OBSTRUCTIVE SIALOLITHIASIS IN BUFFALO AND ITS MANAGEMENT

V.B. Joshi, S.P. Tyagi and Avinash Sharma

ABSTRACT

A nine year old female buffalo was presented in the clinic which had developed two hard swellings its on right cheek 9 months before. Following this, a larger diffuse soft swelling had appeared caudal to the farmer. The softer swelling had gradually increased in size and eventually ruptured one-month before leading to continuous leakage of transparent viscous fluid since then. On clinical examination, the condition was diagnosed as salivary fistula resulting from the complete obstruction of the flow of saliva through the Stenson’s duct by sialoliths. Sialolithiasis has been reported in a number of animal species but not in buffaloes so far. Therefore, this condition and its successful surgical treatment are described in the present communication.

INTRODUCTION

Sialoliths, or salivary calculi, may form in the salivary glands or salivary ducts of animals, and may eventually obliterate the passage of saliva. This may either lead to formation of a salivary cyst and then a fistula or may cause salivary gland atrophy. A case of a buffalo having salivary fistula due to sialoliths is presented in the present communication. Sialolithiasis has been reported in a number of animal species but not in buffaloes so far. Therefore, this condition and its successful surgical treatment are described.

Case history and clinical examination:

A nine-year-old female buffalo had developed nine months before two hard swellings on right cheek which had gradually been increasing in size. After a few months, a larger diffuse soft swelling started developing distal to them and gradually increased in size leading to its eventual rupture one month back releasing a clear transparent viscous fluid. Continuous leakage of this fluid from the opening had been observed since then. The clinical examination of the animal revealed the presence of two well-defined hard nodular swellings at the course of Stenson’s duct over massatter muscle on right cheek. The saliva (pH 8.5) was observed leaking continuously through a small fistula caudo-ventral to these swellings (Figure 1). Exploration of the fistula revealed marked enlargement and complete obliteration of the lumen of Stenson’s duct by two hard intra-luminal mass rostral to the fistulous opening. The case was diagnosed as salivary fistula resulting from complete obliteration of Stenson’s duct by sialoliths. Surgical intervention for removal of calculi and repair of fistula was contemplated.

Anaesthetic and surgical management:

The animal was routinely prepared for aseptic surgery. The animal was sedated with 5ml Triflupromazine (Siquil, Sarabhai. India Ltd.) administered intramuscularly 30 minutes prior to surgery. Local analgesia of surgical site was achieved by subcutaneous infiltration of 10 ml of 2% Lignocaine HCl (Xylocaine, Astra-IDL). A 5-cm long

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linear incision was given on skin directly over the hard swellings. The Stenson’s duct was dissected carefully taking care to avoid accompanying veins and arteries (Figure 2). The calculi were exposed by an incision on the duct and these were removed with the help of an Allis tissue forceps. The duct was lavaged with Ringer’s solution, and its patency was confirmed by catheterization rostrally. Careful dissection, debridement and excision of superfluous part of the wall of fistula and duct were then done followed by lavaging with Ringer’s solution. The fistulous opening of the duct was then closed with chronic catgut sutures applied in a simple continuous manner. The first suture line was buried under the overlying fascia again by catgut sutures. The skin was closed routinely with silk sutures in an interrupted mattress pattern. The animal was given Inj. Streptomycin (Dicrystin, Sarabhai India Ltd.) 2.5 gm I/M and Inj. Diclofenec sod. (Zobid, Sarabhai India Ltd.) 15 ml I/M daily for 7 days besides regular antiseptic dressing of wound post operatively. The surgical wound eventually healed normally and no leakage of saliva was seen thereafter. No recurrence of the condition had been reported six months after the surgery.

**DISCUSSION**

The occurrence of sialoliths or salivary calculi has been reported in different kinds of animals such as dog (Bartels, 1978), cattle (Ali et al., 1978), monkey (Ensley et al., 1981), donkey (Misk et al., 1984), horse (Bouayad et al., 1991), camel (Barvalia et al., 1992), chimpanzee (Orkin et al., 1990) etc. These are seen more often in horses than in other species (Hofmeyr, 1988). Sialoliths form in a duct or in the salivary gland itself, generally as a result of chronic inflammation, which provides desquamated cells or consolidated exudates as a minute nidus upon which calcium salts precipitate (Orkin et al., 1990). Small foreign bodies entering the ostium of salivary duct may also initiate the precipitation of salts (Hofmeyr 1988; Baskett et al., 1995). The cross sectioning of the sialoliths in the present case revealed the presence of hay straw in the centre (Figure 4). This suggests that the hay straw might have accidentally entered the salivary duct, probably during rumination, and acted as nidus for the deposition of salivary salts. The continuous deposition of salts may result in formation of very large sized calculi of various shapes, sometimes up to several centimeters in length and diameter (Jones et al., 1997). In the present case, one calculus was almost cylindrical (approximately 2.5 cm x 2.0 cm x 2.0 cm) and weighing 10.14 gm whereas, another calculus occupying rostral position in the duct was almost rounded (diameter 2.0 cm) and weighed 6.77 gm (Figure 3). The main component of sialoliths in the present case was identified to be calcium carbonate; there were also with traces of magnesium and phosphate. Calcium carbonate is routinely identified in cases of sialoliths in other species of animals also (Hofmeyr, 1988). Larger calculi obliterate the salivary ducts, and this may result in atrophy of associated salivary gland. However, generally before this process is complete, a cyst may form in the obstructed duct due to the dilating effect of the entrapped secretions. A salivary fistula occasionally forms when an injury creates an opening from the duct to the outside of the body (Orkin et al., 1990). The early surgical intervention is must for the treatment of this condition to save the affected salivary gland from atrophy.

