Effect of addition of two types of commercial baker's yeast on some rumen fermentation characteristics in Awassi lambs

Ameer M. Kadhim[1] **Ali A. Saeed**[2]
[1]Directorate of Agriculture of Kerbala, [2] College of Agriculture, Al-Qasim Green University

Abstract

This study was carried out at Animal field of Animal Production Department - College of Agriculture - Al-Qasim Green University using 16 male lambs to investigate the effect of addition of two commercial products of baker's yeast (CPBY) and their mixture on rumen fermentation characteristics. The study included 4 treatments in which, ground wheat straw was offered ad libitum whereas concentrate diet was offered at level of 2.75% of live body weight with two meals at morning and evening, without addition (T_1) or with addition of the Angel CPBY (T_2), Super Maya (T_3) at rate of 2 kg/100 kg, and their equalized mixture (T_4). Rumen fluid samples were collected from all lambs before feeding and 3 and 6 hours thereafter. Results revealed that pH was not significantly affected by type of CPBY added to concentrate diet, however, addition of Super Maya CPBY increased ($P<0.05$) ruminal concentrations of ammonia nitrogen (NH_3-N) and total volatile fatty acids (TVFA) from 3.90 to 4.38 mg/100 ml and from 8.60 to 11.07 mmol/100 ml, respectively. Results also showed that pH values and TVFA concentrations were significantly ($P<0.01$) affected by time of collecting rumen liquid samples from lambs.

Key Words: Awassi lambs, commercial baker's yeast, rumen fermentation

Introduction

Animal production plays an important role in food security due to the continuous natural increase of the population. Therefore, improving the animal production has become an urgent need to meet the growing needs of animal protein, and this will be impossible without providing adequate quantities and types of feed. The decrease in the quantity and quality of available feed and the lack of green forage and natural pastures lowered productivity of farm animals, the case requires attention to diversify and improve feed sources.

Specialists in ruminant nutrition paid great interest in changing the rumen microbial ecosystem to improve efficiency of production and alleviate the growing concern about the use of antibiotics and growth promoters used in the industry of animal feed, which led to an increase in the use of microbial additives during the past two decades [11]. Baker's yeast is one of such these additives due to its beneficial effects on animal performance [15].

The mode of action of yeast includes stabilizing the ruminal pH through maintaining the redox potential, increasing the number of cellulose-degrading microbial populations and enhancing the digestion of fiber, making use of starch and sugars to reduce the rate of lactic acid production and avoiding rumen acidity, finally, liberating vitamins and growth factors to stimulate microbial activity [30].

Can, et. al., [7] indicated that there was a significant ($P<0.05$) increase in the ruminal concentration of NH_3-N from 42.28 to 44.03 and 49.61 mg/100 ml as a result of adding yeast to the diets of Awassi rams at a level of 10 and 20 g/day, respectively. In view of the availability of different products and origins of commercial baker's yeast in the local markets at very low prices as compared with the high prices of yeast culture, the current study was conducted to investigate the effect of adding two types of that yeast, Angel and Super Maya and their mixture on some rumen fermentation characteristics in Awassi lambs.

Material and methods

The study was conducted in the sheep field of the Department of Animal Production /

College of Agriculture / Al-Qasim Green University for the period from 10/10/2019 to 31/5/2020 using a complete randomized design. The field experiment lasted for 70 days, preceded by a relatively long preliminary period for adaptation of the animals to individual cages and experimental rations. The experimental diets included concentrate, which was offered at a rate of 2.75% of live body weight along with free choice of ground wheat straw.

Four nutritional treatments were used in the study, including roughage and concentrate diets. Concentrate diet without commercial products of baker's yeast (CPBY) was offered to lambs in the first treatment as a control one. Angel or Super Maya CPBY were added at a rate of 2 kg/100 kg concentrate diet and offered to lambs in the second and third treatments, respectively. In the 4th treatment, lambs were fed concentrate diet with both Angel or Super Maya CPBY at rate of 1 kg/100 kg for each.

In addition to additives including NaCl, mineral and vitamin mixture and urea, concentrate diet was prepared by mixing ground wheat bran, yellow corn, soybean meal and barley at levels of 30, 18, 5 and 44.35%, respectively. The presence of 12.5% of crude protein and 1.34 g of rumen degradable nitrogen (RDN) per mega joule (MJ) of metabolizable energy (ME) was taken into account when preparing the concentrate diet. Chemical composition of concentrate diet, its ingredient and wheat straw is shown in table 1.

