

Study on the Prevalence of Babesiosis in Domestic Cattles of Various Areas of Sindh, Pakistan

Mahaveer¹, Muhammad Umer¹, Sajid Abbas², Wasim Abbas², Saba Naazir^{2,*}, Rehana Shahnawaz²

¹Faculty of Veterinary Sciences, Shaheed Benazir Bhutto University of Veterinary and Animal Sciences, Sakrand, Pakistan

²Faculty of Animals Husbandry & Veterinary Sciences, Sindh Agriculture University, Tandojam, Pakistan

Email address:

sabanaazir96@gmail.com (Saba Naazir)

*Corresponding author

To cite this article:

Mahaveer, Muhammad Umer, Sajid Abbas, Wasim Abbas, Saba Naazir, Rehana Shahnawaz. Study on the Prevalence of Babesiosis in Domestic Cattles of Various Areas of Sindh, Pakistan. *Research & Development*. Vol. 3, No. 3, 2022, pp. 149-153.

doi: 10.11648/j.rd.20220303.12

Received: May 29, 2022; **Accepted:** June 27, 2022; **Published:** August 29, 2022

Abstract: The current study was done to determine the incidence of babesiosis among domestic cattle in Sindh, in light of the relevance of tick-borne diseases in the livestock industry. Over the course of a year, n=1500 blood samples were taken from clinically questionable animals. A microscope was used to analyse all of the blood samples. Babesiosis was found to be prevalent in 51.47% of the population. *B. boves* had a much higher prevalence 32.8% than *B. bigemina* 18.67%. Female cattle were more susceptible to both *B. boves* and *B. bigemina* than male cattle. Both *B. boves* 38.57% and *B. bigemina* 23.57% were found to be very positive in cattle under the age of two years. Similarly, during the summer season, the rate of positive for both *B. boves* 51.33% and *B. bigemina* 31.3% was observed to be high. Tick and disease prevalence in a certain area, as well as the season, are contributing variables in *Babesia* diagnosis, particularly in areas like Sindh, where modern testing is not available. Babesiosis can be treated with a variety of different medications. Antiprotozoal medicines such as imidocarb dipropionate and diminazine aceturate are commonly used in conjunction with antibiotics such as Doxycycline and Enrofloxacin. Another option is Metronidazole. The combination of atovaquone and azithromycin has been shown to be effective against *Babesia gibsoni*, but Asian genotypes of *B. gibsoni* are thought to be resistant. No medicine exists that can entirely eradicate the infectious pathogen.

Keywords: Babesia, Prevalence, Microscopy, Cattle, Sindh

1. Introduction

Babesiosis is an animal disease transmitted by ticks that causes significant death and morbidity [20]. It is a fatal disease for the cattle sector, hurting cattle output in several Asian nations, including Pakistan [1]. Babesiosis may also affect domestic animals such as sheep, horses, goats, dogs, and pigs [2]. Babesiosis is a highly pathogenic parasite that causes acute and chronic diseases in cattle and buffaloes [4]. *Babesia* infection intensity and clinical symptoms differ according to the infecting species, age, and immunological condition of the patient. Jaundice, anemia, hemoglobinuria, and fever are all symptoms of the condition [6]. Babesiosis is a globally spread protozoal disease caused by *Babesia* that affects a wide range of animal species [29, 51]. Although the cattle business is the most economically important for this disease [15] babesiosis is

becoming a more common and serious problem in young cattle [35]. This disease is not only important for veterinarians, but it also has zoonotic potential [30]. Humans are usually infected by *B. microti* and *B. divergens* species [7]. Ticks of the *Rhipicephalus* genus are the main vectors for disease transmission, but *Dermacentor reticularis*, *Haemaphysalis bispinosa*, and *Haemaphysalis longicornis* transmit *Babesia gibsoni* [31]. Due to intravascular and extravascular hemolysis, the major clinical symptoms of Babesiosis in cattle include anaemia and fever [22]. In the years 2015 and 2016, the overall prevalence of canine Babesiosis in Sindh, Pakistan, was found to be 13.74% and 15.67%, respectively [23, 32]. This season, it has been reported that male cattle's of a young age have an increased tick population [40]. Babesiosis is becoming more common in Sindh as a result of the country's hot and humid weather [34, 38]. Bovine babesiosis and other tick-borne

