Study Of Blood Parasites In Gallus Gallus Domesticus (Linnaeus, 1758) In Gulberg Town, Karachi.

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Abstract:
There were different blood parasites in avian blood. Different blood parasites were observed in Gallus *gallus domesticus.* We observed 50 blood samples of *Gallus gallus domesticus* in Gulbergtown. 35 samples were infected with different blood parasites and 15 samples were uninfected in which 5 samples of female and 10 samples of males. In 24 samples of female chickens (70%) infections were noticed and in males 11 samples (30%) infection of haemoparasites were noticed. In infected samples of female chicken, we observed 3 different haemoparasites; *leukocytozoan* (80%) *haemoproteus* (5%), *aegyptianella* (15%). In male chicken, all were infected with *leukocytozoan.* They were all extracellular and they were mostly rounded in shape. Some were microgametocytes and some were macrogametocytes. Some *leukocytozoan* were flagellated.

During the examination of blood smear of Gallus domestic some extracellular elongated gametocytes were observed. Roundish shape poly microgametocytes were observed. The RBC's of the host cell form a narrow dark violet color and also a thin and oval shape with a clear nucleolus.*Aegyptianella* infection was noticed in blood smear of chicken. They were intracellular and extracellular. Some extracellular *Aegyptianella* and some intracellular *Aegyptianella* infection were observed during examination of blood smear of chicken. In our results only the female samples were infected (15%) with *aegyptianella* and no male samples were infected (0%). *Haemoproteus* was intracellular parasite and can be invaginated in the nucleus of erythrocytes. *Haemoproteus* also be observed in our study in the nucleus of erythrocyte of infected blood of *Gallus gallus domesticus.*

Key words *Gallus gallus domesticus.* Avian blood parasites, Blood smear, Leishman stain, *Homoproteus Leukocytozoan*

Introduction:

Avian haemoparasites are known to cause high mortality rates, reproductive failures, growth retardation, decreased productivity, and to be pathogenic to domestic poultry. (Samadova, 2017) Several forms of bacteria, bacterial, fungal, and parasitic pathogens can easily infest Gallus gallus domesticus. Chicken is one of the most important domesticated poultry species that is intensively raised and the most advanced and productive enterprise in the development of animals. The industry plays an important role in the supply of animal protein (meat and eggs) to humans. (Opara *et.al.*2014).

Pakistan is a developing country where the poultry sector is a growing industry. In rural economies, it plays a critical role. This field of poultry employs around 5 million people and has a long-term growth trend. It is also an important component of the farming system, giving Pakistan's agricultural people an important role. Chicken can be affected by many health problems, but parasitic infection place a key role. (Nathet *et. al.*2014)

Several recent studies have focused on avian blood parasites as a model system for interactions between host parasites in an evolutionary and ecological sense. (i.e., Bensch et al., 2004; Hell-gren et al., 2004; Ricklefs et al., 2005). A much greater literature exists on these parasites in poultry compared to the reported knowledge on wild birds. Extensive laboratory studies have been carried out describing their pathologies, especially for Leucocytozoon species. (Garnham, 1966; Noblet et al., 1976 Morii, 1992; Nakamura et al., 1997; Ito and Gotanda, 2005).Based on the present taxonomy, 3 Leucocytozoon species and 3 Trypanosoma species are found in domestic Gallus gallus domesticus chicken.

(Sehgal *et. al* 2006) found 3 species of *Leucocytozoon a*nd 3 species of *Trypanosoma* in the domestic chicken *Gallus gallus domesticus,* mainly in tropical and subtropical regions worldwide.The avian blood parasite causes economic losses and impacts the development of poultry. (Takang*et al.*,2017).

The protozoan disease of birds affecting the blood and tissue cells of the internal organs isleukocytozoonosis. These parasites are assigned to the phylum apicomplexa sub-order haemospororina. Simulidae (black fleas) are used by leukocytozoan animals as vectors. The lifecycle involves reproduction by sporogony in insects with tissue cell schizogony (merogony) and erythrocyte or leukocytes. (Nathet *et al*.,2014). There are two subgenera of the genus Leucocytozoon: Akiba and Leucocytozoon - based on the vector species. Acute outbreaks of leucocytozoonosis in chickens and quails have been identified. Hey, L.caulleryi, L. L., and sabrazesi. Schoutedeni in fowls. Leucocytozoon macleani has been documented in chickens and quails (Valkiunas 1997).

Although the pathogenicity of many Leucocytozoidae (Sporozoa, Haemosporida) species in wild birds is unknown, many cases of mortality in domestic chickens and other poultry specieshave been recorded. (Garnham, 1966; Bennett *et al*., 1993; Valkiu¯nas, 2005. In particular, Leucocytozoon caulleryi is virulent; infected chickens also display extreme symptoms of anorexia,ataxia, and anemia and have difficulty breathing.

Haemosporidians are known to be highly pathogenic to domestic poultry with high mortalities. (Hasson 2015). Numerous bird species all over the world can be parasitized by avian haemosporidians. The wide range of infection rates for blood parasites is between 50 percent and100 percent or less. Haemoparasites with significant impacts on avian hosts' physiology, ecology, health, population dynamics, sexual selection and production performance can promote species extinction (Nourani *et al*., 2018). Haemosporidian parasites are common blood parasites of reptiles, animals, and mammals with some developmental stages in the infected hosts' tissues andcirculating blood cells. (Archawaranon, M. 2005). Unicellular eukaryotic genus parasites, Haemoproteus, Leucocytozoon and Plasmoduimim, are the most frequently identified parasites inperipheral blood smears. (Benedikt *et al.,* 2006).

Parasites that affect wild as well as domestic birds (Peirce MA, Bevan BJ.1997). Rickettsial pathogens, which seriously affect most birds, are one of these micro-organisms belonging to the genus Aegyptianella (Tarello and Riccieri 2003, Urquhart *et all.*, 2003). *Aegyptianella* was first described by carpano (1929) in both chickens and geese in Egypt (Castlle MD, Christensen BM.1985.). Within the erythrocytes, *Aegyptianella spp* occurs and the morphology was described by (Thrall MA.*et al.,* 2004). Aegyptianella spp are transmitted by the fowl tick Argas persicus (Gothe R,Hartmann S.1979, Leeflang P, Ilemobade AA.1977).

The presence in the red cells of birds of these rickettsial species can lead to conditions ranging from a stable carrier to a highly pathogenic and sometimes fatal disease. (Castlle MD, Christensen BM.1985, Tarello W.2001).The main clinical sings of acute Aegyptianellosis are fever, anemia, anorexia, diarrhea, pale discoloration of legs, staggering gait and jaundice (Thrall MA.*et al.,* 2004, Tarello W.2001, Soulsby EJL. Helminths.1986)

The goal of our study is to report the presence of different haemoparasites in *Gallus gallus domesticus* in Gulberg town, Karachi Pakistan.

