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ORIGINAL ARTICLE

Prevalence of gastro intestinal parasites in pigs in Punjab, India

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Abstract Gastrointestinal parasites are a common problem in pigs in India. The important risk factors include coprophagic behaviour of pigs and their free access to garbage. To investigate the gastrohelmenthic spectrum in pigs of Punjab, we examined 265 faecal samples from farm (n = 47) and scavenging pigs (n = 218) using faecal floatation method. *Ascaris suum*, unsporulated oocysts, *Trichuris* spp. and *Strongyloides* were recorded in 27.5, 15.4, 1.8 and 4.5 % of the pig faecal samples, respectively. Overall prevalence was significantly higher in pigs >1 year (56.5 %) than pigs ≤1 year (39.6; $p = 0.01$) Parasite positivity was neither significantly related with location ($p = 0.309$) nor with management practices ($p = 0.69$). High prevalence of gastro intestinal parasites in pigs in Punjab warrants intervention policies to control this problem.

Keywords *Ascaris* species · Gastro intestinal parasites · India · Pigs · Punjab · *Strongyloides* species

Introduction

Pig farming in India is an attractive business particularly for the persons belonging to lower socio economic groups. In India, most of the pig farmers prefer backyard farming. Pigs are let loose to feed in garbage dumps during the day time, thus they may expose to a variety of pathogens including parasites. Such pigs harbouring zoonotic parasites, can act as potential source of human health hazards (Chawhan et al. 2014). In addition, swine parasites lead to economic losses due to condemnation of liver, decrease in carcass yield and feed conversion (Stephenson et al. 1980; Hale et al. 1985). In India, various studies reported presence of nematodes (Ascaris spp., *Trichuris* spp., *Strongyle* spp., *Strongyloides* spp.) and protozoa (Isospora spp., *Eimeria* spp., *Cryptosporidium* spp., and *Giardia* spp.) in pigs (Deka et al. 2005; Kumari et al. 2002; Khajuria et al. 2010; Yadav and Tandon 1989).

Swine ascariasis is caused by *Ascaris suum* and adults worms may lower the growth rate in young pigs. On the other hand, human ascariasis primarily occurs due to *Ascaris lumbricoides* (human nematode) and occasionally by *A. suum* (swine nematode) (Barriga, 1982). It is a reasonable assumption that a significant proportion of respiratory illnesses observed in people having contact with pigs is caused by *A. suum* as well as by *A. lumbricoides* (WHO 1967), hence indicating zoonotic potential of *A. suum*. To our knowledge, prevalence estimates of gastrointestinal parasites in pigs have been carried out in Punjab 47 years ago (Gupta and Sood 1968), thus current study was planned to re-assess prevalence of gastro intestinal parasites in pigs in Punjab, India.

Materials and methods

Study area and selection of animals

The current study was carried out in Punjab state of India. As per the 19th livestock census (2012) of India, there are 32,221 pigs in Punjab, India (DAHP 2016). Out of 22 districts in the state, we collected samples from 3 districts

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Table 1 District wise prevalence and distribution of gastro intestinal parasites in Punjab, India (n = 265)

Name of the district	No. of samples examined	No. of samples positive (%)	*Ascaris suum* (%)	Unsporulated oocysts (%)	*Trichuris* species (%)	*Strongyloides* species (%)
Ludhiana	215	103 (47.9)	54 (25.1)	34 (32.3)	5 (4.7)	10 (4.6)
Hoshiarpur	25	16 (64.0)	10 (40.0)	4 (16.0)	–	2 (8.0)
Jalandhar	25	12 (48.0)	9 (75.0)	3 (25.0)	–	–
Total	265	131 (49.4)	73 (27.5)	41 (15.4)	5 (1.8)	12 (4.5)

Table 2 Prevalence and distribution of gastro intestinal parasites in farm and scavenging pigs in Punjab, India

Management system	No. of samples examined	No. of samples positive (%)	*Ascaris suum* (%)	Unsporulated oocysts (%)	*Trichuris* species (%)	*Strongyloides* species (%)
Scavenging pigs	218	109 (50.0)	67 (61.4)	29 (13.3)	3 (0.01)	10 (4.5)
Farm pigs	47	22 (46.8)	6 (12.7)	12 (25.5)	2 (4.2)	2 (4.2)
Total	265	131 (49.4)	73 (27.5)	41 (15.4)	5 (1.8)	12 (4.5)

