Vet.Med.J.,Giza. Vol.46, No.4 B (1998):693 - 700 .

THE CONCOMITANT OCCURRENCE OF HYPOMAGNESEMIC TETANY IN GROWING LAMBS WITH FEEDING UREA SUPPLEMENTED RATION. CLINICAL, BIOCHEMICAL AND THERAPEUTIC APPROACH.

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SUMMARY

On February 1998 veterinary attention was requested for cases of staggering and convulsion in growing lambs fed upon 1.5% urea supplemented ration. The cases had been treated as urea toxicity using 6% acetic acid orally, two days previously without any responce. Keen clinical examination was performed, lambs showed erected ears, opisthotonus , obvious termors and tetany of the limbs followed by clonic convulsions. There were tachypnea and tachycardia without change in rectal tempreture the clinical signs began two hours post feeding. Ruminal pH and ammonia nitrogen were higher than normal, serum magnesium, calcium and inorganic phosphorous were lower than normal. Acetyl-cholinesterasce, was almost within normal activity. Ration was chemically analyzed and calculated quantitatively and qualitatively. The condition was diagnosod clinically and confirmed biochemically as hypomagnesemic tetany attributed to sudden and acute elevation of ruminal ammonia nitrogen sequalae to feeding of 1.5 % urea supplemented ration. The disorder was treated by injecting each lamb with 50 ml of Cal. D.Mag I/V., followed by 20 ml of 20% magnesium sulphate S/C, 5 ml of tonophosphan I/M and 1 ampule. of neurazine (choloropromazine Hcl 50 mg) I/M. The condition was controlled by lowering urea level to 1% and elevation of digestable energy of the ration, beside the addition of magnesium, calcium and phosphorous supplement.

INTRODUCTION

Hypomagnesemic tetany is a highly fatal disease of all classes of ruminants. It is characterized by hypomagnesemia and clinically by tonic and clonic muscular spasms and convulsions (Radostitis et al., 1995). Hypomagnesemic tetany can occure in both sexes in all groups of animals under varied management and dietary programs. Lambs can be affected and the clinical signs

resemble those described in cattle. The disease kills an estimated 1% to 3% of cattle, goats and sheep annually (Hunt, 1996). Hypomagnesemia of sheep is less common. It may be caused by a dietary deficiency or the impairment of availabilty and absorption of dietary magnesium. Many factors are capable of causing hypomagnesemia. one of the important factors is the sudden elevation of ruminal ammonia nitrogen concentration which impair magnesium absorption. (Martens and Rayssiguier, 1980 and Fontenot et al., 1989). This elevation resulted may from heavy grass fertilization by nitrogen or feeding urea as non protein nitrogen in ration of ruminants (Bartley et al., 1970 and Rihani et al., 1993).

The present study estimate the level of urea concomitant with the development of hypomagnesmic tetany in lambs, the associated clinical signs, serum and ruminal biochemical changes were determined and a therapeutic trials were carried out. The safe level of urea in ration of lambs were determined.

MATERIALS AND METHODS

1- Animals:

Thirteen growing lambs with an average weight of 20 kg were used during 25-day study . The lambs were reared in private sheep sector in El-Marg area Libya. Lambs were fed on 5% urea supplemented concentrate ration. Each lamb received 0.5 kg daily of the concentrate and ad-libitum roughaqe (wheat straw). The Composition of the ration is shown in table (1).

Diagnostic and treatment trial.

Hypomagnesemic tetany were diagnosed in 5 of previously mentioned lambs. These lambs were subjected to thorough clinical examination according to Kelly (1984). When definite signs of muscle tetany observed, each lamb was injected 50 ml of Cal-D-Mag, intravenously, 20 ml of 20% magnesium sulphate subcutaneously and 1 ampule of neurazine (50 mg chloropromazino Hcl) intramuscularly. The treatment was repeated 12 hours latter in case of persistence of clinical signs as mentioned by Wilcox and Hoff, (1974) and Radostitis, et. al. (1995)

The lambs were observed after treatment. Ruminal liquor and blood samples were collected before and 24 hours after treatment.

Control trial.

The eight other used lambs were randomely selected from the same sector where hypomagnesemic tateny had been diagnosed. The selected lambs were confined in separate crates and then returned to the flock at the end of the trial period (15 days).

The lambs were fed on formulated ration with 1% urea, high digestable energy and additional minerals supplementation. The ration was isonitrogenous and isoenergetic. Each lamb received 0.5kg daily beside ad.libitum roughage. The Composition of the formulated ration is shown in table (1). Ruminal liquor and blood samples were collected, before, 1 and 2 weaks post formulated ration feeding. Ruminal liquor were, collected at 0,1,2 and 4 hours post

concentrate feeding each sample day.