Material and Method:

To study the presence of blood parasites in *Gallus gallus domesticus,* 50 blood samples ofbroiler chickens 29 females and 21 males were randomly collected from Gulberg Town, Karachi Pakistan during the month February to August 2019 and the ages of the chicken were almost 14- 15 days old. The weight of the chickens was 1.5kg – 2kg.

After the collection of blood sample in anti-coagulant tube, blood smear was prepared on a clean and dry microscopic glass slide by thin smear technique and air dry it. Now, cover the well dried,thin blood smear with undiluted Leishman Stain solution by counting the drops of Leishman stain.Let it stand for 2 minutes, the methanol present in the stain fixes the smear onto the glass slide. After 2 minutes, add twice the amount of distilled water or Phosphate buffer solution and mix the content by swirling or by blowing gently. Rinse the slides thoroughly with Phosphate buffer solution up to 2 minutes or until it acquires a purple-pinkish tinge. Air dry the slides in a tilted position so that the water easily removes out of the slides. Let it dry in air for few hours and then observe the slides under oil immersion objective lens of the microscope with a 100X lens.

Result:

In present study, we examined total 50 blood samples of *Gallus gallus domesticus* where (70%) 35 samples were infected with different blood parasites and (30%) 15 samples were uninfected in which 5 samples of female and 10 samples of males. In 24 samples of female chickens (70%) infection were noticed and in males 11 samples (30%) infection of haemoparasites were noticed. In infected samples of female chicken, we observed 3 different haemoparasites; *Leukocytozoan* (80%) *Haemoproteus* (5%), *Aegyptianella* (15%). In male chicken, all were infected with *leukocytozoan.*(Table 01)

The *leukocytozoan* found are all extracellular and they are mostly rounded in shape. Some are microgametocytes and some are macrogametocytes. Some *leukocytozoan* are flagellated.

Extracellular flagellated *leucocytozoan* is observed in the blood smear of chicken. The exflagellation process of *Leucocytozoon* is a form of sexual maturation, the microgametocyte became underwent a process of maturation with the formation of microgametocyte and subsequent exflagellation.(Fig 1) During the examination of blood smear of *Gallus gallus domesticus* some extracellular elongated gametocytes were observed.(Fig 2). Roundish shape poly microgametocytes were observed between mononuclear erythrocytes, altered the morphology of erythrocytes and made some clusters. (Fig 4).The RBC's of the host cell form a narrow dark violet color and also a thin and oval shape with a clear nucleolus.The Rounded macrogametocyte also observed in our study(Fig 3& 5). Another macrogametocyte with some conical end is observed in blood smear of chicken, in this slide morphology of erythrocytes is completely change, some cells compressed and elongated with compress nucleus. (Fig 6).

Aegyptianella species occur within the erythrocytes. They are intracellular and extracellular. Aegyptianellosis is an acute tickborne febrile disease caused by *aegyptianella species.* Some extracellular *Aegyptianell*a are observed during examination of blood smear of chicken (Fig7) and some intracellular *Aegyptianella* infection were observed in blood smear of chicken (Fig 8). In our results only the female samples were infected (15%) with *Aegyptianella* and no male samples were infected (0%). *Haemoproteus* is intracellular parasite and can be invaginated in the nucleus of erythrocytes. *Haemoproteus* can be observed in the nucleus of erythrocyte of infected blood of *Gallus gallus domesticus* (Fig 9).

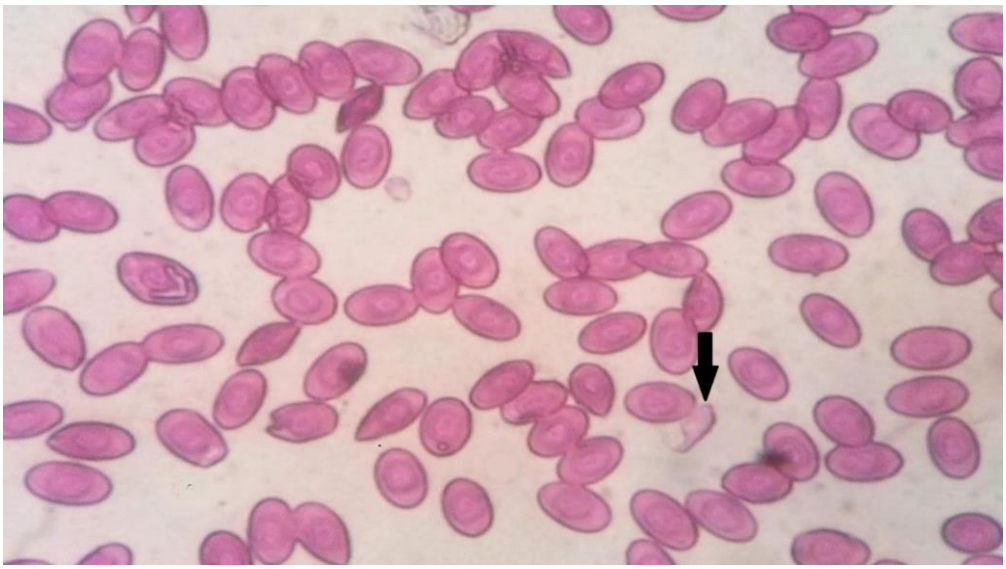


Figure 1: Blood smear of chicken (*Gallus gallus domesticus*) infected by Exflagellatedleucocytozoon sp.(100X)

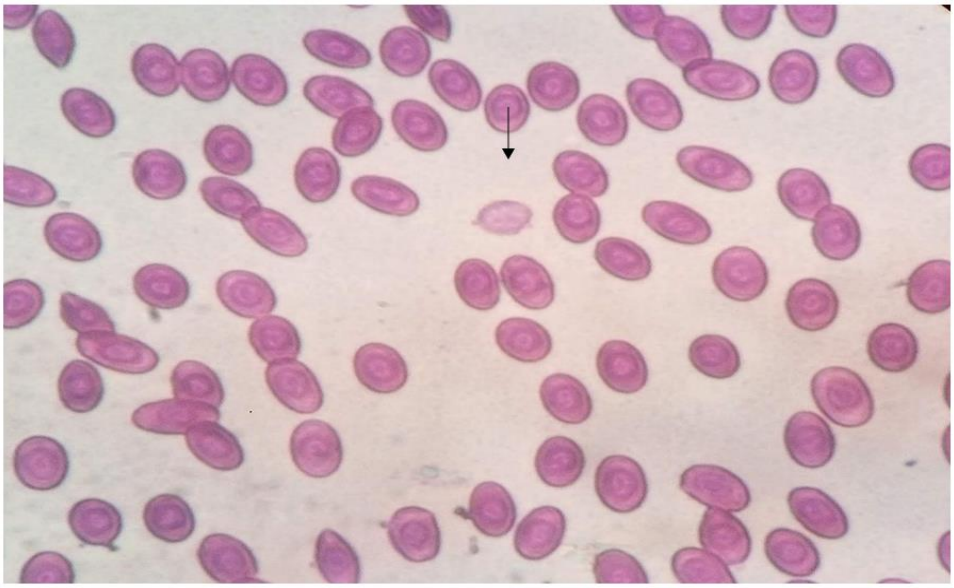


Figure 2: Image of blood smear of *Gallus gallus domsticus* infected withleucocytozoon spp. Elongated gametocytes.

