Riddle *et al.* (1945) and Urist (1959). The mean level of diffusible Ca in the plasma during egg-shell calcification is about 8·4 mg/100 ml, but in some individuals it may fall to 7·6 mg/100 ml, and there is no reason to believe that this latter figure represents a minimum (Taylor & Hertelendy, 1961).

It may be claimed with some justification that the laying capacity of a hen is directly related to her ability to absorb and metabolize Ca, and these functions are largely under hormonal control. Nutrition and endocrinology are in fact so closely interrelated in the Ca metabolism of the laying hen that they cannot be considered separately with any degree of understanding.

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The importance of hypocalcaemia in the development of hypomagnesaemic tetany

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It is generally considered that the normal concentration of magnesium in the blood plasma of cattle is within the range 2·0–2·5 mg/100 ml. Allcroft (1947*a*) has defined hypomagnesaemia as being associated with concentrations below 1·7 mg Mg/100 ml. Rook & Balch (1958) regarded 1·8 mg Mg/100 ml as the lower limit of the normal range, and Butler (1963) designated concentrations of Mg below 1·8 mg/100 ml as hypomagnesaemic. Many other authorities would accept this value of 1·7–1·8 mg/100 ml as being the lower limit of the normal range. Hypomagnesaemia is not however synonymous with clinical tetany. Although Butler (1963) recorded an 8·7% incidence of hypomagnesaemia (<1·8 mg Mg/100 ml) in a survey covering

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some 5000 cows in Scotland during the spring grazing period, the actual incidence of clinical tetany was only 1·1%. Clinical tetany was recorded in 25% of the 108 herds studied, but hypomagnesaemia (<1·8 mg Mg/100 ml) was detected in clinically normal cows in 41% of the herds.

There are many reports in the literature to indicate that individual cows in a particular herd may experience severe hypomagnesaemia without showing signs of clinical tetany. Allcroft & Green (1938) recorded that in a group of fifty-two cows twelve had plasma Mg concentrations between 0·5 and 1·0 mg/100 ml and a further twenty-nine animals had values within the range 1·0–1·5 mg/100 ml. There was no clinical tetany. Bartlett, Brown, Foot, Rowland, Allcroft & Parr (1954) reported experiments involving forty-two cows. Eight had plasma Mg concentrations between 0·6 and 1·0 mg/100 ml and a further eighteen cows had values at or below 0·6 mg/100 ml. Of these eighteen, only five showed signs of grass tetany and two others died suddenly. Hughes & Cornelius (1960) found that, in a herd of sixteen cows, seven had plasma Mg concentrations between 1·0 and 1·5 mg/100 ml and a further nine (of which only two died of clinical tetany) had concentrations between 0·5 and 1·0 mg/100 ml. Kemp, Deijs, Hewkes & van Es (1960) have presented data concerning the plasma Mg concentrations of 822 cows in Holland. There were twenty-three cases of clinical tetany of which seventeen were associated with plasma Mg concentrations below 0·5 mg/100 ml and six with values between 0·5 and 1·0 mg/100 ml. There were, however, fifteen healthy cows with values below 0·5 mg/100 ml and as many as 126 with concentrations between 0·5 and 1·0 mg/100 ml which showed no signs of tetany. Walsh & Conway (1960) found that only two of seven cows with plasma Mg concentrations below 1·0 mg/100 ml became clinically affected. Birch & Wolton (1961) reported only two clinical cases of tetany in a herd of eighteen cows. They recorded, however, four blood samples with concentrations of under 0·5 mg Mg/100 ml and a further ten with values between 0·5 and 1·0 mg/100 ml. Storry (1961) in an experiment involving sixteen cows on heavily fertilized herbage found that three animals had plasma Mg concentrations between 0·6 and 1·0 mg/100 ml but that none exhibited clinical tetany. McConaghy, McAllister, Todd, Rankin & Kerr (1963) found that of eighteen cows, five had plasma Mg concentrations below 1·0 mg/100 ml but there were no signs of tetany.

