

Growth Performance, Rumen Fermentation Parameters and Selected Serum Macro and Micro Mineral in Egyptian Steers Fed on Berseem Hay

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Abstract: The present study was carried out to clarify the effect of fed on berseem hay on growth performance, rumen fermentation parameters and macro and micro mineral in Egyptian steers. Twenty Egyptian steers were used and divided into 2 equal groups: Group (A) fed on berseem and Group (B) fed on berseem hay besides concentrates in both groups. Blood and rumen liquor samples were taken from both groups in 45 day and 90 day of study beside estimation of body weight every 2 weeks was carried. Results showed significant increase of body weight in steers in group (B) than group (A) and results of rumen fermentation revealed significant increase ($p \leq 0.001$) in PH, TVFAs concentration, ammonia concentration and total protozoa count in steers in group (B) than group (A). Serum analysis for selected macro and micro mineral showed significant increase ($p \leq 0.001$) in calcium, phosphorus, sodium and potassium levels in steers in group (B) than group (A). Fed on berseem hay had great effect on steers growth and weight gain through improvement of dry matter intake and rumen fermentation properties.

Key words: Growth • Rumen Fermentation • Steers • Macro Mineral • Berseem Hay

INTRODUCTION

The aim of any feeding system is to supply the correct and balance amount of nutrients to animals at the proper time to obtain optimum productive efficiency and profitability [1]. To obtain high levels of productivity in feedlot project through superior feed conversion efficiency it is essential to provide an adequate well-balanced ration while feed constitutes the principal component of the total cost of animal production project. The cost of energy feeds exceed that of all other feeds. Also, Nowadays the price of animal feed stuffs especially concentrates is expensive which conflict on the price of animal products [2]. In Egypt there is a gap between the available feedstuff and farm animal requirements [3]. So depending on the fodder and preservative fodder as the main source of livestock feeding one of the most important solution for this problem. Berseem (*Trifolium alexandricum*) is the main fodder during winter season, however its slow growth

and presence of saponins which cause bloat in grazing animals [4]. Hence, need is always felt that there should be use of preservative berseem (Berseem hay) as the weather in Egypt all over the year is almost hot and to maximize the profitability for solve of this problem. Feed resource scarce in both quality and quantity especially during the long dry season [5], so the need for preservation of essential fodders as berseem is essential to achieve proper productivity for animal during hot seasons. This study was aimed to investigate the effect of berseem hay in comparison with berseem on growth performance, rumen fermentation parameters and selected micro and macro nutrient in blood of fattening steers in Egypt.

MATERIALS AND METHODS

The present study was carried out at private farm in Port Said governorate, (for 3 months) from January to April 2014. Twenty apparent healthy male steers about 12 to 15 months of age, with average live body weight

Table 1: Formulation of experimental ration for group (A) and group (B) with calculated analysis (%).

Ingredients	Group A (n=10)	Group B (n=10)
Ground yellow corn	51.2	51.2
Soya bean meal (44%cp)	8	8
Cotton seedcake (41%cp)	12	12
Wheat bran	25	25
Limestone	3	3
Vitamin & mineral premix	0.3	0.3
Common salt	0.5	0.5

Table 2: Chemical composition of the experimental ration

Dry matter (DM) %	89.9
Ash %	5.26
Crude protein (CP) %	15.4
Ether extract (EE) %	3.24
Crude fiber (CF) %	6
N- Free extract (NFE) %	60
Total net energy (TNE) mcak/kg	12.72

Table 3: Chemical composition of fresh Berseem and Berseem hay

Nutrient (%)	Fresh Berseem	Berseem hay
DM	16	90
CP	2.65	13.5
CF	3.7	21.9
EE	0.6	2.2
Ash	2.3	11.6
Calcium	0.57	2.28
Total phosphorus	0.05	26

190±40 kg were divided randomly into two equal groups (A, B) according to their ages and their live body weight (10 animal each). Animals in both groups were fed ration with the same concentrates mixture as shown in Table (1) but differ in roughage as in group A were fed fresh berseem (*Trifolium alexandricum*) while in group B were fed berseem hay (Animals consumed concentrates mixture in gradual manner with lowering the amount of roughage in the same time all over the experimental period). Chemical composition of experimental ration was performed according to the methods of AOAC. [6] as shown in Table (2&3).

