

Investigation on Prevalence and Management of Health Impediments in Captive Falcons of United Arab Emirates

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Abstract

A variety of viral, bacterial and fungal diseases are seen in falcons. However, most of the diseases are not fatal if precautions and treatment are given in time. Bacterial infections are not as dangerous as viral diseases. Most bacterial and viral diseases are transmitted to falcons through preys. The main prophylactic actions involve optimizing the conditions in captivity to meet all the animal's natural requirements. The protozoan diseases occurring in falcons are Trichomoniasis, Coccidiosis and Babesiosis. The helminths are Trematodes, Cestodes and Nematodes. Ticks, mites, lice, louse flies, blowflies and feather flies are common ectoparasites. Proper management, better hygiene, balanced diet and routine check up will prevent almost all diseases to a certain extent. Notable infrastructure is required for better healthcare and management of diseases of these birds. The present study was conducted at falcon hospitals, clinics and breeding centers in Abu Dhabi, Dubai, Sharjah, Al Ain etc. in United Arab Emirates during 2011-2015. The management strategy adopted by the clinics or hospitals in each case was studied and documented. A critical examination of the current health care practices was conducted and attempts were made to develop a strategy to take care of the shortcomings.

Key Words: Falcon Hospital, viral, bacterial, fungal, protozoan, helminthes, etc

Introduction

The majority of the infections are transmitted through their natural preys. A large variety of infectious diseases are prevalent in falcons. It is possible that wild falcons due to their acquired immunity may be resistant to some of the infectious agents. Health care management includes all measures employed in an effort to restore the birds' health. The primary role of disease prevention in falcons should involve optimizing the conditions in captivity to meet all the animal's natural requirements. This includes plain cage rest, providing nourishment or simple rehydration techniques. Maintaining these birds, that occupies special status in the trophic chain and are highly sensitive to local environment, healthy deep

knowledge and experience are needed. The present study attempts to document the viral, bacterial and fungal diseases of falcons, the diseases caused by internal and external parasites and other diseases by non-biological agents in falcon species.

Materials and Methods

The medical history of the individual birds of interest was collected. The methodology adopted to collect information and data was to visit the hospitals and clinics, observe the individuals and document their health status and examine individuals that are ill or inactive. The management strategy adopted by the clinics or hospitals in each case was studied and documented. Experts handling the cases were also met and discussed about the technical details.

The data and other relevant information were collected from falcon hospitals, clinics and breeding centers in Abu Dhabi, Dubai, Sharjah and Al Ain in United Arab Emirates. In the cases where detailed examination of the birds was required they were anesthetized, using isoflurane gas. The fecal samples, pharyngeal swabs and blood samples were also tested for presence of microbes. In certain cases methods of X-ray tests, biopsies and endoscopies were also done. The study was conducted during 2011-2015.

Results

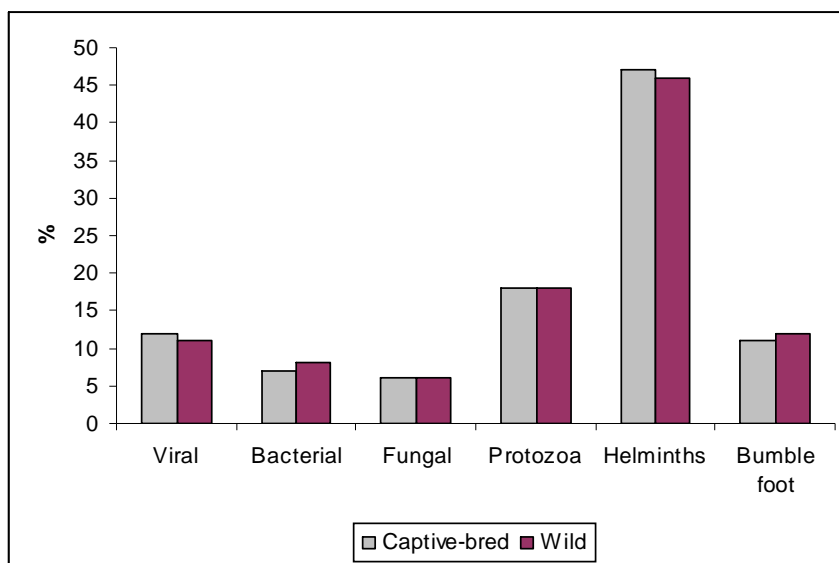
The major infectious diseases seen in falcons are viral, bacterial, mycoplasmal, chlamidial and fungal diseases. The

