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# تأثير التغذية على حجم بروتوزوا الكرش في الماعز

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استعمل أربع من الماعز البلدية مركب لها ناصور الكرش الصناعي لدراسة تأثير نوع وزمن التغذية على حجم بروتوزوا الكرش. تم تغذية الماعز لمدة ٣٠ يوم كفترة تأقلم قبل أخذ العينات على البرسيم كعليقة خضراء والذرة العويجه والردة والتبن كعليقة جافة. كانت الحيوانات تتغذى مرة واحدة في اليوم وتؤخذ العينات مرتين يوميا مرة كل ستة ساعات وكل ٢٢ ساعة بعد التغذية.

كان حجم البروتوزوا على العليقة المركزة ضعفي حجمها على العليقة الخضراء. ومعظم كتلة البروتوزوا على العليقة الجافه يرجع الى جنس الدبلود ينيم والانتود ينيم، بينما على العليقة الخضراء كان يرجع الى جنس الايزوتريكا بروستوما.

بالنسبة لتأثير الزمن بعد ٢٢ ساعه من التغذية كانت معظم كتلة البروتوزوا سواء على العليقة الخضراء أو الجافة ترجع الى جنس الدبلود ينيم والانتود ينيم. وبعد ٦ ساعات من التغذية كانت معظم كتلة البروتوزوا على العليقة الخضراء ترجع لجنسي الايزوتريكا والانتود ينيم كوداتم وعلى العليقة المركزة لوجود الانتود ينيم سمبلكس.

معظم كتلة البروتوزوا على العليقة الخضراء ترجع الى الأجناس كبيرة الحجم. بينما في حالة العليقة الجافه ترجع الى الأجناس صغيرة الحجم.

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# *DIETERY EFFECT UPON THE VOLUME OF RUMEN PROTOZOA IN GOAT*

*(With 4 Tables and 3 Figures)*

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## *SUMMARY*

Four female Baladi goats with rumen fistula were used in two experiments to investigate the effect of green fodder (Barseem) and Dry ration (Sorghoum, Bran, wheat straw) upon the protozoal volume in rumen of goat. Animals were fed green and dry ration up to 30 days as period of adaptation before sampling start. The Goats were fed once per day, samples were taken 6 and 22 hours after feeding.

On concentrates protozoal volume was twice as that on green fodder. Most of the protozoal bulk on dry ration refered to Diplodinium species and Entodinium, while on green ration it was due to Isotricha prostoma.

According to the time of feeding, at 22 hours most of the protozoal mass was due to Diplodinium and Entodinium species on green and dry ration. At 6 hours after feeding on green fodder most of the protozoal volume was due to Isotricha species and Entodinium caudatum. On concentrates it was due to Entodinium simplex.

On green fodder most of the protozoal volume was due to large size protozoa. On contentrates it was due to small size species.

## *INTRODUCTION*

The protozoa in the rumen accomplish specific function in the metabolism during decomposition of food stuff.

The function of the protozoa in the rumen for their host animal has been interpreted early that protozoa provided their animals with animal protein which contain essential amino-acids than bacterial protein. The quantity of protein which will be provided by protozoa to their animals will be estimated through measuring the volume of protozoa in the rumen content.

Very few data are available on protozoal volume in goat. FERBER (1928) found that protozoa form 1/12 of rumen content in goat. HARMEYER and HILL (1964) estimated that protozoal volume of goat form 9.4 % of rumen content.

The aim of this work is to study the volume of different protozoal species to the total rumen content in goat. Also the effect of diet on protozoal volume.

## MATERIALS and METHODS

Four adult fistulated female Egyption Baladi goats from Assiut Governate were used.

Two experiments were performed : In the first experiment, the animals were fed Egyptian clover (Barseem), for 30 days as a period of adaptation for green fodder before sampling started.

In the seconed experiment, the animals were fed wheat straw, bran, Sorghums as dry ration Sampling started after 30 days as period of adaptation. During experiments the diet was given once per day at the morning. Samples from numen content were collected twice daily 6 hours after feeding and 22 hours after feeding.

Total and differential count for protozoa was performed according to (HARMEYER, 1963).

