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GROWTH PERFORMANCE OF GROWING LAMBS FED DIETS DIFFERING IN CONCENTRATE: ROUGHAGE RATIO AND SUPPLEMENTED WITH A PROBIOTIC

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SUMMARY

Twenty four growing male Rahmani lambs (26.8 kg) were divided into 4 equal groups (6 lambs each), and were used to study the effect of feeding diets at two roughage (berseem hay, BH) : concentrate (concentrate feed mixture, CFM) ratios (66.6 : 33.4 and 33.4 : 66.6%) i.e. high roughage (HR) and high CFM (HC) either with yeast culture (YCS) or without YC supplementation (UYC) (0.25 g/10 kg live body weight) on their productive performance and some blood constituents .The experimental period lasted for 180 days. Results obtained revealed that animal performance in terms of average daily gain, feed conversion efficiency and cost of feed/kg gain were higher with HC diets compared with HR ones. The YCS showed beneficial positive effect on tested animal performance parameters . Most of blood constituents were not significantly affected by C:R ratio and YCS and their interaction .

Keywords: Yeast culture, roughage: concentrate ratio, sheep, blood constituents, animal performance

INTRODUCTION

Consistent literature has been published regarding the interest of the use of active dried yeast as a probiotic for ruminants (Dawson, 1994, Newbold *et al*., 1996, Abou Ward, 2001 El-Ashry *et al.*2001a&b and Gabr *et a*l., 2004) .

There is a widespread belief among dairy and beef producers and ruminant nutritionists that yeast products are beneficial by enhancing dry matter intake and overall animal performance. However, using yeast culture in ruminant diets recorded different responses, which may be referred to many different interactions among yeast sort, yeast level, diet and its composition, and also stage of livestock production. The ratio between roughage to concentrate (R:C) represents one of the major dietary factors involved to influence the feed intake and utilization by ruminant animals (*Gabr ,2000*). The first part of present study has recently published by Gabr *et al*. (2004) and showed that yeast culture supplementation had positive effects on some rumen parameters (pH values, VFA's and ammonia-N concentrations) , nutrients digestibility coefficients and feeding values (TDN and DCP%) of tested

diets with sheep , and had higher influence when included with high concentrate than high roughage – based diet.

The main objectives of this study were to investigate the effect of supplementing yeast culture to growing sheep diets at two roughage :concentrate ratios on some blood constituents and productive performance .

MATERIALS AND METHODS

The experimental work of this study was carried out at El-Serw Experimental Research Station, Animal Production Research Institute, Agriculture Research Center. Two diets containing two ratios (33.4 : 66.6) of roughage (3rd cut berseem hay (*Trifolium alexandrinum,* L.) and concentrate (concentrate feed mixture ,CFM) i.e. high roughage (HR) and high CFM (HC) without (UYC) or with yeast culture supplementation (YCS) were tested. The level of 0.25 g YC (Lacture) /d/10 kg BW based on a recommended dose suggested by Gado *et al.* (1998) in rations of small ruminants was used. The tested diets were as follows: Diet 1: CFM, 66.6% + 33.4% BH with YC (HC), Diet 2: CFM, 66.6% + 33.4% BH without YC(HC) , Diet 3: CFM, 33.4% + 66.6% BH with YC (HR) and Diet 4: CFM, 33.4% + 66.6% BH without YC (HR).The chemical composition of the ingredients and the calculated composition of tested diets is previously published by Gabr *et al*. (2004) and presented in Table (1) . The concentrate feed mixture (CFM) contained 24% undecorticated cotton seed meal, 20% yellow corn, 10% soybean meal, 14% rice bran, 25% wheat bran, 3% molasses, 2.5% limestone and 1.5% salt.

Twenty-four growing male Rahmani lambs, selected from El-Serw Station herd (26.5±0.95 kg) were randomly distributed according to their body weights into four equal groups, 6 lambs each. The animals of each group were kept in a separate shaded pen . The animals were fed for two weeks as a transitional period on the same experimental diets . Diets were offered at equal portions twice daily at 8.0 a.m and 3.0 p.m. Group feeding was applied and animals had no opportunity to eat other feeds. Offered amounts of roughage and concentrate were adjusted to keep (R:C) ratio to be closed to (33.4:66.6 or 66.6:33.4) every two weeks according to the change of live body weight. The amount of yeast culture was mixed with the mash portion of CFM prior feeding directly. Lambs were weighed at the beginning of the experiment and thereafter at two weeks intervals till the end of the experiment which lasted for 180 days. Feed intake was recorded and feed conversion was calculated. The nutrient requirements recommended by NRC (1985) for sheep were applied where it was adjusted every two weeks according to changes in body weight.

