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EPIDEMIOLOGICAL STUDIES ON SEVERE ANAEMIA IN BUFFALOES IN PUNJAB, INDIA

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ABSTRACT

The present study was designed to investigate the prevalence and etiology of anaemia in buffaloes in Punjab. During the period from January 2018 to December 2019, a total of 4885 buffaloes presented to the clinics and their clinical records were screened for anaemia. Of these 206 buffaloes were positive for anaemia with Hb level of <8 g/dL and among them 62 had severe anaemia with Hb level of <6 g/dL. The overall hospital prevalence of anaemia was recorded to be 4.21% and that of severe anaemia was 1.27%. The major cause of anaemia was inflammatory associated anaemia (51.61%) followed by post parturient haemoglobinuria (24.19%) and idiopathic haematuria (6.45%). The risk factors associated with development of anaemia in buffaloes were murrah breed, female sex, age > than 5 years, early pregnancy, lactation and winter season. Reduction in the haematological parameters (Hb, PCV and RBC count) was observed in different etiologies, which indicated severe anaemia.

Keywords: *Bubalus bubalis*, buffaloes, etiology, haematology, prevalence, severe anaemia

INTRODUCTION

India has achieved tremendous self-sustained development in the dairy sector. The total bovine population of the country was 302.79 million, of which 109.85 million was contributed by the buffalo population. Modern husbandry practices and production stress plays a pivotal role in the animals succumbing to illness. Anaemia is a major health problem occurs as a result of many disease conditions. Various etiologies like infectious, inflammatory, nutritional, neoplastic and immune-mediated conditions are responsible for anaemia in buffaloes. The treatment of anaemia in buffaloes mostly involved empirical therapy without addressing the primary cause as no appropriate literature is available about the various etiologies of anaemia in buffaloes. This needs to be studied in detail in different geographical regions to elucidate the appropriate prophylaxis and therapeutic management. Scientific research on management and health care ensures an improvement in their productivity. Therefore, the present study was envisaged to determine the prevalence and etiologies associated with anaemia in buffaloes in Punjab.

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MATERIALS AND METHODS

The present study was conducted at teaching veterinary clinical complex of GADVASU, Ludhiana and the records of a total of 4885 buffaloes presented to the clinics over a period of January 2018 to December 2019 were screened for anaemia. Anaemia was categorized as mild (8 to 10 g/dL), moderate (6 to 8 g/dL) and severe (<6 g/dL), based on the Hb concentration. The data regarding the etiology and hematological parameters in cases of severe anaemia was analyzed and compared with different epidemiological parameters such as breeds, sex, age groups, physiological status (pregnancy and lactation) and season. The collected data was subjected to basic statistical analysis as per Snedecor and Cochran (1989).

RESULTS AND DISCUSSIONS

Hospital prevalence and severity of anaemia in buffaloes

The hospital prevalence of anaemia in buffaloes was recorded to be 4.21% whereas Priyanka *et al.* (2020), who reported a 10.58% prevalence of anaemia in buffaloes. This might be due to the fact that presentation of buffaloes to the clinics for anaemic reasons was apparently less than cattle and needs further investigation. Based on the Hb concentration, it was observed that majority of the buffaloes suffered from severe (1.27%, mean Hb 4.53±0.14 g/dL) followed by moderate anaemia (2.94%, mean Hb 7.36±0.05 g/dL). Similar findings were recorded by Bhosale *et al*. (2020), who classified anaemia as moderate and severe based on Hb concentration 7.68±0.40 vs 5.15±0.75 g/dL respectively. The paucity of literature or work has been conducted to categorize the anaemia based on the level of haemoglobin in bubaline practice. The root cause of these variations could be due to the severity and stage of the ailment. Therefore, intense haematological evaluation should be carried out to evaluate the severity and stage of the disease.