For every species the length and breadth of 150 cells were estimated using micrometer eye piece. The cilia and appendages of one cell were not taken in consideration.

The volume was estimated according to the method of HERMEYER and HILL (1964).

## RESULTS and DISCUSSION

On green ration protozoal volume forms 7.3 % of total rumen content, when protozoal number was 510 - 726 X 10 /ml rumen content. While on concentrates it forms 15.43% of total rumen content, where protozoal numer was 1.342.563 x 10 /ml rumen content (Tables 2, 3).

It is clear that protozoal volume on concentrates was twice as that on green fodder. Most of the protozoal bulk on dry ration refered to Diplodinium and Entodinium species while on green ration it was due to isotricha prostoma.

Entodinium simplex is the most prominant species. On concentrates it forms 97.7 mm /ml , five times as that on green fodder 20.7 mm /ml. In relation to the total protozoal mass it forms 62.9% on concentrates less than double as that on green fodder.

Diplodinium species on dry ration form 14.5 and 35.4 mm /ml double as that on green ration 7.1 and 16.8 mm /ml. In relation to the total protozoal mass, they share with the same percent 9.3 to 9.8 and 23.2 to 23.5% (Table 3, Fig. 3).

Isotricha prostoma is the most prominant species on green fodder and forms 23.73 mm /ml four time as those on dry ration 6.26 mm /ml . In relation to the total protozoal mass it forms 31.4% eight time as that on concentrates 4.1% (Table 3, Fig. 1).

According to the diurnal variation in protozoal volume; on green fodder at 6 hours after feeding most of the protozoal volume was due to Entodinium simplex and Isotricha prostoma which chiefly digest soluble sugars in forages (HUNGATE, 1955). At 22 hours after feeding most of the protozoal volume was due to Diplodinium, Diplodinium caudatum beside Entodinium simplex. As most of the rumen content was cellulose and amylopectine from ruptured Isotricha (SUGDEN and OXFORD, 1952). which represents the energy source for these species.

On concentrates at 6 hour after feeding most of the protozoal volume was due to Entodinium 69% and Diplodinium Caudatum 20.2%. At 22 hours Diplodinium species (Diplodinium

and Diplodinium Caudatum) form 39% and Entodinium form 56% (Table 3, Fig. 2).

From table 4, it is clear that large size protozoa form 67.4% on green fodder and 37% on concentrates. MOWRY and BECKER (1930) and BARABANOW (1962) found it to range from 50 - 65% in sheep.

On the other hand, small size protozoal species form 32.4% on green fodder and 62.9% on concentrates. In goats KANDATSUE and TAKAHASHI (1955)found it to form 50%. EADIE (1959) recorded 80-90%. HARMAYER and HILL (1964) found that small species form 90% of protozoal population in goat and form about 20% of total protozoal volume on mixed food stuffs.

So it is clear from above results the importance of addition of green fodder to the ration. As it acts as stimulator for division of large size protozoal species. This will increase the protozoal mass and microbial protein. These finding was supported by HARMEYER (1963), who stated that although Isotricha prostoma, Isotricha intestinalis and Ophryoscolex constitute 10 to 15% of the total population of rumen, but they form 86% of total protozoal nitrogen. Ophryoscolex was present in small percent on green fodder. KORULOV and KROTHOVA (1971) stated that Ophryoscolex can synthesize essential amino acids in large degree than other forms of protozoa.

The decrease in protozoal number due to diluting effect of green fodder can be correctedby additon of roughage and small amount of concentrates. Also dependance on concentrate alone was expensive and waistage.

## *REFERENCES*

Barabanow, I.A. (1962): Vliyamie biovetina na fayna rubtra Yognyat. (Die Wirkung Von Biovetin auf die Pansenfauna bei hammern). Veterinariya I., 60 - 62.

Eadie, J.M. (1959): Some aspects of rumen ciliate protozoa Proc. Nutr. Soc. 18, 123 - 126.

Farber, K.E. (1928): Derzahl und masse der in passen. U.S.W.Z. fur Tierzuchting, 12. 31.

Harmyer, J. (1963): Isolation, differentition and analytical studies on the protozoal founa of goats Inaug Diss. Hanover.

