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Bharat S Siddhapara
M.V.Sc. Scholar, Department of Veterinary Physiology and Biochemistry, College of Veterinary Science and Animal Husbandry, Kamdhenu University, Navsari, Gujarat, India

Virendra K Singh
Assistant Professor, Department of Veterinary Physiology and Biochemistry, College of Veterinary Science and Animal Husbandry, Kamdhenu University, Navsari, Gujarat, India

Sandhya S Chaudhary
Professor and Head, Department of Veterinary Physiology and Biochemistry, College of Veterinary Science and Animal Husbandry, Kamdhenu University, Navsari, Gujarat, India

Gopal Puri
Associate Professor, Department of Veterinary Physiology and Biochemistry, College of Veterinary Science and Animal Husbandry, Kamdhenu University, Navsari, Gujarat, India

Axay B Joshi
Ph.D. Scholar, Department of Veterinary Physiology and Biochemistry, College of Veterinary Science and Animal Husbandry, Kamdhenu University, Navsari, Gujarat, India

Tanvi D Manat
Assistant Professor, Department of Veterinary Physiology and Biochemistry, College of Veterinary Science and Animal Husbandry, Kamdhenu University, Navsari, Gujarat, India

Prashant G Rathod
Ph.D. Scholar, Department of Veterinary Physiology and Biochemistry, College of Veterinary Science and Animal Husbandry, Kamdhenu University, Navsari, Gujarat, India

Corresponding Author:
Bharat S Siddhapara
M.V.Sc. Scholar, Department of Veterinary Physiology and Biochemistry, College of Veterinary Science and Animal Husbandry, Kamdhenu University, Navsari, Gujarat, India

Clinico-hematological profile of diarrheic Surti buffalo calves

Bharat S Siddhapara, Virendra K Singh, Sandhya S Chaudhary, Gopal Puri, Axay B Joshi, Tanvi D Manat and Prashant G Rathod

Abstract
The present study was conducted to study Clinico-hematological profile of diarrheic Surti buffalo calves. Thirty Surti buffalo calves were selected and divided into two groups viz healthy (n=10) and diarrheic calves (n=20). Recording of clinical profile scores such as fecal consistency, clinical dehydration as well as clinical depression was done simultaneous to blood collection in all the calves as soon as diarrhea was reported. Blood was analyzed for hematological parameters. Scores for fecal consistency, clinical dehydration as well as clinical depression were significantly ($p \leq 0.05$) higher in diarrheic calves as compared to healthy calves. Results obtained revealed that as compared to healthy control calves, diarrheic calves had significantly ($p \leq 0.05$) higher total erythrocyte count, hemoglobin concentration, hematocrit and mean corpuscular haemoglobin. Therefore, it was concluded that early changes during diarrhoea include increase in scores of fecal consistencies, clinical dehydration as well as clinical depression indicative of mild to moderate severity of diarrhea along with higher hematological parameters.

Keywords: Clinical profile, haematological profile, diarrhoea, Surti buffalo calves

1. Introduction
Livestock is an integral part of Indian agriculture scenario. Buffaloes are important contributors to livestock production in the country. Surti buffaloes are an important breed native to south Gujarat state. They contribute to milk and meat production and acts as means to ensure livelihood and nutritional security of the society at large. Production performance as an adult will depend on robust foundation laid during calfhood. Thus, successful calf raising is key to future performance of buffaloes as an adult. However initial days of life of calf is critical as they may suffer from several diseases such as commonly occurring diarrhea. Diarrhoea inflicts harms not only in terms of poor health but also to economical aspects in terms of treatment and management cost as well as drastic losses in terms of calf mortality. Diarrhoea in calves as a devastating disease has overwhelmed dairy industry (Pourjafar *et al*., 2011; Elhassan *et al*., 2011) [1, 2].
Irrespective of etiology, if diarrhea is left untreated and unmanaged may change its severity from mild to moderate and severe. Diarrhoea may be assessed with the help of clinical profiling in terms of fecal consistency score, clinical dehydration score and clinical depression score. However associated hemogram changes are also important to be studied as hematological changes are considered indicators of welfare and health may also help in accurately determining the severity of the disease. Studies done to observe early changes during calf diarrhea will not only help to quickly control the disease but also minimize economic losses. Therefore, the present study was planned with the objective to study clinico-hematological profile of diarrheic Surti buffalo calves.

2. Materials and Methods
The present study was approved by Institutional Animal Ethics Committee (IAEC) and was conducted at Department of Veterinary Physiology and Biochemistry, College of Veterinary Science and Animal Husbandry, Navsari (Kamdhenu University), Gujarat, India. Thirty Surti buffalo calves approximately of 2 months of age were selected for study from organized farm of Navsari city lying in southern coastal region of south Gujarat. Selected calves were divided into two groups i.e., healthy calves (n=10) as well as those suffering from diarrhoea i.e., diarrheic calves (n=20). Recording of clinical profile scores and collection of whole blood was done in all the calves.