Etiologies of severe anaemia in buffaloes

In the present study, various etiological factors contributing to anaemia were mineral deficiency, haemoprotozoans, systemic and infectious causes, neoplasm and idiopathic anaemia. The etiologies associated with the Hb level<6 g/dL were studied in buffaloes (Table 1 and Figure 1). Inflammatory associated anaemia was found to be the most common cause of anaemia (51.61%, mean Hb 4.73±0.17 g/dL) in buffaloes followed by post parturient haemoglobinuria (24.19%, mean Hb 4.57±0.30 g/dL) and idiopathic haematuria (6.45% mean Hb 3.40±0.23 g/dL). Ferraro *et al.* (2020) reported that blood loss during the penetration of the reticulum by foreign body or the chronic inflammatory process led to anaemia in traumatic reticulo peritonitis and traumatic pericarditis whereas Reddy *et al.* (2015) reported anaemia in acute diffused peritonitis condition. The results of present study were not in agreement with Lakhpati *et al.* (2019). Feeding of berseem (*Trifolium alexandrinum*), mustard, gram/lentil straw and wheat straw in the ration was responsible for causing post parturient haemoglobinuria in buffaloes. This might be owing to lower phosphorus content in feed or the presence of inhibitory substances such as metallic ions, which interfere with dietary absorption and assimilation of phosphorus (Sivakanesan, 1999). Pneumonia could cause anaemia due to the release of toxins by pathogens which ultimately lead to haemolysis in buffaloes (Abdulla *et al*., 2015).

Epidemiological factors related to diseases causing severe anaemia in buffaloes

Breed

The breed-wise prevalence revealed that inflammatory associated anaemia (29/53, mean Hb 4.68 g/dL) and post parturient haemoglobinuria (13/53, mean Hb 4.52 g/dL) was the highest in the Murrah as compared with the *Nili-ravi* breed of buffaloes (Table 2). This showed that the practice of rearing Murrah buffaloes in Punjab due to its adaptability, production and feeding practices might predispose them to severe anaemia.

Age

The buffaloes more than 5 years old had the highest prevalence of inflammatory associated anaemia (17/40, mean Hb 4.53 g/dL) followed by the post parturient haemoglobinuria (12/40, mean Hb 4.57 g/dL). The same etiologies also contributed to the occurrence of severe anaemia in the age group of 2 to 5 years whereas among the age-group of 6 months to 2 years single case of inflammatory associated anaemia (1/1, mean Hb 5.80 g/dL) was observed. The result coincided with Fubini *et al*. (2018) who reported the incidence of anaemia in cases of traumatic reticulo peritonitis in animals over one year old. This might be due to the switching of rations and allowing the animals to graze. The highest risk of occurrence of post parturient haemoglobinuria was recorded in the 3rd to 6th parity (Soren *et al*., 2014). This retrospective finding was corroborated with the previous research findings.

Pregnancy

In early pregnant buffaloes, inflammatory associated anaemia (4/5, mean Hb 4.90 g/dL) was reported highest followed by idiopathic haematuria (1/5, mean Hb 3.80 g/dL). Same etiologies were associated with severe anaemia in mid gestation period in addition to the involvement of abomasal ulcer (1/5, mean Hb 5.90 g/dL). Neoplasia, inflammatory associated anaemia and idiopathic haematuria were the recorded etiologies in cases of severe anaemia in buffaloes with late gestation. Inflammatory associated anaemia was mostly reported in pregnant animals due to the gravid uterus in the last trimester compressing the rumen and the reticulum, which was attributed to the penetration of the object and causing peritonitis and/or pericarditis.

Lactation

The occurrence of severe anaemia was highest in early lactation followed by mid and late lactation period. Post parturient haemoglobinuria (15/28, mean Hb 4.57 g/dL) was reported highest in early lactation followed by inflammatory associated anaemia (9/28, mean Hb 4.57 g/dL). These results were in agreement with Das and Mehul (2016) findings in which the haematological parameters such as PCV, RBC count, Hb concentration were reported to be low in early stage of lactation in buffaloes. Post parturient haemoglobinuria was more common in buffaloes during advanced pregnancy or within a month of parturition (Purohit *et al*., 2014).