Samples of rumen fluid were collected from all lambs at three times, before feeding and 3 and 6 hours after offering the morning meal of concentrate diet to study the diurnal changes in rumen fermentation parameters. A special plastic tube was used for collecting rumen fluid as described by Saeed [33].

The rumen fluid was then filtered through two layers of cheese cloth and filter paper, then a few drops of 50% sulfuric acid solution were added to the filtered rumen liquid in order to kill rumen microbes and stop fermentations [23]. Three samples representing collection times for each animal were kept frozen until analysis were performed.

Table 1. Chemical composition of concentrate diet*, its ingredients and wheat straw (%)

Ingredients	DM	% in DM						ME MJ/100 g
		Ash	OM	CP	CF	EE	NFE	
Wheat bran	93.55	4.69	95.31	14.14	13.16	3.30	64.71	1.24
Yellow corn	89.09	1.14	98.86	7.20	4.15	5.84	81.67	1.43
Barley	92.69	2.88	97.12	11.86	6.70	3.75	74.81	1.34
Soybean meal	94.31	21.38	78.62	42.79	5.23	1.47	29.13	1.00
Urea	-	-	-	287.5*	-	-	-	-
Concentrate	89.75	4.87	95.13	14.47	4.10	4.43	72.13	1.34**
Wheat straw	91.19	8.91	91.09	2.69	37.44	2.13	48.83	0.97**

*** 46 × 6.25**

****Level of ME in diets was estimated according to MAFF [25] equation with subsequent conversion of values from MJ/kg DM to MJ/100 g DM in consistence with chemical composition based on percentage determinations: ME (MJ/ Kg DM) = 0.012 CP + 0.031 EE + 0.005 CF + 0.014 NFE.**

Level of RDN was estimated according to previous studies in which the ruminal effective degradability of protein fraction in the different ingredients of concentrate diet had been determined as follows: 80% and 60% for barley and yellow corn respectively [19], 70% for soybean meal [2], and 67% for wheat bran [31].

NaCl and mineral-vitamin mix manufactured by Turkish Proofed Company were added to concentrate diet at rate of 1% for each. Urea was added at rate of 0.65% to ensure existence of a standard ratio of 1.34 g RDN/MJ of ME. The calculated percentage of RDN was 1.79 g / 100 g DM of the concentrate diet.

The pH of rumen fluid samples was recorded immediately after filtration through cheese cloth and before acidification using Mi 180 Bench pH Meter. Rumen fluid samples preserved by freezing were thawed and centrifuged at 3000 RPM for 20 minutes. Then the concentration of NH_3-N was determined by MgO distillation [5]. The second fraction frozen rumen fluid samples were thawed and centrifuged at 3000 RPM for 20 minutes. Then the concentration of VFA was determined using the method proposed by Markham [26]. Data obtained was statistically analyzed according to factorial experiments (2×2) in completely randomized design (CRD). Statistical Analysis System, SAS [34] was used for that purpose.

Results and discussion:

Effect of the type CPBY on some rumen fermentation characteristics

Table 2 shows the effect of type of CPBY on some rumen fermentation characteristics. The results showed that the pH values were not significantly affected by the type of CPBY added to the concentrate diet. The mean values were 7.33, 7.36, 7.40 and 7.34 in the samples of rumen fluid collected from lambs in experimental treatments. This result agreed with that obtained by [16], the authors indicated that adding baker's yeast at a level of 5 g/day to the diet of Awassi lambs did not significantly affect the pH values in samples of rumen fluid collected from lambs, which were 6.70 and 6.70 for the addition and control treatments respectively.

Adding baker's yeast to the diet can improve the rumen environment by maintaining the pH values at normal levels and avoiding too low pH when diets containing low levels of crude fiber was fed [14]. The stabilization of rumen pH is crucial in creating a suitable environment for the growth of cellulose-degrading bacteria and improving fiber digestion [21]. Jia, et. al., [22] confirmed that baker's yeast can stimulate lactate-utilizing bacteria, stabilizing the rumen pH and promoting fibrolytic activity.