Fecal consistency scores (Table 1), clinical dehydration scores (Table 2), clinical depression scores (Table 3) of all the calves were recorded as per scoring method (Walker *et al*., 1998) [3] mentioned below:

Table 1: Fecal consistency score

Score	Interpretation
0	Normal, faeces which is well formed
1	Pasty faeces
2	Semi-liquid faeces still with a solid component
3	Watery faeces

Table 2: Clinical dehydration score

Score	Interpretation
0	Normal, eyes are bright, skin pliable
1	Mild dehydration, slight loss of skin elasticity, skin tents >3 seconds, eyes do not recess into orbit
2	Moderate dehydration, slight loss of skin tents >3 seconds but < 10 seconds, eyes slightly recess into orbit
3	Severe dehydration unable to stand or suckle

Table 3: Clinical depression score

Score	Interpretation
0	Normal
1	Mild depression, suckles but not vigorously
2	Moderate, able to stand, weak suckling
3	Severe depression unable to stand and suckle

Whole blood (5 ml) was collected from jugular vein of healthy as well as calves suffering from diarrhoea in vacutainer containing anticoagulant K_3EDTA for hematological analysis. Analysis of hematological parameters such as total erythrocyte count (TEC), hemoglobin concentration (Hb), hematocrit (Hct)/packed cell volume (PCV) as well as and calculation of erythrocytic indices such as mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH) and mean corpuscular hemoglobin concentration (MCHC) was done.

Data obtained was tabulated and statistically analyzed using descriptive statistics to calculate Mean±SE, minimum and maximum values for each parameter in both the groups. Comparison of means between groups was done using student t-test for differences at 5% level of significance ($p \leq 0.05$).

3. Results

The results for clinical profile and haematological profile of healthy (control) and diarrheic (treatment) Surti buffalo calves are mentioned in table 4 and 5 respectively.

3.1 Clinical profile of calves

Fecal consistency score in healthy calves was 0.00±0.00 and diarrheic calves was 1.80±0.17. Minimum and maximum fecal consistency score in healthy calves ranged from 0 to 0 and in diarrheic calves from 1 to 3. Fecal consistency score was significantly ($p \leq 0.05$) higher in diarrheic calves as compared to healthy calves.

Clinical score of dehydration in calves of control group that were healthy was 0.00±0.00 and diarrheic calves was 1.35±0.11. Minimum and maximum Clinical dehydration score in healthy calves ranged from 0 to 0 and in diarrheic calves from 1 to 2. Clinical dehydration score was significantly ($p \leq 0.05$) higher in diarrheic calves as compared to healthy calves.

Clinical depression score in healthy calves was 0.00±0.00 and diarrheic calves was 1.45^{a}±0.11. Minimum and maximum fecal consistency score in healthy calves was 0 and in diarrheic calves ranged from 1 to 2. Clinical depression score was significantly ($p \leq 0.05$) higher in diarrheic calves as compared to healthy calves.

Table 4: Clinical profile of healthy and diarrheic Surti buffalo calves

Parameter	Group	Mean±SE	Range
Fecal consistency score (Scale 0-3)	Healthy calves (n=10)	0.00^{b}±0.00	0.00-0.00
	Diarrheic calves (n=20)	1.80^{a}±0.17	1.00-3.00
Clinical dehydration score (Scale 0-3)	Healthy calves (n=10)	0.00^{b}±0.00	0.00-0.00
	Diarrheic calves (n=20)	1.35^{a}±0.11	1.00-2.00
Clinical depression score (Scale 0-3)	Healthy calves (n=10)	0.00^{b}±0.00	0.00-0.00
	Diarrheic calves (n=20)	1.45^{a}±0.11	1.00-2.00
Means with alphabetical superscripts (a, b) differ significantly ($p \leq 0.05$) between groups			

3.2 Haematological Profile

Total erythrocyte count (TEC) in healthy calves was 6.83±0.15 $x10^6$ cell/µL and diarrheic calves was 7.33±0.13 $x10^6$ cell/µL. Minimum and maximum total erythrocyte count (TEC) of healthy calves ranged from 5.97 to 7.49 cells/µL and of diarrheic calves from 6.11 $x10^6$ to 8.40 $x10^6$ cells/µL. Total erythrocyte count (TEC) of diarrheic calves was significantly ($p \leq 0.05$) higher as compared to healthy calves.