The perusal of the literature failed to reveal any report about the occurrence of sialoliths in buffaloes so far. Therefore this case is reported to record the occurrence of sialoliths in buffaloes in India.
Figure 1. Nodular swelling in the course of a dilated Stenson’s duct with caudoventral fistula.

![Image of nodular swelling](image1.png)

Figure 2. Dissected Stenson’s duct with sialolith in its lumen.

![Image of dissected duct](image2.png)

Figure 3. Sialoliths removed from the Stenson’s duct.

![Image of sialoliths](image3.png)
Figure 4. Cross section of sialoliths showing hay straw in the centre.

REFERENCES


INTRODUCTION

Even though cattle occupy an important place in the agricultural economy of India, so far as milk production is concerned, the buffalo has taken her place as a milk producing animal. This is because of the poor performance of Indian cow. The excess fat in buffalo milk is usually skimmed off to pay for the processing and distribution of milk, enabling the consumer to get their milk at the same price that is paid to the producers. Buffalo milk fat has less cholesterol and more tocopherol, which is a natural antioxidant. Buffalo milk is richer in calcium and phosphorous and lower in sodium and potassium than cow milk. The peroxidase activity in buffalo milk is 2-4 times higher than that in cow milk, which accounts for the natural preservability of buffalo milk. The buffalo milk having 1 1/2 times more total solids with very high fat percentage than cow milk is generally preferred for manufacture of milk products. It is because of this fact that the housewife and the dairyman give preference to buffalo milk in the country. In one study it was observed that buffaloes had been found to thrive on course fodders and were better converters of poor quality roughages into milk and meat. They are reported to have 5% higher digestibility of crude fibre than high yielding cows, and 4-5% higher efficiency of utilization of metabolic energy for milk production and withstand high dry heat as well as humid climate as compared to Zebu cattle. Very little has been done to improve the productivity of these animals, and there is very little reliable data regarding her growth, nutrition or breeding efficiency. The Agriculture College Dairy Farm, Pune, had been maintaining a good herd of Surti, Murrah and Murrah-Surti-Surti-Murrah cross bred buffaloes for last number of years. Asystematic records regarding the birth weight, rate of growth, age at first calving, breeding after calving and performance records for large number of lactations are available about them.

In this study an attempt has been made to study the effect of age at first calving and subsequent period of breeding on the performance of buffaloes-maintained at the Agricultural College Pune. This data will be useful to the private buffalo keepers, co-operative milk producer societies, private organizations engaged in production on large scale basis.

MATERIALS AND METHODS

Agriculture College Dairy Farm, Pune, one of the oldest such institutions in India, was started with a view to carrying on systematic research work on Surti, Murrah (Delhi) and cross-bred buffaloes (crossing between Delhi and Surti or Surti Delhi, intentional or not). However, records of large number of such buffaloes have been kept since 1948
regarding their breeding, feeding, care, and management. The institution also provides facilities for teaching and research and was under the control of Maharashtra Agricultural University (Pune), India.

I. Effect of Age at First calving on subsequent Performance:

Age at first calving is a controversial point not only among the farmers but also among many animal breeders as they feel that too early age at first calving, has an adverse effect on the future performance of animals. In order to verify the correctness of this view point, 81 Surti, 62 Murrah (Delhi) and 37 Cross-Bred heifers from 1922-1967, 1948-1967 and 1948-1967, respectively, were grouped according to age at first calving, and the effect of this age was studied on subsequent performance by critically, studying the records of 489, 222 and 188 calvings, respectively. These animals were grouped in ten groups with an interval of three month between two groups; heifers calving between 33 to 35 months were included in the first group, and heifers calving at the age of 60 months and above were included in the last group. The study was restricted up to ten lactations for all the groups as the data available was adequate up to that period only.

II. Effect of period of fruitful service after calving on subsequent performance of buffaloes:

As in case of age at first calving, there are controversial views regarding the period after calving at which breeding bull should be shown to the calved animals. In order to get reliable information on this point, 393 calvings of 75 Surti buffaloes, 155 calvings of 44 Murrah and 151 calvings of 31 cross-breed buffaloes were grouped according to the number of days required for fruitful conception after calving, and its effect was studied on the performance of subsequent lactations. The buffaloes which conceived in 56 days after calving were included in first group, and the buffaloes which conceived after 281 days included in last group. Ten groups were formulated with an interval of 28 days between two groups as the oestrus period in case of buffalo is of 28 day, duration.

