with 20% formalin to prevent postmortal distention resulting from microbial fermentation. Later, 5% formalin was injected into the forestomach to set off the shape of the limp ruminal and reticular walls. This treatment prevented not only the microbial fermentation, but also the constriction (up to 30%) occurring in some tissues and organs as a result of fixation with formalin. The full forestomach was photographed and circumferences (see Scheme 1) and volumes (volume of forced-out liquid) were measured. The compartments were separated after closing the inlet and outlet openings with forceps or ligatures and their volumes were measured. Then the compartments were emptied, thoroughly washed and, after dripping, weighed. Their inner surfaces were photographed and the height of papillae in various parts of the rumen (see Scheme 2), the size of reticular cells, the number and size of omasal folds, the shapes of the reticular and omasal grooves, and the pattern of mucosae in openings connecting the forestomach compartments and the abomasum were recorded.

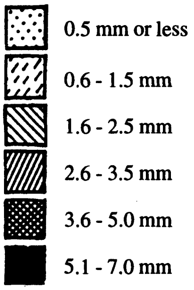


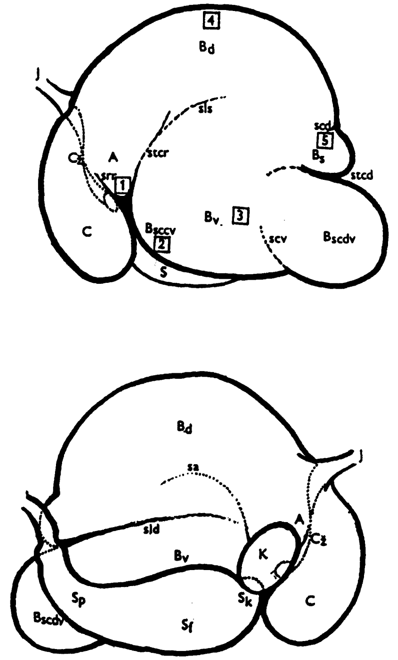
Scheme 1: Sites of measurements of ruminal, reticular and omasal circumferences

Samples for further examinations (counting of papillae per 1 cm^2, histology, electron microscopy) were also collected from various parts of the rumen (see Scheme 3). The results of the examinations will be published in a separate paper.



Scheme 2: Distribution of ruminal papillae by their heights (pp d 230)





Scheme 3: Caprine forestomach and abomasum (pp day 230). 1 - 5 = sampling sites for histological examinations and counting of papillae

A – atrium ruminis, B_d – saccus dorsalis, B_v – saccus ventralis, B_s – saccus caecus caudodorsalis, B_{scdv} – saccus caecus caudoventralis, srr – sulcus ruminoreticularis, stcr – sulcus transversus cranialis, sls – sulcus longitudinalis sinister, scd – sulcus coronarius dorsalis, stcd – sulcus transversus caudalis, scv – sulcus coronarius ventralis, sld – sulcus longitudinalis dexter, sa – sulcus accesorius, J – oesophagus, C – reticulum, C_z – sulcus reticuli, K – omasum, S – abomasum, S_k – pars cardiaca abomasi, S_f – pars fundalis abomasi, S_p – pars pylorica abomasi

Results and Discussion

Rumen

The development of the forestomach is controlled by the genetic code, age-dependent growth and differentiation of the mucosal structures, and considerably also by the food quality and quantity. While the pattern is rather uniform in individuals of the same age, breed and sex during the early ontogenesis, variations increase during and after weaning. The values of the maximal volumes and masses of the forestomach compartments in animals of various live body mass and ages are presented in Figs. 1 and 2, respectively. The curves reflect differences in the onset of the development of mass and volumes of the rumen, reticulum and omasum, corresponding to differences in the onset of the full functional activity during the milk feeding, weaning (approx. on pp d 90) and the gradual change to foraging (from pp d 30) periods.

While the ruminal volume grows between pp days 30 and 90 at a rate exceeding that of live body mass gains, empty weights begin to increase from pp day 7 and the growth rate exceeds that of live weight only after pp d 30. The rate of increase of empty weight is highest between pp d 30 and 90. Individual variations are low until pp d 30, but grow, particularly those of empty ruminal mass, from pp day 90 apparently owing to differences in the time of weaning and the change to roughage. The high individual variations of empty

Table 1
Empty mass of forestomach compartments (g)

Age cat.	Age (days)	n	Live body mass (g)		Empty mass (g)					
					Rumen		Reticulum		Omasum	
			ø	v±	ø	±	ø	±	ø	±
I	1–5	5	2,730	178	15.8	1.19	4.3	0.23	3.1	0.43
II	8–14	6	4,350	776	25.1	7.80	6.2	1.10	3.5	0.53
III	21	4	6,350	1 626	37.6	6.92	7.3	1.90	4.7	1.69
IV	26–33	5	7,240	1 092	63.8	17.93	13.7	2.89	6.5	1.46
V	48–56	5	10,070	896	164.3	22.27	30.6	3.78	14.0	1.80
VI	88–109	8	13,880	2 944	332.5	72.06	52.1	7.35	30.4	5.90
VII	120	4	14,800	983	370.0	70.71	43.7	7.50	31.3	4.27
VIII	140–150	5	17,400	2 124	397.5	52.36	63.7	6.29	48.2	2.36
IX	180–190	5	21,620	5 142	454.0	66.18	76.0	24.08	71.8	23.04
X	212–232	5	32,100	7 130	603.0	36.09	112.5	25.0	80.0	23.45

n= number of animals

Table 2
Maximum volumes of forestomach compartments (ml)

