Effect of level of supplementation with *Saccharomyces cerevisae* on performance of Awassi lambs

Ali A. Saeed
College of agriculture - University of Babylon

Abstract

24 Awassi lambs were used in an individual feeding experiment to investigate the effect of supplementation with baker's yeast (SC) on their performance. Concentrate diets containing 0, 6, 8 or 10 g/head/day of SC were offered to lambs twice a day at rate of 3% of body weight (BW), in addition to free choice of barley straw. Results revealed that straw dry matter (DM) and organic matter (OM) intakes were increased ($P<0.05$) due to supplementation with 8 and 10 as compared to supplementation with 0 and 6 g/day of SC. Similarly, total digestible DM, OM and nitrogen intakes were improved ($P<0.05$) for the same reason. Lambs received SC gained higher ($P<0.05$) weight as compared to those fed control diet. Average daily gain (ADG) values were 195.42, 187, 179.57 and 162.71 g/day for lambs fed diets supplemented with 10, 8, 6 and 0 of SC respectively. Results also showed that supplementation with SC improved feed conversion ratio (FCR), however, significant ($P<0.05$) response was limited to higher level of SC as compared to control, and appeared only when FCR was expressed on basis of total DM and OM intakes (6.25 vs. 6.75 g DM/g gain and 5.58 vs. 6.02 g OM/g gain). Regarding digestibility, results revealed that supplementation lambs diets with yeast improved ($P<0.05$) digestibility of DM and its organic components regardless to level of supplementation, though, digestibility of EE was not affected.

Introduction

Ruminants are the best converters of plant food into human food. This conversion is possible only by undergoing process of ruminant digestion. The digested feed is absorbed in the body and utilized for body growth, maintenance and production. The ingested feed is fermented extensively by a diverse population of anaerobic microorganisms in the reticulorumen before passing into the lower digestive tract. Fermentation processes lead to increase microbial population (Hungate, 1966).

Researchers had been interested in manipulating the ruminal ecosystem to increase production efficiency of ruminants. Manipulating rumen digestion system through the addition of direct feed microbial to ruminant diets so as to enhance cellulose digestion and improves animal's performance is the most interest in recent years (Giger-Reverdin, et. al., 2004; Haddad and Goussous, 2005).

Sheep are known for their excellent ability to utilize organic feed; however production effectiveness is generally lower in this species than in other farm animals. Therefore, attempts are made to supplement their diets with feed additives stimulating productivity. One such natural stimulator, with probiotic and prebiotic properties is *Saccharomyces cerevisiae* yeast, which has a wide spectrum of activity (Lyons, 2001). Probiotics are regularly used in livestock feeding for enhancing growth, improving appetite, rumen function, proper nutrient utilization and higher microbial protein synthesis (Vijay Muley and TokeIssue (2007)

Reasonable research works has been conducted worldwide reporting the positive effects of incorporation of yeast on the performance of ruminants, however, little was done concerning farm animals in Iraq.

The objective of this study is to spot light on the benefits of introducing baker's yeast in diets of lambs.

Materials and methods

The effect of supplementation diet with four levels of baker's yeast (*Saccharomyces cerevisiae*, SC) on productive performance of lambs was investigated. 24 Awassi lambs (weighing 24.45 ± 0.44 kg) were individually fed in 1×1.5 m pens. Concentrate diet (control) formulated by grinding and mixing 37% barley, 40% yellow corn and 18% wheat bran plus 1.5% urea and essential additives containing 1% $CaCO_3$, 1% NaCl and 1.5% mineral and vitamin mixture. Approximate analysis of these ingredients and barley straw is shown in table 1.

