

# **Prevalence and intensity of gastrointestinal parasites in slaughter pigs at Sanawari slaughter slab in Arusha, Tanzania**

**H E Nonga and N Paulo**

*Department of Veterinary Medicine and Public Health, Faculty of Veterinary Medicine, Sokoine University of Agriculture,  
PO Box 3021, Morogoro, Tanzania.  
[nongahezron@yahoo.co.uk](mailto:nongahezron@yahoo.co.uk) / [hezron@suanet.ac.tz](mailto:hezron@suanet.ac.tz)*

## **Abstract**

This cross sectional study was conducted in Arusha city in March 2014 to establish the prevalence and intensity of different gastrointestinal parasites in different parts of intestines of slaughter pigs at Sanawari slaughter slab in Arusha. A total of 300 intestinal contents were collected from 100 slaughter pigs. Pig origins, sex, age and management systems were gathered from owners before the animal was slaughtered.

It was found that majority (78%) of slaughter pigs came from Mbulu, were male (56%), adult (86%) and were extensively managed (78%). Parasitic infection was observed in 83% of slaughter pigs and two types of parasites recorded namely helminths (79.0%) and coccidia (19.0%). The common helminth identified was the group of Strongyles (52.0%). Other species included *Ascaris* spp. (37.0%), *Strongyloides* spp. (15.0%), *Trichuris* spp. (5.0%) and *Metastrongylus* spp. (4.0%). Sixteen pigs had adult worms identified as *Ascaris suum*. Parasite eggs/oocysts recovery rate was higher ( $P = 0.002$ ) in large intestine (59.0%) than small intestine (41.0%) and caecum (31.0). Similarly, infection by Strongyles was higher (52.0%) than the rest of helminths ( $P = 0.001$ ). Mean EPG of  $1083 \pm 1031$  and OPG of  $664 \pm 496$  were recorded. Large intestine had higher mean EPG counts ( $768 \pm 631$ ) than small intestine and caecum ( $P < 0.05$ ). Similarly, there was a statistically significant higher ( $P < 0.05$ ) count of Strongyles eggs in large intestine compared to small intestine and caecum. It was concluded that slaughter pig in Arusha had high infection of gastrointestinal parasite that reflect the status of infection in other animals at the farms. Therefore, to improve pig production, routine gastrointestinal parasite control is recommended.

**Key words:** *Disease, management system, risk factor, subsistence*

## **Introduction**

In Tanzania, pig industry is at infancy stage since majority of pigs are kept for subsistence purposes, as income generating activity for the rural poor and provision of protein/meat, dowry and manure especially in developing countries. With such kind of pig industry, its contribution to the national Gross Domestic Product (GDP) and human nutrition is questionable. The livestock sector generally contributes over 3.8% of GDP which mostly is from cattle (MLFD 2010). Pig population in Tanzania is up to two million of which more than 90% are kept by small-scale farmers who practice indoor and outdoor (free range) production systems that suffer from inadequate disease control practices, limited knowledge on pig husbandry and management system and lack of organized breeding programmes (Mkupasi 2013). Generally, the pig industry in Tanzania and other developing countries faces a number of challenges including high level of stress, poor husbandry practices, poor animal genetic potential and inbreeding, poor nutrition, inadequate health and veterinary support services, diseases, and lack of slaughter and marketing infrastructure (Lekule and Kyvsgaard 2003; MLFD 2010; Mkupasi 2013).

Diseases in particular parasitic infection is a major hindrance to profitable pig production since it causes high morbidity and mortality rates and compromises the production and reproduction performance of pigs in Africa (Permin et al 1999; Lekule and Kyvsgaard 2003; Nissen et al 2011). Gastrointestinal parasite of pigs can result in loss of appetite, poor growth rate, poor feed conversion efficiency and potentiation of other pathogens or even death (Stewart and Hoyt 2006). These consequently lead to significant economic losses like decreased litter size, poor growth rate, reduced weight gain and death after heavy infection. Parasitic infections in pigs reared under tropical and sub-tropical areas, tend to be high compared to other areas possibly because of favourable conditions for growth and multiplications (Blood et al 2007; Aiello and Moses 2010).

