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EVALUATION OF CHEMICAL AND ELECTROLYTE COMPONENTS OF MILK IN SUBCLINICAL MASTITIS IN HOLSTEIN X HARYANA CATTLE

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ABSTRACT : The present investigation was carried out to investigate whether the chemical and electrolyte components of milk can be used as an indicator to detect subclinical mastitis in Holstein x Haryana cows. The bacterial cultural examination revealed 32 cows comprising 34 quarters are SCM positive. SCM positive and negative samples were estimated for electrical conductivity (EC) and pH with respective meters, sodium (Na+) and potassium (K+) with Flame photometer and chloride (Cl-) by titremetric method. The result demonstrated statistically significant (p<0.01) increase in EC, Na+ and Cl- and decrease in K+. After studying the correlation coefficient among the milk components and comparing them with a Gold standard (Log10 SCC) separately in normal and infected milk it was found that Na+, Cl- and K+ are the indicators of SCM in the present study.

Key words : Subclinical mastitis, Chemical, Electrolyte, Log10 SCC.

INTRODUCTION :

Milk a fluid with many virtues is considered sacred from Vedic period. The National Commission on Agriculture had put dairy next to agriculture, and consider it as a cushion to crop failure. Animal Husbandry has taken up several crossbreeding programs to grade up low milk producing indigenous breeds with high yielding foreign breeds.

Mastitis especially subclinical form is one of the most economically costly and menacing disease of dairy industry worldwide, and stands as the major obstacle towards healthy milk production. It directly affects both the technical characteristics as well as hygienic quality of milk (Gera *et al*. 2006). The residues in the form of antibiotics and micro-organisms make milk unfit for human consumption even after cure, aggravating monetary loss (Jensen 1995).

Till date no planned cross-sectional monitoring technique is available for detecting SCM at least in organized farms. So the new trend is to find suitable biochemical indicators to detect SCM. There are several reports on how mastitis affects the electrical conductivity (EC), pH and electrolyte concentration in cow milk, but the work done on evaluating them as putative indicator for detecting SCM is scanty. Pertaining to the situation at hand the present study was undertaken to evaluate the aforesaid milk components as an indicator of SCM.

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MATERIALS AND METHODS :

Milk samples collected aseptically from apparently healthy Holstein x Haryana cows with no history of mastitis were cultured in 5% ovine blood agar media. The resulting growth was purified and identified on the basis of morphology, colony characteristics and Gram's reaction (Tuteja *et al*. 2001). SCM positive and n*eg*ative samples were put to analysis. The somatic cell count was counted by microscopical methods after staining with Newman - Lampert stain for 30 seconds. (Schalm *et al*. 1971). EC was estimated in fresh milk samples by Systronics conductivity meter 306. The pH of the milk was estimated by Systronics µpH system 361 pH meters also in fresh milk samples. Sodium (Na+) and potassium (K+) were estimated with Flame photometer Elico CL 361 after di-acid (nitric acid and per chloric acid at the ratio (4 : 1) digestion by the method described in the instruction manual provided with the flame photometer. Chloride (Cl-) content of the milk was estimated by titremetric method by multiplying the volume of 0.1 N of silver nitrate required to titrate 10% potassium dichromate with 0.0355 (A Laboratory Manual of Milk Industry Foundation 2005).

Mean comparison was done by t-test. SCC values were transformed to Log10. Pearson's correlation coefficients were used to investigate the relationship between the milk components separately in normal and infected milk samples. All the statistical analysis was done using SPSS statistical software (Petrie and Watson 2008).

Table 1: Mean ± S.E of somatic cell count chemical and electrolyte profile in milk from Normal and subclinical mastitis cases in Holstein X Haryana cows (n=34).