Age cat.	Age (days)	n	Live body mass (g)		Rumen (ml)		Reticulum (ml)		Omasum (ml)	
			ø	±	ø	±	ø	±	ø	±
I	1–5	5	2,730	178	31.4	5.4	3.9	0.79	2.5	0.45
II	8–14	6	4,350	776	54.8	8.5	8.3	1.64	6.5	0.21
III	21	4	6,350	1 626	177.5	3.5	25.0	0.0	8.1	1.14
IV	26–33	5	7,240	1 092	266.0	31.5	57.0	23.78	9.2	1.16
V	48–56	5	10,070	896	1683.3	284.3	100.0	20.00	38.3	2.88
VI	88–109	8	13,880	2 944	2568.7	179.2	155.0	43.75	85.6	9.03
VII	120	4	14,800	983	2512.5	278.0	151.0	38.81	95.0	36.74
VIII	140–150	5	17,400	2 124	2987.5	413.1	181.0	114.33	113.7	13.14
IX	180–190	5	21,620	5 142	3859.0	1401.7	196.0	88.35	145.0	48.09
X	212–232	5	32,100	7 130	4500.0	1065.4	500.0	141.42	213.7	41.90

ruminal masses persisted up to the end of the observation period. In its final phase (pp d 210 - 230), the rate of live body mass gains and their variations increased as a result of pre-auction freshening (Table 1).

The dynamics of the ruminal growth corresponded to those of live body mass gains from pp day 90 up to the end of the observation period (Table 2). The increase of empty mass, resulting from the thickening of the ruminal wall, was followed by an increase of the volume due to dilatation (Plate 2, Figs. 11 and 12). This change is evident particularly in the dorsal and the posterior ventral blind sacs.

Ruminal papillae develop only after birth. In 2- to 5-day-old kids, they are visible as low, semispherical projections distributed uniformly over the whole surface of the ruminal mucosa including the ruminal pillars. From pp days 7 - 10, the ruminal papillae with circular cross sections began to differentiate and from pp d 30, i.e. at the time of the onset of the ruminal functions, they flattened and assume the typical tongue-like shape. On the pillars, the papillae remained low, were often arranged in rows, or disappeared (Plate 2, Fig. 16). The height of the papillae, which was measured in various areas of the ruminal mucosa (see Scheme 2), was obviously associated with the rate of absorption of volatile fatty acids (J e l í n e k et al. 1989). The maximal growth rate was observed in the ruminal atrium and in the anterior part of the ventral sac. The distribution of the papillae by their heights in male goats with fully functional rumens (aged 230 days) is shown in Scheme 2. The highest (up to 7 mm) and most numerous papillae are found in the ruminal atrium (Plate 2, Fig. 14b) and the ventral sac. On the other hand, the lowest (up to 0.5 mm) and the least numerous ones are found in the dorsal part; this is obviously due to the dilatation and thinning of the dorsal ruminal wall. The number of the papillae per 1 cm^2 can hardly be related to the rate of absorption or used for the determination of the area of the absorption surface as attempted by B e r g et al. (1986) in goats. The fully developed, tongue-like papillae were arranged obliquely to the surface and attempts to stretch as small an area as 1 cm^2 resulted in places in an aggregation of the papillae leaving other places free of the papillae. The number of papillae per 1 cm^2 decreased as the ruminal volume and inner surface area increased by dilatation of the ruminal wall. The decrease, however, was not proportional to the volume and surface area changes, because the differentiation and formation of new papillae continue after birth. In the early phase, the newly formed papillae were low and as their tips did not reach the level of the mucosal relief they may have escaped counting. The arrangement of the papillae in a fully functional rumen in various age categories is evident from Figs. 13 and 15.

The values of the maximal ruminal circumference (see Scheme 1 and Table 1) are of a limited significance and subject to methodological errors. The shape of the rumen differs somewhat from the conventional descriptions of the ruminants' rumen. Compared with the bovine rumen, the ruminal insula is often absent, the posterior dorsal blind sac is less marked off and the posterior ventral blind sac is larger. The arrangement of the sacs and grooves in 230-day-old animals is shown in Scheme 3.