Other workers who have recorded severe hypomagnesaemia in cattle (below 1·0 mg/100 ml and frequently below 0·5 mg/100 ml) without clinical signs of tetany include Muth & Haag (1945), Breirem, Ender, Halse & Slagsvold (1949), Bartlett, Brown, Foot, Head, Line, Rook, Rowland & Zundel (1957), Ender, Dishington & Helgebostad (1957), Simesen (1957), Kemp (1958), Line, Head, Rook, Foot & Rowland (1958) and Rook & Balch (1958).

It is thus evident that severe hypomagnesaemia in cattle is not necessarily the only factor involved in the precipitation of clinical tetany. Allcroft (1947*a*,*b*) has reported the remarkably high incidence of 76% of animals having hypomagnesaemia (<1·7 mg Mg/100 ml) which had a concomitant hypocalcaemia (<8·4 mg Ca/100 ml).

This finding prompted a survey of the literature covering cases of clinical tetany in cattle for which both Ca and Mg concentrations in the plasma have been

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quoted. Table 1 summarizes these findings. Many other reports concerning clinical hypomagnesaemia cannot be quoted in this context as unfortunately Ca analyses were not apparently undertaken.

Table 1. *Plasma calcium and magnesium concentrations in 244 cases of clinical tetany in cattle*

Reference	No. of cases	Plasma Ca (mg/100 ml) Mean	Plasma Ca (mg/100 ml) Range	Plasma Mg (mg/100 ml) Mean	Plasma Mg (mg/100 ml) Range
		Individual values given			
Sjollema (1930)	55	6·65	3·90–9·50	0·45	0·16–1·16
Allcroft & Green (1934)	18	7·30	4·60–10·90	0·64	0·35–1·15
Metzger (1936)	1	7·50	—	0·15	—
Nicholson & Shearer (1938)	2	6·50	5·70–7·30	0·75	0·52–0·99
Nolan & Hull (1941)	12	6·63	4·90–8·35	0·90	0·10–2·46
Breirem *et al.* (1949)	3	6·10	5·60–6·90	0·46	0·32–0·55
McBarron (1952)	2	4·10	3·70–4·40	1·45	1·30–1·60
Inglis, Weipers & Pearce (1959)	1	11·8	—	0·58	—
Ender *et al.* (1957)	2	6·30	5·10–7·50	0·30	0·20–0·40
Simesen (1957)	3	5·23	4·90–5·40	0·70	0·66–0·75
Weighton (1957)	1	6·30	—	0·60	—
Mershon & Custer (1958)	20	6·30	4·20–9·80	0·70	0·10–1·70
Hughes & Cornelius (1960)	2	6·50	6·00–7·00	0·63	0·60–0·67
Storry (1961)	3	6·36	6·24–6·44	0·73	0·57–0·81
Rook (1963)	1	6·80	—	0·19	—
Mean for 126 cases		6·49		0·58	
		Individual values not given			
Dryerre (1932)	42	9·30	5·60–11·00	0·39	0·10–1·16
Hopkirk, Marshall & Blake (1933)	35	7·00	4·50–9·60	0·81	0·30–1·50
Weighton (1942)	13	7·40	—	1·00	—
Ender *et al.* (1948)	8	6·65	—	0·71	—
Bartlett *et al.* (1954)	6	—	6·80–8·00	—	<0·60
Bartlett *et al.* (1957)	1	>8·00	—	<0·60	—
Smyth, Conway & Walsh (1958)	2	>8·00	—	0·70	—
Butler (1963)	11	5·97	2·91–8·11	1·27	0·58–1·75
Mean for 118 cases		7·68		0·71	
Overall mean for 244 cases		7·02		0·64	

