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IMPACT OF YEAST ADDITION TO DIETS OF SUCKLING AND GROWING OSSIMI LAMBS ON THEIR PRODUCTIVE PERFORMANCE

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SUMMARY

Two experiments were carried out to study the effect of yeast addition on the *productive performance of suckling and growing Ossimi lambs. In the first experiment, sixteen suckling lambs (8 weeks old and 8.63± 0.26 kg live weight) were divided into two equal groups (8 each) and fed either 200 ml of milk (S1, control) or 200 ml of milk plus yeast, Saccharomyces cerevisiae, SC, 2 g/h/d, for 8 weeks. In the second experiment, another 16 growing lambs (4 - 5 months old and 21.4± 0.63 kg live body weight) were randomly assigned to two groups (8 each) and fed either clover hay plus concentrate feed mixture (14% CP and 65 %TDN) without (R1) or with (R2) SC, 2 g / h /d, for 90 days. At the end of the trial, four animals from each group were used in digestibility trials.*

The data of suckling lambs showed that there was insignificant increase in the average daily gain by 7.26% for lambs in S2 compared with those in S1. Addition of yeast to the growing lambs diet (R2) significantly (P<0.05) improved the digestibility coefficients of CP and CF by 6.71 and 4.88%, respectively compared with control (R1). There was insignificant improvement in the digestibility coefficients of DM, OM, EE and NFE for lambs fed R2 (82.55, 85.76, 86.44 and 88.15%) compared with those fed R1 (79.90, 83.61, 84.85 and 87.68%). The nutritive value as TDN and DCP was significantly (P<0.05) improved with yeast supplementation in R2 being 78.24 and 10.74%, respectively compared with R1; 74.76 and 10.42% in the same order. There were no significant effects of yeast supplementation on ruminal pH, NH_3-N and VFA's being respectively, 6.27, 25.37 and 3.74 for R1 vs. 6.40, 25.27 and 3.59 for R2. There was a significant (P<0.05) improvement in the average daily gain by 27% with yeast addition in R2. Feed conversion (g DMI/ g gain), was better in R2 than R1 being 5.14 vs. 6.21, respectively.

From the economical point of view, supplementing suckling lambs with yeast increased the net profit by LE 16.8. While adding yeast to growing lambs diet reduced the feed cost/kg gain by 17% compared with the control group, which enhanced its net profit by LE 87.5 / lamb. The results indicates the importance of adding yeast to rations of growing lambs to increase the economic efficiency and optimizing net profit of sheep flocks. Therefore, it could be concluded that, adding yeast to growing lambs rations is more efficient than administrating it to lambs before weaning.

Keywords: Sheep, Ossimi, yeast, growth rate, economic efficiency

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INTRODUCTION

In Egypt, there is a gap between the available feedstuffs and farm animal feed requirements which was estimated as a shortage of 3.1 million tons of TDN per year (Fayed *et al*., 2009). Therefore, it is important to find more proper and cost-effective feeding systems for enhancing growth rates of fattened lambs which contribute a valid source of red meat in Egypt (Abdel-Moneim, 2009). Hence, many efforts have been made to use non-traditional feeds (El-Kady *et al*., 2008, Fayed *et a*l., 2009 and Mousa, 2011) or otherwise adding probiotics to rations of lambs (Abo Ward *et al*., 2008, Fayed *et al*., 2009 and Mukhtar *et al*., 2010).

At the same time, the progressive reduction in use of antibiotic as growth promoters created interest in the corporation of microbial strains in animal feed to replace antibiotics. Currently, considerable attention is being given to use probiotic in animal feeding programs. Currently, two main types of probiotics based on either yeast (*Saccharomyces cervisuae*) or fungal (*Aspergillus oryzae*) cultures, solely or in combination with other microorganisms, are available for use in animal rations (Frumholtz *et al*., 1989). Probiotics have been used in small amounts as supplements in animal feeds for improving their performance (Dawson, 1993; Beauchemin *et al*., 2003 and Krehbiel *et al*., 2003). Moreover, many of the beneficial productive responses associated with using probiotic supplements can be directly related to their effects on the microbial population in the digestive tract (Dawson, 1993). Probiotics regulate the microbial environment of the intestine, decrease digestive disorders, inhibit pathogenic intestinal microorganisms and improve feed conversion efficiency and health performance of the host animals.