RESULTS AND DISCUSSION

The results of the findings are presented under the following headings:

A) Effect of age at first calving on,

i) total lactational milk yield.

ii) per day milk yield during lactation

iii) per day milk yield from calving to calving

iv) milk days

v) dry days

vi) average performance of Surti, Delhi (Murrah) and cross-breed in respect of their economic traits.

B) Effect of period of fruitful service after calving on,

i) total lactational milk yield

ii) per day milk yield during lactation.

iii) per day milk yield from calving to calving

iv) milk days

v) dry days

vi) average performance of Surti, Delhi and cross-breed buffaloes pertaining to their economic traits.
Table 1. Effect of age at first calving on the economic traits.

<table>
<thead>
<tr>
<th>Breed</th>
<th>No. of Animals</th>
<th>No. of Lactations Studied</th>
<th>Per day Milk Yield during Lactation (L)</th>
<th>Per day Milk Yield from calving to calving (L)</th>
<th>Av. milk days</th>
<th>Av. milk yield</th>
<th>Av. age at first calving</th>
<th>Y.M.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surti (1922-1967)</td>
<td>81</td>
<td>489</td>
<td>4.94</td>
<td>3.76</td>
<td>363</td>
<td>113</td>
<td>1,793</td>
<td>4-1-15</td>
</tr>
<tr>
<td>Delhi(Murrah) (1984-1967)</td>
<td>62</td>
<td>222</td>
<td>5.60</td>
<td>3.88</td>
<td>350</td>
<td>125</td>
<td>1,843</td>
<td>4-4-13</td>
</tr>
<tr>
<td>Cross-Breed (1948-1967)</td>
<td>37</td>
<td>188</td>
<td>5.17</td>
<td>3.78</td>
<td>336</td>
<td>124</td>
<td>1,736</td>
<td>4-2-21</td>
</tr>
</tbody>
</table>

Table 2. Effect of period of fruitful service after calving on the economic traits.

<table>
<thead>
<tr>
<th>Breed</th>
<th>No. of Animals</th>
<th>No. of Lactations</th>
<th>Per day milk yield during Lactation (L)</th>
<th>Per day milk yield from calving to calving (L)</th>
<th>Av. milk days</th>
<th>Av. milk yield</th>
<th>Av. service period after calving</th>
<th>Y.M.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surti</td>
<td>75</td>
<td>393</td>
<td>4.70</td>
<td>4.12</td>
<td>347</td>
<td>113</td>
<td>1,902</td>
<td>157</td>
</tr>
<tr>
<td>Murrah</td>
<td>44</td>
<td>155</td>
<td>6.14</td>
<td>4.60</td>
<td>337</td>
<td>113</td>
<td>2,069</td>
<td>144</td>
</tr>
<tr>
<td>Cross-Breed</td>
<td>31</td>
<td>151</td>
<td>5.53</td>
<td>3.93</td>
<td>312</td>
<td>127</td>
<td>1,729</td>
<td>145</td>
</tr>
</tbody>
</table>
In this study, the effect of age at first calving and subsequent period of breeding on the performance of buffaloes was assessed with special reference to the economic aspects.

The average age at first calving observed in Surti, Murrha (Delhi) and cross-breed heifers was 4 years 1 month 15 days, 4 years 4 months 13 days, and 4 years 2 months 21 days, respectively, with the average weights at this time of 409, 435 and 401 kg, respectively.

The consolidated data regarding the age at first calving of the Surti, Murrha, (Delhi) and cross-breed heifers was presented in Table 1. It is seen that the Murrah buffaloes have greater average age at first calving as compared to Surti and cross-breed heifers. More than 48% of the heifers calved between the ages of 33 to 47 months in the case of Surti, buffaloes, but for the similar period in the case of Delhi (Murrha) and cross-bred heifers, the percentages were 29 and 43, respectively. The remaining heifers calved after 48 months of age. Since the period up to the age at first calving is economically unproductive in the life of heifers, it is necessary to carry-out intensive research to bring down this period.

The results regarding the effect of age at first calving on the performance were studied up to 10 lactations in Surti, Delhi and cross-breed buffaloes calving from 33 months of age to 60 and above months are shown in Table 1.

The Surti buffaloes calving in the group of 33 to 35 months showed the overall average of 3.81 litres, which was slightly above the overall average for all the groups calving in different age levels for 10 lactations. The group of heifers calving at the age 60 months and above did not show any increase in milk production during their life time. On the contrary, these animals gave an average 3.40 litres of milk as compared with the average of 3.76 litres for the entire herd for 10 lactations. It is observed that most of the Surti buffaloes did not give maximum milk yield in the first lactation irrespective of the age at first calving. The milk yield gradually increased from second to eighth lactation.

In case of the Delhi (Murrah) buffalo breed, the heifers, calving at the early age that is, 4 years, produced more milk than the animals calving after 57 months of age similar observations are made in cross breed buffaloes. From these results, one can say that even though the age at first calving is increased in all buffalo breeds, there is no additional increase in milk yield in that proportion. These findings are in agreement with those of Gethin (1950).

From the results pertaining to the effect of age at first calving on milk days, dry days, and calving intervals for 10 lactations of these buffalo breeds, it is observed that there is no effect of age at first calving either on milk days, dry days, or calving interval.

