OBSERVATION ON RUMEN PROTOZOA OF CAMEL IN COMPARISON WITH OTHER RUMINANTS

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SUMMARY

Protozoa was counted and identified in the rumen liquor of camel in comparison with goat, sheep and cattle. Three animals from each ruminant species were fed *ad lib.* on berseem (*Trifolium alexandrinum*) hay as a sole feedstuff. Rumen liquor was collected through a stomach tube before feeding and 3 hr post-feeding.

Total protozoal number in camel was 792,000/ml rumen liquor before feeding and increased by 17% post-feeding. Cattle showed similar protozoal number to that of Camel and lower than those of goat and sheep. Camel was the only ruminant showed the presence of *Diplodinium cameli* and this result emphasized the findings of other workers. The other protozoal species observed in the rumen of the experimental ruminants were: *Isotricha prostoma, Dasytricha ruminantium, Entodinium furca, E. bursa, E. ecaudatum, E. minimum, E. simplex, E. triacum, Epidinium ecaudatum, Diplodinium dentatum, Buetschlia parva and B. neglectum.* The protozoal number and type in the rumen of the different ruminant species were investigated.

Key words: *Protozoa, camel and cattle*

INTRODUCTION

Dromedary camels are a major resource in deserts, which occupy most of Arabian lands. They consume and digest natural poor desert range better than other desert dominant animals (Gihad *et al.*, 1989; El-Banna 1993; Gihad 1995; Mohamed 1996). To study the ability of camel to digest low quality roughages compared with other ruminants microbial digestion should be investigated. The role of microflora and microfuna in the process of microbial digestion in ruminants is of utmost importance.

Rumen ciliate protozoa play diverse and important roles in ruminal metabolism of nutrients (Williams and Coleman, 1992), these authors collected the available information on ruminal protozoa from in vivo and in vitro experiments. The information showed that the many kinds of protozoa present in the rumen have different metabolic functions and a different influence on ruminal fermentation, hence, some may be and some may not be beneficial to the ruminant host.

The microbiology of the rumen is an extremely complex subject due to the large number of organsims present with their diverse nature, and the shifting population that result from changes in the diet of the host animal. The number and types of these organisms varies according to the consumed feed (Attia *et al.*, 1980a&b). In addition marked changes may be noted within and between animals on the same or similar diets (Church, 1975).

Rumen protozoa have been known to exist since mid 19*th* century, as they are much larger than bacteria and can easily be seen with the aid of microscope. Data on the role of protozoa in nutrition, metabolism and related subjects are of origin that is more recent.

This paper presents data on the count and identification of protozoa in the rumen liquor of camel, sheep, goat and cattle fed berseem hay as a sole ration.

MATERIALS AND METHODS

This study was carried out on camel, sheep, goat and cattle. Three mature male animals of each species weighed in average 328 Kg, aged 3 years for camel, 50 Kg, aged 1,5 – 2 years for sheep, 27 Kg aged 1,5 – 2 years for goat and 250 Kg aged 1 year for cattle were used. Animals were fed Berseem (*Trifolium alexandrinum)* hay solely, which was offered *ad Libitum*, twice daily, for two weeks before rumen liquor collection. Suitable stomach tubes were used for rumen liquor collection just before morning feeding and three hours after offering hay. Collected samples were filtered through two layers of cheesecloth.

The ruminal protozoa were identified according to the method described by Ogimoto and Imais (1981) were the collected rumen liquor samples were immediately fixed three times of their volume by methyle green formol-saline (MFS) solution and stored in dark until examination. The identification, differentiation and classification of protozoa depended upon the size of the cell, type and location of the cilia, macro and micronucleus plates and various spines and projections of the external cuticle. Photographs and description methods given by Hungate (1966), Church (1975) and Ogimoto and Imais (1981) helped in the identification of protozoa species.

Protozoal count was done by the method employed by Abou-El-Naga (1967) using usual slide and 1100 (22x50) square millimeter area cover. The following formula was applied for counting protozoa in 0.1 ml of diluted rumen liquor:

N x 22 x 50 x 10 x 4

where :N is the average count of 30 fields.

Statistical analysis was performed using the GLM procedure of SAS, 1996, following by Duncan's Multiple Range Test.

