The Prevalence of Gastrointestinal Protozoa Infection in Pigs in Umuahia South, Abia State Nigeria

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Received:- 07 February 2025/ Revised:- 13 February 2025/ Accepted:- 21 February 2025/ Published: 28-02-2025

Abstract— *Pig production plays a major role in boosting the economy in most regions of the world by serving as a source of income and satisfying the growing demand for livestock and livestock products. However, the challenges affecting pig production are enormous, such as gastrointestinal parasitism in the form of protozoan infection, which often is not diagnosed early until damage is done, reducing economic gains and resulting in losses. A cross-sectional study of six small-scale pig farms in Umuahia South LGA, with the objective of determining the prevalence of gastrointestinal protozoans of the pigs was undertaken. A total of 116 pigs were randomly selected comprising of 29 pigs categorized as young less than 6 months and 87 pigs as adult aged above 6 months, 50 male and 66 female, 96 pigs raised intensively and 20 pigs reared under extensive management was sampled from July to September for protozoan infection. Faecal samples were obtained from pigs of various ages, sexes, and those raised under intensive and extensive farm systems and analyzed in the laboratory using standard techniques. The results of the frequency of protozoan infection were calculated and presented as percentages. Four different types of protozoans were found to infect pigs in Umuahia South LGA of Abia State, namely: Cryptosporidium spp. (33.6%), Balantidium spp. (34.5%), Entamoeba spp. (14.7%) and Giardia spp. (42.2%). The occurrence of the various protozoan parasites was higher in females, adult and intensively reared pigs when compared with males, young and extensively reared pigs. These protozoan parasites are capable of causing considerable loss in pig production and can cause infection in humans. Therefore, farmers in the study area should be sensitized on the herd health programmes and practice good hygienic measures to reduce the incidence of gastrointestinal protozoa in pig herds.*

***Keywords— Abia State, Gastrointestinal, Pig, Protozoa, Umuahia South, Zoonotic*.**

I. INTRODUCTION

Pigs (*Sus Scrofa Domesticus*) generally referred to as swine is one of the abundant livestock species raised in Nigeria, most especially in the middle-belt and southern part of the country accounting for about nine million pigs out of the fourteen million pigs reared in the West African sub-region (Bernard *et al*., 2021). Pigs are reared primarily as a source of animal protein such as ham, pork, bacon and gammon and other meat products, raw materials for biomedical products and manure (Ejinaka and Onyali, 2020; Bernard *et al*., 2021). Pig production is among the fastest growing sectors in the livestock industry, and it is projected to continue rapidly growing in the years to come with the thought of bridging the deficiency in animal-derived protein and as a useful tool to fight poverty in low-and middle-income countries (Nwachukwu and Udegbunam, 2020). Pigs are inexpensive to raise, making them a popular and more acceptable choice among farmers with limited resources especially in the rural communities (Adesehinwa *et al*., 2024). The choice of pig rearing over other food-producing animals such as ruminants is due to their polytocous nature, high feed conversion efficiency, early maturation rate, short gestation duration, and are very hardy in tolerating less-than-ideal tropical environmental conditions (Bernard *et al*., 2021).

Various constraints affect the sustainable development of the swine industry, with diseases caused by gastrointestinal parasites being the most common (Unanam and Lekko, 2023). Pigs are known to harbor parasites, some of which are zoonotic, including

helminths and protozoans which can negatively impact feed conversion, growth rate, and weight gain and can result in condemnation of organs following slaughter and huge financial losses (Ajibo *et al*., 2020). Certain parasites of pigs with the potential to affect humans become major public health issues as there have been outbreaks of waterborne diseases reportedly caused by *Giardialamblia* and *Cryptosporidium* spp. (Abiola *et al*., 2018).

Internal parasites of pigs are widespread globally and its occurrence is of great importance most especially in Nigeria with favorable climatic conditions that allows for easy transmission of these parasites in pigs (Ejinaka and Onyali, 2020). There are several studies that have been carried out in different parts of Nigeria on the gastrointestinal parasites of pigs focusing on nematodes (helminths) and cestodes (tapeworms) with less emphasis on protozoans of pigs; Fabiyi (1979) in Jos reported 15 helminth species in pigs, and Sowemimo *et al*. (2012) identified 5 species of parasites from pigs in Ibadan. Hence, there is paucity of information on the gastrointestinal protozoans affecting pigs, especially in the study area. This study aims to provide epidemiological data on the prevalence and intensity of protozoans affecting pigs in Umuahia South, Abia State, Nigeria.

