Evaluation of the efficacy of rumen cannulation technique on some rumen metabolic parameters in buffaloes

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ABSTRACT: This experimental study was carried out to determine the efficacy of rumen cannulation technique on some rumen metabolic parameters in buffaloes. Four healthy male River (Azari) buffaloes with no previous history of gastrointestinal dysfunction were chosen. There are several surgical techniques that can be used for rumen cannulation in farm animals, including buffaloes. This procedure was performed in a modified two-stage technique. In the first stage, the dorso – lateral portion of the dorsal sac of the rumen wall was sutured to the skin incision in the left para lumbar fossa region. In the second – stage, after six days left, the exposed rumen wall area was incised and the cannula was inserted and fixed manually in the rumenal opening incision site. In order to evaluate the efficacy of rumen cannulation technique on some rumen metabolic parameters, this study was achieved with different levels of NDF, and chewing behavior and their relationship with ruminal acidity, was measured in a change over design. Two diets with 2 levels of NDF were used as treatments. First and second diets had 52 and 47 % of NDF, respectively. Animals fed ad libitum at 09:00 and 21:00. There were no significant differences between chemical composition, particles distribution, geometric mean, its standard deviation and physically effective factor (pef) of diets, dry matter intake (kg/d) and nutrients intake (NDF, ADF, NFC and crude protein) and their digestibility. Increasing NFC reduced ruminal pH at 0.5, 1.0, 4.5, 6.0 9.0 and 10.0 h post feeding. In addition, there were not significant differences on eating time, rumination time and total chewing activity between diets. All data obtained in this study were in normal range may indicating the efficacy of this cannulation method. More investigation should be done to determine the efficacy and comparison of the other surgical rumen cannulation techniques on Azari buffaloes of Iran.

INTRODUCTION - There is considerable physiological difference between cattle and buffaloes. The rumen movements, fluid volume in reticuluromen, rate of passage of digesta and other differences (Mandal et al., 2003). Most of the experiments conducted on comparative digestibility coefficients in cattle and buffaloes showed that buffaloes are superior to cattle in their ability to digest the organic nutrients (Mandal et al., 2003). Apparently less DMI, slow eating habit, and slow passage rate of digesta contribute to slightly higher digestibility observed in buffaloes than in cattle (Mandal et al., 2003). Gupta, (1970) and
Ichhponani et al., (1966) observed considerably higher in vitro digestibility of cellulose in buffaloes than in cattle. Wanapat, (2001) in a comparative digestibility study found that rumen pH was higher than that of cattle which may be due to better rumen metabolic controlling mechanisms of buffaloes. Chewing activity of buffaloes may partly explain rumen pH alteration and nutrients digestibility.

Ruminal cannulation (fistulation) is a surgically created fistula between the dorsal sac of the rumen and the body surface in the left paralumbar fossa. The techniques of rumenal cannulation have been developed for experimental purposes, as well as for the relief of chronic bloat. The experimental techniques are used for quantitative studies of digestion in the rumen (Turner and Mcilwarith, 1989). Rumen cannulation is performed by a single–stage technique or a two–stage method (Dougherty, 1981 and Lumley et al., 1990). The two–stage procedure is usually recommended for cattle (Dougherty, 1981) but can be used in buffaloes as well. There is no available data on effect of rumen cannulation on normal rumen digestive activities in buffaloes. This experimental study was carried out to determine the efficacy of rumen cannulation technique on some rumen metabolic parameters with different levels of fibrous and non-fibrous carbohydrate levels on chewing activity and nutrients digestibility in buffaloes.

MATERIAL AND METHODS - Four healthy male River (Azari) buffaloes with mean BW of 380.5±7.5 and no previous history of gastrointestinal dysfunction were chosen. There are several surgical techniques that can be used for rumen cannulation in farm animals, including buffaloes. This procedure was performed in a modified two-stage technique (Dougherty, 1981). In the first stage, a vertical skin incision was made in the mid paralumbar fossa. The incision was continued through the delicate subcutaneous fat tissue, and the muscular layers of the abdominal wall were divided in the “grid” technique (Turner and Mcilwarith, 1989). The external abdominal oblique muscle, internal abdominal oblique muscle, and transverse abdominal muscle were dissected bluntly along the direction of its fibers. The dorsal sac of rumen was exposed after sharp incision of the parietal peritoneum. Accordingly, this portion was anchored to the skin by application of four interrupted horizontal mattress sutures using No. 1 silk (SUTUPAK ETHICON). In the second stage, at six days postoperative when the wound epithelialization takes place, the exposed rumen wall was incised longitudinally at the mid point between the cranially and caudally placed tak sutures for a distance of eight cm. The plastic–bovine cannula* was inserted manually into the opening and fixed.