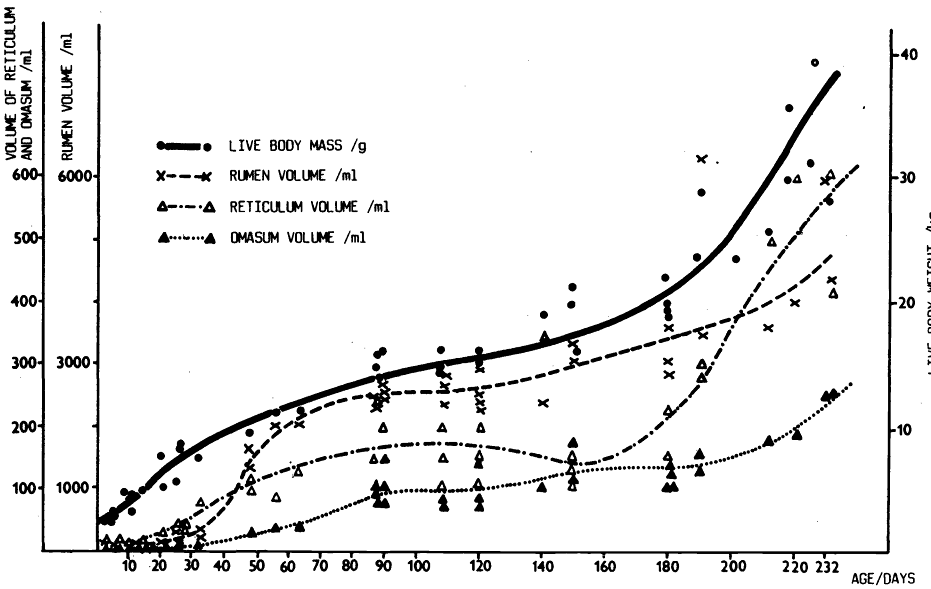


Fig. 1. Volumes of caprine forestomach compartments. Live body mass given in kg.

The functional development of the reticulum follows that of the rumen. Individual variations in the increase of its empty mass are relatively small (Fig. 2). The reticular volume began to increase markedly between pp days 20 and 30. The variations became rather high from pp d 90 reflecting the functional status of this compartment. Occasionally, a decrease of mean volume values was observed between pp d 120 and 180, probably as a result of differences in ration sizes. Generally, the volume of the caprine reticulum relative to the volumes of the remaining forestomach compartments is higher than in cattle (N i c k e l et al. 1960). The developmental changes of the volume are also reflected in the size of reticular cells. The dilatation of the reticular wall was accompanied by an enlargement of the cells and those in the ventro-cranial part reached the size of 14 to 24 mm towards the end of the observation period. Small and uniform grounds of the reticular

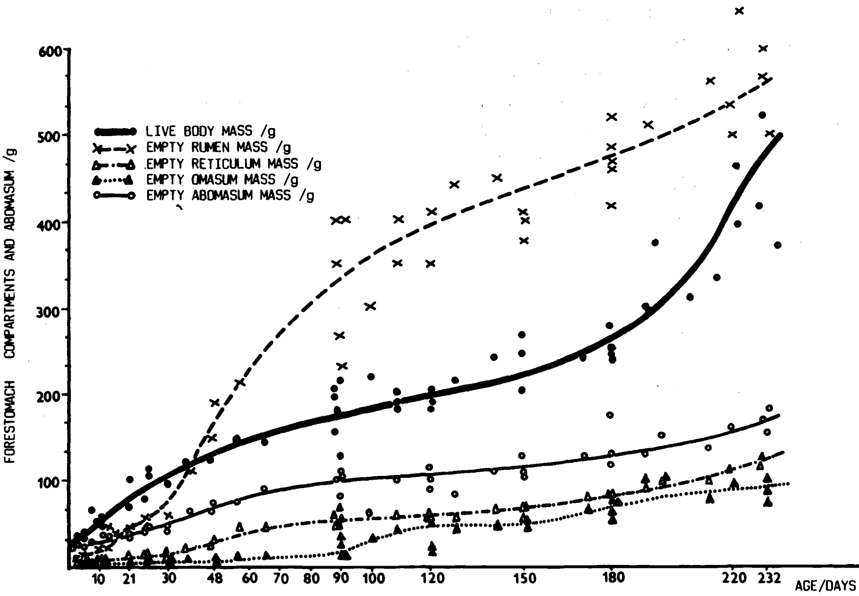


Fig. 2. Mass of caprine forestomach compartments. Live body mass given in kg.

cells with folded mucosa covered by minute papillae can be seen on the inner surface of the reticulum in the early postnatal period. The dilatation of the reticulum was accompanied by an enlargement of the cells, particularly in the ventral part (Plate 3, Figs. 17, 19, 21, 22).

The beanlike omasum develops as the last of the caprine forestomach compartments. It is the smallest of the compartments after birth and remains so in adult animals. Dilatation of the anterior part above the omasal groove was mostly responsible for the slow increase of its volume between pp days 40 and 90. The differentiation and functional development of the omasal folds are finished as late as between pp d 90 and 120. The folds stick together "puttied" by the mass of disintegrating cells and only the omasal channel between the omasal groove and free edges of the omasal folds is passable (Plate 3, Figs. 17, 18, 19). The mucosa of the reticulo-omasal opening was covered by sharp papillae. Rows of lower papillae ran towards the omasum and followed up with the longest omasal folds (Plate 2, Fig. 14a).