(100X).

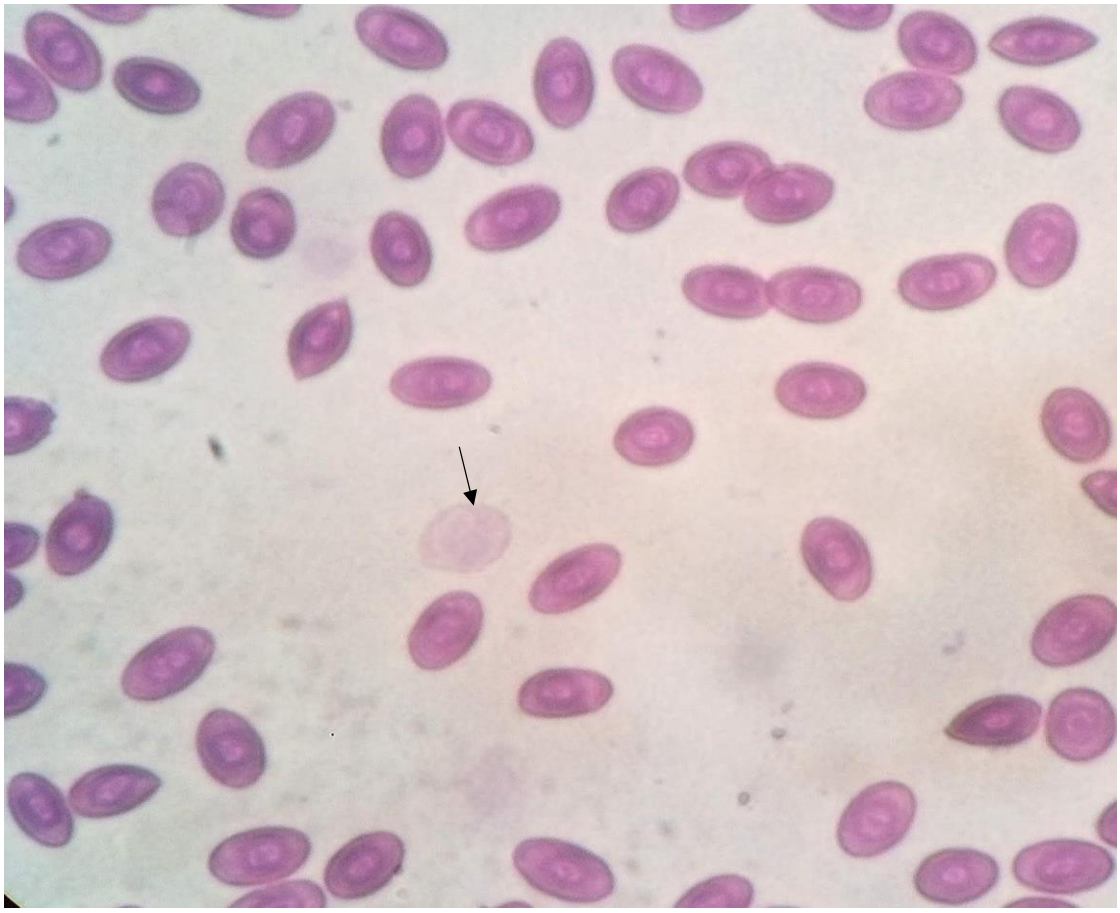


Figure3: Blood smear of chicken infected with round macrogametocyte of *leukocytozoan* spp. (100X)

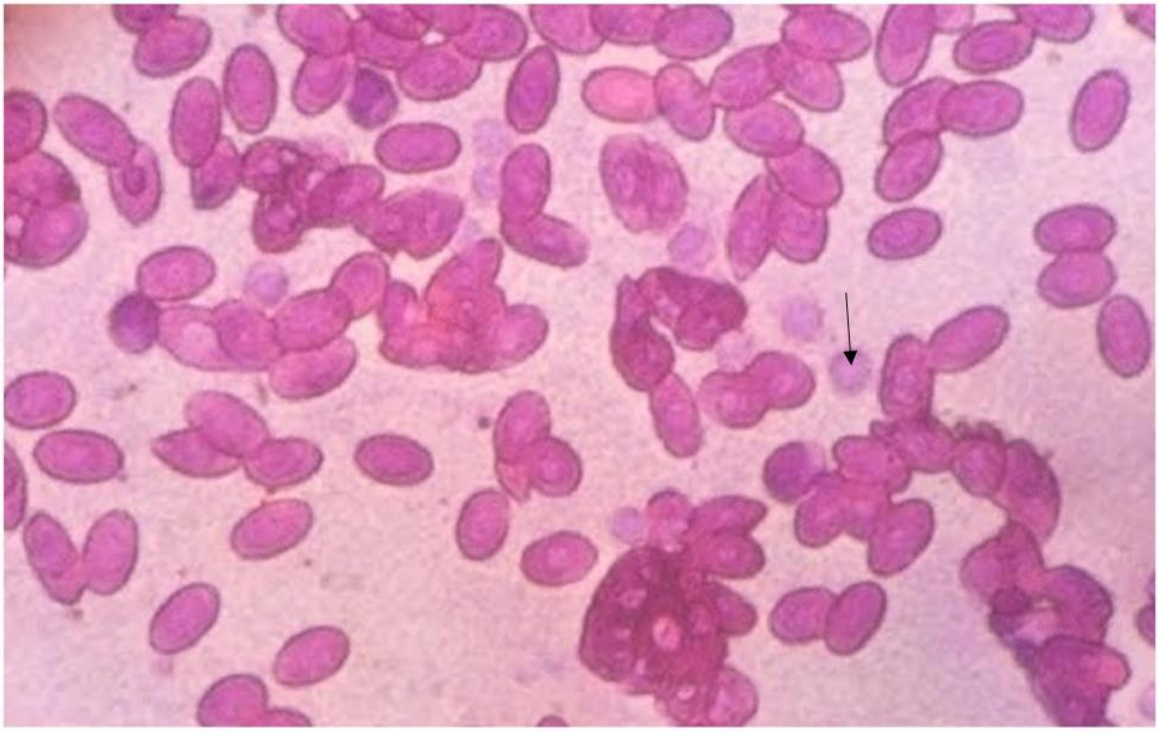


Figure4: Microgametocyte of *leukocytozoan* from blood smear of chicken (round gametocytes) (100X).