Harmyer, J. and Hill, H. (1964): The total content of protozoa in the rumen of goat and guanako. ZblVet. Med. Reihe A, Bd. 11, Heft 6. 493 - 501.

Hungate, R.E. (1955): Mutualistic intestinal protzoa - Biochemistry and physiology of protozoa - 2: 159-199. In Hunter, S.H. and Zowffeds (ed). New York. Academic press.

Kandatsu, M. and TakaHashi , N. (1955): Studies on reticulo - rumen digestion. 2- On the artificial culture of some Entodenia. J. Agric. Chem. Soc., Japan, 29, 833 - 838.

Karulov,H.B. and Krothova,A.B. (1971): Physiology and Biochemistry of ruminant. Koloc Moscow.

Mowry, H.A. and Becker, E.R. (1930): Experiments on the biology of infusoria inhabiting the rumen of goats. Iowa state call. J. 5. 35 - 60.

Sugden, B. and Oxford, A.E. (1952): Some cultural studies with holotricha ciliate protozoa of sheep rumen. J. Gen. Microbiol., 7, 145 - 153.

**TABLE (1)**

The average length and breadth of individual protozoal species from rumen content of goat fed on green (Barseem) and dry concentrate (Wheat bran and grain sorghum) ration.

| Type of protozoa | Early morning | | | | Afternoon | | | |
|---|---|---|---|---|---|---|---|---|
| | Length (range) | Average | Breadth (range) | Average | Length (range) | Average | Breadth (range) | Average |
| | Green | | | | | | | |
| Diplodinium | 125.8-222 | 160 ±1.74 | 59.2-111 | 73.3 ±0.82 | 118.4-199.8 | 156.2 ±1.54 | 59.2-88.8 | 74.4 ±0.69 |
| D.caudatum | 125.8-207.2 | 183 ±1.72 | 51.8-96.2 | 74.1 ±0.76 | 111 -207.2 | 159.6 ±1.9 | 59.2-88.8 | 74 ±0.88 |
| I.prostome | 59.2-185 | 135.1 ±4.09 | 37 -111 | 71.7 ±2.17 | 88.8-177.6 | 131.7 ±4.58 | 51.8-111 | 72.9 ±3.13 |
| I.intestinalis | 59.2-125 | 76.2 ±1.54 | 44.4-74 | 50.9 ±1.08 | 59.2-125.8 | 84.1 ±2.15 | 37 -66.6 | 50.7 ±1.35 |
| Entodinium | 44.4-88.8 | 61.9 ±1.26 | 29.6-59.2 | 40.6 ±0.47 | 44.4-81.4 | 61.2 ±1.54 | 29.6-51.8 | 40.6 ±0.92 |
| E.caudatum | 66.6-111 | 85.5 ±1.78 | 44.4-74 | 56.6 ±0.76 | 74 -96.2 | 85.8 ±1.23 | 51.8-66.6 | 59 ±1.07 |
| Dasytricarumi-natum. | 74 -111 | 80.4 ±1.71 | 51.8-74 | 55 ±0.78 | 74 -111 | 89.7 ±2.36 | 51.8-74 | 61.6 1.29 |
| Ophryoscolex | 185 -236.8 | 212.5 ±7.03 | 88.8-111 | 100.1 ±2.02 | 222 | 222 | 103.6 | 103.6 |
| | Concentrate | | | | | | | |
| Diplodinium | 125.8-207.2 | 157 ±2.6 | 59.2-111 | 85.9 ±1.8 | 125.8-222 | 175.8 ±3.58 | 59.2-88.8 | 73.9 ±0.18 |
| D.caudatum | 111 -185 | 152.4 ±3.48 | 51.8-81.4 | 68.5 ±1.4 | 88.8-207.2 | 163.2 ±4.4 | 59.2-88.8 | 72.2 ±1.30 |
| I.prostome | 96.2-207.2 | 157.2 ±5.10 | 59.2-111 | 95 ±2.85 | 96.2-199.8 | 153.8 ±5.14 | 59.2-125.8 | 79.7 ±2.76 |
| I.intestinalis | 81.4-214.6 | 101.6 ±3.54 | 44.4-103.6 | 54.8 ±2.78 | 81.4-148 | 89.4 ±3.53 | 37 -74 | 52.2 ±1.78 |
| Entodinium | 44.4-111 | 67.4 ±3.62 | 29.6-74 | 45.6 ±2.29 | 44.4-96.2 | 66.4 ±2.84 | 29.6-66.6 | 45.6 ±1.76 |

