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Gastrointestinal parasites infestation in military working dogs/ K9 in Al Muthanna Governorate in compare to semi housed dogs

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Abstract

Protection and safety tasks of any country are best achieved with the help of military working dogs (MWDs/ K9). Recently, MWD/ K9 have extensively used in Iraq to help the reinforce security and investigate the explosive devices. A mystifying amount of infective stages of parasites are harbored dogs which can transmit to man and other domestic animals and create a major threat to public health. Therefore, any shortage of diagnosis or treatment against these zoonotic certain diseases can help in spread it. This study designed to determine the prevalence of gastrointestinal parasite in MWD/ K9, which serve in the department of police academy in Samawah city/Al Muthanna Governorate, and compare it with semi housed dogs (SHD) using different coprological techniques. Totally, 19 MWD/K9/ exotic (pure) breeds which ranging from 4.5 to 8 years old were nominated as dogs of the current study. Moreover, two SHD of local breed around 2 years old were also used in this study. The fecal samples were collected from all dogs and examined by direct and different coprological techniques. The total percentage of the gastrointestinal parasite in all examined fecal samples from MWD/K9 and SHD was 80.95% (17 out of 21). The percentage of the positive samples were 78.94% (15 out of 19) and 100% (2 out of 2) in MWD/ K9 and SHD respectively. In both MWD/ K9 and SHD, the fecal sample of each dog revealed more than one type of parasites. The recognized parasites were *Echinococcus granulosa*, *Dipylidium caninum, Ancylostoma caninum, Toxocara canis, Toxoplasma gondii, Strongyloides spp. , Isospora spp. , Cryptosporidium spp. and Giardia spp.*. The percentages of parasites in MWD/ K9 in descending order were 68.42%, 57.89%, 36.84%, 10.52% and 1% for *Isospora spp, Cryptosporidium spp., Giardia spp., Toxoplasma gondii and Aelurostrongylus abstrusus*. Both SHD revealed all types of parasites except *Aelurostrongylus abstrusus* for the first and *Aelurostrongylus abstrusus & Ancylostoma caninum* for the second. A significance differences ($p \leq 0.01$) was seen in the percentages of parasitic infestation between MWD/ K9 and SHD. In conclusion, this study approved that the MWD/ K9 harbored at least one parasite although all these dogs were subjected to regular deworming protocol. In addition, this study approved the high parasitic infestation in SHD than the MWD/K9. The authors recommend to take a strong precautions such as high cleaning level and provide healthy and cooked foods to all dogs accompanied with an effective anti-parasitic treatment and prevention regime according to a plan to reduce the human being risk from the infected dogs the source of parasitic zoonotic diseases.

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Keywords: *Echinococcus granulosus, Isospora spp,* Military working dog (MWD)/ K9, SHD, zoonotic disease, parasite.

Introduction

Group security and assembly protection are basic in a war atmosphere. Current events in Iraq have established a tendency for the use of explosive devices by insurgents. The security of armed bases and arrest of people who break that security are huge tasks that cannot be accomplished successfully without trained patrol dogs. Protection and safety tasks are best achieved with the help of military working dogs (MWDs/ K9). MWD/ K9 have extensively used in Iraq to help in reinforce security and investigate the explosive devices. Scene requirements and mission needs define the essentiality for allocation of MWD/ trainer groups. The necessity for dog groups branches from the value of the dogs, i.e., the capability to discover explosives or criminal drugs and to implement patrol missions. As soon as the task requirement for MWDs is recognized, service program leaders consult a MWD database for the position, ability, and fitness for responsibility status of dogs. All divisions of the military have dog teams that are trained and ready for allocation. The MWD department / K9 are distributed in all Iraqi governorates to secure the safety and prevent the terrorist action and warfare.