Table 1.Chemical composition of barley straw and ingredients used in formulation of the concentrate diets (g/kg DM)

Item	Barley straw	Barley	Yellow corn	Wheat bran
Dry matter (DM)	945.0	934.8	921.5	908.7
% of DM				
Organic matter (OM)	894.3	911.3	921.8	915.0
Crude protein (CP)	30.5	91.2	81.0	142.5
Crude fiber (CF)	384.9	62.5	47.2	114.8
Ether extract (EE)	26.8	33.7	51.8	43.7
N-free extract (NFE)	452.1	723.9	741.8	614.0

Approximate analysis of concentrate diet showed that it contained (g/kg DM) 907.9 DM, 109.5 ash, 130.8 CP, 62.5 CF, 38 EE, 659.2 NFE, 12.27 MJ of metabolizable energy (ME), 16.5 rumen degradable nitrogen (RDN), 4.43 undegradable dietary nitrogen (UDN), accordingly RDN:ME ratio was 1.34 g RDN/MJ of ME (ARC, 1984). Level of RDN and UDN were estimated by using values of effective degradability of protein reported by Humady, (1988) for barley and yellow corn, Paya, et. al., (2008) for wheat bran. ME value was estimated according to MAFF equation, (1975) where:

ME as MJ/ kg DM = 0.012 CP +0.031 EE+0.005 CF +0.014 NFE.

Concentrate diets were offered twice a day, at 8 a.m. and 4 p.m. in quantities calculated to support maintenance and daily gain of 200 g (Al-Jassim, et. al., 1996), and provide a constant daily intake of RDN, UDN, metabolizable energy and RDN:ME ratio across treatments.

SC was offered to lambs at rate of 0, 6, 8 or 10 g/ head/day and experimental treatments were donated according to these levels as SC_0, SC_6, SC_8 and SC_{10} respectively. All the allowances were included in the concentrate diets by hand mixing just before the morning meal in order to secure that lambs received all their allowances of yeast. Akmaya commercial baker's yeast (made in turkey), was used due to its low price and availability in local markets. Barley straw was offered *adlibitum*. Water was available at all times.

Diets were gradually offered to the lambs over a period of two weeks before the start of the experiment. Allowances of concentrates were adjusted each week according to live body weight (LBW). Lambs were weighed weekly to nearest 0.5 kg before morning meal. Feed intake was daily recorded. LBW gain was maintained for ten weeks and FCR was estimated accordingly.

Digestibility of diets was determined by the traditional method, in which, quantities of the offered and refused diets were recorded daily during the 6 days-collection period. Feces were collected by using simple hand made digestion sacs as described by Saeed (2008). Feces excreted by each lambs were collected quantitatively and was subsampled for chemical analysis.

Chemical analysis of feces and feedstuffs were determined according to AOAC (1990). Data was statistically analyzed using CRD procedure by (SAS, 2001). Duncan's multiple range tests was used to determine the significance of differences between treatments means (Duncan, 1955).

Results and discussion

Daily feed intake, live weight gain, feed conversion ratio and digestibility were determined in the current study as a criterion for the benefit of introducing commercial baker's yeast in lamb's diet. The following discussion will deal with these productive parameters in order to judge any responses may exist.

1- Feed intake

Feed intake is an important criterion for evaluation of diets and may give a preliminary judgment on some important nutritional characteristics such as palatability and the impact of physical appearance of diets and its chemical composition. Straw and total intakes as affected by supplementation with baker's yeast are presented in table 2. As shown supplementation control diet with SC improved (P<0.05) straw DM and OM intakes by 80.81 and 90.36 g/day for SC_8 and SC_{10} respectively. This result agreed with many others which reported a positive influence of SC on intake in growing animals (Lesmeister, et. al., 2004; Erasmus, et. al., 2005; Sinclair, et. al., 2006 and Lascano and Heinrichs, 2007). Although the improvement was correlated with higher levels of SC, feeding low level also improved straw DM and OM intakes by 42.67 and 38.16 g/day respectively, but it failed to be significant.

The general trend of increasing intake of roughage due to yeast addition may attributed to its stimulated effect on cellulolytic activity (Jouany and Morgavi 2007), which can improve voluntary feed intake (Wohlt, et. al., 1998). However, some papers reported no effect (Kung and Muck 1997 and Nikkhah, et. al., 2004). Total DM and OM intakes adopted similar trend. This may be related to the effect of supplementation with SC on straw intake, because intake of concentrate was slightly changed as a probable result to feeding frequency (Hassan and Al-sultan, 1995b). Higher values for TDMI were achieved by lambs fed SC_8 and SC_{10} (121.9 and 124.58 g/day) and for TOMI (108.78 and 111.21 g/day) as compared to SC_0 . As with straw DM and OM intakes, TDMI and TOMI by lambs in SC_6 treatment were mathematically higher than those in control (63 and 56.21 g/day for former and later values respectively).