Although, in general, the relief of the omasal mucosa corresponds to the descriptions of the macroscopic pattern of the cross section (Ist, IInd IIIrd, and, as the case may be, IVth order folds), the arrangement is different in various parts of the compartment. It is evident from longitudinal and cross sections at various levels between the reticulo-omasal and omaso-abomasal openings (Plate 4, Figs. 23 through 28) that only thick and short folds were present behind the sphincter of the reticulo-omasal opening and above the omasal groove. Caudally, they wear on as seven to nine Ist order folds, and the IInd, IIIrd and occasionally IVth order folds differentiated only in the first third of the compartment. Towards the omaso-abomasal opening, the thickness of the folds diminished, but all of them reached up to and close it completely (Plate 4, Fig. 24b). When the sphincter of the reticulo-omasal opening is closed, digesta are forced by omasal contractions through the narrow between-fold spaces into the omaso-abomasal opening. The crushing and pressing function of the omasum is enhanced by sharp papillae covering the folds. Both sides of the folds controlling the unidirectional

Table 3

Maximum circumferences of forestomach compartments (cm, for measurement sites see Scheme 1)

Age cat.	Age (days)	n	Live body mass (g) Ø	±	Circumference/cm Rumen Ø	±	Reticulum Ø	±	Omasum Ø	±
I	1–5	5	2,730	178	11.68	0.80	6.34	0.72	4.68	0.31
II	8–14	6	4,350	776	14.20	0.81	7.70	0.24	5.40	0.80
III	21	4	6,350	1 626	19.75	4.59	8.75	0.35	7.75	0.35
IV	26–33	5	7,240	1 092	23.56	2.22	10.60	1.08	6.74	0.37
V	48–56	5	10,070	896	39.66	4.50	15.33	1.15	10.0	2.18
VI	88–109	8	13,880	2 944	56.37	10.94	18.37	2.92	12.28	2.58
VII	120	4	14,800	983	50.00	8.75	16.25	4.71	13.00	2.94
VIII	140–150	5	17,400	2 124	55.00	2.16	18.75	1.89	16.25	2.06
IX	180–190	5	21,620	5 142	61.80	7.69	19.40	6.80	18.80	3.56
X	212–232	5	32,100	7 130	72.50	11.61	32.25	2.50	20.50	1.73

Table 4

Height of ruminal papillae (mm)

Age	Age (days)	n	Atrium Ø	±	Recessus r. Ø	±	Sac. ventr. Ø	±	Sac. dors. Ø	±	Sac. caec. cd. Ø	±
I	1–5	5	0.51	0.31	0.41	0.21	0.38	0.10	0.31	0.12	0.32	0.20
II	8–14	6	1.10	0.51	1.16	0.51	0.91	0.20	0.58	0.02	0.50	0.10
III	21	4	1.30	0.70	0.75	0.35	0.75	0.35	0.50	0.01	0.50	0.00
IV	26–33	5	1.50	0.67	0.90	0.22	0.70	0.27	0.60	0.22	0.60	0.22
V	48–56	5	2.00	0.00	1.16	0.76	1.00	0.00	0.83	0.28	1.00	0.00
VI	88–109	8	3.93	0.86	1.31	0.65	1.56	0.82	1.50	0.59	1.06	0.62
VII	120	4	3.25	0.95	1.50	0.57	1.25	0.50	1.25	0.50	1.25	0.50
VIII	140–150	5	4.50	1.00	2.75	0.95	2.75	0.95	1.55	0.50	1.25	0.50
IX	180–190	5	4.00	1.41	2.60	0.54	2.00	1.00	1.40	0.44	1.40	0.89
X	212–232	5	6.50	1.09	3.00	0.81	1.75	0.86	1.62	0.47	2.75	0.28