common internal parasites are protozoans and helminths such as trematodes, cestodes and nematodes. The external parasites include arachnids such as ticks, fowl mites, red mites, quill mites and epidermatid mites and insects such as feather lice, feather flies and blowflies. Some unidentified endoparasites were also noticed during the study. The symptoms of major diseases and effects are documented and given in Table 1. It was found that the common diseases equally affect both the wild and captive-bred ones (Table 1 & Figure 1). However it may be noted that the wild-bred individuals were under captivity for some period and hence it is likely that the observed disease frequency is due to captivity.

Diseases	2011			2012			2013			2014			2015		
	P	S	G	P	S	G	P	S	G	P	S	G	P	S	G
Viral	59 (11)	73 (9)	60 (10)	52 (12)	65 (8)	57 (7)	52 (5)	51 (10)	47 (6)	50 (12)	60 (13)	76 (13)	54 (13)	80 (11)	54 (6)
Bacterial	25 (7)	22 (12)	31 (7)	27 (10)	45 (13)	34 (7)	45 (8)	23 (8)	39 (9)	41 (12)	42 (11)	40 (10)	38 (7)	31 (3)	41 (7)
Fungal	35 (7)	32 (5)	27 (8)	35 (8)	35 (8)	18 (2)	43 (5)	27 (8)	41 (4)	32 (4)	18 (4)	32 (7)	39 (7)	27 (5)	34 (7)
Protozoa	121 (32)	95 (23)	94 (24)	90 (32)	91 (22)	88 (18)	89 (20)	78 (15)	80 (12)	84 (13)	72 (18)	88 ⁽¹⁷⁾	92 (11)	81 (19)	89 (15)
Helminths	210 (55)	215 (61)	230 (68)	231 (62)	210 (51)	221 (55)	229 (52)	219 (57)	210 (51)	209 (47)	236 (62)	248 ⁽⁶⁶⁾	239 (62)	219 (58)	230 (53)
Bumble foot	44 (8)	49 (13)	58 (15)	51 (18)	46 (10)	53 (10)	59 (11)	41 (9)	49 (10)	54 (10)	52 (11)	53 (15)	45 (12)	57 (7)	54 (12)

P - Peregrine falcon, S - Saker falcon, G - Gyr falcon

Figure 1. Percentage of various diseases affecting the purebred and captive falcons during



2011-2015.

In falcons' nutrition deficiencies and metabolic disorders occur when they are not provided with a balanced diet. Morbidity is also widely seen with sub-optimal environment. Inadequate levels of certain vitamins in the diet can result metabolic disorders (Table 2). Dehydration is sometimes serious for falcons. Water evaporates from the falcon's buccal lining and skin surface, causing dehydration (Plate 1 & Table 2). Especially in times of hunting period, falcons need additional water. Then the falcons are given a bath, their food sprayed or dipped slightly in fresh water. It is believed that falcons have a higher requirement for vitamin A than mammals and prone to deficiency complications in captivity that can be managed by supplements. Inadequate levels of calcium and phosphorous may cause rickets in growing falcons or osteomalacia in adults. Providing constant supply of chopped rats may prevent rickets in growing individuals. Boned meat consumption may also control development of osteomalacia in adults. Whole animal diet can keep away the deficiency diseases successfully. In case of

administering artificial food supplements as tablets, they need to be placed in the digestive tract carefully to guide to the stomach. In few occasions during the present study falcons had breathing problems due to choking and required immediate medical attention. The Helminths are Nematodes, Trematodes and Cestodes. Ascarids, Serratospeculum, Capillaria and Filarial worms are Nematodes seen in falcons. Serratospeculum seurati is a common parasite with an intermediate host in falcons especially during the hunting season, and widespread in Middle East (Fig. 2).

