COMPARATIVE STUDY ON SOME NUTRITIONAL ASPECTS OF CAMELS, BULLS, SHEEP AND GOATS

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SUMMARY

Four ruminant species of farm animals namely ; Friesian bulls, Najdi rams, Damascus bucks and Majahim camels were used to study the microbial activity and rumen parameters. Each animal was fitted with permanent rumen cannula. Animals were raised under the same conditions and fed individually. Results showed that camels needed less DM intake per unit body weight than bulls, sheep and goats .

The rumen pH values of the different animal species occurred in narrow ranges. Ruminal ammonia nitrogen concentration for camels was lower than those recorded for sheep , goats and bulls in all collected samples . Ruminal total volatile fatty acids were not significantly differed .Camels had the highest rumen protozoal count (ranged between 3.1 and 3.8 x 10^5 /ml), while other ruminants had higher total bacterial count

Key words : camels , bulls, sheep , goats , feed intake , rumen activity , microorganisms

INTRODUCTION

The total population of camels in the world is about 19 million , of which 14 million are un Africa and Near East and 4.9 million in Asia (FAO/WHO/OLE, 1992). The vast majority of camels are dromedaries *(Camillus dromedaries*, one humped camel) found mainly in desert (arid lands) , whereas bactrians (*Camillus bactrianus*, two humped camel) are more prevalent in the cooler areas (Chapman 1991). The one – humped camel was domesticated about 3000 BC in Arabia (Bulliet, 1975). The population of camels in Saudi Arabia is estimated to be 61000 and they are all dromedaries (Chapman, 1991) . Cameis in Saudi Arabia play a major role in supplying the desert dwellers with milk and meat under extremely hostile conditions of temperature , drought and lack of pasture (Yagil and Etzion 1980).

Although camelidae are ruminating animals, they are not classified as Ruminantia . They differ from true ruminants in that they walk on the pads of the two last digits instead of on the sole of the hoof , they have no horns or antlers and they have a completely different stomach system

The same general characteristics of rumination and microbial digestion of fibrous feeds in a large and compartmented stomach system have developed independently in camelids and ruminants and at different geological times. The independent development resulted in marked differences in morphology, history and motility of the stomach system (Schwartz and Dioli, 1992).

Stomach motility also differs strongly between ruminants and camelids. In the former the total digesta in the reticulo-rumen are mixed and transported within

the organ some hours after feed intake rather homogeneously, whereas in the latter particles and fluid are separated in a suction-pressure rhythm during the motility cycle, whereby fluids and solutes are pressed into the glandular sacs for potential absorption (Schwartz and Dioli, 1992).

There are common conclusions that camels have lower requirements of energy and protein for maintenance than other ruminants and under drought conditions camel can decrease its feed intake and metabolic rate (Wardeh and Farid 1990 and Farid 1995).

In a series of comparative study carried out with camel and other domestic ruminants; feeding behaviour and dietary preferences between camel, cattle, donkey and sheep on semi arid regions during the dry and the green seasons were investigated (Schwartz, 1988 and Rutagwenda *et al.* 1990). Digestive physiology of the forestomach in camelids and their adaptation to extreme dietary conditions (Farid *et al.*, 1979, Engelhardt *et al.*, 1988 and Hofmann 1988). Dietary energy, protein and their interaction on nutrient utilization by sheep, goats and camels was also studied (El-Banna 1993). Growth performance in camel calves and cattle steers has been recently investigated (El-Badawi and Yacout 1999).

Although these comparative studies have been carried out in various animal species on different nutritional aspects, there is limited information on the digestive microorganism of camel in Saudi Arabia. The objective of this research was to study the fermentation parameters and microorganisms of the forestomach in camels in central region of Saudi Arabia (Qassim area) in comparison with Friesian bulls, sheep and goats under the same farming condition.

MATERIAL AND METHODS

This study was carried out at the experimental station, College of Agriculture and Veterinary Medicine, King Saud University, Al-Qassim branch, Saudi Arabia.

Four species of adult male animals, namely ; Friesian bulls averaging 325 Kg, Najda rams 42.6 Kg, Damascus bucks 27.5 Kg, and Majahim camels 408 Kg, two of each species, were assigned to the trial . All of the animals were surgically prepared with a rumen cannula 6 weeks prior to the experimental period, which lasted 8 weeks. The 4 species of animals were raised under the same conditions and fed a uniform ration consisted of Lucerne hay, barley grains and concentrates mixture for 8 weeks. Rations were offered twice daily at 8 a.m. and 4 p.m. in two equal portions. Rations were formulated to supply the allowances according to Kearl (1982). Water was available at all times. Feed ingredients and chemical composition of the experimental rations are given in Tables 1 and 2.

The official methods of AOAC (1990) were used for running the proximate chemical analysis.

