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# The Aerobic Bacteria of Equine Wound Infection Associated with Type of Animal Use and Sampling

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## Summary

Most of the bacterial isolates were recovered from animals used for riding. *Enterococcus faecalis* is highly dominated (24 isolates) from riding donkeys, while *Staph. aureus* and *Enterococcus faecalis* (2 isolates) were mostly isolated from riding horses. Many bacterial species were recovered from swabs, tissues and exudate samples in different seasons; *Enterococcus faecium* was isolated only in the rainy season. Compared to sampling technique 119 bacterial isolates were obtained from swab specimens. *Enterococcus faecalis* was the major isolate (22.9%) and *Staph. aureus* (20.3%).

## Introduction

Equines include horses, donkeys, mules and jugles are worldwide in distribution, they engaged in draught purpose either as pack animals, pulling carts or other works. The draught animals are kept for agricultural uses and pack animals are for carrying loads, mobile grocery and shops. Equines are used for riding, racing, hunting etc. (Drew *et al.*, 2004). During this heavy work equines are exposed to different stresses among which improper housing and beating with sticks. Most of the wounded animals receive no medical care and the treatment is costly. According to purpose, animals can be exposed to different types of wounds with the possibility of contamination with different pathogens, which may aggravate healing. The condition of the wound also needs certain sampling technique to obtain good bacterial isolation for better treatment. Since there is no record on equine wound infection found; this study was tried to explain the relationship between the animal purpose and sampling in association with wound infection.

## Materials and Methods

Seasonal collection of samples from 93 donkeys and 23 horses was carried out in Kordofan State. The purpose and the number of animals in each group together with 83 swabs, 23 tissues and 10 exudates were used for the isolation of the bacteria contaminating the wounds. Detailed information on animal species, animal purpose and types of samples tested are shown in Table 1. Propagation, isolation and identification of the bacteria obtained were carried out according to Barrow and Feltham (1993).

## Results

A total of 159 organisms were isolated from different samples collected during different seasons of the year. Prevalence and distribution of the bacteria isolated depend on the type animal purpose samples tested, animal species and type of wound.

**1- Isolation of bacteria compared to animal purpose:**
Hundred (100) bacterial isolates were isolated from riding donkeys, while 13 were recovered from riding horses, the difference mainly due to the number of samples tested. 25 bacterial isolates were obtained from pulling cart donkeys, 11 from pulling horses, while 8 isolates were recovered from pack donkeys and 3 from pack horses.
The number and species of the isolated organisms in relation to animal's purpose are shown in Table 2. *Enterococcus faecalis* (24 isolates), *Staphylococcus auresu* and *Staph. epidermidis* (14 isolates) were mostly isolated from riding donkeys, less number was obtained from pulling donkeys. *Staphylococcus aureus* and *Enterococcus faecalis* (2 isolates) were the dominant isolates from riding horses.
**2- Isolations in relation to samples and seasons:**
Many bacterial species were isolated from swabs, tissues and exudates in different seasons. The result showed variable number and species of the isolates. *Staphylococcus aureus, Enterococcus faecalis and Enterococcus faecium* proved to be more dominant in all seasons except Enterococcus faecium in the rainy season, specially from swab specimens, the results are shown in Table 3.
**3- Bacterial species isolated in relation to samples tested:**
One hundred and nineteen (119) bacterial isolates were isolated from swab specimens. *Entrococcus faecalis* present a majority of the isolates, 27(22.9%), *Staph. aureus* 24 (20.3%). Seventeen (17) bacterial isolates were recovered from exudate samples, *Staph. epidermidis* was more prevalent, 5(29.4%). Tissue scrapings revealed 23 isolates, where *Bacillus Licheniformis* (5(20.8%) proved the highest number isolated followed by *Staph. aureus*, 4(16.7%) and *Bacillus firmus*, 3(12.5%). Numbers and percentages of species isolated compared to samples are shown in Table (4).

## Discussion

Equines are important animals for draught purposes. In Kordofan state equines are used as pack animals, for agricultural uses, riding, racing or hunting. During this heavy work equines are exposed to different stresses and injuries. A total of 159 organisms were recovered. The prevalence and distribution of bacteria isolated depend on animal purpose, samples tested, animal species and type of wound. The number of bacteria isolated was high in riding donkeys and horses compared to other animal purposes, this is mainly attributed to the number of animals tested in each group and again in pulling and packing animals contamination was less expected due to heavy protection of these animals by cloth or cotton to avoid severe injuries.

