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# Gastrointestinal parasites of sheep in Kafrelsheikh governorate, Egypt: Prevalence, control and public health implications

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ABSTRACT

Gastrointestinal (GI) parasitism is a primary cause of losses in sheep production. A cross-sectional study was designed to investigate the prevalence, control strategies and public health importance of the GI parasites of sheep from Nile-Delta, Egypt. The prevalence of GI parasites in a total of 224 individual sheep was 50%: Protozoa (29.02%) and helminths (37.05%). The prevalence of helminths infection was by *Strongyle*-group (19.21%), *Paramphistomes* (9.38%), *Strongyloides papillosus* (4.02%), *Trichuris* spp. (2.68%), *Moniezia* spp. (0.89%) and *Nematodirus* spp. (0.45%). No single infection with *Fasciola* spp. was recorded. The protozoan infections included *Eimeria* spp. (16.52%), *Entamoeba* spp. (10.27%), *Giardia duodenalis* (0.45%), and, for the first time in sheep population in Egypt, *Balantidium coli* cyst (1.79%). Multivariate logistic regression analysis showed that usage of multiple anti-parasitic drug combinations and "Twice per year treatment" regime were associated with a substantial reduction of parasitic infection among examined sheep. The relative risk (RR) associated with lab technicians' lack of awareness of *Fasciola* and *Balantidium* zoonotic parasites was higher by 3 and 9 times than that of *Giardia*, respectively. In conclusion, GI parasites are endemic at high levels among sheep in the study area. Also, continuous awareness campaigns about zoonotic parasites are essential to reduce the possible public health threats.



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## 1. Introduction

Sheep production is considered a major sector of meat supply for human consumption in Egypt and contributes to development of the rural areas. In Egypt total sheep population was estimated at 5.5 million heads, most of them allocated in Nile-Delta (Statistics of Live Stocks, 2011). Gastrointestinal (GI) parasitism is considered one of the most serious and underestimated problems, which hinders sheep productivity (Perry and Randolph, 1999). Moreover, studies have shown that some of sheep GI parasites are of public health importance and they were incriminated in zoonotic transmission to human either by direct contact with sheep manure or indirectly through ingestion of contaminated food or water (Byomi et al., 2010; Feng and Xiao, 2011; Ralph et al., 2006). In Egypt, the risk of zoonotic transmission of some diseases via sheep should be carefully considered because majority of sheep flocks are reared as free-range animals with access to various agriculture fields and water sources. Such a rearing system provides many possible routes of environmental contamination by disease pathogens. This study aimed firstly to estimate the prevalence of GI parasites among sheep in Kafrelsheikh governorate of the Nile Delta region, Egypt. Secondly, the efficacy of parasitic infections' treatment regimens was evaluated by shepherd's questionnaires. Finally, public health threats were estimated using lab technician's questionnaires and statistical modeling.

## 2. Materials and methods

### 2.1. Study area and design

Kafrelsheikh is one of the five governorates in the Nile Delta and located north to Cairo (31°06′42″N 30°56′45″E). It is an agricultural governorate with a high density of livestock and human population. In Kafrelsheikh governorate, sheep are raised either in small numbers kept in the household by farmers or in village flocks managed by shepherds (Aidaros, 2005). One shepherd would often keep sheep from a number of different owners; as a result, animals from different households are part of the same flock for grazing and breeding during most of the year. Some village flocks are sometimes combined together to make a large flock managed by more than one shepherd. The flocks are reared by the free-range system, where animals graze freely all over the country as there is no regulation of animal movement in Egypt (Aidaros, 2005). Owing to the similarities of sheep husbandry system of management across the Nile Delta, the situation of parasitic diseases in Kafrelsheikh governorate is not likely to differ considerably from neighboring governorates in the Nile Delta region. A cross sectional survey was designed to investigate the prevalence of GI parasites (genera/species) among sheep and risk factors associated with infection. The sampling target population was all sheep in 10 main villages of Kafrelsheikh governorate. Each of these villages was assumed to have similar sheep flock size. Individual sheep was the primary sampling units. The total number of animals was obtained from the census of animal population at Kafrelsheikh governorate 2010. The sample size was estimated using Win episcope 2.0 programme as 270 individual sheep. This number was divided equally on the 10 villages of Kafrelsheikh governorate. Within each village, 27 sheep were equally divided between the existing flocks. Individual sheep were selected from each herd by simple random sampling.

### 2.2. Samples and laboratory examination

Between February and July, 2013 a total of 224 (not 270 due to lack of collaboration of some shepherds) fresh fecal samples were collected from the rectum of tested sheep in the study area. Samples were processed for morphological examination by formalin-ethyl ether centrifugation-concentration method according to Garcia (2001). When required wet mounts from sediments were stained with Lugol's iodine 5% and examined under light microscope at high magnification (x400). Identification was done according to Soulsby (1982).

### 2.3. Questionnaires design and target populations

Two structured questionnaires were built in this study. The first one was for estimation of the public health relative risks associated with lack of awareness, presence and prevalence of some parasitic zoonoses among human population at Kafrelsheikh governorate. Only *Fasciola* species, *Giardia* spp. and *Balantidium* spp. were the only parasites included in this questionnaire owing to their characteristic (egg/cyst) morphology based on the light microscope examination routinely used for identification of parasitic infection in human stool samples in the private labs in Egypt. This questionnaire was designed and distributed to some technicians (n = 14) in private human laboratories in the study area. To estimate the lack of awareness of zoonotic parasites among technicians, the questionnaire was supplied with photos of *Fasciola* egg and *Giardia* cyst obtained from CDC (2013), while the *Balantidium coli* cyst photo was obtained from the sheep feces samples in this study. Only the respondents who correctly recognized the parasite egg or cyst where asked for the presence and prevalence of these parasites according to their own lab records. The other questionnaire was designed and distributed to the shepherds (n = 26) of the examined sheep flocks looking for types of anthelmintics used for parasitic control, and the regime of application of these medications. The shepherds in this study always used drug combination instead of single medication per flock. According to the drug combinations used by the shepherds, medications were divided into three groups: [A: Curafluke (5% oral suspension of Fenbendazole and Rafoxanide) + Dovenix (Nitroxinil 2.5%, subcutaneous injection solution) + Ivomec (1% ivermectin, subcutaneous injection solution), B: Dovenix + Ivomec, and C: Curafluke + Dovenix]. Regime of drugs application was estimated as "Twice per year" vs. ">Twice per year". To study the effect of geographical region, three regions were allocated in the study area; each of them represents a set of closely located villages.

### 2.4. Epidemiological analysis

#### 2.4.1. Prevalence calculation

The prevalence of different parasites among examined sheep was estimated as percentage by dividing the number of infected