Forty two rumen samples were withdrawn through the fistulae from each animal just before feeding and 5 hrs after feeding. Rumen contents were strained through four layers of cheesecloth and pH was measured immediately. Ammonia was determined as described by Al-Rabbat *et al.* (1977) and total VFA 's by Warner (1964).

The anaerobic techniques, methods of media preparation and use of media were essentially those of Hungate (1966)

Table (1): Feed ingredients of the experimental rations.

Lucerne hay	**50 %**	Calcium Carbonate	**2 %**
Barley grains	**30 %**	Common Salt	**1 %**
Concentrate mix.	**16 %**	Min. and Vitamin mix.	**1 %**

Table (2) : Chemical composition of the experimental ration (% on DM basis)

Feed type	DM	OM	CP	EE	CF	NFE	Ash	ME (Mcal)
Lucerne Hay	91.5	96.4	12.7	3.5	29.6	45.7	8.5	2.1
Barley grains	91.2	97.4	11.3	2.1	11.9	72.1	2.6	2.9
Conc. Mixture	90.1	93.3	14.2	2.6	8.6	67.9	6.7	2.7
Exp. Ration	91.0	93.3	12.0	2.8	20.8	57.7	6.7	2.3

Table (3): Average daily feed intake of Camels , bulls , sheep and Goat fed the experimental ration

Item	Camels	Bulls	Sheep	Goats
Average Body weight (kg)	408	325	42.6	27.5
Metabolic weight 0.75	90.7	76.5	16.7	12.0
Av. Dry matter intake :				
% of Body wt .	1.79	2.52	2.82	2.91
Kg / h /day	7.3	8.2	1.2	0.8
g / h / kg B. wt /d	18.3c	25.2bc	28.2a	29.1a
Relative intake %	100	138	154	151
G / h / kg Bwt..75/d	80.4b	107.2a	71.8c	66.7c
Relative intake %	100	132	89	83

A,b,c = Means not sharing the same superscript within each row are significantly different (p< 0.05).

as modified by Bryant (1972). Samples of rumen contents were collected 0 and 5 hrs. after feeding.

For bacterial isolation, portions (10 g.) of rumen fluid taken immediately to the laboratory, diluted in serial ten fold dilutions, and incubated in tubes, using the anaerobic cultural techniques and procedures for preparation of media described by Dehority (1969). Isolated bacteria were presumptively identified using the procedure of Bryant *et al.*, (1960 and 1961).

For protozoal cell count, 30 ml of rumen fluid were mixed with 10 ml formalin solution 40 % for killing and fixing the cells . therefore the volume was calibrated to 100 ml using saline solution. Three samples each of 5 ml were taken 5 ml of iodine solution. (1% iodine and 2% KI) were added to each sample and the volume was adjusted to 25 ml with sod sol .From each diluted sample 3 representative samples of 0.1 ml aliquot were withdrawn for protozoal counting using slides with a measured cover slide dimensions. Counts were made in 30 microscopic fields area as follow by Shawket (1976).

Statistical analysis was carried out according to S.A.S (1992)

RESULTS AND DISCUSSION

Feed intake

The average daily feed intake of camels, bulls, sheep and goats fed the experimental ration can be seen in Table 3. Results indicated that camels needed less DM.-Intake per unit body weight than bulls, sheep and goats being 18.3, 25.2, 28.2, and 29.1 g/ kg Body weight, respectively .When intake was related to metabolic body weight, goats then sheep had the least intake which was significantly less than camels ,while bulls were significantly the more feed consumer species . Kearl (1982) reported average values of 70 and 68 g DM/d/kg $^{0.75}$ for sheep and goats breeds in developing countries, respectively. The maximum ad-lib DMI for camels in this experiment (81.2g/d/kg $^{0.75}$) was similar to that reported by Farid (1995) for dromedary camels (82.8g/kg $^{0.75}$) .

Ruminal fermentation

The ruminal pH values of the four animal species were of narrow ranges . It was noted (Table 4) that all the pH values after feeding were lower than those before feeding, especially in camels.

Ruminal ammonia nitrogen concentrations in camels were lower than those reported in bulls, sheep and goats at all samples collected. This could be explained on the basis that :

1-Camels usually recycled more urea than other ruminants (Schmidt – Nielsen, 1964 and Farid *et al.* 1979).

2-Microbial population in camels was found to be higher in count of protozoa (Table 5). This findings is in agreement with that found by Shawket (1976) and Farid *et al.* (1979).

The concentration of total V F A in the rumen fluids among the four animal species was not significantly differed, especially before feeding.