Despite of the challenges of pig production, the industry is increasingly becoming an important economic activity in Tanzania and other African countries especially amongst many marginalised and resource poor communities. This trend is likely to continue due to minimal investment capital required and quick return from piggery project, and diminishing grazing land for ruminants. Therefore, in support of the pig industry, research work need to be undertaken so as to disclose the prevailing limitations and suggest solutions. The current study was undertaken to determine prevalence and intensity of gastrointestinal parasites in slaughter pigs at Sanawari slaughter slab in Arusha, Tanzania. The importance of this is based on the fact that the knowledge of the spectra of parasites and their epidemiology is important in the formulation of effective parasite control measures aimed at improving the pig industry. The study adopted the slaughterhouse approach as source of samples to reflect what is in the farms since it is cheap and slaughter animals are received from different places of the region.

## **Materials and methods**

### **Study area and animals**

This cross sectional study was conducted in March 2014 at Sanawari slaughter slab, which serves as a city slaughter place for pig in Arusha. Sanawari slaughter slab caters for adult and grower pigs predominantly of the mixed cross breed of Large white, Landrace, Hampshire and Saddleback f pigs. The bulk of the slaughter pig come from Mbulu district while others come from Karatu, Arumeru, Moshi and around Arusha periurban areas. On average, the slab slaughters between 15 and 20 pigs per day.

## **Sample collection and handling**

Simple random selection was adopted to get the pig for sampling. Every third pig in the slaughter line was selected for sampling. On the day of slaughter slabs visits, simple questionnaires were administered to the butchers who were also owners of pigs slaughtered. Information collected included source, age, sex, and general management of pigs where they were bought. A total of 100 animals were sampled within the two weeks of the study. After the carcass was opened, the gastrointestinal track was carefully pulled out, straightened and placed on the floor to clearly display the small intestine, caecum and large intestine. By use of a pair of scissors, each intestinal part was transversely cut to separate, longitudinally sliced and the contents were emptied into two duplicate gloves. From the gastrointestinal tract of each study pig, three duplicate samples were collected (from the small intestine, caecum and large intestine) for laboratory analysis. The collected samples were stored under refrigeration at 4°C so as to prevent hatching of eggs before transport them to the laboratory within 15 days of sampling. In the due process of collecting intestinal content samples, some of the gastrointestinal tract had obviously seen adult round worms which were being collected and stored in 70% alcohol for the laboratory identification. Parasite analysis in the samples was done at Veterinary Parasitology laboratory, Sokoine University of Agriculture, Morogoro.

## **Laboratory sample analysis**

### *Qualitative sample analysis*

Qualitative analysis of helminth eggs and coccidia oocysts was done as described by Hansen and Perry (1990). Briefly three grams of intestinal contents were mixed with floatation fluid (super saturated salt solution), shaken thoroughly and filtered into a test tube. The solution was filled into the test tube to the top and covered with glass cover slip and left to stand for 20 minutes. Thereafter the cover slip was carefully lifted off from the test tube and placed on the microscope slide. Presence of parasites (helminth eggs/oocysts) was examined using a 10× eyepiece and a 4× objective (40× total magnification) on a light microscope. Helminth eggs/coccidia oocysts and adult helminth samples were identified by using standard identification keys based on their morphological features (Soulsby, 1982).

