in a few cases occurs at a fairly remote point in the molecule[2–5]. Therefore it seems likely that the formation of such derivatives may be a fairly general way by which amino acids are "grasped", perhaps for translocation as well as for structural modification.

Apparently it is the simultaneous presence of the amino acid and a definite level of pyridoxal in the extracellular fluid, rather than an adequate cellular supply of pyridoxal, which brings about the stimulation. One of the requirements of the "carrier" hypothesis of active transport (see for example ROSENBERG[6]) is that the carrier must be maintained at a higher concentration at the outer than at the inner limit of the membrane phase.

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BIOSYNTHESIS OF MILK PROTEINS IN THE FASTING GOAT

by

B. A. ASKONAS AND P. N. CAMPBELL

National Institute for Medical Research, Mill Hill, London, N.W.7 (England)

Estimations of the amount of amino acid taken up by the mammary gland based on arterio-venous differences have suggested that the free amino acids of the blood could not be the major precursors of the milk proteins since they accounted for less than 40% of the milk protein (SHAW AND PETERSON[1]). According to GRAHAM *et al.*[2] milk protein nitrogen is chiefly derived from blood globulin, and REINEKE *et al.*[3] observed that the mammary gland of lactating goats removed a glyco-protein fraction from the blood. Recent studies with intravenously injected labelled amino acids, however, have shown that in rabbit (CAMPBELL AND WORK[4]) as well as in goat (BARRY[5], WORK *et al.*[6], ASKONAS *et al.*[7]) the isolated whey and casein proteins showed higher radioactivity than the plasma proteins. This suggested that the free amino acids of the blood represented the major precursors of the milk proteins. The apparent contradiction between these two sets of results may be attributed to the difficulty of determining the blood flow and small differences in the amino-acid levels in arterio-venous balance experiments (FOLLEY[8]).

REINEKE *et al.*[3] claimed from arterio-venous balance experiments that in the fasting goat there was no uptake of amino acids by the mammary gland in spite of the continued secretion of milk. This has been taken to indicate that the blood amino acids are not essential for the synthesis of milk proteins. If this were true it would indicate that the mechanism for synthesis of milk proteins in the fasting animal was different from that in the normal animal.

In order to test this possibility the following experiments were carried out with a lactating goat. The goat was given approximately 50 μc. of ^{35}S-methionine (6 mg) by intravenous injection immediately after milking dry, and the animal was milked at frequent intervals during the following 6 h. The milk proteins were fractionated into casein and whey protein fractions (CAMPBELL AND WORK[4]) and the activity of the fractions determined. The experiment was then repeated on the same goat after it had been starved for 48 h prior to injection of the methionine. Posterior pituitary extract was used to ensure complete drainage of the gland at the last milking.

The activities of the milk proteins from the two experiments are compared in the table. In both the normal and the fasting animal the activity of the milk proteins far exceeds that of the plasma protein, suggesting that in both cases the mechanism of synthesis was the same and therefore that the blood proteins are not the major precursors of the milk protein. It will be observed that whereas in the control animal the radioactivity of the milk proteins reached its maximum value 1¾ hours after the injection of the ^{35}S-methionine, in the fasting goat maximal activity was longer delayed

(4½ hours) and the peak was less sharp. The considerable reduction in milk output caused by starvation (about 50%) may well contribute to this difference in the shape of the two activity/time curves. Injection of posterior pituitary extract resulted in an increased milk flow suggesting that not all of the milk had been removed from the gland by the earlier milkings. With a small milk output, dilution of the newly produced radioactive protein with the stored protein will play a greater part, and the rise as well as fall in activity will be more gradual. One must also consider that in the fasting goat the rate of decrease in radioactivity of free amino acid in blood may differ from the rate in control animals.

We conclude from these experiments that there is no fundamental difference between the biosynthesis of the milk proteins in the fasting and normal animal. It seems probable that the failure of REINEKE *et al.*[3] to detect uptake of amino acids by the mammary gland of the starving goat was due to the inadequacy of the method used.

TABLE I

ACTIVITIES OF MILK PROTEINS ISOLATED AFTER ADMINISTRATION OF ^{35}S-METHIONINE BY INTRAVENOUS INJECTION TO LACTATING GOAT

(Activities expressed as counts/min/2 sq.cm sample of dried protein at infinite thickness)

	Time after injection (min)								
	45	*100*	*160*	*225*	*280*	*345*	*400*	*495*	*1440*
Control									
Casein	160	1235	1104	811	579	392	392	179	
Whey protein	71	679	609	460	313	244	244	109	
Plasma protein				12				12	
Fasting									
Casein		101	418		520		405		107
Whey protein		61	272		452		347		97
Plasma protein							22		

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