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Diagnostic evaluation of rumen function and physiological parameters in buffaloes with fore-stomach disorders

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Abstract

Fore-stomach disorders are among the most prevalent digestive disturbances in buffaloes, leading to reduced productivity and significant economic losses. The present study was undertaken to evaluate the diagnostic significance of rumen function and selected physiological parameters such as rumen consistency, rectal temperature, respiration rate, heart rate, and ruminal motility in buffaloes affected with various fore-stomach disorders. Buffaloes suffering from simple indigestion, acidosis, alkalosis, tympany, ruminal impaction, traumatic reticulo-peritonitis (TRP), traumatic pericarditis (TP), diaphragmatic hernia, and omasal impaction were compared with healthy controls.

Rumen consistency was predominantly tense in most disorders, whereas doughy and hard consistency were characteristic of ruminal impaction. Rectal temperature remained within normal limits in most disorders but showed significant elevation in TRP and TP, indicating systemic inflammatory response. Respiration and heart rates were significantly increased in severe conditions, while ruminal motility was reduced in almost all disorders. The study concludes that rumen function and physiological parameters are valuable diagnostic indicators for differentiation and assessment of severity in fore-stomach disorders in buffaloes.

Keywords: Buffalo, fore-stomach disorders, rumen motility, traumatic reticulo-peritonitis, Tympany

Introduction

Fore-stomach disorders in buffaloes are commonly encountered in veterinary clinical practice and include conditions such as simple indigestion, ruminal acidosis, alkalosis, tympany, impactions, and traumatic conditions like reticulo-peritonitis and pericarditis. These disorders disturb rumen physiology, microbial activity, and fermentation processes, ultimately affecting animal health and leading to decreased productivity and economic losses. (Constable *et al.*, 2017; Radostits *et al.*, 2020) ^[11, 12].

The rumen plays a crucial role in digestion, and any dysfunction can lead to significant systemic consequences. Clinical and physiological parameters such as rumen consistency, ruminal motility, rectal temperature, respiration rate, and heart rate serve as important diagnostic tools in identifying and differentiating fore-stomach disorders in buffaloes (Smith, 2020) ^[12]. Under field conditions, where advanced diagnostic tools may not always be readily available, the assessment of rumen function along with basic physiological parameters provides a practical and cost-effective approach for diagnosis (Radostits *et al.*, 2007) ^[11].

Parameters such as rumen motility and consistency reflect the functional status of the rumen, while rectal temperature, respiration rate, and heart rate indicate the degree of systemic involvement (Constable *et al.*, 2017; Rosenberger, 1990) ^[11, 15].

Alterations in rumen function, along with changes in physiological parameters, provide valuable insight into the severity and progression of these conditions. Therefore, the combined assessment of rumen function and physiological parameters plays a vital role in the early diagnosis and effective management of fore-stomach disorders, ultimately improving clinical outcomes and minimizing economic losses.

However, although several studies have evaluated individual fore-stomach disorders, a comparative clinico-physiological assessment across multiple such disorders in buffaloes remains limited. In this context, the present study was designed to evaluate and compare rumen function and selected physiological parameters in buffaloes affected with different fore-stomach disorders.

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Materials and Methods

The study was conducted on buffaloes presented to the Veterinary Clinical Complex. During study 10 healthy buffaloes (control group) and 107 buffaloes affected with different fore-stomach disorders were included. The affected buffaloes were categorized into groups such as simple indigestion, ruminal acidosis, alkalosis, tympany, ruminal impaction, traumatic reticulo-peritonitis, traumatic pericarditis, diaphragmatic hernia, and omasal impaction.

A detailed clinical examination was carried out for each animal. Rumen consistency was assessed by palpation, rectal temperature was recorded using a clinical thermometer, respiration rate was measured per minute, heart rate was determined by auscultation, and ruminal motility was assessed by observing ruminal contractions per minute. The data were expressed as Mean $\pm$ Standard Error (SE) and analysed statistically using ANOVA to determine the significance of differences among groups.