Table 5

Sizes of reticular and omasal mucosal structures

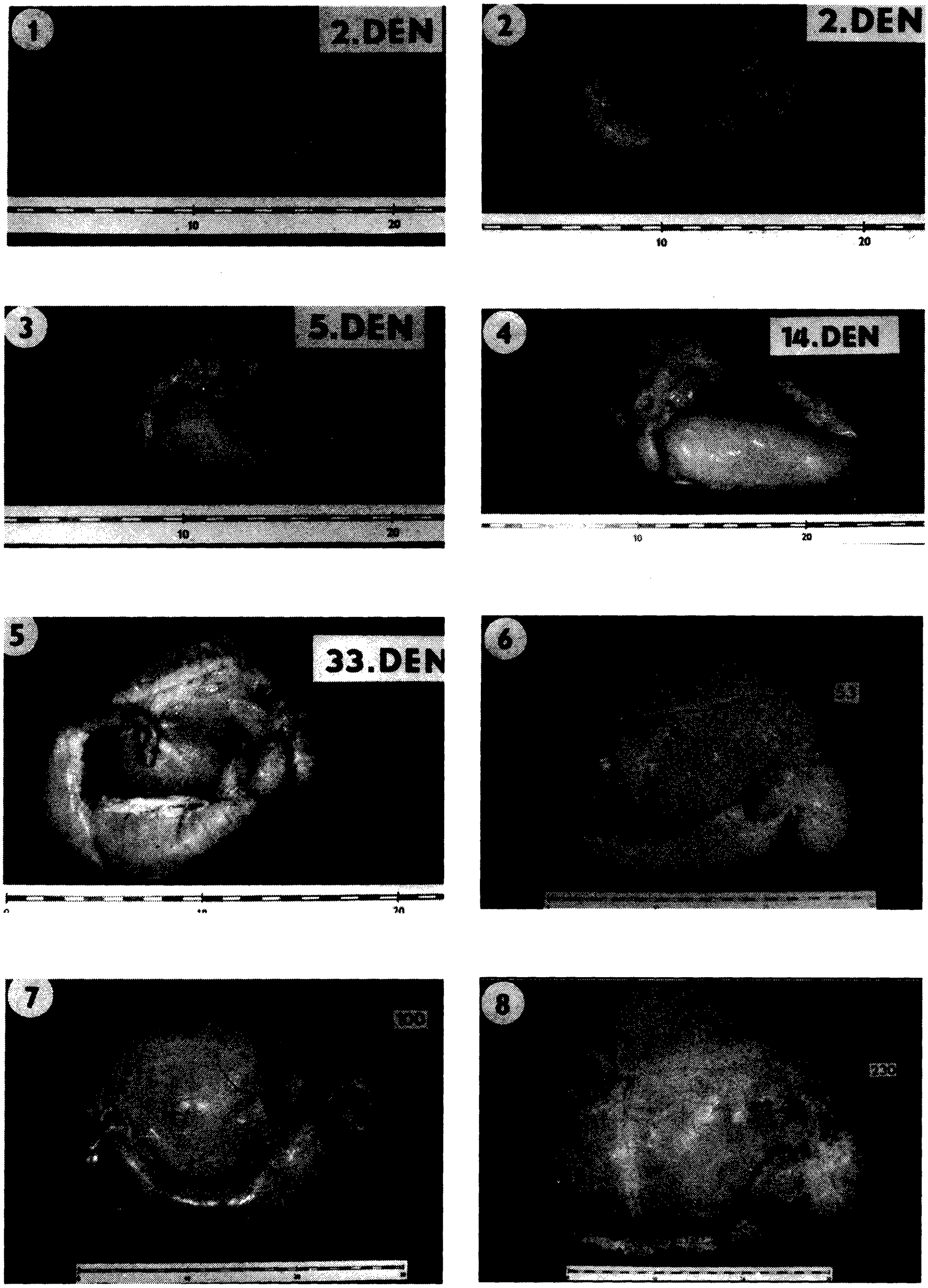
Age cat.	Age (days)	n	Reticulum Max. cell size (mm) Ø	±	Omasum Number of folds+) Ist order Ø	±	IInt order Ø	±	IIIrd order Ø	±	Max. height/mm Ist order folds Ø	±
I	1–5	5	1.5	0.57	(7.0)	(0.0)	(6.0)	(0.0)	(14.0)	(2.0)	(6.0)	(0.0)
II	8–14	6	3.5	1.37	(7.0)	(0.0)	(6.0)	(0.0)	(14.0)	(2.0)	(6.0)	(0.0)
III	21	4	4.0	1.41	(7.0)	(0.0)	(6.0)	(0.0)	(14.0)	(2.0)	(6.0)	(0.0)
IV	26–33	5	5.4	1.14	(7.0)	(0.0)	(6.0)	(0.0)	(14.0)	(2.0)	(8.0)	(0.0)
V	48–56	5	10.0	1.73	7.3	1.15	6.6	1.15	13.3	2.5	18.66	4.16
VI	88–109	8	12.2	2.43	7.25	1.66	6.7	1.16	12.1	2.5	24.37	3.88
VII	120	4	12.0	2.70	9.5	1.73	9.2	1.25	18.2	3.8	27.00	6.97
VIII	140–150	5	13.2	2.06	8.7	0.95	8.7	2.50	17.2	3.4	31.00	8.67
IX	180–190	5	13.8	4.14	7.8	1.30	7.8	0.83	15.6	1.6	33.20	4.86
X	212–232	5	15.7	2.98	8.0	0.81	8.0	1.41	14.7	2.2	36.25	10.14

+) Omasal folds are not differentiated before pp d 30. Measurements were possible only after forcible opening of the wall in an omasal section (Fig. 21); the number of the Ist and IInd order folds varies between 32 and 34 (max. 40); IVth order folds are not developed in the full extent in all individuals. The size of the reticular cells is rather uniform before pp d 21.

passage of digesta into the abomasum are covered by glandular mucosa, but, unlike in sheep (J e l í n e k and J e l í n e k 1989a), no massive deposits of fat can be found here.