Milewski and Sobiech [27] reported that the addition of baker's yeast decreased the rumen concentration of lactic acid and increased the pH value accordingly. In another study, the decrease in the rumen concentration of lactic acid was associated with a high pH, and the direct effect of adding baker's yeast was associated with preventing the accumulation of lactic acid in the fermentation environment of the rumen [17].

Table 2. Effect of type of commercial bread yeast added to concentrated feed on some rumen fermentation characteristics (mean ± SE)

rumen fermentation parameters	Type of yeast added (2 kg / ton concentrated feed)				*P*
	without	Angel	Super Maya	Mix	
pH	7.33 ±0.16	7.36 ±0.13	7.40 ±0.07	7.34 ±0.03	NS
Ammonia nitrogen mg/100 ml	3.90^{b} ±0.13	4.28^{b} ±0.11	4.38^{a} ±0.14	4.44^{a} ±0.10	*
Total fatty acid mmol/100 ml	8.60^{b} ±0.87	8.70^{b} ±0.81	11.07^{a} ±0.55	9.47^{ab} ±0.18	*

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

Although there was no significant effect of adding CPBY on rumen pH values in the current study, Gaffer, et. al., [12] found that adding commercial baker's yeast at a level of 15 g/day to buffalo ration consisting of roughage and concentrate diets decreased (P<0.05) the rumen pH from 5.83 to 5.76 .

Results of the current study also showed a significant (P<0.05) increase in the rumen concentration of NH_3-N from 3.90 in the

control treatment to 4.38 mg/100 ml due to feeding Super Maya CPBY. This result is consistent with the study of Abou Elenin, et. al., [3], in which it was found that the adding baker's yeast at a level of 10 g/day to the concentrate ration of weaned Rahmani lambs significantly increased (P<0.05) rumen concentration of NH_3-N from 22.15 to 24.98 mg/100 ml. Similar trend was achieved by [32], where, the addition of baker's yeast to goat rations at levels of 2.5, 5 and 7 g/day increased (P<0.05) rumen concentration of NH_3-N from 10.43 in the control treatment to 12.51 and 12.32 and 12.14 mg/100 ml in the addition treatments, respectively.

Sharifi, et. al., [35] attributed the increase in the rumen concentration of NH_3-N to the increase in ruminal protein degradation processes including the hydrolysis of peptides and the deamination of amino groups from amino acids. Several studies showed the beneficial effects of baker's yeast on rumen conditions and on the number and activity of rumen microorganisms [9]. One possible explanation for the increase in the rumen concentration of NH_3-N was based on the role of baker's yeast in stimulating proteolytic microorganisms [29].

in spite of the significant increase in the rumen concentration of NH_3-N due to adding Super Maya CPBY to the concentrate diet in a current study, this concentration (4.38 mg/100 ml) was not significantly affected by addition of Angel CPBY. This is consistent with the study of [10] in which they found that adding baker's yeast to the diet of weaned lambs at a level of 20 g/day did not significantly affect the rumen concentration of NH_3-N, which was 6.60 and 7.38 mg/100 ml for the addition and control treatments, respectively. However, Lascano, et. al., [24] observed a significant decrease in the rumen concentration of NH_3-N in Holstein calves from 5.73 to 3.41 mg/100 ml as a result of adding yeast culture to the concentrate diet at a level of 1 g/kg.

In the current study, rumen concentration of NH_3-N was also increased (P<0.05) due to adding equal parts of Super Maya and Angel CPBY mixture to the concentrate diet of lambs in comparison with mean values recorded in the rumen liquid samples collected from lambs fed a concentrate diet free of yeast and from those fed concentrate diet with Angel CPBY. According to this result, it may concluded that Super Maya CPBY was distinguished by certain characteristics as compared with Angel CPBY. The effect of Super Maya CPBY was noticed through high rumen concentration of NH_3-N in the 4th treatment in which the mixture of both types was used.

With regard to the rumen concentration of TVFA, a significant increase (P<0.05) was recorded from 8.60 in the control treatment to 11.07 mmol/100 ml due to adding Super Maya CPBY. This results agreed with that obtained by [33], where, adding baker's yeast to the concentrate diets of Awassi lambs increased (P<0.05) the rumen concentration of TVFA from 11.15 to 11.74 mmol/100 ml. This may be due to the ability of yeast to stimulate the rumen microorganisms and change the final products of rumen fermentation due to shifting the metabolic activities of beneficial microorganisms in the rumen [18].