RESULTS AND DISCUSSION

Protozoal count

The microscopic examination (X1000) of the total count of protozoa in 1 ml rumen liquor of the experimental ruminant species before feeding and 3 hr after feeding are presented in (Table 1). The number of protozoa after feeding was higher than before feeding by 17%, 18%, 20% and 32% in the rumen liquor of camel, cattle, sheep and goat, respectively. The herein tabulated total numbers of protozoa are seemingly lower than those estimated by Attia *et al.*, (1980a&b) and Pant and Ray (1971). Those authors counted and identified protozoa in the rumen liquor of sheep and goats fed berseem hay as well as other feedstuffs. Similar results were detected when the herein results for large ruminants were compared with the findings of El-Kholy and Salama (1995). This result might be due to the stomach tube procedure of rumen liquor collection, since it might be diluted by saliva. Otherwise, the rumen compartment from where the sample was collected could be another factor. The protozoal counts in the rumen liquor of sheep and goat are higher than those for

Table (1). Average total numbers of protozoa per millilter rumen liquor collected from different ruminant species.

Animals	Before feeding (B)	After feeding (A)	Increase % $\frac{A-B}{B} x100$
Camel	79,200	92,400	17
Cattle	74,800	88,000	18
Sheep	110,000	132,000	20
Goat	96,800	127,800	32

Table (2). Identified protozoa and their density[1] in rumenLiquor of experimental ruminants.

	Sheep		Goat		Cattle		Camel	
Protozoa species	B	A	B	A	B	A	B	A
Genus: *Isotricha*								
I. prostoma	+				+	++		
Genus: *Dasytricha*								
D. ruminantium							+	
Genus: *Entodinium*								
E. furca					+			
E. bursa		+	+	++	+			
E. ecaudatum		++	+		++	+	+	
E. minimum		+	+	+				
E. simplex	+			+		++	++	++
E. triacum	+							
Genus: *Epidinium*								
E. ecaudatum		+		++		+	+	++
Genus: *Diplodinium*								
D. dentatum					+	+		
D. cameli								+
Genus: *Buetschlia*								
B. parva								+
B. neglectum							+	+