Clinical tetany in cattle

Amongst the earliest relevant papers concerning cattle were those of Sjollema (1930), Dryerre (1932), Hopkirk *et al.* (1933) and Allcroft & Green (1934). Sjollema (1930) reported fifty-five clinical cases. The mean and range of plasma Ca and Mg concentrations were 6·65 (3·90–9·50) and 0·45 (0·16–1·16) mg/100 ml respectively. Eighteen of the fifty-five animals had plasma Ca values below 6·0 mg/100 ml. Twenty-two had values between 6·0 and 8·0, and fifteen above 8·0 mg/100 ml. Hopkirk *et al.* (1933) did not present values for individual cows, but for a total of thirty-five clinical cases the mean plasma Ca concentration was 7·0 mg/100 ml and the range was 4·5–9·6. The mean plasma Mg concentration was 0·81 mg/100 ml. In contrast, nine healthy cows on a farm where clinical tetany was

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occurring had a mean plasma Ca concentration of 9·2 mg/100 ml and there were no individual values below 8·0. Allcroft & Green (1934) presented information concerning eighteen individual clinical cases. The mean plasma Ca and Mg concentrations were 7·30 and 0·64 mg/100 ml respectively. Only five of the eighteen cows had plasma Ca concentrations above 8·0 mg/100 ml. Eight had values between 6·0 and 8·0 and a further five had values below 6·0 mg/100 ml. In marked contrast, however, Dryerre (1932) claimed that hypocalcaemia was not involved in clinical tetany and that only two of forty-two samples showed plasma Ca concentrations below 8·0 mg/100 ml.

Many other workers have subsequently confirmed a generally occurring condition of hypocalcaemia accompanying hypomagnesaemia in clinical tetany. Nolan & Hull (1941) found for twelve clinical cases that the mean plasma Ca and Mg concentrations were 6·63 and 0·90 mg/100 ml respectively. There were five individuals with plasma Ca values below 6·0 mg/100 ml, five between 6·0 and 8·0 and only two above 8·0. Weighton (1942) reported mean Ca and Mg concentrations of 7·4 and 1·0 mg/100 ml for thirteen confirmed clinical cases of tetany. Ender, Halse & Slagsvold (1948) quoted mean values of 6·65 mg Ca/100 ml and 0·71 mg Mg/100 ml for eight clinically affected cows. Mershon & Custer (1958) reported that only four of twenty cows with clinical grass tetany had plasma Ca levels above 8·0 mg/100 ml but that eleven had values between 4·0 and 6·0 and the remaining five had values between 6·0 and 8·0. Butler (1963) recorded the mean and range of plasma Ca and Mg concentrations for eleven cows before treatment to correct clinical signs. The range of Ca concentrations was 2·91–8·81 (mean 5·97 mg/100 ml) and the comparable values for Mg were 0·58–1·75 (mean 1·27 mg/100 ml).

Several workers have detailed the plasma Ca and Mg values of isolated clinical cases together with values for the remaining unaffected cattle in the herd. They have drawn attention to the marked importance of reduced plasma Ca concentrations in clinical tetany and considered this to be the prime feature in distinguishing this condition from hypomagnesaemia without tetany. In a series of experiments Bartlett *et al.* (1954) recorded a total of eighteen cows with plasma Mg concentrations at or below 0·6 mg/100 ml of which five showed clinical tetany and two others died suddenly. The data for plasma Ca concentrations were not reported in detail but they regarded it as noteworthy that in the clinical cases of grass tetany values in the range 6·8–8·0 mg/100 ml were recorded within 2–3 days before signs or death occurred. On the other hand, where low serum Mg values were recorded without any marked change in the Ca concentrations (i.e. maintenance in the range 8·0–10·9 mg/100 ml) no clinical signs were recorded. Simesen (1957) reported three clinical cases for which the ranges of plasma Ca and Mg values were 4·9–5·4 and 0·66–0·75 mg/100 ml respectively. In contrast, three other unaffected animals in the herd had Mg values below 1·0 mg/100 ml, but the Ca concentrations were normal at 9·5–9·8 mg/100 ml. Hughes & Cornelius (1960) found that the two cows that had clinical tetany in a herd of sixteen had plasma Ca values of 7·0 and 6·0 and Mg levels of 0·60 and 0·67 mg/100 ml respectively. A further five animals which showed no signs of tetany had equally low Mg values of 0·52–0·75 mg/100 ml but these were associated

