Original Research

Journal of Advanced Veterinary Research
(2024) Volume 14, Issue 1, 223-227

Prevalence of mites infestation in smallholder pig farms in selected villages in Roma Valley, Lesotho

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ARTICLE INFO

Recieved: 17 October 2023

Accepted: 15 January 2024

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Keywords:

Age
Lesotho
Management
Mites
Pigs
Prevalence
Sex

ABSTRACT

Studies to elucidate the magnitude of mites problem in pigs, its distribution and the possible risk factors associated with infestation are lacking in Lesotho. A cross sectional study was conducted from 138 pigs selected from 70 households to determine the prevalence of pig mites and its associated risk factors. The structured questionnaires were administered to gather information from 70 pig farmers on pig management and potential risk factors for mite infestation. Binary logistic regression within SPSS (20.00) was used for determining the prevalence of mites in different parameters. Out of 138 pigs examined 91 (65.9%) tested positive for *Sarcoptes scabiei*. Female (56.5%) pigs were significantly ($p<0.05$) more infected than males (11.5%). The prevalence of mites differed significantly ($p<0.05$) between different age groups where young (41.4%) pigs had higher infection than adult pigs (26.5%). In terms of body regions, there was no statistical significant variation on the prevalence of mites between the back (53.6%) and the flanks (50.0%) however, both of these rates were significantly higher than the prevalence rate recorded for the ears (26.1%). It is concluded that pig mites represent a common health problem whereby sex, age and body region are important risk factors associated with infestation.

Introduction

The role played by livestock production in supporting the livelihoods of people in developing countries cannot be underestimated (Herrero *et al*., 2013). Davis *et al*. (2007) reiterated that 68% of household in developing countries earn income from livestock. An estimation of up to 1.3 billion people globally is employed in different livestock product value chains (Herrero *et al*., 2009). Livestock farming accounts for 62% of the total agricultural output in Lesotho and it is mainly dominated by wool and mohair production. However, given the escalating rate of climate change which affects the quality and capacity of rangelands it is imperative to resort to livestock rearing which reduces more pressure on the rangelands like keeping of piggery.

Small scale pig keeping in Lesotho has emerged as one of the common endeavors of subsistence for the majority of Basotho (Kompi *et al*., 2023). According to Lesotho Livestock Statistic Report (2018/2019), improved pig breeds available in the country include; Large white, Land race, Duroc and Large black however, these breeds are largely dominated by indigenous pig breeds. In Lesotho pig production is still at infant stage because the Lesotho Agricultural Census (2019/2020) revealed an estimation of 85, 679 as the total population of pigs in the country. This can also be justified by the fact that the local food chain stores are flooded with pork and pork products which are imported from South Africa.

Relative to other meat producing animals like beef, pigs are small, adaptable, rapidly growing and multiparous (Adhikari *et al*., 2021). Similarly, Madzimure *et al*. (2013) stated that pigs are easy to raise and do not require much space, unlike other livestock sectors which are popular in Lesotho. According to Nonga and Lugendo (2015) pig keeping is progressively becoming an imperative economic activity in most resource poor communities of developing countries. The aforementioned trend is likely to continue as Speedy (2003) indicated that pig keeping requires minimal investment in capital while also offering quick returns.

Despite the unfolding importance of pig production in the country, the sector is frequently confronted with several health constraints which include among others higher incidences of ectoparasites. The prevalence of ectoparasites in pigs is also confirmed by Kagira *et al*. (2010) in Kenya who noted that piggery industry is affected by certain disease with ectoparasites being the most important. Muhammad *et al*. (2021) indicated that ectoparasites of pigs including lice, ticks and mites inhibit the skin surface of the host and are detrimental because they depend on their host for sustenance, maturation and multiplication. Moreover, ectoparasites are the primary means of spreading specific pathogens (Sahito *et al*., 2017). According to Apanaskeyich *et al*. (2018) ticks and mites are the key vectors of numerous bacterial, viral, rickettsial and protozoal diseases, from which some are zoonotic. Wilson and Swai (2014) indicated that farmers experience some economic losses as the results of parasitic diseases due to higher incidences of mortality, decreased litter size, poor growth rate, reduced weight gain and poor reproduction performance. Several authors have attributed the prevalence of internal and external parasites to climatic and management factors (Wilson and Swai, 2013; Nonga and Paulo, 2015).

Despite the increasing concern of farmers on Sarcoptic mange infes-

ISSN: 2090-6277/2090-6269/

tation in pigs in Lesotho, currently there are no studies that have been documented to ascertain the magnitude of mange problem in pigs, its distribution and the possible risk factors for the infestation. In the light of the given situation the current study was undertaken to determine the prevalence of mange in pigs and its associated risk factors and to evaluate farmer's management practices in relation to the prevalence of pig mites.

