



## The Prevalence of Some Parasitic Zoonoses in Different Slaughtered Animal Species at Abattoir in the Mid-Delta of Egypt; with Special Reference to its Economic Implications

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### Key words

Slaughterhouse prevalence, Parasites, Zoonoses, Economic losses, Egypt.

### ABSTRACT:

Parasitic diseases are a multi-problem that affects animal productivity, public health and economy. A total of 45,094 animals slaughtered over three years in Elmahalla Elkubra slaughterhouse, Gharbia, Egypt were surveyed to determine the prevalence of Fascioliasis, Cysticercosis and Hydatidosis. Economic losses associated with Fascioliasis were estimated as well. The overall prevalences of Fascioliasis and Cysticercosis were 0.2% and 0.6%, respectively. Hydatidosis was not found in any of the examined animal species. The highest rates of Cysticercosis and Fascioliasis prevalences were reported in sheep (1.2%, 0.41%), followed by cows (0.44%, 0.14%) and lastly buffaloes (0.13%, 0.07%), respectively. Pattern of the parasitic diseases over three years showed a significant increase in sheep Cysticercosis and significant decrease in cows Cysticercosis, sheep Fascioliasis and cows Fascioliasis. The total economic losses due to Fascioliasis in terms of liver condemnations and carcasses weight losses over the three years of study was estimated as 106,331.3 EGP (16,800.4 USD). This study highlights the impact of these parasitic diseases in the study region and may eventually stimulate better efforts towards the control and possible eradication of these parasitic zoonosis in Egypt.

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## 1. INTRODUCTION

Slaughterhouses surveillance could be used to monitor the infectious disease status among food animals (Mellau et al., 2010) and play an important role in eliminating various diseases that are not fit for human consumption (Alton et al., 2010). Fascioliasis (i.e. a disease caused by the *Fasciola* trematode), Cysticercosis (i.e. infection with cysticerci; the metacestodes of adult *Teania* spp.) and Hydatidosis (i.e. infection with hydatid cyst; the larval stage of *Echinococcus granulosus*) are major zoonotic parasitic diseases that have a great impact on animals' production, food safety as well as public health (Perry and Randolph, 1999). As public health hazards, direct ingestion of bovine cysticercosis will result in infection of human with Taeniasis (Haridy et al., 1999b), while in case of Fascioliasis and Hydatidosis the role of animals is to continue the cycle of the disease and consequently result in the persistence of infection in the region (Yousef and Uga, 2014). Several studies reported the existence of these parasitic zoonoses among human population in Egypt (Haridy et al., 1999b; Sabri et al., 2005; Nossair and Abdella, 2014), which emphasis the importance of effective monitoring and control of these infection among animal population in the country. Parasitic diseases may significantly impact the economy

especially in developing countries as Egypt. Economic losses associated with Fascioliasis include direct losses in the form of condemnation of the liver of slaughtered animals and carcasses weight losses at the slaughter (Degheidy and Al-Malki, 2012; Uduak, 2014) or indirect as poor feed conversion, weight loss, slow fattening, reduced milk yield, reproductive failure and ultimately death (Ayana et al., 2009; Biu et al., 2013). Furthermore, previous studies showed that Cysticercosis and Hydatidosis usually result in downgrading and condemnation of animal carcasses and offal leading to substantial loss in livestock industry in many countries (Benner et al., 2010; Birhanu and Abda, 2014). Although several studies highlighted the economic losses associated with parasitic disease worldwide (Benner et al., 2010; Biu et al., 2013; Birhanu and Abda, 2014). Yet information regarding financial loss due to parasite-related condemnation of offal and carcasses is very limited in Egypt. In a developing country as Egypt where livestock production is an important segment of the agricultural practice and country income, it is necessary to continue monitoring for the status of the parasitic diseases with regard to its magnitude of occurrence and negative economic impact. Therefore, the objectives of the current study were to determine the prevalence of Fascioliasis,

Cysticercosis and Hydatidosis infections, which are responsible for the condemnation of carcasses and offal in a slaughterhouse located in Mid-Delta of Egypt; and estimation of direct economic losses associated with some of these diseases.

