Effect of Addition of Two Types of Commercial Baker's Yeast on Some Blood Biochemical Parameters of Awassi Lambs

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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 changes in blood parameters. The study included 4 treatments in which, ground 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 CPBY of Angel (T_2), Super Maya (T_3) at rate of 2 kg/ton, and their equalized mixture (T_4). Samples were withdrawn from all lambs at the 10th week before feeding and 3 and 6 hours thereafter. Results revealed that glucose concentration was significantly ($P<0.05$) increased from 63.82 to 69.36 mg/100 ml and similar significant decrease in urea nitrogen concentration from 43.17 to 35.70 mg/100 ml due to addition of Super Maya CPBY. Whereas, effect of addition of that kind of CPBY on total protein concentration (TP) included its mixture with Angel CPBY. Thus, values were increased from 5.47 in control treatment to 5.75 and 5.67 mg/100 ml for both treatments respectively. Results of a current study also showed that all blood parameters were significantly ($P<0.01$) affected by time of withdrawing blood samples.

Key Words: Awassi lambs, commercial baker's yeast, blood parameters.

تأثير اضافة نوعين من خميرة الخبز التجارية في بعض معايير الدم الكيموحيوية للحملان العواسية

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الخلاصة

اجريت الدراسة الحالية في حقل الاغنام التابع لقسم الانتاج الحيواني/ كلية الزراعة/ جامعة القاسم الخضراء باستخدام 16 حمل عواسي ذكري للتحري عن تأثير اضافة نوعين من خميرة الخبز التجارية ومزيجهما على التغير في معايير الدم. وتضمنت الدراسة اربعة معاملات قدم فيها تبن المجروش بصورة حرة فيما قدم العلف المركز بمعدل 2.75% من وزن الجسم الحي وبوجبتين، صباحية ومسائية بدون اضافة (معاملة 1) او بإضافة خميرة الخبز التجارية نوع Angel (معاملة 2) و Super Maya (معاملة 3) الى العليقة المركزة بمعدل 2 كغم/طن ومزيجهما مناصفة (معاملة 4) . سحبت نماذج الدم من

 ISSN 2072-3875

جميع الحملان في الاسبوع العاشر قبل التغذية وبعدها بثلاث وست ساعات. اظهرت النتائج زيادة تركيز الكلوكوز معنويا (P<0.05) من 63.82 الى 69.36 ملغم/100 مل وانخفاض معنوي مماثل في تركيز نيتروجين اليوريا من 43.17 الى 35.70 ملغم/100 مل نتيجة لإضافة خميرة الخبز التجارية نوع Super Maya، فيما شمل تأثير اضافة ذلك النوع من الخميرة على تركيز البروتين الكلي مزيجها مع المنتوج التجارية نوع Angel لترتفع القيم من 5.47 في معاملة المقارنة الى 5.75 و 5.67 ملغم/100 مل لكلا المعاملتين على التوالي. كما اظهرت النتائج تأثر تركيز كل معايير الدم معنويا بأوقات سحب نماذج الدم.

كلمات مفتاحية: حملان عواسية، خميرة الخبز التجارية، معايير الدم

Introduction

Ruminant nutrition programs represent a meeting point in providing accurate needs of nutrients in a suitable time to ensure good level of productivity and profitability of the projects (17). Therefore, breeders seek to follow feeding strategies and systems to reduce feeding costs and improve the performance and health of animals (6). Ruminants are the basis on which entire livestock production is based and represent a basic source of national wealth, which plays a pivotal role in the agricultural sector and is an important source of national income (9). Sheep occupy an important place in livestock production, due to the economic advantage of is raising them (34).

Over the past decades, ruminant nutritionists and microbiologists have shown a great interest in manipulation of the rumen microbial ecosystem in order to improve production efficiency and to find solutions to the growing concern about the use of antibiotics and growth stimulators in the animal feed industry, therefore, the interest in using microbial additives to improve animal performance has increased during the past two decades (15).