### *Quantitative faecal sample analysis*

Quantitative analysis of helminth eggs and coccidia oocysts was done as described by Hansen and Perry (1990). Quantification of helminths eggs and coccidia oocyst in intestinal content samples was done by use of McMaster counting technique. Briefly, 4 g of intestinal content sample was placed into a tube containing 56 ml of flotation fluid and stirred thoroughly. The intestinal content suspension was filtered through a tea strainer into a second tube. A filtered sample was taken using a Pasteur pipette and filled into a McMaster counting chamber and left to stand for five minutes. The sample was examined under a microscope at 10 x 10 magnification and all the eggs of different species were separately counted in the graved area of both chambers. The same was done for coccidia oocysts. Thereafter, the egg and oocyst per gram (EPG/OPG) of intestinal content was calculated by adding the counts of both chambers and multiplied by 50. The guideline to interpretation of intestinal content egg and oocyst counts in pig samples adopted that of sheep as described by Hansen and Perry (1990) with some modifications. Helminth count of <100 EPG was grouped as low levels of infection while >300 EPG was grouped as significant high levels. For coccidia oocyst, ≤5 000 was low level and above which was regarded as high level of infection.

## Data analysis

The collected data was entered into a Microsoft<sup>R</sup> Excel version 2007 spread-sheet and were analysed using Epi Info<sup>TM</sup> Version 7 (Centre for Disease Control, Atlanta, USA). Using Statcalc, proportions of categorical variables were computed and further compared using the chi-square test at a critical probability of  $P < 0.05$ . The strength of associations between dependent and independent variables were determined using 2 x 2 contingency tables.

## Results

### General results

A total of 300 intestinal content samples were collected from 100 slaughter pigs at Sanawari slaughter slab. The details of pig origins, sex, age, management system and status of parasitic infection are detailed in Table 1. Generally, up to 83% of all slaughter pigs were infected with gastrointestinal parasites in particular helminthes in the group of nematodes. The common types of parasitic infections in pigs were helminths (79.0%) and coccidia (19.0%). A total of 15% of the pig were infected with both helminths and coccidia, 64% infected with helminths only while 4% coccidian alone.

**Table 1:** Biodata and status of parasitic infections in slaughter pigs at Sanawari slaughter slab (n=100)

Category	Number (%)
<b>District of origin</b>	
Arusha	22 (11.0)
Mbulu	78 (78.0)
<b>Sex</b>	
Female	44 (44.0)
Male	56 (56.0)
<b>Age</b>	
Adult	86 (86.0)
Growers	14 (14.0)
<b>Management systems</b>	
Extensive	78 (78.0)
Intensive	22 (22.0)
<b>General parasitic infections</b>	
Infected	83 (83.0)
Not infected	17 (16.0)
<b>Helminths infection</b>	
Infected	79 (79.0)
Not infected	21 (21.0)
<b>Coccidial infection</b>	
Infected	19 (19.0)
Not infected	81 (81.0)

## Parasite infection and species in gastrointestinal tract of slaughter pig

Different species of parasites that had infected into different parts of the intestine are shown in Table 2. The nematode eggs were; Strongyles (52.0%), *Ascaris* spp. (37.0%), *Strongyloides* spp. (15.0%), *Trichuris* spp. (5.0%) and *Metastrongylus* spp. (4.0%). Coccidian oocysts were detected in 19.0% of the animals. Sixteen pigs (16%) out of 100 had obvious adult worms in the small intestine (2/6) and large intestine (4/6) which were all identified as *Ascaris suum*.

Comparison of magnitude of parasite eggs/oocysts recovery based on part of intestine showed that large intestine had higher recovery rate (59.0%) than the small intestine (41.0%) and caecum (31.0). The difference of eggs/oocysts recovery rate between intestinal parts was statistically significant ( $p = 0.002$ ). Similarly, infection by Strongyles was higher (52.0%) than the rest of parasites. The difference of species wise recovery rate was statistically significant ( $p = 0.0001$ ).