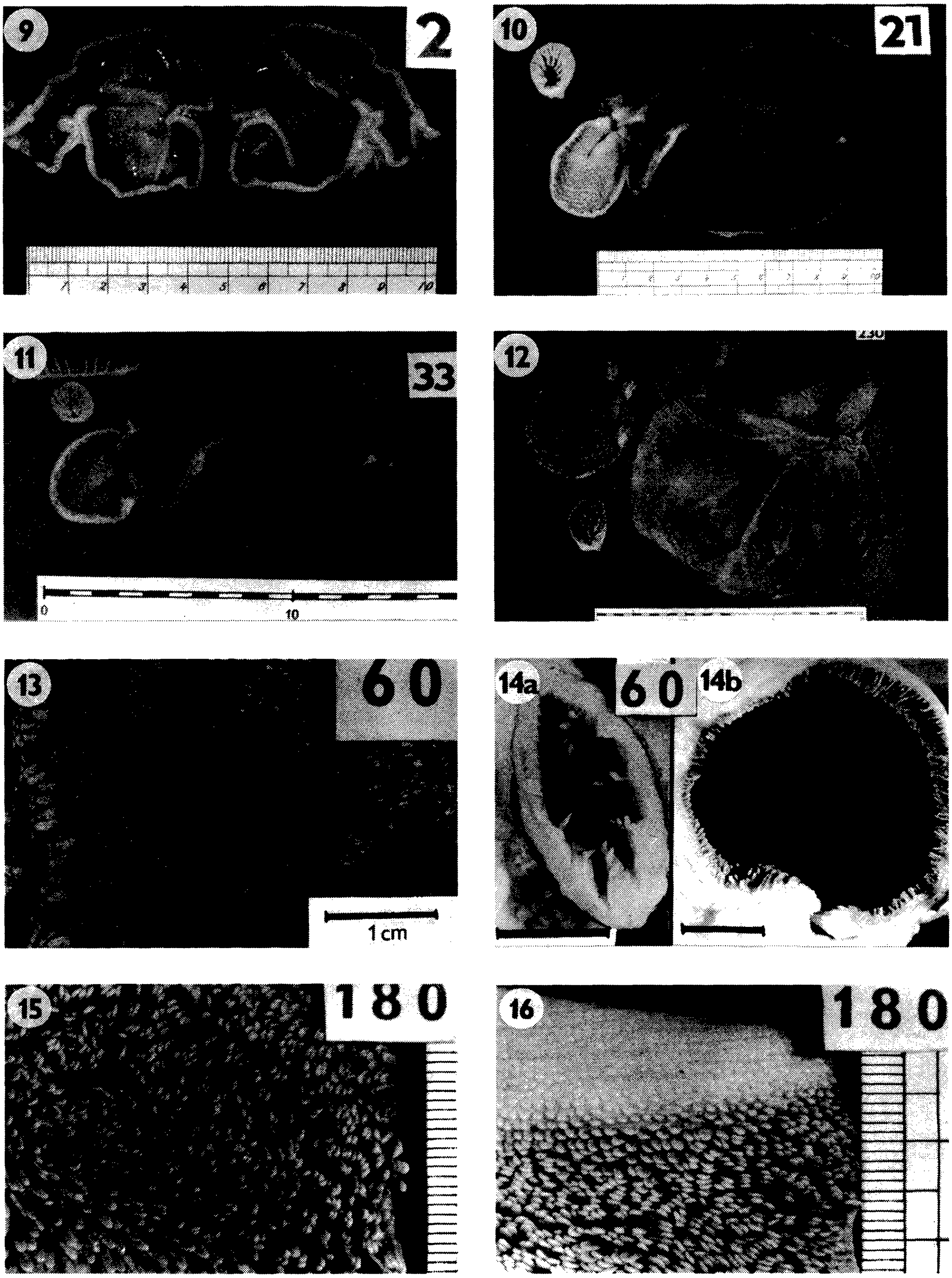
The preliminary partial fixation of the forestomach and its contents is considered more suitable for the measurement of the volumes of the forestomach compartments than filling an untreated organ with water, as used by L a g e r l ö f (1930) in goats and sheep and

Plate 1



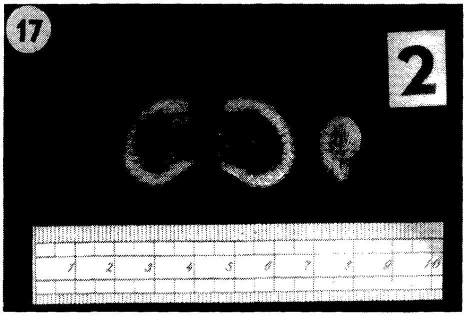
Left (Fig. 1) and right (Fig. 2) sides of the forestomach on pp day 2; left side of the forestomach and abomasum on pp d 5 (Fig. 3) and 14 (Fig. 4); right side of the forestomach and abomasum in pp d 23 (Fig. 5), 53 (Fig. 6), 100 (Fig. 7), and 230 (Fig., 8).