Canine family including MWD/K9 like other animals is susceptible to the parasitic diseases that readily zoonotic and infect humans. More than 60 zoonotic diseases are correlated with dogs. These parasitic diseases are the most significant zoonoses worldwide and are nominated to be the more dangerous hazard to socioeconomic stability particularly in the developing countries (Otranto, and Eberhard, 2011). Concerning gastrointestinal parasites, dogs are hosts of numerous species, comprising extensive parasites that affect humans. These disease including helminths such as *Ancylostoma caninum* and *Toxocara canis* that can create a serious public health problem worldwide (Rhindali *et al.,* 2006; Dantas-Torres and Otranto, 2014). Hookworms (*Ancylostoma spp.*), causes cutaneous larva migrans (CLM), visceral larva migrans (VLM) and eosinophilic enteritis. Moreover, toxocariasis is a major health problem because infections often result in multi-systemic disease by visceral migration and damage that may affect vital structures, such as the eyes, liver and brain (McCarthy and Moore, 2000; Despommier, 2003). Besides, dogs also are the certain host for various intestinal parasites which can cause severe zoonotic diseases like hydatidosis that caused by *Echinococcus granulosus* (Razmi , 2009). Additionally, these diseases represent pronounced hygienic importance (Santarém *et al.,* 2004; Hohlenwerger *et al.,* 2011). Although, an extensive range of therapeutic and prophylactic methods recently available, eggs and oocysts of parasites have commonly distinguished in the feces of dogs, and their shedding in the atmosphere assists transmission to further hosts, comprising human being . Majorities of these intestinal parasites (e.g. *Toxocara spp*., *Ancylostoma spp.* and *Cystoisospora canis*) represent international spreading. Gastrointestinal parasitic diseases can cause adverse effects on MWD/ K9 and reduce its activities and values. Additionally, these parasites can also transmitted to the workers and trainer who spend long times with these dogs and become in close contact with most significant eliminated zoonoses pathogens. Therefore, continuous treatment and prophylactic programs should applied to protect these dog from parasitic infestation.

In spite of the progresses in the immunological methods and founded of molecular tests, parasitological analytical techniques, still are valuable for recognizing gastrointestinal parasites via examining for diverse parasitic stages (e.g. eggs, larvae, oocysts or trophozoites) that are shed in feces, because of their low cost and simplicity (De Santana *et al.,* 2015; Papini *et al.,* 2012; Hoffman *et al.,* 1934; Willis, 1921). Conversely, since the diagnosis is established on observing eggs or oocysts, approval may perhaps in some cases be tough (De Santana et *al.,* 2015). Moreover, selecting the best appropriate technique for use within the routine of the diagnostic laboratory may indicate a difficulty for competent diagnosis. For zoonotic enteric parasites of dogs and cats, significance valuation of their likely impacts on animal and human health, as well as the arrangement of ideal procedures for parasite control, depend significantly on strong prevalence data in animals and in publics. In Iraq, of particular concern are *Echinococcus granulosa*, *Toxocara* species, *Cryptosporidium* and *Giardia* species, and *Toxoplasma gondii*. These parasites also happen in other domestic animals and/or wildlife hosts in Iraq, which in some situations can be essential causes of people infection. In Iraq, scarce surveys studies on prevalence of enteric parasites in dogs have been reported and, established mainly on fecal examinations. For example, these include studies on zoonotic gastrointestinal parasites in police and house dogs in Baghdad governorate (Khalaf *et al.,* 2015). This study approved the prevalence of parasitic infestation with a total percentage of 27.61 %. Moreover, it also approved more parasitic infestation in house dogs than police dogs with percentages of 36.36 and 25.89 % respectively. Meanwhile, the study found the following parasite: *Toxocara canis* 11 (8.20%), *Isospora spp.* 19 (14.17%), *Cryptosporidium spp.* 5 (3.73%) and *Sarcocystis spp.* 3 (2.23%) with variation in the infestation that depend on the age and sex of the dogs. There are no analogous available data from other Iraqi governorates. The recent prevalence of gastrointestinal parasites in housed, SHD or MWD is nearly unknown in Iraq and has never been investigated on Al Muthanna Governorate. Consequently, the present study intends to diagnosis the gastrointestinal parasite in MWD/ K9, in Samawah city/Al Muthanna governorate, and compare it with the SHD using different coprological techniques.

Materials and Methods

Area of study

The study was conducted between December 2016 and March 2017 on MWD/ K9 that serve in the department of police dog academy in Samawah city /Al Muthanna governorate/ Iraq. Moreover, SHD were also included in this study to acts as positive control, as these dogs have never been treated or vaccinated by their owner. Totally 19 MWD/K9/ exotic (pure) breed that ranging from 4.5 to 8 years old, were nominated as dogs of the current study. Each MWD/K9 was housed in a single cage and fed on dry food (Figure.1). All these dogs were subjected to regular deworming protocol. Moreover, SHD of local breed around 2 years old were used as positive control dogs. These dogs fed on uncooked food and never subjected to any deworming medication. These fecal samples were examined for the presence of gastrointestinal parasites using different coprological techniques.

Figure. 1: shows MWD/ K9/ exotic (pure) breeds

Fecal samples

Fresh fecal samples from all dogs were collected and kept at plastic containers at the early morning and transferred immediately to the laboratory (Figure. 2). The animal's name, sex and age of each dog were recorded.

Figure.2: shows procedures of the collection and examination of fecal sample
1. Collection of fresh fecal sample from dog; 2. Labeled the samples; 3. Transfer samples immediately to the laboratory; 4. Preparation of different solutions for coprological examination; 5& 6 Preparation and examination each samples using various solutions; 7. Preparation of slides for examination; 8. Examination of slide under light microscope; 9. Capture of image using digital Camera.

