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Faecal Egg Counts and Associated Risk Factors of Gastrointestinal Parasites in Pigs Reared in Urban and Semi-Urban Areas of Maseru District, Lesotho

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ABSTRACT

Gastrointestinal parasites are among the major constraints limiting pig productivity worldwide through reduced growth, poor feed efficiency, and increased economic losses. In Lesotho, information regarding the burden of gastrointestinal parasites in pigs remains limited despite the growing importance of pig production. Therefore, the objective of this study was to assess faecal egg counts of gastrointestinal parasites and determine associated risk factors in pigs reared under urban and semi-urban production systems in Maseru District, Lesotho. A cross-sectional study was conducted involving 100 pigs sampled from 50 farms located in urban and semi-urban regions. Faecal samples were collected and examined using the McMaster flotation technique to determine eggs per gram of faeces and identify parasite groups. Data were entered into Microsoft Excel and analyzed using SPSS version 20.0. Parasite prevalence was calculated, and binary logistic regression within generalized estimating equations was used to evaluate the effects of region, age, sex, and breed on parasite infection. The results revealed that nematodes and coccidia were the predominant gastrointestinal parasites, while cestodes occurred at low levels. Faecal egg counts of nematodes and coccidia were significantly higher ($p \leq 0.05$) in pigs from semi-urban regions than those from urban regions. Female pigs also exhibited significantly higher infection levels than males ($p \leq 0.05$), whereas age and breed had no significant effect on parasite burden ($p \geq 0.05$). The study concludes that gastrointestinal parasitism is prevalent among pigs in Maseru District, with region and sex being important determinants of infection levels. Improved husbandry practices, farmer education, biosecurity measures, and targeted parasite control programs are recommended to reduce parasite burdens and enhance pig productivity. training, and biosecurity improvements to mitigate productivity losses in pig production.

INTRODUCTION

Pig farming is a rapidly growing and economically significant livestock sector in Lesotho, characterized by intensive production systems that integrate breeding, farrowing, growth, and finishing within a single enterprise (Matache, 2016). The sector provides quick returns on investment and requires relatively less land compared to other livestock species, making it accessible to small- and medium-scale farmers (Enem *et al.,* 2010). Pork production also contributes substantially to food security and human nutrition by providing an important source of animal protein (Matache, 2016). Despite its potential, pig production in Lesotho faces numerous challenges, including high feed costs, inadequate slaughter facilities, poor-quality breeding stock, weak market systems, and limited access to veterinary and extension services (Montsho & Moreki, 2012; Patr *et al.,* 2014). Among these constraints, gastrointestinal parasitism is a critical factor limiting productivity, as it reduces feed efficiency, slows growth, increases piglet mortality, and results in economic losses due to organ condemnation at slaughter (Kouam *et al.,* 2018; Alarcon *et al.,* 2017). These parasites impair digestive function by causing intestinal irritation, competing for nutrients, and reducing nutrient absorption (Amadi *et al.,* 2018). However, information on the prevalence and intensity of gastrointestinal parasites in pigs in Lesotho remains scarce, particularly across different age groups and production settings. This study therefore aims to evaluate the faecal egg counts of gastrointestinal parasites in pigs from urban and semi-urban regions of the Maseru district to better understand their impact on productivity and inform effective control strategies.

LITERATURE REVIEW

Gastrointestinal (GI) parasites are a major constraint to pig production worldwide, adversely affecting productivity through reduced feed conversion efficiency, slower growth rates, decreased weight gain, increased piglet mortality, and organ condemnation at slaughter (Alarcon *et al.,* 2017). These parasites colonize the digestive tract, causing irritation, indigestion, and reduced appetite, while competing with the host for essential nutrients and damaging the intestinal lining, which impairs nutrient absorption (Amadi *et al.,* 2018). Despite these documented effects, there is limited scientific information regarding the faecal egg counts, diversity of GI parasites, and their overall impact on pig production in Lesotho. Globally, GI parasites are prevalent across all pig production systems.