Recent research has focused on direct use of microbial additives to the diet, such as baker's yeast, as feed additives due to their beneficial effects on animal performance (5, 21). The mode of action of yeast includes stabilizing rumen pH by maintaining the reduction redox, increasing the number of cellulolytic populations, enhancing the digestion of fibers accordingly, making use of starch and sugars to reduce the rate of lactic acid production, avoiding the rumen acidity and releasing vitamins and growth factors to stimulate microbial activity (35).

Many studies showed that the use of baker's yeast (BY) in ruminants feeding would lead to different positive changes including blood parameters (39). Hassan and Saeed (22) referred to a significant increase (P<0.01) in blood glucose concentration from 67.67 to 71.49 mg/100

 ISSN 2072-3875

ml due to addition of CPBY to the concentrate diet of Awassi lambs at a level of 0.5%. Areeg, et. al.(10) showed that the blood concentration of triglycerides was increased ($P<0.01$) in the blood samples withdrawn before feeding from 16.5 to 23 and from 10 to 16 mg/100 ml as a result of addition of CPBY at a level of 5 g/day to the ration of Awassi lambs formulating from concentrate and roughage at levels of 60:30 and 40:60 respectively.

Since there are different CPBY available in the local markets and from different origins with very low prices as compared with that of yeast culture, the current study was conducted to investigate the effect of addition of two types of that yeast, Angel and Super Maya and their mixture on some blood biochemical parameters in Awassi lambs

Material and methods

This study was carried out at the animal field/Animal Production Department-College of Agriculture- Al-Qasim Green University for a period from 10/10/2019 to 31/5/2020 according to the complete random design. The field experiment was lasted for 70 days preceded by a relatively long preliminary period for ensure that the animals were well adapted to individual cages. The experimental diets included the concentrate offered at a rate of 2.75% of body weight and ground wheat straw *ad libitum*. Four dietary treatments were used in the study including concentrate and straw, as follows:

T_1: concentrate diet without addition of CPBY.

T_2: concentrate diet with Angel's yeast at a rate of 2 kg /100 kg concentrate diet.

T_3: concentrate diet with Super Maya at a rate of 2 kg/100 kg concentrate diet.

T_4: concentrate diet with a mixture of both types of CPBY at a rate of 1 kg/100 kg concentrate diet for each.

The concentrate diet was prepared at the field by mixing its ingredients including yellow corn, barley, wheat bran, and soybeans in proportions that ensure 12.5% of crude protein and 1.34 g of rumen degradable nitrogen (RDN) per mega joule (MJ) of metabolizable energy (ME). These ingredients were well mixed together, then the second part of ingredients consisting CPBY, vitamins, salts and urea were added to the main mixture and mixed together for several times to homogenized mixture. Table (1) shows the chemical analysis of the concentrate diet, ingredients and wheat straw.

Blood samples were withdrawn from the jugular vein within one day at the last week of the experiment from all lambs, before morning feeding (zero time), 3 and 6 hours thereafter. Blood samples were transferred into sterile plastic tubes and centrifuged to separate the serum. The

 ISSN 2072-3875

separated serum was collected and stored at -20 Co until analysis was performed spectrophotometrically using SP-3000 UV-Visible Spectrophotometer. The concentration of blood glucose (BG) was determined according to the enzymatic colorimetric method using commercial kit produced by Spanish Linear company on wave length of 500 µm (13).

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

Ingredients	DM	% in DM						ME
		Ash	OM	CP	CF	EE	NFE	MJ/100 g
Wheat bran	93.55	5.48	95.31	14.14	13.96	4.39	62.52	1.23
Yellow corn	89.09	2.22	98.86	7.20	5.84	5.84	80.80	1.37
Barley	92.69	5.65	97.12	11.86	6.71	3.75	75.49	1.27
Soybean meal	94.31	7.87	78.62	42.79	1.47	1.47	39.35	1.18
Urea	-	-	-	287.5*	-	-	-	-
Concentrate	89.75	7.95	95.13	14.47	5.88	4.43	71.13	1.25**
Wheat straw	91.19	7.12	91.09	2.69	35.67	2.13	51.69	1.00**

*** 46 × 6.25**

****Level of ME in diets was estimated according to MAFF (30) 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 (24), 70% for soybean meal (1), and 67% for wheat bran (37).