Materials and methods

The study was undertaken in Roma which is within the foothills of Maseru District. According to Olaleye *et al.* (2022) the foothills in Lesotho are characterised by an altitude of 1800-2000 m above sea level, an area of 4588 km2, steep rolling topography, mean annual rainfall of 900-1000 mm and mean annual temperature of -8 to 30°C.

The study animals were pigs of different age and sex groups managed intensively. Only one breed of pigs which is duroc was used in the study in order to minimize the effect that might be due to breed differences. The age of the pigs was obtained from farms records and accordingly pigs were categorized into young (≤7 months) and old (≥8 months). Heavily pregnant sows were excluded for sampling to avoid exposing them to stress.

This study had two components, being the survey and the experiment. Initially, the list of households having pigs within selected villages was established with the assistance of the extension officers form the Ministry of Agriculture and Food Security. In each village meetings were held to explain the purpose of the study and to seek farmers willingness to participate. A cross-sectional study was conducted from January to March 2023 from 70 farmers selected randomly from the established list. The selected farmers were interviewed. 138 pigs were selected from the interviewed farmers and the criterion for inclusion was all pigs with no obvious signs of illness. Accordingly farms were categorized into small (<10), medium (10-20) and large (>20).

The data was collected face to face using the structured questionnaires. Important sections of the questionnaire included: farmers demographic informatiuon, housing management (cleaning routines) and external parasites control programme. Preferably the target was to interview the household heads however in the absence of the head of household, the second most senior household member was interviewed. Prior to the field study the questionnaires were pilot tested among a small group of pig smallholder.

Pigs were manually restrained and their body was inspected for the presence of mites. Animal skin scrapings were collected from different parts of the body including ears, the back and flanks. Using a clean surgical blade, skin scrapings were collected until the traces of blood could be seen (Muhammad *et al*., 2021; Taylor *et al*., 2016). All the samples were then placed into clean plastic containers that were labelled according to the swine owner, location, body region, sex, age, and date of sample collection. After sample collection, the scrapped area was disinfected using Iodine and sprayed with broad-spectrum antibiotics to prevent any secondary infections. The collected samples were packed in a cooler box and were transported to the Animal Science Laboratory at the National University of Lesotho for identification.

In the laboratory, the samples were transferred from the plastic containers into a glass petri dish, crushed and add 10 ml of potassium hydroxide (KOH) 10 % . The solution was allowed to stay for 24 hours to allow digestion of crusts. Digested material was transferred into a centrifuge tube and centrifuge (5 minutes at 2000rpm). The supernatant was discarded and the tube was filled with distilled water, re-centrifuge and discard the supernatant again. At this point, the sediment was pipetted to a microscope slide and examined directly for the presence of mites under an electronic microscope and the sample was observed under ×10 and ×40 objectives (Nonga and Lugendo, 2015).

The data was analyzed using SPSS version 20.00. For the analysis of survey the percentages were determined using the cross-tabs and the significance was tested by Chi-square. The prevalence of *Sarcoptes scabiei* in different sex and age groups was determined using binary logistic regression within generalized linear model. Odds ratios (OR) were used to determine the degree of association between the different risk factors and the pig mites. The prevalence of *Sarcoptes scabiei* in different body regions was determined by repeated measures within general linear model. In all the analysis significance was tested at 0.05. the rsults were presented in tables.

Results

The summary of farmers profile as demonstrated in Table 1 revealed that pig keeping is mainly dominated by females across the three farm sizes, small (56.7%), medium (75.0%) and large (50.0%). The results further showed that the majority of the respondents cross the three farm sizes small (40.7%), medium (39.3%) and large (33.3%) have attained tertiary level as their highest level of education. Moreover, it was observed that the majority of respondents have between 3 to 6 years in pig farming however very few of them are members of piggery associations within their communities. When significance was tested at 0.05 the results from the chi-square confirmed that farm size had no significant effect on the gender of the farmer (p= 0.47), highest level of education (p= 0.60), experience in pig farming (0.83) and whether an individual is a member of piggery association or not (0.53).

In terms of piggery housing management and it was observed that almost all respondents clean the pens of their pigs and majority of them clean the pens on daily bases. Despite the fact that farmers clean the pens of their animals, most of them across the three farm sizes small (81.5%), medium (71.4%) and large (86.7%) do not use the disinfectant during cleaning. The results of the chi-square showed that farm size had no effect on cleaning of the pens (0.46), frequency of cleaning (p= 0.73) and the use of disinfectant (p= 0.59).