Parameter	Normal	Infected
Chloride (mM)	$54.46^{a} \pm 6.98$	$61.89^{b} \pm 11.51$
Electrical conductivity (mS/cm)	$5.58^{a} \pm 0.15$	$6.71^{b} \pm 0.12$
pH	6.85 ± 0.26	6.92 ± 0.17
Potassium (mM)	$63.35^{a} \pm 6.37$	$49.27^{b} \pm 5.74$
Sodium (mM)	$25.07^{a} \pm 2.70$	$42.56^{b} \pm 4.23$
Somatic cell count (x 10^5 cells/ml)	$0.72^{a} \pm 0.15$	$2.26^{b} \pm 0.07$

Mean having different superscripts a & b horizontally differ significantly at p<0.01.

RESULTS AND DISCUSSION :

The cultural examination revealed 32 animals comprising 34 quarters positive for SCM. The SCM positive samples had somatic cell count >2 x 105 cells per ml of milk (Table 1) which was in accordance with the reports of Apporao *et al*. (2009).

EC of the infected milk samples increased significantly (p<0.01) whereas pH comparable in the present investigation (Table 1), which is in consonance with the finding of Ognean *et al.* (2007).

Table 2 : Correlation coefficient amongst milk components in normal and subclinical mastitis milk of Holstein x Haryana cows.

	Log_{10} SCC		EC		pH		Na		K		Cl-	
	Normal milk	Infected milk	Normal milk	Infected milk	Normal milk	Infected milk	Normal milk	Infected milk	Normal milk	Infected milk	Normal milk	Infected milk
Log_{10} SCC	-	-	-0.143	**0.375***	-0.238	0.344	-0.233	**0.656 ** **	-0.136	**-0.565 ****	-0.166	**0.498 ****
EC	-	-	-	-	0.134	0.241	-0.121	**0.410 ***	-0.166	-0.425*	0.124	**0.422 ***
pH	-	-	-	-	-	-	-0.127	0.156	-0.144	-0.137	-0.154	0.211
Na	-	-	-	-	-	-	-	-	**0.369 ***	**-0.467 ****	**0.489* ***	**0.491 ****
K	-	-	-	-	-	-	-	-	-	-	**-0.382***	**-0.518 ****
Cl-	-	-	-	-	-	-	-	-	-	-	-0.166	-

* and ** indicate significant at p<0.05 and p<0.01, respectively.

Ilie *et al*. (2010) also reported significant increase in EC in SCM milk and attributed the increase of electrolytes in SCM milk samples. The insignificant increase of pH was due to the fact that the inflammatory reaction and leukocyte population in SCM were insufficient to raise the alkalinity beyond the buffering capacity of milk buffers (Schalm *et al*. 1971). Insignificant changes in pH might also be due to increase level of citrates and bicarbonates during inflammation (Ogola *et al*. 2007).

The electrolyte profile showed significant (p<0.01) alternation. In one side Na and Cl- increased, on the other hand K decreased in SCM milk (Table 1). The increase in the concentration of Na and Cl- and lowering of K concentration were in agreement with previous reports of Sood *et al*. (2008) and Forsback *et al*. (2010) in cow milk. Sood *et al*. (2008) attributed to increased blood capillary permeability, destruction of tight junctions and active ion pumping system (Forsback *et al*. 2010).

Table 2 reveals that Log10 SCC was correlated with EC at p<0.05 and with the electrolytes at p<0.01in infected milk samples only. EC was found to be correlated with Cl- in infected milk samples. The electrolytes were found to be correlated with each other in both normal and infected milk samples, which indicate that change in one will surely cause change in the other. The same for the electrolytes was observed by Sood *et al*. (2008) in pure bred cow milk. To the best of our knowledge no such report exists for EC and pH on cow or buffalo milk, so far.

Hence, it can be concluded that there is no single indicator of SCM. After evaluating the correlation coefficient of milk chemical and electrolyte profile and comparing with Log10 SCC, a Gold standard test, the estimation of electrolytes and EC can be helpful to diagnose SCM.

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