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with a range of from 9·0 to 10·0 mg Ca/100 ml. Storry (1961) reported no cases of clinical tetany in an experiment in which individual Mg values fell as low as 0·6–0·7 mg/100 ml and plasma Ca concentrations remained normal. In contrast, however, there were three cases of clinical tetany in cattle on an adjacent field at the same time. For these animals the plasma Ca concentrations ranged from 6·24 to 6·44 and were combined with Mg levels in the range 0·57–0·81 mg/100 ml.

Table 2. *Percentage distribution of plasma calcium and magnesium concentrations of 126 cows with clinical tetany*

Plasma Ca (mg/100 ml)	Plasma Mg (mg/100 ml)			% of samples within each Ca concentration range
	0·0–0·5	0·5–1·0	1·0–1·75	
<4·0–6·0	18·8	12·6	4·7	36·1
6·0–8·0	24·5	18·8	1·6	44·9
>8·0	8·7	8·7	1·6	19·0
% of samples within each Mg concentration range	52·0	40·1	7·9	100·0

Table 2 summarizes the plasma Ca and Mg values for the 126 clinical cases detailed in the first part of Table 1 for which individual values are quoted. A total of 74·7% of the clinical cases were associated with combined plasma concentrations of under 8·0 mg Ca/100 ml and under 1·0 mg Mg/100 ml. Only 19% of clinical cases were associated with Ca values above 8·0 mg/100 ml. The mean values for both Ca and Mg given by Hopkirk *et al.* (1933), Weighton (1942), Ender *et al.* (1948) and Butler (1963) confirm the importance of a combined hypocalcaemia and hypomagnesaemia where clinical tetany is concerned.

Hypomagnesaemia in sheep

Hemingway & Ritchie (1963) found that the mean plasma Mg concentration for 389 ewes in twelve flocks about 1 month after lambing was 1·68 mg/100 ml. Clinical tetany was not a problem in these flocks (two cases in 389 ewes) although some 15% of individuals had concentrations below 1·0 mg/100 ml. In two separate flocks of twenty-four ewes the mean plasma Mg values were as low as 0·99 and 1·13 mg/100 ml, and over 50% of the ewes had values below 1·0 mg/100 ml. It was frequently recorded that ewes with lambs could have plasma Mg concentrations of the order of 0·25–0·50 mg/100 ml for long periods with no sign of clinical tetany in the flock. One group of twenty-four ewes had as many as 25% of the individuals in this category.

In a further experiment Hemingway, Ritchie, Brown & Peart (1965) found a mean plasma Mg concentration as low as 0·75 mg/100 ml for forty-four lactating ewes of which only four had clinical tetany (which was associated with a combined hypocalcaemia). However, twenty more of the ewes had plasma Mg concentrations below 0·5 mg/100 ml on at least one sampling occasion and showed no signs of tetany.

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Allcroft (1960) has indicated that individual ewes may have plasma Mg values as low as 0·7 mg/100 ml without experiencing clinical tetany, and Herd & Peebles (1962) reported values as low as 0·5 mg/100 ml in apparently normal ewes. Inglis *et al.* (1959), Michael (1961), Owen & Sinclair (1961) and L'Estrange & Axford (1964*a*,*b*) have also shown that plasma Mg concentrations of lactating ewes may fall below 1·0 mg/100 ml without the ewes necessarily showing clinical signs.

In a survey of 298 outbreaks of sudden death in sheep, Watt (1960) concluded that some 12% were due to hypomagnesaemia, 5% to a combined hypocalcaemia and hypomagnesaemia and 8% to hypocalcaemia alone. A survey of the literature has indicated that a combined hypocalcaemia and hypomagnesaemia is, however, almost invariably involved in the clinical condition in lactating ewes. Individual plasma Ca and Mg concentrations in sixteen cases of clinical tetany in lactating ewes together with a further six cases in non-lactating sheep are presented in Table 3.

