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PREVALENCE OF *Salmonella* SPECIES IN STRAY CATS IN MOSUL CITY, IRAQ

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ABSTRACT*:* Stray carnivores are often exposed to intestinal infection with *Salmonella* species and might remain carriers for long period, so they have great possibilities for shedding these organisms; particularly the stray cats in cities are more than others because of their size and habits; thus they might contribute actively in contamination of environment. The aim of this study was to detect *Salmonella species* in stray cats and to access their role in spreading of *salmonella* infection. Rectal swabs from 59 apparently healthy cats were cultured, tetrathionate broth and *Salmonella–Shigella* agar were used. Euthanization and post mortem examinations were done later. Bacterial isolation from internal organs was carried out also. Morphological properties and biochemical tests were dependent for detection of Salmonella organisms. They were serotyped in Central Health Laboratory in Baghdad. A high isolation rate of *Salmonellae* (10.16%) was recorded (by rectal swabs). Various *Salmonella* serovars were observed: *S. anatum* (3.38%), *S. montevideo* (3.38%), *S. typhimurim* (1.69%) and *S. brenrderup* (1.69%). The isolation rate from internal organs was lower (0.67%) than that from rectum, *S. typhimurim* (1.69%) and *S. montevideo* (1.69%) were isolated from small intestine and mesenteric lymph nodes respectively. Stray cats have great chances to get intestinal infection in comparison with the house cats due to their living style. In conclusion asymptomatic (carriers) stray cats were considered a dangerous source of infection with *Salmonellae*, besides their significant role in contamination of environment; they will threat public and animal health particularly in cities.

Keywords: Salmonella, Cats, Enteric Infection in Mosul.

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INTRODUCTION

Salmonellosis is a world wide spread infection, it causes considerable economic losses and it is of public health significance (Hoelzer et al., 2011). *Salmonella* species mostly inhibits the intestinal tract of vertebrate and invertebrate, consequently they are excreted in feces and resulting in contamination of food, water and environment (Hale et al., 2012). Despite the disappearance of clinical signs the infected cats remain carriers for long period; particularly those recovered from acute infection continue to shed salmonellae in their feces for 12 week (Wall et al., 1995). Moreover excretion of the organisms may be increased with stress factors and prolong uses of antibiotics (Shane et al., 2003 and Mather et al., 2013). Cats can carry *Salmonella* organisms asymptomatically and the clinical form is uncommon (Gallaway, 2008). Stray cats feed on diet of animal sources: rodents, wild birds, carcasses and west products of slaughters which will in turn increase the infection rate in cats and other species of animals. Salmonellosis had been extensively investigated in the different parts of the world: Infection rate of salmonellosis in apparently healthy cats (160) in Iran was 9.4% and in pet cats 18.4% (Shimi and Barin, 1977), in Sudan 10.5% (Khan, 1970), in the same instance very few studies on stray carnivores were performed in Iraq: high rate of *Salmonella* infection was reported in stray dogs in Mosul governorate- Iraq (Zenad and Ali, 2003), also it was reported a higher infection rate in diseased than healthy cats (Shimi and Barin, 1977). This was a preliminary study on cats in Mosul city. The aim of the present work is to find the prevalence of *Salmonella* species in stray cats and to access their role in spreading of disease in Mosul city.

MATRIAL AND METHODS

Fifty nine stray cats had been captured by using suitable cages, they were apparently healthy. Rectal swabs were taken for culturing, all these cats were humanly euthanized and post mortem examination was carried out.

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Specimens (one gram) from internal organs: mesenteric lymph node, spleen, liver, brain and one milliliter of small intestinal content were collected; tissue organs were aseptically cut into small pieces. All tissue specimens and rectal swabs were inoculated into 10 ml buffer pepton water and incubated at 37 ◦c for 24 hours, one ml of the later transferred into 10 ml of enrichment tetrathionate broth and incubated at 42 ◦c for 48 hours, one loop full from the later broth was streaked on selective *Salmonella-Shigella* agar and incubated at 37 ◦c for 24 hours. The characteristic appearance of *Salmonella* colonies was dependent for identification and selection of them for further biochemical tests: triple sugar iron, Simmon citrate and urea agar test. Accordingly those give positive reaction in triple sugar iron test and Simmon's citrate as well as negative reaction to urease, were selected for serotyping in Central Health Laboratory in Baghdad-Iraq (OIE, 2003). This work was done by approval of veterinary medicine college council and diroctorate of veterinary hospital in Mosul city.