The significant improvement in the rumen concentration of TVFA resulted from adding Super Maya CPBY to the concentrate feed in the current study was inconsistent with what obtained by [10], where no significant effect of adding baker's yeast to lambs ration at a level of 20 g/day on the rumen concentration of TVFA was recorded, the mean values were 7.38 and 6.6 mmol/100 ml for the addition and control treatments respectively.

Effect of sampling time on some rumen fermentation characteristics

Table 3 shows the diurnal changes of the rumen fermentation characteristics. The results revealed that the highest pH values (P<0.01) were recorded in the samples of rumen fluids collected from lambs before feeding as compared with those collected three and six hours thereafter, the mean values were 7.36, 6.25 and 6.61, respectively. This result is consistent with that obtained by [15], in which the pH of the rumen fluid took similar pattern to what was shown in the current study, the values were 7.45, 6.37 and 6.62 in the rumen fluid samples collected from Awassi lambs

before and 3and 6 hours thereafter, respectively.

The high pH values in the rumen fluid samples collected from lambs before feeding in the current study may be due to the effect of consuming wheat straw from the evening of the previous day until the morning meal of the concentrate diet, the rumination processes during that period and the consequent secretion of large amounts of saliva [6]. The decrease in pH values in samples collected 3 hours post feeding can be explained by the effect of organic acid produced by the fermentation of soluble carbohydrates content in the concentrate diet of morning meal [8]. Galip [13] reported that the ruminal pH reflects the rate of carbohydrate fermentation. With the consumption of fermentable carbohydrates, a significant decrease in the ruminal pH of was observed after a meal [28].

Table 3. Effect of sampling time of rumen fluid on some rumen fermentation characteristics (mean ± SE)

time of collecting rumen fluid samples	Before feeding	After feeding, hours		*P*
	0 time	3	6	
pH	7.36^{a} ±0.051	6.25^{c} ±0.058	6.61^{b} ±0.056	**
Ammonia nitrogen, mg/100ml	4.23 ±0.13	4.14 ±0.09	4.16 ±0.26	N.S
Total volatile fatty acid, mmol/100 ml	4.81^{b} ±0.32	11.49^{a} ±0.94	12.08^{a} ±0.63	**

Means in the same row with different superscripts are significantly different
**** (P<0.01), NS= Non-significant.**

In spite of a significant decrease (P<0.01) in the pH values recorded in samples collected after three hours of morning feeding in the current study, Inal, et. al., [20] did not notice any changes in these values in the Akararam Kangal rams fed a diet consisting of 75% concentrate and 25% green forage, the mean pH values in the rumen fluid samples collected before feeding were 6.91 and 6.81, while in the samples collected after three hours, 5.61 and 5.41 and in the samples collected after six hours, 5.64 and 5.47 for the control and addition treatments respectively.

Rumen concentration of NH_3-N was not significantly affected by the time of collecting rumen fluid samples in the current study, the mean values were 4.23, 4.14 and 4.16 mg/100 ml in samples of rumen fluid collected before feeding and 3 and 6 hours thereafter, respectively. This result is consistent with that observed by [4], in which, there were no significant differences in the rumen concentration of NH_3-N in samples of rumen fluid collected before feeding, 31.52 and 35.02, three hours thereafter, 31.52 and 35.02, and six hours thereafter, 24.52. and 24.52 mg/100 ml.

With regard to the rumen concentration of TVFA, a significant (P<0.01) increase in their concentration was observed from 4.81 in samples collected from rumen fluid before feeding to 11.49 and 12.08 mmol/100 ml in samples collected from lambs after 3 and 6 hours of post feeding. This agreed with the results obtained by [1], in which a significant (P<0.01) increase was found in the rumen concentration of TVFA in rumen fluid samples collected from goats before feeding and six hours thereafter, the mean values were 8.54 and 12.32 vs. 9.20 mmol/100 ml in rumen fluid samples collected three hours post feeding.