Raptor Pox is a viral infection transmitted by mosquitoes generally causing ugly sores or scabs on the faces and legs of falcons (Plate 2 & Table 2). Trichomoniasis is one of the most well-known parasitic diseases in falcons caused by a protozoan parasite that lives in upper digestive tracts of pigeons and other birds. The symptom of this disease is presence of

lesions on tongue (Plate 3). In falcons, this disease is seen due to the consumption of infected pigeon; for this reason the local Arab falconers call this 'the pigeon disease' or 'gurha fie lissan' in Arabic which means mouth canker. The disease has fatal results, but it is treated with trichomonacidal drugs. Coccidiosis is the most frequently diagnosed pathological parasitic infestation in the Gulf region. Coccidia (*Caryospora sp.*) are unicellular protozoa (Plate 4 & Table 2). It is found that bumble foot disease was caused among 80% of the falcons by poor perches in aviaries. It is advisable to keep an eye

on perches and change them regularly. Changing the perches in a while gives a stimulus to the falcons (Plate 5 & Table 2). Apart from perches, baths, feed ledges and hidden retreats are also necessary in the enclosures. To breed falcons successfully in captivity, a certain amount of privacy should be given to pairs. In Saker, Peregrine, Gyr and Luggar falcons, there were many cases of the pox during my study period (Plate 6 & Table 2). It was noticed that the viral pox because of the scabs on faces and legs disturbed the activities of falcons badly. By vaccination this disease can be prevented effectively.

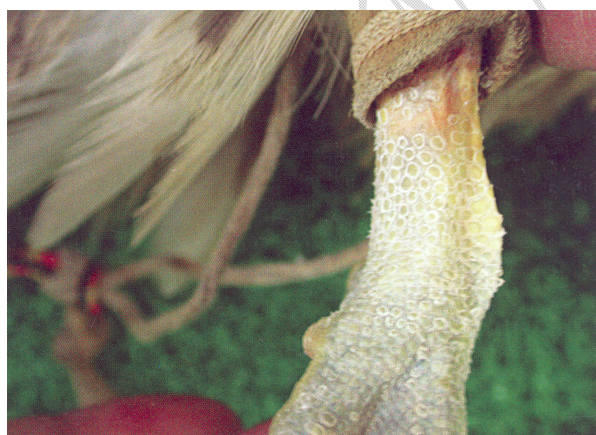


Plate 1. The folded skin of a falcon's leg due to dehydration



Plate 2. A case of viral pox in an immature Peregrine falcon



Plate 4. Trichomoniasis in a Saker falcon

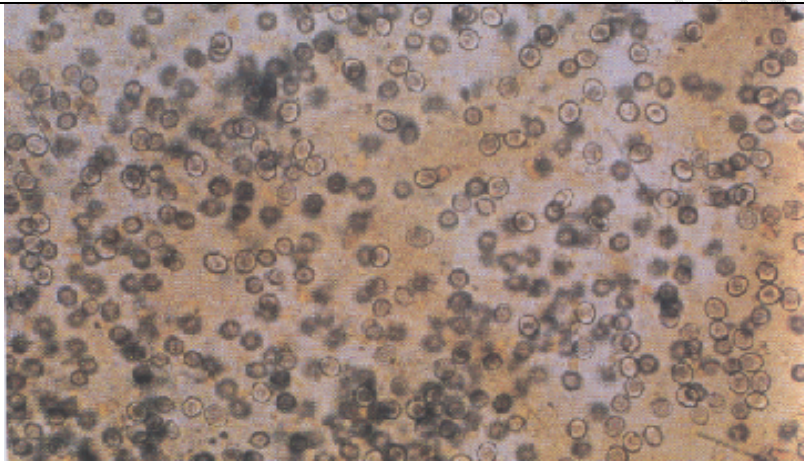


Plate 5. *Caryospora neofalconis* (Microscopic view in faeces of Peregrine falcon with Coccidiosis)

