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Short Communication

Animal Ecology Enhances Farmers' Zoonotic Bacterial Occupational Diseases at High Altitude Area

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ABSTRACT

Farmers' zoonotic bacterial occupational diseases are endemic to numerous communities, and this has been of great public health concern. Farm animals are a reservoir of zoonotic bacteria that causes farmers zoonotic illness. The study aim to examine the role of animal ecology as zoonotic bacterial sources. Animal farm at high altitude area, "Taif" was used for this study; samples were aseptically collected from used surfaces of instruments including ration containers, water containers, doors, soils and farmers' body (hands and legs). The zoonotic bacteria were isolated from the samples. Morphological characteristics and biochemical tests were used to identify the isolated zoonotic bacteria. The most prevalent of zoonotic bacteria obtained was *Escherichia coli* which were isolated from the soils and farmer legs with a prevalent rate of 30% in each case. *Staphylococcus aureus*, coagulase negative *Staphylococcus*, *Escherichia coli* and *Enterobacter* spp were all found in the water containers with a prevalent rate of 10% for each of the organisms. It was observed that zoonotic bacteria *Staphylococcous aureus* had the highest growth values of 15% from doors, 12% from soils and farmer hands, 11% from ration containers, 8% from water containers and 8% from farmer legs. The findings concluded that animal ecology enhanced the transmission of zoonotic bacteria from animals to farmers thus causing occupational zoonotic diseases and increasing the risk of community acquired infections at high altitude area. However, good environmental sanitation and improved animal husbandary practice will protect farmers' health in this area.

Keywords: Animal ecology, Zoonotic bacterial, High altitude area, Occupational diseases.

Introduction

Farmers' occupational diseases are caused by zoonotic bacteria that are transmitted between animals and farmers.[1] The disease occur in about 60–70% of farmers, and is spread through contaminated food.[2] These diseases correlated with zoonotic bacteria that were endemic in the community, causing multiple farmers' diseases resulting in a huge community health burden.[3] The farm animals are a reservoir of zoonotic bacteria that causes various diseases in farmers.[4-6] The exposure of farmers to contaminated materials such as soil, animal wastes increases the risk of these diseases.[7-8]

Escherichia coli is a common zoonotic bacteria found in faecal matter, and in most cases causes gastrointestinal infections in farmers.[9] Other zoonotic bacteria include; *Staphylococcus aureus* and *Enterobacter* spp., and are majorly transmitted through contaminated drinking water and animal products such as milk.[10] Farmers' exposure to these contaminated sources causes various enteric infections.[11-15]

The aim of this study was to investigate the role of animal ecology as a source of zoonotic bacteria, which are transmitted from farm animals to farmers at high altitude area.

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Materials and Methods

Samples collection

Animal farm at high altitude area "Taif, KSA" was selected for this study. "Sterile swabs" were used to collect samples aseptically from used surfaces of instruments including; ration (animal feed) containers, water containers, doors, soils and from farmers' body (hands and legs). The soil samples were collected in sterile polyethylene bags. All samples were kept in an icebox under aseptic conditions, and were sent to the Laboratory.[16-17]

Zoonotic bacterial isolation and identification

The sample was injected into 9 mL of peptone water, and MacConkey broth was used in duplicate tubes for each sample. The tubes were incubated overnight at 37ºC. Then 0.5 mL of the overnight culture was inoculated in Mannitol Salt, Blood agar, and MacConkey agar. The plates were incubated at 37ºC for 48 hours. Bacterial isolation and identification were done following standard methods,[18] then confirmed microscopically.[19]

Statistical analysis

All data collected were analyses on Microsoft Excel computer program.[20]

Results and Discussion

Table 1, Figures 1 and 2 showed the mean signs of zoonotic bacterial growth on the different farm materials as well as on the body of the farmer. The main zoonotic bacterial transmission sources included; ration containers, water containers, soils, and doors. Zoonotic bacterial