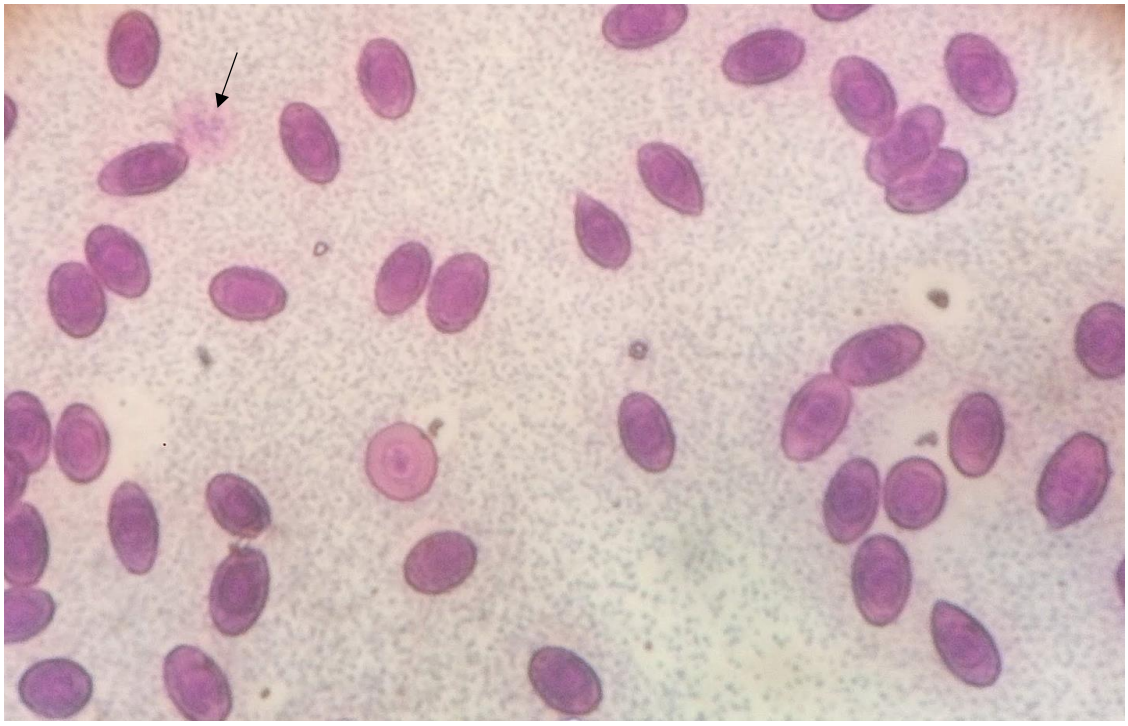


Figure 5: Blood smear of chicken showing infection of roundish shape macrogametocytes of *leukocytozoan* spp.

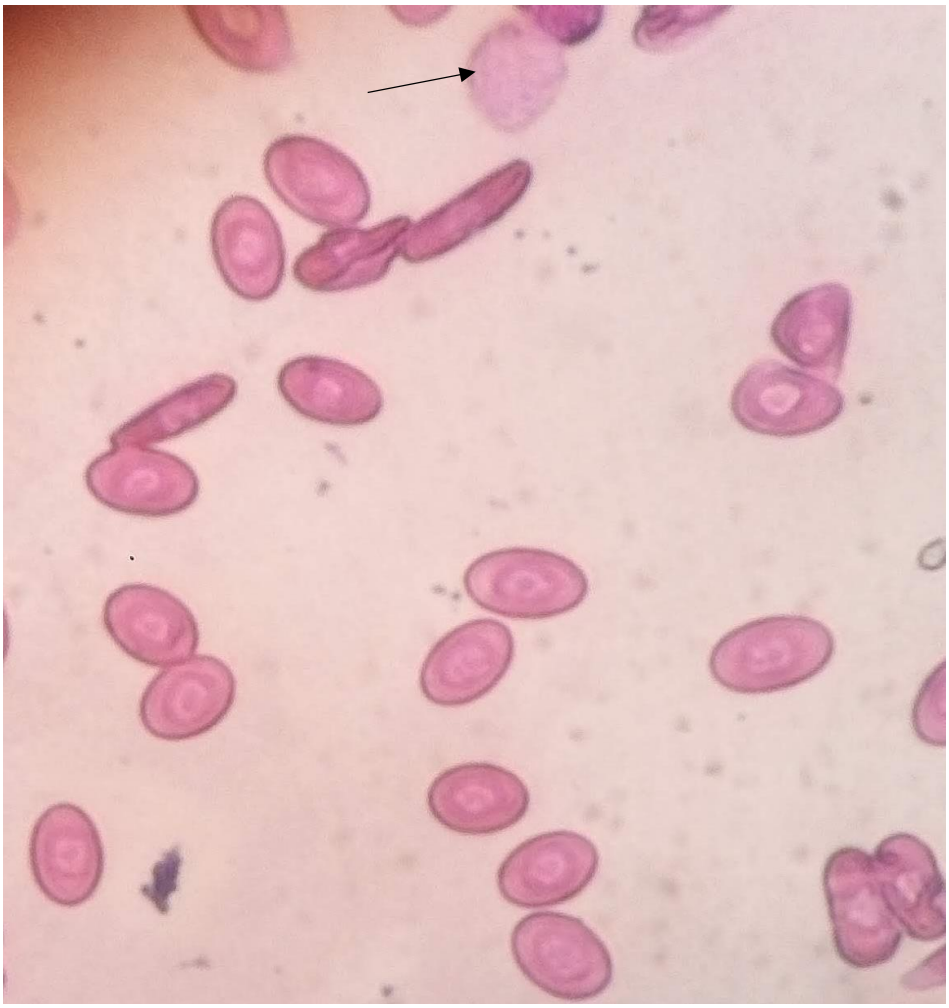


Figure 6: Blood smear of chicken infected by *leukocytozoan* (rounded macrogametocyte) (100X).

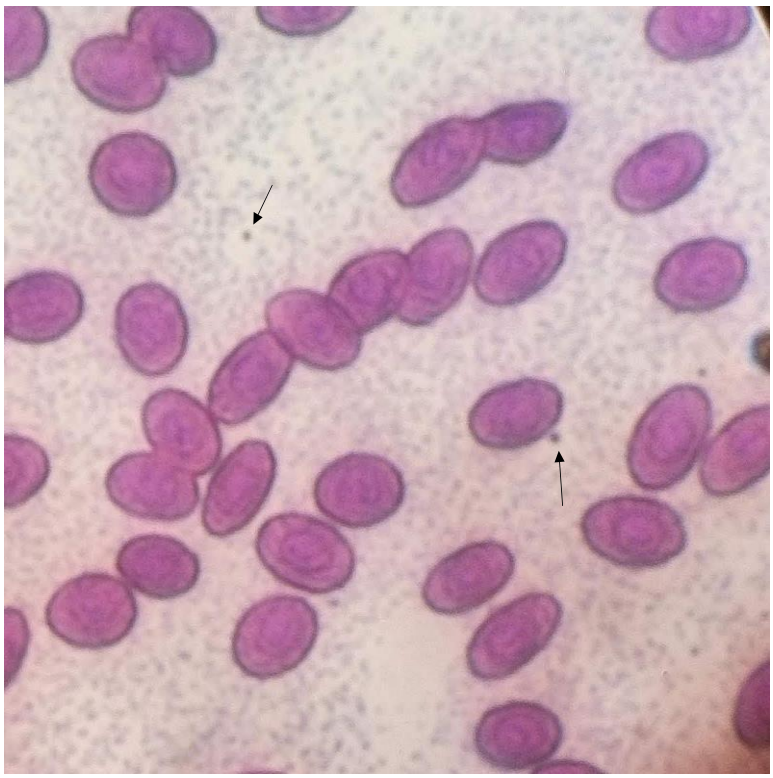


Figure 7: Extra cellular Aegyptianella spp. in bood smear of infected *Gallus gallusdomesticus*. (100X)