Table 2. Feed intake as affected by supplementation with SC

Item of intake g/day	SC_0	SC_6	SC_8	SC_{10}	L.S
Straw dry matter intake (SDMI)	348.44^b ± 12.43	391.11^b ± 12.93	429.25^a ± 13.87	438.80^a ± 13.53	*
Total dry matter intake (TDMI)	1098.60^b ± 34.56	1161.60^b ± 37.43	1220.50^a ± 40.09	1223.18^a ±39.20	*
Total digestible dry matter intake (TDDMI)	727.33^c ± 28.94	805.37^b ± 30.02	875.22^a ± 32.17	874.32^a ± 32.01	*
Straw organic matter intake (SOMI)	311.60^b ± 10.22	349.76^b ± 11.12	383.87^a ± 11.80	392.41^a ± 12.00	*
Total organic matter intake (TOMI)	979.69^b ± 32.51	1035.90^b ± 34.18	1088.47^a ± 34.97	1090.90^a ± 33.86	*
Total digestible organic matter intake (TDOMI)	637.68^b ± 25.85	708.99^b ± 28.64	756.48^a ± 30.17	779.44^a ± 30.78	*
Straw nitrogen intake (SNI)	1.70 ± 0.04	1.90 ± 0.05	2.09 ± 0.05	2.14 ± 0.06	NS
Total nitrogen intake (TNI)	17.38^b ± 0.61	18.00^b ± 0.64	18.62^a ± 0.67	18.53^a ± 0.65	*
Total digestible nitrogen intake (TDNI)	11.15^b ± 0.43	12.19^a ± 0.50	12.76^a ± 0.48	12.76^a ± 0.54	*

Means in the same row with different superscripts are significantly different.
* (P<0.05), LS= level of significance, NS= Non significant.

Regarding total digestible DM and OM intakes, results revealed that supplementation control diet (SC_0) with low level of yeast (SC_6) improved (P<0.05) TDDM intake by 10.72%, this improvement was proceeded by 20.33 and 20.20% with medium (SC_8) and high (SC_{10}) level of SC respectively. This is expected since DM digestibility was improved in a similar manner due to supplementation with yeast (table 5). Since SC appeared to stimulate the rate of degradation as evidenced by improved digestibility; the animals can ingest more DM to fill their digestive compartment at the same level. This physical regulation could be involved to explain the higher feed intake by supplemented animals in a current study. Feed intake is often considered to be a function of the initial rate of digestion (Denev, et. al., 2007). Another factor that can influence the physical regulation of intake is the outflow rate of digesta from the rumen, but the effect of yeast on this parameter is really inconsistent (Jouany, 2001).

Results also showed that straw N intake was not influenced by supplementation concentrate basal diet with SC, whereas, total N intake (TNI) was significantly ($P<0.05$) increased by 7.13 and 6.61% in SC_8 and SC_{10} as compared to SC_0, supplementation with 6 g SC increased TNI by 3.56% only. However, supplementation with yeast improved ($P<0.05$) TNI when expressed as total digestible NI regardless to level of yeast.

2- Live body weight gain (LBWG)

Gain is the most important target that producer aims to reach to, because it directly relates to economics of animal production. In growing animals, when we talk about gain, we directly mention to growth rate.

The following part of results and discussion will deal with this important feature. Final live body weight (LBW) and live body weight gain parameters as affected by level of supplementation with SC are presented in table 3.

Table 3. Live body weight gain as affected by supplementation with SC

	SC_0	SC_6	SC_8	SC_{10}	LS
Initial live body weight (ILBW) kg	24.68 ± 0.65	24.47 ± 0.62	24.73 ± 0.69	24.67 ± 0.65	NS
Final live body weight (FLBW) kg	36.07 ± 0.73	37.04 ± 0.74	37.82 ±0.79	38.35 ±0.82	NS
Growth period (day)	70	70	70	70	
Total gain (TG) kg	11.39^b ± 0.09	12.57^a ± 0.12	13.09^a ±0.14	13.68^a ±0.16	*
Average daily gain (ADG) g/day	162.71^b ± 1.69	179.57^a ± 1.81	187.00^a ± 1.93	195.42^a ± 2.27	*
Improvement, %	-	10.36	14.92	20.10	

Means in the same row with different superscripts are significantly different
* ($P<0.05$), LS= level of significance, NS= Non significant.