## DIET AND RUMEN PROTOZOA VOLUME

**Table (2)**

Total and individual protozoal species volume in mm /ml of rumen content of goat fed on green (Barseem) and concentrates (Wheat bran and grain Sorghum) ration.

| Diet | Time of sampling / Mean | Total Protozoal number/gm | Diplodinium vol. in $mm^3$ | Diplodinium caudatum vol. in $mm^3$ | Isotricha prostoma vol. in $mm^3$ | Isotricha intestinalis vol. in $mm^3$ | Entodinium vol. in $mm^3$ | Entodinium caudatum vol. in $mm^3$ | Dasytricha vol. in $mm^3$ | Ophryoscolex vol. in $mm^3$ | Total Volume | Protozoal vol. in % of the rumen content |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Green ration | Early morning | 547.303 | 9.4 | 23.2 | 7.7 | 0.6 | 24.4 | 1.5 | 1.4 | 1.4 | 69.6 mm | 6.96 % |
| | Afternoon | 474.148 | 4.7 | 10.5 | 39.8 | 1.5 | 17.0 | 2.5 | 0.9 | 0.2 | 77.1 mm | 7.71 % |
| | Mean | 510.726 | 7.1 | 16.8 | 23.75 | 1.1 | 20.7 | 2.0 | 1.2 | 0.8 | 73.4 mm | 7.34 % |
| Dry ration | Early morning | 1080.667 | 18.4 | 37.1 | 6.7 | 0.4 | 79.8 | - | - | - | 142.4 mm | 14.25% |
| | Afternoon | 1604.459 | 10.6 | 33.6 | 5.9 | 0.3 | 116.0 | - | - | - | 166.4 mm | 16.64 % |
| | Mean | 1342.563 | 14.5 | 35.4 | 6.3 | 0.4 | 97.9 | - | - | - | 154.3 mm | 15.43 % |

Morning : 22 h. ater feeding

Afternoon : 6 h. after feeding.

**Table (3)**

Mean individual protozoal species volume % in rumen content of goat fed green (Barseem) and concantrates (wheat bran and grain sarghums) diet

| Diet | Time of sampling / mean | Diplodindum | Diplodinium caudatum | Isotrcicha prostoma | Isotrecha Intestinalis | Entodinium | Entodinium caudatus | Dasytrica ruminatum | Ophryoscolex |
|---|---|---|---|---|---|---|---|---|---|
| Green | Early morning | 13.5 | 33.3 | 11.1 | 0.7 | 35.1 | 2.2 | 2.0 | 2.0 |
| | Afternoon | 6.1 | 13.6 | 51.6 | 2.0 | 22.0 | 1.2 | 1.1 | 0.3 |
| | Mean | 9.8 | 23.5 | 31.4 | 1.5 | 28.6 | 2.1 | 1.5 | 1.2 |
| Concentrate | Early morning | 12.9 | 26.1 | 4.7 | 0.3 | 56.0 | - | - | - |
| | Afternoon | 6.3 | 20.2 | 3.5 | 0.2 | 69.7 | - | - | - |
| | Mean | 9.3 | 23.2 | 4.1 | 0.3 | 62.9 | - | - | - |

Morning : 22h after feeding Afternoon: 6h after feeding

## DIET AND RUMEN PROTOZOA VOLUME

**Table (4)**

Large size and small size prolowoal species volume % and number in rumen content of goat fed gren (Barseem) and concentrates (Wheat bran, Sorghums and wheat straw) diet.

| Diet | Time of Large sampling / mean | Size Species S!ecoes | | Small Size Species | |
|---|---|---|---|---|---|
| | | volume | number | volume | number |
| Green | Early morning | 60.6 | 15.7 | 39.3 | 84.3 |
| | Afternoon | 73.6 | 30.0 | 26.3 | 69.0 |
| | Mean | 67.4 | 22.9 | 32.4 | 77.2 |
| Concentrate | Early morning | 44.0 | 12.6 | 56.0 | 86.3 |
| | Afternoon | 30.2 | 6.7 | 69.7 | 93.2 |
| | Mean | 37.0 | 9.7 | 62.9 | 89.8 |

Large size species: Diplodinium, Diplodinium Caudatum, Isotricha prostoma, Isotricha. Intestinalis and Ophryoscolex.