representing almost 15 % of the total districts. The faecal samples were collected from three districts of Punjab viz Ludhiana (30.91°N 75.85°E), Hoshiarpur (31.53°N 75.92°E) and Jalandhar (31.326°N 75.576°E). As per the 19th livestock census (2012), districts Ludhiana, Hoshiarpur and Jalandhar were home to 8064, 532 and 1430 pigs in the year 2012, respectively. The sample size was calculated to estimate the disease prevalence with a high degree of precision by taking into account 89.19 % sensitivity and 70.55 % specificity of faecal flotation (Salvador et al. 2014). A minimum design prevalence of 65.46 % for *A. suum* and 16.66 % for *Trichuris* species as reported in a previous study (Laha et al. 2014) were used for sample size estimations. Sample size estimations were carried out using the Survey Toolbox and a sample size of 18 ($p = 0.0329$) and 234 ($p = 0.00498$) pigs was required for *A. suum* and *Trichuris* species, respectively for freedom testing with imperfect tests (Cameron 1999). In view of pig population of the selected districts, 218 and 25 samples each were collected from Ludhiana and other districts, respectively. In brief, we collected 265 pig (*Sus scrofa*) faecal samples both from farm (n = 47) and scavenging pigs (n = 218). Age of animals was recorded. Approximately 30–40 g of faecal samples were collected and transferred in the self-sealed plastic bags to the laboratory within 2–3 h.

Faecal floatation method

Approximately 1–2 g of faeces was added to 3 ml of floatation fluid in a 12 ml test tube and mixed thoroughly. The zinc sulphate solution (33 %) was used as a floatation fluid. With gentle stirring, sufficient flotation fluid was added to form a positive meniscus at the rim of the test tube. Floatation fluid was left undisturbed for 20 min. Positive meniscus was transferred on a glass slide for microscopic examination.

Statistical analysis

Prevalence was calculated as the number of positive samples divided by total number of samples tested. Correlation between prevalence and the factors (location of sample collection, age and management practices) was analysed by Chi square test. Value of p less than 0.05 was considered as statistically significant.

Results

The parasitic eggs/oocysts were detected in 49.4 % of the samples. *A. suum* was most prevalent parasite (27.5 %) followed by unsporulated oocysts (15.4 %), *Strongyloides species* (4.5 %) and *Trichuris* species (1.8 %) (Table 1). The overall prevalence of gastro intestinal parasitic eggs/oocysts was slightly higher in scavenging pigs (50 %) than farm pigs (Table 2). Parasite positivity was neither significantly related with location ($p = 0.309$) nor with management practices ($p = 0.69$). Overall prevalence was significantly higher in pigs >1 year (56.5 %) than pigs ≤1 year (39.6; $p = 0.01$) of age (Table 3). In our study, *A. suum* was most prevalent parasite when compared to other helminths, thus we studied its association with the risk factors. Prevalence of *A. suum* was significantly higher in adult pigs ($p = 0.00001$) as well as in scavenging pigs

Table 3 Age wise prevalence and distribution of gastro intestinal parasites in Punjab, India

Age of the pigs	No. of samples examined	No. of samples positive (%)	*Ascaris suum* (%)	Unsporulated oocysts (%)	*Trichuris* species (%)	*Strongyloides* species (%)
Les than one year	111	44 (39.6)	15 (13.5)	22 (19.8)	–	7 (6.3)
More than one year	154	87 (56.5)	58 (37.6)	19 (12.3)	5 (3.2)	5 (3.2)
Total	265	131 (49.4)	73 (27.5)	41 (15.4)	5 (1.8)	12 (4.5)

($p = 0.012$) but no significant association was observed between prevalence and location.

Discussion

Overall high prevalence in present study corroborates with the previous studies conducted in India (Dadas et al. 2016; Khajuria et al. 2010). High prevalence of 50, 68 and 80 % of gastrointestinal parasitic infections were observed in pigs from Jammu and Kashmir, Maharashtra and Meghalaya states, respectively (Dadas et al. 2016; Khajuria et al. 2010; Yadav and Tandon 1989) whereas in northeast states of India, Laha et al. (2014) reported lower prevalence (38 %) in pigs than the present study. Varied climate factors at different geographical locations and management practices could be attributed to this difference. Slightly higher prevalence found in scavenging pigs than farm pigs could be attributed to management practices as well as sample biasness (218 scavenging pigs vs. 47 farmed pigs). We reported *A. suum* as a most common parasite and this finding is in agreement with the reports from other parts of India (Yadav and Tandon 1989; Kumari et al. 2002; Deka et al. 2005; Laha et al. 2014) as well as other countries (Tamboura et al. 2006; Tomass et al. 2012). High prevalence of *A. suum* in pigs in Punjab is of public health concern. Similarly, high prevalence (52–65 %) of *A. suum* in pigs has also been reported from north eastern states (Yadav and Tandon 1989; Laha et al. 2014).

Free ranging of pigs and their freer access to potentially contaminated areas is an important risk for persistence of these parasites in India (Kaur et al. 2016; Chawhan et al. 2014). High prevalence of gastrointestinal parasites from Punjab indicates the need to further study prevalence and distribution of these parasites in pigs throughout Punjab and also to adopt proper preventive and control measures (hygienic rearing practices and proper garbage disposal systems) to control this problem.

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Compliance with ethical standards

Conflict of interest No financial or personal relationships between the authors and other people or organizations have inappropriately influenced (bias) this work.

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