



RESEARCH ARTICLE

Studies on Efficacy of Therapeutic Protocols for Ketosis in Dairy Cows

Khadim Hussain Dar¹, Muhammad Moin Ansari^{2*}, Hilal Ahmad Tantary³, Mubashir Ahmad Baba¹ and Ifat Ashraf³

¹Teaching Veterinary Clinical Services Complex; ²Division of Veterinary Surgery and Radiology; ³Division of Clinical Medicine; Faculty of Veterinary Sciences and Animal Husbandry, Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir, Jammu and Kashmir- 190006, India

ARTICLE INFO

Received: June 10, 2014
Revised: June 14, 2014
Accepted: June 23, 2014

Key words:

Cow
Ketone bodies
Ketosis
Therapeutic protocol

*Corresponding Author

Muhammad Moin Ansari
drmoim7862003@gmail.com

ABSTRACT

A study was undertaken to compare the efficacy of different therapeutic protocols in sixty four ketotic dairy cows. All the ketotic dairy cows were equally divided into group 1st, 2nd, 3rd and 4th. Animals in 1st group received 25% dextrose intravenously two pints and gluconeogenic precursors fortified with B-complex vitamin 100 ml twice orally for four days, animals in 2nd group received 25% dextrose intravenously two pints and insulin 200 IU subcutaneously for two days, animals in 3rd group received liquid glucose and sodium bicarbonate orally for four days, and animals in 4th group received 25% dextrose two pints intravenously and 5ml isoflupredone acetate intramuscularly for three days respectively. The mean recovery time (days) was recorded highest in group 4th (2.3±0.26) followed by 2nd (2.6±0.16), 1st (3.3±0.26) and 3rd (3.9±0.23). Therefore, during the current study glucose administration either parentally or orally in combination with gluconeogenic precursors fortified with B-complex vitamins, insulin, sodium bicarbonate and isoflupredone acetate gave excellent recovery rate.

Cite This Article as: Dar KH, MM Ansari, HA Tantary, MA Baba and I Ashraf, 2014. Studies on efficacy of therapeutic protocols for ketosis in dairy cows. *Inter J Vet Sci*, 3(3): 147-150. www.ijvets.com

INTRODUCTION

Ketosis is a common metabolic disorder frequently observed in dairy cows during the early lactation period and characterized by increased levels of ketone bodies in the blood, urine, and milk (Tehrani-Sharif *et al.*, 2011; Zhang *et al.*, 2012). In a heavy milking animal 60% to 80% of the blood glucose is utilized by the mammary glands in the production of milk (Annison and Linzell, 1963). Ketone bodies comprise beta-hydroxybutyrate (BHBA), acetoacetate (AcAc), and acetone (Ac) at 70, 28 and 2%, respectively. BHBA is the predominant circulating ketone body in ruminants, and there is a strong correlation between the whole blood concentrations of BHBA and AcAc (Kauppinen, 1983). Ketone bodies can freely diffuse across the cell membrane and provide energy during prolonged fasting (Laffel, 1999). Clinical ketosis is easy to diagnose by its clinical symptoms. Whereas subclinical ketosis (SCK) in dairy cattle is defined as the excess level of circulating ketone bodies in the absence of the clinical signs of ketosis (Andersson, 1988). Furthermore, associations between elevated concentration of circulating ketone bodies and periparturient uterine disease has been established (Reist

et al., 2003). High incidence of ketosis both in clinical and subclinical form causes economic loss to the dairy farmers due to loss of milk production as well as sharp drop of milk and failure of affected animals to return to normal production after recovery (Radostits *et al.*, 2000). Current communication reports comparative efficacy of different therapeutic protocols in the management of ketosis in dairy cows at different stages of lactation.