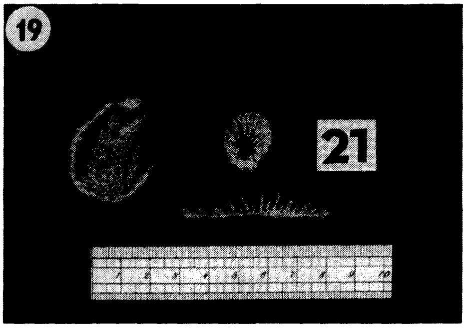
Plate 2

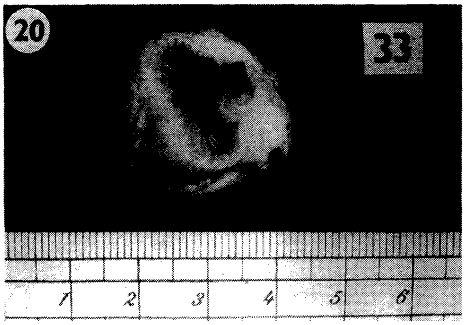


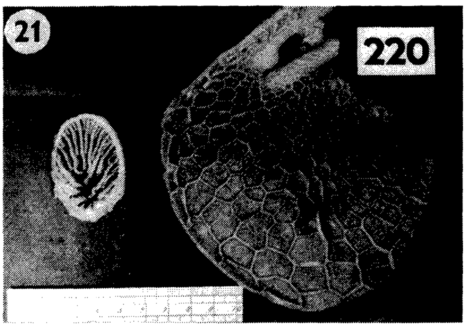
Section of the rumen on pp d 2 (Fig. 9); sections of the rumen, reticulum and omasum on pp d 21 (Fig. 10), 33 (Fig. 11) and 230 (Plate, Fig. 12). Papillae in the ruminal atrium on pp d 60 (Fig. 13) and 180 (Fig. 15). A view from the omasum into the reticulo-omasal opening (Fig. 14a); a view into the ruminal atrium (section) with the reticular groove (Fig. 14b); ruminal papillae around the boundary between the ventral sac and the anterior pillar (Fig. 16).