Anadan *et al*. (1998), mentioned that the average daily gain of Cheghu crossbred kids was improved by 38.9% with probiotic supplementation compared with unsupplemented kids. While, in the case of suckling animals, the addition of probiotics would be of great usefulness probably because its antigenic stimulation would favor the maturation of immune system thus preventing infection (Perdigon and Alvarez, 1992).

This study aimed to investigate the effect of yeast in diets, as a probiotic, on the growth performance of suckling and growing lambs.

MATERIALS AND METHODS

Animals and feeding:

Thirty-two Ossimi lambs, related to a commercial sheep flock located in Delta region, were used to study the impact of yeast addition on growth and economic performances, before and after weaning. Two experiments were carried out at the same time. In the first, sixteen suckling lambs (8 weeks old and 8.63±0.26 kg average live body weight) were divided into two equal groups (8 each), according to their body weight, and randomly assigned to feding either 200 ml of milk without (control, S1) or with (S2) yeast (*Saccharomyces cerevisiae*, SC, Star Yeast, ICC, Brazil), 2 g/h/d, for 8 weeks. Lambs were weighed weekly during the experiment period to calculate the average daily gain (ADG). In the second trial, sixteen growing lambs (4 - 5 months old and 21.4± 0.63kg average live body weight) were randomly assigned to two feeding groups (8 each) one was fed either clover hay plus concentrate feed mixture (14% CP and 65 %TDN) (R1) and the second was fed the same feed with 2 g/h/d yeast for 90 days. Animals were fed the concentrate feed mixture (CFM), at 2%

of their live body weight, twice daily at 8:00 am and 15:00 pm. While, clover hay (CH) was offered *ad. libitum*. The chemical composition of feedstuffs in this experiment was presented in Table (1). The feed residue was collected and weighed to record feed intake. Lambs were weighed weekly before morning feeding meanwhile, the amounts of CFM was modified according to the changes in body weight. Initial and final weights of lambs were used to calculate the average daily gain (ADG), total gain and feed conversion.

Table 1. Chemical composition of feedstuff used in experiment II, (% as DM basis)

Item	Experimental feedstuff	
	Concentrate feed mixture (CFM)*	Clover hay (CH)
OM	90.20	87.83
CP	14.02	11.99
EE	2.25	1.75
CF	9.50	30.32
NFE	64.43	43.77
Ash	9.80	12.17

*CFM consists of 40% corn, 30% cottonseed meal, 25% wheat bran, 3% lime stone, 1% salt and 1% minerals and vitamins.

Digestibility trial:

At the end of the growth trial, 4 animals from each group were used to determine the nutrients digestibility using metabolic cages. Digestibility trials were conducted for, 3 days preliminary period followed by 7 days collection period. During total collection period urine was collected in bowls and feces was collected in polyethylene bags fixed to the rear of lambs. Feces and urine were collected once daily before morning feeding and representative samples were collected and stored at -20°C for further analysis. Urine samples were acidified with 50% H_2SO_4 during collection to avoid N lose **(**Nisa *et al*., 2004). At the end of the end of the collection period, urine and fecal samples from individual pens were thawed and mixed together to make samples for individual lambs pen and homogenized. Composite samples of feces were dried at 55°C for 96 h and ground to 1 mm particles.

Rumen activity:

At the end of each digestibility trial, rumen liquor samples were taken from animals via polyethylene stomach tube before morning feeding and at 2 and 4 hrs after feeding. The samples were filtered through three layers of cheese cloth to get clear liquid to immediately determine pH value, then samples were subjected to ammonia nitrogen (NH_3-N) and total volatile fatty acids (TVFA's) were determined.