While it increased after feeding to reach the highest values in bulls and sheep; and the lowest in camels followed by goats

Bacterial and Protozoal counts

The bacterial and protozoal counts isolated from the rumen of sheep, goats, bulls and camels can be seen in (Table 5). The camels had the highest total rumen protozoa count, ranged between 3.0 to 3.8 $x10^5$ /ml).Sheep showed the lowest rumen protozoal count 1.0-1.1$x10^5$ /ml. Bulls and goats showed medium total count of protozoa. However Hassona et.al(1995)noticed that the total

Table (4): Ruminal Fermentation Parameters in Camels , Bulls,Sheep and Goats (Mean ± SE)

Animal sp.	Sampling Time *	pH	NH_3-N (Mg/100ml.)	Total VFA (meq/100ml)
Camels	BF	7.5	13.3	7.2
	AF	6.78	1.0.0	13.5
	SE ±	0.06	0.11	0.14
Bulls	BF	6.80	16.1	8.8
	AF	6.45	19.3	16.1
	SE ±	0.0i	0.19	0.22
Sheep	BF	6.95	16.3	9.1
	AF	6.77	20.2	15.5
	SE ±	0.02	0.33	0.11
Goats	BF	6.95	15.8	7.5
	AF	6.64	18.0	14.7
	SE ±	0.02	0.40	0.15

BF : Before feeding (0 hrs just befor feeding)
AF : After feeding (5 hrs post feeding)
SE : Standard error of the mean

Table (5): Mean total Bacterial and protozoal Counts isolated from The rumen of Camels, Bulls ,Sheep and Goats.

Animal sp.	Sampling Time	Total Bacterial (count /mlx10^9)	Total Protozoal (count/mlx10^5)
*Camels	BF	0.72	3.03
	AF	0.87	3.82
	SE ±	0.09	0.08
*Bulls	BF	1.41	0.95
	AF	2.10	1.50
	SE ±	0.09	0.08
*Sheep	BF	0.95	1.11
	AF	1.36	0.99
	SE ±	0.08	0.10
*Goats	BF	0.87	1.95
	AF	0.99	2.18
	SE ±	0.01	0.05

*Means of 42 samples (Sampless were collected from each fistulated animal 2 times daily for 21 days).

cell counts of ruminal protozoa ranged between 6.1-8.7x10^5 in goats and between 4.7 and 7.2x10^5 in sheep. The present results agree with them in that , the total protozoal cell counts were higher in goats than in sheep. The difference in the total counts can be due to the type of diet. Entodinium sp, count made up, on the average 82%,80%,78%,and 70% of protozoal population in camels , sheep ,goats and bulls, respectively. Epidenium sp.made up 18% of protozoal population in camels while it was absent in sheep and goats.

This finding is similar to the earlier results of Shawket (1976), where total protozoal counts in sheep and camels were compared and determined.

The total bacterial counts took the opposite trend of protozoa, where camels and goats showed the lowest ruminal bacterial count (6.5to8.8x10^8 /ml .in camels and 8.7to9.9x10^8/ ml in goats). The reason for the lower number of bacteria and higher number of protozoa in camels and goats than sheep and bulls is probably due to a faster engulfment of bacteria by the huge count of protozoa. All rumen bacteria sp. that have been tested in-vitro by Onodera (1980) were engulfed by Entodinium protozoa ; it was calculated by 50cells/min. It can also be noted that total bacterial counts in sheep had larger values than in goats. This is also previously reported by Kobeisy (1992).

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دراسة مقارنة على بعض النواحى الغذائية فى الإبل ،العجول ، الأغنام ، الماعز

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استخدم فى هذه الدراسة أربع أنواع من الحيوانات المزرعية: الإبل المحلية السعودية، العجول الفريزيان، الكباش النجدى، والتيوس الدمشقى وذلك فى دراسة مقارنة للنشاط الميكروبى، معاملات الهضم ومقاييس التخمر فى الكرش.

تم إجراء عملية تركيب فستيزلا مستديمة فى الكرش فى جميع الحيوانات الحيوانات لتسهيل أخذ العينات. وقد وضعت الحيوانات تحت نفس الظروف البيئية والغذائية وغذيت فردياً على نفس العليقة تبعاً لاحتياجاتها الغذائية.

أوضحت النتائج أن كمية المادة الغذائية المأكولة فى الجمال أعلى من العجول والأغنام والماعزبالنسبة لوحدة الوزن . وقد وجدت حدود ضيقة فى قيم الـ pH فى حموضة سائل الكرش بين الأنواع المختلفة. كان تركيز الأمونيا فى سائل الكرش للإبل أقل عن كل من الأغنام والماعز والعجول فى جميع العينات المأخوذة. لم يوجد اختلاف فى تركيز الأحماض الدهنية الطيارة الكلية فى الكرش بين الأنواع الحيوانية تحت الدراسة.

أظهرت النتائج أن أعلى عدد من خلايا البروتوزوا كان فى كرش الإبل وقد تراوحت أعدادها ما بين ٣,١ إلى ٣,٨ × ١٠ ^{٥}/ ملليلتر، بينما ارتفعت أعداد الخلايا البكتيرية فى سلالات المجترات الأخرى.