Small size species: Entodinium, Entodinium Caudatumn, Dasytrica ruminatum.

Morning : 22 h after feeding.

After noon : 6 h after feeding.

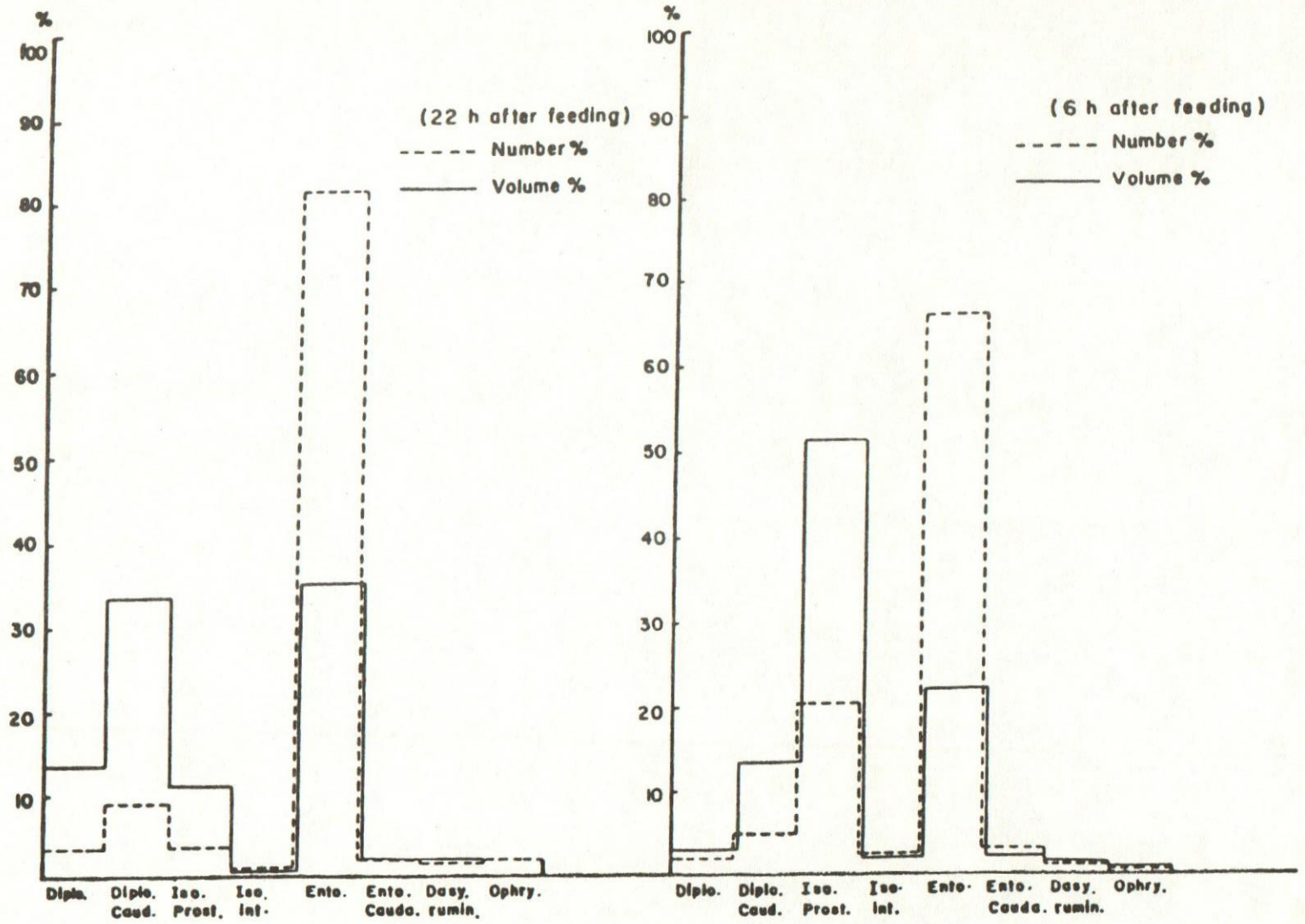


Fig. (1): Percentage of protozoal number and volume on green (Barseem) diet.