Season

Among the anaemic cases reported during winter season, post parturient haemoglobinuria had the major occurrence (13/26, mean Hb 4.41 g/dL) followed by the idiopathic haematuria (3/26, mean Hb 3.26 g/dL). These study findings were in accordance with Akhtar *et al.* (2006) that nutritional haemoglobinuria and anaemia occurred during winter season. Soren *et al.* (2014)

Table 1. Retrospective data revealing etiology of severe anaemia in buffaloes.

Etiology	Hb<6 (g/dL) (n=62)	Hb<5 (g/dL) (n=40)	Hb<4 (g/dL) (n=20)	Hb<3 (g/dL) (n=07)
Inflammatory associated anaemia	32 (4.73±0.17)	20 (4.14±0.16)	07 (3.31±0.13)	2 (2.85±0.15)
Post parturient haemoglobinuria	15 (4.57±0.30)	09 (3.89±0.33)	05 (3.36±0.47)	01 (1.50)
Idiopathic haematuria	04 (3.40±0.23)	04 (3.40±0.23)	04 (3.40±0.23)	02 (3.00±0.00)
Neoplasia	03 (3.73±0.86)	02 (2.90±0.40)	02 (2.90±0.40)	01 (2.50)
Abomasal ulcer	02 (4.85±1.05)	01 (3.80)	01 (3.80)	0 (0.00)
Hemorrhagic Enteritis	02 (5.15±0.55)	01 (4.6)	0 (0.00)	0 (0.00)
Haemoprotozoan disease	02 (3.75±1.55)	01 (2.2)	01 (2.2)	01 (2.2)
Idiopathic anaemia	02 (4.55±0.05)	02 (4.55±0.05)	0 (0.00)	0 (0.00)

Values in parenthesis denote Mean±S.E.

Table 2. Epidemiological factors related to diseases causing anaemia in buffaloes (Hb<6, n=62).

Epidemiological factor etiology	Breed		Age			Pregnancy			Lactation			Season			
	Murrah	*Nili-Ravi*	6M-2yr	2-5 yr	>5 yr	E	M	L	E	M	L	M	P.M	W	S
Inflammatory associated anaemia (n=32)	29 (4.68)	03 (5.13)	01 (5.80)	14 (4.89)	17 (4.53)	04 (4.90)	03 (4.86)	01 (3.50)	09 (4.57)	07 (4.82)	01 (3.50)	15 (4.56)	02 (4.65)	07 (4.91)	08 (4.88)
Post parturient haemoglobinuria (n=15)	13 (4.52)	02 (4.90)	0	03 (4.53)	12 (4.57)	0	0	0	15 (4.57)	0	0	0	0	13 (4.41)	02 (5.55)
Idiopathic haematuria (n=04)	03 (3.53)	01 (3.00)	0	0	04 (3.40)	01 (3.80)	01 (3.00)	01 (3.80)	01 (3.00)	02 (3.40)	01 (3.80)	0	0	03 (3.26)	01 (3.80)
Neoplasia (n=03)	02 (2.90)	01 (5.40)	0	0	03 (3.73)	0	0	01 (3.30)	01 (2.50)	0	01 (3.30)	01 (5.40)	01 (2.50)	0	01 (3.30)
Abomasal ulcer (n=02)	01 (5.90)	01 (3.80)	0	01 (5.90)	01 (3.80)	0	01 (5.90)	0	0	0	02 (4.85)	01 (3.80)	0	01 (5.90)	0
Hemorrhagic Enteritis (n=02)	02 (5.15)	0	0	01 (5.70)	01 (4.60)	0	0	0	0	0	0	01 (5.70)	01 (4.60)	0	0
Haemoprotozoan disease (n=02)	01 (5.30)	01 (2.20)	0	01 (5.30)	01 (2.20)	0	0	0	01 (2.20)	0	0	01 (5.30)	0	01 (2.20)	0
Idiopathic anaemia (n=02)	02 (4.55)	0	0	01 (4.60)	01 (4.50)	0	0	0	01 (4.50)	0	0	01 (4.50)	0	01 (4.60)	0
Total	53	09	01	21	40	05	05	03	28	09	05	20	04	26	12

