



Use of a staphylococcal vaccine to reduce prevalence of mastitis and lower somatic cell counts in a registered Saanen dairy goat herd



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ABSTRACT

This investigation evaluated the efficacy of a bacterin in reducing the prevalence of staphylococcal mastitis and somatic cell counts (SCC) in a dairy goat herd. Does were vaccinated or left as controls, and the levels of mastitis and SCC monitored over 18 months. *Staphylococcus caprae* (42.5%), *S. xylosus* (15.1%), and *S. simulans* (10.0%) were the predominant causes of intramammary infections (IMI). The infection rate was 1.64 IMI/doe among vaccinates, which tended to be lower ($P < 0.12$) than controls (2.67 IMI/doe). The spontaneous cure rate of IMI after immunization was 1.28 cures/doe in vaccinates, which was higher than controls (0.6 cures/doe; $P < 0.043$). Average SCC of milk samples from vaccinates tended to be lower than that of controls ($1274 \times 10^3/\text{ml}$ vs. $1529 \times 10^3/\text{ml}$, respectively) ($P < 0.10$). Results support the continued study of mastitis vaccines for use in managing staphylococcal mastitis and SCC in dairy goats.

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The prevalence of mastitis in does ranges between 5% and 30%, with coagulase-negative staphylococci (CNS) identified as the most frequent isolates (Contreras et al., 2007). CNS are less pathogenic than *Staphylococcus aureus*, but produce persistent subclinical mastitis with markedly elevated somatic cell counts (SCC) (Contreras et al., 1997). Prevention is the key to controlling staphylococcal mastitis, as once this disease is established, chronic inflammation of mammary tissues and elevated SCC will likely ensue, resulting in reduced milk yield (Leitner et al., 2004) and economic losses to the dairy operation (Koop et al., 2012). Vaccination as a preventative measure against *S. aureus* and the CNS in goats has been attempted, but new intramammary infections (IMI) were not reduced (Derbyshire and Smith, 1969). The staphylococcal vaccine, Lysigin® (Boehringer Ingelheim, Vetmedica, Inc., St. Joseph, MO) was successful in preventing new *S. aureus* and CNS infections in dairy heifers (Nickerson et al., 1999). The purpose of this study was to determine the efficacy of Lysigin® in a commercial Grade A dairy goat herd in Georgia (USA) that was in jeopardy of losing its milk market due to elevated herd SCC.

This investigation included 30 Saanen does at various stages of lactation. Does were milked twice daily in a parlor using DeLaval milking equipment for approximately 10 months then dried off. Breeding occurred most often from late summer to early winter, and does kidded in the spring and early summer of the year. Milking

hygiene included pre- and postmilking sanitization of teats using a chlorine-based germicide. Use of animals was approved by the University of Georgia (UGA) Institutional Animal Care and Use Committee, and all procedures were carried via the Guide for the Care and Use of Agricultural Animals in Agricultural Research and Teaching (FASS, 1999).

Does were divided into (1) vaccinated ($n = 15$) and (2) non-vaccinated controls ($n = 15$), and balanced by udder infection status, days in milk, average daily milk yield, and SCC. Vaccinates were inoculated with 3 ml of Lysigin® intramuscularly in the right semi-membranosus muscle of the rear leg following the prevaccination milk sampling, and repeated at 6-month intervals thereafter, with a booster given 2 weeks after the initial vaccination.

Milk samples were taken aseptically from each udder half of all does three times at monthly intervals prior to vaccination and at 6-week intervals throughout an 18-month period after vaccination, and processed for bacteriology using standard procedures (Nickerson et al., 1999). After presumptive identification based on colony morphology and hemolytic patterns, bacteria were further identified. If a presumptive identification could not be made, a Gram stain of the isolate in question was prepared. Staphylococci were differentiated from streptococci by means of the catalase test, and final verification of the bacterial species was performed using the API Staph test (bioMérieux, Inc.).