As shown supplemented lambs gained higher ($P<0.05$) weight as compared to those fed control diet. Similarly, increasing gain due to the inclusion of SC in sheep diet was widely reported (Cole, et. al., 1992; Ahmed and Salah, 2002; Garg, et. al., 2009; Milewski, 2009). In a current study, ADG of lambs was improved by 10.36, 14.92 and 20.10% due to supplementation with baker's yeast at level of 6, 8 and 10 g/head/day respectively. Ahmed and Salah (2002) reported percentage increase of 13.8 and 30.2% due to addition of

SC to sheep at rate of 4 and 8 g/h/day. The improvement in their study has been attributed to the increase in N digestibility and better utilization of the dietary N as evident by the increased count of proteolytic bacteria. In a present study, CP digestibility was improved by 5.61, 6.87 and 7.37% due to supplementation with SC at level of 6, 8 and 10 g/head/day respectively. Girard and Dawson (1994) demonstrated that flow of peptide has been increased. Flow of bacterial nitrogen to duodenum with about 10-20% was shown by Erasmus, et. al., (1992).

Results of a current study also showed that the interval gain achieved by lambs within each two continual increase in level of supplementation was nearby, 4.69 and 4.50%, for 6 vs. 8 and 8 vs. 10 g/head/day. This may refers to the probiotic activity of baker's yeast on ruminal ecosystem. The probiotic activity of yeast was described by Dobicki, et. al., (2005) in a study of calves. These authors reported that yeast supplements caused significant changes in the rumen microbial flora by lowering protozoan counts and increasing the size of bacterial populations responsible for the course of ruminal processes. The above inhibited the degradation of bacterial and feed protein and enhanced its flow to the distal segments of the digestive tract, thus leading to a significant increase in the body weight gains of calves. Similar production results were noted in an experiment conducted on lambs fed the yeast feed supplement containing *Saccharomyces cerevisiae* dried brewer yeast (2001).

3- Feed conversion ratio (FCR)

FCR is one of the important criterions that judgment of benefit of animal production may depend on. It is closely related to feed intake and gain in body weight, in a matter of fact, it is estimated by means of these parameters. This part of discussion will expresses FCR according to total DMI, OMI, N, and digestible intake of these nutrients and their relation to gain. FCR values are presented in table 4.

Table 4. Feed conversion ratio as affected by supplementation with SC

	SC_0	SC_6	SC_8	SC_{10}	LS
g total dry matter intake /g gain	6.75^{bc} ± 0.12	6.64^{ab} 0.11	6.52^{ab} ± 0.10	6.25^{a} ± 0.09	*
g total organic matter intake /g gain	6.02^{bc} ± 0.09	5.76^{ab} ± 0.10	5.82^{ab} ± 0.10	5.58^{a} ± 0.08	*
g total nitrogen intake /g gain	0.106 ± 0.002	0.100 ± 0.002	0.099 ± 0.001	0.094 ± 0.001	NS
g total digestible dry matter intake /g gain	4.47 ± 0.103	4.48 ± 0.105	4.68 ± 0.106	4.47 ± 0.104	NS
g total digestible organic matter intake /g gain	3.91 ± 0.096	3.94 ± 0.095	4.04 ± 0.010	3.98 ± 0.098	NS
g total digestible nitrogen intake /g gain	0.068 ± 0.003	0.067 ± 0.002	0.065 ± 0.002	0.065 ± 0.002	NS

Means in the same row with different superscripts are significantly different

* (P<0.05), LS= level of significance, NS= Non significant.