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While clinical disease is relatively uncommon and usually associated with heavy infections or coccidiosis caused by Cystoisospora suis, subclinical infections are widespread and can significantly reduce growth performance and feed efficiency (Pettersson, 2021). Risk factors such as poor hygiene, inadequate management practices, and environmental contamination strongly influence parasite transmission, resulting in varying infection levels across production systems (Alarcon *et al.,* 2017; Nonga & Paulo, 2015). Moreover, several GI parasites including Entamoeba polecki, Ascaris suum, and Toxoplasma gondii are zoonotic, posing a public health risk through ingestion of contaminated materials, colostrum, or skin penetration (Atawalna *et al.,* 2016). Housing conditions, flooring, and bedding materials further affect parasite prevalence, with certain husbandry systems inadvertently promoting parasite survival (Isaia *et al.,* 2020).

Helminths, comprising nematodes (roundworms) and platyhelminths (flatworms), have complex life cycles involving eggs, larvae, and adult stages. They are transmitted via faecal oral, transdermal, vector-borne, or predator prey routes (Taylor *et al.,* 2016; Mendoza-Gomez *et al.,* 2015). Helminths can persist in hosts by modulating immune responses and producing environmentally resistant stages, facilitating rapid reinfection, especially under warm, humid conditions (Jirillo *et al.,* 2014; Roesel *et al.,* 2017; Dadas *et al.,* 2016). Common GI parasites in pigs include Ascaris suum, Trichuris suis, Oesophagostomum spp., Cystoisospora suis, and Eimeria spp., with prevalence influenced by age and management practices (Pettersson, 2021; Kochanowski *et al.,* 2017). Protozoan parasites, particularly Eimeria spp. and Cystoisospora suis, are major causes of coccidiosis in young pigs, leading to diarrhoea and poor growth (Obonyo *et al.,* 2013). Nematodes such as Ascaris suum, Trichuris suis, and Strongyloides ransomi also contribute substantially to disease burden (Zheng *et al.,* 2019). Certain species, including Balantidium coli and Cryptosporidium spp., are zoonotic and transmitted through contaminated food or water (Solaymani-Mohammadi & Petri, 2006; Zheng *et al.,* 2019). Parasite prevalence is closely linked to agro-ecological conditions and production systems. Intensive pig production systems generally exhibit lower infection rates due to improved hygiene and biosecurity, while extensive and backyard systems show higher prevalence owing to poor sanitation and increased environmental exposure (Amadi *et al.,* 2018; Leo *et al.,* 2019; Pittman *et al.,* 2010; Shrestha *et al.,* 2017). Semi-intensive systems may display intermediate or elevated infection levels because of partial environmental exposure (Lekko *et al.,* 2018), whereas indoor systems typically experience reduced parasite burdens (Pinilla *et al.,* 2020).

Host factors including age, breed, sex, and physiological status also influence parasite dynamics. Young pigs are generally more susceptible and often exhibit clinical signs, while older pigs develop partial immunity, resulting in lower parasite burdens (Roepstorff *et al.,* 2011; Greve, 2012). Certain parasites, such as Cryptosporidium spp., can infect pigs across all age groups (Zheng *et al.,* 2019). Evidence on breed susceptibility remains inconsistent, although local breeds may display lower infection levels due to adaptation and acquired immunity (Zvinorova *et al.,* 2016; Mendoza-Gomez *et al.,* 2015; Maganga *et al.,* 2019). Female pigs, particularly during pregnancy and lactation, tend to have higher parasite burdens due to hormonal and immunological changes, making them more susceptible than males (Abonyi & Njoga, 2019; Nwafor *et al.,* 2019). Despite the wealth of global literature on GI parasites in pigs, significant knowledge gaps persist regarding parasite prevalence, diversity, and intensity in Lesotho's pig production systems. Most existing studies focus on intensive systems in developed countries, with limited empirical data from semi-urban and rural settings typical of Lesotho. Furthermore, the relationship between specific host factors (age, breed, sex) and faecal egg counts in local production contexts remains poorly characterized. Understanding these dynamics is critical for developing effective parasite control strategies and improving pig productivity in Lesotho.