Table 1. Chemical analysis of the tested ingredients and formulated diets

Item	DM %	Chemical analysis (% on DM basis)						
		OM	CP	CF	EE	NFE	Ash	GE
Berseem hay (BH)	86.70	87.10	11.0	30.93	2.13	43.04	12.90	16.91
CFM	91.00	91.00	15.55	16.86	3.3	55.56	9.00	17.82
Calculated chemical composition of tested diets,%								
HC diet	89.63	89.33	13.61	22.87	2.65	50.21	10.67	17.43
HR diet	88.17	88.09	12.11	27.37	2.36	46.21	11.91	17.13

HC: high CFM HR : high BH

Blood samples were taken during the last month of the feeding trial from the Jugular vein of growing lambs at 4 hrs post-feeding into heparin – coated tubes and plasma was separated by centrifugation at 4000 r.p.m. for 10 minutes. The plasma samples were used for determination of total protein (Henry *et al.,* 1974), albumin (A) (Doumas *et al.,*1971), globulin(G) (by calculation), A/G ratio (by calculation), urea (Fawcett and Scott, 1960), glucose (Teuscher and Richterich, 1971), cholesterol (Allain *et al.,* 1974) and GOT and GPT (Reitman and Friankel, 1957) concentrations.

Data were analyzed using the general linear model procedure of SAS (1996). Differences among means were evaluated using Duncan's Multiple Range Test (1955).

RESULTS AND DISCUSSION

Effects of R: C ratio and YCS on animal performance:

The effects of R:C ratio on animal performance are presented in Tables 2 and 3. It was clear (Table 2) that animals fed HC diet had significantly ($P<0.01$) higher total body weight gain (kg) than those fed HR diet, being 27.17 and 20.83 kg, respectively. This could be related to the higher total DCP intake by G1 and G2 fed (HC) diet than those fed the HR ones (G3 and G4), being 146.72, 141.28, 131.35 and 125.9 g/d, respectively (Table 3) . Also, body weight gain (BWG) (g/h/d) for animals fed HC diets was significantly ($P<0.05$) higher than those fed on HR one, being 150.92 and 115.74 g/h/d , respectively. The obtained results came in line with those recorded by Baik *et al.* (1997) and Hatfield *et al.* (1997) who found that increasing levels of concentrate improved the growth rate of sheep. Generally, it was clear from Table 2 that YCS had no significant effects on final live body weight (FLBW) and BWG. However, the higher value (140.28 g/h/d) of BWG was recorded with YCS diet, while the lower value (126.39 g/h/d) was recorded with USYC diet. The obtained results are in agreement with those of Seymour *et al.* (1991); Drennan and Moloney (1993); Shetawei (1993) and Fayed (2001). They reported that no significant effect on BWG was detected by YCS.

Table 2. Mean effect of R:C ratio and YC supplementation on changes in live body weight (kg), average body weight gain and daily weight gain of the tested groups throughout the experimental period

Weights	C:R ratio			YC supplementation		
	HC	HR	±SE	+	-	±SE
Av. Initial LBW, Kg	26.83	26.83	0.96	26.58	27.08	0.95
Av. Final LBW, Kg	54.00^{A}	47.67^{B}	1.36	51.83	49.83	1.87
Total Gain (kg)	27.17^{A}	20.83^{B}	1.34	25.25	22.75	1.82
Average daily gain DG (g)	150.92^{a}	115.74^{b}	7.43	140.28	126.39	10.13

a, b & A and B, means in the same row with different superscripts differ significantly ($P<0.05$) & ($P<0.01$).

Data in Table (3) indicate that interaction between R:C ratio and YC supplementation were not significant on BWG. However, the higher values of final gain were recorded with groups treated with YC (G1 and G3), being 28.83 and 21.67 kg, for HC and HR, respectively, while the lower values were recorded with the

USYC groups (G2 and G4) being 25.5 and 20 kg, respectively. Also, daily gain (g/h/d) took the same trend of total final gain.

The daily feed intake as DM/g/h/d was slightly higher for the two groups fed HC and those fed HR diets being lower for HC and higher for HR diets. Concerning, the feed conversion, the results in Table 3 reveal that the values were 8.38, 9.49, 12.56 and 13.61 kg DM intake/kg body gain for group 1, 2, 3 and 4, respectively. Also, feed conversion as expressed as (kg TDN or DCP/kg gain) was nearly similar for HC diets being lower relative to the HR diets As for the feeding cost h/d, the results in Table 3 show that there were no considerable differences among tested diets, however feed cost/kg gain was lower for YCS with HC or HR diets. However, feed cost/kg/gain was higher (on average) by about 27.7% for HR diets than that of HC ones.