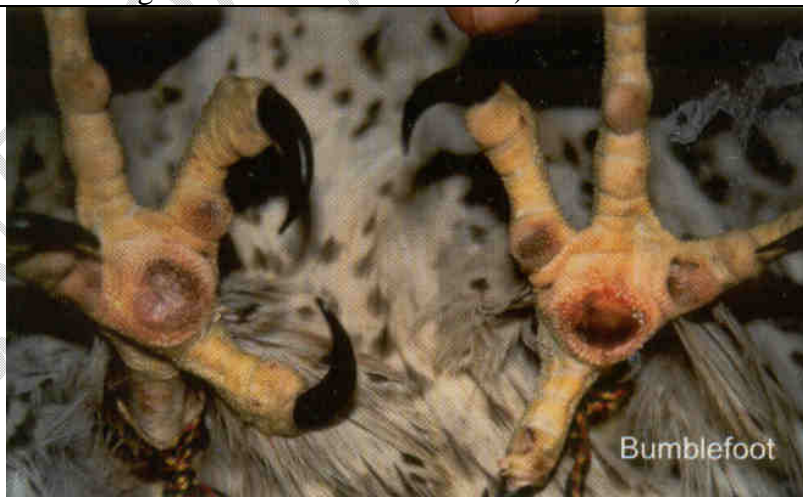


Plate 6. The feet of a Saker falcon infected with Bumblefoot

Fig. 2. Life Cycle of *Serratospiculum seurati*

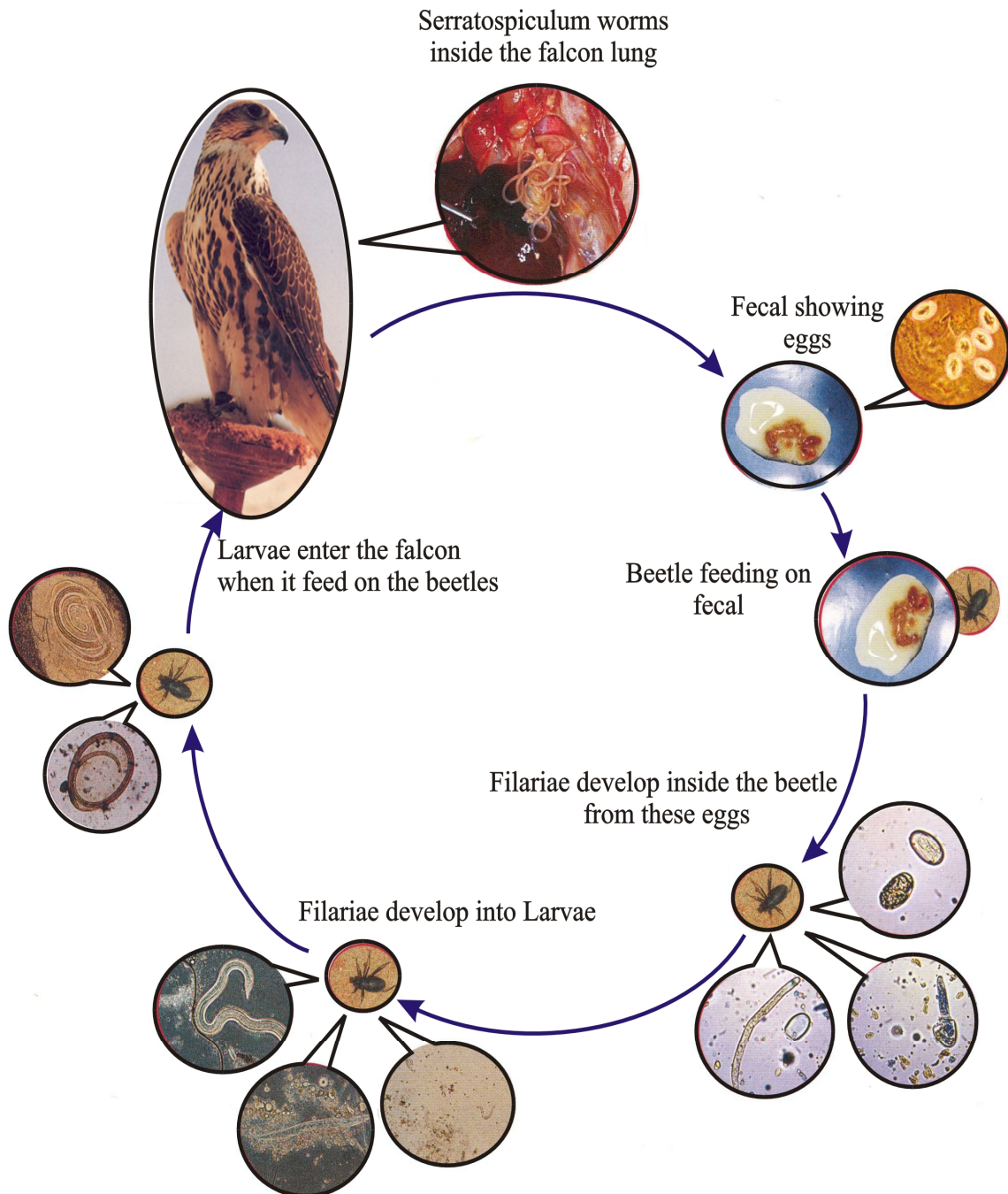


Table 2 Major diseases affecting falcons, their symptoms, pathogens and treatment					
No	Diseases	Symptoms	Pathogen	Medicines	Remarks
1	Viral diseases a. Viral Pox	Pinhead sized papules on the unfeathered areas of the skin, feet and eyelids.	Avipox falconi	No specific treatment. Supportive treatment (broad spectrum, antibacterial and anti fungal therapy).	Vaccination, protection from mosquito bites
	b. Newcastle disease	Mild neurological signs, gentle tremors, severe ataxia.	Paramyxovirus	No specific treatment, but supported treatment	Prevention by vaccination.
2	Bacterial diseases a. Chlamydiosis	Discharge from eyes and nose, diarrhea, weight loss etc.	Chlamydia psittaci	Antibiotics like Doxycycline, Enrofloxacin effective	Avoid feeding with ducks, turkeys and pigeons affected with the disease.
	b. Salmonellosis	The falcons were depressed, dehydrated and had greenish urates.	Salmonella. sp.	Enrofloxacin, Tetracycline etc.	Avoid feeding pigeons affected with the disease.
	c. Mycoplasma	Respiratory dysfunction, air sacculitis, pneumonia and tracheitis.	Mycoplasma. sp.	Enrofloxacin, tylosin.	Avoid feeding pigeons affected with the disease.
