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Short communication

Poultry as reservoir hosts for fishborne zoonotic trematodes in Vietnamese fish farms

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ABSTRACT

Fishborne zoonotic trematodes (FZT) are widespread in Vietnam and Southeast Asia. It is now recognized that the risk of being infected from eating raw fish dishes applies not only to humans, but also to domestic animals (e.g., cats, dogs, and pigs) and fish-eating birds. The role of ducks and chicken, commonly raised on fish farms, as reservoir hosts, however, has not been adequately investigated. To study this question, chickens and ducks from integrated poultry-fish farms in Nghia Lac and Nghia Phu communes, Nam Dinh province, Vietnam were surveyed for FZT infections. A total of 50 ducks and 50 chickens from each commune were examined. Results revealed that 12% of chickens and 30% of ducks were infected with various species of trematodes, including two zoonotic species, *Centrocestus formosanus* and *Echinostoma cinetorchis*. Both occurred in chickens whereas only *E. cinetorchis* was found in ducks. Prevalence of these zoonotic species was 12% and 7% in ducks and chickens, respectively. Among other trematodes, *Hypoderaeum conoideum*, also a zoonotic fluke, was the most prevalent (20–30%). The feeding of snails and fish remains to poultry, either intentionally or by discharge of waste from the slaughter of ducks and chickens into the ponds, was identified as risk factors for trematode infection. The FZT species and low prevalence found in poultry in these communes indicate their role as reservoir hosts is minor.

1. Introduction

Fishborne zoonotic trematodes (FZT) including liver and intestinal trematodes are increasingly being recognized as significant public health problem (Chai et al., 2005). The parasites are especially of concern to the fast growing aquaculture industries of Southeast Asia. Studies on freshwater fish were conducted in Vietnam and found that in the Mekong Delta, 1.2–29.7% of cultured fish were infected with FZT metacercariae (Thu et al., 2007; Thien et al., 2009) whereas in the North, prevalence of FZT was 44.6% in Nghe An province (Chi et al., 2008) and was >50% in Nam Dinh province (Van et al., in press).

The role of reservoir hosts for FZT in aquaculture systems has recently been demonstrated, including the importance of treatment of infected domestic animals for sustainable prevention and control of FZT in fish farms (Anh et al., 2009a,b). There are a wide range of potential definitive hosts in the life cycle of FZT, apart from humans, particularly domestic and wild animals and fish-eating birds (Chai et al., 2005; Schuster et al., 2007; Anh et al., 2009a). In Vietnam, chicken and duck are common poultry in Vietnamese fish farms. Ducks are often maintained in so-called VAC ponds (integration of vegetable, pond and

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animal husbandry farming) and chickens allowed to roam freely around ponds. Their role, however, in maintaining the life cycle of FZT in aquaculture systems is not understood. The aim of the study reported here was therefore to determine the prevalence of FZT in chickens and ducks in two northern Vietnam communes endemic for FZT. Greater knowledge on the role of poultry as reservoir hosts is needed to develop an effective integrated control program for FZT in fish aquaculture.

2. Materials and methods

2.1. Sampling method

From April to May 2009, a cross-sectional survey was conducted for FZT in ducks and chickens in Nghia Lac and Nghia Phu communes in Nam Dinh province which is located in northern Vietnam. A total of 33 and 27 fish-farming households from Nghia Phu and Nghia Lac communes, respectively, were randomly selected from a list of households and ducks and chickens purchased from them. A total of 6 of the selected households in Nghia Phu and 9 in Nghia Lac was included in a study on FZT infections in fish in 2006 (Van et al., in press). A total of 50 ducks and 50 chickens were surveyed, 5 ducks and 5 chickens per selected household if possible. If chickens and/or ducks were not reared in a selected household, the household was replaced by other randomly selected households. During sampling, farmers were asked questions about certain practices relating to poultry husbandry: where the poultry are fed, the types of commercial feeds fed, and whether snails and fish remains are used to feed the fish.

2.2. Parasite recovery and identification

The chickens and ducks were killed by exsanguinations from the neck vein and their intestines and livers removed to separate dishes containing saline. The livers were opened following the main tributaries of the biliary duct, and any visible trematodes picked out and, placed in a separate Petri-dish containing saline. Livers were cut into small, thin pieces and placed in saline for 10 min, then crushed and filtered through a tea strainer (Anh et al., 2009a) and any visible trematodes observed were isolated. The intestines were opened and their contents were flushed with tap water into a cup, and then filtered through a tea strainer, visible trematodes were isolated and the intestinal contents remains were subsequently filtered through a 400 μm mesh. The sieve retentate was then washed into a Petri-dish with saline and searched for minute trematodes under a stereomicroscope. The fluid that passed through the sieve was allowed to settle and the sediment also searched for trematodes. Finally, the intestine was cut into small pieces and placed in a bucket with warm saline for 1 h and the fluid then was poured into conical flasks. The sediment was subsequently allowed to settle for 30 min, and then examined in Petri-dishes under a stereomicroscope.

All isolated trematodes from an individual chicken or duck were combined in one flask and fixed in hot 5% formalin. After counting the number of trematodes recovered, all the trematodes were stained in Semichon's acetocarmine and identified with published keys (Yamaguti, 1971; Pearson and Ow-Yang, 1982; Jones et al., 2005).

2.3. Statistical analysis

Prevalence estimates for total trematode infections and for individual trematode species, by commune and animal species (chicken or duck) were compared using logistic regression adjusting for clustering within households. Similarly, intensity of infection for all trematode infections and for individual trematode species, were compared between communes and animal species after adjusting for clustering within households using negative binomial regression (Hilbe, 2006). The ancilliary parameter was estimated using a full maximum likelihood estimation and this was then specified in a generalized linear model as described in Hilbe (2006). Factors that were not significant were removed from the final model. Potential risk factors were then tested for significance by adding them one by one to these models. A P-value less than 0.05 were taken to indicate a significant difference.

3. Results

Prevalence of trematode species in chicken and duck in the two communes is presented in Table 1. Chickens were collected from 41 farms and ducks from 24 farms. Among them, 24% and 63% of the farms had infected chickens and ducks, respectively. Overall the prevalence of trematode infections (all species combined) was 12% and 30% in chickens and ducks, respectively. Two species were identified as fishborne zoonotic trematodes in chickens, *Centrocestus formosanus* and *Echinostoma cinetorchis*

Table 1
Prevalence (%) of trematodes in chickens and ducks from the Nghia Lac and Nghia Phu communes.

Identified trematode species	Nghia Lac commune		Nghia Phu commune	
	Chicken $n = 50$	Duck $n = 50$	Chicken $n = 50$	Duck $n = 50$
Centrocestus formosanus	2.0 (1)	0.0	4.0 (7)	0.0
Echinostoma cinetorchis	2.0 (1)	4.0 (1)	6.0 (13)	20.0 (14)
Hypoderaeum conoideum	4.0 (2)	14.0 (2)	12.0 (20)	28.0 (36)
Nigerina hardoiensis	0.0	0.0	0.0	2.0 (1)
Notocotylus spp.	0.0	2.0 (1)	0.0	0.0
Total	8.0 (2)	18.0 (2)	16.0 (32)	42.0 (45)

Numbers in parentheses are the maximum number of trematodes recovered in one animal.