RESEARCH ARTICLE

A Hospital-Based Study on Gastrointestinal Impaction Disorders in Dairy Buffaloes

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Abstract

Gastrointestinal impaction is mainly encountered during months of feed scarcity. Present study was aimed to throw light on the clinical characteristics of gastrointestinal impaction in 103 dairy buffaloes out of 1036 brought to VCC, LUVAS, Hisar, Haryana for various ailments and its associated haemato-biochemical alterations during March 2022 to June 2022. Overall hospital-based prevalence of gastrointestinal impaction was found to be 9.94 % (103/1036), being significantly higher in May month in comparison to other three months. Majority (70.8%) animals were anorectic and had rumen stasis, hard rumen texture. Haematological picture depicted significant neutrophilia and lymphopenia with non-significant variation in other parameters. Biochemical analysis revealed hypocalcemia, hyperglycemia, hyponatremia, hypochloremia, hypophosphatemia, hypokalemia and increased BUN with non-significant variation in total protein and creatinine. Standard treatment either surgical or non-surgical was based on clinical and haemato-biochemical variations. The dairy buffaloes are prone to gastrointestinal impaction on wheat and paddy straw feeding although the gradual introduction of new fodder with supplementation of minerals and electrolytes along with proper treatment of fresh wheat straw should be adopted for prevention of gastrointestinal impaction.

Key words: Buffaloes, Foreign body syndrome, Hypocalcemia, Hypokalemia, Impaction

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Introduction

With recent modifications in agricultural, animal production, and feeding practices, there is an increase in the incidence of gastrointestinal disorders particularly impaction syndrome in dairy animals (Hussain and Uppal, 2012). Impaction refers to ingesta accumulation in the gastrointestinal tract that is one of the major causes of mechanical dysfunction of the fore-stomach leading to high economic loss to the farmers owing to reduced milk production and mortality many a time. Fore-stomach is the major organ involved in the digestion of ruminants where due to microbial activity modification of plant materials occurs (Biswal *et al.,* 2016). A combination of low digestibility and excessive intake of the roughages leads to their accumulation in the fore-stomach and abomasum with resulting rumeno-abomasal impaction.

Gastrointestinal (GI) impaction is mainly encountered during months of feed scarcity (Prasad and Rekib, 1979) and occurs due to feeding of poor-quality hay, straw, or roughages deficient in protein and readily digestible carbohydrate, overeating of young grasses, ingestion of moldy or decomposed feed, polythene bags, ropes, and other plastic materials (Radostits *et al.,* 2007). Most pronounced signs include decreased rumen motility or rumen atony, abdominal distension, anorexia, constipated feces, occasional diarrhoea, normal to increased temperature, increased pulse rate, hard consistency of rumen, and solid mass on the left side on per rectal examination (Singh *et al.,* 2016; Kumar *et al.,* 2019). In India and abroad, various studies have been undertaken on clinical and haemato-biochemical alterations in GI impaction disorders. However, hospital-based epidemiological studies of these conditions seem to receive little attention, especially from Indian workers. So, the present study was designed to document hospital-based prevalence along with clinical and haemato-biochemical alterations of gastrointestinal impaction during a specific period of summer in dairy buffaloes of Haryana.

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Materials and Methods

Ethical Considerations: The study being clinical based on clinical cases reported at a veterinary hospital, LUVAS, Hisar, Haryana (India) for treatment, no approval of IAEC was required.

Selection and Examination of Animals

The present study was carried out for four months, *i.e.,* during March 2022 to June 2022 in dairy buffaloes (n=1036) brought to a referral hospital, Lala Lajpat Rai University of Veterinary and Animal Sciences, Hisar, India. Out of 1036 registered buffaloes, 103 female buffaloes aged 4-8 years with illness ranging from 2 days to 45 days were included in the study. The clinical examination included a recording of rectal temperature (°F), the appearance of the mucous membrane, palpation of lymph node, heart rate, fecal consistency and output, and rumen consistency, rumen motility, auscultation of lung and heart and per-rectal examination.

Blood and Radiological Examination

Blood and serum samples were collected from each case and processed for the estimation of haemato-biochemical parameters. A complete blood count was performed using an automatic blood analyzer calibrated for buffalo blood (HD Consortium India Limited, India). Estimation of serum biochemical parameters included glucose, blood urea nitrogen (BUN), creatinine, calcium (Ca), phosphorous, sodium (Na), chloride (Cl), potassium (K), and total protein using an automated random access clinical chemistry analyzer (EM Destiny 180, Erba Diagnostics Mannheim GmbH).