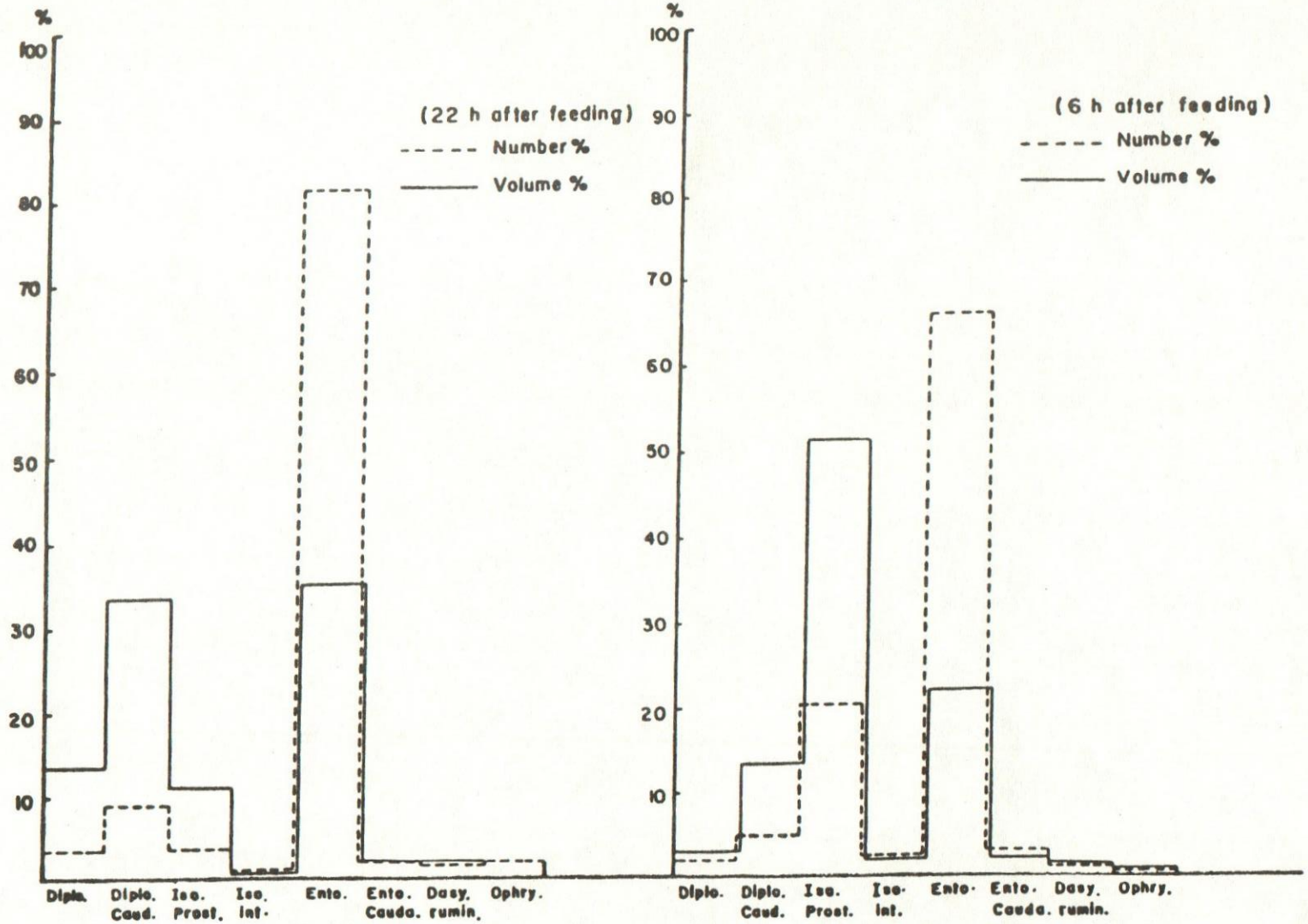


Fig. (1): Percentage of protozoal number and volume on green (Barseem) diet.