B= Before feeding
A= Post feeding
[1] Density: + = low ++ = Medium +++ = High

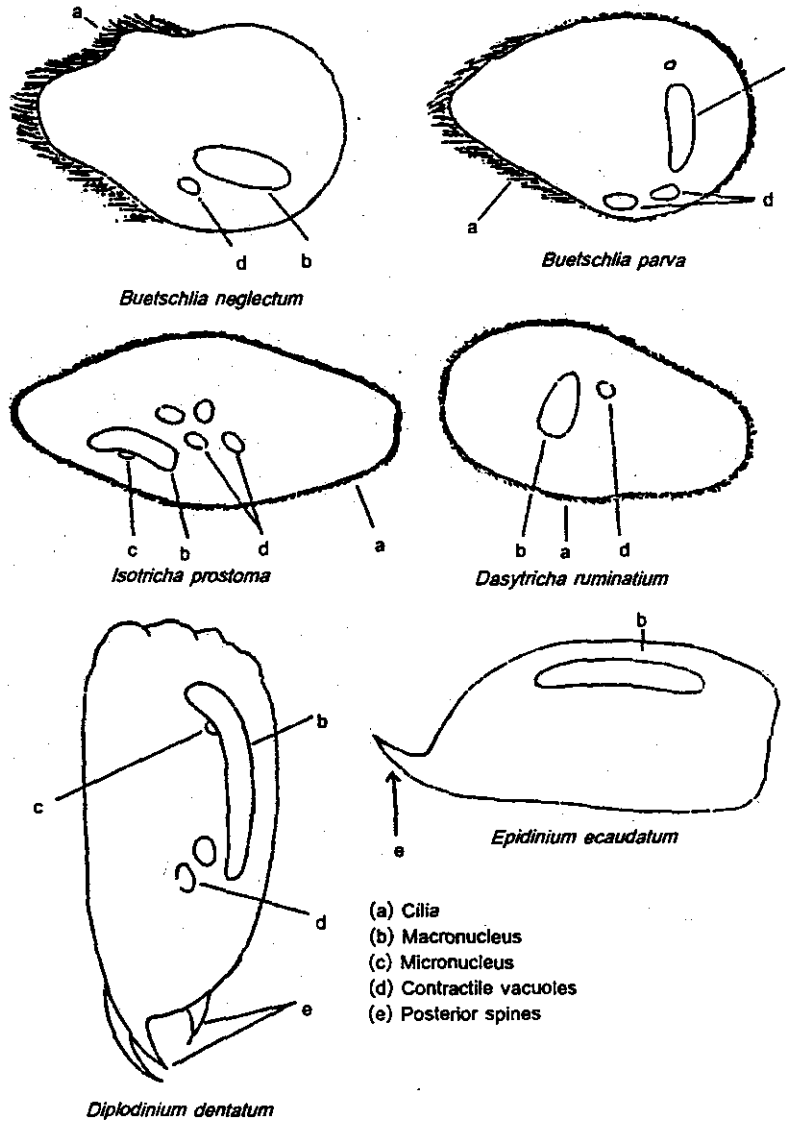
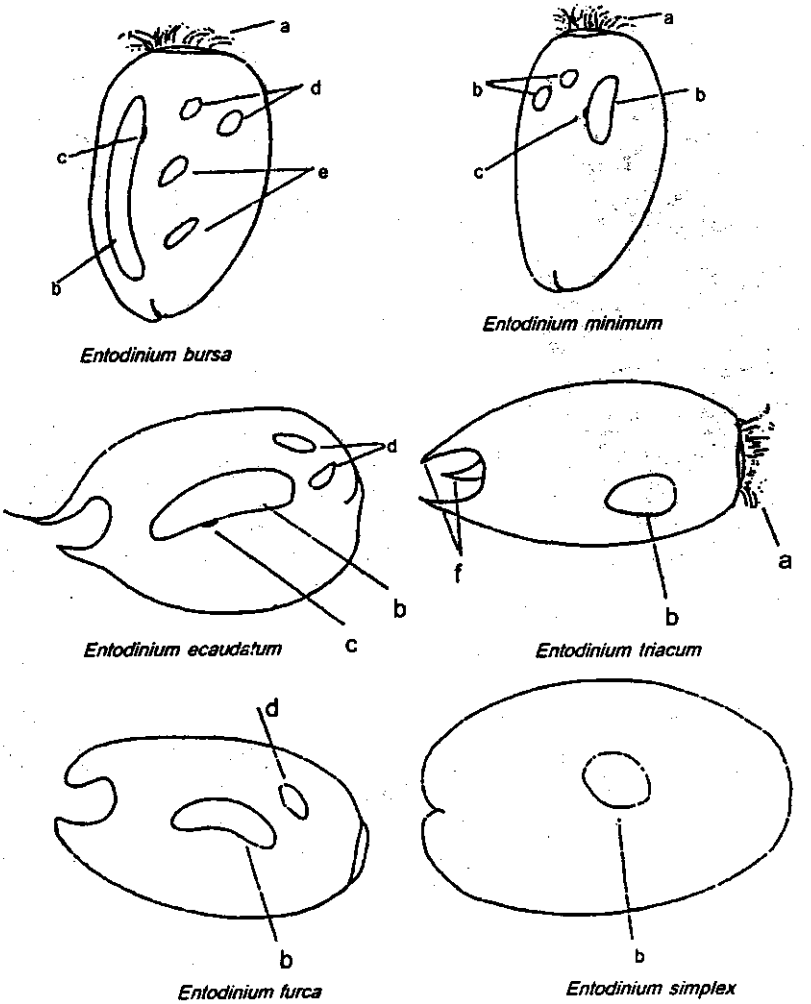


Figure 1 : Diagrammatic sketch of different protozoa species



(a) Cilia (b) Macronucleus (c) Micronucleus
(d) Contractile vacuoles (e) Food vacuoles (f) 3 forked posterior end