Table 3. *Plasma calcium and magnesium concentrations in twenty-two cases of clinical tetany in sheep*

Reference	No. of cases	Plasma Ca (mg/100 ml) Mean	Range	Plasma Mg (mg/100 ml) Mean	Range
O'Moore (1955)	2	6·00	—	1·20	—
Penny & Arnold (1955)	3	3·66	3·20–4·20	0·73	0·70–0·80
Inglis *et al.* (1959)	1	3·40	—	1·07	—
McAleese & Forbes (1959)	5*	6·42	6·40–6·50	0·51	0·40–0·60
Michael (1961)	1	2·80	—	1·60	—
Herd & Peebles (1962)	1	7·00	—	0·70	—
Ritchie *et al.* (1962)	1*	9·80	—	0·73	—
Hemingway & Richie (1963)	1	4·00	—	0·46	—
Hemingway *et al.* (1965)	4	5·13	3·79–5·89	0·40	0·25–0·50
L'Estrange & Axford (1964*a*)	2	4·85	3·70–6·00	0·36	0·20–0·52
L'Estrange & Axford (1964*b*)	1	4·16	—	0·58	—
Mean		5·31		0·66	

*Non-lactating sheep fed on low-Mg diets.

With the exception of a plasma Ca concentration of 9·8 mg/100 ml recorded by Ritchie, Hemingway, Inglis & Peacock (1962), for a non-lactating ewe on a Mg-deficient diet, all the remaining cases of clinical tetany were associated with values below 6·5 mg/100 ml and about half were connected with Ca concentrations below 5·0 mg/100 ml. Plasma Mg concentrations below 0·8 mg/100 ml were recorded for the majority of the sheep. O'Moore (1955) contrasted mean values of 6·0 and 1·2 mg/100 ml of Ca and Mg respectively for two clinical cases of tetany with mean values of 9·5 and 1·4 mg/100 ml for four healthy ewes in the same flock. Similarly, Herd & Peebles (1962) have contrasted a single clinical case of tetany in a lactating ewe (7·0 mg Ca, 0·70 mg Mg/100 ml) with mean values of 9·25 mg Ca and 0·77 mg Mg/100 ml for four healthy ewes in the same flock. Inglis *et al.* (1959) recorded that for the ten blood samples taken from flocks in which clinical tetany was occurring, plasma Mg concentrations ranged from 0·25 to 1·07 mg/100 ml. One ewe had a

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plasma Ca level below 6·0 mg/100 ml, four had values between 6·0 and 8·0 and five above 8·0 mg/100 ml. Only limited value can however be placed on the examination of blood samples from healthy animals in a flock in which clinical tetany has occurred, in that healthy animals may not necessarily reflect the same trends as those individuals which are clinically affected. Hemingway *et al.* (1965) recorded four clinical cases of combined hypocalcaemia and hypomagnesaemia in a flock of forty-four ewes (Table 3). Four other ewes in this flock had plasma Ca levels below 7·0 mg/100 ml, associated with Mg concentrations of under 0·65 mg/100 ml, but clinical tetany did not ensue. On the other hand, Hemingway & Ritchie (1963) reported only two low Ca values in some 389 ewes, 15% of which had plasma Mg values of under 1·0 mg/100 ml. These were associated with the only two clinical cases of tetany recorded. A combined hypocalcaemia (<7·0 mg Ca/100 ml) and hypomagnesaemia (<0·7 mg Mg/100 ml) must therefore be considered to confer a very high degree of risk of clinical tetany such as would not occur as a result of this degree of hypomagnesaemia alone.