## 2. MATERIALS AND METHODS

### 2.1. Study area:

Elmahalla Elkubra slaughterhouse located in Elmahalla Elkubra city, the largest city of Gharbia governorate located in Mid-Delta of Egypt (30° 57'53.43''N and 31° 10'07.00''E). Elmahalla Elkubra slaughterhouse is one of the two major slaughterhouses in Gharbia governorate with an average of more than 15,000 head slaughtered annually (based on the slaughterhouse records).

### 2.2. Study design:

The study was conducted through active survey by conducting several visits to the slaughterhouse during the period between January to February 2013. In addition, a retrospective study was included using the information obtained from the slaughterhouse official records about the total number of animal slaughtered, condemnation of organ and carcasses and reasons for condemnation during the period between March 2010 to December 2012. Data collected from both active and retrospective survey represent a total of three years study period.

### 2.3. Post-mortem detection of parasitic diseases:

A total of 45,094 animals (19,089 buffaloes, 11,281 cows and 14,724 sheep) were slaughtered and examined during the study period (Table 1). The average age of buffaloes and cows included in this study was between 2 -  $\geq$  5 years, while sheep aged between 1.5 -  $\geq$  4 years. As a part of routine meat inspection, each slaughtered animal was examined by a well-trained veterinarian (i.e. meat inspector) assigned by Egyptian Veterinary Organization. Diagnosis of lesions in carcasses and offal and consequent condemnation (total or partial) was carried out by visual inspection, palpation or if necessary, incision of the suspected cases according to the national standards of the Egyptian Veterinary Organization and related-laws. During the authors' visits to the slaughterhouse, chosen samples from condemned organs due to parasitic diseases were collected and examined in lab for distinct macroscopic and microscopic morphological

characteristic according to (Soulsby, 1982) for confirmation of the diagnosis (Fig. 1).

### 2.4. Prevalence calculation:

Prevalence calculation was conducted according to Thrusfield (2007) as follows:

#### 2.4.1. The prevalence of the parasitic diseases:

The prevalence of different parasites among examined animals was estimated by dividing the number of infected animals for each disease (animals with condemned organs or carcasses) by the total number of slaughtered animals then multiplies by 100.

#### 2.4.2. The prevalence pattern of the parasitic diseases over 3 year's period:

The prevalence pattern of different parasites over 3 years was estimated by dividing the number of infected animals for each disease per year by the total number of slaughtered animals per same year then multiplies by 100.

### 2.5. Estimation of economic losses due to Fascioliasis:

#### 2.5.1. Direct losses due to liver condemnation during the period of the study:

It was calculated according Ogunrinade and Ogunrinade (1980) with few modification using the following equation:

$$EL = Ecs * Coy * Roz$$

Where EL = Economic loss estimated during the study period; Ecs = Number of animal slaughtered during the study period; Coy = Average cost of single animal liver during the study period; Roz = The prevalence of animal fascioliasis during the study period.

#### 2.5.2. Economic losses due to carcasses weight losses by Fascioliasis during the period of the study:

It was calculated according to Swai and Ulicky (2009) who applied modification based on the estimates of Cawdery et al. (1977) who reported 10% carcass weight loss due to fascioliasis, so the final equation was as follows:

$$EL = Ecs * (Coy * 10%) * Roz$$

Where EL = Economic loss estimated during the study period; Ecs = Number of animal slaughtered during the study period; Coy = Average cost of single animal carcass during the study period; Roz = The prevalence of animal fascioliasis during the study period.

**Table 1.** The total number of slaughtered animals per year during the period between March 2010 to February 2013 in the slaughterhouse of Elmahalla Elkobra City, Gharbia, Egypt.