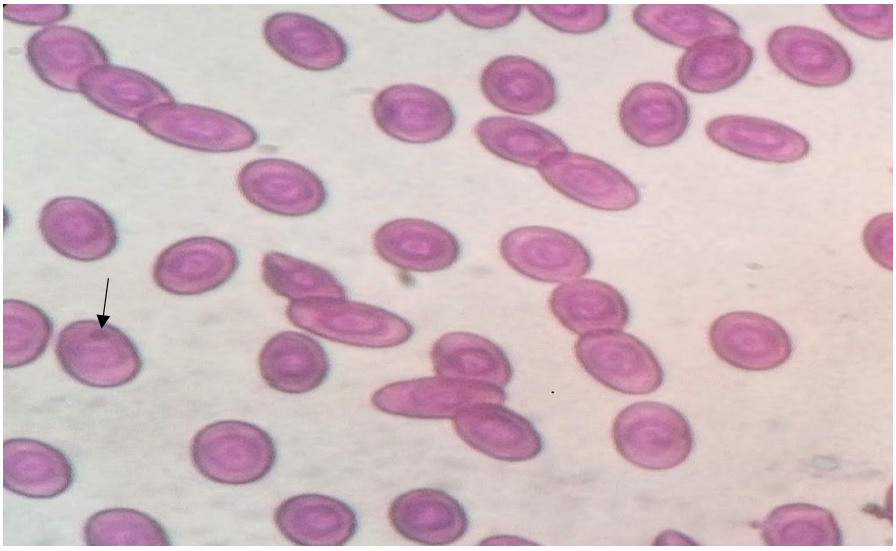
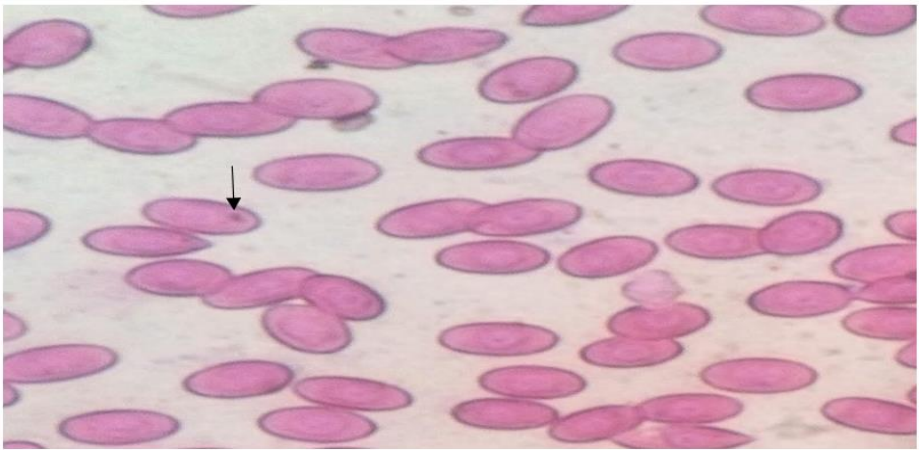


Figure 8: Intracellular Aegyptianella specie in different blood smears of *Gallus gallus domesticus*



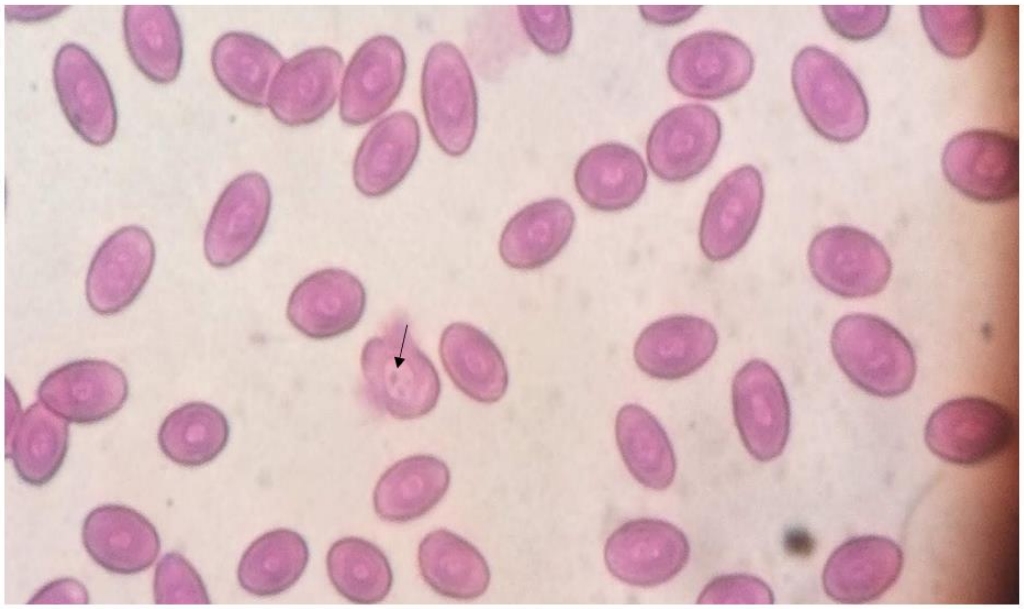
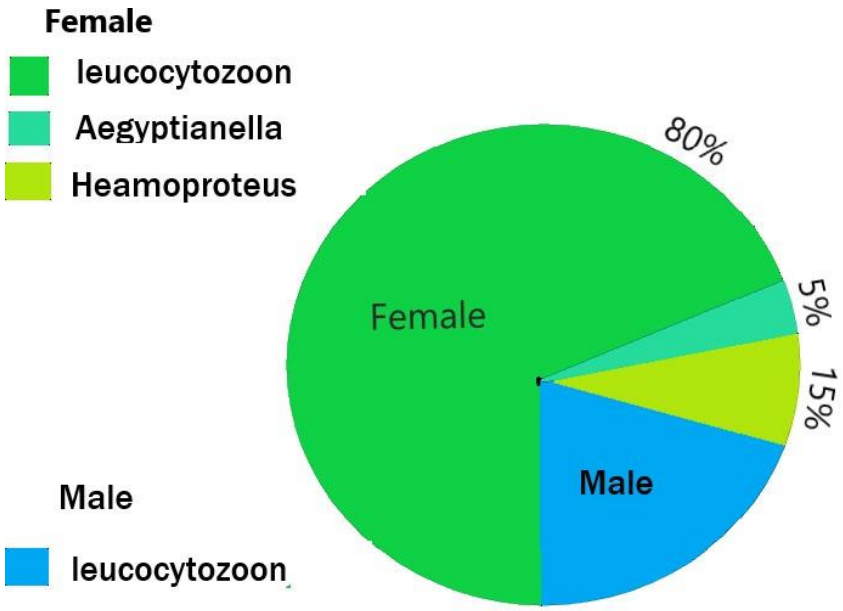