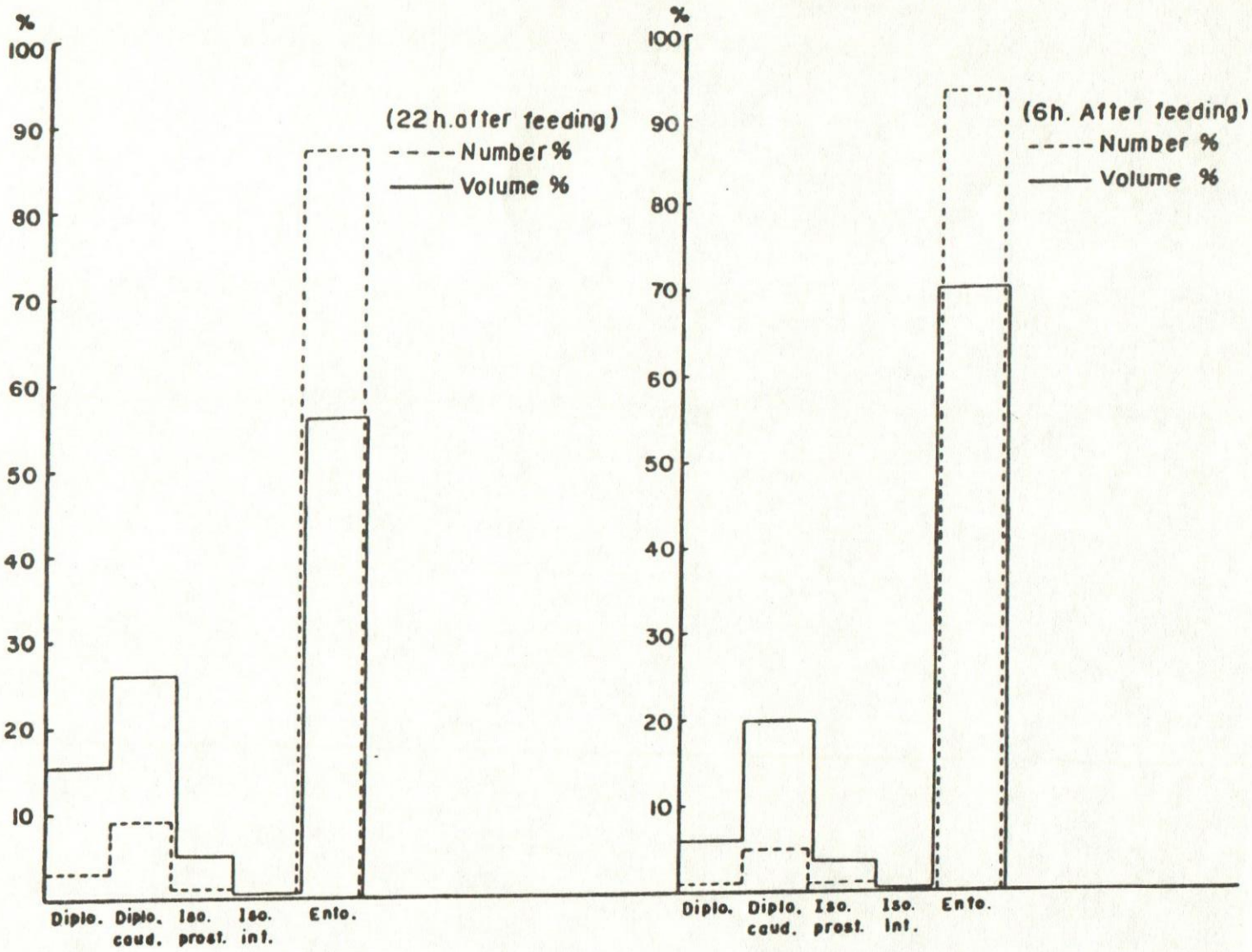


Fig. (2): Percentage of protozoal number and volume on concentrate (Wheat bran and sorghum) diet.