Species	2010-2011	2011-2012	2012-2013	Total
Buffaloes	6996	7028	5065	<b>19089</b>
Cows	4074	3492	3715	<b>11281</b>
Sheep	4983	4832	4909	<b>14724</b>
<b>Total</b>	<b>16053</b>	<b>15352</b>	<b>13689</b>	<b>45094</b>

**Table 2.** The overall prevalence of parasitic diseases in the slaughtered animals during the period between March 2010 to February 2013 in the slaughterhouse of Elmahalla Elkobra City, Gharbia, Egypt.

Species	TSA	Cysticercosis		Fascioliasis	
		No.	(%)	No.	(%)
Buffaloes	19089	24	0.13	14	0.07
Cows	11281	50	0.44	16	0.14
Sheep	14724	179	1.2	60	0.41
<b>Total</b>	<b>45094</b>	<b>253</b>	<b>0.7</b>	<b>90</b>	<b>0.2</b>
<b>p-value</b>		<b>0.00001*</b>		<b>0.00001*</b>	

\*Significant ( $p$ -value <0.05). TSA: Total Slaughtered Animals.

**Table 3.** The pattern of the parasitic diseases of the slaughtered animals during the period between March 2010 to February 2013 in the slaughterhouse of Elmahalla Elkobra City, Gharbia, Egypt.

Species	Cysticercosis				Fascioliasis			
	10-11	11-12	12-13	p-value	10-11	11-12	12-13	p-value
<b>Buffaloes</b>	0.07	0.11	0.22	<b>0.08</b>	0.09	0.1	0.04	<b>0.5</b>
<b>Cows</b>	0.76	0.2	0.32	<b>0.001*</b>	0.22	0.2	0	<b>0.02*</b>
<b>Sheep</b>	0.84	1.37	1.45	<b>0.01*</b>	0.76	0.31	0.14	<b>0.0001*</b>

\*Significant ( $p$ -value <0.05)

**Table 4.** Economic losses associated with Fascioliasis prevalence in the slaughtered animals during the period between March 2010 to February 2013 in the slaughterhouse of Elmahalla Elkobra City, Gharbia, Egypt

Species	Offal and Carcass wt loss	Average weight (kg)	Total Monetary loss		
			EGP	USD	
<b>Buffaloes</b>	Liver (No.)	14	6.25	6327.1	999.7
	Carcass wt loss (%)	10	41	32871.3	5193.7
	<b>Total</b>			<b>39198.4</b>	<b>6193.4</b>
<b>Cows</b>	Liver (No.)	16	6.25	7478.2	1181.6
	Carcass wt loss (%)	10	41	38851.8	6138.6
	<b>Total</b>			<b>46330</b>	<b>7320.2</b>
<b>Sheep</b>	Liver (No.)	60	1.28	5409.01	854.6
	Carcass wt loss (%)	10	4.25	15393.9	2432.2
	<b>Total</b>			<b>20802.9</b>	<b>3286.8</b>
<b>Total</b>				<b>106331.3</b>	<b>16800.4</b>

\*Currency conversion was calculated according to the rating of 1 EGP = 0.158 USD (31/12/2012). EGP: Egyptian pound. USD: United States Dollar. Wt: weight.

The average weight by Kilogram (kg) and market price by Egyptian pound (EGP) for the liver and whole carcass of each animal was determined by interviewing personnel of the slaughterhouse and butchers during the study period. The average weight for cows and buffaloes carcasses was 410kg (370kg-450kg) and average weight for liver was 6.25kg (5kg - 7.5kg). While in sheep the average weights of carcass and liver were 42.5kg (30kg - 55kg) and 1.28kg (0.75g - 1.8kg), respectively. The average price for 1kg of liver and 1kg of meat was 70 EGP and 60 EGP, respectively for all animals.

### 2.6. Statistical analysis:

Chi square test ( $X^2$ ) was used for comparison of the prevalence rates of the parasitic diseases between species and years of the study. Differences were considered significant when  $p < 0.05$ . Statistical calculations were conducted using the statistical packages Microsoft Excel, Win episcope 2.0 and SAS 9.2 (SAS Institute Inc. 2008) software. Data were computed and represented in tables and figures.