Figure 9: Intracellular parasite *Heamoproteus spp*. observed in infected blood sample of *Gallus gallusdomesticus.*

Prevalence in Chicken Blood Smear		
Parasite specie	**Male**	**Female**
Leucocytozoan	100%	80%
Heamoproteus	_	5%
Aegyptianella	_	15%

TABLE # 1: Showing prevalence of infection in blood of *Gallus gallus domesticus.*



Piechart showing prevalence of infection in Gallus gallus domesticus

Discussion:

In present study we detected round and oval gametocytes of *leukocytozoan* and macro and microgametocytes of *Leukocytozoon*.There were numbers of reports on *Leucocytozoon* in many birds in Africa (Huchzermeyer.FW.1973,Permin.A.*et.al.*, 2002), Israel (Gill H.*et.al*., 2005), New Zealand , Spain (Merino S.*et al*., 1997), and USA (Stuht JN.*et.al*., 1999). However, this is the firststudy the prevalence and ultrastructural investigation of *Leucocytozoon* among *Gallus gallus domesticus* in Gulburg town. The current data demonstrated that *Leucocytozoon spp.* infections are distributed in the study area chick population, These findings are agree with **(**Dezfoulian *et al.*,2013), Operated in Southwestern Iran on Leucocytozoonosis in Domestic Birds: An Ultrastructural Analysis in Lorestan Province. Leukocytozoon species have infected a total of 44 (16.0 percent)

birds. In these results, birds with relatively high Leukocytozoan prevalence included chicken with5.1% (n=14) infected, geese with 4.3% (n=12) infected, ducks with 3.6% (n=10) and turkeys with 2.9% (n=8) infected.mostly chick are infected with *leukocytozoan.* Haemaprotozoa infection has been suggested to be species-specific; host range and gametocyte characteristics, such as staining characteristics, size, nature, and degree of host cell distortion and altered shape, and host cell nucleus location, are criteria for species designation. (Greiner, E.C.*et al.,* 1994, Forrester, D.J.*et al*.,2001, Remple, J.D.2004)

In present study we found round and elongate form of *Leucocytozoon* gametocyte. Ahmadov *et al.* (2019) completely agree with the present study. An elongate form and round formwere observed in birds. The appearance of both round and elongated gametocytes evidenced that the *Leucocytozoon* is a pathogenic strain. They found only the elongated form of the blood parasite in chickens. Though both elongated and round forms were observed but there were more elongated forms. In recent study, exflagellated *leucocytozoan* is observed in blood smear of chicken. Garnham (1967) observed Exflagellation in *Plasmodium*, Hepatocystis and *Leucocytozoon*. Exflagellation of mature microgametocytes took a place in a moist environment within 2.5 to 3 minutes. In present study we observed exflagellated *leucocytozoan* in blood smear of chicken (Fig1). The factors including surface tension, temperature change, mechanical force and pH werelisted as being responsible for the rupture of host cell membrane (Dezfoulian *et al.,* 2013).

Ozmen *et.al.,* (2009) examined roundish and fusiform gametocytes in the red blood cells. Gametocytes in roundish shape was rarer than fusiform in host cell in the blood smear of buzzard (Buteo buteo). These findings agree with the present study and roundish microgametocytes observed in blood smear of *Gallus gallus domesticus*(Fig 4).

In recent study, macrogametocyte of *Leucocytozoon spp.* Observed from blood smears of chickens (Fig5).These findings were also observed by Samadova *et al*., (2017). They observed themature round gametocytes of *Leucocytozoon* sp. from chickens in erythrocytes. The measurementsof the macrogametocyte of *Leucocytozoon* spp. from blood smears of chickens were 14.6±0.3μM×12.7±0.19μM. Invasion intensity ranged from 1-2 per 100 microscopic fields. The nucleus of parasite was 3.75±0.13μM×3.0±0.09 μM in measurement. In spindle-shaped host cellsthe macrogametocyte of *Leucocytozoan* sp. of quails was 13.4±0.15μM×5.0±0.11μM in measurement. The nucleus of parasite was 2.1±0.1μM×1.5±0.08μM in measurement. The complete round gametocytes of *Leucocytozoon* sp. of quails was 15,0±0,28×7,36±0,05. In spindle- shaped host cells the macrogametocyte of *Leucocytozoon* sp. of quails was 13.4±0.15μM×5.0±0.11μM in measurement. The nucleus of parasite was 2.1±0.1μM×1.5±0.08μMin measurement. The mature round gametocytes of *Leucocytozoon sp.* of quails was15,0±0,28×7,36±0,05.

In the current research, haemoproteus was found at a prevalence rate of 5 percent, while Haemoproteus spp. was found by Hasson (2017). With a prevailing rate of 6 (17.6 percent). The variations identified in the prevalence of avian haemoparasite infection are due to variables associated with the methods used for diagnosis, breeding season, sampling effort and location, including poultry species and the richness of arthropods. vectors responsible for transmission the parasites (Braga et al., 2011;Gimba et al., 2014). Occurrence of Haemoproteus spp. detected by Nourani (2018)(Haemosporida: Haemoproteidae) from the New Host Records of East Iranian Passerine Birds. Rate of infection by age group for Haemoproteus spp. In contrast with immature hosts, a higher infection rate for mature people (39.13 percent) was shown (28.57 percent). Yoshimura et al. 2014 observed that the haemosporidian infection rate in Japan's Columbiformes,Anseriformes and crow species (Passeriformes) was 21%, 17% and 93.8%, respectively. Prevalence is a dynamic parasite parameter and appears to be affected by a large number of variables, such as age, gender, habitat, altitude, immune system, etc.

In present study rate of infection of *Aegyptianella spp.* was 15% out of 50 chicken was detected. (Suleiman 2012) observed 50 chicken for *aegyptianella spp* infection and found (20%) infection in chicken. Rate of frequency can be differ because of many factors like age, environment, immunity etc.