3	Fungal diseases a. Aspergillosis	Weakness, exercise intolerance and dyspnea with open mouth and abdominal breathing.	Aspergillus fumigatus	Treatment successful if given earlier. Flucytosine, Amphotericin are effective.	Optimal nutrition, good management, maintenance of body condition
	b. Candidiasis	Reduced food intake, yellowish white plaque on the oral mucosa.	Candidia albicans	Broad-spectrum antifungal drugs.	As above
4	Protozoan diseases a. Trichomoniasis	Yellowish caseous lesions develop in the oral cavity, and on tongue. And foul necrotic odor.	Trichomonas gallinae	Carnidazole is successful and supplementation of vitamins.	Maintaining healthy disease resistant birds

	b. Coccidiosis	Weight loss, lethargic, depressed and changes in fecal consistency.	Caryospora.s p	Clazuril, toltrazuryl are very effective.	Hygienic measures important
5	Helminthes a. Trematodes	Severe infection, diarrhea and weakness	Flukes	Fenbendazole, praziquantel are effective	Rare in captivity
	b. Cestodes	Diarrhea and weakness.	Tape worms	Praziquantel effective	Rare in captivity
	c. Nematodes	Weight loss, depression, yellowish deposits on the mucus of the pharynx etc.	Capillaria, Serratospeculum sp., Ascarids etc.	Fenbendazole is very effective.	Serratospeculum may be removed endoscopically.
6	Bumble foot	Inflammation and swelling on foot, advanced case may lead to death.	Secondary bacterial infection	Therapy directly dependant on stage of disease	Commonly seen in captive birds