The radiographic examination of the reticulo-diaphragmatic and thoracic regions of affected animals was done, whenever required, in a standing position (lateral view), to identify foreign body syndrome and pneumonic changes, if any.

Rumen Liquor Analysis

Rumen liquor samples (10–15 mL) were collected using a 16-gauge, 4- or 6-inch-long needle inserted perpendicularly into the left paralumbar fossa from 20 representative animals. Rumen liquor was filtered through a double-layer muslin cloth and then centrifuged. It was immediately examined for physical characters, *i.e.,* color, odour, and consistency, chemical character (pH) using universal pH paper indicator and microscopic examination for evaluating protozoal motility that was graded from +1 to +4.

Based on history, clinical findings, and ancillary testing, *i.e.,* per rectal examination, rumen liquor analysis, and radiography, all the animals were divided into nine different etiology-based clinical conditions of gastro-intestinal impaction, and based on the degree of severity of impaction, were categorized into mild, moderate, and severe. Therapy either surgical or medical management was chosen based on the investigative findings in individual cases.

Statistical Analysis

All statistical analyses were performed using the IBM, SPSS Statistic 23 program, and results were represented as mean ± standard error. Significance was set at $p \leq 0.05$ and $p \leq 0.01$ levels. Data were subjected to a student t-test for comparison between control values and animals with rumen impaction.

Results and Discussion

On the basis of clinical and ancillary test findings, the hospital-based prevalence of gastrointestinal impaction during the study period was found to be 9.94% (103/1036). The prevalence of nine different etiology-based clinical conditions of gastro-intestinal impaction observed is depicted in Table 1. Out of 103 buffaloes, 60 animals were diagnosed with different conditions, *viz*., traumatic reticulo-peritonitis (n=21), diaphragmatic hernia (n=15), pneumonia (n=11), hydrothorax (n=7), and traumatic pericarditis (n=6), based on thoracic and reticulo-diaphragmatic radiography, and ultrasonography (Table 1). Month-wise hospital-based prevalence and anamnesis of affected animals have been depicted in Table 2 and 3. Major proportions of animals (89.3%) were having a history of a recent change in fodder. According to degree of severity of impaction, maximum cases (56) were of a moderate category with seventeen (17) animals having severe gastrointestinal impaction (Table 3).

Table 1: Primary etiological characterization of dairy buffaloes affected with gastrointestinal impaction

Primary etiological characterization	No. of cases (n=103)
Traumatic reticulo-peritonitis	21 (20.39%)
Diaphragmatic hernia	15 (14.56%)
Reticular abscess	5 (4.85%)
Late pregnancy indigestion	3 (2.91%)
Traumatic pericarditis	6 (5.82%)
Fore-stomach impaction	26 (25.24%)
Intestinal impaction	9 (8.73%)
Hydrothorax	7 (6.79%)
Pneumonia	11 (10.67%)

Table 2: Month wise prevalence of impaction in affected buffaloes

Month	Total no. of cases (n= 1036)	Total no. of impaction cases (n= 103)
March	272	19 (18.45%)
April	245	19 (18.45%)
May	283	55 (53.39%)
June	236	10 (9.71%)

Table 3: Clinical profile of gastro-intestinal impaction affected dairy buffaloes (n=103)

Clinical profile	Clinical stage		
	Mild (n= 30)	Moderate (n=56)	Severe (n= 17)
Reduction in faeces	+ (0-7 d)	++ (7-15 d)	+++ (>15 d)
Reduced rumination	+	++	+++
Tympany/ Bloat	-	+	++
Reduction in feed intake	+	++	+++/++++
Depression	+	++	+++

-, Negative clinical findings; +, Positive clinical findings; the number of "+" symbols indicate degree of the finding/severity.

In present study, the affected animals were presented and studied during the green fodder scarcity period (May to July) in Haryana, India. Kumar *et al.* (2019) and Prasad and Rekib (1979) also confirmed impaction during the green fodder scarcity period. Hospital-based prevalence of gastrointestinal impaction in diary buffaloes found during the specific period in the present study (9.94%) was similar to that (7.5%) reported by Hussain *et al.* (2012) in Indian water buffalo. History revealed that a major proportion of cases was associated with the feeding of wheat straw and drastic change in fodder, which may be because of poor digestibility and low nutritional value of wheat straw (Radostits *et al.,* 2007; Toor and Saini, 2008). Affected buffaloes under study were mainly adults ranging from 4-8 years of age. Morwal *et al.* (2019) also reported impaction in buffaloes aged 4-8 years in and around the Udaipur district of Rajasthan, India. However, Sharma *et al.* (2003) reported that the average age of cattle with gastrointestinal affection was below five years and trichobezoar was associated with acute rumen tympany in calves and young cattle. High occurrence in buffaloes having age more than 4 years (adult) in the present study could be due to differences in feeding habits and practices among adults and heifers.