**Table 2:** Parasite infections and species in different intestinal parts of slaughter pigs (n=100)

Category	Number with eggs/oocysts	Percentage
<b>Coccidia oocysts recovery</b>		
Small intestine	41	41.0
Caecum	31	31.0
Large intestine	59	59.0
<b>Helminth eggs recovery</b>		
Small intestine	32	32.0
Caecum	31	31.0
Large intestine	56	56.0
<b>Parasite species</b>		
Strongyles	52	52.0
<i>Ascaris</i> spp.	37	37.0
<i>Strongyloides</i> spp.	15	15.0
<i>Trichuris</i> spp.	5	5.0
<i>Metastrongylus</i> spp.	4	4.0
Coccidia oocysts	19	19.0

## Quantification of different species of parasites in gastrointestinal tract of slaughter pig

The quantities of parasite species in different parts of the GIT are shown in Table 3. The mean EPG was  $1083 \pm 1031$  with the helminth egg count ranging between 300 and 4500. The mean OPG was  $664 \pm 496$  and oocyst count ranged between 300 and 2100. All the 79 pigs that were infected with helminths had significantly high levels of eggs while all the pig with coccidia infection had low level of infection. Large intestine had higher mean EPG count ( $768 \pm 631$ ) than the small intestine and caecum. The mean

differences in parasite egg/oocyst counts between GIT parts were statistically significant ( $P < 0.05$ ). Similarly, there was a statistically significant higher ( $P < 0.05$ ) count of Strongyles eggs in large intestine compared to small intestine and caecum.

**Table 3:** Species of parasites and amount infecting different parts of the gastrointestinal tract of slaughter pigs (n=100)

	Number (%) infected	Mean EPG/OPG	Minimum	Maximum
<b>Coccidia oocysts and helminth eggs quantification in GIT parts</b>				
Small intestine	41 (41.0)	549 ± 373	300	1800
Caecum	31 (31.0)	649 ± 585	300	2700
Large intestine	59 (59.0)	768 ± 631	300	3300
<b>Helminth eggs and quantification in GIT parts</b>				
Small intestine	32 (32.0)	525 ± 403	300	1800
Caecum	31 (31.0)	610 ± 561	300	2700
Large intestine	56 (56.0)	756 ± 650	300	3300
<b>Strongyles</b>				
Small intestine	11 (11.0)	330 ± 95	300	600
Caecum	20 (20.0)	569 ± 373	300	1500
Large intestine	41 (41.0)	527 ± 418	300	1800
<b>Strongyloides spp.</b>				
Small intestine	5 (5.0)	360 ± 134	300	600
Caecum	4 (4.0)	375 ± 150	300	600
Large intestine	15 (15.0)	580 ± 310	300	1200
<b>Ascaris spp.</b>				
Small intestine	21 (21.0)	357 ± 262	300	1500
Caecum	11 (11.0)	625 ± 414	300	1500
Large intestine	17 (17.0)	653 ± 427	300	1500
<b>Trichuris spp.</b>				
Small intestine	1 (1.0)	300 ± 0	300	300
Caecum	0 (0.0)	0	0	0
Large intestine	5 (5.0)	480 ± 268	300	900
<b>Metastrongylus spp.</b>				
Small intestine	1 (1.0)	900 ± 0	900	900
Caecum	0 (0.0)	0	0	0
Large intestine	4 (4.0)	600 ± 245	300	900
<b>Coccidia spp.</b>				
Small intestine	11 (11.0)	546 ± 295	300	1200
Caecum	3 (3.0)	600 ± 300	300	900
Large intestine	9 (9.0)	533 ± 250	300	900

## Risk factors of parasite infection in pigs

Table 4 summarizes the results of the factors which were considered to possibly predispose the pigs to parasite infections. Although pigs in the group of growers, pigs extensively managed, pigs from Mbulu and female pigs had high infection rates, the proportions were statistically not significant ( $P > 0.05$ ).