Over the post-vaccination trial period, numbers of new IMI that were diagnosed in previously uninfected udder halves of vaccinates and controls were determined. A new IMI was confirmed if the same bacterial isolate was cultured from at least two consecutive sampling times, and differences in new IMI between treat-

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ments were analyzed (SAS, 2013). Additionally, the ability of an infected udder half to resolve naturally without antibiotic intervention (spontaneous cure) was determined in udder halves of vaccinates and controls. An infection was considered cured if an infected half cultured negative at the subsequent sampling time and for the duration of the lactation. Differences in spontaneous cures between treatments were analyzed as earlier (SAS, 2013). SCC were determined on milk samples collected before and during the trial using a DeLaval Cell Counter (DCC, DeLaval International AB, Tumba, Sweden).

Overall prevalence of infected does across treatments during the 18-month trial period was 68.1% (range 55–83%). This range of infected does is greater than the 5–30% range as reviewed by Contreras et al. (2007) and underscores the focus of this trial in reducing the development of new IMI and lowering the herd SCC. *S. caprae* (42.5%), *S. xylosum* (15.1%), and *S. simulans* (10.0%) were the predominant bacterial isolates, as previously observed (White and Hinckley, 1999).

The new IMI rate was 1.64 IMI/doe among vaccinates, which tended to be lower ($P < 0.122$) than controls (2.67 IMI/doe). The majority of new IMI were caused by *S. caprae* (31.7%) and *S. xylosum* (23.9%). An evaluation of the spontaneous cure rate revealed a cure rate of 1.28 cures/doe among vaccinates, which was higher ($P < 0.043$) than the rate of 0.6 cures/doe among controls. The majority of cures occurred with *S. caprae* (44.4%) and *S. xylosum* (22.3%). A previous trial also demonstrated an increase in the spontaneous cure rate of *S. aureus* IMI over three lactations among cows vaccinated with Lysigin® compared with unvaccinated controls; additionally, SCC were also lower in vaccinates (Pankey et al., 1985).

Average SCC of vaccinates ($1274 \times 10^3/\text{ml}$) tended to be lower ($P < 0.10$) than that of controls ($1529 \times 10^3/\text{ml}$), but still within the previously reported ranges of 1000×10^3 – $2000 \times 10^3/\text{ml}$ (Hinckley, 1990). Average SCC for uninfected halves was $1001 \times 10^3/\text{ml}$ and average SCC for infected halves was $1805 \times 10^3/\text{ml}$, which are in line with those reviewed by Ruegg (2011) that demonstrated a SCC range of 270×10^3 – $2000 \times 10^3/\text{ml}$ for uninfected halves and 650×10^3 – $4200 \times 10^3/\text{ml}$ for infected halves.

Highest SCC were associated with infections caused by *S. simulans* ($3253 \times 10^3/\text{ml}$) followed by *S. sciuri* ($3109 \times 10^3/\text{ml}$), and *Staphylococcus* spp. ($2286 \times 10^3/\text{ml}$). Pre-vaccination SCC for vaccinates averaged $1534 \times 10^3/\text{ml}$ and post-vaccination SCC averaged $1203 \times 10^3/\text{ml}$.

For the nonvaccinated control group, SCC averaged $1908 \times 10^3/\text{ml}$ for the prevaccination sampling dates and $1402 \times 10^3/\text{ml}$ for post-vaccination sampling dates.

In summary, vaccination tended to decrease the new IMI rate among immunized goats and significantly increased the spontaneous cure rate compared with controls. Likewise, SCC were reduced in vaccinates compared with controls. The legal SCC limit for herd milk in dairy goats is $1500 \times 10^3/\text{ml}$. Even a small reduction in herd SCC (e.g. a reduction to $1267 \times 10^3/\text{ml}$, as in this case for vaccinates) is sufficient to allow the sale of goat milk for human consumption, supporting the continued evaluation of immunization for mastitis control in dairy goats.

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