Al-Alousi *et al.* (1994) reported 2% infection rate with *Aegyptianella spp.* among this studyof endoparasites in turkeys in Mosul city. Desfoulian *et al* (2011) observed that in chickens, ducks,geese and turkeys, the percentage of infection was 33.3 percent, 9.5 percent, 33.3 percent, 23.9 percent, and the overall percentage of infection was 7.6 percent. Swai (2011) found that Aegyptianella is highly pathogenic to birds, especially chickens, with a 30-80% mortality risk among young birds, and Aegyptianella is identified as one of the major hemoparasites in the production of poultry. Poulsen (2010) observed that Aegyptianella infection is prevalent among free-range birds raised in the tropics, with a prevalence of 9% and 6% in Ghana and Zimbabwe, respectively. Dezfoulian 2011 observed the Aegyptianella spp. prevalence. In the northern, southern and central regions of the province of Lorestan, four genera of domestic poultry have been evaluated. Out of 275 birds used in this study, 21 (7.6 percent) were contaminated with the species. Seven chickens (33.3 percent), 2 ducks (9.5 percent), 7 geese (33.3 percent), and 5 turkeys (23.9 percent), respectively, were detected with Aegyptianella.

Conclusion

In conclusion, the study of blood parasites in Gallus gallus domesticus in Gulberg town, Karachi, revealed the presence of various blood parasites in avian blood. Out of the 50 blood samples of Gallus gallus domesticus examined, 35

samples were found to be infected with different blood parasites, while 15 samples remained uninfected. Among the infected samples, the prevalence of blood parasites was higher in female chickens (70%) compared to males (30%).

The most common blood parasite observed in infected female chickens was leukocytozoan, accounting for 80% of infections. Haemoproteus was observed in a smaller proportion (5%), and aegyptianella accounted for 15% of infections in female chickens. On the other hand, all infectedmale chickens showed the presence of leukocytozoan. This study shed light on the prevalence and diversity of blood parasites in Gallus gallus domesticus in Gulberg town, Karachi. The findings suggest that female chickens were more susceptible to certain blood parasites, such as aegyptianella, while leukocytozoan was prevalent in both male and female chickens.Understanding the presence and characteristics of these blood parasites is crucial for the management and control of avian diseases in the region. Further research and monitoring are warranted to gain a comprehensive understanding of the impact of these blood parasites on the health and well-being of Gallus gallus domesticus in the area**.**

References

1. Al-Alousi Ti, Daoud Ms, Al-Bayati Mm. A Study Of Endoparasites Of Turkeys InMosul – Iraq. *Iraq J Vet Sci*. 1994 ; 7(3): 123-128.
2. Ahmadov Ei, Hasanova Jv, Mammadova Fz, Samadova So And Topchiyeva Sh"Leucocytozoonosis In Chickens (Gallus Gallus Domesticus)". *Acta Scientific Medical Sciences*. 3.2 (2019): 110-112.
3. Bensch, S., J. Pe ´Rez-Tris, J. Waldenstro ¨M, And O. Hellgren.2004. Linkage Between Nuclear And Mitochondrial Dna Sequences In Avian Malari Parasites:Multiple Cases Of Cryptic Speciation? Evolution 58: 1617–1621.
4. Braga, E.M., Silveira, P., Belo, N.O. And Valkiūnas, G. Recent Advances In The Study Of Avian Malaria:An Overview With An Emphasis On The Distribution Of Plasmodium Spp. In Brazil. *Memorias Instituto Oswaldocruz*.(2011) 106:3-11.
5. Castlle Md, Christensen Bm. Isolation And Identification Of Aegyptianella Pullorum (Ricketsttiales, Anaplasmataceae) In Wild Turkeys From North America. *Avian Dis.* 1985; 29(2): 437-45.
6. Dezfoulian O, Zibaei M, Nayebzabeh H, Zakian N, Haghgoo M. Prevalence And Ultrastructural Study Of Aegyptianella Spp. In Domestic Birds From Southwestern Area, Iran. *Iranian Journal Of Veterinary Research, Shiraz University*. 2011 ; 12(2):167-171.
7. E.G.Suleiman. A Study Of Aegyptianella Spp In Some Species Of Birds In Mosul City-Iraq. *Basrah Journal Of Veterinary Research.* (2012), 11(1):84 – 89.
8. Eman G. Suleiman A Study Of Aegyptianella Spp In Some Species Of Birds In Mosul City-Iraq *Bas.J.Vet.Res.*(2012).11.
9. Forrester, D.J., Foster, G.W., Morrison, J.L.: Leucocytozoon Toddi And Haemoproteus Tinnunculi (Protozoa: Haemosporina) In The Chimango Caracara (Milvago Chimango) In Southern Chile. *Mem. Inst. Oswaldo Cruz.*,(2001); 96: 1023-1024.
10. Garnham Pc, Bird Rg, Baker Jr. Electron Microscope Studies Of Motile Stages Of Malaria Parasites. V. Exflagellation In Plasmodium, Hepatocystis And Leucocytozoon. *Trans Royal Soc Trop Med Hyg*. (1967); 61: 58-68.
11. Garnham, P. C. C. Malaria Parasites And Other Haemosporidia. *Blackwell Scientific Publications, Oxford, U.K.*(1966), 1,114 .
12. Gill H, Paperna I. Leucocytozoonosis In The Israeli Sparrow, Passer Domesticus Biblicus Hartert 1904. *Parasitol Res.* 2005,96:373–7.
13. Gimba ,F.; Zakaria, A.; Mugok, L. B.; Siong ,H. C.; Jaafar, N.; Moktar, Maizatul A;Abdul Rashid, A. R., Amlizawaty, A. ; Abu, J.; Sani, R. A.; Amin-Babjee S. M. And Sharma R.S. Haemoparasites Of Domestic Poultry And Wild Birds In Selangor,Malaysia. *Malaysian Journal Of Veterinary Research*. (2014).5 ,43-51.
14. Godfrey, R. D., Jr., A. M. Fedynich, And D. B. Pence..Quantification Of Hematozoa In Blood Smears. *Journal Of Wildlife Disease* (1987).23:558–565.
15. Gothe R,Hartmann S. The Viability Of Cryopresserved Aegyptianella PullorumCarpano. 1928 In The Vector Argas (Persicargas) Walkeraekaiser And Hoogstraal.*Parasitology Research* .1979; 58(2): 189-190.
16. GOTHE R. and BURKHARDT E. : The erythrocytic entry- and exit-mechanism of Aegyptianellapullorum Carpano, 1928. Z. Parasitenkd., 1979, 60, 221-7.
17. Greiner, E.C., Ritchie, B.W.: Parasites. In: Ritchie, B.W., Harrison, G.J., Harrison,
18. L.R. Eds., Avian Medicine: Principles And Application. *Wingers Publishing Inc.Florida,* (1994); 1007- 1029.
19. Groof. T.C.Et.All. Haemoproteosis Lethality In A Woodpecker, With Molecular And Morphological Characteristics Of Haemoproteus Velans (Haemosporida,Haemoproteidae). *Ijp: Parasites And Wildlife.* (2019).10, 93-100.
20. Hellgren, O., J. Waldenstro ¨M, And S. Bensch. A New Pcr Assay For Simultaneous Studies Of Leukocytozoon, Plasmodium, And Haemoproteus From Avian Blood. *Journal Of Parasitology)* (2004). 90: 797– 802.
21. Huchzermeyer Fw. A Host-Parasite List Of The Haematozoa Of Domestic Poultry In Sub-Saharan Africa And The Isolation Of *Plasmodium Durae* Herman From Turkeys
22. And Francolins In South Africa. *Onderstepoort J Vet.* (1993);60:15–21.
23. Leeflang P, Ilemobade Aa. Tick-Borne Diseases Of Domestic Animals In Northern
24. M. N. Opara.Et.All. Blood And Gastrointestinal Parasites Of Chickens And Turkeys

