CCLXX. A NOTE ON THE VITAMIN D CONTENT OF COW'S COLOSTRUM¹

By KATHLEEN MARY HENRY AND
STANISŁAW KAZIMIERZ KON

*From the National Institute for Research in Dairying,
University of Reading*

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It is generally known that cow's colostrum is much richer in vitamin A and carotene than the later milk but, as far as we know, there is no information with regard to its vitamin D content.

We were interested to see whether the changes in concentration of the antirachitic vitamin are similar to those of vitamin A and of its precursor. We therefore measured the antirachitic potencies of colostrum fats obtained on successive days after calving and compared them with the activity of a normal sample of butter produced at the same time and under similar conditions of feeding.

EXPERIMENTAL

The colostrum was obtained from a Guernsey cow at her fourth calving at the end of July 1936, that is when grass was plentiful and the actinic activity of the sun very high. The cow had been on pasture until 2 days before calving when she was brought indoors for the first few days.

Three separate churnings were made of the colostrum fats. For the first the colostrum of the day of calving and of the following day were mixed, the next 2½ days' yields were again blended and finally one churning combined the second half of the 4th day and the morning of the 5th day after parturition. This last churning was from the first normal milking of the cow. In addition butter was churned from the normal milk of a Guernsey cow which produced her sixth calf in January and which had been on the same pasture as the newly calved cow.

The churned butters were rendered at a temperature of 50° and the filtered fats were stored at -2°.

BIOLOGICAL TESTS

The fats were assayed in prophylactic experiments against the International Standard for vitamin D (v.D. 13) by a technique previously described [Kon & Henry, 1935]. The first colostrum was fed at two levels of intake: 0.05 and 0.1 g. per rat per day (Sundays excepted). Of the second colostrum 0.15 g. was similarly fed and the third colostrum and the control butters were given at the level of 0.3 g. There was one level of 0.2 units of the i.s. and one group of negative controls.

The results of the tests are given in Table I.

¹ Read before the Biochemical Society, 12 February 1937 [Henry & Kon, 1937].

Table I. *Bone ash % of rats receiving colostral and butter fats*

Negative controls			Control butter fat, 0.3 g.			First colostral fat					
						0.05 g.			0.1 g.		
Rat	Litter	Ash %	Rat	Litter	Ash %	Rat	Litter	Ash %	Rat	Litter	Ash %
5879	1	28.3	5878	1	40.2	5894	3	32.8	5895	3	37.1
5886	2	27.6	5906	F_4	35.8	5907	F_4	34.9	5908	F_4	35.0
5916	6	29.5	5917	6	37.1	5924	7	30.5	5925	7	36.0
5941	9	27.9	5944	F_9	39.3	5945	F_9	36.4	5946	F_9	42.7
5955	11	29.0	5956	11	41.6	5957	11	32.2	5958	F_{11}	40.8
5968	13	28.6	5969	13	36.2	5975	14	30.8	5976	14	39.3
Average		28.5				38.4			32.9		
									38.5		
Second colostral fat, 0.15 g.			Third colostral fat, 0.3 g.			I.S. 0.2 units					
Rat	Litter	Ash %	Rat	Litter	Ash %	Rat	Litter	Ash %			
5902	4	33.0	5903	4	37.0	5905	F_4	39.6			
5909	F_4	34.5	5910	5	40.2	5911	5	38.5			
5932	8	36.0	5939	9	37.0	5940	9	44.6			
5947	10	35.1	5948	10	37.0	5949	10	43.6			
5959	F_{11}	36.1	5960	F_{11}	35.0	5967	13	43.6			
5977	14	38.1	5978	14	37.7	—	—	—			
Average		35.5				37.3			42.0		

The signs F_4 , F_9 , F_{11} denote rats foster-fed with litters 4, 9 and 11.

The gains in percentage of ash over the negative controls were as follows:

Substance tested	Level	Gain
Control butter	0.30 g.	+ 9.9
First colostrum	0.05 g.	+ 4.4
	0.10 g.	+ 10.0
Second colostrum	0.15 g.	+ 7.0
Third colostrum	0.30 g.	+ 8.8
I.S.	0.2 unit	+ 13.5

From these gains the vitamin D contents of the fats have been calculated in I.U. by means of the equation

$$\text{Gain in ash \%} = 26.63 + 17.31 \log \text{dose (I.U.)}.$$

The method of calculation has been fully described in a previous paper [Kon & Henry, 1935].¹

The following values were obtained:

Control butter fat	0.41 I.U. per g.
First colostral fat (0 and 1st day after calving). 0.05 g. level,	1.22 I.U. per g.
1.19 I.U. per g.; 0.10 g. level, 1.25 I.U. per g.	
Second colostral fat (2nd, 3rd and $\frac{1}{2}$ -4th day after calving)	0.56 I.U. per g.
Third colostral fat ($\frac{1}{2}$ -4th and $\frac{1}{2}$ -5th day after calving)	0.36 I.U. per g.

The tests on the two levels of the first colostrum agree quite well and give a value of 1.2 I.U. per g. This is definitely higher than values for summer butter obtained by us previously [Kon & Henry, 1935; 1936; Campion *et al.* 1937] and is also some three times higher than either the value for the normal control butter or for the third colostrum. The second colostrum is half as potent as the first and its potency is within the summer range.

We have also carried out on the colostral fats and on the butter Lovibond tintometer estimations [Booth *et al.* 1933] of their vitamin A and carotene

¹ The equation used in the present paper is slightly different from that given in the previous paper as we have recalculated it recently, using additional data collected since 1935.

contents. The results are given in Table II expressed in Moore [1930] blue and yellow units.

Table II. *Vitamin A and carotene contents of the colostral and butter fats*

Substance tested	Days after calving	Carotene	Vitamin A
		Moore yellow units per g.	Moore blue units per g.
First colostral fat	0 and 1st	444.4	400.0
Second colostral fat	2nd, 3rd and $\frac{1}{2}$ -4th	105.0	96.0
Third colostral fat	$\frac{1}{2}$ -4th and $\frac{1}{2}$ -5th	36.4	37.0
Control butter fat	—	48.0	50.0

It will be seen that, in agreement with other workers [Dann, 1933; Semb *et al.* 1934; Gillam *et al.* 1936; Leuschen *et al.* 1937], we get much higher values for the early colostral as compared with later fats, the ratio between the first and third colostrum being 12 : 1 for carotene and 11 : 1 for vitamin A. We obviously must not stress our figures unduly as the measurements were carried out only on the secretion of one cow, but it would appear that in summer the difference between colostral and milk fats is some 3-4 times smaller in the case of the antirachitic factor than in the cases of vitamin A and of carotene.

SUMMARY

The vitamin D content of the colostral fats of a Guernsey cow on pasture was 1.2 I.U. per g. for the 0 and 1st day *post partum*, 0.56 I.U. per g. for the 2nd, 3rd and $\frac{1}{2}$ -4th days and 0.36 I.U. per g. for the $\frac{1}{2}$ -4th and $\frac{1}{2}$ -5th days. Normal control butter fat contained 0.41 I.U. per g. Compared with later milk colostrum contains relatively more vitamin A and carotene than vitamin D.

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