infections are thought to be responsible for more than half of all crossbred cow losses [7, 36]. *Babesia* has about 100 different species that infect a variety of animals [3]. *Babesia bigemina* and *Babesia bovis*, for example, can cause significant mortality and morbidity in cow populations [5]. Tick vectors transfer both *B. bigemina* and *Babesia bovis* from infected to healthy cattle [23]. Ticks are extensively distributed throughout tropical and subtropical nations, particularly in India, Pakistan, and Bangladesh, due to favorable climatic conditions for their growth and development [8, 47]. Babesiosis infected over 1.2 billion cattle in South and Central America, Australia, the United States, and Asia [10, 41]. Babesiosis infection was found to be 20% in Hyderabad [9, 37], 61% in Peshawar [15], and 35% in Dera Ghazi Khan in studies done across Pakistan [11, 42]. In view of the foregoing, it is critical to identify and treat it promptly in order to minimize economic losses in the cattle sector [12, 33]. The current study was undertaken to determine the incidence of babesiosis among domestic cattle in various districts of Sindh, Pakistan, due to the impact of babesiosis on the cattle sector.

2. Material and Methods

2.1. Ethical Approval

The Institutional Review Board of the Sindh Agriculture University Tandojam, Pakistan gave the study its ethical approval.

2.2. Collection of Sample

In a sterile vacutainer with a capacity of 5ml, 1500 blood samples were obtained from cattle's jugular veins and stored in an ice jar.

2.3. Sample Collection Districts

Over the course of a year, samples were obtained from

clinically questionable cattle in various districts of Sindh, Pakistan (Hyderabad, Tandoallahyar, Tando Muhammad Khan, Thatta, Badin, Tharparkar).

2.4. Lab Analysis

The date of collection, age, sex, and location of the samples were all labelled. The samples were taken to SB Molecular Parasitology and Virology Laboratory, where they were maintained at -20°C for further processing. Animal clinical data was documented on a pre-designed questionnaire. Thin and thick blood smears were produced, fixed for one minute with methanol, and stained with Giemsa stain. *B. bovis* and *B. bigemina* were detected on stained slides using a microscope (Olympus Japan) at 200x magnification [22, 33]. The following formula was used to calculate the prevalence rate of babesiosis [21]. The prevalence rate is calculated as the number of positive samples divided by the total number of samples analyzed.

2.5. Statistical Analysis

SPSS statistical software version 20 was used for data entry and analysis.

3. Results and Discussion

Blood testing revealed that n=772 out of 1500 (51.47%) of domestic cattle tested positive for babesiosis. *B. bovis* n=492 (35.46%) was found to be more common than *B. bigemina* n=280 (18.67). According to a study done in southern Punjab, 35% of cattle tested positive for *Babesia* infection [18], 20% in southeastern Punjab [13, 47], and 61% in Khyber Pakhtunkhwa [14, 39]. Similarly, a research done in China indicated a prevalence rate of 7.24% for *Babesia* infection [18, 24] and 11.49% for *Babesia* infection in the Philippines [16, 43].

Table 1. Overall prevalence of babesiosis in domestic cattle.

| Districts | Total Sample | B. Bovos (%) | B. Migemina (%) | Total (%) | P Value |
|---------------------|--------------|--------------|-----------------|-------------|---------|
| Hyderabad | 250 | 91 (36.4) | 56 (22.4) | 147 (58.8) | 0.0096 |
| TandoAllahyar | 250 | 72 (28.4) | 36 (14.4) | 108 (43.2) | |
| Tando Muhammad Khan | 250 | 78 (31.2) | 43 (17.2) | 121 (48.4) | |
| Thatta | 250 | 86 (34.4) | 38 (15.2) | 124 (49.6) | |
| Badin | 250 | 67 (26.8) | 46 (18.4) | 113 (45.2) | |
| Tharparkar | 250 | 98 (39.2) | 61 (24.4) | 159 (63.6) | |
| Total | 1500 | 492 (32.8) | 280 (18.67) | 772 (51.47) | |