Chemical analysis:

The proximate analysis of feeds and feces and urine nitrogen were carried out following the conventional methods of A.O.A.C. (1995). The ruminal ammonia concentration was determined according to Conway (1957) and the ruminal volatile fatty acids concentration was determined according to Warner (1964).

Economic evaluation:

Economic evaluation was based on market prices at the beginning of the experiment at May 2010. The farm gate prices were 15 L.E./ 1 kg yeast, 1500 L.E./

1ton concentrate feed mixture, 1000 L.E./ 1 ton clover hay and 30 L.E. / kg of live lambs.

Statistical analysis:

Data were statistically analyzed using the general linear model of SAS (1998). Multiple range test Duncan (1955) was used to test the significance difference between means**.**

RESULTS AND DISCUSSION

Experiment I.:

Data concerning the effect of yeast addition on growth performance of suckling lambs are presented in Table 2. There was insignificant increase in the average daily gain by 7.26% for lambs in S2 compared withS1. This result agree with findings of Abdelrahman (2010) that newborn Awassi lambs given 2 doses of direct feed microbes were 24.8% higher in average daily gain than those in the control group. This increase in the average daily gain might be due to that probiotics addition improved the protection against pathogenic intestinal microorganisms meanwhile, decreased digestive disorders.

Table 2. Effect of yeast addition in milk on growth performance of suckling lambs

Item	Experimental groups		±SE
	S1	S2	
Live body weight			
Initial live weight, kg	8.37	8.88	2.01
Final live weight, kg	15.81	16.88	1.95
Total gain, kg	7.44	8.00	1.05
Average daily gain, g/day	124	133	25.00

S1: control group S2: yeast treatment group

Experimen II.:

Effect of yeast addition on nutrients digestibility, feeding value and nitrogen balance are presented in Table (3).

Digestion coefficients:

Data indicated that yeast addition in R2 significantly ($P<0.05$) improved the digestibility coefficients of CP and CF by 6.71 and 4.88%, respectively compared with control diet (R1). These results are in agreement with the findings of Abd El-Ghani (2004), Ali (2005) and Mukhtar *et al*. (2010). The improvement of digestion coefficients might be attributed to the increase in the number of rumen cellulolytic bacteria due to yeast addition (Fayed, 2001 and Titi *et al*., 2008). There was insignificant improvement in the digestibility coefficients of DM, OM, EE and NFE for lambs fed R2 compared with those fed R1 being 82.55, 85.76, 86.44 and 88.15% and 79.90, 83.61, 84.85 and 87.68%, respectively. These results are in agreement with the findings of Angeles *et al*. (1998) and Garcia *et al*. (2000). The nutritive value of experimental diets as TDN and DCP was significantly ($P<0.05$) improved with yeast addition in R2, being 78.24 and 10.74%, respectively compared with R1;

74.76 and 10.42% in the same order. This improvement of nutritive value with yeast addition is referred to the improvement of nutrient digestion. The same trend was noticed in nitrogen balance, being 3.83 and 4.89 g for R1 and R2, respectively. This result is in agreement with the findings of Lee *et al*. (2000) and Ali (2005).

Table 3. Digestion coefficients, nutritive value and nitrogen balance of growing lambs fed tested rations.

Item	Tested rations		±SE
	R1	R2	
Digestion coefficients, %			
DM	79.90	82.55	2.01
OM	83.61	85.76	2.15
CP	77.46[b]	82.66[a]	1.95
EE	84.85	86.44	2.10
CF	72.99[b]	76.55[a]	1.99
NFE	87.68	88.15	1.95
Nutritive value, %			
Total digestible nutrients, TDN	74.76[b]	78.24[a]	1.50
Digestible crude protein, DCP	10.42[b]	10.74[a]	0.12
Nitrogen balance			
Nitrogen intake, g/h./d.	10.10	10.09	
Feces nitrogen, g/h./d.	2.28	1.75	
Urine nitrogen, g/h./d.	3.99	3.45	
Nitrogen balance, g	3.83[b]	4.89[a]	0.25

a,b Means on the same row with different superscripts are significantly different ($p<0.05$).
R1: control group R2: yeast supplemented group