Table 3. Effect of feeding tested diets on animal performance

Item	Tested diets				±SE
	HC		HR		
	+ G1	- G2	+ G3	- G4	
No. of animals	6	6	6	6	
Experimental period	180	180	180	180	
Av. Initial LBW, Kg	26.50	27.17	26.67	27.00	1.98
Av. Final LBW, Kg	55.33	52.67	48.33	47.00	2.61
Total BW gain, kg	28.83	25.50	21.67	20.00	2.55
Av. Daily gain, g	160.18	141.67	120.37	111.11	14.17
Daily feed intake, DM g/h/d	1341	1350	1507	1512	
TDN intake g/h/d	980.41	906.39	944.44	901.61	
Total CP intake g/h/d	182.51	183.74	182.50	183.1	
DCP intake g/h/d	146.72	141.28	131.35	125.9	
Feed conversion:					
DM intake kg/kg gain	8.38	9.49	12.56	13.61	
Kg TDN/kg gain*	6.12	6.40	7.84	8.11	
Kg DCP/ kg gain*	0.916	0.997	1.091	1.133	
Economic efficiency :					
Feed cost L.E./h/d	0.71	0.70	0.69	0.69	
Feed cost L.E./kg gain	4.41	4.94	5.77	6.17	

HC: High concentrate feed mixture (CFM). HR: High roughage .
+ : with YC - : without YC
* TDN and DCP % of tested diets were published by Gabr *et al.*(2004).

Effect of R: C ratio and YCS on blood constituents :

The results of blood parameters of the tested groups as affected by R:C ratio and YCS are presented in Table (4). The results indicate that GOT, GPT, cholesterol, total lipids, urea-N concentrations, albumin and A/G ratio were not significantly

affected by R:C ratio. Glucose and total protein were significantly (P<0.01) increased with increasing CFM in the diets by about 8.31% and 4.32% for HC and HR diet, respectively. Globulin was significantly (P<0.05) increased by about 8.68% by increasing CFM in the diet. Also , concentrations of GOT , GPT , glucose, cholesterol, total lipids, albumin and globulin and albumin (A) to globulin (G) ratio (A/G ratio) were not significantly affected by YCS. These results are in accordance with those reported by El-Ashry *et al.* (2001a), Metwally *et al.* (2001) and Ibrahim *et al.* (2002). The YCS increased significantly (P<0.01) urea-N by about 21.58% relative to the unsupplemented diet. These findings are in accordance with those obtained by Giger-Reverdins *et al.* (1996); Gado *et al.* (1998), El-Ashry *et al.* (2001a&b); Fayed (2001) and Ibrahim *et al.* (2002).

Table 4. Mean effect of R:C ratio and YC supplementation on some blood parameters

Item	C:R ratio			YC supplementation		
	HC	HR	±SE	+	-	±SE
GOT (IU/l)	35.98	36.71	1.04	36.02	36.67	1.04
GPT (IU/l)	23.23	23.18	1.05	23.00	23.41	1.03
Glucose (mg/100 ml)	72.711^{A}	67.13^{B}	1.71	71.19	68.65	2.30
Cholesterol (mg/100 ml)	80.53	78.31	3.69	76.83	82.01	3.49
Total lipids (mg/100 ml)	311.53	313.97	11.71	314.93	310.56	11.49
Urea-N (mg/100 ml)	31.62	30.51	2.26	34.09^{A}	28.04^{B}	1.24
Total protein g/100 ml	7.49^{A}	7.18^{B}	0.12	7.46^{a}	7.21^{b}	0.13
Albumin (g/100 ml)	3.86	3.86	0.07	3.89	3.83	0.06
Globulin (g/100 ml)	3.63^{a}	3.34^{b}	0.11	3.57	3.40	0.14
A/G ratio	1.07	1.16	0.04	1.1	1.13	0.05

a, b and A,B.. means in the same row with different superscripts differ significantly (P<0.05) & (P<0.01).

Blood plasma total protein increased significantly (P<0.05) by using YC by about 3.47% compared with the unsupplemented diet. These results are in agreement with those reported by Abo El-Nor and Kholif (1998); El-Ashry *et al.* (2001a&b); Fayed (2001) and Metwally *et al.* (2001).There was no significant effect for the interaction between R:C ratio and YCS on all blood parameters for all tested groups.

It could be concluded that, yeast culture supplementation to growing sheep diets had positive effects on their productive performance without any adverse effect on blood constituents and has higher influence when included with high concentrate diet than high roughage- based diet.