On the other hand, the bacterial species isolated in relation to animal use proved that, the isolation of *Enterococcus faecalis* is more prevailing in riding donkeys, but less in riding horses compared to the samples tested; this may be due to the more care taking place for the riding horses. *Staphylococcus aureus* was isolated from all samples proved the association of this organism with wound infection, Haroid Ellis *et al.*, (1998), Beers and Berkow (1999) and

Rihab (2004). Enterococci were isolated in variable number from most animals tested, this in agreement with Murray (1990), but their role in equine wound infection needs more investigation.

For the isolation of the bacteria many sampling techniques were practiced. Although swab samples were big in numbers, but they resulted in isolation and for all bacterial specimens recovered, this may be due the possibility of the swabs to harbour most of the contaminated bacteria. The exudate and tissue samples showed less isolation, this is also proved that swab samples included both exudate and tissue debris.

The seasonality of sampling showed a high number of isolates from swabs during summer and autumn, this may be due to the optimal conditions of more flies and stress factors.

This study showed that most of the bacterial isolates were recovered from donkeys and horses used for riding with higher number from swab samples during summer and rainy seasons.

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**Table 1. Animal species, use of the animals and the types of samples tested**

| Season | Number of animals testes | | Animal use | | | | | | Types of samples | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Donkeys | | | Horses | | | | | |
| | Donkeys | Horses | Riding | Pack | Pulling cart | Riding | Pack | Pulling cart | Swabs | Tissues | Exudate |
| Winter | 38 | 9 | 24 | 4 | 10 | 2 | 0 | 7 | 31 | 15 | 1 |
| Summer | 32 | 11 | 22 | 1 | 9 | 6 | 2 | 3 | 30 | 7 | 6 |
| Autumn | 23 | 3 | 19 | 0 | 4 | 2 | 0 | 1 | 22 | 1 | 3 |
| Total | 93 | 23 | 65 | 5 | 21 | 10 | 2 | 11 | 83 | 23 | 10 |

Table (2): The number of isolated bacteria in relation to animal's purpose.

| Animal | Donkeys | | | Horses | | | |
|---|---|---|---|---|---|---|---|
| Purpose / Isolated organisms | Ridings (65) | Pulling (23) | Packing (5) | Riding (10) | Pack (2) | Pulling (11) | Total |
| *Staphlococcus aureus* | 14 | 7 | 1 | 2 | 1 | 6 | 31 |
| *Staphlococcus epidemridis* | 14 | 1 | - | 1 | - | 2 | 18 |
| *Enterococcus faecalis* | 24 | 5 | - | 2 | - | - | 31 |
| *Enterococcus faecium* | 11 | 4 | 2 | 1 | - | - | 18 |
| *Bacillus licheniformis* | 10 | 4 | 1 | - | 1 | - | 16 |
| *Bacillus firmus* | 3 | 2 | - | - | - | - | 5 |
| *Streptococcus salivarius* | 1 | - | - | - | - | - | 1 |
| *Streptococcus pyogenes* | 3 | 2 | - | 1 | - | 2 | 8 |
| *Streptococcus bovis* | 1 | - | - | - | - | - | 1 |
| *Genella haemolysans* | 2 | - | - | 1 | - | - | 3 |
| *Bacillus cereus* | - | - | - | 1 | - | 1 | 2 |
| *Aerococcus viridans* | 5 | - | - | 1 | - | - | 6 |
| *Corynebacterium pyogenes* | 4 | - | 1 | 0 | - | - | 5 |
| *Corynebacterium haemolyticum* | 1 | - | - | 1 | - | | 2 |
| *Cornebacterium ulcerans* | 1 | - | - | - | - | - | 1 |
| *Listeria species* | 2 | - | 2 | - | - | - | 4 |
| *Kurthia species* | - | - | - | 2 | - | - | 2 |
| *Micrococcus roseus* | - | - | - | - | 1 | - | 1 |
| *Streptococcus equinus* | 1 | - | - | - | - | - | 1 |
| *Micrococcus varians* | 1 | - | - | - | - | - | 1 |
| *Pathococcus species* | 1 | - | - | - | - | - | 1 |
| *Mycobacterium species* | 1 | - | - | - | - | - | 1 |
| *Total* | 100 | 25 | 7 | 13 | 3 | 11 | 159 |