As shown supplementation control diet with high level of yeast decreased (P<0.05) FCR by 7.40 and 7.30% when estimated according to TDM and TOM intakes respectively. Many workers reported that SC supplemented animals utilized their rations more efficiently as compared to unsupplemented animals (Lascano, et. al., 2009; Ahmed and Salah (2002). Similarly, Schingoethe, et. al., (2004) concluded that yeast can improve feed efficiency. This improvement may be explained by an improvement in either the appetite of the animals or in the diet digestibility (Gomez-Alarcon, et. al., 1990). Heugten, et. al., (2003) reported that supplementation with SC can improve microbial balance in the gut, due to either the yeast cell wall component's mannan-oligosaccharides (MOS) effect on the immune modulation (Newman and Newman, 2001), or a direct effect to reduce pathogenic bacteria and toxic metabolites (Anderson, et. al., 1999).

4- Digestibility of diets:

Digestibility studies are often carried out to evaluate diets with regard to any factors that may be influenced by. In another word, digestibility is a digestion ability of specific diet. Digestibility of nutrients of total diets used in the current study is presented in table 4. As shown supplementation basal concentrate diets offered to lambs with baker's yeast improved (P<0.05) digestibility of DM and its organic components regardless to level of supplementation, though, digestibility of EE was not affected. Similar result was observed by Ahmed and Salah (2002). Since bile salts participate in digestion of dietary fat in the gastrointestinal tract, the failure of yeast to hydrolyze bile acids (El Hennawy, et. al., 1994) may be a reason for this result.

The positive effect of yeast on digestibility were reported by many investigations (Doleźal, et. al., 2005; Galip, 2006; El-Waziry and Ibrahim 2007; Guedes, et. al., 2008; Gaafar, et. al., 2009). Lascano, et. al., (2009) reported that incorporation of yeast had a positive stimulation on number of ruminal bacteria, this can affect DM digestibility because more bacteria are required for rumen degradation. A 1.86 and 2.31 units increase (P<0.05) in DMD and OMD respectively was obtained by Gaafar, et. al., (2009), due to addition of SC to high concentrate diets offered to lactating buffaloes.

Mean improvements (P<0.01) estimated in a current study were (4.64 and 4.70 units for DMD and OMD respectively); the higher values may attributed to differences in digestive ability between buffaloes and sheep and level of yeast. CP digestibility was increased by 3.6, 4.41 and 4.73 units due to supplementation concentrate diets with yeast at rate of 6, 8 and 10 g/head/ day respectively. Lower increase (2.96 units) was reported by Ahmed and Salah (2002). The difference between their and our studies may be attributed to type of roughage used in both studies (50% good quality hay vs. barley straw) and concentrate: roughage ratio (50: 50 vs. 70:30 respectively).

Table 5. Nutrients digestibility (%) of total diets as affected by level of supplementation with SC

Digestibility coefficients	SC_0	SC_6	SC_8	SC_{10}	LS
Dry matter digestibility (DMD)	66.20^c ± 0.69	69.33^b ± 0.73	71.71^a ± 0.88	71.48^a ± 0.82	**
Organic matter digestibility (OMD)	65.09^c ± 0.66	68.44^b ± 0.71	69.50^b ± 0.75	71.45^a ± 0.84	**
Crude protein digestibility (CPD)	64.17^b ± 0.72	67.77^a ± 0.81	68.58^a ± 0.87	68.90^a ± 0.86	*
Crude fiber digestibility (CFD)	64.39^b ± 0.68	67.10^a ± 0.75	68.72^a ± 0.81	68.56^a ± 0.79	*
Ether extract digestibility (EED)	72.89 ± 0.51	73.19 ± 0.59	72.30 ± 0.55	72.89 ± 0.60	NS
Nitrogen free extract digestibility (NFED)	67.00^b ± 0.69	68.73^b ± 0.83	68.97^b ± 0.84	70.14^a ± 0.91	*

Means in the same row with different superscripts are significantly different
* (P<0.05), ** (P<0.01), LS= level of significance, NS= Non significant.

Results also revealed that the tendency of increasing CP digestibility due to supplementation with yeast has been noticed with CF digestibility too, where, it was increased (P<0.05) by 2.71, 4.33 and 4.17 units for SC_6, SC_8 and SC_{10} as compared to SC_6 diets respectively. 3.37 units increase was reported by Gaafar, et. al., (2009). Whereas, Ahmed and Salah (2002) reported higher increase (8.23 units), this clear response may be explained by high quality hay used in the later study. Increasing numbers of rumen cellulolytic bacteria leads to improve fiber digestion. Dawson and Tricarico (2002) reported that yeast addition may stimulate cellulolytic bacteria and improve digestibility.