The current study showed an inverse relationship between the concentration of TVFA and the pH, while the concentration of TVFA increased significantly (P<0.01) after three and six hours of feeding, the pH recorded a significant decrease (P<0.01) as a result of the degradation of soluble carbohydrates and starch to produce organic

acids when lambs consumed their morning meal of concentrate. This agreed with Chaucheyras-Durand, et. al., [8], they believed that a rapid microbial fermentation leads to an increase in the concentration of rumen TVFA, which contributes to lower pH.

Reference:

[1] Abd El-Ghani, A. A. (2004). Influence of diet supplementation with yeast culture (Saccharomyces cerevisiae) on performance of Zaraibi goats. Small Rumin. Res. 52 (3): 223-229.

[2] Abdullah, N. S. (1988). Effect of roughage to concentrate ratio on the response of Awassi lambs to a supplement of dietary rumen undegradable protein. MSc. Thesis, University of Baghdad.

[3] Abou Elenin, E. I. M., E. R. Abd El-Galil, K. E. I. Etman and H. M. El-Shabrawy (2016). Improvement of rumen fermentation and performance of growing lambs by adding natural microbial resources. Asian J. Anim. Sci., 10 (3): 202-212.

[4] Al-Samaraae, F. R., N. N. Al-Anbari and A. M. Al-Nedawi (2016). Specify the best covariance stricter for repeated measurements data with/without missing observations using mixed model. Iraqi J. Agri. Sci., 46 (4): 638-643.

[5] AOAC (2005). Official Methods of Analysis . 15th end. Association of Official Analytical Chemists, Arlington, Virginia.

[6] Bae, D. H., J. C. Welch and A. M. Smith (1979). Forage intake and rumination by sheep. J. Anim. Sci. 49 (5): 1292-1299.

[7] Can, A., N. Denek, M. Seker and H. Ipek (2007). Effect of yeast culture supplementation on nutrient digestibility of Awassi sheep. J. Appl. Anim. Res. 31 (1): 73-77.

[8] Chaucheyras-Durand, F. , N. D. Walker and A. Bach (2008). Effects of active dry yeasts on the rumen microbial ecosystem: Past, present and future. Anim. Feed Sci. Technolo. 145 (1-4): 5-26.

[9] Chevaux, E. and M. M. Fabre (2007). Probiotic yeast in small ruminants. Feed Mix. 15: 28029.

[10] Ding, J., Z. M. Zhou, L. P. Ren and Q. X. Meng (2008). Effect of monensin and live yeast supplementation on growth performance, nutrient digestibility, carcass characteristics and ruminal fermentation parameters in lambs fed steam-flaked corn-based diets. Asian-Aust. J. Anim. Sci., 21(4): 547-554.

[11] El-Waziry, A. and H. R. Ibrahim (2007). Effect of Saccharomyces cerevisiae of yeast on fiber digestion in sheep fed berseem (Trifolium alexandrinum) hay and cellulase activity. Australian J. Basic Appl. Sci., 1(4): 379-385.

[12] Gaafar, H. M. A., E. M. Abdel-Raouf and K. F. A. EL-Reidy (2010). Effect of fibrolytic enzyme supplementation and fiber content of total mixed ration on productive performance of lactating Buffaloes. Slovak J. Anim. Sci., 43: 147-153.

[13] 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 Med. Vet. 157 (12): 609-613.

[14] Guedes, C. M., D. Goncalves, M. A. M. Rodrigues and 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. Technol. 145 (1): 27-40.

[15] Hassan, S. A. and A. A. Saeed (2013). Effect of feeding different levels of dietary protein and addition of baker's yeast (Saccharomyces cerevisiae) on productive parameters of Awassi lambs. J. Agric. Sci. and Tech. A3, 484-497.

[16] Hassan, S. A. and S. F. Mohammed (2016). Effect of Saccaromyces cerevisiae supplementation on rumen characteristics in Awassi lambs fed diets with different roughage to concentrate ratios. Iraqi J. Agric. Sci., 47 (7): 1-11.

[17] Hassan, S. A. and, S. F. Mohammed (2014). Effects of *Saccharomyces cerevisiae* supplementation on growth rate and nutrient digestibility in Awassi lambs fed diets with different roughage to concentrate ratios. Biochem. Biotech. Res., 2 (3): 37-43.