RESULTS

Eight out of 59 apparently healthy cats were positive for *Salmonella* species isolation, the total isolation rate was 13.5% (Figure 1). Four different serovars (by rectal swabs) were isolated (10.16%) from six cats; they were: *Salmonella anatum* (3.38%), *Salmonella montevideo* (3.38%), *Salmonella typhimuruim* (1.69%) and *Salmonella brenderup* (1.69%; Table 1). Two other serotypes were isolated from internal organs of two cats (negative to rectal swab isolation): *Salmonella typhimuruim* (1.69%) from small intestinal content and *Salmonella montevideo* (1.69%) from mesenteric lymph nodes. The isolation rate from internal organs of necropsitzed cats was lesser than that from rectal swabs. The most frequent serotype was *Salmonella montevideo* (37.5%), *Salmonella anatum* and *Salmonella typhimuruim* (25% for each) and *Salmonella brenderup* (12.5%; Figure 1). Insignificant variation among both sexes was observed.

Table 1 - *Salmonella* serovars isolated from different samples.

Samples	No. of samples	No. of (+ve)*samples for *Salmonella sp.*	(%) of different salmonella serovars
Fecal swabs	59	2	*S. anatum* (3.38)
		2	*S. montevideo* (3.38)
		1	*S. typhimurium* (1.69)
		1	*Salmonella brenderup* (1.69)
Total	59	6	10.16
Internal organs			
Mesenteric L.N	59	1	*S. montevideo* (1.69)
Spleen	59	0	-
Liver	59	0	-
Brain	59	0	-
Small intestinal contents	59	1	*S. typhimurium* (1.69)
Total	295	2	0.67

(+ve)*= positive samples of feces and tissues of organs examined for salmonella species