Results and Discussion

The present study revealed that rumen consistency was predominantly tense in 88.78 percent of the buffaloes affected with fore-stomach disorders such as simple indigestion, acidosis, alkalosis, tympany, traumatic reticulo-peritonitis, traumatic pericarditis, and diaphragmatic hernia. This may be attributed to gas accumulation and increased intraruminal pressure. In contrast, ruminal impaction cases exhibited hard (54.54%) and doughy (36.36%) consistency, indicating accumulation of dry ingesta and reduced ruminal fluidity. Similar findings have been reported by Athar (2011) [1] and Hussain and Uppal (2012) [6], who observed firm rumen consistency in impaction cases due to chronic stasis.

The mean rectal temperature in healthy buffaloes was recorded as $100.02 \pm 0.16^\circ\text{F}$. In most fore-stomach disorders such as simple indigestion, acidosis, alkalosis, tympany, diaphragmatic hernia, and omasal impaction, the rectal temperature remained within normal range, indicating absence of systemic involvement. However, a significant increase in rectal temperature was observed in cases of traumatic reticulo-peritonitis ($102.61 \pm 0.28^\circ\text{F}$) and traumatic pericarditis ($103.08 \pm 0.14^\circ\text{F}$), suggesting severe

inflammatory response. This increase may be due to infection and inflammation caused by penetrating foreign bodies in the reticulum, as also reported by Singh *et al.* (1983) [17], Sojka *et al.* (1990) [20], and Sharm. (2022) [16].

The respiration rate in healthy buffaloes was recorded as 22.80 ± 0.85 per minute, whereas a significant increase was observed in most diseased groups, particularly in tympany, traumatic reticulo-peritonitis, and traumatic pericarditis. The highest respiration rate was recorded in traumatic pericarditis ($50.40 \pm 0.98/\text{min}$). This increase may be attributed to pain, elevated body temperature, and mechanical pressure on the diaphragm due to ruminal distension. Similar observations were reported by Mohan *et al.* (2015) [8] and Patel *et al.* (2023) [9].

The mean heart rate in healthy buffaloes was 72.2 ± 1.55 per minute. A significant increase in heart rate was observed in buffaloes affected with traumatic reticulo-peritonitis, traumatic pericarditis, and diaphragmatic hernia. The highest heart rate was observed in traumatic pericarditis ($94.60 \pm 1.60/\text{min}$), which may be due to cardiac involvement, pericardial inflammation, and reduced cardiac efficiency. These findings are in agreement with Radostits *et al.* (2020) [11] and Smith (2020) [21].

Ruminal motility in healthy buffaloes was recorded as 1.5 ± 0.11 per minute, whereas it was reduced in all fore-stomach disorders. The most severe reduction was observed in ruminal impaction ($0.18 \pm 0.16/\text{min}$). The reduction in ruminal motility may be attributed to inflammation, adhesions, pain, and altered rumen microflora. Similar findings have been reported by Ramprabhu *et al.* (2003) [14], Chaudhary *et al.* (2007) [3], and Suthar and Patel (2009) [22].

The findings revealed significant alterations in rumen activity, characterized by reduced or absent motility and changes in rumen consistency in affected animals. Physiological parameters also exhibited marked deviations, with variations in temperature, pulse, and respiration rate indicating systemic involvement.

Overall, the study indicates that non-traumatic fore-stomach disorders cause mild physiological alterations, whereas traumatic conditions such as reticulo-peritonitis and pericarditis result in severe systemic changes including fever, tachycardia, and tachypnea.