MATERIALS AND METHODS

Total 64 dairy cows of 4-13 years of age presented for treatment with gradual loss of appetite characterized by concentrate refusal, followed by silage and then by refusal of hay, weight loss and sudden fall in milk production (25-75%). They were in different lactation numbers (2nd to 7th) and 6-72 days post-parturient. On clinical examination various physiological parameters like rectal temperature, pulse rate, respiratory rate, and ruminal movements were recorded. A characteristic sweetish odour was detected in the breath, milk and urine in most of the cases. Fresh urine and milk samples were collected and analyzed for the presence of ketone bodies using Rothera's reagent and the test was read on the basis

of colour development. i.e., no colour (-), slightly positive (+), moderately positive (++) , highly positive (+++) and very highly positive (++++) respectively. Blood glucose was estimated before and after treatment by standard method (Tietz, 1976). The animals were randomly allotted to four therapeutic groups (Table 1). Animals in 1st groups received 25% dextrose intravenous (IV) two pints and gluconeogenic precursors fortified with B-complex vitamins 150-200 ml twice orally for four days, animals in 2nd group received 25% dextrose IV two pints and insulin 200 I.U subcutaneously (SC) for two days, animals in 3rd group received liquid glucose and sodium bicarbonate orally for four days, and animals in 4th group received 25% dextrose two pints IV and 5ml isoflupredone acetate intramuscularly (IM) for three days respectively.

Statistical analysis

The data recorded, wherever applicable, was statistically analyzed as per Snedecor and Cochran (1984). The efficacy of therapeutic regimens was evaluated on the basis of clinical response and time.

RESULTS

Ketosis was more prevalent in the fourth lactation number cows with history of parturition 6-72 days back, and maximum number of animals had developed ketosis within 60 days after parturition, although ketosis can occur at any age but occurrence of ketosis was found to be highest in 8-9 years old cows. Clinical examination revealed almost normal rectal temperature (101-103⁰F), slightly elevated pulse (60-80/minute) and respiratory (30-40/minute) rates and reduced ruminal movements (1-3/minute). A characteristic sweetish odour was detected in the breath; milk and urine in most of the cases. Urine and milk samples of 32 (50%) animals showed highly positive (+++), 16 (25%) showed moderately positive, (++) and remaining 16 (25%) showed no colour/any reaction with Rothera's reagent. Besides, 8 (12.5%) cows were showing wasting form of the disease and another 8 (12.5%) cows were showed nervous symptoms like head and nose pressing and vigorous licking of their own skin and mangers as well. All the

animals showed very low level of plasma glucose before treatment and a corresponding significant ($P < 0.05$) increase in the values of glucose was observed following the different therapeutic protocols. Animals of group 1st treated with 25% dextrose IV two pints and gluconeogenic precursors fortified with B-complex vitamins 150-200 ml twice orally for four days, recovered 100 percent within 3.3 ± 0.26 days with only 35% of animals needing more than two doses of therapy, whereas animals of group 2nd treated with 25% dextrose and long-acting insulin preparation given SC at 200 IU/day for two days recovered 100 percent within 2.6 ± 0.16 days, thus showed very good response as compared to 1nd and 3rd group because insulin suppresses both adipose mobilization and ketogenesis, resulting in quick glucose restablization so only 30% animals of this group required more than one therapy for recovery. Animals of group 3rd treatment with liquid glucose and sodium bicarbonate orally for four days recovered 100% within 2.9 ± 0.23 days, however, only 55% animals of this group recovered after single therapy, whereas other animals required two or more doses for complete recovery as evident by subsequent disappearance of clinical signs and gradual increase of milk production respectively. The poor recovery in this group could be attributed to the fact that glucose therapy alone is not sufficient to maintain consistent blood glucose level and to restabilize disturbed body metabolism in the ketotic animals.

Recovery in group 4th animals was fastest only in 2.3 ± 0.26 day as compared to the rest of groups which could be attributed to addition of Isoflupredone acetate (glucocorticoid) in therapy which increases blood glucose level within 24 hours by increasing the availability of gluconeogenic amino acids from increased protein mobilization and the faster elimination of ketone bodies from the blood within 24-48 hours of treatment with 75% animals recovering after single therapy due to more sustained response (Table 2).