Similar observation were made by Rannie (1954) Venkayya and Anantkrishnan (1957) and Agarwal (1962)

Consolidated results about the effect of period of fruitful service after calving and the average performance of Surti, Delhi (Murrah) and cross-breed buffaloes is given in Table 2.

In this case also, serving the buffaloes in third or fourth oestrus period is much better in Surti and Delhi buffalo breeds while, in the case of cross-breed buffaloes, no specific statement can be made. Hence, they also can be served in the third or fourth oestrus period.

Serving buffaloes in two oestrus periods after calving gave as good performance as one can get after subsequent oestrus periods since there is no additional advantage in serving the buffaloes after calving in late heat periods and it is advised to serve them as early as possible, preferable, between 56 to 112 days. These results are in agreement with the findings of Kohli and Malik (1960) and Polikhonor (1965).

In this study, the economics worked out by considering all the observations pertaining the economic traits clearly show that there is a necessity to serve the heifers as early as possible so that the calving should take place earlier than 50 months after their birth. In order to achieve this goal in buffaloes, particularly in River-type buffaloes (2n =50) of India, which are dairy breeds, efforts should be made to bring them into servicable age as early as possible by proper breeding, feeding, care, and management.
REFERENCES


Source : Data is produced from the thesis. Submitted to the Maharashtra Krishi Vidyapeeth, Pune. By the author in the year (1969) for awarding the M.Sc. degree in Animal Breeding, under the Faculty, in Agriculture, M.S. India.

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PHYSIOLOGY


Four male swamp buffaloes (*Bubalus bubalis*) each fitted with a duodenal catheter, with an initial body weight of 244 ± 19.8 were used to study the recovery rate of urinary purine derivatives (PD) after duodenally infused with incremental amounts of purine bases (PB). During the experiment, the buffaloes were fed, at a maintenance energy level, a diet containing 40% oil palm frond and 60% concentrates (DM basis). Purine bases in the form of adenosine (50%) and guanosine (50%) were infused into the duodenum in five incremental rates equivalent to 0, 24, 47, 71 and 95 mmol purine per day. Urinary allantoin, the principal PD and uric acid were linearly correlated with PB input, while the contributions of other PD were not effected by treatments. The relationship between daily urinary PD (i.e. allantoin, uric acid) excretion (mmol) and duodenal PB infused (mmol per day) was $Y = 0.12X + 12.78$ ($r^2 = 0.45$, $P < 0.001$), suggesting that only 12% of supplied exogenous PB were excreted in the urine. The intercept suggested that PD excreted at maintenance energy level was 12.8 mmol per day. Urinary PD excretion rate of swamp buffaloes was much lower than those reported for cattle. We postulate that the discrepancy between the two species of ruminants could be due to a lower rate of PD absorption in the small intestine and/or recycling of plasma PD in buffaloes.
IN SACCO DRY MATTER AND PROTEIN DEGRADABILITY OF PAPAYA (CARICA PAPAYA) POMACE IN BUFFALOES

A. Ramesh Babu, D. Srinivasa Rao and M. Parthasarathy

ABSTRACT

Papaya (Carica papaya) pomace was evaluated in sacco using four rumen fistulated buffaloes (280 ± 20.0 b.wt) fed 1.35 kg of concentrate mixture (containing 30% papaya pomace) and 4.5 kg rice straw daily. The average in sacco DM disappearance values were 26.69, 43.50, 67.77, 75.98 and 82.26% at 6, 12, 24, 48 and 72 h incubation, respectively, and the average CP disappearance values were 27.82, 41.25, 46.02, 57.60 and 65.20% at 3, 6, 9, 15 and 24 h incubation, respectively. The readily soluble fraction (a), insoluble but degradable fraction (b) and rate constant / h (c) were 14.54, 13.74; 68.88, 56.20 and 0.0528, 0.1014, respectively for DM and protein fractions of papaya pomace. The effective degradability of DM was 49.9% and protein was 51.4% for papaya pomace. RDP and UDP contents of papaya pomace were 51.4 and 48.6 g per 100 g of protein.

MATERIALS AND METHODS

Papaya pomace was obtained from local fruit juice factory and analysed for proximate constituents (AOAC, 1995) and cell wall constituents (Goering and Van Soest, 1970). Four native male buffaloes of 7 years age (280 ± 20.0 kg) fitted with a rumen fistula (Bar Diamond, Inc., USA) used for this study were daily fed 1.35 kg concentrate mixture (27% maize, 24% de-oiled groundnut cake, 17% de-oiled rice bran, 30% papaya pomace and 2% mineral mixture) and 4.5 kg of rice straw at 8.00 AM to meet the nutrient requirements for maintenance (Kearl, 1982). In sacco studies were conducted according to the methods of Orskov et al. (1980) to study the rumen degradability of DM and CP of papaya pomace after a preliminary feeding period of 14 days.