References

Ahmed, B.M. and M. S. Salah (2002). Effect of Yeast Culture as an Additive to Sheep Feed on Performance, Digestibility, Nitrogen Balance and Rumen Fermentation. J. King Saud Univ. Agric. Sci., 1, 1-3.

Al-Jassim, R.A.M., S.A. Hassan and A.N. Al-Ani (1996). Metabolizable energy requirements for maintenance and growth of Awassi lambs. Small Ruminant Res., 20: 239-245.

Anderson, D.B., R.T. McCracken, J.M. Aminov, R. Simpson, M. Mackie, M.W.A. Verstegen, and H.R. Gaskins (1999). Gut microbiology and growth-promoting antibiotics in swine. Pigs New Inf., 20, 115–122.

AOAC, (1990).Official Methods of Analysis . 15th end. Association of Official Analytical Chemists, Arlington, Virginia.

ARC, (1984). The nutrient requirements of ruminant livestock. Commonwealth Agricultural Bureau, Slough. UK.

Cole, N.A., C.W. Purdy and D.P. Hutcheson (1992). Influence of yeast culture on feeder calves and lambs. J. Anim. Sci., 70, 1682-1690.

Dawson, K.A., and J. Tricarico (2002). The evolution of yeast cultures-20 years of research. In: Navigating from Niche Markets to Mainstream. Proceedings of Alltech's European, Middle Eastern and African Lecture Tour, 26-43.

Denev, S.A., Tz. Peeva, P. Radulova, N. Stancheva, G. Staykova, G. Beev, P. Todorova and S. Tchobanova (2007). Yeast cultures in ruminant nutrition. Bulg. J. Agric. Sci., 13: 357-374.

Dobicki, A., J. Preś, W. Luzak and A. Szyrner (2005). Influence of dried brewery's yeast on body weight gains, physiological and biological indicators of blood and development of rumen microorganisms in calves. Medycyna Wet, 61, 946-949.

Doležali, P., J. Doležali and J. Třináctŷ (2005). The effect of Saccharomyces cerevisiae on ruminal fermentation in dairy cows. Czech J. Anim. Sci., 50: 503–510.

Duncan, D. B. (1955). Multiple range and multipl "F" test. Biometrics, 11:1-12.

El Hennawy, A.A., C. Tse Wong, and S.A. Kocoshis (1994). Failure of *Saccharomyces boulardii* to hydrolyse bile acid *in vitro.* Microbios, 80: 23-29.

El-Waziry, A.M. and H. R. Ibrahim (2007). Effect of *Saccharomyces cerevisiae* of yeast on fiber digestion in Sheep fed berseem (*Trifolium alexandrinum*) hay and cellulase activity. Aust. J. of Basic and App. Sci., 1(4): 379-385.

Erasmus, L.J., P.M. Botha, and A. Kistner (1992). Effect of yeast culture supplement in production, rumen fermentation and duodenal nitrogen flow in dairy cows. J. of Dairy Sci., 75, 3056-3061.

Gaafar, H.M.A., A.M. A.Mohi El-Din, M.I. Basiuoni, and K.F.A. El-Riedy. (2009). Effect of concentrate to roughage ratio and baker's yeast supplementation during hot season on performance of lactating buffaloes. Slovak J. Anim. Sci., 42, (4): 188 – 195.

Galip, N. (2006). Effects of dietary *Saccharomyces cerevisiae* live yeast culture supplementation on ruminal digestion and protozoa count in rams fed with diets with low or high ratio forage/concentrate. Revue Méd. Vét., 157, 12, 609-613.

Garg, D.D., T. Sharma and R.K. Dhuria (2009). Evaluation of groundnut straw based complete feed blocks alone and in combination with yeast in ration of sheep. Anim. Nutr. and Feed Tech., 9, Issue:2

Giger-Reverdin, S., D. Sauvant, J. Tessier, G. Bertin, P. Morand-Fehr, (2004). Effect of live yeast culture supplementation on rumen fermentation in lactating dairy goats. S. Afri. J. Anim. Sci., 34: 89-91.