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growth observed from the soils was 30% (+++), 20% (++), 20% (++) and 10% (+) for *Escherichia coli, Staphylococcus aureus, Enterobacter* spp. and coagulase negative *Staphylococcus*, respectively. From the ration containers, growth percentages of 20% (++), 20% (++), 10% (+) and 10% (+) were recorded for *Staphylococcus aureus,* coagulase negative *Staphylococcous, Escherichia coli,* and *Enterobacter* spp.), respectively. The zoonotic bacteria growth on the doors were 20% (++), 10% (+), 10% (+), and 10% (+) for *Staphylococcus aureus*, coagulase negative *Staphylococcus, Escherichia coli*, and *Enterobacter* spp., respectively. The lowest zoonotic bacterial growth were observed on water containers at growth rate of 10% (+) each for *Staphylococcus aureus,* coagulase negative *Staphylococcous*, *Escherichia coli*, and *Enterobacter* spp. Meanwhile, more zoonotic bacterial growth were recorded on the farmers' legs with values of 30% (+++), 20% (++), 10% (+) and 10% (+) for (*Escherichia coli*, *Enterobacter* spp., *Staphylococcus aureus*, and coagulase negative *Staphylococcous*, respectively, while the farmers' hands recorded growth of 20% (++), 20% (++), 10% (+), and 10% (+) for *Staphylococcus aureus, Escherichia coli,* coagulase negative *Staphylococcous*, and *Enterobacter* spp., respectively. The zoonotic bacterial growth were observed in the order; *Escherichia coli* > *Staphylococcus aureus* > *Enterobacter* spp. > coagulase negative *Staphylococcous*. From the results it was evident that the prevalence of zoonotic bacteria was in descending order from the soils (80%) > farmer legs (70%) > ration containers > farmer hands (60%) > doors (50%) > water containers (40%). This was an indication that animal ecology results in farmers' zoonotic bacterial occupational diseases, posing great community-acquired infection risk at high altitude area.[10-13] The mean percent of zoonotic bacterial growth are shown in Table 2; Figures 3 and 4. The results indicated that the prevalence of *Escherichia coli* was 24% in the soils, 21% in the farmer legs, 11% in the farmer hands, 3% in the ration containers and 2% each in the water containers and doors. *Escherichia coli* has been reported to be responsible for various diseases resulting in both mortality and various morbidities.[1-2] *Staphylococcus aureus* were observed at a percentage of 15% in the doors, 12% in the soils and farmer hands, and 11% in the ration containers. The lowest value was 8% in the water containers and farmer legs. The highest prevalence of zoonotic bacterial contamination was by *Staphylococcus aureus* (15%,), while the lowest was *Enterobacter* spp. (1%). In addition, the highest incidence of *Escherichia coli* was in the farm soils (24%), while coagulase negative *Staphylococcous* was the lowest (5%). *Staphylococcus aureus* was found on the farmers' hand at a rate of 12%, while coagulase negative *Staphylococcous* was found at a rate of 10%. On the farmer legs, the highest zoonotic bacterial contaminant was *Escherichia coli* and was present at a rate of 21%; while coagulase negative *Staphylococcous* was present at a rate of 7%. From all the observations, the incidence of zoonotic bacterial isolates was in a descending order of soils (60%) > farmer legs (50%) > farmer hands (42%) > ration containers (28%) > doors (25%) > water containers (17%). The World Health Organization (WHO) reported that farm animals were major reservoirs of *Escherichia coli*.[5-6] These zoonotic bacteria could possibly reach the farmers by contact with farm animals or contaminated soils.[4,9]

The present study evaluated the zoonotic bacterial sources of these diseases, which are prevalent in animal ecology. The high rate of the zoonotic bacterial growth in every environment is attributed to development of antibiotic resistance by the zoonotic bacteria.[8] These zoonotic bacteria are becoming resistant to commonlly used antibiotic agents.[7] Urgent attention and improved teamwork are required to develop control strategy and policies to combat zoonosis.