Hemoglobin concentration (Hb) of healthy calves was 10.20±0.27 g/dl and diarrheic calves was 11.45±0.25 g/dl. Minimum and maximum hemoglobin concentration (Hb) of healthy calves ranged from 9.00 g/dl to 11.50 g/dl and of diarrheic calves from 9.50 g/dl to 13.50 g/dl. Hemoglobin concentration (Hb) was significantly ($p \leq 0.05$) higher in diarrheic calves as compared to healthy calves.

Hematocrit (Hct) of healthy calves was 33.34±0.38% and diarrheic calves was 34.87±0.49 %. Minimum and maximum hematocrit (Hct) in healthy calves ranged from 32.00 % to 35.70 % and in diarrheic calves from 32.00 % to 39.70 %. Hematocrit (Hct) of diarrheic calves was significantly ($p \leq 0.05$) higher as compared to healthy calves.

Table 5: Hematological profile of healthy and diarrheic Surti buffalo calves

Parameter	Group	Mean±SE	Range
Total erythrocyte count, TEC ($x10^6$ cell/µL)	Healthy calves (n=10)	6.83^b±0.15	5.97-7.49
	Diarrheic calves (n=20)	7.33^a±0.13	6.11-8.40
Hemoglobin concentration, Hb (g/dl)	Healthy calves (n=10)	10.20^b±0.27	9.00-11.50
	Diarrheic calves (n=20)	11.45^a±0.25	9.50-13.50
Hematocrit, (PCV) (%)	Healthy calves (n=10)	33.34^b±0.38	32.00-35.70
	Diarrheic calves (n=20)	34.87^a±0.49	32.00-39.70
Mean corpuscular volume, MCV (fL)	Healthy calves (n=10)	48.97±0.79	45.53-53.60
	Diarrheic calves (n=20)	47.90±1.24	38.33-60.88
Mean corpuscular hemoglobin, MCH (pg)	Healthy calves (n=10)	14.95^b±0.24	13.76-16.20
	Diarrheic calves (n=20)	15.91^a±0.38	12.18-18.82
Mean corpuscular hemoglobin concentration, MCHC (g/dl)	Healthy calves (n=10)	30.55±0.51	28.13-33.33
	Diarrheic calves (n=20)	31.74±1.20	29.24-41.93
Means with alphabetical superscripts (a, b) differ significantly ($p \leq 0.05$) between groups			

Mean corpuscular volume (MCV) of healthy calves was 48.97±0.79 fL and diarrheic calves was 47.90±1.24 fL. Minimum and maximum mean corpuscular volume (MCV) of healthy calves ranged from 45.53-53.60 fL to 38.33-60.88 fL and of diarrheic calves from 38.33 fL to 60.88 fL. As compared to healthy calves, mean corpuscular volume (MCV) was slightly lower in diarrheic calves but the difference was not significant.

Mean corpuscular hemoglobin (MCH) of healthy calves was 14.95±0.24pg and diarrheic calves was 15.91±0.38pg. Minimum and maximum mean corpuscular hemoglobin (MCH) of healthy calves ranged from 13.76 pg to 16.20 pg and of diarrheic calves from 12.18 pg to 18.82 pg. Mean corpuscular hemoglobin (MCH) of diarrheic calves was significantly ($p \leq 0.05$) higher as compared to healthy calves.

Mean corpuscular hemoglobin concentration (MCHC) of healthy calves was 30.55±0.51 and diarrheic calves was 31.74±1.20. Minimum and maximum mean corpuscular hemoglobin concentration (MCHC) of healthy calves ranged from 28.13 to 33.33 and of diarrheic calves from 29.24 to 41.93. Mean corpuscular hemoglobin concentration of diarrheic calves (MCHC) was significantly ($p \leq 0.05$) higher as compared to healthy calves.

4. Discussion

4.1 Clinical profile of calves

Scoring of feces based on consistency is an accurate method for identifying diarrheic calves (Graham *et al*., 2018) [4]. Higher score indicates more fluidic nature of feces and increasing severity of diarrhoea.

In the present study the results for fecal consistency score revealed that healthy calves showed normal and well-formed faeces whereas faeces of calves suffering from diarrhoea ranged from being pasty to watery with most of them resembling semi-liquid consistency along with minimal solid content. Significantly higher fecal consistency score in diarrheic calves indicated that they suffered from diarrhoea of moderate severity.

Generally, consumption of excess milk by pre-ruminant calves leads to excess conversion of lactose to lactic acid causing a change in pH of GIT that may ultimately affect microflora causing indigestion and diarrhoea (Sjaastad *et al*., 2010) [5]. Relevance of fecal consistency score for consistently assessing the severity of diarrhoea has also been highlighted by Renaud *et al*. (2020) [6]. Several factors may affect severity of diarrhoea hence scoring of feces is subjective assessment that requires repetitive application along with other assessment methods for particular breed, species as well as region.