II. MATERIALS AND METHODS

2.1 Study area:

The study was conducted in Umuahia South local government area of Abia State, Nigeria, and lies within longitude 7 29'40.60" E latitude 5 31' 29.68'' N. Umuahia South has an area of 140km^2 and a population of 138,570 according to the 2006 National population census estimation (NPC, 2007). This study was carried out between July and September 2023 during which sampling took place from the various farms: GGAG farm (old Umuahia), JEN venture farm (Olokoro), Unique farm (Umuopara), Chizoba ENT (Ubakala), and Ofovic farm (Old Umuahia) used for the survey.

2.2 Sample collection:

Faecal samples were randomly collected from the rectum of 116 pigs in the various farms in the study area. The faeces were collected using sterile plastic gloves into a clean sterile sample bottle labelled appropriately according to the age, sex, and location taking note of the management practices. The sample bottles containing the faecal samples were placed in a cooler and transported to the parasitology laboratory of the Department of Veterinary Parasitology and Entomology, College of Veterinary Medicine, Michael Okpara University of Agriculture, Umudike. The samples were immediately analyzed for gastrointestinal protozoans.

2.3 Laboratory analysis:

The faecal samples were grossly analyzed for adult parasites. Microscopic examination for various protozoan oocysts/cystswere carried out using direct smear method and modified Ziehl-Neelsen method to detect acid fast organisms as described by Rekha *et al*. (2016) and viewed under the microscope using x 10 and x 40 objective lens. A small amount of the feces was emulsified in a drop of 1% iodine placed in the center of a spotless, grease-free glass slide using applicator sticks. The smear was viewed under a microscope using a × 40 objective lens after being covered with a cover slip as described by Karaye *et al*. (2016). Using the formalin-ether concentration method as described by Brhanie *et al*. (2014), aapproximately1 g of the fecal sample was added to a clean 15 ml conical centrifuge tube filled with 7 ml of 10% formalin using an applicator stick. The applicator stick was used to properly mix the sample. The resultant suspension was put back into the original tube after the filtrate was transferred from the sieve into a beaker. Following the addition of 3 ml of diethyl ether, the mixture was manually agitated and centrifuged for 3 minutes at 2000 rpm. Following centrifugation, the residue was spread out on microscope slides, covered with cover glass, and examined under the microscope with the x 40 objective lens after the supernatant was carefully discarded after centrifugation. The oocysts and cysts were identified according to structural and morphometric standards (Soulsby,1982).

2.4 Statistical analysis:

The collected data were analyzed using descriptive statistics as described by Swai *et al*. (2010). The prevalence (P) of the various gastrointestinal protozoans in different sex, age and management system were calculated and presented in tables using the formula P=d/n. where d is the number of positive samples analyzed at that point in time and n= total number of pigs sample analyzed at that point in time (Thrusfield, 2005). The prevalence was calculated in percentage.