It was observed that majority of respondents across the three farm sizes small (51.9%), medium (57.1%) and large (53.3%) routinely control ectoparasites using acaricides. Moreover, the results confirmed that most respondents do not quarantine new stock on their farms. It was also observed that isolation of sick animals from the heard is done by few pig farmers. The chi-square results indicated that farm size had no significant influence on the use of acaricides (p= 0.92), quarantining of new stock (p= 0.88) and isolation of sick animals (p= 0.17).

The results indicated that out of 138 pigs examined 91 tested positive for *Sarcoptes scabiei* which makes an overall prevalence rate of 65.9% for the study.

The current results presented in Table 2 showed that sex is an important risk factor associated with *Sarcoptes scabiei* infestation whereby males (56.5%) were significantly (p<0.05) more infected than females (11.6%). The results further showed that every one unit increase in females is also predicting increasing likelihood associated with having *Sarcoptes scabiei* relative to males by 9.91 times. The results of the current study also confirm that age is an important risk influencing the prevalence of *Sarcoptes scabiei* whereby adult (41.4%) pigs were significantly more infected than young (26.5%) pigs. Moreover, the results showed that every one unit increase in adult pigs is also predicting increasing chances associated with having *Sarcoptes scabiei* relative to young pigs by 1.96 times.

The current results presnted in Table 3 showed that there was a statistical significance variation (p<0.05) in the prevalence of *Sarcoptes scabiei* in different body regions. There was no observed variation on the prevalence of mites between the back (53.6%) and the flanks (50.0%) however, both were significantly more infected than the ears (26.1%).

Discussion

The results of the current study which show involvement of women in

pig keeping are in accordance with the previous report of Karimuribo *et al*. (2011) in Iringa, Tanzania who similarly observed that women are the most group of the community who are actively engaged in pig farming. One possible explanation for this trend could be progressively escalating rates of unemployment which propels women with no formal employment to participate in livestock keeping as a way of subsistence (Nonga and Lugendo. 2015).

The results further revealed that majority of the respondents have attained tertiary level as their highest level of education. It is evident that educated pig farmers are more likely to adopt best management practices that can potentially minimize the risk of parasite infestations. This includes maintaining proper hygiene and sanitation in housing facilities, implementing appropriate waste management systems, and practicing regular cleaning and disinfection protocols. These measures help create an unfavorable environment for parasite survival and reduce the overall prevalence (Mukaratirwa *et al*., 2013). Involvement of graduated people from universities in agriculture is another important indicator of overwhelming unemployment rate in the country

Table 1. Farmers demographic profile and pig management practices.

Variable	Category	Farm sizes			
		Small (%)	Medium (%)	Large (%)	P-value
Demographic profile of pig farmers					
Gender	Male	43.3	25	50	0.25
	Female	56.7	75	50	
Highest level of education	Did not attend	22.2	10.7	13.3	0.6
	Primary	7.4	10.7	6.7	
	Secondary	3.7	10.7	26.7	
	High school	25.9	28.6	20	
	Tertiary	40.7	39.3	33.3	
Experience with pigs	>2 years	31.7	12.5	0	0.83
	3-6 years	43.3	62.5	100	
	>6 years	25	25	0	
Member of any piggery association	Yes	3.7	7.1	0	0.53
	No	96.3	92.9	100	
Housing management					
Cleaning of pens	Yes	100	96.4	100	0.46
	No	0	3.6	0	
How frequent	Daily	63	74.1	66.7	0.73
	Weekly	7.4	3.7	13.3	
	When necessary	29.6	22.2	20	
Application of disinfectant	Yes	18.5	25.9	13.3	0.59
	No	81.5	71.4	86.7	
Control and preventive measures					
Use of acaricides	Yes	51.9	57.1	53.3	0.92
	No	48.1	42.9	46.7	
Quarantine of new stock	Yes	29.6	32.1	20	0.88
	No	70.4	67.9	80	
Isolation of sick pig	Yes	0	10.7	13.3	0.17
	No	100	89.3	86.7	

Table 2. Effects of Sex and age on the Prevalence of *Sarcoptes scabiei*.

Category	No. of examined animals	Prevalence (%)	95% CI	Exp(B)
Sex				
female	69	39(56.5^{a})	0.45-0.68	9.91
Male	69	8(11.6^{b})	0.04-0.19	1
Age				
Young	68	18(26.5^{a})	0.16-0.37	1.96
Adult	70	29(41.4^{b})	0.30-0.53	1

Percentages with different superscripts within the same column differed significantly, CI = confidence interval, Exp (B) = Exponential beta

Table 3. Prevalence of *Sarcoptes scabiei* in different body regions.