Examination techniques

About 3-5 grams of fecal sample were well mixed with 30 ml of water and strained through a tea strainer to remove the coarse fecal material. The sieved samples were examined grossly for adult nematodes. Each sample inspected by: direct method centrifugal fecal floatation method (1500 rpm/ 5 minutes) using different solutions as follow (Dryden *et al.*, 2005):

1. Saturated zinc sulfate solution composed of 350 grams granular zinc sulfate, dissolved in 1000 ml water / Specific Gravity 1.18.
2. Sheather's Sucrose composed of 454 grams sugar, dissolved in 355 ml water. 6 ml formalin to prevent mold growth/ Specific Gravity 1.275.
3. Saturated Salt (NaCl) 350 g NaCl dissolved in 1000 ml tap water/ Specific Gravity (1.18–1.20).

In addition, fecal sedimentation technique (Zajac and Conboy, 2012) was also used in this study. To facilitate protozoan and cyst identification the iodine solution was used, while the modified Ziehl Neelsen (MZN) staining technique used to detect *cryptosporidium spp.* oocysts in the feces (Henriksen and Pohlenz, 1981). All parasites were recognized depending on eggs, oocysts or cysts color, shape and contents (Zajac and Conboy, 2012; Soulsby, 1982). This study was approved by research and ethical committee college of veterinary medicine/ Al Muthanna University. An agreement letter was sent to the department of police dog academy in Samawah city /Al Muthanna Governorate/ Iraq to enable the researcher to collect the samples. The percentages of infestation was calculated .The statistical analysis System- SAS (2012) was used to determine the significance of the percentages between the study groups.

Results

The total percentage of the gastrointestinal parasite in all examined fecal samples from MWD/K9 and SHD was 17 (80.95%). The percentage of positive samples was 78.94% (15 out of 19) and 100% (2out of 2) in MWD/ K9 and SHD respectively (Table.1). In both MWD/ K9 and SHD, the fecal sample of each dog revealed more than one type of parasites. The recognized parasites were *Echinococcus granulosa* (Figure.3), *Dipylidium caninum* (Figure.4), *Ancylostoma caninum* (Figure.5), *Toxocara canis* (Figure.6), *Toxoplasma gondii* (Figure.7), *Strongyloides sp* (Figure.8) *Isospora spp*. (Figure. 9), *Cryptosporidium spp.* (Figure. 10) and *Giardia spp.* (Figure.11) (Table. 2&3). The percentages of parasites in MWD/ K9 were 68.42, 57.89, 36.84, 10.52% and 1% for *Isospora spp*, *Cryptosporidium spp.*, *Giardia spp.*, *Toxoplasma gondii* and *Aelurostrongylus abstrusus* (Figure. 12) (Table. 2). Both SHD revealed all types of parasites except *Aelurostrongylus abstrusus* for the first and *Aelurostrongylus abstrusus & Ancylostoma caninum* for the second (Table. 3). The results of this study revealed high prevalence rate (100 %) at SHD with significance differences ($p \leq 0.01$) in compare to the percentage (78.94%) at MWD/ K9.

	Police dog		House dog	Total
	Negative	Positive		
number of dog	4	15	2	21
Percentages %	21.06 %	78.94 %	100%	80.95%

Table. 1: Shows the percentages of parasitic infestation in the examined fecal samples from both MWD/K9 and SHD.

Parasites	No. of Police dog	Total	Percentages %
Echinococcus granulosa	0	0	0%
Dipylidium caninum	0	0	0%
Ancylostoma caninum	0	0	0%
Toxocara canis	0	0	0%
Strongyloides sp	0	0	0
Toxoplasma gondii	2	2	10.52%
Isospora spp	13	13	68.42
Cryptosporidium spp.	11	11	57.89
Giardia spp	7	7	36.84
Aelurostrongylus abstrusus	1	1	1%

Table.2: Shows the parasites that found in the MWD/K9

No.	Name of parasite	SHD	
		1	2
1.	*Echinococcus granulosa*	+	+
2.	*Dipylidium caninum*	+	+
3.	*Ancylostoma caninum*	+	-
4.	*Toxocara canis*	+	+
5.	*Toxoplasma gondii*	+	+
6.	*Strongyloides sp*	+	+
7.	*Isospora spp*	+	+
8.	*Cryptosporidium spp.*	+	+
9.	*Giardia spp*	+	+
10.	*Aelurostrongylus abstrusus*	-	-