Dehydration is one of the major complications associated with fluid loss during diarrhoea with signs that manifest as loss of skin turgor and elasticity, increased skin tenting and recession of eyeball. In the present study control group of healthy calves presented normal eyes that were bright and skin was pliable indicating adequate hydration. Significantly higher score for dehydration in treatment group of diarrheic calves of present study indicates that they suffered mild to moderate dehydration with slight loss of skin tent and minor recession of eyes in orbit. Similar dehydration scores for assessing severity of diarrhoea have been successfully used by Sharma (2013) [7] and Jaiswal (2019) [8] in calves.

Depression is a common sequela of diarrhoea, due to hypovolemia and electrolyte imbalance leading to increased compensatory cardiac pumping, muscle weakness and energy deficit.

In the present study, control group of healthy calves showed normal vigour whereas diarrheic calves were unthrifty, less in vigour and reluctant to stand for long duration.

Clinical depression score has been used in many studies to characterize the severity of diarrhoea (Sharma, 2013 and Patil, 2013) [7, 9]. During diarrhoea clinically depressed calves have been frequently reported (Tikoo and Soodan, 2009; Devkate *et al*. 2010 and Kumar *et al*. 2010) [10, 11, 12].

Average age of diarrheic calves in the present study was approximately 2 months (56.35±2.30 days) and the study was done towards the end of winter season that is comfortable for livestock. Even though etiology of diarrhoea is multifactorial (infectious as well as non-infectious), the chances of infections in a well-managed farm that too at 2 months of age is minimal although not exclusive.

Irrespective of the etiology, immediate period following onset of diarrhoea is accompanied with dehydration and hypovolemia that results in hemoconcentration (Radostits *et al*., 2007) [13] and relative increase in blood cells such as erythrocytes (relative polycythaemia). This possibly can be the reason for significant increase in total erythrocyte count, hemoglobin concentration and hematocrit of the diarrheic calves in present study. Higher hematocrit values have been frequently observed in dehydration lasting for short durations (Groove-white and White, 1999) [14]. It acts as a sensitive indicator for assessing severity of dehydration (Dhaliwal *et al*., 1993; Rajora and Pachauri, 2000) [15, 16].

Such increase in TEC, Hb and Hct has been reported invariably in calf diarrhoea. The results of present study for TEC are in agreement with Tikoo and Soodan (2009) [10], Kumar *et al*. (2010) [12], Tikoo *et al*. (2017) [17] and Mir *et al*. (2010) [18]. The results of present study for hemoglobin concentration are in agreement with Tikoo and Soodan (2009)

[10], Kumar *et al*. (2010) [12] (Gupta, 2016) [19], and Asati *et al*. (2008) [20]. The results of present study for hematocrit are in agreement with Tikoo and Soodan (2009) [10], Kumar *et al.* (2010) [12], Asati *et al*. (2008) [20], Kaur *et al*. (2006) [21] and Roy *et al*. (2009) [22].

Therefore, increased levels of TEC, Hb concentration and hematocrit may be considered as initial changes that occur during diarrhoea in Surti buffalo calves.

4.2 Erythrocytic indices

Erythrocytic indices in hemogram profile such as MCV, MCH and MCHC are calculated from values of TEC, Hb and Hct rather than directly measured. So, variation in values simulates the trend of variations of TEC, Hb and Hct. In spite of significant increase in TEC, Hb and Hct their relative increase with respect to each other can nullify and result in non-significant variations of MCV and MCHC as was the case in present study. However, the increase in MCH levels was significantly high in diarrheic calves. Result similar to significant increase in MCH in present study has been reported by Gupta (2016) [19] and Nayak *et al*. (2019) [23]. Nayak *et al.* (2019) [23] have also reported non-significant differences for MCHC between healthy and diarrheic calves. Non-significant differences for MCV and MCHC similar to present study have also been reported by Kumar *et al.* (2018) [24] between normal calves and calves affected from diarrhoea.

5. Conclusion

It was concluded from the present study that as compared to healthy Surti buffalo calves, significant changes in clinico-hematological and biochemical profile of diarrheic Surti buffalo calves comprised of higher clinical profile scores of fecal consistency, clinical dehydration and clinical depression indicative of mild to moderate severity of diarrhea. Initial haematological changes consisted of higher hemogram parameters such as hemoglobin concentration, hematocrit, total erythrocyte counts and mean corpuscular haemoglobin. They should be taken into consideration with progression of diarrhea.

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