Vitamin	Effect	Deficiency
Vitamin A	Protection of mucous tissue Resistance against infection	Lesions on beak and talons, Eye problems, Poor hatching, high chick mortality, predisposing factor for visceral gout of respiratory and alimentary tract
Vitamin B, B1, B2	Important for nerve system	Biotin: necessary for good skin, feather and skin problems
Vitamin C	Wound healing	Level reduced in times of stress like training, transport and Prolonged wound healing
Vitamin D, D3	Balance of calcium and phosphorous	Weak bones, rickets
Vitamin E, K	Immunity, protective effect on stress, stored in liver, blood-clotting factor.	Low immune system, easily contracts by diseases and bleeding.

Discussion

There are several diseases affecting falcons, and the present discussion is intended to cover the common pathological conditions and illness. The widely seen diseases are viral, fungal, bacterial and parasitic diseases. Newcastle disease, raptor pox, falcon herpesvirus and influenza A virus are common viral diseases. Heidenreich (1976) states that 14% of falcons' death is due to viral diseases; while in 30% of the cases antibodies to various viruses were present. Falcons are prone to infections and it is reported recently that some dead Peregrine falcons are found to carry H5N1 bird flu virus, some strains of which are also contagious to human beings (New Scientist 2004 and The Hindu 2004).

New Castle disease caused by virus mostly is fatal to the bird. Raptor pox affects falcon's activities, but is not fatal. Herpes virus and influenza A virus are also seen. Chronic superficial keratitis is a viral infection of cornea, rare among falcons, but a case has been reported in Saker falcon for which grid keratectomy was performed. Grid keratectomy presents a promising, simple and cheap procedure for treating chronic superficial corneal ulcers in birds (Lierz & Lierz 2003).

Chlamydiosis, Salmonellosis, Mycoplasma and Avian tuberculosis is common bacterial disease in falcons. Because mycoplasmas are low in infectivity close contact is necessary for horizontal transmission. While Avian Tuberculosis is common in captive falcons, other diseases are not seen widely. Consuming preys especially pigeons infected with affected bacteria cause these diseases. During 2001-2002 some falcons tested in UAE had Salmonella infection originated from

food animals like mice. These bacterial diseases are not so fatal as that of viral diseases.

The common fungal diseases are Aspergillosis and Candidiasis. These are widely seen in Gyr and Merlin falcons of far northern climates. Aspergillosis is one of the common and potentially fatal diseases of captive falcons (Forbes 1991). This is an infection, influenced by environmental hygienic factors and the animal's resistance to infection. Though Aspergillosis can be cured by surgery, success in advanced stage is difficult. Candidiasis affect esophagus and can be easily treated with antifungal drugs.

Like almost all animals falcons are also carriers of parasites. The diseases caused by parasites are more or less dangerous and common. Endoparasites included protozoan and helminths. Better hygiene and good management is effective in preventing these diseases. The protozoan diseases occurred in falcons is Trichomoniasis, Coccidiosis and Babesiosis. Trichomoniasis affects falcons through the infected prey especially pigeons. Pepler & Oettle (1992) reported a serious outbreak of Trichomoniasis in various raptor species in South Africa. Appropriate quality assurance and ensuring that the prey species are not infected reduce the possibility of infected pigeons transferring trichomoniasis to falcons. Removing head, neck and internal organs of preys for the falcons also is an additional step to control infections. Furthermore pigeon flocks should be medicated with antiprotozoal drugs to reduce the number of protozoan carriers. Freezing the prey at least for 24hrs also is likely to inactivate the trichomonads and reduce the risk of infection. A study in Bahrain about Trichomoniasis by Samour

et al. (1998) reports that Arab falconers commonly do not chill or freeze pigeons before feeding the falcons and this may help explaining the prevalence of Trichomoniasis in falcons in Middle East. It is found that that more than 50% of pigeons in UAE are infected with this protozoan. Di Somma (2002) has also reported considerable increase of Trichomoniasis in falcons of Dubai.

