Alteration of Enzyme Aspartate Transaminase in Goat milk related to Udder Health Status

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Abstract

The present experiment was conducted to study variations in milk SCC and pH, along with activity of whey enzyme Aspartate transaminase (AST) in relation to different udder health status of goats. The average values of milk SCC, pH, and AST differed significantly (P<0.01) among various udder health status of goat. The mean difference for SCC of milk showed significant (P<0.01) differences for all the comparisons varying from 6.88 to 41.88 x 105 cells/ml. The average milk pH values ranged from 6.40 ± 0.09 to 7.36 ± 0.01. The milk SCC and pH increased by 1.039 x 105 cells/ml and 0.24 respectively for each unit rise in CMT score. Similarly, the activity of AST increased by 14.04 AST U/ml for each unit rise in CMT score.

Keywords: Alteration, pH, Somatic Cell Count, Aspartate transaminase, CMT, Goat, Udder, Health, Milk.

Introduction

India ranks first for its genetic resources and numerical superiority of goat in the world (Banerjee, 1998). World's current population of goat is around 810 million and its 15 per cent with 20 well recognized breeds is dwelling in widest ecological range of India. The mineral content of goat milk is slightly higher than that of cow, but has lower iron. Goat milk contains smaller sized fat globules. So, it is easily digestible and has medicinal qualities too. Mastitis is the term which denotes inflammatory condition of the udder irrespective of cause. It is characterized by a range of physical, chemical and microbiological changes in the glandular tissue of udder. The raw milk is also an excellent medium for the multiplication of microorganisms which may be transmitted to the human beings (Shukla et al., 1998).

Therefore, early detection of the disease is most important to facilitate its early treatment in order to minimize the further udder damage and financial losses to the farmers. Milk of normal healthy goat contains a wide variety of enzymes. These enzymes are secreted by the epithelial cells of mammary gland. In mastitis, muscle, tissues of mammary gland are damaged which may lead to increase in the level of these enzymes. Thus, determination of enzymes activity might serve as a possible method for detection of subclinical mastitis and other udder diseases (Kitchen et.al., 1970).

Materials and Methods

The present investigation was carried out in the Department of Veterinary Biochemistry, at the Post Graduate Institute of Veterinary Sciences (PGIVAS), Akola Study comprised of milk samples from normal,

Table -1: Category-wise milk sample on the basis of clinical examination of udder and CMT reaction

Group	Number of CMT negative milk sample	Number of CMT positive milk sample			Number of clinical mastitic milk samples	Total
	Normal	Subclinical			Clinical	
		1+	2+	3+		
No. of halves	12	12	12	12	12	60
No of Goats	85	10	12	10	6	123

subclinical and clinical mastitic quarters of 123 goats collected after thorough clinical examination of udder irrespective of age, breed of goats, feeding practices, stages and season of lactation and its analysis. Following clinical examination and CMT score (Durry and Reed, 1961) of each, half-wise milk samples of goats is grouped in table-1.

For each freshly collected milk samples, the pH was measured using a digital pH meter (E.I. Model 101E). Following staining, SCC estimation done by the method in accordance with Schalm *et al.* (1971).Whey was prepared by method given by Olson *et al.* 1981. The activity of Aspartate transaminase (AST) in whey was estimated by using the laboratory made reagents as per the spectrophotometric method of Reitman and Frankel (1957). The optical densities were read on a digital spectrophotometer (E.I. model 301E) at 505 nm. Standard statistical procedures like, completely randomized design, mean, standard error and regression coefficient laid down by Snedecor and Cochran (1994) Whereas, 't' test and mean differences were calculated as per the method described by Steel and Torrie (1960).

Results and Discussion

Estimation of somatic cell count and pH in milk along with whey AST obtained from healthy and mastitic quarters of goats, generated a sizable data, which were statistically analyzed to interpret the results.
Somatic cell count: The averages of SCC of milk with their standard errors for comparison in different udder health status of goats are presented in Table 2. The results indicated an increase in number of SCC of milk with the increase in severity of mastitis.The average milk SCC obtained for normal group in the present study was near to the findings (7.50×10^5 cells/ml) of Okada (1960) and lower than that (8.29×10^5 cells/ml) of Deutz *et al.* (1990), (8.80×10^5 cells/ml) of Petterson (1981).

The statistical analysis of variance of the data generated for the average SCC of goat milk indicated an increasing trend from normal to clinical mastitic groups (Table 3). The introduction and multiplication of pathogenic organisms, lead to inflammation of mammary gland which resulted in production of inflammatory mediators responsible for the modulation of SCC (Harmon, 1984). The increase in SCC can also be attributed to the increased polymorphonuclear neutrophills, although, lymphocytes, plasmocytes and macrophages are also present in milk (Kitchen, 1981).
pH: The average values of milk pH with their standard errors for comparison of different udder health status of goats are presented in Table 1. The pH of normal group ranged from 5.69 to 6.58 with an average of 6.40 ± 0.09 which was close to that reported by Ali

and Hassan (1988). The increase in pH with the severity of mastitis was also observed by Hamed *et al.* (1993).