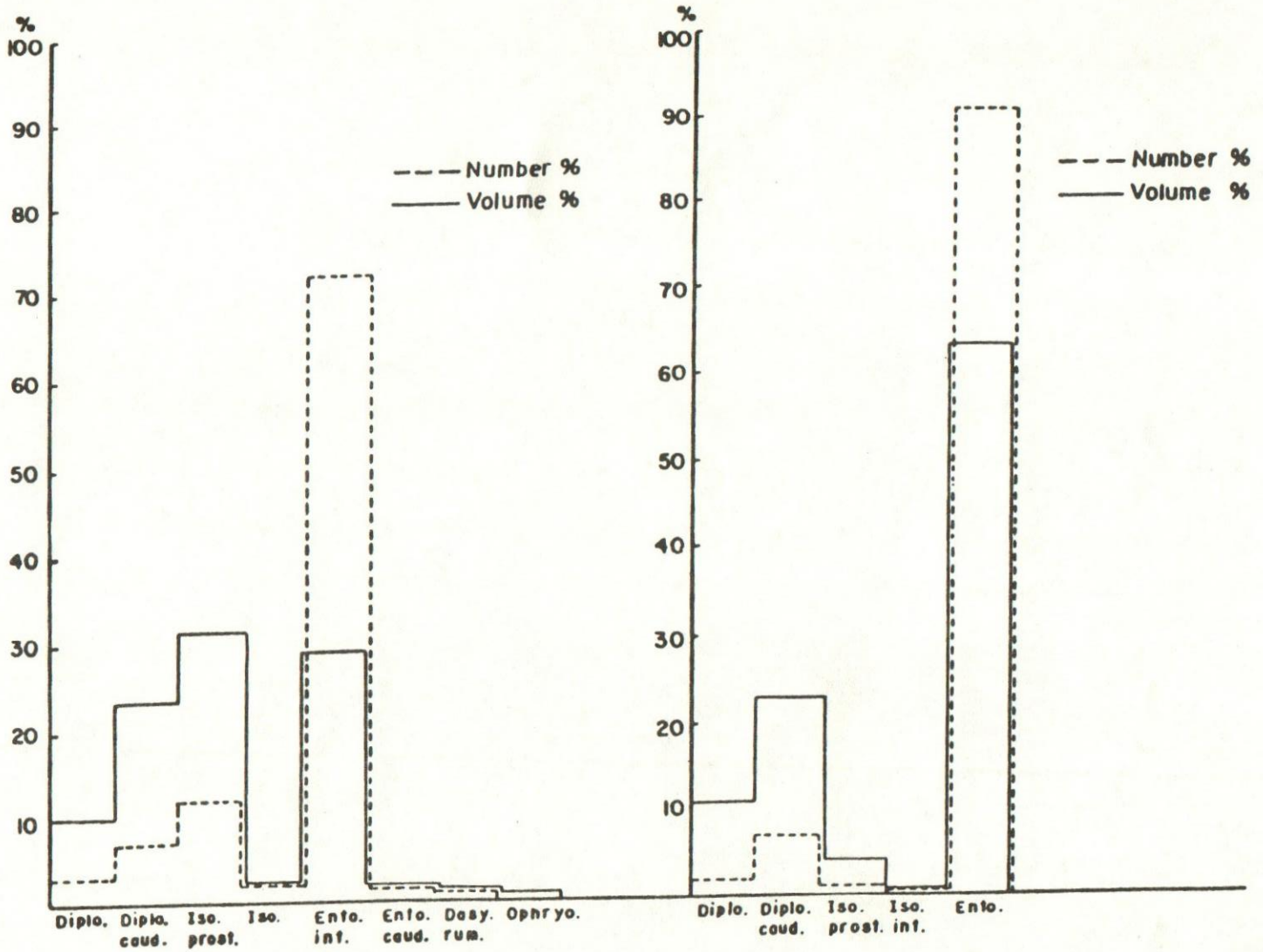


Fig. (3): Mean percentage of protozoal number and volume on green (Barseem) and concentrate (Wheat bran and sorghum) diet.