Ground papaya pomace was sieved through British Standard Sieve (BSS) mesh No. 100 to remove particles smaller than 150 μm. The polyester bags used were of 16 x 7 cm. size with a specified pore size of 44 μm and 33% of the cloth surface open (estal mono, code ASTM 325-44). A 3 g sample of papaya pomace along with a glass marble was kept in the polyester bags, which were wetted in water to escape any lag time for microbial attachment. The bags was manually pushed deep into the liquid phase of ventral sac of the rumen. About 90 cm polypropylene thread was used so that there would be a length of about 60 cm for free movement of the bag inside the rumen. Eight bags on each buffalo were incubated for time intervals of

INTRODUCTION

Papaya (Carica papaya) pomace is a fruit by-product obtained after extraction of juice from the papaya fruit and comprises peels (skins) and seeds. Generally this goes as a waste causing environmental pollution, but if utilized properly will contribute to the national economy and reduce environmental pollution. An attempt was made to determine the chemical composition and the degradability of locally available papaya pomace.
3, 6, 9, 12, 15, 24, 48, 72 h. On removal from the rumen at specified intervals the bags were washed under tap water to remove rumen fluid from the bag’s surface. Bags were dried to constant weight for 48 h in a forced draft oven at 60 °C. The in sacco DM and CP disappearance was estimated.

The constants a, b and c of the Orskov and Mc Donald (1979) model were derived by iterative least square analysis with the aid of a computer. An outflow rate (K) value of 0.04 / h was used to calculate the effective degradability values.

RESULTS AND DISCUSSION

The chemical composition of papaya pomace observed in the present study was 92.20, 18.44, 4.73, 29.58, 28.59, 18.66, 1.84 and 0.61 % for DM, CP, EE, CF, NFE, total ash, calcium and phosphorous, respectively (Table 1). Not much literature is available on the chemical composition of papaya pomace. However, Fouzder et al. (1999) reported that dried papaya skins contained 87.41 % DM, 22.90% CP, 36.80% EE, 12.20% CF, 49.78% NFE and 11.44% total ash.

Table 1. Chemical composition (%DM basis) of papaya pomace.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry matter</td>
<td>92.20</td>
</tr>
<tr>
<td>Crude protein</td>
<td>18.44</td>
</tr>
<tr>
<td>Ether extract</td>
<td>4.73</td>
</tr>
<tr>
<td>Crude fibre</td>
<td>29.58</td>
</tr>
<tr>
<td>Nitrogen free extract</td>
<td>28.59</td>
</tr>
<tr>
<td>Total ash</td>
<td>18.66</td>
</tr>
<tr>
<td>Acid insoluble ash</td>
<td>4.04</td>
</tr>
<tr>
<td>Calcium</td>
<td>1.81</td>
</tr>
<tr>
<td>Phosphorus</td>
<td>0.61</td>
</tr>
</tbody>
</table>

**Cell wall constituents**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neutral detergent fibre</td>
<td>42.05</td>
</tr>
<tr>
<td>Acid detergent fibre</td>
<td>37.07</td>
</tr>
<tr>
<td>Hemicellulose</td>
<td>4.98</td>
</tr>
<tr>
<td>Cellulose</td>
<td>30.37</td>
</tr>
<tr>
<td>Acid detergent lignin (ADL)</td>
<td>6.70</td>
</tr>
</tbody>
</table>
Table 2. Effect of rumen environment on *in sacco* DM and protein degradability (%) of papaya pomace.

<table>
<thead>
<tr>
<th>Incubation period</th>
<th>DM disappearance</th>
<th>Incubation period</th>
<th>CP disappearance</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 h</td>
<td>26.69 ± 1.41</td>
<td>3 h</td>
<td>27.82 ± 2.00</td>
</tr>
<tr>
<td>12 h</td>
<td>43.50 ± 2.32</td>
<td>6 h</td>
<td>41.25 ± 1.94</td>
</tr>
<tr>
<td>24 h</td>
<td>67.77 ± 2.22</td>
<td>9 h</td>
<td>46.02 ± 1.18</td>
</tr>
<tr>
<td>48 h</td>
<td>75.98 ± 1.07</td>
<td>15 h</td>
<td>57.60 ± 3.83</td>
</tr>
<tr>
<td>72 h</td>
<td>82.26 ± 0.75</td>
<td>24 h</td>
<td>65.20 ± 3.71</td>
</tr>
</tbody>
</table>

Degradation kinetics

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>A</td>
<td>14.54</td>
<td>13.74</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>68.88</td>
<td>56.20</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>0.0528</td>
<td>0.1014</td>
<td></td>
</tr>
<tr>
<td>A+b</td>
<td>83.42</td>
<td>69.94</td>
<td></td>
</tr>
<tr>
<td>ED%</td>
<td>49.9</td>
<td>51.4</td>
<td></td>
</tr>
</tbody>
</table>

RDP 51.4 g and UDP 48.6 g per 100 g protein of papaya pomace.
Forty-four percent of DM had disappeared by 12 h incubation and a further 32.5% by the end of 48 h (Table 2). In general, DM disappearance of papaya pomace linearly increased as its incubation period in rumen increased. The instantly soluble DM fraction (a) of papaya pomace was 14.54 and that of insoluble but degradable fraction with time (b) was 68.88 with a rate constant (c) of 0.0528, the effective DM degradability was 49.9 %. In a study with apple pomace, Singh and Narang (1992) reported values of 18.9, 68.8 and 83.5 % respectively for a, b and 48h digestibility of DM in cattle.

