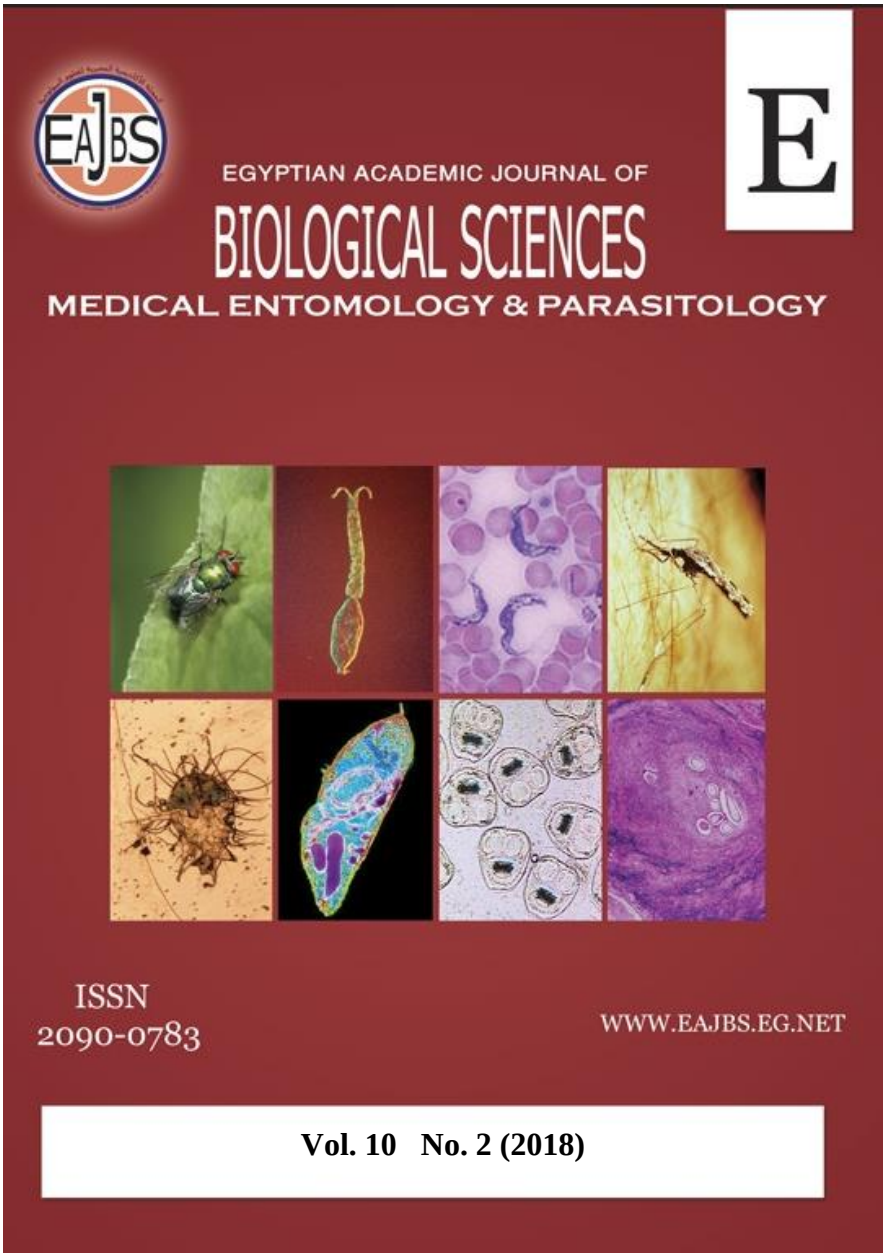

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Public Health and Medically Important Non-Biting Flies in Hail, Saudi Arabia