Table. 3: Shows the parasites that found in the SHD

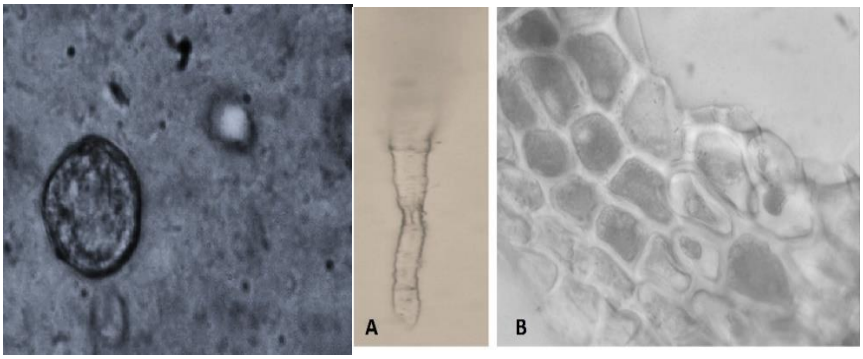

Figure.3: Shows *Echinococcus granulosa* (X100)

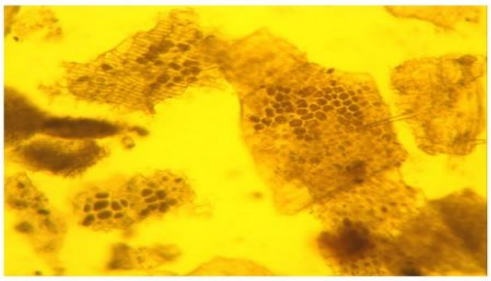

Figure.4: Shows *Dipylidium caninum* (X100)

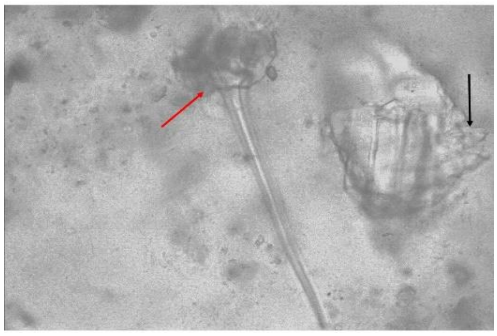

Figure.5: Shows *Ancylostoma caninum* (X100)

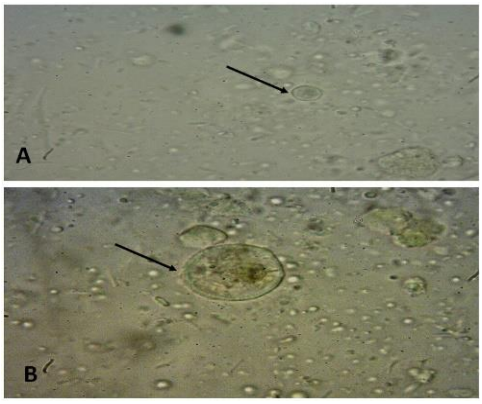

Figure.6: Shows *Toxocara canis* (X100)

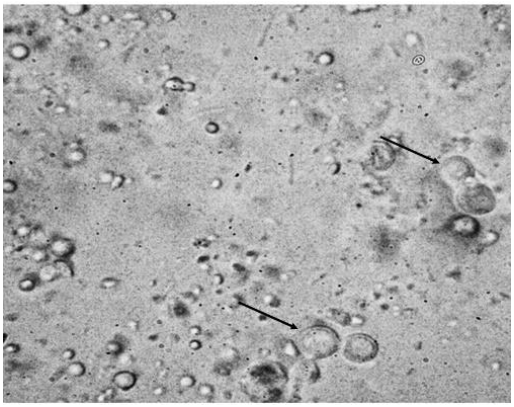

Figure.7: Shows *Toxoplasma gondii* (X100)

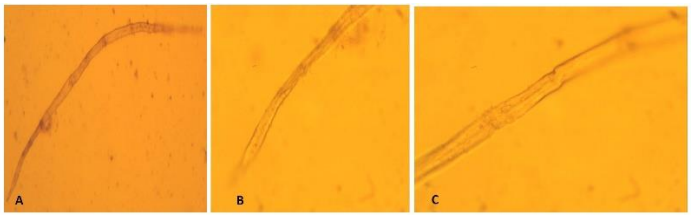

Figure.8: Shows *Strongyloides spp*. (A. X10, B. X20, C.X100)

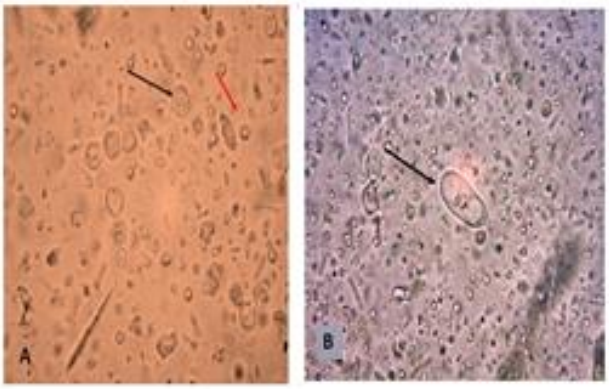

Figure. 9: Shows *Isospora spp*. (A. X10, B.X100)