Gastrointestinal impaction in the present study was found mostly in early lactating non-pregnant buffaloes (89) than advanced pregnant (3) ones. On the contrary, Saini *et al.* (2001) opined that the intra-abdominal pressure due to pregnancy and ruminal tympany might facilitate the penetration of foreign bodies into the reticular wall and other abdominal and thoracic organs in ruminants. The higher number of ruminal disorders in non-pregnant buffaloes in the present study could be due to poor feeding management, although this should be validated with a greater number of animals over a longer time period. The present study inferred adult early lactating non-pregnant buffalo to be more predisposed to gastrointestinal impaction probably due to disturbed calcium homeostasis because of increasing age as well as high milk production hampering its adaptation mechanism (Constable *et al.,* 2017).

Regarding findings of vital parameters, majority of affected animals were having normal temperature (96.1%), respiration rate (77.6%), mucous membrane color (89.3%), and hard rumen consistency (98.05%) with reduced/absent ruminal movements (94.1%)(Table 4). Although increased respiration rate was noticed in some of the clinical cases. Similar findings, *i.e.,* hyperpnea, were reported by Akraiem and Al-Galil, (2016), and Samkange *et al.* (2019) in bovine rumen impaction in eastern-central Namibia. In our study, gastrointestinal impaction due to fore-stomach impaction (26; 25.2%) was the leading etiology followed by traumatic reticulo-peritonitis (21; 20.3%). This might be attributed to drastic changes in feeding habits as well as the lesser availability of green fodder. Untreated wheat straw has reduced nitrogen, the higher mass of lignification, and lower digestibility (40-50%)(Mesfin and Ktaw, 2010). So, it is advised for the pretreatment of straw with urea for improving crude protein, *in vitro* organic matter digestibility, and rumen degradability. Ismail *et al.* (2007) found rumen impaction due to metallic or non-metallic foreign bodies as a most common cause. Anorexia in the present study was attributed to reduced motility of the stomach and intestine, which might have resulted from neurological and functional disturbance, inflammation, grain loading, and mechanical obstruction (Hussain *et al.,* 2022). Ruminal tympany observed in the present study could also be due to factors like failure of the eructation mechanism, traumatic reticulo-peritonitis, motility disorders, and mechanical and functional obstructions.

Table 4: Clinical examination results of 103 buffaloes with gastro-intestinal impaction

Characteristic	Findings	No of animals
General condition	Moderately disturbed	42 (40.78%)
	Severely disturbed	61 (59.22%)
Mucous membrane	Normal	92 (89.32%)
	Congested	11 (10.68%)
Dehydration	Mild	30 (29.16%)
	Moderate	56 (54.36%)
	Severe	17 (16.50%)
Temperature	Normal (99-102 °F)	99 (96.11%)
	Increased (>102 °F)	4 (3.89%)
Heart rate (beats/ min)	Normal (60-80)	78 (75.73%)
	Low (26-35)	25 (24.37%)
Rumen motility	Reduced (<3/2 min)	6 (5.82%)
	Absent	97 (94.18%)
Rumen consistency	Doughy	2 (1.94%)
	Hard	101 (98.06%)
Respiration rate/min	Normal (15-25)	80 (77.67%)
	Slightly raised (>26-35)	23 (22.33%)

The greenish-black colour of ruminal fluid in affected animals suggested prolonged stasis and decomposition of food within the fore-stomach (Priyanka and Dey, 2018). Chronic anorexia and ruminal dysfunction might have caused rumen microbial inactivity, which could have attributed to poor to nil motility of protozoa (Turkar and Uppal, 2007). The majority of animals in our study had ruminal fluid pH in the range of 6-8 with reduced to nil protozoal activity and greenish-black colour suggesting a marginal or developing problem of ruminal alkalosis, which was also reported by Boodur *et al.* (2010), where alkaline pH was because of plastic indigestion cases. The marginally increased range of ruminal fluid pH in the present study might be the presence of plastics, rags, and ropes which probably contributed to the development of ruminal alkalosis. The lower motility and reduction in the number of protozoa in the present study indicated disturbance in the ruminal environment and rumen microflora. The concentration of protozoa in rumen contents generally increased with the addition of concentrates over roughage diets (Dehority and Orpin, 1997). The sluggish

motility and the low number of protozoa observed in the present study could be due to the non-availability of good green fodder causing underfeeding, and undesirable changes in the microbial population.