MATERIALS AND METHODS

Study Area

The study was carried out in two regions of Maseru district, Lesotho; namely urban and semi- urban regions. The urban regions were represented by Qoaling and Khubetsoana villages. While semi urban regions were represented by Roma Valley which was made up of Hata-Butle and Thoteng villages. In Maseru, the summers are warm, the winters are short, cold and dry. Over the course of the year, the temperature typically varies from -1.1 °C to 27.2 °C and is rarely below - 4.4 °C or above. This district experiences significant seasonal variation in monthly rainfall. The rainy period of the year lasts for ten months from August to June with a sliding 31-day rainfall of at least 12.7 mm (Meus, 2009).

Study Design and Sampling

A cross-sectional study was conducted to assess gastrointestinal parasites in pigs in Maseru district. Fecal samples were collected randomly from pigs in two distinct regions : urban and semi-urban. In each area, 50 farmers were randomly selected to participate, making a total of 100 farmers across both regions. From these farmers, fecal samples were obtained from 100 pigs, including 40 males and 60 females, representing different age groups.

Faecal Sample Collection

Faecal samples were preferably collected directly from the rectum, to ensure that they are not contaminated. An average of 5 g of faecal samples was collected randomly from selected animals using sterile disposable plastic gloves. Samples were placed in a screw-capped plastic bottle, clearly marked for identification, kept in a cooler box with dry ice packs and transported on the same day of collection to the National University of Lesotho laboratory for examination. In the laboratory, faecal samples were refrigerated at 4 ºC and processed within 48 hours.

Examination of Faecal Samples

Samples were crushed thoroughly and 2 g of each crushed faecal sample was mixed with 58 ml of sodium chloride (NaCl) solution and blended. After obtaining homogenous mixture, samples were sieved into a beaker. Few drops of amyl alcohol (3-6) were added to treat bubbles in the mixture. The disposable pipettes were used to draw few milliliters and were used to fill the two chambers of the McMaster slides which were viewed under the microscope (10× and 40× objectives) (Taylor *et al.,* 2016). Identification of parasite eggs was based on morphological characteristics. Floating parasite eggs were counted by using laboratory cell counter and each number was multiplied by a factor 50 to give an approximate number of eggs/gram of faeces.

Data Analyses

Data collected from individual animals and parasitological examination results were entered in to Microsoft excel spread sheet. A Statistical Package for Social Sciences (SPSS, version 20.0), was used to analyze the data. The prevalence of each parasite species was calculated as a percentage of number of faecal samples infected in the total number of samples examined ($P = d / n * 50$). Binary logistic regression within generalized estimating equations was used to ascertain the effects of area, age, sex and breed on the likelihood that the pigs have gastrointestinal parasite infection.

RESULTS AND DISCUSSION

Effect of Regions on The Faecal Egg Load of Nematodes, Coccidia, and Cestodes

The present study demonstrated that faecal egg counts (FEC) of nematodes and coccidia were significantly higher ($p \leq 0.05$) in pigs reared under semi-urban agro-ecological conditions compared to those in urban regions. This indicates that pigs raised in semi-urban environments are at a greater risk of gastrointestinal parasite (GIP) infections. The odds of infection were higher in semi-urban systems, suggesting that environmental and management-related factors strongly influence parasite transmission dynamics. This observation is consistent with findings by Lekko *et al.* (2018), who reported higher parasite burdens in pigs raised under semi-intensive systems compared to intensive systems. Similarly, Kristina *et al.* (2016) observed elevated helminth infection rates in pigs reared in less controlled environments, attributing this to climatic factors such as temperature and humidity, which enhance parasite survival and transmission. Environmental contamination and poor hygiene practices commonly associated with semi-urban production systems may explain the higher parasite load observed. According to Dey *et al.* (2014), pigs raised under traditional systems with inadequate sanitation, poor nutrition, and irregular deworming programs are more susceptible to gastrointestinal parasitism. This is further supported by Roepstorff *et al.* (2011), who emphasized that intensive management practices significantly reduce parasite exposure and infection intensity. In addition, Nansen and Roepstorff (1999) reported that parasite transmission is strongly influenced by environmental conditions, particularly moisture and temperature, which favor the development and survival of infective stages. Therefore, semi-urban regions likely provide more favorable ecological conditions for parasite propagation. In contrast, cestode infections did not differ significantly ($p \geq 0.05$) between regions . This suggests that factors influencing cestode transmission, such as intermediate host availability, may be relatively uniform across the study regions. Similar findings were reported by Nganga *et al.* (2008), who observed no significant variation in cestode prevalence across different production systems.

