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Prevalence of some zoonotic causing bacteria and the bacterial shedding levels in animals of Baghdad zoo, Iraq

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Abstract

The objective of this study was to find the prevalence of some zoonotic causing bacteria in animals in Baghdad. Animal included were kangaroo, wolf, bear, lion, tiger, pony, camel, lama, mule deer, Arabian oryx, ostrich and emu. Samples of fresh faeces of the animals were collected biweekly and the bacteria were isolated and counted. Results revealed that five species of zoonotic causing bacteria including *Salmonella* spp., *Shigella* spp., *Listeria monocytogenes*, *Brucella abortus* and *Campylobacter* spp. were isolated from all animal. Bear and Kangaroo have the highest isolation percentage of these bacteria. *Salmonella* spp. had the highest prevalence percentage among bacterial isolates. Bear had the highest total bacterial, Coliform and *Staphylococci* count shedding levels in faeces, whereas camel and pony have the highest fungi count.

Keywords: Zoonotic; Bacteria, Shedding, Animals, Zoo; Baghdad

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Introduction

Diseases that can be transmitted from animals to people are called zoonotic diseases. Zoonotic diseases can be spread by direct contact with infected animals or their faeces, through insects those bite or live on animals, and from contact with organisms that live in the environment where an animal lives (Hugh-Hones et al., 1995; Burroughs et al., 2002).

According to Keen et al. (2007) and CDC (2011), petting zoos are very popular events. They can range from small displays at short-term events like agricultural fairs to large permanent operations. Zoo provides a wonderful opportunity for people, especially children, to see and interact with animals. In addition to the enjoyment of the experience, exposure to animals can be beneficial for other reasons as well, such as educating the public about animals, fostering an understanding of the human-animal bond, and creating greater empathy for animals. However, like any contact with animals, there is also potential for transmission of infectious diseases. Zoos have been linked to numerous outbreaks of diseases such as colibasilosis, cryptosporidiosis, salmonellosis and dermatomycosis (ringworm).

Most of the infections of concern associated with petting zoos spread via the fecal-oral route, meaning the bacteria or parasites are shed in the feces (stool or manure) of an animal and transmitted to people (or other animals) who swallow them. This usually happens when people get fecal contamination on their hands, which is then easily transferred to the mouth (Taylor et al., 2001).

According to some reports (WHO, 2006; Strauch 1991; Hugh-Hones et al., 1995; Goldberg et al., 2007) several species of microorganism causing diarrhoea can passed into the stool of animals. These include *Salmonella*, *Campylobacter*, *E. coli O157*, *Giardia* (Beaver Fever), *Cryptosporidium* and *Yersinia*. The possible symptoms include diarrhea, stomach cramps,

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nausea, vomiting, fever, bloating and gases. Numerous outbreaks of *E. coli O157* infections have been linked to petting zoo.

The aim of this study was to examine of the prevalence bacteria causing zoonotic diseases and the levels of the bacteria shed in the stool of animals kept in Baghdad zoo.

Materials and Methods

Five kangaroo, eight wolf, four bear, twenty four lion, fifteen tiger, four pony, four camel, six of lama, eleven mule deer, six Arabian oryx, six ostrich and twelve emu individuals from zoo of Baghdad were included in this study. Freshly laid faeces samples were collected biweekly using polyethylene sterile bags from all individuals. Samples were transferred to laboratory during one hour for microbiological examinations isolation.

The bacterial species isolated were *Salmonella* Spp. (Bhatia et al., 1979, Cruickshank et al., 1975), *Listeria monocytogenes* (Hitchins, 2003; Pagotto et al., 2001), *Campylobacter* Spp. (Marjaana et al., 2007), *Shigella* Spp. (Uyttendaele et al., 2001) and *Brucella abortus* (Cruickshank et al., 1975; Keid et al., 2004; Al-Obaidi et al., 2009). Microbial levels were eluted by rinse method according to Yousef and Carlstrom (2003). Total bacterial, *Coliform*, *Staphylococci* and fungi (mold and yeast) counts in faeces were done by culturing one ml of each decimal dilutions on nutrient agar, Mac Conkey agar, Staph. #110 agar and Saubroud agar plates respectively, all these measurements were done in triplicates biweekly. Data was presented by percentage.

Results

As shown in Table 1, the prevalence of *Salmonella* spp. and *Listeria monocytogenes* were higher in bear, while *Shigella* spp. was higher in tiger. *Brucella abortus* and *Compylobactor* spp. were higher in kangaroo and bear respectively. No major difference was found in the prevalence of total bacterial, total *Coliform*, *Staphlococci* and fungi count as shown in Table 2.