All animals were kept under equal management condition and the ration was offered daily in two parts at 9 am and 4 pm. Fresh water and salts blocks were available continuously during the experimental period. All animals were weighted every 2 weeks in the morning before feeding. Daily feed allowances were changed quantitatively according to the change in body weight.

Rumen liquor samples were taken from each animal 2 times (after 45 days and 90 days from beginning of study) using stomach tube 4 hrs post feeding and filtered through four layers of cheese cloth for determining

different rumen parameters. The pH value was immediately recorded using digital pH meter, while samples were stored at -20°C until chemical analysis. Ruminant ammonia nitrogen (NH₃-N) concentration was determined according to Conway [7], Ruminant total volatile fatty acids (TVFA's) concentration was determined by steam distillation procedure according to Warner [8] and total protozoal count was estimated according to Dehorety [9].

From each animal two peripheral blood samples (after 45 days and 90 days from beginning of study) were collected from the jugular vein into a clean dry centrifuge tube for collection of clean non-heamolized serum for determination of serum concentration of phosphorus (Spinreact company, Spain), calcium (Spectrum company, Egypt) and sodium, potassium (TECO- diagnostics company, U.S.A) on a specific spectrophotometer (Apple 302, USA).

Statistical Analysis: The obtained results were expressed as mean and mean of standard error (M±SE) and analyzed statistically by using SPSS 16.0 software package (t-Test) (SPSS Inc., Chicago, IL, USA). Significant differences in the values between groups were indicated by P*≤0.05, P**≤0.01 and P***≤0.001

RESULTS AND DISCUSSION

The results cleared that feeding on berseem hay had a great impact on average body weight gain (Kg), ruminal fermentation parameters in comparison with feeding on alfalfa. Data had been tabulated (Table 4) after statistical analysis as following:

In our work we studied the replacement of green berseem by hay which is found in non berseem season in Egypt for about 6 months in year. The results showed that there was significant difference between both groups of bulls on average body weight gain all over the period of study, the same results were recorded by Karsli *et al.* [10] who mentioned that ration consisting exclusively

Table 4: Influence of feeding on berseem hay (Group B) in comparison with feeding on alfalfa (Group A) on average body weight gain (Kg).

Time interval (day)	Group A (n=10)	Group B (n=10)
1- 14 day	1.1	1.2
15-30 day	1.35	1.6
31-45day	1.4	1.8
46-60 day	1.55	1.85
61-75 day	1.6	1.9
76-90day	1.65	2.0

Table 5: Influence of feeding on berseem hay (Group B) in comparison with feeding on alfalfa (Group A) on rumen fermentation parameters at the start of study(45 day) and at the end (90 day).

	Group A (n=10)		Group B(n=10)	
	45 day	90 day	45 day	90 day
PH	5.98 ± 0.41	5.89± 0.05	6.18±0.57	6.46± 0.30***
TVFAs concentration (mmol/L)	96.07 ±2.66	81.18± 1.74***	104.62±2.79	114.61±3.08**
Ammonia concentration (mmol/L)	271.67 ± 1.73	220.3±22.28*	283.90± 2.62	296.36± 2.55***
Total protozoa count (×10 ⁴ /ml)	55.53 ± 0.85	46.59±1.00***	61.50± 0.85	64.83± 0.88***

Denote means values significant at P ≤ 0.05, P** ≤ 0.01, P*** ≤ 0.001

Table 6: Influence of feeding on berseem hay (Group B) in comparison with feeding on alfalfa (Group A) on rumen fermentation parameters at the end (90 day).

Parameters	Group A (n=10)	Group B(n=10)
PH	5.89 ± 0.05	6.46 ± 0.30***
TVFAs concentration (mmol/L)	81.18 ± 1.74	114.61 ± 3.08***
Ammonia concentration (mmol/L)	220.3 ± 22.28	296.36 ± 2.55***
Total protozoa count (×10 ⁴ /ml)	46.59 ± 1.00	64.83 ± 0.88***

Denote means values significant at P ≤ 0.05, P** ≤ 0.01, P*** ≤ 0.001

Table 7: Influence of feeding on berseem hay (Group B) in comparison with feeding on alfalfa (Group A) on selected serum macro and micro mineral at the start of study(45 day) and at the end (90 day).