### 3. RESULTS

A total of 45,094 animals (buffaloes, cows and sheep) were slaughtered and examined during this study period as shown in Table 1. The prevalence of parasitic diseases among all slaughtered animals in Elmahalla Elkubra slaughterhouse during the 3 years of the study period was 0.76%. The most prevalent parasitic infection in slaughtered animals detected during this study was Cysticercosis (0.6%), followed by Fascioliasis (0.2%) (Table 2), while Hydatidosis was not recorded in any of the examined animals. There was a high significant difference ( $p$ -value =

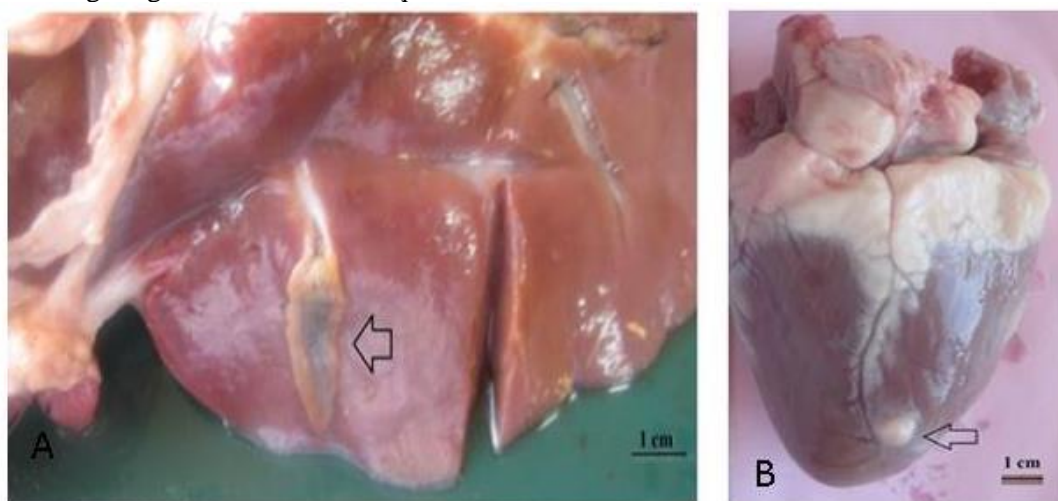
0.00001) in the prevalences of Cysticercosis and Fascioliasis between the different species of slaughtered animals (Table 2). The highest prevalences of Cysticercosis (1.2%) and Fascioliasis (0.41%) were recorded in the sheep, followed by cow (0.44%, 0.14%) and lastly buffaloes (0.13%, 0.07%), respectively as shown in Table 2 and Fig. 2.

Results in Table 3 and Fig. 3 showed that the pattern of the Cysticercosis and Fascioliasis prevalences over the 3 years showed no significant difference in case of Buffaloes. In sheep there was a significant increase in the prevalence of the Cysticercosis ( $p$ -value = 0.01) and highly significant decrease in the prevalence of Fascioliasis ( $p$ -value = 0.0001) over the 3 years of the study. There was a significant decrease in the prevalences of Cysticercosis ( $p$ -value = 0.001) and Fascioliasis ( $p$ -value = 0.02) in slaughtered cow over this study period. (Table 3, Fig. 3).

Economic losses estimated for Fascioliasis in slaughtered animals in Elmahalla Elkubra slaughterhouse during this study period are listed in Table 4. A total of 106,331.3 EGP were the monetary loss due to Fascioliasis in Buffaloes (39, 198.4 EGP), Cow (46,330 EGP), and Sheep (20, 802.9 EGP) due to condemnation of liver and 10% decrease in carcass weight due to Fascioliasis.