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الأداء الإنتاجى للحملان النامية المغذاة على علائق مختلفة فى نسبة المواد المركزة الى الخشنة والمضاف اليها مركبات البروبايوتك

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أجريت هذه الدراسة بمحطة بحوث السرو – معهد بحوث الإنتاج الحيوانى وقسم إنتاج الحيوان بكلية الزراعة – جامعة المنصورة وكان الهدف الرئيسى من هذه الدراسة هو بحث تأثير إضافة الخميرة (لاكتشر) وكذلك نسبة العلف المركز : الخشن (مخلوط العلف المركز : دريس البرسيم) فى علائق الحملان النامية على بعض مكونات الدم و الأداء الإنتاجى .استخدم فى هذه الدراسة ٢٤ حمل رحمانى متوسط وزن ٢٦.٨٣ كجم ±٠.٩٦ قسمت الى أربعة مجموعات متساوية فى الوزن (٦ حملان فى كل مجموعة) واستمرت التجربة لمدة ١٨٠ يوماً وغذيت الحملان على العلائق المختبرة التالية: عليقة ١ : أحتوت على ٦٦.٦% مخلوط علف مركز + ٣٣.٤% دريس برسيم + إضافة خميرة (٠.٢٥ جم من الخميرة (لاكتشر) لكل ١٠ كجم من وزن الجسم)عليقة ٢ : ٦٦.٦% مخلوط علف مركز + ٣٣.٤% دريس برسيم + بدون إضافة خميرة , عليقة ٣ :٣٣.٤% مخلوط علف مركز + ٦٦.٦% دريس برسيم + إضافة خميرة , عليقة ٤ :٣٣.٤% مخلوط علف مركز + ٦٦.٦% دريس برسيم + بدون إضافة خميرة. وأوضحت النتائج الآتى:

١- استهلكت الحملان المغذاه علي علائق غنية في الأعلاف الخشنة كميات أكبر من المادة الجافة مقارنة بتلك المغذاه علي نسبة عالية من الأعلاف المركزة , وكانت قيم التحويل الغذائى(كجم مادة جافة مأكولة/كجم زيادة فى وزن الجسم)هى ٨.٣٨ ، ٩.٤٩ ، ١٢.٥٦ و ١٣.٦١ للمجموعات ١ و ٢ و ٣ و ٤ على التوالى.ووجد أن إضافة الخميرة لم يكن لها تأثير معنوى على الزيادة النهائية للحيوانات بالكجم ولا على معدل الزيادة اليومية بالجم/رأس/يوم ومع ذلك فإن القيمة الأعلى (١٤٠.٢٨ جم/رأس/يوم) للزيادة اليومية سجلت مع العلائق المضاف إليها الخميرة بينما القيمة الأقل (١٢٦.٣٩ جم/رأس/يوم) سجلت مع العليقة غير المضاف إليها الخميرة.

٢- لم تؤثر نسبة المركز إلى الخشن معنوياً على معظم قياسات الدم مثل GOT, GPT والكوليسترول والليبدات الكلية ، نتروجين اليوريا والألبيومين ونسبة الألبيومين إلى الجلوبيولين ولكن الجلوكوز والبروتين الكلى كان يزداد معنوياً عند مستوى ٠.٠١ مع زيادة المركز فى العليقة. وإزداد تركيز الجلوبيولين معنوياً عند مستوى ٠.٠٥ بحوالى ٨.٦٨% مقارنة بالعليقة العالية فى المواد الخشنة. ولم يكن لإضافة الخميرة تأثيراً معنوياً على تركيزات الـ GOT, GPT و الجولكوز والكوليسترول والليبدات الكلية ، والألبيومين و الجلوبيولين ونسبة الألبيومين إلى الجلوبيولين ولكن اليوريا والبروتين الخام ازداد معنوياً مع إضافة الخميرة.

٣- أظهرت الحملان المغذاه على علائق عالية فى المركز (مجموعة ١ ، مجموعة ٢) مع أو بدون إضافة خميرة أعلى وزن نهائي للجسم (٥٥.٣٣ و ٥٢.٦٧ كجم) مقارنة بتلك المغذاه على عليقة عالية فى المادة الخشنة (مجموعة ٣ ، مجموعة ٤) (٤٨.٣٣ و ٤٧ كجم). وأظهرت المجموعتين ١ و ٢ أيضاً أعلى معدل زيادة يومية (١٦٠.١٨ و ١٤١.٦٧جم) مقارنة بالمجموعتين ٣ و ٤ (١٢٠.٣٧ و ١١١.١١ جم/يوم).

ويمكن التوصية بإضافة الخميرة فى علائق الحملان النامية حيث وجد أن لها تأثير إيجابى على الأداء الأنتاجى للحملان النامية وكان هذا التأثير أكثر وضوحاً مع المستوى الأعلى من المركز (٦٦.٦%) مقارنة بالمستوى الأعلى من دريس البرسيم (٦٦.٦%) .