Table 2. Age wise prevalence of babesiosis in domestic cattle.

| Age (Years) | Total Sample | B. Bovos (%) | B. Migemina (%) | Total (%) | P Value |
|-------------|--------------|--------------|-----------------|-------------|---------|
| <2 | 280 | 108 (38.57) | 66 (23.57) | 174 (62.14) | 0.0062 |
| 2<4 | 300 | 110 (36.67) | 64 (21.33) | 174 (58.00) | |
| 4<6 | 325 | 110 (38.85) | 60 (18.46) | 170 (52.31) | |
| 6<8 | 275 | 79 (28.73) | 46 (16.73) | 125 (45.45) | |
| 9 | 320 | 85 (26.56) | 44 (13.75) | 129 (40.31) | |
| Total | 1500 | 492 (32.8) | 280 (18.67) | 772 (51.47) | |

Furthermore, as indicated in Table 1, the frequency of babesiosis was greater in district Tharparkar than in other

districts. This high frequency in Tharparkar may be owing to the hot and humid climate, which encourages tick growth and development [27, 48]. The incidence of *B. boves* and *B. bigemina* in cattle was also investigated using age as a criterion [7]. Babesiosis rates declined with age, according to the research [26, 46].

As demonstrated in Table 2, cattle under the age of two years had a high occurrence of *Babesia* species 62.14% (*B.*

boves 38.57% and *B. bigemina* 23.57%). This high prevalence in younger cattle's might be owing to their thin and fragile skin, which allows ticks to spread the virus more easily, or it could be related to their poor immunity [17, 44]. Overall female cattle's were more prone to babesia species with 58.47% (*B. boves* 37.01% and *B. bigemina* 21.61%) infection than male cattles with 41.60% (*B. boves* 26.98% and *B. bigemina* 14.60%), according to the current study Table 3.

Table 3. Sex wise prevalence of babesiosis in domestic cattle.

| Sex | Total Sample | <i>B. Bovos</i> (%) | <i>B. Migemina</i> (%) | Total (%) | P Value |
|---------|--------------|---------------------|------------------------|-------------|---------|
| Male | 630 | 170 (26.98) | 92 (14.60) | 262 (41.60) | 0.0058 |
| Females | 870 | 322 (37.01) | 188 (21.61) | 510 (58.62) | |
| Total | 1500 | 492 (32.8) | 280 (18.67) | 772 (51.47) | |

It's possible that the high frequency of babesiosis in female cattle is attributable to the use of infected needles for injecting medications to let down milk. Similar findings have been observed elsewhere [19, 49]. *B. boves* and *B. bigemina*

seasonal fluctuation in domestic cattles was also studied [25, 45]. Summer had the highest prevalence of both species (51.33% *B. boves* and 31.3% *B. bigemina*), followed by spring, autumn, and winter (Figure 1).

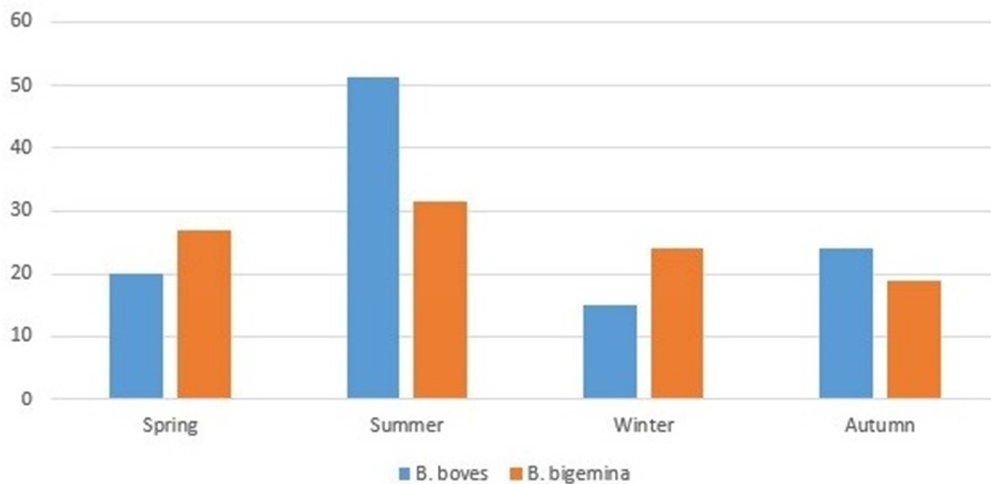


Figure 1. Seasons wise prevalence of babesiosis in domestic cattle.