The mean values of various haemato-biochemical parameters in comparison to healthy animals are depicted in Table 5. The mean value of neutrophils (69.04±1.25%) was significantly higher ($p<0.05$), whereas the mean value of lymphocyte count (26.7±1.54%) was significantly lower as compared to healthy animals ($p<0.05$) while other parameters showed non-significant variation. Similar non-significant changes in the haematology of omasal impaction affected buffaloes have been reported earlier (El-Attar *et al.,* 2012). The majority of diseased animals demonstrated neutrophilia attributable to toxemia as a result of chronic irritation of gastro-intestinal wall due to accumulated ingesta with potential inflammatory complications of impacted feed material (El-Ashker *et al.,* 2018; Kumar *et al.,* 2019).

Table 5: Haemato-biochemical alteration in affected buffaloes (Mean ±SE)

Parameters	Healthy buffaloes# (N=10)	Affected buffaloes (N=103)
Haemoglobin (gm/dL)	11.35±0.31	11.81±0.20 NS
TLC (×10^3/µL)	9.25±0.34	8.65±0.31 NS
PCV (%)	32.70±0.98	36.95±0.65 NS
Neutrophil (%)	58.05±1.52	69.04±1.25*
Lymphocyte (%)	38.30±1.39	26.70±1.54*
Monocyte (%)	3.65±0.44	4.13±0.17 NS
Sodium (mEq/L)	143.48±0.98	117.13±1.63**
Potassium(mEq/L)	4.05±0.08	2.72±0.06**
Chloride (mEq/L)	102.57±1.09	88.59±1.14**
Glucose (mg/ dL)	70.87±4.74	79.05±1.43*
BUN (mg/ dL)	17.80±1.26	58.71±0.90**
Creatinine (mg/ dL)	1.30±0.176	1.57±0.04 NS
Total protein (g/ dL)	6.51±0.143	6.83±0.05 NS
Calcium (mg/ dL)	11.37±0.46	6.02±0.06**
Phosphorus (mg/dl)	5.25±0.29	3.11±0.11*

N Number; *Significant ($p \leq 0.05$), **Highly significant ($p \leq 0.01$), #Kumar *et al.* (2019)

Analysis of serum biochemical parameters of diseased animals (Table 5) showed a statistically significant decrease ($p<0.01$) in the mean value of electrolytes, *viz.,* sodium (117.13±1.63 mEq/L), potassium (2.72±0.06 mEq/L) and chloride (88.59±1.14 mEq/L); calcium (6.02± 0.06 mg/dL) and phosphorus (3.11±0.11 mg/dL) in comparison to healthy animals. Hypokalemia in our study might be attributed to anorexia and urinary loss of potassium or due to fasting and adaptive response to continued hypo-adrenocortical activity due to chronic stress (Kaneko *et al.,* 2008). Low potassium in the majority of animals with chronic loss of appetite observed in the present study also reflected the same. Hypocalcemia and hypochloremia may be due to less assimilation of feed materials as a result of long-standing anorexia (Radostits *et al.,* 2007) or it can be due to excess feeding of poor-quality wheat straw with reduced availability of calcium-rich green fodder. Reduced calcium levels in the present study may have contributed to decreased ruminal motility.

Hyperglycemia (79.05±1.43 mg/dL) and increased BUN (58.71±0.902 mg/dL) values were noted in the present study. An increase in glucose level may be due to the stress of impaction leading to adrenocorticosteroid release, which has a glycogenolytic effect causing hyperglycemia. In GI impaction, the putrefied ingesta liberates toxic amines like histamine in the rumen which after absorption into circulation increases BUN concentration (Dain *et al.,* 1995) or it could be attributed to a decrease in renal blood flow as a part of compensatory mechanisms to maintain circulation in hypovolemia associated with dehydration (Hussain *et al.,* 2022).

Conclusions

In the present study, the hospital-based prevalence of gastrointestinal impaction in buffaloes was found to be 9.94%, particularly during the introduction of new dry fodder. Clinical findings in concurrence with various haemato-biochemical alterations may be helpful to understand pathophysiological changes associated with impaction, and selecting a better treatment regime to safeguard the animal.

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