Figure. 10: shows *Cryptosporidium spp.* (X100)

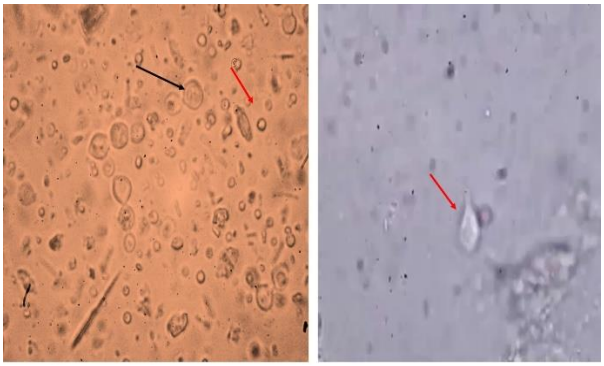

Figure.11: Shows *Giardia spp*. Red arrow (X100)

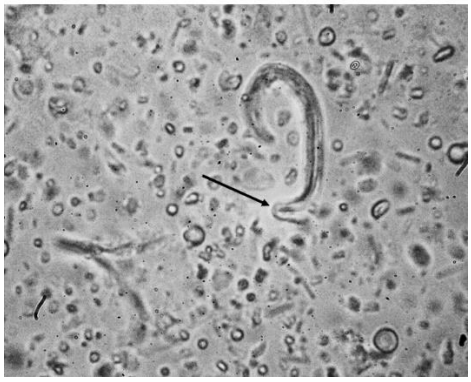

Figure. 12: Shows *Aelurostrongylus abstrusus* (X100)

Discussion

One of the old domestic animal is a dog (*Canis familiaris*). Dog has been maintained close contact with people and other livestock. There is a human demand for keeping a dog and establishing the human-dog partnership. Dogs help with chase and shepherding, and for the early warning security system (Dohoo *et al.,* 1998). Previously, police dogs were only used for some special missions in Iraq. However, the number of dogs and department of dog's academy in each Iraqi Governorate have increased over the last ten years, because of the current security situation, the number of terrorist action targeting the Iraqi people, and the war against terrorists. Dogs are a harbor for a mystifying amount of infective stages of parasites that transmit to man and other domestic animals and create a major threat to public health (Molyneux, 2004). Therefore, any shortage of diagnosis or treatment against certain diseases helps the spread of zoonotic diseases.

Infection from parasitic diseases in animals have constantly been an important issue. It causes low production in productive animals, besides the cost of anti-parasitic treatments (Barger, 1982). Globally, there are 17, 20, 17 and 1 species of trematodes, nematode, cestode and *acanthocephalan* parasites respectively that signify important public health problems (Labarthe *et al.,* 2004) and approved parasitizing in animals (Soulsby, 1977; Eguia-Aguilar *et al.,* 2005).

The results of the present study showed that 80.95% of the examined fecal samples from both MWD/ K9 and SHD were observed positive for at least one of the gastrointestinal parasites. The percentage of infestation were 100% and 78.94% for SHD and MWD/K9 respectively. The first house dog was harbored for very serious zoonotic parasite. These parasites were *Echinococcus granulosa , Dipylidium caninum , Ancylostoma caninum, Toxocara canis , Toxoplasma gondii , Strongyloides sp , Isospora spp , Cryptosporidium spp. , and Giardia spp.*.While the second house dog was harbored for all parasites harbored by the first dog except *Ancylostoma caninum.* Meanwhile, no *Aelurostrongylus abstrusus* was found in both house dogs. Moreover, MWD/ K9 revealed variation in the prevalence rate of parasitic infestation ranging in ascending order from 1% 10.52%, 36.84%, 57.89 and 68.42% for *Aelurostrongylus abstrusus, Toxoplasma gondii, Giardia spp., Cryptosporidium spp.* and *Isospora spp.* respectively. The high percentages of these parasites in the SHD and MWD/K9 is in agreement with the results of the prior studies, which was 78.57% in Ilam province of Iran (Ali *et al.,* 2011), 71% in Cordoba/ Spain (Martinez-Moreno *et al.,* 2007) and

76% in free State Province, South Africa(Minnaar *et al.,* 2002). On the other hand, the current study percentage 80.95% is lesser than percentages reported by other researchers elsewhere as follow: 90.7% and 89.3% in Wondo Genet and Hawassa respectively in Southern Ethiopia (Octavius *et al* .,2011; Berhanu *et al.,* 2013) ; 89.13% in Argentina (Lavallen *et al.,* 2011); 86.8% in Ethiopia (Dagmawi *et al.,* 2012) ; 93.8% in Nigeria (Dejene *et al.,* 2013); 100% in Rabat region, Morocco (Pandey *et al.,* 1987); 86.0% in Karachi (Noor-Ul-Huda *et al.,* 2014) and 100% in the Baghdad area/Iraq (Tarish *et al.,* 1986).

