Prevalence of toxoplasmosis and Q fever in slaughter cattle, pigs, and sheep, at abattoirs in Gauteng and North West provinces of South Africa

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Research Focus Area: Red Meat Safety, Nutritional Value, Consumerism and Consumer Behaviour

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EXECUTIVE SUMMARY

Introduction

Globally, abattoirs are used for passive and active surveillance of diseases of both economic and public health significance. Surveys by serological and cultural assays of slaughter animals may be used to detect newly introduced disease agents and in monitoring disease control and eradication programmes. Information generated from abattoir surveillance could provide an early warning system for impending epidemics or failures of intervention programmes such as vaccination of livestock against certain diseases thereby allowing early intervention efforts to prevent epidemic loss of animals. Losses may result from mortality in animal population, cost of quarantine, isolation and treatment and in some cases loss of international trade. The usefulness of data obtained from abattoirs during surveillance for selected diseases is, however, dependent on the accuracy of the data obtained, data analysis and interpretation.

Q fever (caused by *Coxiella burnetii*) and toxoplasmosis (caused by *Toxoplasma gondii*) are among the understudied reproductive diseases in animals worldwide. Both these zoonotic diseases are economically important as they cause loss of productivity through abortions, foetal deaths and endometritis in infected wildlife and livestock. In addition, these pathogens are of public health concern as they can naturally infect humans. Infections by these two pathogens mostly remain asymptomatic in both livestock and wildlife, making diagnosis based on clinical symptoms difficult.

Despite the fact that there is some literature on the sero-prevalence of toxoplasmosis in wild felids, chinchillas, ferrets, free ranging wild felids, cheetah and dogs in South Africa, there are no data on the epidemiology of toxoplasmosis in livestock except for the publication by Samra *et al.*, 2007 which reported 5.6% sero-prevalence in sheep and the most recent study on toxoplasmosis in livestock in South Africa was documented in 2019. The study reported 32.6%

seroprevalence of Toxoplasma gondii antibodies in cattle in the Mnisi area of Mpumalanga province, South Africa.

There is evidence that Q fever infections cause huge economic losses in livestock and wildlife through congenital defects such as late abortions, premature births and low birth weights in other countries. For instance, in the Netherlands 50355 goats and sheep were culled between December 2009 and June 2010 on 89 bulk tank milk positive farms causing huge losses. Besides a study recently reporting Q fever seroprevalence of 38.4% in cattle in Mnisi community, Bushbuckridge municipality, South Africa, little is known on the prevalence of Q fever in livestock or wildlife in South Africa, albeit in red meat abattoirs.

Q fever and toxoplasmosis are both not considered endemic in South Africa and thus the diseases are not recognized as controlled and notifiable diseases in terms of the Animal Diseases Act 35 of 1984. Thus, there is little known on the prevalence of Q fever and toxoplasmosis in livestock in South Africa. The diseases may go unnoticed causing huge economic losses as they are not continuously monitored.

In this study, we therefore investigated the prevalence of Q fever and toxoplasmosis in slaughter animals in Gauteng and North West abattoirs.

Objective Statements

i) To investigate the prevalence of Q fever and toxoplasmosis in slaughter cattle, pigs and sheep in Gauteng and North West provinces of South Africa using serological assays

ii) To investigate the relationship of animal species, breed, age, sex, abattoir (high and low throughput, and rural/informal) on the prevalence of Q fever and toxoplasmosis infections.

Project Aims

To determine the sero-prevalence of Q-fever and toxoplasmosis in slaughter animals in Gauteng and North West provinces of South Africa using serological assays.

Results

For Gauteng abattoirs, of the 507 animals tested, 6.9% (95% CI: 4.9-9.5%) were positive for antibodies against C. burnetii. The seroprevalence of Q fever by species was 9.4% (31/331) in cattle, 4.3% (3/69) in sheep and 0.9% (1/107) in pigs. The difference in sero-prevalence between sexes was most pronounced in cattle, where it was 17/81 (21%) in females vs. 14/250 (6%) in males. Significant univariate associations with *C. burnetii* seropositivity were seen for species, sex, breed, district and animal origin. However, sex and district were no longer significant in the final multivariable logistic regression model. The Hosmer-Lemeshow test showed adequate model fit (p=0.670). Animals from auctions were more likely to have been exposed to *C. burnetii* than animals from farms and feedlots (OR=5.7; 95%CI: 2.6-12.4; p<0.001). Although not significant in the univariate analysis, the multivariable model showed that the odds of Q fever seropositivity in LT abattoirs was significantly higher than in HT abattoirs (OR 4.1; 95%CI: 1.2-14.0; p=0.023). Breed differences were noted, with a higher seroprevalence (27%) detected in Nguni cattle compared to other breeds, followed by Nguni (6.9%) and Bonsmara (6.6%).

For toxoplasmosis in Gauteng abattoirs: Of the 507 animals tested, 9.8 % were seropositive for toxoplasmosis. The sero-prevalence by species was determined to be 13.9% for cattle, 1.4% for sheep and 2.8% for pigs. The seroprevalence by sex was found to be 11% for females

and 9.6% for males. Jersey cattle showed the highest prevalence of toxoplasmosis (33%), followed by Nguni (20%) and Bonsmara (9.9%).