**Table (3): The seasonality of sampling, number and types of bacteria species isolated**

| Seasons | winter | | | summer | | | autumn | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| Samples (No) / Isolated organisms (No) | Swabs (31) | Tissue (15) | Exudate (1) | Swabs (30) | Tissue (7) | Exudate (6) | Swabs (22) | Tissue (1) | Exudate (3) | |
| *Staphylococcus aureus* | 11 | 1 | 0 | 5 | 3 | 2 | 8 | 0 | 1 | 31 |
| *Staphylococcus epidemidis* | 0 | 0 | 0 | 0 | 1 | 8 | 6 | 0 | 3 | 18 |
| *Enterococcus faecalis* | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| *Enterococcus faecium* | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 |
| *Bacillus licheniformis* | 0 | 0 | 0 | 1 | 0 | 0 | 4 | 0 | 1 | 6 |
| *Bacillus firmus* | 3 | 1 | 0 | 0 | 0 | 1 | 3 | 0 | 0 | 8 |
| *Streptococcus salivarius* | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 |
| *Streptococcus bovis* | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 |
| *Streptococcus pyogenes* | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 |
| *Gemella haemolysans* | 6 | 0 | 0 | 7 | 2 | 0 | 14 | 0 | 2 | 31 |
| *Bacillus cereus* | 5 | 2 | 1 | 7 | 0 | 0 | 2 | 0 | 1 | 18 |
| *Aerococcus viridans* | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 |
| *Corynebacterium pyogenes* | 0 | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 3 |
| *Corynebacterium haemolyticum* | 1 | 0 | 0 | 2 | 1 | 0 | 1 | 0 | 0 | 5 |
| *Corynebacterium ulcerans* | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 2 |
| *Listeria species* | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 |
| *Kurthia species* | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 2 |
| *Micococcus roseus* | 0 | 2 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 4 |
| *Streptococcus equines* | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 2 |
| *Micrococcus varians* | 0 | 3 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 5 |
| *Pediococcus species* | 3 | 4 | 0 | 6 | 1 | 2 | 0 | 0 | 0 | 16 |
| *Mycobacterium species* | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 |
| Total isolates | 31 | 14 | 1 | 38 | 9 | 14 | 44 | 0 | 8 | 159 |

Table (4): Bacterial species isolated (No. and %age) in relation to samples tested

| Samples tested / Bacterial species | Swabs No. (%) | Exudate No. (%) | Tissues No. (%) |
|---|---|---|---|
| *Enterococcus faecalis* | 27(22.9%) | 2(11.8%) | 2(8.3%) |
| *Staphylococcus aureus* | 24(20.3%) | 3(17.6%) | 4(16.7%) |
| *Enterococcus faecium* | 14(11.9%) | 2(11.8%) | 2(8.3%) |
| *Staphylococcus epidemidis* | 12(10.2%) | 5(29.4%) | 1(4.2%) |
| *Bacillus licheniformis* | 9(7.9%) | 2(11.8%) | 5(20.8%) |
| *Streptococcus pyogenes* | 6(5.1%) | 1(5.9%) | 1(4.2%) |
| *Aerococcus viridans* | 5(4.2%) | 1(5.9%) | 0 |
| *Bacillus firmus* | 2(1.7%) | 0 | 3(12.5%) |
| *Listeria species* | 2(1.7%) | 0 | 2(8.3%) |
| *Gemella haemolysans* | 2(1.7%) | 0 | 1(4.2%) |
| *Bacillus cereus* | 2(1.7%) | 0 | 0 |
| *Corynebacterium pyogenes* | 4(3.2%) | 0 | 1(4.2%) |
| *Corynebacterium haemolyticum* | 1(0.8%) | 1(5.9%) | 0 |
| *Micococcus roseus* | 1(0.8%) | 0 | 0 |
| *Streptococcus equines* | 1(0.8%) | 0 | 0 |
| *Streptococcus bovis* | 1(0.8%) | 0 | 0 |
| *Kurthia species* | 1(0.8%) | 0 | 1(4.2%) |
| *Streptococcus salivarius* | 1(0.8%) | 0 | 0 |
| *Pediococcus species* | 1(0.8%) | 0 | 0 |
| *Mycobacterium species* | 1(0.8%) | 0 | 0 |
| *Micrococcus varians* | 1(0.8%) | 0 | 0 |
| *Corynebacterium ulcerans* | 1(0.8%) | 0 | 0 |
| Total | 118 | 17 | 24 |

Note: % is calculated from the total isolates in each sample tested.