K Kiani

25. Reared In The Tropical Rainforest Zone Of Southeastern Nigeria.*Journal OfVeterinary Medicine.*(2014)4, 308-313
26. Merino S, Potti J, Fargallo Ja. Blood Parasites Of Passerine Birds From CentralSpain. J Wildlife Dis.(1997);33:638–41. [Pubmed] [Google Scholar]
27. Milhous W, Solis J. Turkey *Leucocytozoon* Infection. 3. Ultrastructure Of *Leucocytozoon Smithi* Gametocytes. Poultry Sci. (1973);52:2138–46.
28. Morii, T. A Review Of Leucocytozoon Caulleryi Infection In Chickens. *Journal Of Protozoology Research* (1992).02: 128–133.
29. Nakamura, K., Y. Mitarai, N. Tanimura, H. Hara, A. Ikeda, J. Shimada, And T. Isobe.Pathogenesis Of Reduced Egg Production And Soft-Shelled Eggs In Laying Hens Associated With Leucocytozoon Caulleryi Infection.*Journal Of Parasitology* (1997)83: 325–327.
30. Nourani 1,2 , *Mansour Aliabadian 1,3 , Navid Dinparast Djadid 2 , Omid Mirshamsi 1, Occurrence Of Haemoproteus Spp. (Haemosporida: Haemoproteidae) In New Host Records Of Passerine Birds From The East Of Iran Leila. *Iran J Parasitol*: Vol. 13, No. 2, Apr-Jun (2018), Pp.267-274
31. Nourani.L.Et.All.Occurrence Of Haemoproteus Spp. (Haemosporida:Haemoproteidae) In New Host Records Of Passerine Birds From TheEast Of Iran.*Iran J Parasitol*. (2018) .13(2): 267–274.
32. Özmen.O.et.all.Blood Parasites Of Imported Psittacine Birds. *Vet Rec*. (1977);2: 282-3.
33. OZMEN1,O., HALIGÜR, M., ADANIR, R. Identification Of Different Protozoa Species From A Common Buzzard (Buteo Buteo). *Turk. J. Vet. Anim. Sci.* (2009); 33(3): 257-260
34. Permin A, Esmann Jb, Hoj Ch, Hove T, Mukaratirwa S. Ecto-, Endo- And Hae- Moparasites In Free-Range Chickens In The Goromonzi District In Zimbabwe. *PrevVet Med*. (2002);54:213–24.
35. Poulsen Ab, Permin Ao, Yelifari Hl, Nasen P, Block Prevalence And Distribution Of Gastro-Intestinal Helminthes And Haemoparasites In Young Scavenging Chickens In Upper Eastern Region Of Ghana. West Africa. *Preventive Veterinary Medicine*. (2000) ; 45 (3-4): 237-245
36. Raad Hammodi Hasson Haemosporidians Parasites Of Gallus Domesticus ,Poultry In Iraq . I International *Journal Of Advanced Research* (2015), Volume 3, Issue 8, 1046
– 1054
37. *Ravinder N. M.*Et.All.Blood Parasites Of Chickens In Uganda And Cameroon With Molecular Descriptions Of Leucocytozoon Schoutedeni And Trypanosoma Gallinarum. *J. Of Parasitology.*(2006), 92(6):1336-1343 .
38. Remple, J.D. Intracellular Hematozoa Of Raptors: A Review And Update. *J. AvianMed. Surg.*, (2004); 18: 75-88.
39. Ricklefs, R. E., B. L. Swanson, S. M. Fallon, A. Martinez-Abrain, A.Scheuerlein, J. Gray, And S. C. Latta. 2005. Community Relationships Of Avian Malaria Parasites InSouthern Missouri. *Ecological Monographs* 75: 543–559.
40. Samadova So.Et.All. Blood Parasites In Galliformes From The Some Districts Of Absheron Region.*Journal Of Entomology And Zoology Studies* (2017), 5(6), 2404-2407
41. Soulsby Ejl. Helminths, Arthropods And Protozoa Of Domesticated Animals. *7thEd.Philadelphia, Bailliere Tindall, London*; (1986). P.756-757.
42. Stuht Jn, Bowerman Ww, Best Da. Leucocytozoonosis In Nestling Bald Eagles In Michigan And Minnesota. *J Wildlife Dis*. (1999);35:608–12.
43. Swai Es, Kessy M, Sanka P, Bwanga S, Kaaya Je. A Survey On Ectoparasites And Heamoparasites Of Free-Range Indigenous Chickens Of Northern Tanzania. *Livestock Research For Rural Development*.(2010);
44. 22(9).
45. T. C. Nath.Et.All. A Study On The Presence Of Leucocytozoonosis In Pigeon And Chicken Of Hilly Districts Of Bangladesh. *Issues In Biological Sciences And Pharmaceutical Research* (2014), 2 (2), 013-018.
46. Tarello W, Riccieri N, Aegyptianella Like Inclusion Bodies In Two Birds Of Prey From Central Italy. *Revue Med Vet*. (2003); 154 (11): 715-717.
47. Tarello W. Aegyptianella-Like Organisms And Microfilariae In A Severely Diseased Bittern (Botaurus Stellaris Stellaris). *Revue Med Vet*. (2001); 152(2): 189-193.
48. Thrall Ma, Baker Ds, Compbell Tw, Denieola D, Fettman M, Lassen Ed,Rebar A,Weiser G.Veterinary Hematology And Clinical Chemistry. Lippieott Williams AndWilkins. *United State Of America*; (2004). P. 248-249.
49. Urquhart Gm, Armour J, Duncan Jl, Dunn Am, Jennings Fw. Veterinar Parasitology.
50. *2nded. Blackwell Science. Oxford*;(2003).252.
51. Valkiu ¯Nas, G.. Avian Malaria Parasites And Other Haemosporidia. *Crc Press, BocaRaton, Florida*,(2005) 936 P.
52. Valkiunas G. Bird Haemosporida. Acta Zool. Lituanica (Monograph). *Ty-Jour.*
53. (1997), 3-5.
54. Yoshimura A, Koketsu M, Bando H Et Al. Phylogenetic Comparison Of Avian Haemosporidian Parasites From Resident And Migratory Birds In Northern Japan. *JWildl Dis.* (2014); 50(2):235-42.