	Group A (n=10)		Group B (n=10)	
	45 day	90 day	45 day	90 day
Calcium (mg/dl)	9.35 ± 0.02	9.34 ± 0.02	9.54± 0.04	9.63 ± 0.05
Phosphorous (mg/dl)	5.72 ± 0.01	5.69 ± 0.01	5.77 ± 0.01	5.87 ± 0.1***
Sodium (mEq/L)	133.47 ± 0.94	133.22 ± 0.90	136.96 ± 1.00	144.08 ± 1.13***
Potassium (mEq/L)	5.55 ± 0.03	5.59 ± 0.03	5.59 ± 0.03	5.66 ± 0.03*

Denote means values significant at P ≤ 0.05, P** ≤ 0.01, P*** ≤ 0.001

of berseem hay was satisfactory for supporting moderately good gain in weight of cattle, buffalo and sheep. These results may be due to hay feeding encourages buffering through increasing salivation and buffering capacity and increase dry mater intake and protein digestibility. Asar *et al.* [11] reported that berseem hay has anutritive value similar to that of berseem and may completely replace the traditional forage in balanced ration.

From obtained results animal in group (A) that fed on alfalfa showed significant (p≤0.001) reduction in TVFAs concentration, in ammonia concentration (p≤0.05) and in total protozoa count (p≤0.001) at the end of study (90 day) as illustrated in Table (5). Similar results were recorded by Lu and Jorgensen [12], Wallace *et al.* [13], Newbold *et al.* [14], Odenyo *et al.* [15] and Das *et al.* [16]. Decrease total protozoa count due to saponins form irreversible complexes with cholesterol in the protozoal cell membrane, causing breakdown of the membrane, cell lysis and death.

On the other side animal in group (B) that fed on berseem hay showed significant (p≤0.05) increase in TVFAs concentration, (p≤0.001) in ammonia

concentration, PH and total protozoa count at the end of study (90 day) these results in Table (6) may be due to process of drying alfalfa to obtain hay leading to decrease saponin amount and so reflect on rumen fermentation parameters.

Animals fed on berseem hay showed significant increase (p≤0.001) in all rumen fermentation parameters (TVFAs, ammonia, total protozoa count) beside PH value in comparison with animals fed on alfalfa that results explain increase in average body weight gain in animals fed on hay.

Animals fed on alfalfa showed non significant decrease in serum calcium, phosphorous and sodium levels with non significant increase in potassium level while animals fed of berseem hay showed significant increase (P≤0.001) in serum phosphorous and sodium levels and (p ≤ 0.05) in potassium level these changes may be due to high content of calcium, phosphorous and other electrolytes levels in hay composition as shown in Table (7).

Animals fed on berseem hay showed significant increase (p≤0.001) in serum calcium, phosphorous, sodium and potassium levels in comparison with animals

Table 8: Influence of feeding on berseem hay (Group B) in comparison with feeding on alfalfa (Group A) on selected serum macro and micro mineral at the end (90 day).

Parameters	Group A(n=10)	Group B(n=10)
Calcium (mg/dl)	9.34 ± 0.02	9.63 ± 0.05***
Phosphorous (mg/dl)	5.69 ± 0.01	5.87 ± 0.1***
Sodium (mEq/L)	133.22 ± 0.90	144.08 ± 1.13***
Potassium (mEq/L)	5.59 ± 0.03	5.66 ± 0.03***

fed on alfalfa as shown in Table (8). Animals fed on alfalfa showed decrease in serum calcium level may be due to effect of saponin on absorption of calcium as recorded by Das *et al.* [16] and Francis *et al.* [17]

CONCLUSIONS

Depending on berseem hay as a source of forage in feeding of steers has a great effect on increase dry matter intake with improvement of rumen fermentation properties which reflect consequentially on body weight gain of animal.

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