Coccidiosis is the most commonly seen disease all over the world as well as in Gulf. Coccidiosis and intestinal inflammatory disorders can reduce the uptake of B vitamin in falcons (Ward 1971, Stauber 1973). Completion of the parasite's life cycle results in destruction of the intestinal cells. One of the Coccidian infective species *Caryospora neofalconis* was first detected in Gyr falcons suffering from diarrhoea and lethargy by Pavlik *et al.* (1991). In the present study also it was noticed that the falcons showing weight loss, lethargy and diarrhoea, were mostly affected by Coccidia.

Ascarids, Serratospeculum, Capillaria and Filarial worms are Nematodes seen in falcons. *Serratospeculum seurati* is a common parasite especially during hunting season and widespread in Middle East. These species infects the respiratory system. Saker falcons, which are caught from wild in their countries of origin, are infected with these parasites. Such falcons already have lungworms in their air sacs when they are brought to UAE or other GCC countries. During the present study it was found that coccidian eggs are very common in falcons caught from wild, while they are lesser in captive bred individuals indicating that the infection is possible in the field if they consume the vector beetle, the intermediate host of the

parasite. Various species of worms belonging to *Filaridae* can occur in falcons from tropical climates. Many wild caught birds used for falconry in Arab country carry the parasites. The falcons are treated for this disease by endoscopic removal of the parasites. Trematodes are flukes residing in small intestine of falcons causing severe infections. Studies reveal that 71% of Saker falcons and 46% of Peregrine falcons in UAE carry these parasites (Greenwood 1984).

As mentioned earlier in captivity nutrient deficiency cause metabolic disorders in the falcons. Vitamin A deficiency and dehydration may lead to gout in falcons. Organophosphates, carbonates, polychlorinated biphenyles, chlorinated hydrocarbons, which are present in a variety of fungicides; herbicides and insecticides are badly affecting falcons. Lead-induced mortality appears to have been a major factor in the decline of the California Condor (Carpenter *et al.* 2003). There was a significant relationship between lead shot ingestion in falcons and consumption of waterfowl during the hunting season (Mateo *et al.* 2001), indicating that waterfowl can be an important cause of lead toxicity in falcons.

The pressure and temperature of the feet increases at the time of moulting and may cause the bumble foot. Sometimes the talons may grow more and pierce the sole and result injury. In captivity the falcons are tied in 'waqr' and it increases chance for bumble foot. Poor perches in aviaries are known to cause over 80% of the bumble foot disease. In 1990s, bumblefoot posed a major health problem to the falcons in the United Arab Emirates (Muller *et al.* 2000). Traumatic injury is a big reason for death of falcons. Raptors with traumatic injuries need emergency

stabilization (Heatley et al. 2001). It was reported that 15% incidents of eye diseases in falcons are by accidents. 50% of that is a result of traumatic injury, primarily from automobiles, gunshot wounds etc.

Summary And Conclusion

A large variety of viral, bacterial and fungal diseases are widely seen in falcons. Most of the diseases are not so critical if precautions and treatment are taken in proper time. The common viral diseases, which are seen in falcons, are Newcastle disease, raptor pox, falcon herpesvirus and influenza A virus. The common bacterial diseases seen are Chlamydiosis, Salmonellosis, Mycoplasma and Avian tuberculosis. Bacterial infections are not so dangerous as viral diseases in falcons. Most of the bacterial diseases and viral diseases are transmitted to falcons through

their preys. The common fungal diseases are Aspergillosis and Candidiasis. Parasitic organisms can live on their host as ectoparasites or endoparasites. The protozoan diseases occurring in falcons are Trichomoniasis, Coccidiosis and Babesiosis. The helminths are Trematodes, Cestodes and Nematodes. Ticks, mites, lice, louse flies, blowflies and feather flies are common ectoparasites.

This study, based on statistical field research, shows that in captivity wild falcons need a training frequency of twice a day to reduce the bumble foot morbidity rate. In captive falcons nutrition deficiencies and metabolic disorders are directly related to the quality of the food and environment provided. Proper management, better hygiene, balanced diet and routine check up will prevent almost all diseases to a certain extent.

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