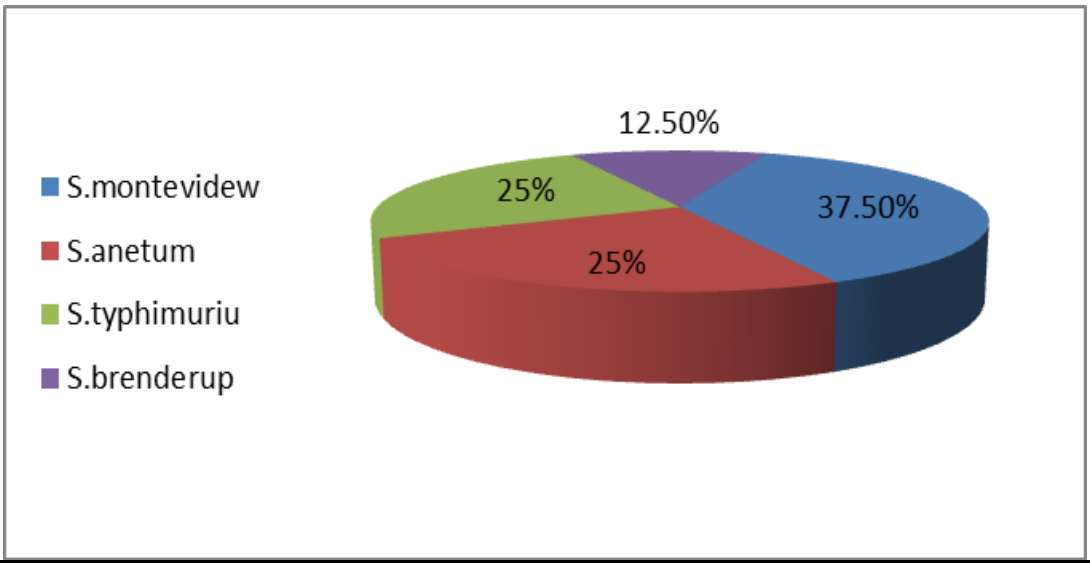

Figure 1 - Frequent rate of different salmonella serovars

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DISCUSSION

Salmonellosis had been investigated in different animal species in Mosul city (Al-Nakshabandy and Zenad, 2004 and Saleem, 2003), as well as in human being (Al-Juboory et al., under publication). Seldom studies on stray carnivores had been done in Iraq. *Salmonella* infection rate was higher in stray dogs (15%) than other species (Zenad and Ali, 2003) in Mosul, in the same instance, low rate of *Salmonella* infection (4.6%) was recorded in housed dogs in Baghdad-capital city- of Iraq (Kallo and Hasso, 2001). The variations of *Salmonella* infection in dogs were recorded in many different countries (Nastasi et al., 1986; Kwaga et al., 1989 and Kozak et al., 2003). These variations could be attributed to differences in geography, time of studies, environments etc., and /or other factors (Ojo and Adetosoye, 2009). A total rate of *Salmonella* infection in stray cats was 13.5%, it was near to that value reported in stray dogs (15%) in Mosul (Zenad and Ali, 2003). Also it was similar to the prevalence of salmonellosis in cats in Iran (13.6%) reported by Shimi and Barin (1977). The isolation rate by rectal swabs (10.16%) was higher than that from internal organs (0.67%), this result increased the probability of shedding Salmonellae in feces of infected cats, furthermore the rate of Salmonella infection in apparently healthy pet cats was 12.8% in Iran (Shimi et al., 1977) also Fox and Beaucage (1979) reported an isolation rate 10.6% in cats from different sources. Moreover a surprising high rate of Salmonella infection (51.4%) in housed cats was reported (Immerseel et al., 2004). In contrary lower infection rate (1.92%) in healthy cats was reported in German (Weber et al., 1995). Similarly 1% of Salmonella infection rate was recorded in Colorado (Hill et al., 2000). Low rate of salmonella infection (0.36%, 0.8%) in healthy cats were also recorded in Belgium and New York (Immerseel et al., 2004 and Spain et al., 2001), however a wide range of isolation rate of salmonellae from clinically normal cats (0-14 %) was reported (Center et al., 1995). The variations of salmonella infection rates in cats in different localities are seemed to be resembled to those in dogs and might be due to the same factors. Despite asymptomatic infection of cats with *Salmonella* species they become carriers and can shed Salmonella organisms (Carter and Quinn, 2000) in their feces. Some researchers considered the apparently healthy cats have low risk on public health (Wilson, 2004). As the *Salmonella* organisms commonly inhibit the digestive tract and their associated lymph nodes of infected cats, they excrete *Salmonella* organisms intermittently in their feces (Gallaway et al., 2008 and Carter and Quinn, 2000). In spite of infected cats being asymptomatic they can perpetuate the *Salmonella* species in their bodies, besides an increase dissemination of *Salmonellae* occurs when they are exposed to stress factors or concurrent diseases (Bhaiyat et al., 2009) and prolong uses of antimicrobial drugs (Mather et al., 2013), therefore carriers will actively contribute to contamination of environment. Moreover stray cats scavenge or hunt: carcasses, west products of slaughter houses, rodents and wild birds, which in turn increase the rate of infection in such species. Also the uncontrolled wandering of stray cats helps in spreading of *Salmonellae* over a wide size area in cities. Moreover the small size and quite behavior of cats as compared to other carnivores; besides the merciful looking to them by people are greatly facilitated the spread of these organisms. This study revealed that *Salmonella montevideo* was the dominant serovar (37.5%) followed by *Salmonella anatum* and *Salmonella typhimurium* (25% for each Figure 1). In other studies the most frequent serovar was *Salmonella typhimurium* (Weber et al., 1995 and Philbey et al., 2008), this could be due to differences in geographical areas, time and species (Jay et al., 2003 and Tewari et al., 2012).

CONCLUSION

Asymptomatic (carriers) stray cats were considered a dangerous source of infection with *Salmonellae*, besides their significant role in contamination of environment; they will threat public and animal health particularly in cities. Conclusively the stray cats are potentially posing a significant threat to public health, therefore stray carnivors in large towns must be taken in consideration when prevention, control or irradication programs of salmonellosis carried out. Condamination of stray cats and dogs is ethically unaccepted now. The campaigns of hunting and surgical castration of males in veterinary hospitals are more humane procedures, beside education and awareness of people were necessary for cooperation.

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