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ABSTRACT

The present study was carried out to isolate pathogenic parasites from many non-biting flies, which collected from three sites; restaurants, farms, and abattoir in Hail province, located 5 Km from Hail city, Saudi Arabia. A total of 4 species and 305 non-biting flies were collected and identified as 275 *Musca domestica* L. (90.2%), 4 *Syrphus corollae* (1.3%), 16 *Chrysomya albiceps* (5.2%), 10 *Fannia canicularis* (3.3%). These flies were examined for isolation of human parasites; the eggs and larvae of the following helminths; 8 *Ascaris lumbricoidis* (36.4%), 4 *Trichuris trichiura* (18.1%), 2 *Taenia* sp. (9.1%), 6 *Enterobius vermicularis* (27.3%), and 2 *Strongyloides stercoralis* (9.1%), and the cyst and oocyst of the following protozoa; 14 *Entamoeba histolytica* (29.8%), 11 *Entamoeba coli* (23.4%), 6 *Giardia lamblia* (12.8%), 12 *Cryptosporidium sp.* (25.5%), and 4 *Toxoplasma gondii* (8.5%) were isolated from the body surface and gut contents of flies. The isolation of ten human intestinal parasites from the body surface and gut of these non-biting flies indicated that they are mechanical vectors of food-borne diseases and threaten public health.

INTRODUCTION

The transmission of causative agents has a very important role in public health. Parasites are important pathogens of public health concerns in various parts of the world especially in endemic countries (Hoorfar, 2011). Unsanitary and poor environments have been observed as the helping factors in disease transmission (El-Sherbini and Gneidy, 2012). The most important source of parasites transmission is through the improper disposal of human waste, contaminated water, unhygienic food and the most common mechanical insect vectors such as flies (Breitschwerdt *et al.*, 2010).

Many species of synanthropic flies always associated with unsanitary environments and parasite transmission. The structural adaptation of body surfaces of the housefly, *Musca domestica* promotes the potential of picking of pathogenic organisms (Fotedar *et al.*, 1992). Houseflies are often found around different sites; restaurants, slaughterhouses, and animal farms which facilitate disease transmission like human intestinal parasites (Getachew *et al.*, 2007; Shoukry and Morsy, 2011; Oyeyemi *et al.*, 2016).

Flies play an important role in transmission of different stages of helminths and protozoan parasites, which cause several diseases to human such as eggs of *Ascaris lumbricoides*, *Trichuris trichiura*, hookworm, *Enterobius vermicularis*, *Strongyloides stercoralis*, *Toxocara canis* and cysts of *Entamoeba histolytica*, *Entamoeba coli*, *Giardia* and *Trichomonas* spp (Sulaiman *et al.*, 1988; Kettle, 1990; Doiz *et al.*, 2000).

The present study aimed to isolate and identify the parasites being carried by non-biting flies, which were caught at different sites of Hail city, Hail province, Saudi Arabia and to evaluate the risk of transmission of parasites by these flies.

MATERIALS AND METHODS

Study Area:

This is an epidemiological investigation of the public health and medical importance of non-biting flies in Hail (located 5 Km from Hail city), Hail province, Saudi Arabia. Hail is one of the 20 Saudi provinces located in northwestern KSA. It has a continental desert climate with hot summers (average high temperature 29.2) and cool winters (average low temperature13.3). Hail is located at a higher altitude with annual precipitation of 100.6 mm. According to the Ministry of the Interior (2013), Hail has a population of 527000 persons. The study sites for the collection of flies were three; food stores, farms, and abattoir. The study was carried out in summer season during the period from July 21, 2016 to September 21, 2016; the duration of the experiments was approximate 60 days.

Collection and Identification of Flies:

A total of 305 samples of non-biting flies were collected from different three locations; food stores, farms, and abattoir by insect sweeping nets or by sticky traps, which settled also in these sites. All flies caught were immediately transferred to a sterilized sample bottle during the process and then transported to the laboratory for the morphological identification. Then, the flies were refrigerated in the freezer at 0°C for 30-35 min to keep them immobilized and thereby enhance ease of handling and identification. The identification was made by examining the flies under a dissecting microscope following the standard taxonomic keys (Harwood and James, 1972).