Meanwhile, the total percentage 78.94% reported in the current study, is higher than the total percentage 27.61% of dog parasitic infestation that reported previously in Baghdad Governorate/ Iraq (Khalaf *et al.,* 2015). Khalaf *et al.,* (2015) approved the prevalence of parasitic infestation with more parasitic infestation in house dogs than police dogs with percentages of 36.36% and 25.89 % respectively. Meanwhile, the study investigated the following parasite: *Toxocara canis* 11 (8.20%), *Isospora spp.* 19 (14.17%), *Cryptosporidium spp.* 5 (3.73%) and *Sarcocystis spp.* 3 (2.23%) with variation in the infestation that depend on the age and sex of the dogs.

However, the high percentage 78.94% reported in the current study in the MWD/ K9 is in compatible with the results of previous study in Turkey that reported lower prevalence percentage 30.4% of the intestinal nematode in military dog with particular mention to *Toxocara canis* (Senlik *et al., 2006*). Moreover, the results of this study is also higher and in compatible with results of Ahmed *et al.,* (2014), who reported lower prevalence 18.3% of zoonotic and other gastrointestinal parasites in police and house dogs in Alexandria, Egypt.

It is worth to mention that the results of the current study revealed that the MWD/K9 reported zero infestation percentage for the public health serious and dangerous parasites such as *Echinococcus granulosa, Dipylidium caninum, Ancylostoma caninum, Strongyloides spp.*. This results might occur due to the effect of the continuous deworming plan applied for these dogs. However, the percentage of other parasite particularly the protozoa such as *Toxoplasma gondii*, *Isospora spp.*, *Cryptosporidium spp.* and *Giardia spp.* might occur due to the decrease in the immunity of the these dogs that occurred because of the stressful hard duties. It might also be due using the narrow spectrum anti-parasitic drugs that it may be not effective on these parasite group. Other factors also have roles on the percentage of the parasites infestation such as the box cleanness, number of dogs, geographical location and veterinary care.

The results of this study revealed 100% percentage of very serious and dangerous gastrointestinal parasitic infestation in the SHD. This result is in agreement with previous study that done on stray dog in Baghdad city/ and reported 100 % prevalence rate (Tarish *et al.,* 1986). The absence of the deworming treatment for the SHD and lack of owner awareness about the seriousness of these parasites on public health lead to increase the infestation rate.

The *Isospora spp.* reported the highest percentage 68.42 % among other parasite in the MWD/K9. This result is disagreed with the results of previous studies that reported low *Isospora spp.* percentage such as Bahrami *et al*., (2011) and Ortuño, Castellà, (2011) and Coggins, (1998), who found that the percentage of *Isospora spp.* were 15.17%, 16.4% and 5.2%.respectively. The *Cryptosporidium spp.* percentage 57.89%

was the second in order after *Isospora spp.* and this result is incompatible with Bahrami *et al.*,(2011), who mentioned that the existing *of Cryptosporidium spp.* in dogs and reported a lower percentage (7.14%) than this study. In the meantime, Ahmed *et al.,* (2014) and Sargent *et al.,* (1998) also indicated that *Cryptosporidium spp.* found in police dogs, house dogs and cats, and these animals considered as the origin of infection for humans.

In conclusion, this study approved that the MWD/ K9 harbored at least one parasite although all these dogs were subjected to regular deworming protocol. In addition, this study approved the higher percentage in SHD than the MWD/K9. *Echinococcus granulosa, Dipylidium caninum, Ancylostoma caninum, Strongyloides spp.* were the serious zoonotic parasitic infection that found in the fecal samples of the SHD and can infect human being and threat the public health. The percentage rates of parasites in MWD/ K9 were in ascending order from 1% 10.52%, 36.84%, 57.89 and 68.42% for *Aelurostrongylus abstrusus*, *Toxoplasma gondii*, *Giardia spp.*, *Cryptosporidium spp.* and *Isospora spp.* respectively. To reduce the human being risk from the source of parasitic zoonotic diseases of infected dogs, precautions should be planned such as the advanced cleaning level, healthy and cooked foods should be supplied to the MWD/K9 and SHD or house dogs. Moreover, an effective anti-parasitic treatment should provide according to the plan for all dogs.