Table 1: The effect of regions on the faecal egg load of nematodes, coccidia and cestodes

Regions	Samples examined	EMM	Exp. B	Sig
Nematodes				
Urban	50	142.00^{a}	0.542	0.00
Semi-urban	50	262.00^{b}	1.00	
Coccidia				
Urban	50	159.00^{a}	0.312	0.00
Semi-urban	50	606.00^{b}	1.00	
Cestodes				
Urban	50	2.00^{a}	2.00	0.56
Semi-urban	50	1.00^{a}	1.00	

Means within a column with a common superscript do not differ significantly (p≥0.05), EMM: Estimated Marginal Means, Exp. BExponentiated regression coefficient (odds ratio)

Effect of Sex on The Faecal Egg Load of Nematodes, Coccidia, And Cestodes

Sex had a significant effect ($p \leq 0.05$) on the faecal egg counts of nematodes and coccidia, with female pigs exhibiting higher infection levels compared to males. However, no significant difference ($p \geq 0.05$) was observed

Table 2: The effect of sex on faecal egg load of nematodes, coccidia and cestodes

Sex	Samples examined	EMM	Exp. B	Sig
		Nematodes		
Female	60	230.83[a]	1.454	0.043
Male	40	158.75[b]	1.00	
		Coccidia		
Female	60	445.83[a]	1.372	0.031
Male	40	325.00[b]	1	
		Cestodes		
Female	60	0.83[a]	0.333	0.343
Male	40	2.50[a]	1	

Means within a column with a common superscript do not differ significantly (p≥0.05), EMM: Estimated Marginal Means, Exp. BExponentiated regression coefficient (odds ratio)

for cestode infections. The increased susceptibility observed in females may be attributed to physiological and hormonal factors. The odds of infection were higher in females, indicating that they are more vulnerable to gastrointestinal parasites. These findings are in agreement with Abonyi and Njoga (2019), who reported that female pigs are more prone to parasitic infections due to their longer productive lifespan compared to males. Furthermore, Swai *et al.* (2010) highlighted that hormonal fluctuations during pregnancy and lactation can suppress the immune response, thereby increasing susceptibility to parasitic infections. This phenomenon, commonly referred to as periparturient relaxation of immunity, has been widely documented in livestock (Houdijk, 2008). Additionally, Zajac and Conboy (2012) reported that stress associated with reproduction can reduce host resistance, leading to increased worm burdens in females. These physiological stresses, combined with prolonged exposure periods, likely explain the higher parasite loads observed in female pigs.

Effect of Age on The Faecal Egg Load of Nematodes, Coccidia, And Cestodes

The results indicated no statistically significant differences

Table 3: The effect of age on faecal egg count of nematodes, coccidia and cestodes

Age	Samples examined	EMM	Exp. B	Sig
		Nematodes		
Young (<3months)	22	218.18[a]	1.298	
Growers (3 - 6 months)	42	222.61[a]	1.325	0.347
Adults (>6 months)	36	168.05[a]	1	
		Coccidia		
Young (<3 months)	22	481.81[a]	1.329	
Growers (3 - 6 months)	42	383.33[a]	1.057	0.256
Adults (>6 months)	36	362.50[a]	1	
		Cestodes		
Young (<3 months)	22	0.00[a]	1.00	0.120
Growers (3 - 6 months)	42	3.57[a]	35.567	
Adults (>6 months)	36	0.00[a]	1	