III. RESULTS

3.1 Microscopy:

FIGURE 1: Cryptosporidium Oocyst

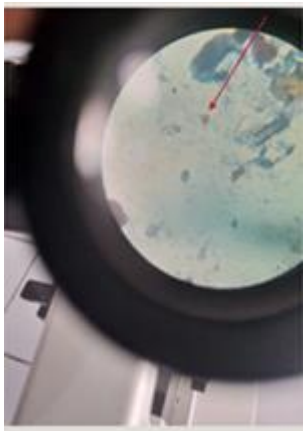

FIGURE 2: Balantidium Oocyst

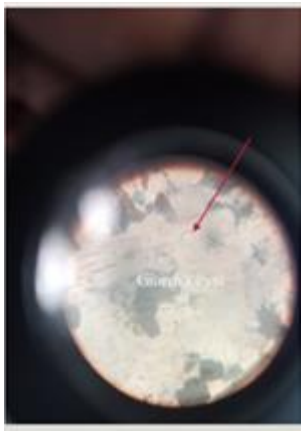

FIGURE 3: Giardia Oocyst

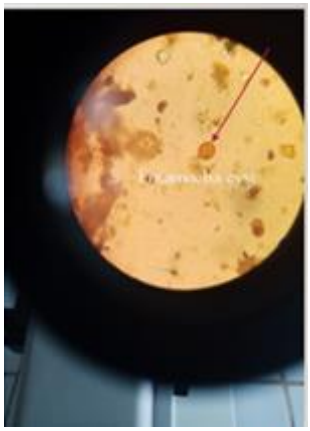

FIGURE 4: Entamoeba Oocyst

In the survey, 116 faecal samples of pigs were analyzed and all were found to be infected with one or more different gastrointestinal protozoa (Table 1). Thus, the prevalence of gastrointestinal protozoans of pigs observed in this study were *Giardia* spp. (42.2%) which had the highest prevalence, followed by *Balantidium* spp. (34.5%); *Cryptosporidium* spp. (33.6%), and *Entamoeba* spp. (14.7%) with the lowest prevalence recorded in this study.

The prevalence of *Giardia* spp. in Table 2 was higher in adult pigs (69.0%) than in piglets (31.0%). The prevalence in females (63.6%) was higher when compared to males (36.0%). *Giardia* spp. was more prevalent in intensively reared pigs (33.3%) and the protozoan was not observed in extensively managed pigs.

The prevalence of *Balantidium* spp. is presented in Table 3. The prevalence was higher in adult pigs (75.7%) than in piglets (24.1%). The prevalence in females (56.0%) was higher than in males (44.0%). Intensively reared pigs (24.0%) had a higher prevalence than in extensively reared pigs (5.0%).

The prevalence of *Cryptosporidium* spp. in Table 4 was higher in adult pigs (79.3%) than in piglets (20.7%). The prevalence in females (54.5%) was higher when compared to males (46.0%). The prevalence was higher in intensively reared pigs (21.9%) than in extensively managed pigs (5.0%).

The prevalence of *Entamoeba* spp. in Table 5 was higher in adult pigs (93.1%) than in piglets (6.9%). The prevalence in females (63.6%) was higher when compared to males (36.0%). The prevalence was higher in intensively reared pigs (7.3%) than in extensively managed pigs (5.0%).

TABLE 1
PREVALENCE OF DIFFERENT SPECIES OF GASTROINTESTINAL PROTOZOAN FROM FAECAL SAMPLES OF 116 PIGS IN UMUAHIA SOUTH

Protozoan type	Number examined	Frequency of infection	Prevalence (%)
Giardia spp.	116	49	42.2
Balantidium spp.	116	40	34.5
Cryptosporidium spp.	116	39	33.6
Entamoeba spp.	116	17	14.7

TABLE 2
PREVALENCE OF *GIARDIA* SPP. IN EACH CATEGORY OF PIGS SAMPLED FROM UMUAHIA SOUTH

Population type	Number examined	Number infected	Prevalence (%)
Young	29	9	31
Adult	87	60	69
Male	50	18	36
Female	66	42	63.6
Intensive management	96	32	33.3
Extensive management	20	0	0

TABLE 3
PREVALENCE OF *BALANTIDIUM* SPP. IN EACH CATEGORY OF PIGS SAMPLED FROM UMUAHIA SOUTH

Population type	Number examined	Number infected	Prevalence (%)
Young	29	7	24.1
Adult	87	66	75.7
Male	50	22	44
Female	66	37	56
Intensive management	96	23	24
Extensive management	20	1	5

TABLE 4
PREVALENCE OF *CRYPTOSPORIDIUM* SPP. IN EACH CATEGORY OF PIGS SAMPLED FROM UMUAHIA SOUTH

Population type	Number examined	Number infected	Prevalence (%)
Young	29	6	20.7
Adult	87	69	79.3
Male	50	23	46
Female	66	36	54.5
Intensive management	96	21	21.9
Extensive management	20	1	5

TABLE 5
PREVALENCE OF *ENTAMOEBA* SPP. IN EACH CATEGORY OF PIGS SAMPLED FROM UMUAHIA SOUTH

Population type	Number examined	Number infected	Prevalence (%)
Young	29	2	6.9
Adult	87	81	93.1
Male	50	18	36
Female	66	42	63.6
Intensive management	96	7	7.3
Extensive management	20	1	5