The conjunction of high tick activity with increased warmth and humidity in the environment may result in more incursions during the summer season [28, 50].

4. Conclusions

Babesia boves (32.8%) were found in greater numbers in the research area's cattles than *B. bigemina* (18.67%). Cattle that were younger were more susceptible to infection than those that were older. In the summer, both *Babesia* species were more common. The study clearly shows that *Babesia* infection is present in the cattle in the study area, placing them at high risk and causing significant economic losses to the country's livestock business.

Conflict of Interest

The authors have declared no conflict of interest.

References

- [1] Abbas A, Kumar L, Rehman S, Mathan, Yousaf A (2021) Prevalence of Gastrointestinal Parasites in Buffalo and Cow Calves in Rural Areas of Rawalpindi, Pakistan. *Biomed J Sci & Tech Res* 40 (2): 32159-32165. DOI: <http://dx.doi.org/10.26717/BJSTR.2021.40.006437>
- [2] Ahmad, I., Khwaja, A., Shams, S., Ayaz, S., Khan, S., Akbar, N. U., Waqar, M., Alam, S., Khan, M. A., Rehman, A. and Zakir, M. (2014). Detection of babesiosis and identification of associated ticks in cattle. *Int. J. Bioassays*, 3: 3195-3199.
- [3] Babar A, Yousaf A, Fazilani SA, Jan MN (2021). Incidence of Bovine *Anaplasma Marginale* in Sindh, Pakistan. *American Journal of Zoology*. Vol. 4, No. 4, pp. 61-64. DOI: <http://dx.doi.org/10.11648/j.ajz.20210404.13>
- [4] Babar A, Yousaf A, Sarki I, Subhani A (2021). Incidence of Bovine *Brucellosis* in Thatta, Sindh-Pakistan. *Advances in Bioscience and Bioengineering*. Vol. 9, No. 4, pp. 92-95. DOI: <http://dx.doi.org/10.11648/j.abb.20210904.11>