**Table 4:** Risk factors of parasite infection in pigs

Risk factor/ Category	Number (%) infected	RR	95% CI	P value
<b>Age</b>				
Adult	70 (86.4)	2.6	0.37 – 18.13	0.456
Grower	13 (92.9)			
<b>Management systems</b>				
Extensive	68 (87.2)	0.4	0.17 – 0.94	3.146
Intensive	15 (68.2)			
<b>District of origin</b>				
Arusha city	15 (68.2)	2.4	1.07 – 5.76	3.146
Mbulu	68 (87.2)			
<b>Sex</b>				
Female	37 (84.1)	0.9	0.36 – 2.15	0.991
Male	46 (82.1)			

## Discussion

This study was conducted to determine the prevalence and intensity of gastrointestinal parasites in slaughter pigs at Sanawari slaughter slab in Arusha. The findings generally show that there were high rates (83%) of intestinal parasites infection in particular helminths. The helminths burden was significantly high being dominated by those in the group of Strongyles and *Ascaris* spp. Coccidia infection was also common to slaughter pigs and some had mixed infections. Most of the parasites were recovered in the large intestine. Presence of significantly high count of helminth eggs and coccidian oocysts signifies that pigs were severely affected by these parasites and that they positively contributed to poor performance and lower pig production. This calls for the combined efforts of control of helminths and coccidia infections in pigs reared in Arusha city and Mbulu district.

It was found that the prevalence of helminths in slaughtered pig was 79% reflecting the status of the problem at the farm level. This is a high infection rate in pig in Tanzania suggestive of obvious helminth effects to the animals. Similar high helminth infection rate (53%) in pigs in Tanzania has been reported by Esrony et al (1997). Elsewhere, Tamboura et al (2006) reported up to 91% helminth infection rate in pigs in Burkina Faso. In Kenya, Zimbabwe and Mozambique the prevalence of gastrointestinal helminths ranged between 35.6% and 83% (Marufu et al 2008; Sowemimo et al 2012; Matos et al 2011; Obonyo et al 2013) which all reflect that the problem of helminth infection in pig is big and wide spread in Africa. Several speculations may be considered but the key cause is likely to be poor animal husbandry and lack of disease control measures as was observed by Obonyo et al (2013) in Kenya. The differences in prevalence of GIT helminths may arise due to differences in environmental conditions that are conducive for the perpetuation of the parasite, abundance of infected definitive hosts, stocking rate,

nature of the feed and feeding patterns of animals and, and inherent characteristics such as host immunity. The prevalence of GIT helminths in pigs of Arusha may therefore reflect the actual situation of the same disease in other areas of the country where very little or no studies have been done.

This study observed that Strongyle nematodes were the predominant parasites as they accounted for up to 52% of all helminth cases. This implies that this category of helminths is the most common in pig farms in Arusha region and other neighbouring places. Other studies in Kenya by Obonyo et al (2012) and Nissen et al (2011) reported similar species of helminthes of pig at almost the same level of infection (65 – 75%). Similarly, studies by Esrony et al (1997) in Tanzania; Marufu et al (2008) in Zimbabwe and Matos et al (2011) in Mozambique reported *Oesophagostomum* species as common pig helminths in smallholder farms while Sowemimo et al (2012) reported *Trichuris suis* as the common pig helminths in Ibadan, Nigeria. The high prevalence of Strongyles especially *Oesophagostomum* spp. may be attributed by its high egg excretion rate and unhygienic conditions which are common in most of the pig production system in East Africa (Karimuribo et al 2011; Nissen et al 2011). The variations in the helminthes species may depend on the common parasites circulating in the local environment, seasonality and management of pigs where the study was conducted. Generally, it shows that Strongyle nematodes are the common species of helminths that may be circulating in pig farms in Arusha and neighbouring areas.