Changes in plasma Ca and Mg during the development of clinical tetany

Table 4 presents data concerning changes in plasma Ca and Mg concentrations in lactating ewes during the few days before the onset of clinical signs. A striking feature of these cases was the existence of low plasma Mg levels for several days before the development of clinical tetany. The mean fall over the critical 4 days was only from 0·63 to 0·42 mg/100 ml. In marked contrast all eight ewes showed pronounced falls in plasma Ca concentrations, generally during the 24 h immediately before the appearance of clinical tetany. A mean concentration of about 8·5 mg/100 ml was maintained from the period 4–2 days before tetany. This value fell to a mean of 7·45 mg/100 ml on the day before tetany, followed by a rapid and severe fall to a mean concentration of 4·81 mg/100 ml during the last 24 h.

Table 4. *Changes in plasma calcium and magnesium concentrations during the development of clinical tetany in eight lactating ewes*

Reference	Plasma Ca (mg/100 ml) Days before tetany					Plasma Mg (mg/100 ml) Days before tetany				
	4	3	2	1	0	4	3	2	1	0
Hemingway & Richie (1963)	6·80				4·00	0·45				0·46
Hemingway *et al.* (1965)		8·63	8·23		5·89		0·80	0·50		0·50
		7·98	7·02		3·79		0·40	0·30		0·25
	8·55	7·82		8·79	5·48	0·65	0·50		0·50	0·45
			9·35		5·48			0·50		0·40
L'Estrange & Axford (1964*a*)	8·20	9·40	10·20	8·20	3·70	0·60	0·65	0·60	0·50	0·52
L'Estrange & Axford (1964*b*)	10·50	11·50	9·80	6·80	6·00	0·82	0·82	0·45	0·30	0·20
			5·50	6·00	4·16			0·58	0·56	0·58
Mean	8·51	8·69	8·35	7·45	4·16	0·63	0·63	0·49	0·46	0·42

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Comparable data for cattle are difficult to obtain, but Ender *et al.* (1948) have reported a similar picture to that for sheep for eight cases of clinical tetany in cattle. Two to five days before the onset of tetany mean plasma Ca and Mg concentrations were 9·9 and 0·72 mg/100 ml respectively. The changes in mean values at the onset of tetany were to 6·65 mg Ca/100 ml and to 0·71 mg Mg/100 ml. Rook (1963) found that the plasma Mg concentration of a cow kept on a low-Mg diet fell to 0·5 mg/100 ml after 4 days. At this stage the cow refused to consume concentrates (which contained supplementary Ca). Within 36 h the plasma Ca level dropped from above 10 to 6·8 mg/100 ml, when the cow collapsed. The plasma Mg level at this time was 0·19 mg/100 ml.

Parr & Allcroft (1953) have reported a number of clinical cases of hypomagnesaemic tetany in milk-fed calves. For all the animals there were low serum concentrations of both Ca and Mg. In some calves serum Mg levels fell to as low as 0·4 mg/100 ml, but clinical signs did not appear until serum Ca levels also fell. The mean values for eight calves that died or were killed in tetany were 6·2 mg Ca/100 ml and 0·6 mg Mg/100 ml. They further indicated that blood samples submitted from clinical cases on a variety of farms showed a similar picture. Parr (1957) later showed that a plasma Mg concentration of 0·6 mg/100 ml associated with tetany in a 12 week-old calf, typical of several others, had persisted for at least 3 weeks before the first signs. The plasma Ca concentration had been 9·6 mg/100 ml at 9 weeks, 9·1 at 10 weeks, 7·4 at 11 weeks and finally fell to 6·0 mg/100 ml at 12 weeks when tetany occurred. In contrast, another calf, typical of others that did not succumb to tetany, had a plasma Mg concentration of 0·5 mg/100 ml, but the Ca level never fell below 10 mg/100 ml. Smith (1957, 1958, 1961) has also indicated that in milk-fed calves a prolonged reduction in plasma Mg concentration is eventually followed by a reduction in plasma Ca values. Much earlier, Huffman & Robinson (1926) associated hypocalcaemia with hypomagnesaemia in calves but later Duncan, Huffman & Robinson (1935) and Huffman & Duncan (1936) considered that this form of tetany was associated with a simple hypomagnesaemia alone. Todd & Rankin (1959) also recorded hypomagnesaemia ($<$0·6 mg/100 ml) without hypocalcaemia ($>$9·0 mg/100 ml) in clinical tetany of milk-fed calves.