- [5] Baloch S, Yousaf A, Shaheen S, Shaheen S, Sarki I, Babar A, Sakhawat A, Arshad M, Rehman K, Musakhail SJ, Bachaya A, Habib F (2021). Study on the Prevalence of Peste Des Petits Virus Antibodies in Caprine and Ovine Through the Contrast of Serological Assessments in Sindh, Pakistan. *Animal and Veterinary Sciences*. Vol. 9, No. 5, pp. 131-135. DOI: <http://dx.doi.org/10.11648/j.bio.20210905.11>
- [6] Baqir Y, Sakhawat A, Yousaf A, Tabbasum R, Awais T, Baloch S, Subhani A, Rubab F, Musakhail SJ, Shahnawaz R, Bhutto AL, Sarki I, Arshad M (2021). Therapeutic management of milk fever with retained placenta in Holstein Friesians cow in a private dairy farm at Sheikhpura, Punjab-Pakistan. *Multidisciplinary Science Journal*: e2021015, DOI: <http://dx.doi.org/10.29327/multiscience.2021015>.
- [7] Baqir Y, Yousaf A, Soomro AG, Jamil T, Sarki I, Rubab F, Haider I (2021) Sorex araneus a pathogenic microbial threat in commercial poultry farms. *Multidisciplinary Science Journal* 3: e2021016, DOI: <http://dx.doi.org/10.29327/multiscience.2021016>.
- [8] Bilawal AM, Babar A, Panhwar IM, Hal K, Farooq MM, Lanjar Z, Soomro AG, Fazilani SA, Jan MN, Lakhani L, Yousaf A, Sarki I, Shahnawaz R, Mathan (2021). Detection of Brucella Abortus in Caprine and Ovine by Real-Time PCR Assay. *Animal and Veterinary Sciences*. 9 (5) 141-144. DOI: <http://dx.doi.org/10.11648/j.avs.20210905.13>
- [9] Ghafar A, Gasser RB, Abbas T, Rehman A, Gauci CG, Jabbar A (2021) Chapter Four - Ticks and tick-borne diseases of bovines in a smallholder livestock context: The Pakistani example. 114, 167-244. <https://doi.org/10.1016/bs.apar.2021.08.009>.
- [10] Habib F, Jabbar A, Shahnawaz R, Memon A, Yousaf A, Bilal M, Jamil T, Khalil R and Sharif A (2019). Prevalence of hemorrhagic septicemia in cattle and buffaloes in Tandojam, Sindh, Pakistan. *Online J. Anim. Feed Res.*, 9 (5): 187-190. DOI: <https://dx.doi.org/10.36380/scil.2019.ojaftr26>
- [11] Habib F, Tabbasum R, Awais T, Sakhawat A, Khalil R, Sharif A, Yousaf A, Arshad M, Sindhu, Shahnawaz R, Shaheen S, Bachaya A, Ramzan M, Rehman K (2021) Prevalence of Bovine Tropical Theileriosis in Cattle in Quetta Balochistan-Pakistan. *Arch Animal Husb & Dairy Sci*. 2 (1) AAHDS. MS. ID. 000540. DOI: <http://dx.doi.org/10.33552/AAHDS.2021.02.000540>.
- [12] Herrera PCT, Vilorio VV, Balbin MM, Mingala CN. (2017) Prevalence of babesiosis (Babesia bovis and Babesia bigemina) in cattle and water buffalo in Nueva Ecija, Philippines using Nested Polymerase Chain Reaction. *Ann Parasitol*. 63 (4): 309-316. doi: 10.17420/ap6304.117. PMID: 29419989.
- [13] Hunfeld KP, Hildebrandt A, Gray JS. (2018) Babesiosis: recent insights into an ancient disease. *Int J Parasitol*. 38 (11): 1219-37. doi: 10.1016/j.ijpara.2008.03.001. Epub 2008 Mar 20. PMID: 18440005.
- [14] Hussain A, Bilal M, Habib F, Gola BA, Muhammad P, Kaker A, Yousaf A, Khalil R (2019). Effects of low temperature upon hatchability and chick quality of Ross-308 broiler breeder eggs during transportation. *Online J. Anim. Feed Res.*, 9 (2): 59-67.
- [15] Hussain A, Yousaf A, Mushtaq A. (2018) Prevalence of mycoplasma gallisepticum in ross-308 broiler breeder through the contrast of serological assessments in Pakistan. *J Dairy Vet Anim Res*. 7 (1): 00185. <http://dx.doi.org/10.15406/jdvar.2018.07.00185>