2- Chemical analysis:

Ruminal liquor were used for estimating pH immediately after collection using pH meter and ruminal ammonia nitrogen according to Conway method (1957), Blood samples used for preparation of sera to estimate levels of magnesium, calcium and phosphrous according to Neil and Nelly (1956), Gindler and king (1972) and Zilversnily (1950) respectively.

Acetylecholinesterase activity also, was estimated acording to Eliman et al., (1961).

3- Ration analysis:

Ration was chemically analysed and calculated quantitively and qualitatively for lamb requirments at 20 kg body weight according to NRC (1985)

4- Analysis of data:

All data were analyzed using a computerized program system SPSS using student T. test with

Table (1): Ingredient composition and chemical analysis of hypomagnesemic tetany induced ration (1) and control formulated ration (II)

Item	* Ration I	** Ration II
Ingredient %		
Barely	75	80.5
Wheat bran	20	15
Urea	1.5	1
Lime stone	1	1
Salt	2	2
*** Premix	0.5	0.5
****Additional minerals	Non	add/per head daily
Chemical analysis %		
C.P	14.1	12.41
E.E	4.82	3.11
C.F	5.09	4.91
Ash	3.83	2.97
NFE	61.35	62.36
T.D.N	66.47	67.28
O.E.M cal/kg.	2.93	2.96

* Ration I: hypomagnesemic tetany induced ration
** Ration II control ration
*** Premix contains essential minerals in limits which meats daily requirements of growing lambs and composed of :
Calcium 200 gm, phosphorous 90 gm, sodium 47.5, magnesium 4 gm, iron 8 gm, copper 2.5 gm, cobalt 0.40 gm, zinc 23.4 gm, manganese 3.6 gm, iodine 0.20 gm, selenium 20 mg and ca-carbonate to 1000 gm.
**** Additional mineral in ration II were 2 gm calcium 1.5 gm phosphorour and 0.5 gm magnesium per head daily

pooled variance estimate and separate variance estimate, and analysis of variance using L.S.D. (low. significant difference). according to Snedecor and Corchran (1982).

RESULTS AND DISCUSSION

obvious tetany, followed by clonic convulsions. Nystagmus and excessive salivations were also noticed, pronounced tachycardia and tachypnea without rectal temperture change were recorded. These clinical signs are typically as those mentioned by Capen and Rosol (1989), Radostits

Table (2): Some ruminal and serum biochemical constituents of lambs fed on hypomagnesemic induced ration before and after treatment.

Item	Before treatment		After treatment	
	mean	SE	mean	SE
Ruminal pH	6.97	0.09	6.79	0.04
Ruminal NH3 (mg/dL)	37.5	1.78	36.7	0.79
Serum magnesium (mg/dL)	0.96 **	0.50	2.63	0.06
Serum calcium (mg/dL)	9.73 **	0.37	12.87	0.22
Serum in-phosphorous (mg/dL)	4.01 **	0.17	6.54	0.21
Serum acetylcholinesterase (u/L)	595.4	7.89	610.2	5.14

- S.E Standar error.
* Significantly different at p 0.05
** Significantly different at p 0.01
(-) Each value respesents an average of 8 observations

Diagnostic and treatment trial:

The contact clinical observations emphasized that the affected lambs were, separated from the herd, erected ears, opisthotonus, tremors, progressed to

et al. (1995) and Smith (1996). The recovary was initiated in time apparently was dramatic, prostrate lamb resumed normal behaviour within minutes after administration of the treatment.

Table (3): Some ruminal biochemical constituents of lambs before and after feeding of control ration.

	Time of Sampling	Before feeding	1 week post feeding	2 weeks post feeding
pH	0 Time	6.73 a	6.74 a	6.59 b
	1 Hour	6.94 b	6.73 ac	6.44 bd
	2 Hour	6.61 c	6.38 d	6.21 e
	4 Hour	6.10 d	5.93 e	6.00 f
Ammonia nitrogen mg/ dL	0 Time	12.01 a	12.02 a	12.77 b
	1 Hour	52.61 b	42.47 c	32.68 d
	2 Hour	35.05 c	25.52 d	25.63 e
	4 Hour	17.92 d	15.51 e	13.56 f

* Each value represents an average of (8) observations.
** Different letters within raw and columns means significante difference at $p \leq 0.05$

Table (4): Some serum biochemical constituent of lamb, before and after feeding of control ration.