There was also a linear increase in the protein disappearance of papaya pomace with increase in the period of incubation in the rumen to 24 h. Twenty-seven percent of the protein had disappeared by 3 h of its incubation and a further 37 % by the end of 24 h incubation. The a and b fractions of papaya pomace were 13.74 and 56.20 %, respectively, with a rate constant of 0.1014. The effective protein degradability was 51.4 %. The RDP and UDP contents of papaya pomace were 51.4 and 48.6 g per 100 g of protein.

It is concluded that papaya pomace with effective degradability of DM and CP up to 49.9 and 51.4 % respectively is a fruit by-product with potential as a feedstuff.

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STUDY OF THE FEEDING BEHAVIOUR AND CONVERSION OF FEED IN BUFFALO CALVES ON DIETS DIFFERENT IN STRUCTURE

K. Dimov and M. Tzankova

ABSTRACT

This study was made to establish some elements of the feeding behaviour and digestion in buffalo calves of rations equal in composition but different in structure.

It was found that buffalo calves which consumed total mixed ration with a good deal of fodder ruminated it for a longer time. The number of chewing movements for one vomited ration was greater and also the duration of ruminating of one ration. The presence of a larger quantity of concentrate mixture in the total mixed ration for fattening buffalo calves improved its conversion.

INTRODUCTION

The type and structure of the diet, the way of feeding, the physical and biochemical treatment of feeds show decisive influence on the elements of the feeding behavior of ruminant animals (Ernst et al., 1974; Levantin and Noiman, 1979; Nedicova and Sofronov, 1979), which is of great importance to form their productive features.

Increasing the diet of concentrate mixture over the optimum level leads to decreasing the time of feeding, and ruminating and reduction in the activity of rumen micro flora (Ernst et al., 1974). The effectiveness of feed conversion depends on the content of easily digested carbohydrates and fibre in diets (Galyean and Owens, 1991). The composition of ration influences the type of fermentative process in the fore-stomach and the activity of rumen micro flora.

The different ways of raising buffalo calves (tied in stables or in free groups) do not significantly influence some elements of their feeding behavior (Stefanova et al., 1985). Comparing buffalo calves and calves on different energy levels of feeding, Dimov et al. (1985) established that in buffalo calves, the duration of feeding was shorter and that of ruminating - greater. The better conversion of feed in buffalo calves compared with calves is probably due to this fact.

The purpose of this study is to establish some elements of feeding behavior of buffalo calves and the digestion of rations that are equal in composition but different in structure.

MATERIALS AND METHODS

The study was carried out in the experimental herd of the Institute - Shumen in buffalo calves from the newly created buffalo population in Bulgaria, equalized in body weight, age and sex. The animals were divided into two groups (n=6) and raised tied in stables.

The ration influence was studied with two diets. the first consisting of 80% of fodders (60% wheat straw and 20% alfalfa hay) and 20% concentrate mix and the second of 75% fodders (55% wheat straw and 20% alfalfa hay) and 25% concentrate mix . The composition of the concentrated mix is given in Table 1. The buffalo calves from the two groups consumed these diets ad libitum, the amounts fed corrected according to their maximal abilities to consume them.
The quantity of feeds (given in groups) and the leftovers were recorded every day.

The animals’ behavior was recorded individually through visual timing for 12 hours (8 a.m.-8 p.m.). The following elements of feeding behavior were recorded: duration of feeding, ruminating, standing and resting, number of chewing movements of ruminating of one vomit diet, and the duration of its ruminating.

To determine the digestion of the rations a balanced experiment was carried out for 7 days comprising three buffalo quantity of excrement were taken every day and conserved with 10 % HCl and formalin.

All results obtained from the study was analyzed using the conventional statistical procedures.

### RESULTS AND DISCUSSION

In the buffalo calves from the two groups fed with rations containing different parts of fodder and concentrated feeds (Table 2) there were no significant differences in the duration of taking feed. But regarding the duration of ruminating, we have to say that it was significantly greater (368 minutes) in the first group in comparison with the second group (313 minutes). A greater number of