Rumen parameters:

Data in Table (4) indicated that there were no significant effects of yeast addition on ruminal pH, NH_3-N and VFA's being, 6.27, 25.37 and 3.74 for R1 vs. 6.40, 25.27 and 3.59 for R2, respectively. These results agree with that obtained by El-Badawi *et al*. (1998), Arcos-Garcia *et al*. (2000) and Ali (2005). While, in other experiments, the addition of probiotic increased ruminal pH and NH_3-N (Williams *et al*., 1991 and Ayala *et al*., 1992) while they decreased in other experiments (Mutsvangwa *et al.,* 1992 and Moloney and Drennan, 1994).

Growth performance:

Results concerning growth performance of growing lambs are presented in Table (5). There were significant ($P<0.05$) increases in the final live body weight (kg), total body weight gain (kg) and average daily gain (g/d) for lambs fed R2 than those fed R1 being, 35.60, 14.84 and 165 and 33.71, 11.71 and 130, respectively. The results agree with the findings of Valdes *et al*. (2000) and Ali (2005). This improvement in average daily gain might be due to the increase in CP digestibility (Haddad and Goussous, 2005). Moreover, yeast in R2 improved total dry mater intake (DMI) by 5.1% compared with R1. This increase in DMI with yeast addition might be due to the improvement of fermentation activity of rumen (Hughes, 1987) or to the initiation of a dynamic action which caused a faster passage rate of feed particles in the gastro-intestinal tract (El-Badawi *et al*., 1998 and Abd-El-Ghani, 2004).

Feed conversion (g DMI/ g gain), was better in R2 than R1 being 5.14 vs. 6.21, respectively. This result is in agreement with that obtained by Abd-El-Ghani (2004) and Ali (2005).

Table 4. Rumenfluid pH, ammonia N and volatile fatty acids of experimental lambs fed the tested rations R1 and R2

Item	Sampling time hrs.	Tested rations		±SE
		R1	R2	
pH	0	6.7	6.8	
	2	5.7	5.7	
	4	6.4	6.7	
	Mean	6.27	6.40	0.75
NH_3-N, mg/100 ml RL	0	22.51	23.74	
	2	30.71	32.36	
	4	22.89	19.71	
	Mean	25.37	25.27	1.25
VFA's, mleq/ mg/100 ml RL	0	2.99	2.79	
	2	4.77	4.52	
	4	3.54	3.45	
	Mean	3.74	3.59	0.52

R1: control group R2: yeast supplementation group

Table 5. Effect of yeast addition on growth performance of growing lambs

Item	Rations		±SE
	R1	R2	
A)Live body weight:			
Initial live body weight, kg	22.00	20.75	1.55
Final live body weight, kg	33.71[b]	35.60[a]	1.95
Total body weight gain, kg	11.71[b]	14.85[a]	1.25
Daily body weight gain, g	130[b]	165[a]	15
B)Feed intake,			
Concentrate, kg/h. /d.	0.557	0.564	
Clover hay, kg/h. /d.	0.250	0.284	
DMI, kg / h/d	0.807	0.848	
TDN intake, kg/h./d.	0.603	0.663	
TDN, kg / kg $w^{0.75}$	0.050	0.054	
C) Feed conversion			
DMI, g feed/ g gain	6.21	5.14	

a,b: Means on the same row with different superscripts are significantly different ($p<0.05$).

Economic evaluation:

The economic evaluation of adding the yeast to the diet of suckling and weaned lambs is presented in table 6. Supplementing suckling lambs with yeast increased the net profit by only LE 16.8. In addition, adding yeast to the growing lambs diet

reduced the feed cost/kg gain by 17% compared with the control which increased its net profit by LE 87.5. That indicates to the benefit of adding yeast to rations of growing lambs to increase the economic efficiency and optimizing net profit of sheep flocks.