Table 1: Mean $\pm$ SE values of clinical parameters (Temperature, Heart Rate, Respiratory Rate and Ruminal motility) in healthy buffaloes and buffaloes affected with various fore-stomach disorders

Parameters	Healthy Buffaloes		Simple Indigestion (n = 35)	Acidosis (n = 18)	Alkalosis (n = 4)	Tympany (n = 21)	Rumen Impaction (n = 11)	Traumatic reticulo-peritonitis (n = 9)	Traumatic pericarditis (n = 5)	Diaphragmatic hernia (n = 3)	Omasal Impaction (n = 1)
	Range	Mean $\pm$ SE									
Temperature ($^\circ\text{F}$)	99-100.7	100 ± 0.15	99.96 ± 0.21	100.57 ± 0.45	100.63 ± 0.27	101.72 ± 0.42	99.82 ± 0.48	$102.61 \pm 0.28^*$	$103.08 \pm 0.14^*$	101.70 ± 0.20	100 ± 00
Heart Rate (per min.)	65-80	72.20 ± 1.55	70.26 ± 2.25	80.05 ± 1.92	76.50 ± 0.63	72.24 ± 2.53	80.90 ± 1.70	$82.78 \pm 1.23^*$	$94.60 \pm 1.60^*$	73.67 ± 0.22	63.00 ± 00
Respiratory Rate (per min.)	20-28	22.80 ± 0.85	$33.86 \pm 1.07^*$	$30.78 \pm 1.10^*$	$32.75 \pm 0.79^*$	$39.81 \pm 0.70^*$	24.34 ± 0.78	$49.56 \pm 1.30^{**}$	$50.40 \pm 0.98^{**}$	$31.67 \pm 0.44^*$	24.00 ± 00
Rumen Consistency	Doughy	00 (00)	00 (00)	00 (00)	00 (00)	06 (54.54)	00 (00)	00 (00)	00 (00)	00 (00)	06 (5.60)
	Hard	00 (00)	00 (00)	00 (00)	00 (00)	05 (45.45)	00 (00)	00 (00)	00 (00)	01 (100)	06 (5.60)
	Tense	35 (100)	18 (100)	04 (100)	21 (100)	00 (00)	09 (100)	05 (100)	03 (100)	00 (00)	95 (88.78)
Rumen motility (per two min)	1-1.5	3.0 ± 00	$2.68 \pm 0.26^*$	$1.44 \pm 0.21^*$	$1.00 \pm 0.18^*$	$1.34 \pm 0.21^*$	$0.68 \pm 0.16^*$	$1.12 \pm 0.17^*$	$1.60 \pm 0.26^*$	$2.60 \pm 0.18^*$	2.00 ± 00

Table 2: Rumen Consistency of fore-stomach disorders in buffaloes

Characteristic	Observations	Number of affected Buffaloes									107
		Simple Indigestion (n = 35)	Acidosis (n = 18)	Alkalosis (n = 4)	Tympany (n = 21)	Rumen Impaction (n = 11)	Traumatic reticulo-peritonitis (n = 9)	Traumatic pericarditis (n = 5)	Diaphragmatic hernia (n = 3)	Omasal Impaction (n = 1)	
Rumen Consistency	Doughy	00 (00)	00 (00)	00 (00)	00 (00)	06 (54.54)	00 (00)	00 (00)	00 (00)	00 (00)	06 (5.60)
	Hard	00 (00)	00 (00)	00 (00)	00 (00)	05 (45.45)	00 (00)	00 (00)	00 (00)	01 (100)	06 (5.60)
	Tense	35 (100)	18 (100)	04 (100)	21 (100)	00 (00)	09 (100)	05 (100)	03 (100)	00 (00)	95 (88.78)

Conclusion

In conclusion, the combined evaluation of rumen related parameters, particularly rumen motility and consistency, serve as primary diagnostic indicators in the assessment of fore-stomach disorders in buffaloes. Alterations such as reduced or absent ruminal motility and changes in rumen consistency are consistently observed across various fore-stomach conditions, reflecting disturbances in ruminal function. Alongside these, physiological parameters including rectal temperature, respiration rate, and heart rate (TRH) provide supportive information regarding the systemic involvement of the disease. While most fore-stomach disorders exhibit mild to moderate systemic changes, more severe or traumatic conditions may be associated with pronounced alterations in these physiological parameters. Thus, the combined evaluation of rumen function and TRH parameters enhances the accuracy of diagnosis, enabling early detection, better clinical assessment, and improved prognosis in buffaloes affected with fore-stomach disorders.

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