Blaxter & Sharman (1955) showed for a large number of calves that as plasma Mg concentrations fell progressively from above 2·0 mg/100 ml to about 1·0 mg/100 ml there was no change in plasma Ca levels. When plasma Mg values fell below about 0·8 mg/100 ml a proportion (10%) of calves had reduced plasma Ca concentrations ($<$8·0 mg/100 ml) and some individual values were less than 7·0 mg/100 ml. Parr (1957) found that 8 g Mg/day given as magnesium carbonate to a calf not only restored the plasma Mg level but also increased the plasma Ca concentration from 7·1 to 9·8 mg/100 ml within 6 days. Parr, however, was unable to increase the plasma Ca concentration in a Mg-depleted calf by giving supplementary dietary Ca. The diet was adequately supplemented with vitamin D. Smith (1961) also recorded that Mg given either orally or by injection increased both plasma Ca and plasma Mg concentrations in Mg-depleted calves. Smith (1957, 1958) had earlier shown that the severe hypocalcaemia (but not the hypomagnesaemia) induced in milk-fed calves

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was alleviated by high dietary levels of vitamin D. There can be no question of a dietary insufficiency of Ca in milk-fed calves, and Blaxter & Sharman (1955) showed that there was no demineralization of bone Ca.

McAleese & Forbes (1959), working with lambs fed indoors on a low-Mg diet, recorded that as serum Mg concentrations were reduced to the order of 0·9–1·2 mg/100 ml serum Ca levels decreased quite rapidly to as low as 6·5 mg/100 ml. Additional Ca and vitamin D had no influence on these low Ca and Mg concentrations. L'Estrange & Axford (1964*b*) in three separate experiments involving ten lactating ewes fed on a low-Mg diet, found that when plasma Mg concentrations fell to below 1·0 mg/100 ml, plasma Ca concentrations were reduced to 4–6 mg/100 ml although the diet contained adequate Ca. Supplementary dietary Mg increased both plasma Ca and plasma Mg concentrations to normal within a few days. They considered that a low concentration of plasma Mg was more important in inducing hypocalcaemia than either loss of appetite or the accompanying low plasma citric acid concentration. In contrast, Ritchie *et al.* (1962) observed no hypocalcaemia when non-lactating ewes were fed on a low-Mg diet which induced severe hypomagnesaemia and one case of clinical tetany.

Conclusion

The majority of cases of clinical tetany in cattle, sheep and milk-fed calves exhibit a combined hypocalcaemia and hypomagnesaemia. In many circumstances all these ruminants seem to be able to experience severe hypomagnesaemia for long periods without signs of clinical tetany. There is evidence to indicate that the actual onset of clinical signs of tetany is in some way associated with a rapid fall in plasma Ca concentration superimposed on an existing state of hypomagnesaemia.

Supplementary Mg has been shown to increase both plasma Mg and plasma Ca concentrations in circumstances in which supplementary Ca is unable to influence either plasma Ca or plasma Mg levels. This may be taken as an indication that severe hypomagnesaemia in some way interferes with plasma Ca metabolism, as has been suggested by Blaxter & Sharman (1955), Neuman & Neuman (1958) and Smith (1961).

Vitamin D, by influencing plasma Ca may possibly have a role in affecting the incidence of clinical tetany although having no influence on plasma Mg concentrations.

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Renal mechanisms of potassium depletion

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In an age in which we are coming to rely more and more upon the results of laboratory investigations as an aid to diagnosis it is perhaps salutary to remember that such investigations are frequently of little value in the diagnosis of potassium depletion. The vast majority of the body K is within the cells, and as a result the

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