	Before feeding	1 week post feeding	2 weeks post feeding
Serum magnesium (mg/dL)	1.78 a	2.51 b	2.55 b
Serum calcium (mg/dL)	9.50 a	11.74 b	13.18 c
Serum phosphore (mg/dL)	3.95 a	5.88 b	6.76 c
Acetyle cholinesters (u/L)	584 a	60.7 a	608 a

* Each value represents an average of a observation.
** Different superscripts within each constituent are significantly different ($p \leq 0.05$)

Data of ruminal pH and ammonia nitrogen (Table 2) revealed that pH did not show significant change than normal pH of sheep rumen, but ammonia nitrogen was higher than normal reported by Bhattacharya and Khan (1973), Kubesy (1987) and Rihani et al. (1993). The trement has no effect on ruminal pH and ammonia nitrogen (Table 2).

Serum magnesium, calcium and phosphorous (Table 2) recorded very low levels than the normal level for lambs as mentioned by Pamela et al., (1977), Mubark (1993) and Radostitis et. al. (1995).

These results are as same as biochemical findings reported by Pamela et al., (1977), Capen and Rosol (1990), Radostitis et al. (1995) and Smith (1996), in case of hypomagnesemic tetany. The treatment result in highly significant increase in the levels of Magnesium, Calcium and Phosphorous (Table 2) which explain the dramatic disappearance of the clinical signs. Acetylecholinesterase. activity (Table 2) revealed no change than normal value reported by Kaneko (1989) and did not significantly changed as a responce of treatment. This result agreed with Simensen (1980) who reported that cholinesterase activity is unaffected by magnesium deficiency. Radostites et al., (1995) reported the development of hypomagnesemic tetany by lowering the serum magnesium level than 1.2 mg/dL.

On the bases of clinical signs and serum biochemical findings beside the results of treatment, it could concluded that lambs were suffering from case of hypomagnesemic tetany. This diagnosis is confirmed by the decreased level of magnesium, which was less than 1.2 mg/dL.

The most accepted explaination of present hypocalcemia and hyposphatemia are those of Pamela et al. (1977) and Radostitis (1995) who reported that hypocalcemia and hypophosphatemia are concurrently present with hypomagnesemia.

Control trial :

The biochemical analysis of the selected lambs before feeding the control ration (table 3) showed significant elevation in ruminal pH at 1 hour post feeding then gradually and significantly decrease at 2 and 4 hours post feeding. Also ruminal ammonia nitrogen showed sudden and highly significant elevation at 1 hours post feeding and decrease significantly at 2 and 4 hours post feeding. This trend is the same as recorded by Bhattacharya, and khan (1973), Pamela et al., (1977), Kubesy (1987), Rihani et al., (1993) and Kubesy et al. (1997). On the other hand serum Magnesium, Calcium and Phosphorous showed lower level than normal approximately as clinical cases. (Table 2).

Based on these results and the results obtained from the diagnostic and treatment trial beside the result of ration analysis, the control ration was

formulated to lower this high elevation of ruminal ammonia level and increase levels of serum minerals by decrease level of urea supplemention to 1% and increase digestable energy as mentioned by Smith (1996) beside give additional minerals supplement.

The effect of given control ration cleared in table (3) that it lead to significant decrease in pH and ammonia nitrogen at one hours post feeding after one weak from feeding control ration supplementation. More significant decrease were recorded at 2 weaks post supplementation. These results was in harmony with those reported by Metson et al. (1966).

Serum Magnesium, Calcium and Phosphorous levels recorded significant elevation one week post supplemention with continuous significant elevation at 2 weeks post supplemention. This elevation was attributed to lowering ammonia nitrogen and the added minerals.

From the all above mentioned, the most acceptable explaination of the occuring hypomagnesemic tetany is that of Martrin and Rayssigvier (1980) who reported that sudden elevation of ruminal ammonia nitrogen were resulted in decrease the absorption of Magnesium through the ruminal wall. The clinical signs caused by the occuring hypomagnesmia is attributed to increase release of acetylecholine at neuromuscular junction as mentioned by Allsop and Paule (1975); and Kolb et al. (1976). The final conclusion is that the most permissable level of urea for growing lambs is 1% with additional minerals especially magnesium to prevent the occurence of hypomagnesemic tetary.

REFERENCES

Allsop, T.F. and Pauli, J.V. (1975): Proc, New Zealand. Soc Animal prod 35-170.

Bartley, E.E.; Davidovich, A.D.; Barr, G.W.; Griffel, G.W.; Dayton, A.D.; Deyoe, C.W. and Bechtle, R.M. (1976): Ammonia toxicity in cattle. 1. Rumen and Blood changes associated with toxicity and treatment methods. J.A.Sci., vol. 43 No. 4 p. 835-841.