### 4. DISCUSSION

Slaughterhouses survey provides excellent indicators for the prevalence of infectious diseases of both public health and economic importance (Raji et al., 2010). The overall prevalence of parasitic diseases in this study was 0.76%, which was less than previous records in Egypt (Sultan et al., 2010; Yousef and Uga, 2014) and other parts of the world (Shalaby et al., 2011; Borji et al., 2012).



**Figure 1.** Pathological lesions due to parasitic diseases in slaughtered sheep in the slaughterhouse of Elmahalla Elkobra City, Gharbia, Egypt. (A): Mature worm of Fasciola spp. in the condemned liver of sheep, (B): Cysticerci in the condemned heart of sheep. Scale bar= 1cm.

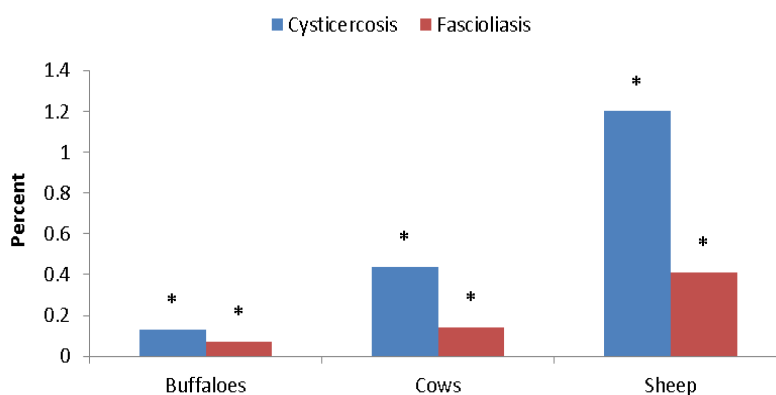
Fascioliasis constitutes both economic and public health constraints to ruminant production in Egypt and other developing countries as well. The reported prevalence of *Fasciola* spp. (0.2%) was lower than other studies in Egypt (Sultan et al., 2010; Yousef and Uga, 2014), in Nigeria (Uduak, 2014) and in Saudi Arabia (KSA) by Degheidy and Al-Malki (2012). The highest rate of *Fasciola* spp. prevalence was reported in sheep, which agreed with result reported in KSA by Shalaby et al. (2011). Different results were showed by Aysen et al. (1999) in Turkey and Haridy et al. (1999a) in Egypt who reported higher prevalence of Fascioliasis in cattle than sheep. Cows showed significant higher prevalence of Fascioliasis than Buffaloes. These results agreed with Haridy et al. (1999a). This difference in the prevalence of Fascioliasis reported from various studies may be attributed to many factors including differences in resistance to infection, grazing habits and breeds of animals as well as difference in the local climatic conditions (Chanie and Bengashaw, 2012).

Food animals act as intermediate host for infection with larval stage (*Cysticerci*) of *Taenia* spp. Sheep is the intermediate host of dogs' taenids. While cows and buffaloes are the intermediate host of *Taenia saginata* that infect human causing sever pathological conditions (Haridy et al., 1999b). In the current study, prevalence of Cysticercosis in slaughtered animals was found high especially in sheep, which agreed with pervious studies (Sultan et al., 2010; Borji et al., 2012). This can be attributed to the predominant free-range husbandry system of sheep and the problem of uncontrolled stray dog in Egypt, which allows the persistence of the life cycle in-between dogs and sheep in the Egypt (Abidi et al., 1989). For bovine Cysticercosis, cows was significantly higher than buffaloes, which agreed