Preparation of Flies for Parasite Isolation:

The preparation of flies for parasite isolation and examination followed the following; each fly was shaken into the 10 ml tube containing normal saline for 2 min. After the removal of flies, the washing was centrifuged at 2000 rpm for 10 min and the sediments were examined under a light microscope to identify parasites attached externally to the body surface of the flies. The Lugol's iodine solution was added to the glass slide for the identification of parasite eggs (Cheesbrough, 1998).

After external washing, the flies were washed in 70% ethyl alcohol for 5 min to decontaminate external surfaces, allowed to dry at room temperature and then washed with sterile normal saline three times for 2-3 min. The flies were dissected under the dissecting microscope from the abdomen end up to the second tergite. The gut contents were liberated and smeared on the glass slide for examination under the microscope to identify different parasite stages (Adegbola *et al.*, 1994).

RESULTS

A total of 4 species and 305 non-biting flies were collected and identified as 275 *Musca domestica* L. (90.2%), 4 *Syrphus corollae* (1.3%), 16 *Chrysomya albiceps* (5.2%) and 10 *Fannia canicularis* (3.3%). 57 *Musca domestica* was infested with helminths (20.7%) and 123 with protozoan parasites (44.7%), 2 *Syrphus corollae* was infested with only protozoan parasites (50%), while no. of positive of *Chrysomya albiceps* with helminths was 2 (12.5%) and protozoan parasites was 4 (25%), and *Fannia canicularris* was infested with helminths (no. of positive was 3 = 30%) and protozoa (no. of positive was 1 = 10%) (Table 1).

In primary isolation, the eggs and larvae of the following helminths; 8 *Ascaris lumbricoidis* (36.4%), 4 *Trichuris trichiura* (18.1%), 2 *Taenia* sp. (9.1%), 6 *Enterobius vermicularis* (27.3%), and 2 *Strongyloides stercoralis* (9.1%) were isolated from the body surface and the gut contents of non-biting flies (Table 2).

The cyst and oocyst of the following protozoa; 14 *Entamoeba histolytica* (29.8%), 11 *Entamoeba coli* (23.4%), 6 *Giardia lamblia* (12.8%), 12 *Cryptosporidium* sp. (25.5%), and 4 *Toxoplasma gondii* (8.5%) were isolated from the body surface and the gut contents of non-biting flies (Table 3).

Table 1: Human intestinal parasites isolated from different species of non-biting flies.

Parasite species	Non-biting flies Species							
	Musca domestica (no = 275)		*Syrphus corollae* (no = 4)		*Chrysomya albiceps* (no = 16)		*Fannia canicularis* (no =10)	
	No. Positive	No. Negative	No. Positive	No. Negative	No. Positive	No. Negative	No. Positive	No. Negative
Helminths	57	218	0	4	2	14	3	7
Protozoa	123	152	2	2	4	12	1	9

Table 2: Helminths parasites found on the body surface and in the gut contents of non-biting flies.

Helminths	Parasite stage	Body surface	Gut
Ascaris lumbricoidis	Egg	3	5
Trichuris trichiura	Egg	1	3
Taenia sp.	Egg	0	2
Enterobius vermicularis	Egg	3	3
Strongyloides stercoralis	Larva	0	2

Table 3: Protozoan parasites found on the body surface and in the gut contents of non-biting flies.

Protozoa	Parasitic stage	Body surface	Gut
Entamoeba histolytica	Cyst	4	10
Entamoeba coli	Cyst	3	8
Giardia lamblia	Cyst	1	5
Cryptosporidium sp.	Oocyst	3	9
Toxoplasma gondii	Oocyst	0	4

DISCUSSION

The present study shows that the four species of non-biting flies; *Musca domestica*, *Syrphus corollae*, *Chrysomya albiceps* and *Fannia canicularis* which collected from different three sites in Hail region were infected by the following helminths; *Ascaris lumbricoidis*, *Trichuris trichiura*, *Taenia* sp., *Enterobius vermicularis*, and *Strongyloides stercoralis*, and the following protozoa; *Entamoeba histolytica*, *Entamoeba coli*, *Giardia lamblia*, *Cryptosporidium* sp., and *Toxoplasma gondii*.