For Q fever in North West Province abattoirs: The sero-prevalence was 12.2% and by animal species it was 10.5% in cattle and 16.5% in sheep. The difference between sexes was 9.7% for males and 15.9% for females. J.Jersey cattle showed the highest prevalence of Q fever (17.9%) followed by Dorper (9.3%), then Nguni (7.8%).

The sero-prevalence of toxoplasmosis for animals slaughtered in North West Province was 14% and by species it was found to be 19.8% in cattle and 1.8% in sheep. The prevalence by sex, was found to be 8% in males and 18.5% in females. Jersey cattle showed the highest prevalence of toxoplasmosis (21.4%), followed by Nguni (16.4%).

Conclusion

Based on the seroprevalence data of Q fever and toxoplasmosis from animals slaughtered in Gauteng, cattle had the highest level of exposure to the pathogens compared to sheep and pigs. Contrary, in animals slaughtered in Northwest, sheep showed the highest prevalence of Q fever. Jersey and Nguni cattle seem more likely to be highly exposed to both pathogens, than the other breeds. Likewise, females showed a higher level of exposure than males for both pathogens. In conclusion, we have documented the sero-prevalence and risk factors associated with *C. burnetii* and *T. gondii* in red meat abattoirs of Gauteng and North West Provinces, South Africa. This study will hopefully contribute to future epidemiological investigations. It is therefore imperative to conduct more studies on Q fever and toxoplasmosis in livestock in other provinces of South Africa. These studies should also focus on the isolation and molecular and genomic analyses of circulating strains of *C. burnetii* and those of *T. gondii* in the country.

Popular Article

Title for Popular Article

Q fever and toxoplasmosis in abattoirs of Gauteng and North West Provinces of South Africa: Neglected abortion causing diseases

1 January 2021

Introduction

There is evidence that Q fever, caused by *Coxiella burnetii*, and toxoplasmosis, caused by *Toxoplasma gondii*, infections cause huge economic loses in livestock and wildlife through congenital defects such as late abortions, premature births and low birth weights. However, these two diseases are not considered endemic in South Africa and thus they are not recognized as controlled and notifiable in terms of the Animal Diseases Act 35 of 1984. Thus, there is little knowledge on the prevalence of Q fever and toxoplasmosis in livestock in South Africa. These diseases may go unnoticed causing huge economic losses through reproductive disorders as they are not continuously monitored.

Neglected abortion causing diseases in livestock: filling the knowledge gap

Little is known on the prevalence of Q-fever and toxoplasmosis in livestock in South Africa. Abattoirs are useful for passive and active surveillance of diseases of both economic and public health significance.

The seroprevalence of Q fever in animals slaughtered in Gauteng abattoirs was found to be 6.9% and that of toxoplasmosis to be 9.7%. The seroprevalence of Q fever by species was 9.4% in cattle, 4.3% in sheep and 0.9% in pigs. The difference in seroprevalence between sexes was most pronounced in cattle, where it was 21% in females vs. 6% in males. Animals from auctions were more likely to have been exposed to *Coxiella burnetii* than animals from farms and feedlots. Breed differences were noted, with a higher seroprevalence (27%) detected in Nguni cattle compared to other breeds (6.9% in Jersey, 6.6% in Bonsmara, 4.3% in Dorper and 0.9% in Large white).

For toxoplasmosis, there was a pronounced association of seropositivity to animal species where 13.9% of cattle, 1.4% of sheep and 2.8% of pigs of animals positive for to toxoplasmosis.

For animals from North West Province abattoirs, the seroprevalence of Q fever was 12.2% and by animal species it was 10.5% in cattle and 16.5% in sheep. The difference between sexes was 9.7% for males and 15.9% for females. Jersey cattle showed the highest prevalence of Q fever (17.9%) followed by Dorper (9.3%), then Nguni (7.8%). The seroprevalence of toxoplasmosis for animals slaughtered in North West Province, by species was found to be 19.8% in cattle and 1.8% in sheep. The prevalence by sex, was 8% in males and 18.5% in females. Jersey cattle showed the highest prevalence of toxoplasmosis (21.4%), followed by Nguni (16.4%).

Conclusion

Except for Q fever in animals from North West abattoirs, cattle had the highest level of exposure to both pathogens compared to sheep and pigs. Certain breeds seem to be more likely to be exposed to these two diseases that the others. We also observed association of positivity and animal's sex. For this reason, there is a possibility that cattle, pose the highest risk of abattoir workers being exposed to these pathogens at slaughter and processing. *Coxiella burnetii* and *Toxoplasma gondii* may be of economic importance to the livestock industry and of zoonotic significance to personnel in the farming sector, including livestock farmers, animal attendants and veterinarians, and to consumers of under-cooked products such as milk. It is therefore imperative to conduct more studies on Q fever and toxoplasmosis in livestock in other provinces of South Africa. These studies should specifically focus on the epidemiology of two diseases, including molecular strain characterization.

Figure 1: Mr Maruping Mangena, a PhD student with pigs inside collection crushes in preparation for slaughter and sample collection in Sedibeng district, Gauteng province.

Figure 2: Mr Letlhogonolo Diseko, a PhD student with blood samples collected from cattle and sheep at Potchefstroom abattoir in Dr Kenneth Kaunda District, North West Province.

Acknowledgements

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