- [16] Hussain D, Yousaf A, Wakeel A, Noori B, Aijaz H, Tunio Sk, Naazir S, Soomro AG, Mathan, Khalil R, Sharif A (2021) Prevalence Of Respiratory Diseases In Different Broiler And Layer Poultry Farms In Rawalpindi Of Punjab-Pakistan. *Research In: Agricultural & Veterinary Sciences*. 5 (3) 85-91.
- [17] Iqbal T, Yousaf Y, BiBi N, Kumar L, Rehman S, Tunio S, Farooq MM, Channo A, Wakeel A, Lanjar Z, Panhwar IM, Soomro AG, Mathan (2021). Ultrasonographic biometry of the ovaries and follicles in cyclic and non-cyclic kundhi buffalo. *Multidisciplinary Science Journal*: e2022005. DOI: <https://doi.org/10.29327/multiscience.2022005>
- [18] Irshad, N., Qayyum, M., Hussain, M. and Khan, M. Q., 2010. Prevalence of tick infestation and theileriosis in sheep and goats. *Pak. Vet. J.*, 30: 178-180.
- [19] Iseki H, Zhou L, Kim C, Inpankaew T, Sununta C, Yokoyama N, Xuan X, Jittapalpong S, Igarashi I. (2010). Seroprevalence of Babesia infections of dairy cows in northern Thailand. *Vet Parasitol*. 24; 170 (3-4): 193-6. DOI: 10.1016/j.vetpar.2010.02.038. Epub 2010 Mar 3. PMID: 20363078.
- [20] Jabbar A, Hameed A, Yousaf A, Riaz A and Ditta YA (2019). The Influence of Hairline Crack Eggs on Hatchery Parameters and Chicks Performance. *World Vet. J*. 9 (2): 76-83.
- [21] Jabbar A, Yousaf A, Hameed A, Riaz A and Ditta YA (2019). Influence of Fumigation strength on Hatchery Parameters and Later Life of Chicks. *J Holistic vet Sci Ani Care* 1 (1): 101.
- [22] Jabbar A, Yousaf A. (2017). Effect of age wise incubation programme on broiler breeder hatchability and post hatch performance. *Online J. Anim. Feed Res.*, 7 (1): 13-17.
- [23] Jamali MK, Tabbasum R, Bhutto AL, Sindhu, Ramzan M, Musakhail SJ, Rehman K, Bachaya A, Habib F, Arshad M, Awais T, Sakhawat A, Sarki I, Fatima S, Fawad M, Yousaf A (2021). Prevalence of Toxoplasma Gondii in Sheep and Goats in Multan (Punjab), Pakistan. *Arch Animal Husb & Dairy Sci*. 2 (4): AAHDS. MS. ID. 000541. DOI: <http://dx.doi.org/10.33552/AAHDS.2021.02.000541>
- [24] Jamali MK, Yousaf A, Sarki I, Babar A, Sharma SN (2021). Assessments of Prevalence of Brucellosis in Camels Through the Contrast of Serological Assessments in South Punjab, Pakistan. *American Journal of Zoology*. Vol. 4, No. 4, pp. 65-68. DOI: <http://dx.doi.org/10.11648/j.ajz.20210404.14>
- [25] Khan A, Noushin R, Attaullah M, Khan SN, Hussain R, Dawar F, Rehman F, Ijaz M and Ullah K (2021). Prevalence of Tick Born Babesia Infection in Domestic Cattle of Khyber Pakhtunkhwa, Pakistan. *Pakistan J. Zool.*, pp 1-3. DOI: <https://dx.doi.org/10.17582/journal.pjz/20190403040418>
- [26] Khan A, Rind R, Shoaib M, Kamboh AA, Mughal GA, Lakho SA, Malhi KK, Nizamani AR, Yousaf A (2016). Isolation, identification and antibiogram of Escherichia coli from table eggs. *J. Anim. Health Prod*. 4 (1): 1-5 <http://dx.doi.org/10.14737/journal.jahp/2016/4.1.1.5>
- [27] Khan A, Yousaf A, Shahnawaz R, Latif Bhutto A, Baqir Y, Sakhawat A, Tabbasum R, Awais T, Arshad M, Habib F, Shaheen S, Bachaya A, Rahman K (2021). Snake Bite Case in Holstein Friesian Cattle at Private Dairy Farm in Hyderabad, Sindh. *OA J Ani Plant Husbandry*, 2 (1): 180005.