Bhattacharya, A.N. and Khan, A.R. (1973): Wheat straw and urea in pelleted rations far growing fattening sheep. J. A. Sci vol. 37 No. 1 p. 136-140.

Capen, C.C. and Rosol, T.J. (1989): In clinical Biochemistry of domestic animals 4th. edition. Kaneko, J.J. Academic press. Inc. San Diego New York Berkeley Boston, London, Toronto.

Conway, E. J. (1957): Microdiffusion analysis an volumetric errors 4nd Ed., crosby - lock wood and sons, Ltd London.

Eliman, G.L.; Countney, K.D.; Andres, V. and Featherstone, R.M. (1961): New and rapid colorimetric determination of acetyl cholinesterase activity. Biochem. Pharm. 7:88-95.

Fontenot, J.P.; Allen, V.G.; Bunce, G.E. and Goff, J.P. (1989): Factors influencing magnesium absorption and metabolism in ruminants. J. Anim. Sci. 67:3445 - 3455.

Gindler; M. and King, J.D. (1972): Determination of serum calcium Am. J. Clin. Path. (58). p: 376.

Hunt, E. (1996): In "Large animal internal medicine. Smith, B.P. p. 1325, The C.V. Mosby Company St. Louis

Baltimore. Philadelphea Toronto.

Kaneko, J.J. (1989): Clinical biochemistery of domestic animals. 4th. Ed. Academic press, inc. Harcourt Braco. Jovanovich, Publishers San Diego. New York.

Kelly, W.R. (1984): Veterinary clinical diagnosis 3rd edition, Bailliere Tindall. London.

Kolb, E.; Ellrich, T.H. and Grudel, G. (1976): Monatschefte veterinar med. 31. 765.

Kubesy, A.M. (1987): Studies on the effect of non-protein nitrogen supplementation on animal health and production in sheep. Ph. D. Thesis Faculty of Vet. Medicin, Cairo University.

Kubesy, A.A.; F.M.K. Saleh, and S.A. Saadany (1997): Effect of urea supplementation or ammontion of rice straw on some ruminal and serum biochemical constituents of Lactating cows. Proceeding of Alex. J. of vet. Sci.: (the 2nd scientific conference for vet. medical researchs.

Martens, H. and Rayssiguier, Y. (1`980): In "Digestive physiology and metabolism in ruminants" CY. Ruckebuch and P. Thivend. eds". pp. 447: 466 MTP press limited Lancaster, England.

Metson, A.J.; Saunders, W.M.H.; Collic, T.W. and Coroham, V.W. (1966): Chemical composition of pastures in relation to grass tetany in beef breeding cows. New Zealand J. of agricultural research. 9, 410-436.

Mubark, M.G.A. (1993): Some studies on ricketes in sheep and goats M.V. Sc. Thesis Faculty of Vet. Medicine, Cairo University.

Neil, D., W. and Nelly, R.A. (1956): Estimation of magnesium in serum using titan yellow. J. Clinical Pathology 2. 161.

N.R.C. (1985): Nutrient requirement of sheep 6th ed. National Academy press Washington D.C. U.S.A.

Pamela, R.; Henry, W.; Smith, H. and Canninghan, M.D. (1977): Effect of histamine and ammonia on hypomagnesemia in ruminants. J. of Anim Sci. vol. 44 No. 2. pp. 276 - 281.

Radostitis, O.M.; Blood, D.C and Gay, C.C. (1995): Veterinary medicine, a text book of diseases of cattle, sheep pigs, goats and horses, eighth ed. ELBS. The english Language book Society.

Rihani, N.; Garrett, W.N. and Zinn, R.A. (1993); Influence of level of urea and Method of supplementation on characteristic of digestion of high - Fiber diets by sheep. J. Anim. Sci. 71: 1657-1665.

Snedecor, G. W. and Corchran, W. C. : (1982) " Statistial metods". 7th Ed. The lowo Univ. press, Ames Lowa, U.S.A.

Simensen, M.G. (1980): In "Clinical biochemistry of domestic animals" (G.S. Kaneko ed) 3rd Ed. pp. 575 - 648 Academic press New York.

Smith, B.P. (1996): Large animal internal medicine 2nd ed. The C.V. Mosby company. St. Louis Baltimore, Phladelphia. Toronto.

Zilversnily, D.B. (1950): Determination of serum inorganic phosphorous J. Lab. Clin., Med. 35, p. 155.