*Ascaris* spp. were also common helminth species which their eggs were identified in 37% of the slaughtered pigs. Specifically, adult worms that were recovered from the intestines during this study were identified as *Ascaris suum*. However, the prevalence recorded for *A. suum* in this study is higher than 12.7% reported from Eastern Ghana (Tiwari et al., 2009), 11.1% from Southwest Nigeria (Sowemimo et al 2012) and 5.2% from China (Weng et al 2005) but lower than 54.6% from Bostwana (Nsoso et al 2000). High infection rate by *A. suum* is correlated with wetness, temperature and unhygienic environment (Kagira 2010; Obonyo et al 2012). Ascariasis is a common infection of pigs and among the leading causes of liver condemnation during post-mortem meat inspection. *Ascaris suum* infection causes pathological effects to the liver and lungs called milk spots due to larval migrations. A study carried out in the northern highlands of Tanzania recorded a prevalence of 44.3% of *A. suum* infection in pigs (Ngowi et al 2004). However, Mkupasi et al (2010) reported a prevalence of up to 8.1% in slaughtered pigs in Dar es Salaam, Tanzania. This implies that the parasite is prevalent in pigs in Tanzania and causes high economic losses to the farmers. Indeed, *A. suum* was formally considered to be a parasite of pigs only but recent studies have reported it as among the causes of visceral larva migrans in humans (Sakakibara et al 2002). In addition, human cases with liver and lung lesions as well as cases and epidemics of eosinophilia pneumonia have been reported and positive *A. suum* specific antibodies were detected in all the cases (Arimura et al 2001; Kakihara et al 2004). Therefore high prevalence of *A. suum* in pig has public health implications.

Other helminth species identified were *Strongyloides* spp. (15.0%), *Trichuris* spp. (5.0%) and *Metastrongylus* spp. (4.0%). *Strongyloides* spp. are also among the common parasites of pig in Tanzania as previously reported by Esrony et al (1997). Elsewhere, in Kenya (Obonyo et al 2013; Nissen et al 2011), Zimbabwe (Marufu et al 2008), Mozambique (Matos et al 2011) and Nigeria (Sowemimo et al 2012) also reported similar species of helminthes in pigs at variable levels of infection. The differences in the prevalence's of *Strongyloides* and other helminth species may be due to the differences in climatic conditions, management systems, breeds and local circulating parasites in the locality. The survival of *Strongyloides* larvae depends on the environmental temperature and moisture. The larvae of these species are susceptible to desiccation with the dry areas providing unfavourable environment for survival of *Strongyloides* larvae (Esrony et al 1997; Marufu et al 2008).



It was found during this study that the mean EPG was  $1,083 \pm 1,031$  (range 300 – 4,500) which generally show heavy worm burden in pigs. The EPG recorded in the current study is lower than that previously reported by Esrony et al (1997) which ranged between 100 and 22,000 in Morogoro. Elsewhere lower mean EPG than the current study has been recorded (526 - 1,175) in Kenya (Obonyo et al 2012) and in Nigeria (13 – 30) (Sowemimo et al 2012). Heavy worm burden retards performance of pig that has implications to the industry. Though the impacts of nematode infections was not determined during the current study, it is obvious that heavy worm infestations in pigs has significant economic losses evidenced by decreased litter size, poor growth rate, reduced weight gain and death especially in piglets.

It was further observed that large intestine had higher mean parasite count ( $768 \pm 631$ ) than the small intestine and caecum. This might be due to the fact that it is the last part of the GIT and that whatever parasites that may be in the upper parts can easily be taken downstream of the gastrointestinal track by peristalsis to the large intestine before are shaded out in faeces. This may account for the differences in the observed parasite recovery rate along different parts of the intestines. However, the parasites may have preferences to the site. More studies are recommended before concluding that the large intestine as the preferred gastrointestinal track site by parasites.

The findings of this study further showed that the prevalence rate in different categories of age groups, management system, origin and sex were not statistically significant. This implies that the predisposition to parasite infection was uniform regardless of different factors available. This may be contributed by homogenous type of pig production systems existing in the study areas as previously reported, characterised by poor animal husbandry with limited disease control programmes (MLFD 2010; Mkupasi 2013).

### Conclusions

- There is high gastrointestinal parasite infection rate in pigs reared in Arusha and Mbulu and infection is dominated by *Strongyles*, *Ascaris* spp. and *Strongyloides*.
- Strategic gastrointestinal parasite control is recommended.

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