DISCUSSION

Ketosis of dairy cows is a metabolic disorder which may appear as a primary disease or in association with

Table 1: Design for therapeutic evaluation of ketosis in cows

Group	Number of animals	Therapeutic Regimen	Dose and Route	Duration
1	16	Inj. Dextrose ^A 25% + Gluconeogenic precursors fortified with B-complex vitamins ^B	Two pints (540mlx2) IV 150-200 ml orally twice	4 days
2	16	Inj. Dextrose ^A 25% + Inj. Insulin ^C	(540mlx2) IV 200 I.U S/C	2 days
3	16	Liquid glucose ^D + Sodium bicarbonate	500 grams orally 30 grams orally	4 days
4	16	Inj. Dextrose ^A 25% + Inj. Isoflupredone acetate ^E	(540mlx2) IV 5 ml IM	3 days

^A Wocktrose: Wockhard Limited, Mumbai India; ^B Anabolite: Virbac Animal Health Limited, Mumbai India; ^C Xylitol: S.D. Fine-Chem Limited, Mumbai India; ^D Liquid Glucose: Raja Ram Maize Products, Chhattisgarh India; ^E Isofluid: Zydus Animal Health Limited, Ahmedabad India

Table 2: Comparative efficacy of different therapeutic protocols for ketosis in cows

Observations	Group 1	Group 2	Group 3	Group 4
Mean blood glucose level before therapy	32.67±1.34	29.43±3.31	31.21±1.44	28.97±1.85
Mean blood glucose level after therapy	41.63±4.61	45.73±2.41	48.33±2.86	50.35±2.28
Mean recovery time in days	3.3±0.26	2.6±0.16	3.9±0.23	2.3±0.26
Recovery by single therapy (%)	65	70	55	75
Percentage recovery (%)	100	100	100	100

other pathological conditions in late pregnancy and early lactation due to negative energy balance (Asrat *et al.*, 2013). In absence of sufficient energy intake for high producing dairy cows requirement of glucose increases which causes mobilization of body fat, fat accumulation in the liver and the rate of ketone body production and contributes to results in ketosis (Bendixen *et al.*, 1987). In the current study dairy cows had gradual loss of appetite, weight loss and decrease in milk production over several days. As feed intake decreases, weight loss is rapid and milk production drops so during early lactation, reduction in energy intake is not compensated by reduction in milk production. This is in agreement of the finding of Mir and Malik (2003) in bovine ketosis. Clinical findings include normal temperature, slightly elevated pulse and respiratory rates, although the ruminal movements may be decreased in amplitude and number but are with normal range unless the course duration is long when they virtually disappear with firm and dry faeces, moderate depression and sometimes reluctance to move. Similar clinical findings of ketosis were also reported by Radostits *et al.* (2000) and Asrat *et al.* (2013). Cows of any age may be affected but the disease appeared commonly in later lactation. The ketotic cows were of different age (4-13 years) and lactation numbers (2nd to 7th) but ketosis was more prevalent in the fourth lactation number cows with history of parturition 6- 72 days back, but maximum number of animals had developed ketosis within 60 days after parturition (Zhang *et al.*, 2012), also occurrence of ketosis was found to be highest in 8-9 years old cows (Anderson and Emanuelson, 1985). A characteristic sweetish odour was also detected in the breath, milk and urine in most of the cases (Swain and Tripathy, 1987). Rothera's test with urine and milk in the present study showed the development of very slightly purple (-), slightly purple (+), moderate purple (++) and dark-purple (+++) colour. These observations corroborates with the earlier report (Fox, 1971). Even though, effective treatments are available for cattle, only rational treatment is to relieve the need for glucose formation from tissue, allow ketone bodies utilization to continue normally and maintain adequate dietary energy levels to prevent relapse (Mir and Malik, 2003). Although all the four treatment regimen resulted in 100% recovery, but the recovery in group 4th animals was fastest only in 2.3±0.26 days followed by group 2nd with full recovery in 2.6±0.16 days, and group 1st animals with recovery in 3.3±0.26 days, whereas animals of group 3rd were last to recover within 2.9±0.23 days after initial dose. With disappearance of ketone bodies and the improvement of sequential clinical signs most of the also restored to their original milk yield within 12 hours after treatment. Among the different treatment 25% dextrose administered cows restore their original milk yield within 12 hours (Banerjee, 1992). The decreased glucose level before treatment was found in all four groups (Ambore *et al.*, 2001). The low level of blood glucose in all the four groups could be attributed to negative energy balance reflecting the greater demand of glucose in the mammary gland (Anantwar and Singh, 1993). Hyp- insulinemia remains a constant feature in ketotic animals (Teli and Ali, 2007). The decrease in the insulin levels could be attributed to the diminished ability of β -cells of endocrine

pancreas to synthesize and release insulin (Mir and Malik, 2003). Therefore in present investigation the glucose administration either parentally or orally in combination with gluconeogenic precursors fortified with B-complex vitamins, insulin, sodium bicarbonate and isoflupredone acetate elevated blood glucose levels which in turn triggered the synthesis and further release of insulin from the pancreas.