- [28] Mathan, Jabbar A, Shahnawaz R, Yousaf A, Ahmad F, Habib F, Nissa Rais M, Sharif A, Khalil R and Naz Jagirani (2020) Prevalence of Various Poultry Diseases in Different Seasons in District Rawalpindi, Pakistan". *EC Veterinary Science* 5.9: 87-92. <https://dx.doi.org/10.31080/ecve.2020.05.00298>
- [29] Mushtaq A, Babar A, Yousaf A, Sarki I, Baloch S, Shahnawaz R, Bhutto AL, Subhani A, Khalil R and Sharif A (2021) Prevalence of Toxoplasmosis in Different Animals Species in Distract Rawalpindi, Punjab". *Acta Scientific Veterinary Sciences*. 3 (11): 21-24.
- [30] Naazir S, Naazir N, Naazir T, Yousaf A, Wakeel A, Noori B, Aijaz H, Tunio Sk, Habib F (2021) Incidences Of Brucella Abortus In Serum And Milk Samples Of Cattle In Rawalpindi. Research In: *Agricultural & Veterinary Sciences*. 5 (3) 121-127.
- [31] Panhwar MI, Hal K, Farooq MM, Lanjar Z, Bhutto AL, Baloch S, Shahnawaz R (2021). Detection of Toxoplasma Gondii Infection in Goats and Sheep using the Indirect Haemagglutination Test in Peshawar, Kyber Pakhtunkhwa-Pakistan. *J Vet Med Animal Sci*. 4 (2): 1087.
- [32] Sakhawat A, Tabbasum R, Awais T, Arshad M, Yousaf A, Fatima S, Jamali MK, Fawad M, Sindhu (2021). Antibacterial activity of Lactic acid bacteria producing Bacteriocins. *Int J Biotech & Bioeng*. 7: 9. 169-174.
- [33] Soomro AG, Arain MB, Yousaf A, Rubab F, Sharna SN, Lodhi MK (2021). Therapeutic Management of Canine Babesiosis in German Shepherd Bitch at Hyderabad, Sindh. *American Journal of Zoology*. Vol. 4, No. 4, pp. 57-60. DOI: <http://dx.doi.org/10.11648/j.ajz.20210404.12>
- [34] Soomro AG, Yousaf A, Fawad M, Fatima S, Jamali MK (2021). Therapeutic Management of Tetanus in a Kamori Male Goat. *American Journal of Zoology*. Vol. 4, No. 4, pp. 69-71. DOI: <http://dx.doi.org/10.11648/j.ajz.20210404.15>
- [35] Tabbasum R, Awais T, Sakhawat A, Khalil R, Sharif A, Yousaf A, Arshad M, Sindhu, Shahnawaz R, Habib F, Shaheen S, Bachaya A, Ramzan M, Rahman K and Zahra G (2021) Prevalence and Risk Factors of Theileriosis in Goat and Sheep in Lahore. *J Vet Sci Res* 6 (2): 000215. DOI: <http://dx.doi.org/10.23880/oajvsr-16000215>
- [36] Yousaf A, Abbas M, Laghari RA, Hassan J, Rubab F, Jamil T, Haider I, Abbas U, BiBi N. (2017). Epidemiological investigation on outbreak of brucellosis at private dairy farms of Sindh, Pakistan. *Online J. Anim. Feed Res.*, 7 (1): 09-12.
- [37] Yousaf A, Abbas M, Laghari RA, Kachiwal AB, Jamil T, Abbas U. (2016). Therapeutic management of tetanus in Kundhi buffalo calf at Hyderabad, Sindh. *Online J. Anim. Feed Res.*, 6 (5): 103-106.
- [38] Yousaf A, Jabbar A, Ditta Y. A (2017). Effect of pre-warming on broiler breeder eggs hatchability and post-hatch performance. *J. Anim. Health Prod*. 5 (1): 1-4. <http://dx.doi.org/10.14737/journal.jahp/2017/5.1.1.4>
- [39] Yousaf A, Jabbar A, Laghari IH, Abbas M (2017). Effect of incubation duration on broiler breeder eggs hatchability and post-hatch performance. *J. Anim. Health Prod*. 5 (4): 127-131.
- [40] Yousaf A, Laghari RA, Shoaib M, Ahmad A, Malhi KK, Mughal GA, Lakho S, Khetran IB (2016). The prevalence of brucellosis in Kundhi buffaloes in District Hyderabad, Pakistan. *J. Anim. Health Prod*. 4 (1): 6-8. <http://dx.doi.org/10.14737/journal.jahp/2016/4.1.6.8>
