Proteins of Ruminant Colostrum

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1. The proteins in the whey of ewe colostrum resemble those obtained from goat colostrum in containing two main electrophoretic components, with mobilities of -2×10^{-5} and $-3.9 \times 10^{-5} \text{ cm}^2 \text{ sec}^{-1} \text{ V}^{-1}$ in sodium veronal buffer, pH 8.6 and I 0.1, at 1° . 2. Of 32 samples of goat colostrum examined by paper electrophoresis 27 contained the immune lactoglobulin characteristic of colostrum; of 55 samples of cow colostrum all contained immune lactoglobulin.

The colostrum ingested by the young ruminant gives rise to a transient proteinuria of the newborn animal. Smith & Little (1924) showed that it occurred in calves, and McDougall & McCarthy (1953) showed that it was also true for lambs. Smith (1946) and Deutsch (1947) made a physico-chemical study of the proteins of cow and goat colostrum but did not report on the proteins of ewe colostrum at the time of lambing.

McDougall (1965), in a comparative study of proteinuria in calves, kids and lambs under practical conditions of management, found that proteinuria occurred regularly in lambs but was often absent in goats and calves. This could be due to the colostrum ingested not being very rich in proteins.

The present work answers two questions on colostrum proteins that are relevant to the proteinuria of the newborn animal. These are: how do the proteins of ewe colostrum compare with those of goat and cow colostrum, and does the colostrum of goats and cows vary much in protein composition?

The proteins of ewe colostrum have been examined by boundary electrophoresis and compared with those of goat and cow colostrum by paper electrophoresis. The protein composition of samples of colostrum from goats and cows has been judged qualitatively by the presence of the characteristic protein of colostrum, the immune lactoglobulin, indicated by the slow-migrating zone obtained on paper electrophoretograms of the colostrum proteins.

MATERIALS AND METHODS

Colostrum samples from six ewes, 32 goats and 55 cows were obtained, before suckling or milking had commenced, from animals in the Institute herds over a number of years; they were clarified by the method of Cole (1942) before electrophoretic examination.

Paper electrophoresis was carried out on horizontally

suspended Whatman 3MM paper in sodium veronal buffer, pH 8.6 and I 0.05, for 16 hr. at 0.4 mA/cm. width of paper.

Boundary electrophoresis was carried out in the Tiselius apparatus (Hilger) in sodium veronal buffer, pH 8.6 and I 0.1, at 1° .

RESULTS AND DISCUSSION

The paper electrophoretograms of the colostrum proteins are shown in Fig. 1 and the boundary-electrophoresis diagrams for ewe colostrum protein in Fig. 2.

The proteins of ewe colostrum resemble those of goat colostrum in containing two main components. Their average mobilities were -2×10^{-5} and $-3.9 \times 10^{-5} \text{ cm}^2 \text{ sec}^{-1} \text{ V}^{-1}$; these values are similar to those reported by Deutsch (1947) for goat colostrum, i.e. -1.7×10^{-5} and $-3.9 \times 10^{-5} \text{ cm}^2 \text{ sec}^{-1} \text{ V}^{-1}$. These values are also similar to those of the immune lactoglobulin and the

Fig. 1. Paper electrophoretograms of colostrum whey proteins in veronal buffer, pH 8.6 and I 0.05. (a) Bovine colostrum; (b) sheep colostrum; (c) goat colostrum. ILG, Immune lactoglobulin; β -LG, β -lactoglobulin of bovine colostrum. The arrow indicates the direction of migration, and + and - indicate the electrode disposition. The current was 0.4 mA/cm. of paper width for 16 hr.

α -lactalbumin of cow colostrum. Neither goat nor ewe colostrum contains components with a mobility near that of β -lactoglobulin of cow colostrum. On average, each component represented 47% of the total protein. A third minor component with a

mobility of $-6.4 \times 10^{-5} \text{ cm}^2 \text{ sec}^{-1} \text{ v}^{-1}$ accounted for the remaining 6%. A similar component with a mobility of $-6.5 \times 10^{-5} \text{ cm}^2 \text{ sec}^{-1} \text{ v}^{-1}$ was found by Deutsch (1947) in goat colostrum.

Of 55 samples of cow colostrum examined all contained immune lactoglobulin. Of 32 samples of goat colostrum, 27 contained immune lactoglobulin. The deficiencies in the goat colostrum would appear from the herd records, to be due to the animals coming into milk too soon or due to the absence of an adequate dry period.

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Fig. 2. Moving-boundary-electrophoresis diagrams of colostrum whey proteins in veronal buffer, pH 8.6 and I 0.1, at 1° with E 5.6 v/cm. (a) Goat colostrum after 60 min.; (b) ewe colostrum after 60 min.; (c) ewe colostrum after 176 min. The arrow indicates the direction of migration, and ϵ and δ are the stationary boundaries in the descending and ascending limbs respectively.