The high parasitic infection was in *Musca domestica* compared with other non-biting flies under the current study, these results were in consistency with (Link, 2002). Also, the present results reveal that non-biting flies contaminated with more parasites in their guts than body surfaces. These results were in agreement with the findings of other studies (Sulaiman *et al.*, 1988; Umeche and Mandah, 1989; Monzon *et al.*, 1991; Szostakowska *et al.*, 2004; Getachew *et al.*, 2007; Fetene and Worku, 2009; Adenusi and Adewoga, 2013). However, the present findings in contrast with other investigations (Oliveira *et al.*, 2002). In the present study, different species of non-biting flies carried helminth egg and larvae in the gut and this similarly with other investigators (Sulaiman *et al.*, 1988; Getachew *et al.*, 2007).

The present results show that *Musca domestica* was infected with helminths eggs by high numbers. In agreement with these results, Forster *et al.*, (2009) suggested that groups of 120 *Musca domestica* were

infected with nematode eggs on its body surface.

The high isolation of *Entamoeba histolytica* from the gut and body surface of non-biting flies captured in three locations; food stores, farms and abattoir had been reported from other studies (Adeyeba and Okpala, 2000; Nmorsia *et al.,* 2006) and also occurrence of *Entamoeba histolytica* agree with (Pai *et al.,* 2003)**.**

The Most contaminated non-biting flies species with different parasites in the present study is *Musca domestica* followed by *Chrysomya albiceps*, *Fannia canicularis* and *Syrphus corollae*. Similar results were reported by other studies (Sulaiman *et al.,* 1988; Umeche and Mandah, 1989; Getachew *et al.,* 2007; Fetene and Worku, 2009).

CONCLUSION

The present study clearly reveals that the four species of non-biting flies; *Musca domestica*, *Syrphus corollae*, *Chrysomya albiceps* and *Fannia canicularis* were collected from different three sites in Hail region. The isolation of ten human intestinal parasites from the body surface and gut of these non-biting flies indicated that they are mechanical vectors of food-borne diseases. So it is very important the control of non-biting flies which play an important role in parasitic disease transmission and threaten public health.

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ARABIC SUMMARY

الذباب غير الماص للدماء المهم طبياً والصحة العامة في حائل بالمملكة العربية السعودية

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أجريت هذه الدراسة لعزل الطفيليات المسببة للأمراض من العديد من الذباب الغير ماص للدماء والذي جُمِعَ من ثلاثة مواقع؛ المطاعم والمزارع والمجازر في منطقة حائل، وتقع على بعد 5 كم من مدينة حائل، المملكة العربية السعودية. تم جمع 4 أنواع من الذباب حوالي 305 ذبابة غير ماصة للدماء، وتم تعريفها كالآتي: *Musca domestica* L. 275 (90.2%)، 4 *Syrphus corollae* (1.3%)، 16 *Chrysomya albiceps* (5.2%)، 10 *Fannia canicularis* (3.3%). تم فحص الذباب لعزل الطفيليات الممرضة للإنسان؛ تم عزل بيض ويرقات الديدان التالية ؛ 8 *Ascaris lumbricoidis* (36.4%)، 4 *Trichuris trichiura* (18.1%)، 2 *Taenia* sp. (9.1%)، 6 *Enterobius vermicularis* (27.3%)، 2 *Strongyloides stercoralis* (9.1%)، وكيس وبيض الأوليات الحيوانية التالية؛ 14، *Entamoeba histolytica* (29.8%)، 11 *Entamoeba coli* (23.4%)، 6 *Giardia lamblia* (12.8%)، 12 *Cryptosporidium* sp. (25.5%)، 4 *Toxoplasma gondii* (8.5%) من سطح الجسم ومحتوى أمعاء الذباب. أشار عزل عشرة من الطفيليات المعوية الممرضة للإنسان من سطح الجسم والقناة الهضمية للذباب الغير ماص للدماء، أن الذباب يعتبر ناقل ميكانيكي للأمراض المنقولة عن طريق الأغذية ويهدد الصحة العامة.