Discussion

The global health programs aimed to control zoonosis suggest different strategies including eradication, neutralization of reservoir, reducing potential contact, increasing host resistant, implementing consumer protection strategies, identifying animals appropriately, maintaining health, communication and education (Hugh-Hones et al., 1995). Species of zoonotic bacteria transmission is affected by the host's characteristics (age, sex, personal hygiene, food hygiene, health status, nutritional status and immunity) and behaviour (Rowe, 1995).

Animals' faeces contain many genera of zoonotic bacteria including *Escherichia coli*, *Pseudomonas* spp., *Staphylococcus* spp., *Streptococcus* spp. and Y*ersinia* spp. (Brittingham et al., 1998). In the current study, *Salmonella* spp. was the most prevalevant in animal faeces since they can infect or contaminate nearly all living animals from insects to mammals (Strauch, 1991). Infectious agents transmitted between humans and animals are important to both public health and livestock economics. Taylor et al. (2001) estimated that 75% of emerging human infectious diseases are zoonotic or have recent zoonotic origins, with livestock serving as important reservoirs of infection. *Escherichia coli* is a special concern due to its relation with livestock-associated zoonosis (Gruner, 1996; Böhm et al., 1997). *E. coli* can range in virulence from a benign commensal to highly virulent enteropathogenic forms such as the O157:H7 serovar (Strauch, 1991). Although all forms of the bacterium are

Table 1: Prevalence of some zoonotic diseases causing bacteria in feces of animals in Baghdad zoo

Animals	Number of animals	Bacteria species				
		Salmonella Spp.	*Shigella* Spp.	*Listeria monocytogenes*	*Brucella abortus*	*Campylobacter* Spp.
Kangaroo	5	4 (80.0)	3 (60.0)	4 (80.0)	3 (60.0)	2 (40.0)
Wolf	8	6 (75.0)	3 (37.5)	6 (750)	3 (37.5)	5 (62.5)
Bear	4	4 (100.0)	1 (25.0)	4 (100.0)	2 (50.0)	3 (75.0)
Lion	24	21 (87.5)	8 (33.3)	16 (75.0)	12 (50.0)	11 45.8[b]
Tiger	15	10 (66.7)	9 (60.0)	13 (86.7)	7 (46.7)	6 (40.0)
Pony	4	2 (50.0)	1 (25.0)	2 (50.0)	1 (25.0)	2 (50.0)
Camel	4	1 (25.0)	1 (25.0)	1 (25.0)	0 (0.0)	0 (0.0)
Lama	6	3 (50.0)	1 (16.7)	1 (16.7)	3 (50.0)	1 (16.7)
Mule deer	11	7 (63.6)	5 (27.3)	4 (36.4)	5 (45.5)	3 (27.3)
Arabian Oryx	6	3 (50)	1 (16.7)	1 (16.4)	0 (0.0)	0 (0.0)
Ostrich	6	2 (33.3)	2 (33.3)	2 (33.3)	0 (0.0)	3 (50.0)
Emu	12	3 (25.0)	3 (5.0)	1 (8.3)	0 (0.0)	5 (41.7)

Values in parenthesis indicate the percentage prevalence

zoonotic, few cause clinical disease in infected animals (Galland et al., 2001) despite the potential of some for high virulence in people. Also, *E. coli* shed by animals can persist in soil, water, manure and feed, where it can spread to other uninfected animals (Hancock et al., 1998) and humans (Strauch, 1998).

Table 2: Prevalance of total bacterial, coliform, Staphlococci and fungi count (Log no.) found in feces of zoo animals

Animal	Total bacterial count	Total coliform count	*Staphy-lococci* count	Fungi Count
Kangroo	11.7	8.3	3.7	2.7
Wolf	11.8	8.5	3.8	2.8
Bear	12.5	8.9	4.5	2.5
Lion	11.7	8.6	4.3	2.3
Tiger	11.9	8.5	4.5	2.3
Pony	10.5	7.8	3.3	3.2
Camel	10.4	7.8	3.1	3.5
Lama	10.6	8.0	3.5	3.3
Mule deer	10.5	8.2	3.4	3.3
Arabian oryx	10.4	8.0	3.4	3.4
Ostrich	10.3	8.1	3.2	3.0
Emu	10.3	8	3.3	3.1