Figure 2 : Diagrammatic sketch of genus *Entodinium* of protozoa

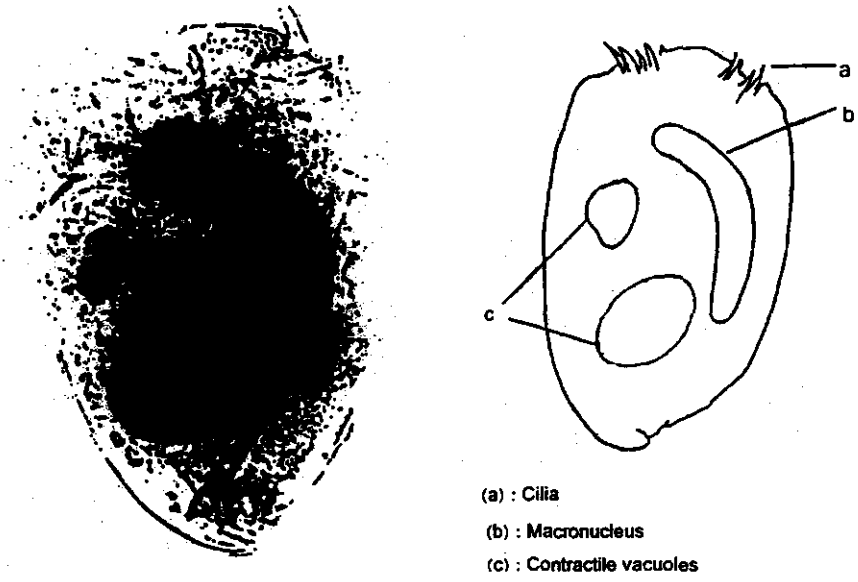


Figure 3 : Microscopic (X 1000) and diagrammatic sketch of *Diplodinium* spes\cies of protozoa

cattle and camel. These findings are in line with those of Nour *et al.*, 1979, who studied the count difference between small and large ruminants.

Protozoa identification

The identified protozoa species and their density in the rumen liquor of the experimental ruminants are presented in (Table 2). The protozoa species as shown in figures 1, 2 and 3 were identified according to the description and photographs given by Hungate (1966) and Ogimoto and Imais (1981). The tabulated results showed fluctuated results either between the ruminant species or before and after offering feed.

Protozoa of genus *Entodinium* and *Epidinium* showed higher density with all experimental animals fed berseem hay than other genus. This result is in line with the findings of Shalaby (1990). Hungate (1996) reviewed that most of cellulose digestion by rumen protozoa has been found with *in vitro* cultures of genus ***Entodinium*** and ***Epidinium***.This results special for genus *Epidinium* was differed from the reported by Abu Akkade and El- Shazly, (1964), Naga *et al.* (1968) and Shawkat (1976).

However, not all varieties of Entodinium species were found in the rumen of tested animals (Table 2). On the other hand, Entodinium spp. made up 89 and 91% of the ciliate protozoal population in cattle, fed medium- or high- concentrate barley-based diets (Hristove et al., 2001).

Diplodinium cameli, Dasytricha ruminantium, Buetschlia parva and *Buetschlia neglectum* were identified in camel rumen liquor, while they had not been identified with other experimental ruminant species. *Epidinium sp.* has been found in low numbers in sheep and cattle, but moderate numbers has been found in camel. *Isortricha prostoma* was identified with low density in sheep and high density in cattle but not found in goats and camels. *Diplodinium* and related genera seem to be absent in sheep, goat and camel, but present in cattle.

Presence and absence of different protozoa in the rumen are affected by many factors more than the host animal. Therefore, it is difficult to assert specific protozoa species for certain ruminants. However, the herein results emphasize this fact, but *Diplodinium cameli* (fig. 3) could be taken as a specific species in camel rumen, This result agree with the findings of Dogiel (1926), Nassar (1971), and Sakr (1988), who found *Diplodinium cameli* only in camel rumen.

Further investigations on microbial digestion in camel should be undertaken since such studies might be an additional clarification for the high ability of camel to digest poor quality natural desert range.

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تصنيف البروتوزوا فى كرش الإبل بالمقارنة بالمجترات الأخرى

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أجريت هذه الدراسة بكلية الزراعة جامعة القاهرة لتحديد أنواع و أعداد البروتوزوا فى كل من الإبل و الماعز و الأغنام و الماشية.

وكان قد تم تغذية ثلاث حيوانات من كل نوع من هذه الحيوانات حتى الشبع على دريس البرسيم المصرى و جمع سائل الكرش من خلال لى معدى قبل التغذية و بعد ٣ ساعات من التغذية.

وقد كان عدد البروتوزوا فى الإبل ٧٩٢٠٠٠ / مللى من سائل الكرش قبل التغذية وزاد بنسبة ١٧% بعد التغذية.

وقد أظهر عدد البروتوزوا فى الإبل تشابهاً مع الماشية وكان أقل من الأغنام و الماعز.

وكانت الإبل هى المجتـرات الوحيـدة التى أظهرت وجـود البروتـوزوا من نـــوع

Diplodinium Cameli

والأنواع الأخرى من البروتوزوا شوهدت فى كرش مجترات التجربة و التى تمثلت فى كل من

Isotricha Prostoma , Dasytricha Ruminantum , Entodinium Furca , E.bursa , E.caudatum , E.minimum , E.simplex , E.triacum , Epidiniumn , Ecaudatum ,Diplodinium dentatum , Buetschlida Parva and B.neglectum.

وتم فى هذا البحث دراسة الأنواع المختلفة من البروتوزوا الموجودة فى الكرش و أعدادها.