(M = Month; Yr = Year), (Pregnancy and lactation; E = Early; M = Mid; L = Late), (Season; M = Monsoon; P.M- = Post Monsoon; W = Winter; S = Summer). Values in parenthesis denoted mean Hb concentration.

Table 3. Haematological alterations in severely anaemic buffaloes based on etiology (Hb<6, n=62).

Etiology	Hb (g/dL)	PCV (%)	TEC (10^6/µL)	MCV (fL)	MCH (pg)	MCHC (%)	TLC (10^3/µL)	N (%)	L (%)	E (%)	Platelets (10^3/ µL)
Inflammatory associated anaemia (n=32)	4.73±0.17	13.88±0.52	2.51±0.16	55.22±2.23	19.36±0.67	34.21±0.56	11.20±0.13	64.71±4.01	34.97±4.03	2.50±0.50	210.52±42.26
Post parturient haemoglobinuria (n=15)	4.57±0.30	13.46±1.02	2.23±0.19	62.01±2.54	22.66±0.73	34.40±1.16	12.09±1.40	67.20±2.65	32.27±2.58	3.00±1.00	308.29±27.26
Idiopathic haematuria (n=04)	3.40±0.23	9.98±0.75	1.74±0.00	51.72±0.00	21.84±0.00	34.39±2.63	11.19±4.60	52.50±11.56	47.50±11.56	NA	430.00±0.00
Neoplasia (n=03)	3.73±0.86	10.73±2.17	2.43±0.80	51.74±5.30	18.48±1.76	34.37±1.37	10.50±4.90	74.67±7.90	25.33±7.90	NA	65.50±4.50
Abomasal ulcer (n=02)	4.85±1.05	13.55±3.25	2.68±0.66	50.72±0.27	18.26±0.55	36.01±0.89	8.30±0.50	83.00±7.00	17.00±7.00	NA	220.00±69.0
Hemorrhagic Enteritis (n=02)	5.15±0.55	14.85±1.45	3.24±0.83	47.87±7.72	16.56±2.52	34.64±0.32	11.08±2.25	76.00±6.00	24.00±6.00	NA	140.00±41.00
Haemoprotozoan disease (n=02)	3.75±1.55	10.45±3.55	2.83±0.00	49.47±0.00	18.73±0.00	34.87±2.99	12.83±3.10	63.00±3.00	37.00±3.00	NA	NA
Idiopathic anaemia (n=02)	4.55±0.05	13.95±0.15	3.42±0.00	40.35±0.00	13.45±0.00	32.62±0.71	5.60±4.24	61.00±11.00	39.00±11.00	NA	103.00±0.00
Control	11.9±0.11	29.60±0.22	7.00±0.07	42.0±0.20	20.52±0.48	37.40±0.06	9.33±0.15	35.20±0.08	56.40±1.20	1.60±0.00	233.20±4.92

Values in parenthesis denoted mean±S.E.