Girard, I.D. and K.A. Dawson (1994). Effects of yeast culture on the growth of representative ruminal bacteria. J. Anim. Sci., 77 (Suppl. l): 300.

Gomez-Alarcon, R.A., C. Dudas, and J.T. Huber. (1990). Influence of cultures of *Aspergillus oryzae* on rumen and total tract digestibility of dietary components. J. Dairy Sci., 73:703.

Guedes, C.M., D. Gonc¸alves, M.A.M. Rodrigues, A. Dias-da-Silva (2008). Effects of a *Saccharomyces cerevisiae* yeast on ruminal fermentation and fiber degradation of maize silages in cows. Anim. Feed Sci. Tech., 145, 27–40.

Haddad, S.G. and S.N. Goussous (2005). Effect of yeast culture supplementation on nutrient intake, digestibility and growth performance of Awassi lambs. Anim. Feed Sci. Tech., 18: 343-348.

Hassan, S.A. and A.A. AL-Sultan (1995b). Awassi lambs responses to dietary supplement of rumen degradable protein 2-Effect of frequency of feeding. IPA J. Agric. Res., 5: 100-111.

Heugten, E.van. D.W. Funderburke and K.L. Dorton (2003). Growth performance, nutrient digestibility, and fecal microflora in weanling pigs fed live yeast. J. Anim. Sci., 81: 1004–1012.

Humady, D.T.K.C. (1988). Digestion and utilization of rumen undegradable protein by sheep and goats. MSc. Thesis, University of Baghdad.

Hungate, R.E. (1966). The rumen and its microbes. Academic Press, Inc., New York, NY.

Jouany, J.P. (2001). 20 years of research and now more relevant than ever- the coming of age of yeast cultures in ruminant diets. In: Responding to a Changing Agricultural Landscape. Alltech's European, Middle Eastern and African Lecture Tour., 44-69.

Jouany, J.P. and D.P. Morgavi (2007). Use of 'natural' products as alternatives to antibiotic feed additives in ruminant production. Anim., 1 : 1443-1466.

Kung, L. and R.E. Muck (1997). Animal response to silage additives. Proceedings of the conference on Silage: Field to feedbunk. North American Conference Hershey, PA. NRAES-99.

Lascano, G.J., and A.J. Heinrichs (2007). Yeast culture (*Saccharomyces cerevisiae*) supplementation in growing animals in the dairy industry. CAB Reviews: Perspect. Agric. Vet. Sci. Nutr. Nat. Reso., 2:049.

Lascano, G.J., G.I. Zanton, F.X. Suarez-Mena and A.J. Heinrichs (2009). Effect of limit feeding high- and low-concentrate diets with Saccharomyces cerevisiae on digestibility and on dairy heifer growth and first-lactation performance. J. Dairy Sci., 92:5100-5110.

Lesmeister, K.E., A.J. Heinrichs and M.T. Gabler (2004). Effect of supplemental yeast (Saccharomyces cerevisiae) culture on rumen development, growth characteristics, and blood parameters in neonatal dairy calves. J. Dairy Sci., 87, p.1832–1839.

Lyons, P. (2001). A time for answer: solution for the 2001 feed industry. In: *Science and Technology in the Feed Industry*. Edited by Lyons T.P. and Jacques K.A. Proceedings of Alltech's Seventeenth Annual Symposium, Nottingham University Press, 2001, pp. 1-23.

MAFF (1975). (Ministry of Agriculture, Fisheries and Food Department of Agriculture and Fisheries for Scotland). Energy allowance and feeding system for ruminants, Technical Bulletin. p. 33.

Milewski, S. (2009). Effect of yeast preparations *Saccharomyces cerevisiae* on meat performance traits and blood hematological indices in sucking lambs. Medycyna Wet, 65, 51-54.

Newman, K.E., and M.C. Newman (2001). Evaluation of manannoligosaccharides on the microflora and immunoglobulin status of sows and piglet performance. J. Anim. Sci., 79 (Suppl.1), 189 (Abstr.).

Nikkhah, A., M.D. Bonadaki and A. Zali (2004). Effects of feeding yeast (*Saccharomyces cerevisiae*) on productive performance of lactating Holstein dairy cow. Iranian J. Agric. Sci., 35: 53–60.