Means with a column with a common superscript do not differ significantly, EMM: Estimated Marginal Means, Exp. BExponentiated regression coefficient (odds ratio)

Table 4: The effect of breed on nematodes, coccidia and cestodes

Breed	Samples examined	EMM	Exp. B	Sig
		Nematodes		
Largewhite	27	187.03[a]	0.992	
Crossbreed	27	177.77[a]	0.943	
Indigenous breed	15	270.00[a]	1.433	0.742
Landrace	18	213.88[a]	1.135	
Duroc	13	188.46[a]	1	
		Coccidia		
Largewhite	27	474.07[a]	1.643	
Cross breed	27	335.18[a]	1.162	
Indigenous breed	15	546.66[a]	1.895	0.286
Landrace	18	330.55[a]	1.146	
Duroc	13	288.46[a]	1	
		Cestodes		
Largewhite	27	3.703[a]	1.266	
Crossbreed	27	1.85[a]	6.331	
Indigenous breed	15	0.00[a]	1.001	0.32
Landrace	18	0.00[a]	1.001	
Duroc	13	0.00[a]	1	

Means within a column with a common superscript do not differ significantly ($p \geq 0.05$), EMM: Estimated Marginal Means, Exp. BExponentiated regression coefficient (odds ratio)

($p \geq 0.05$) in faecal egg counts of nematodes, coccidia, and cestodes among different age groups (young, middle-aged, and adult pigs). However, numerical variations were observed, suggesting age-related trends in parasite susceptibility. Young pigs exhibited relatively higher coccidia counts, while middle-aged pigs showed higher nematode and cestode burdens. These patterns, although not statistically significant, are biologically relevant. The findings partially agree with Roepstorff *et al.* (2011), who reported that young pigs are generally more susceptible to parasitic infections due to their underdeveloped immune systems. Similarly, Greve (2012) noted that piglets tend to experience more severe infections compared to older pigs. Zheng *et al.* (2019) also reported higher infection rates in pigs aged 1–2 months, particularly for coccidial infections. This supports the observed trend in the present study where younger pigs had higher coccidia loads. On the other hand, the lack of significant differences across age groups may suggest that continuous exposure to infective stages in the environment leads to uniform infection pressure across all age categories. According to Nansen and Roepstorff (1999), repeated exposure to parasites can result in the development of partial immunity, thereby reducing age-related differences in infection intensity.

Effect of Breed on The Faecal Egg Load of Nematodes, Coccidia, And Cestodes

The study found no significant differences ($p \geq 0.05$) in faecal egg counts among different pig breeds (Large White, Landrace, Duroc, Crossbreeds, and Indigenous pigs). This suggests that breed did not play a major role in determining susceptibility to gastrointestinal parasites under the conditions of this study. These findings are consistent with Maganga *et al.* (2005), who reported no significant variation in parasite infestation among different pig breeds. Similarly, studies by Permin *et al.* (1999) indicate that management practices often have a greater influence on parasite burden than genetic factors. However, the present results contradict findings by Pinilla *et al.* (2020), who reported higher parasite loads in exotic breeds compared to indigenous breeds. Likewise, Zvinorova *et al.* (2016) observed that local breeds tend to be more resistant to parasitic infections due to long-term adaptation and acquired immunity. The discrepancy between studies may be attributed to differences in environmental conditions, management systems, and genetic adaptation. According to Baker *et al.* (2003), genetic resistance to parasites can vary widely depending on breed and environmental exposure, but such differences may not be evident under uniform management conditions.

CONCLUSION

This study demonstrated that gastrointestinal parasites, particularly nematodes and coccidia, are prevalent in pigs in Maseru Regional location and sex significantly influenced faecal egg counts of gastrointestinal parasites.. The higher parasite burden in semi-urban regions emphasizes the need for improved management and hygiene practices. Effective parasite control strategies are essential to enhance pig productivity and reduce economic losses.

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