[18] Hossain, S. A., S. Parnerkar, N. Haque, R. S. Gupta, D. Kumar and A.K. Tyagi (2012). Influence of dietary supplementation of live yeast (*Saccharomyces Cerevisiae*) on nutrient utilization, ruminal and biochemical profiles of Kankrej calves. Int. J. Appl. Anim. Sci. 1 (1): 30-38.

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

[20] Inal, F., E. Gurbuz , B. Coskun, M. S. Alatas, O. B. Citil, E. S. Polat, E. Seker and C. Ozcan (2010). The effects of live yeast culture (*Saccharomyces Cerevisiae*) on rumen fermentation and nutrient degradability in yearling lambs. Kafkas Univ. Vet. Fak. Derg. 16 (5): 799-804.

[21] Ismaeel, M. A., Z. T. Al-doori and S. N. Hussein (2019). Effect of saccharomyces cerevisiae as a feed additive on some aspects of productive and reproductive performance in adult Awassi lambs. Egypt. J. Vet. Sci., 50 (5): 39-45.

[22] Jia, P., K. Cui, T. M., F. Wan, W. Wang, D. Yang, Y. Wang, B. Guo, L. Zhao and Q. Diao (2018). Influence of dietary supplementation with *Bacillus* licheniformis and Saccharomyces *cerevisiae* as alternatives to monensin on growth performance, antioxidant, immunity, ruminal fermentation and microbial diversity of fattening lambs.doi:10.1038/s41598-018-35081-4.

[23] Kazemi-Bonchenari, M., K. Rezayazdi., A. Nikkhah., H. Kohram and M. Dehghan-Banadaky. (2010). The effects of different levels of sodium caseinate on rumen fermentation pattern, digestibility and microbial protein synthesis of Holstein dairy cows. Afri. J. Biotech., 9: 1990-1998.

[24] 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 (10): 5100-5010.

[25] MAFF (1975). Ministry of Agriculture, Fisheries and Food Department, of Agriculture and fisheries of Scotland. Energy allowances and feed systems for ruminants. Technical Bulletin, 33.

[26] Markham, R. (1942). A steam distillation apparatus suitable for micro-Kjeldahl analysis. Biochem. J. 36 (10-12): 790.

[27] Milewski, S. and P. Sobiech (2009). Effect of dietary supplementation with Saccharomyces cerevisiae dried yeast on milk yield, blood biochemical and hematological indices in ewes. Bull Vet. 53: 753-758.

[28] Nocek, J. E. (1997). Bovine acidosis: implications on laminitis. J. Dairy Sci. 80 (5): 1005–1028.

[29] Obeidat, B. S. , K. l. Z. Mahmoud, M. D. Obeidat, M. Ata, R. T. Kridli, S. G. Haddad, H. H. Titi, K. I. Jawasreh, H. J. Altamimi, H. S. Subih, S. M. Hatamleh, M. A. Abu Ishmais and R. Abu Affan (2018). The effects of Saccharomyces cerevisiae supplementation on intake, nutrient digestibility, and rumen fluid pH in Awassi female lambs. Vet. World, 11 (7): 1015-1020.

[30] Ondarza, M. B. D., C. J. Sniffen, L. Dussert, E. Chevaux , J. Sullivan and N. Walker (2010). Multiple-study analysis of the effect of live yeast on milk yield, milk component content and yield, and feed efficiency. American Registry of Professional Anim. Sci., 26 (6): 661–666.

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

[32] Pramote, P., Y. Han, S. Traiyakun, J. Khotsakdee and S. Paengkoum (2011). Supplementation of *Saccharomyces Cerevisia*e or *Lactobacillus* Acidophilus in goats diets. World Academy of Science. Engineering and Technology 59. Protein. Nutrition Abstracts and Review (Series B). 62:787-818.

[33] Saeed, A. A. (2011). Effect of level and degradability of dietary protein fed without baker's yeast (saccharomyces cerevisiae) on Turkish Awassi lamb's performance. PhD. Thesis, University of Baghdad.

[34] SAS (2010). SAS/STAT User's Guide for Personal Computers. Release6.12.SAS. Institute Inc., Cary, NC, USA.
[35] Sharifi, M., M. Bashtani, A. A. Naserian and H. Khorasani (2013). Effect of dietary crude protein level on the performance and apparent digestibility of Iranian Saanen kids. Afr. J. Biotechnol, 12 (26): 4202-4205.