The statistical analysis of variance of the data generated for the average pH of goat milk indicated an increasing trend from normal to clinical mastitic groups (Table 3).The slight acidity of normal milk was due to acidic group of casein, citrate, phosphate, dissolved carbon dioxide and increasing alkalinity of the mastitic milk might be because of decreased lactate production by the udder tissues (Schalm *et al.*,1971).
Aspartate transaminase: The averages of AST activity in whey with their standard errors for comparison in different udder health status of goats are presented in Table 2. The results indicated an increase in the activity of AST with the increase in severity of mastitis. The statistical analysis of data indicated significant ($P < 0.01$) increase in the average AST activity with increase in the severity of the infection (Table3).

Kitchen *et al.* (1970) reported that the release of various enzymes into body fluid was from damaged tissue or inflamed cells in mastitis. Moreover, the increased AST activity in mastitic milk was recorded to be caused by the liberation of parenchyma cells of udder and disintegrating leucocytes or both and other sources like serum (Bogin and Ziv, 1973).

Conclusion

The statistical analysis and interpretation of data led to conclusions that the somatic cell count of milk can be used as reliable indicator of diagnostic importance for clinical and subclinical conditions of udder inflammation in goats. The alterations in the somatic cell count of milk, activity of AST in milk whey are proportional to the severity of the udder infection as detected by CMT reaction.

Acknowledgement

References

1. Ali, M. V. and A. K. Hassan (1988): Physical and chemical properties of goat milk. Mesopo-tammian J. Agric. 20(3): 213-219.
2. Banerjee, G. C. (1998): A Text Book of Animal Husbandry. 8th Ed. Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi. pp 933.
3. Bogin, E. and G. Ziv (1973): Enzymes and minerals in normal and mastitis milk. Cornell Vet. 63 : 666-676.
4. Deutz, A. A. Pernthaner, G. Schlerka and W.

Barima garther (1990): Cell count of milk from sheep and goats and the occurrence of bacterial mastitis in lower Austria. Wiener Tieraztliche monatsschrijt. 77(3) : 70-77.

5. Durry, A. R. and G. W. Reed (1961): A herd irritation index using the California mastitis test. Vet. Med. 56 : 147-150.

6. Hamed, A. I., N. A. Abou-Zeid, K. M. K. Kerbakry and A. A. Radwan (1993): Physical and chemical properties of subclinical mastitic sheeps and goats milk. Egyptian J. Dairy Sci. 21(1) : 133-149.

7. Harmon, R. J. (1984): Physiology of mastitis and factors affecting somatic cell counts. J. Dairy Sci., 77(7) : 2103-2112.

8. Kitchen, B. J. (1981): Review of the progress of dairy science. Bovine mastitis: Milk compositional changes and elated diagnostic test. J. Dairy Sci., 48 : 167-188.

9. Kitchen, B. J., G. C. Taylor and I. C. White (1970): Milk enzymes, their distribution and activity. J. Dairy Res., 37 : 279-288.

10. Okada, M. (1960): Histology of mammary gland. VII. Histological and histochemical. Studies of cells in the milk of domestic animals. Tohoku J. Agric. Res. 11, 31-51.

11. Olson, D. P., R. C. Bull, L. F. Woodard and K. Kelley (1981): Effects of maternal nutritional restriction and cold stress on young calves. Absorption of Colostral Immunoglobulins. American J. Vet. Res. 42 : 876-880.

12. Petterson, K. E. (1981): Cell content in goats milk. Acta. Vet. Scand. 22 : 226-237.

13. Reitman, S. and S. Frankel (1957): A calorimetric method for the determination of serum glutamic oxalacetic and glutamic pyruvic transaminase. American J. Clin. Pathol. 28(1) : 56-63.

14. Schalm, O. W., E. J. Caroll and L. C. Jain (1971): Bovine mastitis. 1st Edi. Lea and Febiger, Philadephia, U. S. A. pp 95-127.

15. Shukla, S. K., V. P. Dixit, D. C. Thapliyal and Arun Kumar (1998): Bacteriological studies of mastitis in dairy cows. Indian Vet. Med. J. 22 : 261-264.

16. Snedecor, W. and W. G. Cochran (1994): Statistical methods, 8th Edn, East West Press Pvt. Ltd. New Delhi. pp 217-232.

17. Steel, R. G. O. and J. H. Torrie (1960): Principal and procedures of statistics. McGraw Hill Book Company, Inc. New York : 78-79.

Table-2. Mean and standard error for somatic cell count, Ph and Aspartate transaminase (AST) of milk in different udder health status of goat

Udder health status	Normal milk	Subclinical	Clinical		
			1+	2+	3+
SCC (x 10^5 cell/ml)	6.84a± 0.9	16.45b± 0.5	26.34c± 1.2	41.8d ± 1.7	48.68e ± 1.5
pH	6.40a± 0.09	6.66b± 0.01	6.82c± 0.03	7.12d± 0.02	7.36e ± 0.01
AST	146.44a± 4.37	173.19b± 2.34	188.32c± 0.89	195.40d± 0.70	205.56e± 1.29

Different superscripts indicate significance between udder health status

Table-3. Analysis of variance for SCC, Ph and Aspartate transaminase (AST) of milk

Parameters	Source of variation	Degree of freedom	MSS	Fcal
SCC	Udder health status	4	13516.125	676.72906**
PH	Udder health status	4	1.70	69.01**
AST	Udder health status	4	6309.23	94.40**

** = Significant at 1% level CD for treatment = 3.65

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