AI (OH) intramuscularly Medicine and Surgery was administrated for a contact time of 30 seconds (Nickerson, 1994). Staphylococcus aureus mastitis vaccine (DXS+, Germ 10D, Cenavisa S. A., Laboratories, Fair International Trading Co., Karachi, Pakistan) was used for a study period of three months. The dip solution was prepared as a teat dip. Teat dipping was done after each milking in normal and sub-clinically affected dairy buffaloes and observed decreasing value of milk lactose with the severity of mastitis, mean lactose of SFMT score of N, T, P1, P2 and P3 was 5.10, 4.52, 4.66, 3.92 and 2.66 % respectively. Increase in SCC is correlated with a greater potential for proteolysis and consequently, with increased proteolysis indexes Mastitic milk undergoes more proteolytic activity (meaning there's breakdown in milk protein) than normal milk (Auldist et al., 1996). In Pakistan very limited work has been undertaken to see the effect of teat dipping/staphylococcus aureus vaccination on sub-clinical mastitis and milk composition.

MATERIAL AND METHODS

The study was conducted at Livestock Experiment Station (LES), Department of Livestock Management, University of Agriculture, Faisalabad, on 20 lactating Sahiwal cows apparently free of mastitis. All animals were hand milked and no mastitis control program was in practice at this farm. Animals with one or more blind, non functional quarters were not included in the panel of study subjects. Similarly, animals which have had an episode of mastitis from calving to start of trial were excluded. The cows of same parity and stage of lactation were divided randomly into following four groups, each comprising of five cows, C=Control; TD=Post-milking teat dipping only; AV=Staphylococcus aureus vaccination only; BDV=Teat dipping and staphylococcus aureus vaccination. An Iodophor (Germ IOD, Cenavisa S. A., Laboratories, Fair International Trading Co., Karachi, Pakistan) was used as a teat dip. Teat dipping was done after each milking for a study period of three months. The dip solution was prepared @ 150ml/L of water immediately before use, providing 0.27% available iodine. Each teat was dipped separately in a dip cup, especially made for this purpose, for a contact time of 30 seconds (Nickerson, 1994). Staphylococcus aureus mastitis vaccine (DXS+ Al (OH₃) adjuvant) prepared by Department of Clinical Medicine and Surgery was administrated intramuscularly @ 5ml/animal in the neck region twice at four weeks interval and data was recorded at day 0 (Pre-trial) and then on monthly basis up to 12 weeks. The surf field mastitis test as described by Muhammad et al. (1995) was used to determine the prevalence and incidence of mastitis and data was computed according to Thrusfield (1995). Milk samples were collected from all the cows by following the procedure of NMC (1990), for the determination of milk fat and protein. Formol titration method was used for the determination of milk protein but fat % was determined according to Aggrawala and Sharma (1961).

RESULTS AND DISCUSSION

Prevalence and incidence

Point prevalence tends to increase in cows of control group at each sampling interval (0.50 to 0.80) where as a reduction trend was observed in all other groups. The point prevalence in vaccinated cows, teat dipped cows and BDV group decreased from 0.50 to 0.45, 0.40 to 0.10 and 0.30 to 0.05, respectively (Table 1). Animal based prevalence of mastitis is presented in table 2.

Table 1. Effect of teat dipping/Staphylococcus aureus vaccination on point prevalence of sub-clinical mastitis

<table>
<thead>
<tr>
<th>Groups</th>
<th>Sampling days</th>
<th>% change</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
<td>30</td>
</tr>
<tr>
<td>C</td>
<td>0.50</td>
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</tr>
<tr>
<td>TD</td>
<td>0.40</td>
<td>0.25</td>
</tr>
<tr>
<td>AV</td>
<td>0.50</td>
<td>0.90</td>
</tr>
<tr>
<td>BDV</td>
<td>0.30</td>
<td>0.40</td>
</tr>
</tbody>
</table>

C = Control
AV = Staphylococcus aureus vaccination
TD = Teat dipping only
DV = Teat dipping plus Staphylococcus aureus vaccination
* = % decrease  ** = % increase

Table 2. Effect of teat dipping/Staphylococcus aureus vaccination on animal based prevalence of sub-clinical mastitis in Sahiwal cows

<table>
<thead>
<tr>
<th>Groups</th>
<th>Sampling days</th>
<th>% change</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
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<tr>
<td>C</td>
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<tr>
<td>TD</td>
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<td>3</td>
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<tr>
<td>AV</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>BDV</td>
<td>4</td>
<td>4</td>
</tr>
</tbody>
</table>

C = Control
AV = Staphylococcus aureus vaccination
TD = Teat dipping only
DV = Teat dipping plus Staphylococcus aureus vaccination
* = % decrease  ** = % increase
Continuous teat dipping can reduce the rate of new mastitis infections up to 75% but if teat dipping is discontinued the rate of new infection will increase rapidly.

