Research Journal of Poultry Sciences 6 (2): 29-32, 2013
ISSN: 1993-5285

Zoonotic Hymenolepis diminuta and *Ornithonyssus* sp. in Rats Cohabiting Chickens in Poultry Farm, Jos, Nigeria

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Abstract: Rats constitute a major threat to poultry production in Nigeria. They act as reservoir of pathogens such as *Salmonella* sp. in poultry, *Yersinia* sp. and Lassa virus in humans and the few zoonotic *Hymenolepis* sp. in human. Coprological examination of rats feces confirmed the existence of pathogens of human and veterinary importance in black rats (*Rattus rattus*) extensively living in the poultry farm. A prevalence of 5.7% of *Hymenolepis diminuta* eggs and 4.3% *Ornithonyssus* sp. eggs from seventy rats were discovered. Coprological study of chickens in the pen was negative to the pathogens confirmed non transmissible hymenolepiasis in chicken. Education of the farm workers on improved hygienic practices in the pens and zoonotic importance of the pathogens is implied. Rodent control must be strategically implemented.

Key words: *Rattus rattus*, *Hymenolepis diminuta*, *Ornithonyssus* sp., chicken, coprology, zoonosis, Nigeria

INTRODUCTION

Rodents can cause major problems due to destruction and contamination of food and also by the spread of various diseases. The order rodentia (rodere, to gnaw) constitutes the most successful mammalian group, both in terms of the number of species and individuals as stated by Backhans and Fellstrom (2012). Rats and other rodents are usually *H. diminuta*'s definitive targets and natural reservoir. Coprophilic arthropods act as obligatory intermediate hosts. When the infected arthropod is eaten by the definitive host, cysticercoids develop into an adult worm in its body cavity and its eggs are eliminated in feces (Tena *et al*., 1998).

A low prevalence of *Hymenolepis* sp. (19.5%) in *Rattus rattus* in Nsukka area where University of Nigeria, Nsuka is sited as reported (Onyenwe *et al*., 2009). This low prevalence may be due to the husbandry system whereby the feed may not be heavily contaminated with infective cestode eggs since they usually disperse their feces over a large area. In intensively managed albino rats and mice that are confined in cages with their repeated mixing of their faeces with feed could lead to a high prevalence (Ngongeh *et al*., 2011).

Cestode infections are known to be common in man and rodents all over the world. Cestodes of rodents (*Hymenolepis* sp.) are also known to infect man (Ngongeh *et al*., 2011). Rats have been incriminated as the reservoir of zoonotic diseases such as hymenolepiasis (Anonymous, 1976). Hymenolepiasis in ducks and geese is very common everywhere; it occurs less often in chickens. The animals become infected in the spring when they eat infested intermediate and reservoir hosts (such as water fleas, gammarids and pond snails) (http://encyclopedia2.thefreedictionary.com/hymenolepis+diminuta). Current estimates suggest that over half's of the world population is infected with intestinal helminths (Ascaris, hookworms, Trichuris, Enterobius, Strongyloides and tapeworms) and that most of these infected people live in remote rural areas in the developing countries. These diseases which are currently referred to as neglected diseases of neglected populations, cause enormous hazards to the health of people, particularly of children by contributing to malnutrition, anaemia and retarded growth according to Yadav and Temjenmongla (2011).

The aim of this study was to investigate by coprological examination the relationship of rats cohabiting chicken houses with chickens in regard to helminthes transmission and maintenance in the poultry flock.

MATERIALS AND METHODS

Habitat and management: Seventy rats specimen were sampled from an institutionalized laying poultry farm in September 2012. They inhabited on the roof, floor of the pen and the environment where poultry wastes are

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usually dumped at the back of the pen. At the time of the study the area was overgrown with bush which serves as a natural habitat for the rats in their multitudes.

There was increased contact with the birds as the rats also feed on the carcasses overnight in the cages before they were removed by farm attendants. Feed was easily accessed in the open troughs attached to the cages and feed that poured on the floor apart from fecal droppings. Water was accessed in the open drainages where dirty and probably contaminated poultry water troughs containing fecal droppings and wood shavings are washed. The chickens were housed in cages and fed with layer mash and watered *ad libitum*. Fecal droppings collect on thick nylon that is easily moved by trolley action for cleaning.

Fecal collection: Rats were captured using traps and killed manually. Feces were collected from the lower intestine during necropsy and were submitted for coprological identification at the Helminthology Laboratory, Parasitology Department, National Veterinary Research Institute (NVRI), Vom, Nigeria.

Fecal egg counts: Fecal egg counts were done by both the flotation and modified McMaster techniques. Initially the flotation was employed. Feces was weighed, macerated in saturated sodium chloride solution and passed through a fine coffee strainer to trap the residue. The residue was discarded while the filtrate was put in test tubes and more salt solution added until a convex meniscus was formed. Cover slips were then placed over the tubes and removed after 3 min and viewed under the microscope. Eggs where present were counted and divided by the weight of feces to obtain the egg per gram of feces (epg). Where more than 100 eggs were detected then the eggs on the slide and cover slip were recovered by rinsing with the saturated salt solution into a petri dish and together with the suspension in the test tube transferred into 50 mL graduated teflon tubes. The volume of the salt was then adjusted and counted by the modified McMaster technique as described by Ngongeh *et al.* (2011). Briefly the presence of cestode eggs in the feces was checked and quantified where present by the modified McMaster technique as described by Ngongeh *et al.* (2011).

RESULTS AND DISCUSSION

Coprological study revealed high to moderate infection with the eggs of *Hymenolepis diminuta* 5.7% (4/70). Also, found were eggs of rat mites (*Ornithonyssus* sp.) in 4.3% (3/70) of the rats.