Two experimental TMR diets were formulated according to recommendations of Mandal et al., (2003) to meet the nutrient requirements of rumen fistulated buffaloes. The diets 1 and 2 had 52 and 47% of NDF, respectively and other nutrient compositions been similar. Experimental period was considered to be 27 days, including 15d for adaptation to the diet, 7d for measuring the nutrients digestibility and passage rates of rumen digesta, 2d for rumen liquor gathering and 3d for determination of chewing activity of buffaloes. Particle size distributions, the distributions of sizes and physically effective factor NDF (Pef) of diets measured using the American Society of Agricultural Engineers (Kononoff, 2002) sieves Eating and ruminating activities were monitored visually for calves in the treatments over a 24 h period for 3 d. Rumen pH was measured using a portable digital pH meter at different

* The cannula dimensions: the flange is 22 cm in diameter and 4 mm thick. The neck is 11 cm long and the inside hole 6 cm designed in Karj-Iran.
intervals until 12h post feeding. Data were analyzed using switch back design with mixed procedure by SAS, (2002) statistical software.

**RESULTS AND CONCLUSIONS** - There were no significant differences between chemical composition, particles distribution, geometric mean, its standard deviation and physically effective factor (pef) of diets, dry matter intake (kg/d) and nutrients intake (NDF, ADF, NFC and crude protein) and their digestibility (p<0.05). Rumen pH, eating, rumination and chewing activity of calves fed 2 experimental TMR diets are shown in Table 1. There is no available data on chewing activity of buffalo calves to compare with; however the results of this study showed buffaloes generally have higher chewing activity, eating and rumination behavior. It seems lower fiber and consequent higher NFC changed chewing activity in the buffaloes. Higher NFC concentration led to better digestion of nutrients which may be due to lower intake of these nutrients. Nevertheless, rumen pH at higher NFC containing diet was decreased. It seems the buffaloes at this situation avoid rumen pH declining by increasing chewing activity per different nutrients.

| Traits                        | Experimental diets | SEM   | P2  |
|-------------------------------|--------------------|-------|-----|
|                               | Diet2 (47% NDF)    | Diet1 (52% NDF) |     |     |
| Eating (min/d)                | 259.17             | 253.33| 13.49| NS  |
| Rumination (min/d)            | 508.33             | 546.67| 9.71 | NS  |
| Total chewing activity (min/d)| 767.50             | 800.00| 18.52| NS  |
| Chewing behavior per different nutrient (min/kg) | | | | |
| NDF                           | 182.64             | 157.59| 6.16 | NS  |
| PeNDF                         | 214.87             | 179.08| 2.72 | NS  |
| Rumen pH (h/postfeeding)      |                    |       |     |     |
| 0.5                           | 7.06b              | 7.09a | 0.006| *   |
| 1                             | 6.95b              | 7.32a | 0.020| *   |
| 1.5                           | 6.86               | 6.86  | 0.029| NS  |
| 3                             | 6.54               | 6.58  | 0.011| NS  |
| 4.5                           | 6.40b              | 6.58a | 0.009| *   |
| 6                             | 6.17b              | 6.46a | 0.020| *   |
| 12                            | 6.51b              | 7.13a | 0.125| *   |

1= Non fibrous carbohydrate, 2=Means within a row with different superscripts differ (P < 0.05).

Based on the results of this study, it is believed since in this modified technique cannula failure is virtually eliminated and no crucial adverse consequences are seen, it might be considered as a useful alternative method for rumen cannulation in buffaloes. Thus, the technique could be suggested to scientists who deal with experimental studies on buffaloes nutrition and husbandry. In addition, all rumen metabolic obtained data in this study were
in normal range may indicate the efficacy of this cannulation method. However, more investigation should be done to determine the efficacy of the cannula and to compare its value with other surgical rumen cannulation techniques on buffaloes.

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