References

Ahmed WM, Mousa WM, Aboelhadid SM, Tawfik, MM. (2014). Prevalence of zoonotic and other gastrointestinal parasites in police and house dogs in Alexandria, Egypt. Veterinary World. 7(5): 275-280.

Ali mohammad B, Ali zaman D, Hoosain N, Abdolmahdi N, Salman A (2011). Epidemiological survey of gastro-intestinal parasites in stray dogs and catsin Ilam province of Iran. Aust. J. Basic Appl. Sci. 5(9):1944-1948.

Barger IA (1982). Helminth parasites and animal production. In Biology and Control Endoparasites". L.E.A. Symons, AD Donald and JK Dineen, Eds. Academic Press. Sydney, Australia pp. 133-155.

Berhanu M, Alemayehu R, Desie S (2013). Gastrointestinal helminthes of dogs and owners' perception of dogs' parasitic zoonoses in Hawassa, Southern Ethiopia. J. Vet. Med. Anim. Health. 5(1):20-26.

Bahrami A, Doosti A, Nahravanian H, Noorian A, Asbchi SA. (2011). Epidemiological Survey of Gastro-Intestinal Parasites in Stray Dogs and Cats .Aust. J. Basic & Appl. Sci. 5(9): 1944-1948.

Coggins JR. (1998). Effect of Season, Sex, and Age on Prevalence of Parasitism in Dogs from Southeastern Wisconsin. J. Helminthol. Soc. Wash. 65(2):219-224.

Dagmawi P, Mekonnen A, Abebe F, Berhanu M (2012). Prevalence of gastrointestinal helminthes among dogs and owners perception about zoonotic dog parasites in Hawassa town, Ethiopia.J. Public Health Epidemiol. 4(8):205-209.

Dantas-Torres, F. and Otranto, D. (2014). Dogs, cats, parasites, and humans in Brazil: opening the black box. Parasites & Vectors, vol. 7, no. 1, pp. 22. http://dx.doi.org/10.1186/1756-3305-7-22. PMid:24423244.

Dejene G, Mesula G, Efriem D, Kassahun A, Solomon M (2013). Gastrointestinal helminthes in dogs and community perception on parasite zoonosis at Hawassa city, Ethiopia.Global Vet. 11 (4):432-440.

Despommier, D. (2003). Toxocariasis: clinical aspects, epidemiology, medical ecology, and molecular aspects. Clinical Microbiology Reviews, vol. 16, no. 2, pp. 265-272. http://dx.doi.org/10.1128/CMR.16.2.265-272.2003. PMid:12692098.

De Santana, B.B., da Silva, T.L.B., Ramos, R.A.N., Alves, L.C. and de Carvalho, G.A. (2015). Evaluation of Different Parasitological Techniques for Diagnosing Intestinal Parasites in Dogs. Open Journal of Veterinary Medicine, 5, 19-24. http://dx.doi.org/10.4236/ojvm.2015.52003

Dohoo IR, McDonell WN, Rhodes CS, Elazhary YL, (1998). Veterinary research and human health. Can.Vet.J. 39:549-556.

Dryden M W, Payne P A, Ridley R, and Smith V. (2005). Comparison of Common Fecal Flotation Techniques for the Recovery of Parasite Eggs and Oocysts Veterinary Therapeutics • 6(1): 15-28.

Eguia-Aguilar P, Cruz-Reyes A, Martinez-Maya JJ (2005). Ecological análisis and description of the intestinal helmintos present in dogs inMexico City. Vet. Parasitol. 127:139-146.

Hohlenwerger, M.C., Almeida, M.A.O., Silva, A., Carvalho, S.M.S., Schilling, A.C. and Munhoz, A.D. (2011). Larvas de Ancilostomatídeos em sedimentos de solo de praias de Salvador, Bahia. Revista Brasileira de Medicina Veterinária, 33, 111-114.

Hoffman, W.A., Pons, J.A. and Janer, J.L. (1934). The Sedimentation Concentration Method in Schistosomiasis Mansoni. Puerto Rico Journal of Public Health and Tropical Medicine, 9, 283-289.

Henriksen SA and Pohlenz JFL. (1981). Staining of Cryptosporidia Acta, Vet. Scand. 22: 594-596.

Khalaf M Jenan, Majeed A Shaimaa, Khalil K Nuha. (2015). Epidemiological Study of Zoonotic Gastrointestinal Parasites in Police and House Dogs in Baghdad governorate/ Iraq. MRVSA. 4 (1), 18-26.

Labarthe N, Serrao LM, Ferreira RAM, Almeida ONK, GuerreroJ. (2004). A survey of gastrointestinal helminthes in cats of the metropolitan region of Rio de Janeiro, Brazil. Vet. Parasitol. 123:133-139.