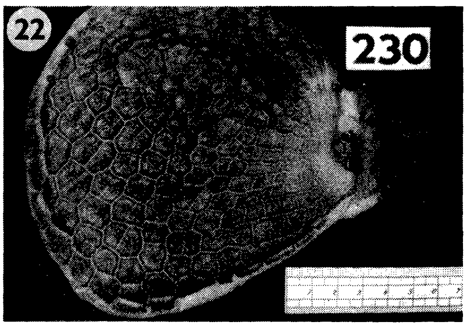
Plate 3





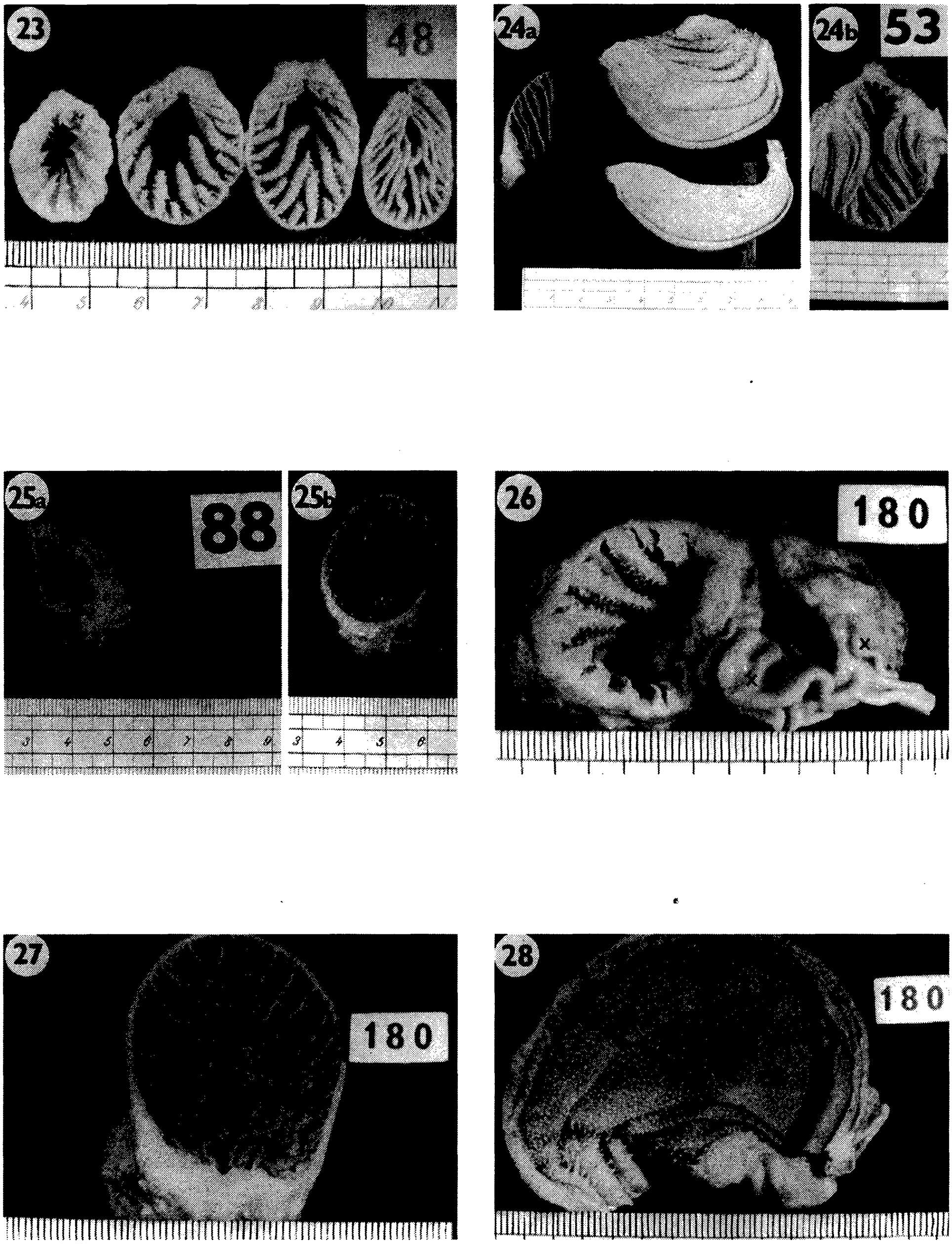






Reticulum and omasum on pp d 2 (Fig. 17), 19 (Fig. 19), 220 (Fig. 21), and 230 (Fig. 22); section through the omasum and reticular groove on pp d 14 (Fig. 18); reticular groove on pp d 33 (Fig. 20).

Plate 4



Various segments and levels of the omasum on pp days 48 (Fig. 23), 53 (Figs. 24a, b), 88 (Figs. 25a, b), and 180 (Figs. 27, 28); section through the omasum behind the reticulo-omasal opening (left side), and mucosal folds in the reticulo-omasal opening (asterisk) on pp d 180 (Fig. 26).

T a m a t e (1957) in young goats. Already the alleviation of the pressure of the surrounding organs and the abdominal wall upon exenteration results in a dilatation of the forestomach and a further dilatation, exceeding the physiological standard, sets in immediately thereafter. As a result, data which do not correspond to actual values of the rumen *in situ* are often published. N i c k e l et al. (1973) give the following forestomach volumes for adult small ruminants: rumen 13 to 20 l; reticulum 1 to 2 l; omasum 0.3 to 0.9 l. The postmortal dilatation changes primarily the volumes of the rumen and reticulum, while that of the omasum changes less markedly owing to its specific anatomical structure and low content of water in digesta. The determination of the actual omasal volume is rather difficult. Dipping into a liquid and measuring of the displaced volume, disregarding the wall thickness, is applicable for the rumen and reticulum, but less suitable for the omasum, because a part of the inner volume is occupied by the folds and the actual capacity is lower than the values given in Table 2. Compared with the results of investigations in Merino sheep, carried out by the same method, the values obtained in males of the Whitehaired Hornless breed show a higher variability which was apparently due to differences in herd management, the time of change from milk to roughages and probably a higher within-breed variability. It should be noted that a set of animals with defined age reared and fed under strictly defined conditions was at disposal for the measurements in sheep (J e l í n e k and J e l í n e k 1989ab; J e l í n e k et al. 1989; J e l í n e k et al 1989).

Regarding the fact that no data were available on the dynamics of the development of the forestomach in a defined goat breed during the rearing period and that earlier data obtained in adult animals are difficult to compare (F r i e d r i c h 1940, and others) the morphometric values presented here can be taken as a contribution to the current knowledge of the ontogenesis of the digestive tract in this small ruminant species.

Dynamika vývoje předžaludku kozy domácí (*Capra aegagrus* f. *hircus*) v postnatální ontogenezi

U 52 jedinců samčího pohlaví kozy domácí, (*Capra aegagrus* f. *hircus*), plemene: koza bílá krátkosrstá bezrohá , od 2. do 232. dne věku, byly sledovány základní morfometrické hodnoty dynamiky rozvoje jednotlivých oddílů předžaludku, a to: maximální objem a obvod, hmotnost prázdného bachoru, čepce a knihy a rozvoj jejich slizničních struktur. Objem bachoru výrazně vzrostl mezi 30.-90. dnem věku a dynamika změn předčila nárůst živé hmotnosti zvířete. Teprve po 180.dni převýšil nárůst živé hmotnosti změny objemu i hmotnosti bachoru. Od 90. dne věku byla variabilita hodnot nárůstu hmotnosti prázdného orgánu i jeho maximálního objemu vysoká, což je výsledkem odstavu a individuálních odchylek v přechodu na objemné krmivo. Mezi 7.-10. dnem věku docházelo k diferenciaci bachorových papil, které po 30. dni získávaly plochý, jazýčkovitý tvar. Výška bachorových papil je podmíněna lokalizací a stimulací resorbujících se těkavých mastných kyselin. Ve ventrální části atrium ruminis a resessus ruminis dosahovaly papily výšky 5-7 mm, v ostatních částech od 1-3,5 mm, na pilae ruminis a v dorzální části saccus dorsalis chyběly nebo nepřesahovaly výšku 0,5 mm.

Čepec se rozvíjel spolu s bachorem, a to plynule mezi 30.-90. dnem věku (hmotnost i objem), po 180.dni se výrazně zvětšoval jeho objem.

Hmotnost prázdné knihy se intenzivně zvětšovala až po 90. dni věku a její objem pak mezi 40.-90. dnem a po 210. dni věku.

Slizniční relief v čepci a knize se diferencoval postupně s funkčním zapojením. Hodnoty obvodů, objemů a hmotností jednotlivých oddílů předžaludku, výšky bachorových papil, čepcových komůrek a uspořádání listů v knize vyplývají z grafů, tabulek, schémat a fotodokumentace práce.

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