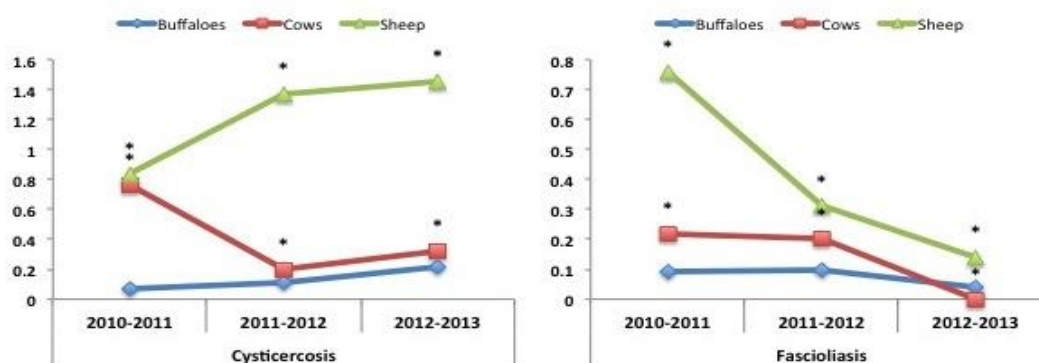
with other report in Egypt (Haridy et al., 1999b) and may be attributed to difference in animals' resistance or simply for the growing intensive production of cows in Egypt with increased frequency of contact with human in this system.

It is well known that all ruminants can be intermediate hosts for *E. granulosus* (Rahman et al., 1992; Haridy et al., 2006). Nevertheless, in the current study, none of the examined animal was infected with Hydatidosis. Several surveys on the frequency of Hydatidosis in different governorates of Egypt reported the existance of the disease in all farm animals including sheep and cattle (Rahman et al., 1992; Haridy et al., 2006; Sabri et al., 2005). It is not clear why the disease was not found in any of the examined animals in the region of the study (Elmahalla Elkubra, Gharbia governorate) but it could be attributed to the possible low prevalence of Echinococcosis among dogs in the study region.

Monitoring of the prevalence pattern of the parasitic diseases revealed that buffaloes showed no significant change in the pattern of the three diseases during the 3 years of the study. In sheep there was a significant increase in the prevalence of Cysticercosis during the study period. This highlighted the persistence of the life cycle in-between dogs and sheep, which reflect the inefficiency of the control program with regard to this species. There was a significant decrease in the prevalence of fascioliasis in sheep and cows over the three years of the study. This marked decrease in animal Fascioliasis coincide with the dramatic decrease of animal Fascioliasis previously recorded in Egypt (Soliman, 2008). This may be attributed to the improvement in public awareness and successful implementation of control programs for Fascioliasis in Egypt (Yousef and Uga, 2014).



**Figure 2.** The prevalence of Cysticercosis and Fascioliasis in slaughtered animals during the period between March 2010 to February 2013 in the slaughterhouse of Elmahalla Elkobra City, Gharbia, Egypt. \*Significant ( $p$ -value < 0.05)



**Figure 3.** The pattern of Cysticercosis and Fascioliasis diseases in slaughtered animals during the period between March 2010 to February 2013 in the slaughterhouse of Elmahalla Elkobra City, Gharbia, Egypt. \*Significant ( $p$ -value <0.05).

Fascioliasis is one of the most economically important diseases of domesticated livestock. In this study the total monetary losses due to Fascioliasis in terms of liver condemnation and carcasses weight was 106,331.3 EGP (16,800.4USD). These economic losses were higher than those reported by Uduak (2014). But they were lower than that of Degheidy and Al-Malki (2012) who reported an annual loss of 75,000 SR (20,000 USD) due to animal Fascioliasis in KSA. Differences in economic losses between different regions attributed basically to the difference in the prevalence of the disease and the local market prices.

## 5. CONCLUSION

Slaughterhouse survey may be a good tool to monitor the status of infectious disease especially those of public health importance. In this study, Cysticercosis was the most prevalent parasitic disease followed by Fascioliasis in the examined slaughtered animals in Elmahalla Elkobra slaughterhouse over three years of investigation. On the other hand, Hydatidosis was not recorded in any of the slaughtered animals during the study period. Sheep was the most affected species with Cysticercosis and Fascioliasis. Special attention should be given to these animals for efficient control of these diseases. There was an annual decrease in Fascioliasis prevalence, yet it still imposes a significant economic impact especially in a middle-income country as Egypt. This study provides some basic information that may help in assessment of these diseases impact and allows better designing for control programs.

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