Lavallen CM, Dopchiz MC, Lobianco E, Hollmann P, Denegri G. (2011). Intestinal parasites of zoonotic importance in dogs from the District of General Pueyrredón (Buenos Aires, Argentina). Rev. Med. Vet. 22 (1):19-24.

Martinez-Moreno FJ, Hernandez S, Lopez-Cobos E, Becerra C, Acosta I, Martinez-Moreno A. (2007). Estimation of canine intestinal parasites in Cordoba (Spain) and their risk to public health. Vet. Parasitol. 143:7-13.

Mccarthy, J. and Moore, T.A. (2000). Emerging helminth zoonoses. International journal for parasitology, vol. 30, no. 12-13, pp. 1351-1359. Http://dx.doi.org/10.1016/s0020-7519(00)00122- 3. Pmid:11113260.

Minnaar WN, Krecek RC, Fourie LJ (2002). Helminths in dogs from a peri-urban resource-limited community in Free State Province, South Africa. Vet. Parasitol. 107(4):343-349.

Molyneux DH (2004). 'Neglected' diseases but unrecognized successes-challenges and opportunities for infectious disease control. Lancet364:380-383.

Noor-Ul-Huda P, Hakim AS, Muhammad AG, Mujeeb-Ur-Rehman M, Murk P, Muhammad IS, Muhammad AM, Aneela PK (2014). Prevalence of intestinal parasites and risk perception of zoonotic infection for humans. Dyn. Microbiol. Infect. Dis.1(1):1-7.

Octavius J, Nigatu K, Tesfu K, Getachew T, Chanda M, (2011). Prevalence of dog gastrointestinal parasites and risk perception of zoonotic infection by dog owners in Wondo Genet, Southern Ethiopia. J. Public Health Epidemiol 3(11): 550-555.

Ortuño A and Castellà J. (2011). Intestinal Parasites in Shelter Dogs and Risk Factors Associated with the Facility and its Management. Israel Journal of Veterinary Medicine. 66 (3) :103-107.

Otranto, D. and Eberhard, M.L. (2011). Zoonotic Helminths Affecting the Human Eye. Parasites & Vectors, 4, 41. http://dx.doi.org/10.1186/1756-3305-4-41

Papini, R., Campisi, E., Faggi, E., Pini, G. and Mancianti, F. (2012). Prevalence of Toxocara canis Eggs in Dog Faeces from Public Places of Florence, Italy. Helminthologia, 49, 154-158. http://dx.doi.org/10.2478/s11687-012-0031-0

Razmi GR. (2009). Survey of dogs' parasites in Khorasan Razavi Province, Iran. Iran J Parasitol.4:48-54.

Pandey VS, Dakkak A, Elmamoune M (1987). Parasites of stray dogs in the Rabat region, Morocco. Ann. Trop. Med. Parasitol. 81(1):53-55.

Rhindali L, Biggeri A, Carbon S, et al. (2006). Canine fecal contamination and parasitic risk in the city of Naples (Southern Italy). BMC Vet Res. 2: 29.

Santarém, V.A., Giuffrida, R. and Zanin, G.A. (2004). Larva migrans cutânea: Ocorrência de casos humanos e identificação de larvas de Ancylostoma spp. em parque público do município de Taciba, São Paulo. Revista da Sociedade Brasileira de Medicina Tropical, 37, 179-181. http://dx.doi.org/10.1590/S0037-86822004000200014

Sargent KD, Morgan UM, Elliot AD, Thompson RCA. (1998). Morphological and genetic characterization of Cryptosporidium oocysts from domestic cats. Vet Parasitol. 77: 221–227.

Senlik B, Cirak VY, Karabacak A. (2006). Intestinal nematode infections in Turkish military dogs with special reference to *Toxocara canis*. J. Helminthol. 80 (3): 299-303.

Soulsby EJL. (1982). Helminths, Arthropods and Protozoa of Domesticated Animals.7th edition, Bailliere Tindall, London.

Soulsby EJL (1977). Helminths, arthropods, and protozoa of domestic animals, 6th edition, Lea and Febiger, Philadelphia.

Tarish JH, Al-Saqur IM, Al-Abbasy SN, Kadhim FS. (1986). Theprevalence of parasitic helminthes in stray dogs in the Baghdad area. Iraq. Ann. Trop. Med. Parasitol. 80(3):329-331.

Willis, H.H. (1921). A Simple Levitation Method for the Detection of Hookworm Ova. Medical Journal of Australia, 2, 375-376.

Zajac AM and Conboy GA. (2012). Veterinary clinical parasitology 8th edition, John Wiley & Sons. 40-87.