Values in parenthesis indicate the percentage prevalence

Animal's exhibits are popular sources of entertainment and educational enrichment that provide opportunities for direct and sometimes close human-animal contact. Zoonotic enteric human disease outbreaks associated with animal exhibits have increased in the past decade in North America and Europe. These outbreaks are usually attributable to the protozoan *Cryptosporidium parvum* and to nontyphoid *Salmonella enterica* and especially to Shiga-toxigenic *Escherichia coli* (STEC) O157 bacterial infections (de Vries, 1993). At least 17 animal exhibit-associated (agricultural fair, petting zoo, or open farm) STEC O157 outbreaks have occurred in the United States since 1999, and these outbreaks have affected 1,317 people, caused 69 hemolytic-uremic syndrome cases, and killed two persons (Excoffier et al., 1992; Excoffier et al., 2005; Goldberg et al., 2008). Since 1990, there have been at least four animal exhibit *Salmonella enterica* outbreaks in the United States attributable to *Salmonella enterica* serovars Typhimurium and Enteritidis (de Vries, 1993).

The *Salmonella Enteritidis* serovar outbreak, which was associated with visiting a temporary exhibit of a Komodo dragon at a metropolitan zoo, affected 65 persons, mostly children (Hancock et al., 1998). Carnivores animals have the highest total bacteria, *Coliform* and *Staphylococci* shedding levels in faeces, whereas pony and ruminant animals have the highest fungi (molds and yeasts) in faeces. Species of bacteria and bacterial count a intestine and gut are affected mainly by the animal's feed and feeding program, age, sex, health status, immunity and behaviour (Rowe, 1995). The major source of carnivores animals are meat which is rich source of nitrogen for bacteria in the gut. Protein can enhance growth of most proteolytic bacteria and raise the level of total bacteria, *Coliform Staphylococci* and many of zoonotic causing bacteria (Yousef and Carlstrom, 2003).

In conclusion the present data may provide basic information for further research in zoo animals in Baghdad, Iraq.

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References

Al-Obaidi, F.A., Al-Ramahi, H.S. and Al-Shadeedi, S.M. 2009. Proceeding of the 9th scientific conference of the College of Veterinary Medicine, University of Baghdad, from March 31st to April 1st of 2009, Vol. 1: 221–227.

Bhatia, T.R., McNabb C.D., Wyman H. and Nayar, G.P. 1979. *Salmonella* isolation from litter as an indicator of flock and carcass contamination. *Avian Disease*, 24(4):838-847.

Böhm, R., Fink, A., Martens, W., Philipp, W., Weber, A. and Winter, D. 1997. Abschlußbericht zum Forschungsvorhaben 02-WA 9257/5 Veterinärund seuchenhygienische Untersuchungen zur Überprüfung von Gülleaufbereitung sverfahren und der erzeugten Gülleaufbereitungsprodukte, Insitut für Umwelt- und Tierhygiene, Universität Hohenheim, D-70593 Stuttgart.

Brittingham, M.C., Temple, S.A. and Duncan, R.M. 1998. A survey of the prevalence of selected bacteria in wild birds. *Journal of Wildlife Disease*, 24 (2): 299-307.

Burroughs, T., Knobler, S. and Lederberg, J. 2002. The Emergence of Zoonotic Diseases: Understanding the Impact on Animal and Human Health-Workshop Summary. National Academy Press, Washington, D.C.

Communicable Disease Control (CDC), 2011. Guidelines for prevention of zoonotic diseases from petting zoos and open farms, Pp: 1-21.

Cruickshank, R., Duguid, J.P., Marmoin, B.P. and Swain, R.H. 1975. Medical Microbiology. 12th (ed.), Churchill Livingstone. Edinburg, London and New York. Pp:403-419.

de Vries, H. 1993. The rowwise correlation between two proximity matrices and the partial rowwise correlation. *Psychometrika,*58:53–69.

Excoffier, L., Laval, G. and Schnieder, S. 2005. Arlequin version 3.0: an integrated software

package for population genetics data analysis. *Evolution Bioinformation*, 1:47–50.

Excoffier, L., Smouse, P.E. and Quattro, J.M. 1992. Analysis of molecular variance inferred from metric distance among DNA haplotypes: applications to human mitochondrial DNA restriction data. *Genetics*, 131:479–491.

Galland, J.C., Hyatt, D.R., Crupper, S.S. and Acheson, D.W. 2001. Prevalence, antibiotic susceptibility and diversity of *Escherichia coli* O157:H7 isolates from a longitudinal study of beef cattle feedlots. *Applied Environmental Microbiology*, 67:1619–1627.