<table>
<thead>
<tr>
<th>Kinds of feeds</th>
<th>I ration</th>
<th></th>
<th></th>
<th>II ration</th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>%</td>
<td>Total</td>
<td>Total</td>
<td>%</td>
<td>Total</td>
<td>Total</td>
</tr>
<tr>
<td></td>
<td>feed units</td>
<td>Crude</td>
<td>Protein, g</td>
<td>feed units</td>
<td>Crude</td>
<td>Protein, g</td>
</tr>
<tr>
<td>1. Wheat</td>
<td>50</td>
<td>59,00</td>
<td>6500</td>
<td>45</td>
<td>56,64</td>
<td>6240</td>
</tr>
<tr>
<td>2. Barley</td>
<td>11</td>
<td>11,00</td>
<td>1180</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>3. Maize</td>
<td>35</td>
<td>45,50</td>
<td>3045</td>
<td>40</td>
<td>52,00</td>
<td>3480</td>
</tr>
<tr>
<td>4. Sunflower oil meal</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>8</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>5. Dicalcium phosphate</td>
<td>2,2</td>
<td>-</td>
<td>-</td>
<td>2,2</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>6. Trace mineral mixture</td>
<td>0,3</td>
<td>-</td>
<td>-</td>
<td>0,3</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>7. Vitamin and mineral mix</td>
<td>0,5</td>
<td>-</td>
<td>-</td>
<td>0,5</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>8. Salt</td>
<td>1,0</td>
<td>-</td>
<td>-</td>
<td>1,0</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Total:</td>
<td>100</td>
<td>115,50</td>
<td>107,33</td>
<td>100</td>
<td>118,00</td>
<td>125,60</td>
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</table>

Table 1. Composition of the consumed concentrate mix.
chewing movements for ruminating of one vomited ration (60 movements) and a greater duration of ruminating (54 second) was observed in calves that ate I ration. There were differences in the values of duration of resting and standing between the different groups; these differences are mathematically insignificant.

The analysis of data presented in Table 3 shows that including a larger quantity of concentrated feed in the total mixed rations for fattening calves increases the conversion of the ration. The coefficients of digestion of the separate nutrients were higher in the group in which the concentrate feed costituted 25 % out of the total diet weight, in comparison with the group eating that diet containing 20% concentrated feed. The differences ascertained between the values of the coefficients of digestion and the separate nutrients were statistically significant (P<0.05) only in regard to digestion of organic matter and NFE.

### CONCLUSIONS

There were no significant differences between the duration of taking feed in buffalo calves fed with rations containing different quantities of fodder and concentrated feed.

There was a tendency toward longer ruminating of feed, greater numbers of chewing movements for ruminating of one vomited ration, and...
longer duration of ruminating in buffalo calves that ate rations containing a larger proportion of fodder. Moreover, a higher percentage of concentrated feed in the total mixed ration for fattening calves increased its conversion.

<table>
<thead>
<tr>
<th>Group</th>
<th>Organic matter % x±Sx</th>
<th>Crude protein % x±Sx</th>
<th>Crude fats % x±Sx</th>
<th>NFE % x±Sx</th>
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<tr>
<td>I group</td>
<td>76.43±0.550</td>
<td>65.96±1.740</td>
<td>2.94±0.516</td>
<td>66.28±0.891</td>
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<tr>
<td>II group</td>
<td>79.43±0.531</td>
<td>70.65±1.133</td>
<td>85.17±0.886</td>
<td>71.50±1.168</td>
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REFERENCES


RESEARCH ABSTRACTS

FEEDING AND NUTRITION


Two experiments were carried out to compare rumen fluid (R) and faeces (F) as sources of inocula for in vitro organic matter digestibility (IVOMD) measurement. Rice straw, wheat straw, mixed grass, timothy grass (Phleum pratense), red clover (Trifolium pratense), Glicidica sepium, rice grain, and wheat grain were used as test feeds. In the first experiment, three non-lactating cows in Sweden were used as a source of rumen fluid and faeces, whereas in the second, three male swamp buffaloes in Vietnam were used. In Exp. 1 the dairy cows were fed silage, wheat straw and concentrate, while in Exp. 2 the buffaloes were offered rice straw, fresh grass and rice bran. All samples were incubated for 48 and 72 h. The same feed samples, chemicals and IVOMD determination procedures were used in both experiments. Rumen inocula gave higher (P<0.001) IVOMD values compared to those from faecal inoculation. There were differences (P<0.001) between incubation times for both faecal and rumen fluid inoculations in both species. However, there was no difference between rumen content at 48 h and faeces at 72 h incubation with buffalo inocula. Average IVOMD values for cattle were 75.1, 79.4, 64.4 and 69.9 and for buffalo 75.1, 79.5, 63.7 and 73.7, respectively, for R48, R72, F48 and F72 and did not differ among species. No significant differences were found among individual animals in both species. The IVOMD values for rumen fluid and faecal inoculations were closely correlated with R2 values more than or equal to 0.90 but the values in the swamp buffaloes to be higher than in cattle (0.96 vs. 0.92). Results suggest that faeces of dairy cattle and swamp buffaloes may be used as inocula sources for in vitro digestibility measurements.