- [41] Yousaf A, Rais M-ul-N, Mushtaq A, Jamil T (2018). Prevalence of black quarter (BQ) disease in private dairy farm in Hyderabad, Sindh province of Pakistan. *Online J. Anim. Feed Res.*, 8 (1): 01-04.
- [42] Yousaf A, Sarki I, Babar A, Khalil R, Sharif A, Arshad M, Tabbasum R, Awais T, Sakhawat A, Shahnawaz R, Baloch S, Bhutto AL (2021). Detection of Foot and Mouth Disease Viruses in Cattle using Indirect Elisa and Real Time PCR. *J Vet Med Animal Sci*. 4 (2): 1086.
- [43] Yousaf A, Sarki I, Babar A, Khalil R, Sharif A, Arshad M, Tabbasum R, Awais T, Sakhawat A, Shahnawaz R, Baloch S, Bhutto AL (2021). Detection of Foot and Mouth Disease Viruses in Cattle using Indirect Elisa and Real Time PCR. *J Vet Med Animal Sci*. 4 (2): 1086.
- [44] Yousaf A, Shahnawaz R, Jamil T, Mushtaq A (2018). Prevalence of coccidiosis in different broiler poultry farms in Potohar region (distract Rawalpindi) of Punjab- Pakistan. *J Dairy Vet Anim Res*. 7 (3): 87-90. <http://dx.doi.org/10.15406/jdvar.2018.07.00196>
- [45] Yousaf A, Soomro AG, Subhani A, Fazilani SA, Jan MN, Babar A, Arain MB, Lakhani L, Panhwar MI, Hal K, Farooq MM, Lanjar Z, Bhutto AL, Baloch S, Shahnawaz R (2021). Detection of Toxoplasma Gondii Infection in Goats and Sheep using the Indirect Haemagglutination Test in Peshawar, Kyber Pakhtunkhwa-Pakistan. *J Vet Med Animal Sci*. 4 (2): 1087.
- [46] Yousaf A, Tabasam MS, Memon A, Rajput N, Shahnawaz R, Rajpar S, Jamil T, Mushtaq M (2019). Prevalence of ascaridia galli in different broiler poultry farms of potohar region of rawalpindi-pakistan. *J Dairy Vet Anim Res*. 8 (1): 71-73. <http://dx.doi.org/10.15406/jdvar.2019.08.00245>
- [47] Yousaf A, Tabbasum R, Awais T, Sakhawat A, Khan S, Bhutto AL, Khalil R, Sharif A, Arshad M, Baloch S, Shahnawaz R, Habib F, Shaheen S, Bachaya A, Ramzan M, Rahamn K, Zahra G (2021). Prevalence of Toxoplasma Gondii in Domestic Breeds of Goats in Faisalabad, Punjab. *Animal and Veterinary Sciences*. 9 (5) 145-148. DOI: <http://dx.doi.org/10.11648/j.avs.20210905.14>
- [48] Yousaf A, Tunio S, Mohy-ud-din G, Kakar A, Habib F, AG Soomro, Akram W, Naazir S, Ismail M, Naazir T, Naazir S (2021). A Review Study on Legs Lameness and Weaknesses Assessment Methods in Commercial Broiler Farming in Pakistan. *Biomed J Sci & Tech Res* 40 (2): 32113-32120. DOI: <http://dx.doi.org/10.26717/BJSTR.2021.40.006433>
- [49] Yousaf, A., Rahman K, Shahnawaz, R. (2015) 'To evaluate the Sero- Occurrence of brucellosis in buffalo and goat through the contrast of serological assessments in Tandojam (Pakistan)', *IOSR Journal of Agriculture and Veterinary Science*, 8 (1): 45-46.
- [50] Zhou, Z., Li, K., Sun, Y., Shi, J., Li, H., Chen, Y., Yang, H., Li, X., Wu, B., Li, X. and Wang, Z., 2019. Molecular epidemiology and risk factors of *Anaplasma* spp., *Babesia* spp. and *Theileria* spp. infection in cattle in Chongqing, China *PLoS One*, 14: 1-11. <https://doi.org/10.1371/journal.pone.0215585>
- [51] Zulfiqar, S., Shahnawaz, S., Ali, M., Bhutta, A. M., Iqbal, S., Hayat, S., Qadir, S., Latif, M., Kiran, N., Saeed, A., Ali, M. and Iqbal, F., (2012). Detection of Babesia bovis in blood samples and its effect on the hematological and serum biochemical profile in large ruminants from Southern Punjab. *Asian Pac. J. trop. Biomed*. 2: 104-108. [https://doi.org/10.1016/S2221-1691\(11\)60202-5](https://doi.org/10.1016/S2221-1691(11)60202-5)