Goldberg, T.L., Gillespie, T.R., Rwego, I.B., Estoff E.E. and Chapman, C.A. 2008. Forest fragmentation as cause of bacterial transmission among primates, humans and livestock. *Uganda Emergency Infectious Diseases*, 14:1375–1382.

Goldberg, T.L., Gillepsie, T.R., Rwego, I.B., Wheeler, E., Estoff, L.E. and Chapman, C.A. 2007. Pattrens of gastrointestinal bacteria exchange between chimpaneezs and humans involved research and tourism in western Uganda. *Biology Conservation*, 135: 511-517.

Gruner, C., 1996. Gesundheitszustand und Belastung von Beschäftigten im Abfallbereich. Erste Ergebnisse und Schlussfolgerungen für die Praxis, pp 315- 334. In: Biologische Abfallbehandlung III (Wiemer, K., Kern, M., Eds.), Baetza-Verlag, Witzenhausen.

Hancock, D.D., Besser, T.E. and Rice, D.H. 1998. Ecology of *Escherichia coli* O157:H7 in cattle and impact of management practices, p. 85–91. *In* J. B. Kaper and A. D. O'Brien (ed.), *Escherichia coli* O157:H7 and other Shiga toxin-producing *E. coli* strains. ASM Press, Washington, DC.

Hitchins, A.D. 2003. Detection and Enumeration of *Listeria monocytogenes* in Foods. Chapter 101. In: Jackson, G.J. (coordinator), Bacteriologial Analytical manual. 10th (ed.), Revision A., AOAC Int., Gaithersburg, M.D., USA.

Hugh-Hones M., Hubbert W.T. and Hagstad H.V. 1995. Principles of zoonosis control and prevention. In Zoonosis, recognition, control and prevention. 1St (ed.), Iowa State University Press. Ames.79-120.

Keen, J.E., Durso, L.M. and Meehan, T.P. 2007. Isolation of *Salmonella enterica* and Shiga-Toxigenic *Escherichia coli* O157 from Feces of Animals in Public Contact Areas of United States Zoological Parks. *Applied Environmental Microbiology*,73 (1): 1362-365.

Keid, L.B., Soares, R.M., Morais, Z.M., Richtzenhain, L.J. and Vasconcellos, S.A. 2004. *Brucella* spp. Isolation from dogs from commercial breeding kennels in Sao Paulo state, Brasil. *Brazilian Journal of Microbiology*, 35:161-166.

Marjaana, H., Heiska, H. and Hänninen, M. 2007. Prevalence of *Campylobacter* spp. in cattle in Finland and antimicrobial susceptibilities of ovine *Campylobacter jejuni* strains. *Applied and Environmental Microbiology*, 73 (10):3232-3238.

Pagotto, F., Daley, E., Farber, J. and Warburton, D. 2001. Isolation of *Listeria monocytogenes* from all food and environmental samples. MFHPB-30, Health products and food branch, HPB Method, Ottawa, Canada.

Rowe, D.R. 1995. Hand book of waste water reclamation and reuse, 1st (ed.), Lewis Publications, USA.

Strauch, D. 1991. Survival of pathogenic micro-organisms and parasites in excreta, manure and sewage sludge. *Revue Scientifique Technique* International *Office of* Epizootics, 10. 813-846.

Strauch, D., 1998. Pathogenic micro-organisms in sludge. Anaerobic digestion and disinfection methods to make sludge usable as fertilizer. *European Water Management*, 2 (2): 12-26.

Taylor, L.H., Latham, S.M. and Woolhouse, M.E. 2001. Risk factors for human disease emergence. *Philosophical Transactions of the Royal Society* B*: Biological Sciences*, 356:983–989.

Uyttendaele, M., Bagamboula, C.F., De Smet, E., Van Wilder, S. and Debevere, J. 2001. Evaluation of culture media for enrichment and isolation of *Shigella sonnei* and *S. flexneri. International Journal of Food Microbiology*, 70(3): 255-265.

World Health Organization (WHO), 2006. Brucellosis in humans and animals. Publications of the World Health Organization can be obtained from WHO Press, World Health Organization, 20 Avenue Appia, 1211 Geneva 27, Switzerland.

Yousef, A. and Carlstrom, C. 2003. Food Microbiology. A Laboratory Manual. A John Wiley and Sons, INC., Publication. Ohio State University. USA, 25 – 76.