IMMUNOLOGY


Immunological response was assessed following single dermal spray of fenvalerate in buffalo calves. Nine, 5-6 months old healthy male buffalo calves were divided equally into three groups and were sprayed dermally with 0, 0.06 and 0.6 percent concentration of fenvalerate all over the body except the head region. Humoral immunity was assessed by determining haemagglutination titres (HA) against sheep red blood cells (SRBC). Delayed type hypersensitivity (DTH) was determined by measuring skin thickness (mm) against PPD for cellular immune response. A significant (P<0.01) reduction was observed in the HA titres against SRBC and skin thickness in the DTH response in fenvalerate treated calves as compared to control. It is concluded from the study that fenvalerate caused immunosuppression following its single dermal spray in 0.06 and 0.6% concentrations in buffalo calves.
Gangliosides (GS) were evaluated in Swiss cow’s milk (SCM), Italian buffalo milk (IBM) and its serum, Pakistan buffalo colostrum (PBC), Pakistan buffalo mature milk (PMB), and Pakistan buffalo milk from rice-growing areas (PBR). Dairy GS were obtained from the Folch’s upper (hydrophilic) and lower (lipophilic) extraction phases, respectively, and determined as lipid-bound sialic acid (LBSA) by colorimetry. Molar ratios of LBSA in the hydro- and lipophilic GS fractions were 52:48 to 79:21. Mature buffalo milk types had 40-100% more LBSA in the lipophilic GS fraction compared to SCM. Liquid PBC was higher in LBSA (24 nmol/g) compared to mature milk types (8-11 nmol/g). Thin-layer chromatography (TLC) and scanning densitometry showed distinct profiles of hydrophilic and lipophilic GS fractions. Lipophilic GS (but importantly not hydrophilic GS) from IBM and its serum decreased prostaglandin series 2 production by 75-80% in cultured human colonic epithelial cells exposed to tumor necrosis factor a (TNFa). Hydrophilic GD₃ and lipophilic GM₃ selectively bound rotavirus particles prepared from a rhesus strain and its mutant. A GS fraction in IBM showed a GM₁ – specific binding to cholera toxin subunit B (CTB). IBM serum (IBMS) was a rich source of LBSA (420 nmol/g proteins). In summary, improved methodology led to increased LBSA recovery and isolation of additional and bioactive milk GS. Human and Italian buffalo milk had similar CTB binding, and both had increased polysialo-GS compared to cows milk. The toxin binding properties of buffalo milk GS, and the anti-inflammatory activity of the lipophilized GS fraction could be important for developing innovative food applications, as well as the subject of future research.
content of dry matter of cheese (from 45.94 to 54.91%). The processing efficiency (ratio between the dry matter yield of cheese and the estimated dry matter of milk) is also always higher for the milk with the highest percentage of fat and proteins (from about 74 to about 80%). From the analyzed samples of buffalo milk it comes out that the best forecast of dry matter yield is obtained by an equation (R²=0.92) which uses, besides the fat content, the percentage of proteins and the three lactodynamograph parametres, even if with the only determination of fat content it is possible to foresee the cheese yield with a good reliability (R²=0.87).

**REPRODUCTION**

Gianluca Neglia, Biance Gasparrini, Viviana Caracciolo di Brienza, Rossella Di Palo, Giuseppe Campanile, Giorgio Antonio Presicce, Luigi Zicarelli, Dipartimento di Scienze Zootecniche e Ispezione degli Alimenti, Federico II University, Via Delpino 1, 80137 Napoli, Italy. **Bovine and buffalo in vitro embryo production using oocytes derived from abattoir ovaries or collected by transvaginal follicle aspiration.** Theriogenology (2003). 59: 1123-1130.

This study was undertaken in order to evaluate the effect of oocyte source (live animals and abattoir ovaries) on subsequent embryo development in buffalo (*Bubalus bubalis*). Cow ovaries were also collected as oocyte donors for in vitro embryo production (IVEP). Three hundred thirty-eight oocytes were recovered by ovum pick up (OPU, Group A) from 8 pluriparous buffalo cows, while 1,127 and 1,457 oocytes were aspirated, respectively, from buffalo (Group B) and bovine (Group C) slaughterhouse ovaries. Cumulus enclosed oocytes (COCs) suitable for IVEP were in vitro matured (IVM), fertilized (IVF) and cultured (IVC) to the tight morula (TM) and blastocyst (Bl) stage.

Within slaughterhouse groups cattle oocytes had a higher cleavage rate (83.9% versus 64.8%; P<0.05) and yielded 49.2% more blastocysts than buffalo. However, when data are related to the total number of cleaved oocytes, only 13.7% more blastocysts were produced in cattle than in buffalo. In conclusion, in buffalo species the source of oocytes significantly affected post-fertilization embryo development, as demonstrated by the higher Bl yields derived from OPU-derived oocytes. A higher overall IVEP efficiency, mainly related to the higher cleavage rate, was recorded in cattle compared with buffalo when ovaries from an abattoir were used as oocyte donors.


Early return-to-estrus after embryo collection would shorten the interval between consecutive superovulations and improve efficiency of embryo production. Following superovulation and embryo collection, 80 buffaloes were treated with 15.0 mg Luprostiol (PGF₂α analogue) for the induction of luteolysis and early return-to-estrus. A total of 67.5% donor animals returned to estrus, on average 11.8 ± 2.84 days after the PGF₂α treatment. The number of ovulations ≤5 or >5 CL) had no significant effect on the percentage of donors returning to estrus within 30 days, as 70% of the buffaloes with ≤5 CL and 65% with >5 CL returned to estrus during this time. However, an increase in the number of ovulations significantly delayed the return to estrus as this duration was 9.7 ± 0.93 days in the buffaloes with ≤5 CL compared to 14.1 ± 2.129 days in those having >5 CL.

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**BUFFALO BULLETIN**

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