The reduction in prevalence and incidence of mastitis following vaccination is also in line with those of Calzolari et al. (1997), Hoedemarker et al. (2001), and Leitner et al. (2003) who conducted a field trial and found 70% protection from infection in cows vaccinated with Staphylococcus aureus vaccine. In this study, teat dipping was found more effective than vaccination. The probable reason might be that teat dipping covered the infection both due to Staphylococcus and Streptococcus where as vaccination against Staphylococcus aureus covers these bacteria only. Secondly, teat dipping prevents the entry of new bacteria which is not true in case of vaccination. Thirdly, dipping of full teat was done after each milking for a contact time of 30 seconds and dip solution may suck by the teat canal and remained adhere with the teat skin for some time post milking. Thus the bacteria present in teat canal and skin flora opportunists both are killed due to quality dip used in this study, and provided a germicidal residue on teats between milking. Ultimately bacterial population decreased which leads to reduction in mastitis. The above justification was also supported by Neave et al. (1969), Ward and Schultaz (1972) who reported that proportion of quarter infected with Staphylococcus aureus and Streptococcus aglactiae both are decreased due to teat dipping.

### Milk composition

During a study period of 90 days, fat ranged from 4.0 to 4.6% in all groups whereas protein% was in the range of 2.8 to 3.4. At the end of study, optimum fat% was found in BDV group and minimum in control cows. Almost the same trend was found in case of protein contents. The results of the present study are in accordance of Calzolari et al. (1997) and Giraudo et al. (1997) who stated that mastitis lowers the quality of milk by reducing the fat and protein contents. In the present study decrease in fat and protein contents may be attributed to an increase in somatic cell count that leads to the release of lipolytic (lipases) and proteolytic (plasmin) enzymes which degraded the triglycerides of the milk fat and casein contents. This justification was also supported by Schmidt et al. (1988) and Barbano (1989).

### REFERENCES


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**Table 3. Effect of teat dipping/Staphylococcus aureus vaccination on milk fat % in Sahiwal cows**

<table>
<thead>
<tr>
<th>Groups</th>
<th>Sampling days</th>
<th>% change</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
<td>30</td>
</tr>
<tr>
<td>C</td>
<td>4.2</td>
<td>4.3</td>
</tr>
<tr>
<td>TD</td>
<td>4.0</td>
<td>4</td>
</tr>
<tr>
<td>AV</td>
<td>4</td>
<td>4.3</td>
</tr>
<tr>
<td>BDV</td>
<td>4.2</td>
<td>4.5</td>
</tr>
</tbody>
</table>

C = Control

AV = Staphylococcus aureus vaccination

TD = Teat dipping only

DV = Teat dipping plus Staphylococcus aureus vaccination

* = % decrease

** = % Increase

The highest reduction in animal based prevalence of sub-clinical mastitis was found due to teat dipping plus vaccination (75%) followed by teat dipping only (33.33%) and vaccination only (25%). However, prevalence of mastitis increased (25%) in control group. Both management tools, teat dipping and vaccination was found effective in reducing the prevalence and incidence of mastitis in lactating cows. This reduction is in conformity with the findings of Funk et al. 1975, Songhua et al. 1990, Boddie et al. 2000 and Foret et al. 2003 who reported that teat dipping reduced the new intra mammary infections.

Schultz and Smith (1972) found a reduction of new IMI up to 90% due to teat dipping in iodophor containing 1% available iodine. Bilal and Abdullah 2003 reported a decrease of 75% in positives quarters of cows dipped in 1% KMnO4 solution. The results of the present study are also in alignment with those of Nickerson (1994) who reported that dipping of teats immediately after milking is a safe and effective method to reduce the rate of new infection. He further pointed out that continuous teat dipping can reduce the rate of new mastitis infections up to 75% but if teat dipping is discontinued the rate of new infection will increase rapidly.

**Table 4. Effect of teat dipping/Staphylococcus aureus vaccination on milk protein % in Sahiwal cows**

<table>
<thead>
<tr>
<th>Groups</th>
<th>Sampling days</th>
<th>% change</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
<td>30</td>
</tr>
<tr>
<td>C</td>
<td>3.2</td>
<td>3.1</td>
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<tr>
<td>TD</td>
<td>3.2</td>
<td>3.3</td>
</tr>
<tr>
<td>AV</td>
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<td>3.2</td>
</tr>
<tr>
<td>BDV</td>
<td>2.9</td>
<td>3.0</td>
</tr>
</tbody>
</table>

C = Control

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* = % decrease

** = % Increase

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