Acknowledgement

The authors are highly thankful to the Professor and Head, Teaching Veterinary Clinical Service Complex, Kashmir and owner of the dairy cow for providing necessary facilities and close supervision throughout the tenure for this study.

REFERENCES

- Ambore BN, DN Rajguru and M Saleem, 2001. Prevalence, biochemistry and treatment of sub-clinical ketosis in buffaloes. *Ind Vet J*, 78: 1033-1036.
- Anantwar LG and B Singh, 1993. Epidemiology, clinicopathology and treatment of clinical ketosis in buffaloes. *Ind Vet J*, 70: 152-156.
- Anderson L and U Emanuelson, 1985. An epidemiological study of hyper ketonemia in Swedish dairy cows: determinants and relation to fertility. *Prev Vet Med*, 3: 449-462.
- Andersson L, 1988. Subclinical ketosis in dairy cows. *Vet Clin North Amer Food*, 4: 233-248.
- Annisson EF and JL Linzell, 1963. Oxidation of glucose and acetate by the mammary gland. *J Physiol*, 185: 372-355.
- Asrat M, GH Tadesse, RV Gounder and R Nagappan, 2013. Prevalence and treatment of ketosis in dairy cows in and around Addis Ababa, Ethiopia. *Brit J Dairy Sci*, 3: 26-30.
- Banerjee AK, 1992. Studies on efficacy of some drugs for effective treatment of ketosis in ruminants. *Lives Advisor*, 17: 1451-1459.
- Bendixen PH, B Vilson and R Ekesbol, 1987. Disease frequencies in dairy cows in Sweden. *Prev Vet Med*, 5: 99-109.
- Fox FH, 1971. Clinical diagnosis and treatment of ketosis. *J Dairy Sci*, 54: 974-985.
- Kauppinen K, 1983. Prevalence of bovine ketosis in relation to number and stage of lactation. *Acta Vet Scand*, 24: 349-361.
- Laffel L, 1999. Ketone bodies: a review of physiology, pathophysiology and application of monitoring to diabetes. *Diab Met Res Rev*, 15: 412-426.
- Mir AQ and HU Malik, 2003. Oral glucose therapy- a new approach in the treatment of bovine ketosis. *Ind J Vet Med*, 23: 16-18.
- Radostits OM, CC Gay, DC Blood and KW Hinchdiff, 2000. *Veterinary Medicine*. 9th ed WB. Saunders, London. pp: 1452-1461.
- Reist M, DK Erdin, DV Euw, KM Tschumperlin, H Leuenberger, HM Hammon, N Kunzi and JW Blum, 2003. Use of threshold serum and milk ketone concentrations to identify risk for ketosis and

- endometritis in high-yielding dairy cows. *Amer J Vet Res*, 64: 188-194.
- Snedecor GW and WG Cochran, 1984. *Statistical methods*. 8th ed. Iowa State University Press, Iowa, USA. pp: 287-292.
- Swain PK and SD Tripathy, 1987. Management of ketosis in crossbred cows. *Ind J Vet Med*, 7: 121.
- Tehrani-Sharif M, M Hadadi, HH Noughabi, A Mohammadi, F Rostami and H Sharifi, 2011. Bovine subclinical ketosis in dairy herds in Nishaboor, Iran. *Comp Clin Pathol*, 10: 1007-1008.
- Teli SA and SL Ali, 2007. Plasma glucose and insulin profiles in ketotic buffaloes, *Vet Scan*, 2: 103-107.
- Tietz NW, 1976. In: *Clinical Guide to Laboratory Tests*. WB. Saunders Company Ltd. London. pp: 238-239.
- Zhang Z, G Liu, H Wang, Lix and Z1 Wang, 2012. Detection of subclinical ketosis in dairy cows. *Pak Vet J*, 32: 156-160.