No. Examined	Prevalence (%)	S.E
138	36(26.1^{a})	0.03
138	74(53.6^{b})	0.04
138	69(50.0^{b})	0.04

Percentages with different superscripts within the same column differed significantly, S.E standard error.

The overall prevalence rate of 65.9% for mange recorded in the current study is in proximity with 63.7% which was reported in Kenya by Kagira *et al.* (2013). Similarly, the currents findings are close to the observations of Cozma *et al.* (1997) who concluded that 70% of pigs sampled in Romania were highly infested with Sarcoptic Scabiei. The present results however contradict the report of Abel *et al.* (2017) in Angónia district, Mozambique who reported 0% of mange in pigs. The current results are far above 45% and 37.5% reported in Germany and Chattishgarh by Damriyasa *et al.* (2004) and Maiti *et al.* (2004) respectively. Accorting to Nonga and Lugendo (2015) the disparities between different studies can possible be explained by variations in local prevalence of sarcoptic mange in the specific region, seasonality, the type of pig management, sampling techniques and laboratory methodologies employed.

The obtained 65.9% prevalence rate in the current study is on the higher side considering that the majority of the respondents across the three farm sizes small (51.9%), medium (57.1%) and large (53.3%) reported that they routinely use acaricides for the control of external parasites (Table 1). This can possibly suggests that parasites are developing resistance to commonly used drugs as this is a worldwide concern. Wolstenholme *et al.* (2004) confirmed the emerging resistance of parasites to commonly used drugs. Resistance to antiparasitic is an emerging problem with substantial consequences in livestock around the world (Wolstenholme *et al*., 2004; Sangster *et al*., 2018).

The current results can also be attributed to suboptimal bio-security measures in the study area as it was confirmed that the majority of the respondents do not quarantine new stock and isolate sick animals from the others hence increasing the chances for cross contamination (Table 1). Isolating and monitoring new additions to the herd helps identify and treat any individuals carrying parasites before they can spread to other pigs (Cringoli *et al*., 2017). According to Laha (2015) a strict bio-security measures are able to minimize parasite from the herd. Moreover, it was observed that the majority of the respondents do not use disinfectant during cleaning of the pens which also suggests that the cleaning programme in most farms is suboptimal. Constant cleaning and disinfection of pens, equipment, and bedding materials help eliminate parasite eggs, and larvae from the environment, reducing the potential for re-infection and parasite transmission (Quiroz-Romero *et al*., 2014).

In terms of sex the current results showed that females (56.5) were significantly more infected than males (11.6%). Similarly, the findings of Ali *et al.* (2021) also revealed higher mites prevalence in females than in males, 2.85% and 0.64% respectively. The present results are also in accordance with the conclusion of Tefera and Gebreah (2001) who reported a higher disease prevalence rate in female pigs than in males. Sangioni *et al.* (2017) indicated that parasitic infestation in females can be attributable to several parameters including physiological status or reproductive function (pregnancy, parturition, and lactation), which can substantially weaken activities of the immune system thereby exposing animals to parasitic infection.

The prevalence of mites between different age groups varied and it was observed that adult pigs were severely more infected than young pigs. This observation is in line with the work of Odo *et al.* (2016) who reported higher infection rate in adults than in young pigs. These results however contradict the report from previous researchers who recorded higher prevalence rate of infestation in young pigs than adult (Tefera and Gebreah, 2001; Dinka *et al*., 2010). Moreover, different results have been reported by Rajkhowa *et al.* (2012) who indicated that younger animals suffered more (44.53%) than adult animals (24.37%). According to Ozsvari (2018) adult pigs are likely to be become infected with *Sarcoptes scabiei* through direct contact with infected animals, as well as indirect contact with contaminated materials such as bedding, feed, or equipment. One other possible reason why young pigs are less infected might be owing to the fact that in most cases farmers have a tendency to take good care for young animals than they do with adult animals.

The prevalence of *S. scabiei* was significantly ($P < 0.05$) lower at the ears than at the back and flank this is because the whole body (back and flanks) is exposed to the mites' attachment (Muhammad *et al*., 2021). According to Debnath *et al.* (2020), mites first tend to colonize the skin on the inner surface of the ear, and from this side, they move out throughout the body, tail, and legs, which accounts for the high incidence of mites surrounding the ear. The current study contradicts this assertion.

Conclusion

With these results it is concluded that the bio-security measures implemented in most farms are suboptimal hence likely exposing pigs to infestation by parasites. Pig mites represent a common health problem in the study area and sex, age and body region are important risk factors associated with mites infestation.

Acknowledgments

The authors would like to awknowledge pig owners for thier willingness to participate in the study. Technicians in the Animal Science lab (NUL) are slo awknowledged.

Conflict of interest

The authors declare no conflict of interest.

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