IV. DISCUSSION

The protozoan parasites observed in this study belonged to four genera namely; *Balantidium*, *Cryptosporidium*, *Entamoeba*, and *Giardia*. This is comparable to the study of Gagman *et al*. (2015) in Jos, Plateau State who identified five different protozoa including *G. lamblia* (6.77%), *Isospora* spp. (7.90%), *Eimeria* spp. (7.14%), *B. coli* (9.40%), and *Entamoeba* spp. (4.70%). However, the prevalence of *Giardia* spp. (42.2%), *Balantidium* spp. (34.5%) and *Entamoeba* spp. (14.7%) in this study were higher than what was obtained in Gagman *et al*. (2015). *Eimeria* and *Isospora* spp., were not identified in this study, and this could be due to differences in diagnostic techniques used in both studies. The findings in this study where all the fecal samples analyzed were positive for one or more gastrointestinal protozoan parasites show that there is a high prevalence of gastrointestinal protozoan infection of pigs in Umuahia South. This is similar to the report of Nwoha and Ekwurike (2011) who recorded one or more parasite in all the fecal samples of intensively managed pig farms in Umuahia City of Abia state examined for gastrointestinal parasites. There was varying prevalence of the four species of protozoan parasites observed in this study with *Giardia* spp. being the most prevalent while *Entamoeba* spp. had the lowest prevalence. This contrasts the study of Ejinaka and Onyali (2020) who reported *Balantidium coli* and *Entamoeba histolytica* having the highest frequencies in their study and are the only two of the four protozoa parasites observed in this study. The varying prevalence could be attributed to differences in the breed, diet, herd management techniques, and even genetic resistance of the pigs (Ejinaka and Onyali, 2020).

The various protozoan parasites of pigs observed in this study were higher in females than in males. This however agrees with Tamboura *et al*. (2006) in Burkina Faso which reported that the frequency of pig parasites was higher among female scavengers but contrasts the studies of Nsoso *et al*. (2000), Kumar *et al*. (2002), and Sowemimo *et al*. (2012) where higher prevalence was recorded in males than in females. This could be due to the reason that females are usually kept for breeding for a longer time unlike males that are typically and sold off thus, exposing the females to a higher parasitic burden for longer periods (Akanni *et al*. 2017).

The protozoan infection was lower in young pigs (piglets) in relation to age as compared with adult mature pigs including boars and sows of reproductive ages. This is in agreement with the studies of Atawalna *et al*. (2016) and Akanni *et al*. (2017). It is suggested that low prevalence of parasites in piglets could be due to maternal immunity acquired from the sow through milk while higher frequency of parasites in adult pigs could be a result of pre-exposure, weaker immune systems, and possibly inadequate nutrition over time (Ejinaka and Onyali, 2020).

The higher prevalence of protozoa infection in intensive system of management as compared to the extensive system observed in this study could be due to the higher population size of intensively reared pigs in this study, poor environment and managemental practices like high stocking density, inadequate nutrition and low immunity status observed in the farms visited. This contrasts the study of Ogbe *et al*. (2023) who reported a high prevalence of gastrointestinal parasites in extensively managed pigs in Aba, Abia State.

V. CONCLUSION

In conclusion, the protozoan type observed in this study are zoonotic and they are also capable of causing adverse health conditions in pig herd. Therefore, it is advocated that regular monitoring of pig farms by veterinarians to screen faeces for protozoan parasites and administration of appropriate anthelminthic be done to reduce the burden of parasites in pig farms. Farmers should also be encouraged to attend trainings on the importance of herd health management, adopt modern day practices for better productivity in order to decrease the burden of gastrointestinal protozoa infection of pigs. This study also shows that protozoan parasites capable of being implicated in zoonotic infection of humans either via water or food can be found in faecal samples of pigs thus, creates a burden on public health. In Abia State where pork is widely consumed, further studies on investigation and public health assessment of the impact of these zoonotic parasites should be carried out and more public awareness raised towards the prevention of protozoan infection in humans.

ACKNOWLEDGEMENT

The authors are profoundly grateful to the technologists of Veterinary Parasitology and Entomology Department, College of Veterinary Medicine, Michael Okpara University of Agriculture, Umudike for the technical assistance during the laboratory analysis for this work.

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