Paya, H., A. Tagizadeh, H. Janamohamadi and G.A. Moghadam (2008). Ruminal dry matter and crude protein degradability of some tropical (Iranian) feeds used in ruminant's diets estimated using the in situ and in vitro techniques. Res. J. Bio. Sci., 3. 7. 720-725.

Saeed, A.A. (2008). Effect of ensiling and level of supplementation with concentrate on the voluntary intake and digestibility of wheat straw by Arabi lambs. Alquadisya J. Vet. Med.7 (1).

SAS. (2001). SAS/STAT User's Guide for Personal Computers. Release 6.12.SAS. Institute Inc., Cary, NC, USA.

Schingoethe, D.J., K.N. Linke, K.F. Kalscheur, A.R. Hippen, D.R. Rennich and I.K.Yoon (2004). Feed efficiency of mid-lactation dairy cows fed yeast culture during summer. J. Dairy Sci., 87: 4178-4181.

Sinclair, L.A., K. Ranson, S. Ames and D. Wilde (2006). The effect of including Yea-Sacc ®1026 yeast culture on the intake and performance of high yielding dairy cows fed a diet high in starch. Proceedings of the 22nd Annual Symposium „Nutritional Biotechnology in the Feed and Food Industries" (Suppl.1), Lexington, KY, USA, April 23-26.

Vijay Muley, V., and S. TokeIssue. (2007). Ruminant digestion and milk production.Veterinary technical bulletin.issue 17.

Wohlt, J.E., T.T. Corcione and P.K. Zajac (1998). Effect of yeast on feed intake and performance of cows fed diets based on corn silage during early lactation. J. Dairy Sci., 81: 1345-1352.

تاثير مستوى الأكمال بخميرة *Saccharomyces cerevisae* في اداء الحملان العواسية

علي امين سعيد
كلية الزراعة-جامعة بابل

الخلاصة

اجريت تجربة باسلوب التغذية الفردية باستخدام 24 حمل عواسي لدراسة تأثير الأكمال بخميرة الخبز على اداء تلك الحملان. تم تقديم الأغذية المركزة الحاوية على 0 ، 6 ، 8 او 10 غم/رأس/يوم من خميرة الخبز الى الحملان مرتين يوميا بمعدل 3% من وزن الجسم بالأضافة الى تبن الشعير بصورة حرة. اظهرت النتائج ارتفاع التناول من المادة الجافة والمادة العضوية للتبن وبصورة معنوية (P<0.05) نتيجة للأكمال بالخميرة بمعدل 8 و 10 بالمقارنة مع 0 و 6 غم/رأس/يوم. كما لوحظ تحسن التناول من المادة الجافة المهضومة والمادة العضوية المهضومة (P<0.05) ولنفس السبب السابق. وقد حققت الحملان التي حصلت على الخميرة زيادة وزنية اكبر (P<0.05) بالمقارنة مع الحملان التي تناولت عليقة المقارنة. وبلغت قيم معدل الزيادة الوزنية اليومية 195.42 ، 187، 179.57 و162.71 غم/يوم للحملان التي اكمل غذائها بالخميرة بمعدل 10، 8، 6 و 0 غم/رأس/يوم على التوالي. وقد اشارت النتائج ايضا الى ان الأكمال بالخميرة ادى الى تحسين معامل التحويل الغذائي الا ان الأستجابة (P<0.05) قد اقتصرت على المستويات المرتفعة من الخميرة، و قد ظهر ذلك عند التعبير عن معامل التحويل الغذائي على اساس التناول من المادة الجافة الكلية والمادة العضوية الكلية فقط (6.25 مقابل 6.75 غم مادة جافة/غم زيادة وزنية و 5.58 مقابل 6.02 غم مادة عضوية/غم زيادة وزنية. فيما يتعلق بالهضم، اوضحت النتائج بأن اكمال اغذية الحملان بالخميرة ادى الى تحسن (P<0.05) في هضم المادة الجافة ومكوناتها العضوية بغض النظر عن مستوى الأكمال، بالرغم من عدم تأثر هضم مستخلص الأيثر.