From the previous results in the first and second experiments, it could be concluded that, in feeding plans, adding yeast to either suckling or growing lambs diets had benefit effects on growth performance and economical efficiency. But adding yeast in growing lambs rations is more efficient than it's oral administration to lambs before weaning.

Table 6. Effect of adding yeast to suckling (Exp. 1) and growing lambs diets (Exp. 2) on the economic evaluation of sheep flocks

	G1	G2
Economic evaluation of Exp. I		
Cost of yeast / h (LE)	0	1.6
Revenue / h (LE)	-	16.8
Profit / h (LE)	-	15.2
Economic evaluation of Exp. 2		
Cost of feed intake (LE / h / d)		
Concentrate	0.84	0.85
Clover hay	0.25	0.28
Yeast	0.00	0.03
Feed cost / daily gain, L.E.	1.09	1.16
Feed cost / kg gain, L.E.	8.40	7.00
Cost through the whole exp. period (LE/h)		
Cost of yeast	-	2.70
Cost of G2 – G1 for concente consumption	-	0.94
Cost of G2 – G1 for clover hay consumption	-	3.06
Revenue / h (LE)	-	94.2
Profit / h (LE)	-	87.5

G1: control group G2: yeast treatment group

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تأثير إضافة الخميرة لغذاء الحملان الأوسيمى الرضيعة والمفطومة على أدائها الإنتاجى

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تم إجراء تجربتين لمعرفة تأثير إضافة الخميرة على الأداء الإنتاجى للحملان الأوسيمى الرضيعة والمفطومة. تم استخدام عدد ١٦ حمل رضيع بالتجربة الأولى وتقسيمهم لمجموعتين، الأولى أعطيت لبن بمعدل ٢٠٠ مللتر والثانية أعطيت لبن بمعدل ٢٠٠ مللتر بالإضافة لـ ٢ جم/حمل من الخميرة يومياً ولمدة ثمان أسابيع. بينما فى التجربة الثانية تم استخدام عدد ١٦ من الحملان المفطومة (عمر ٤- ٥- أشهر) وتغذيتهم إما على دريس البرسيم و مخلوط المركزات فقط أو إضافة الخميرة للعليقة المركزة بمعدل ٢ جم/ حمل يومياً و لمدة ٩٠ يوماً. تم الإستعانة بأربعة حملان من كل مجموعة لإجراء تجربة هضم.

لم يوجد تأثير معنوى للخميرة على الحملان الرضيعة و التى أدت لزيادة معدل النمو اليومى للحملان بمقدار ٧.٢٦% بالمجموعة المعاملة مقارنة بمجموعة الكنترول. بينما وجد أن إضافة الخميرة لغلائق الحملان النامية بعد الفطام أدى إلى حدوث زيادة معنوية لمعاملات هضم البروتين والألياف وأخرى غير معنوية لمعاملات هضم المادة الجافة , المادة العضوية ، مستخلص الإيثير والمستخلص الخالى من الأزوت. كذلك تحسنت قيمة المواد المهضومة الكلية و البروتين المهضوم للمجموعة المعاملة بالخميرة. بينما لم يكن لإضافة الخميرة تأثيراً معنوياً على درجة حموضة الكرش و نيتروجين الأمونيا أو الأحماض الدهنية الطيارة. وقد زاد معدل النمو اليومى للحملان المفطومة بمقدار ٢٧% بإضافة الخميرة للعليقة.

من الناحية الإقتصادية ، فإن معاملة الحملان الرضيعة بالخميرة أدى إلى زيادة معدل الربح/ حمل بمقدار ١٦.٨ جنيهاً مصرياً. بينما إضافة الخميرة لعلائق الحملان المفطومة أدى إلى تخفيض تكلفة العليقة / كجم زيادة وزنية بمقدار ١٧% الأمر الذى ترتب عليه زيادة معدل الربح/ حمل بمقدار ٨٧.٥ جنيهاً مصرياً. الأمر الذى يشير لأهمية إضافة الخميرة لعلائق الحملان المفطومة لم له من تحسين للكفاءة الإقتصادية ومن ثم تعظيم الربح لمشاريع الأغنام.