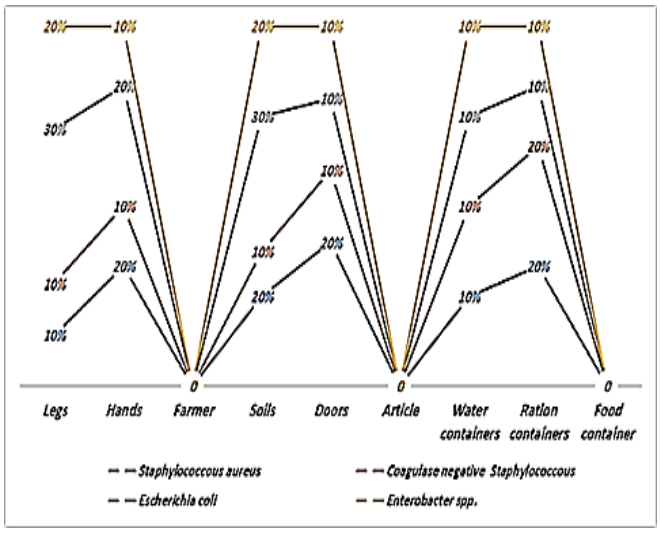

Figure 1: Mean signs of zoonotic bacterial growth

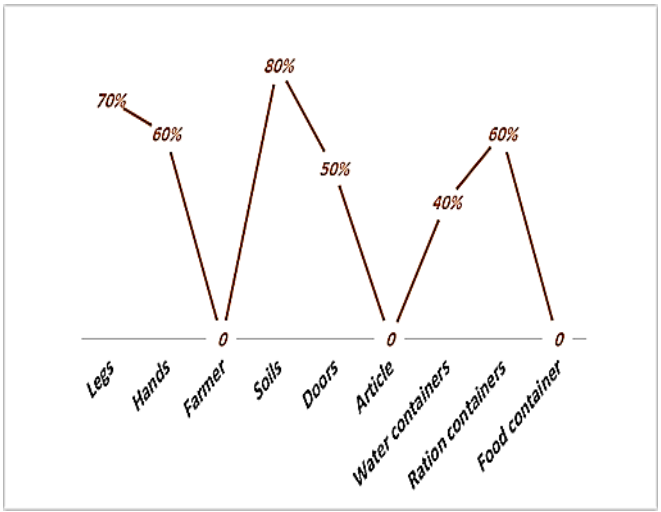

Figure 2: Total signs of zoonotic bacterial growth

Table 1: Mean signs of zoonotic bacterial growth

Items	Gram positive		Gram negative		Total
	Staphylococcus aureus	Coagulase negative Staphylococcus	*Escherichia coli*	*Enterobacter spp.*	(%)
Food container					
Ration containers	20% (++)	20% (++)	10% (+)	10% (+)	60%
Water containers	10% (+)	10% (+)	10% (+)	10% (+)	40%
Article					
Doors	20% (++)	10% (+)	10% (+)	10% (+)	50%
Soils	20% (++)	10% (+)	30% (+++)	20% (++)	80%
Farmer					
Hands	20% (++)	10% (+)	20% (++)	10% (+)	60%
Legs	10% (+)	10% (+)	30% (+++)	20% (++)	70%

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Table 2: Mean percent of zoonotic bacterial growth

Items	*Gram positive*		*Gram negative*		*Total (%)*
	Staphylococcous aureus	*Coagulase negative Staphylococcous*	*Escherichia coli*	*Enterobacter spp.*	
Food container					
Ration containers	*11%*	*12%*	*3%*	*2%*	*28%*
Water containers	*8%*	*6%*	*2%*	*1%*	*17%*
Article					
Doors	*15%*	*7%*	*2%*	*1%*	*25%*
Soils	*12%*	*5%*	*24%*	*19%*	*60%*
Farmer					
Hands	*12%*	*10%*	*11%*	*9%*	*42%*
Legs	*8%*	*7%*	*21%*	*14%*	*50%*

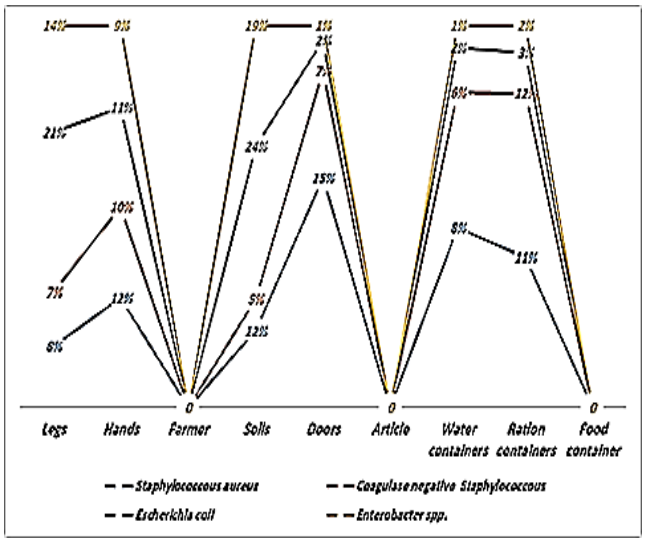

Figure 3: Mean percent of zoonotic bacterial growth

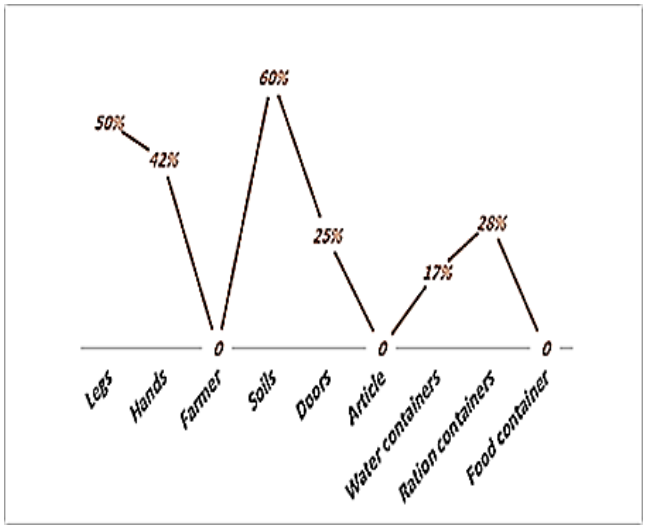

Figure 4: Total percent of zoonotic bacterial growth

Conclusion

The results presented the zoonotic bacteria were transmitted from animals to farmers through (farm tools, soil and the farmers' body), in addition they associated with farmers occupational diseases which affected the community health at high altitude area. It was recommended these diseases could control by improving the animal ecology to reduce the zoonotic bacteria. This geared towards reducing the incidence, which could achieved by monitoring the quality and improving the animal environmental factors in the animal farms at high altitude area.

Conflict of interest

The authors declare no conflict of interest.

Authors' Declaration

The authors hereby declare that the work presented in this article is original and that any liability for claims relating to the content of this article will be borne by them.

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