Hymenolepis diminuta's prevalence of 5.7% from 1 pen was reported in this study unlike 19.5% prevalence of *Hymenolepis* sp. reported in *Rattus rattus* in University of Nigeria, Nsukka area by Ngongeh *et al.* (2011). Where as a prevalence of 5% was reported in rats in Iran in 41 poultry houses (Allymehr *et al*., 2012), in England on farms 22% prevalence was reported (http://www.ratbehavior.org). In Belgrade 30.5% prevalence of *H. diminuta* was recorded by Kataranovski *et al.* (2011). These suggest that *H. diminuta* infection in rats is common with a wider geographic spread and that the prevalence could be higher if the study covers more farms in Jos and Plateau State, Nigeria.

This investigation showed a low prevalence of *H. diminuta* in the rats that were extensively raised, quite disimilar with the study of Ngongeh *et al.* (2011) who detected 66% in 231 rats intensively raised in the laboratory. This is best explained thus the rats in this study had unrestricted access to chicken feed and waste in and out of the pens and also chicken carcasses were found to be consumed by the rats in the pens. Implying that coprophagy was unlikely by the rats as a result of which the transmission rate among the rats was very low even if the feces were infective. This epidemiologically important factor means that if there is no transovarian transmission the pathogen will not be perpetuated among free rats in the population. Controlling the rat pathogen by chemotherapy especially where the rat can be bred for consumption is quite easy.

Coprological studies of chickens feces in the pen were negative for *H. diminuta*, confirming earlier report but recorded occurrence in ducks and geese (http://encyclopedia2.thefreedictionary.com/hymenolepis+diminuta). This is an important finding epidemiologically, the chickens were hostile host or non susceptible to *H. diminuta* and it could also mean the absence of an intermediate host required for a complete direct life cycle in the study area. Since, the cycle of transmission could not be sustained between rats and chicken, there was no transmission of *H. diminuta* from the rats to chicken. Further study may shed more light on this.

Rodents represent one of the most important sources of zoonoses for mammals and that increases in the population densities of rodents resulted in the dispersal of zoonoses and brought them into closer contact with humans (Beltrame *et al*., 2012). Based on the dynamics of a disease in a population using the epidemic triad, the presence of *H. diminuta*, the farm workers and the rats in poultry house (environment) especially with poor hygienic practices, hymenolepiasis could be considered an occupational disease of poultry farm workers.

Fig. 1: Rats cohabits with chicken such that rats fecal droppings were found in the feed trough

Elsewhere human cases though rare were reported in Spain and Italy (Marangi *et al*., 2003; Tena *et al*., 1998). Evidence of a source of infection incriminating rat infestation has been found in other human cases observed in developed countries (Marangi *et al*., 2003). Further study would be necessary to substantiate this proposition in the study area.

The chicken mite, *Dermanyssus gallinae* and the tropical rat mite, *Ornithonyssus bacoti* are potential vectors of zoonotic pathogens (Allymehr *et al*., 2012). Eggs of rat mite *Ornithonyssus* sp. found in 4.3% of the rats is an important findings in this study; implying that rats can serve as reservoir host of mites to chicken and the farm workers. Through their bites they suck the host blood and cutaneous irritation causing severe itching. (http://www.sbcvcd.org/documents/brochures/rat-birdmitebroch.pdf).

In this pen, rats cohabits with chicken such that rats fecal droppings were found in the feed trough (Fig. 1) causing contamination of feed thus predisposing the chickens to infections following ingestion of fecal and urinal droppings.

Hymenolepis diminuta is a tapeworm that occurs throughout the world. Its principal definitive hosts are rodents. Nevertheless, in rare instances, it can infect humans when by accidental ingestion of infected arthropods, cysticercoids find their way to the small intestine (Tena *et al*., 1998). Complementing other authors' findings (Tena *et al*., 1998), the farm workers are at increased risk of zoonotic hymenolepiasis, most importantly with poor hygienic practices at the farm. Rats are hunted for human consumption especially during dry season in rural communities thus many more people could be exposed to and harboring *H. diminuta* in Nigeria.

CONCLUSION

The study reports Hymenolepiasis in the rats cohabiting chickens in a poultry farm with a zoonotic implication to poultry farm worker in an institutionalized poultry farm. The study did not establish Hymenolepiasis in the chickens. Apparently *H. diminuta* may require an intermediate host for a transmission to chicken to be achieved thus completing its life cycle. Chicken can ingest the eggs of *H. diminuta* and become non infective but may passed the eggs to humans in contact and rats could re ingests the eggs. Rats must be adequately controlled in farms strategically. According to Paramasvaran *et al*. (2012), if the rodent population increases there will be concomitant increased risk of maintaining zoonotic infection. Considering the rat-man proximity, this situation may pose considerable threat to human and animal health in the future. Upgrading the hygienic practices in the farm would reduce flies and arthropods population; thus preventing ingestion of *H. diminuta* eggs in rats fecal droppings by chickens.

There is a need to intensify on the study of rodents in poultry farms most importantly because of increased contacts of human and poultry with rodents. Due to scant of literatures on *Hymenolepis diminuta* infection in poultry in Nigeria, this would represent a pioneer research in establishing the absence of Hymenolepiasis in poultry due to rats.

ACKNOWLEDGEMENT

The Executive Director Veterinary Research and the management are appreciated, the entire staff of poultry department particularly the junior staff for catching the rats, staff of necropsy section, central diagnostic and also staff helmintology laboratory, parasitology department; all are highly appreciated.

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