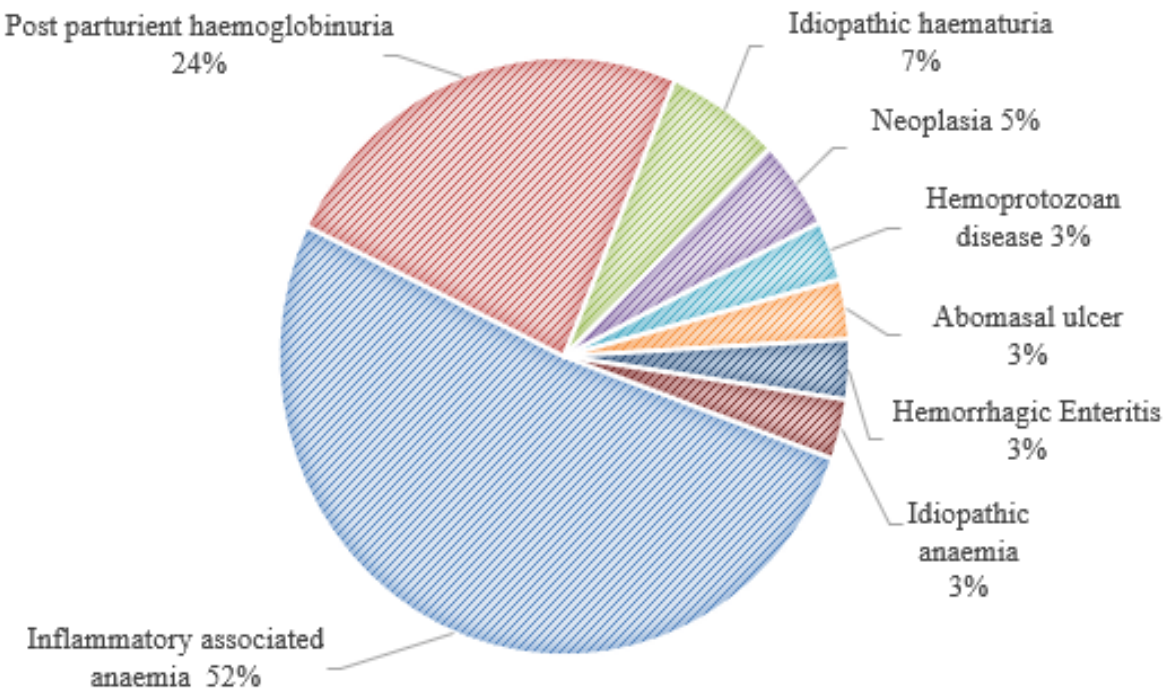


Figure 1. Various etiologies with Hb <6 g/dL in buffaloes.

reported a higher incidence of post parturient haemoglobinuria during winter while Jain *et al.* (2009) reported a higher incidence during summer season. The occurrence of traumatic reticulo peritonitis and pericarditis was most common during the dry season due to close grazing (Khalphallah *et al*., 2017), pattern of feeding by using the prehensile organ and feeding of chaffed green fodder accidently mixed with foreign objects which attributed to the development of foreign body syndrome in buffaloes leading to blood loss or inflammatory associated anaemia.

Haematological alterations in severely anaemic buffaloes based on etiology

In this present investigation, inflammatory associated anaemia was the predominant condition observed in buffaloes (Table 3) (mean Hb 4.73±0.17 g/dL and PCV 13.88±0.52%) followed by post parturient haemoglobinuria (mean Hb and PCV values of 4.57±0.30 g/dL and 13.46±1.02% respectively). These observations were similar to the findings of Soren *et al*. (2014) (mean Hb 4.58±0.20 g/dL). Abomasal ulcer, haemorrhagic enteritis, haemoprotozoan diseases and idiopathic anaemia had the lowest incidence. Anaemia of inflammatory disease (AID) could be caused by both infectious and noninfectious origin (Jones and Allison, 2007). Soluble inflammatory mediators were released during chronic inflammation limiting erythrocytic life span and impeding the activity of bone marrow.

CONCLUSION

The main etiology causing severe anaemia in buffaloes was found to be inflammatory associated with anaemia and post parturient haemoglobinuria. It is concluded that regular monitoring of the health state and prophylaxis was essential to avert such life-threatening severe anaemic conditions in buffaloes in order to improve production and thereby increase the livelihood of the farming community.

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