NaCl and mineral-vitamin mix manufactured by Turkish Profeed Company were added to concentrate at rate of 1% for each. Urea was added at rate of 0.62% to ensure existence of a standard ratio of 1.34 g RDN/MJ of ME. The calculated percentage of dissolved nitrogen in the rumen was 1.67 g / 100 g dry matter for the concentrated feed.

The concentration of blood total protein (BTP) was determined according to the Biuret method using commercial kit produced by French Biolabo company on wave length of 500 µm (19). The concentration of blood urea nitrogen (BUN) was determined according to the

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Berthelot method using commercial kit produced by Spanish Linear company on wave length of 600 µm (36). The concentration of blood triglycerides (BTG) was determined according to the GPO method using commercial kit produced by French Biolabo company on wave length of 500 µm (16). The following equation was used to estimate the concentrations of blood parameters:

Concentration (mg or g/100ml) = $\frac{A}{A^o}\times$ Concentration of standard solution

Where, A is absorption of sample, A^o is absorption of standard solution.

Results and discussion

1- Effect of addition of type of CPBY on blood parameters

Table (2) shows the effect of the type of CPBY added to the concentrate diet on the blood parameters including the concentration of BG, BTP, BUN and BTG in the serum. Results of the current study revealed that BG concentration was significantly (P<0.05) increased from 63.82 in the control treatment to 69.36 mg/100 ml due to the addition of super Maya baker's yeast to the concentrate diet. Similarly, Hassan and Saeed (22) reported that addition of Akmaya CPBY to concentrate diet of Awassi lambs increased BG concentration.

Table 2- Effect of type of commercial bread yeast added to concentrated feed on blood biochemical parameters concentration (mean ± SE)

Blood parameter	Type of yeast added (2 kg / ton concentrated feed)				*P*
	without	Angel	Super Maya	Mix	
BG, mg/100 ml	63.82^{b} ±0.53	66.54^{ab} ±1.39	69.36^{a} ±2.18	66.72^{ab} ±1.13	*
TP, g/100ml	5.47^{b} ±0.03	5.54^{b} ±0.02	5.75^{a} ±0.04	5.67^{a} ±0.04	**
BUN mg/100 ml	43.17^{a} ±2.01	41.76^{ab} ±0.98	35.70^{b} ±3.21	38.45^{ab} ±0.92	*
TG, mg/100 ml	20.50 ±4.03	21.69 ±1.06	22.92 ±1.19	22.31 ±3.83	NS

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

The increase in BG concentration in a current study may be due to the effect of Super Maya type of CPBY that may increase the activity of the amylase

 ISSN 2072-3875

enzyme and the enhancement of the rate of hydrolysis and absorption of dietary carbohydrates in the small intestine (41). Moreover, baker's yeast provide favorable ruminal condition for cellulolytic bacteria to break down crude fibers as a result of its stimulating role to lactate utilizing bacteria and hence stabilizing ruminal pH (25). It is probable that this condition may lead to enhance glucose production associated with increasing ruminal concentration of propionate, the main precursor of glucose via gluconeogenesis pathway, which can also be enhanced by reducing blood insulin concentration (14). Areej, et. al., (10) believed that baker's yeast play a role of in improving liver function. This enhances the idea of increased rate of conversion of propionate into glucose in the liver .

Results of a current study showed also that there was a significant increase ($P<0.01$) blood concentration of total protein (BTP) from 5.47 in the control treatment to 5.75 g/100 ml due to addition of Super Maya CPBY. This result agrees with the findings of Areeg, et. al., (10) in which, a significant increase ($P<0.01$) in BTP resulted when CPBY was added to the concentrate diet of Awassi lambs at a level of 5 g/day. Similar results were obtained by many other studies (18, 2, 32).

The significant increase in the BTP achieved in the current study may be due to the role of added yeast in stimulating microbial activity, especially the fiber-degrading bacteria, which leads to enhance the synthesis of microbial protein in the rumen and increasing its flow to the small intestine (20). Areeg, et. al., (10) attributed this increase in BTP to an increase in protein release as affected by addition of CPBY and to the improvement in the metabolic processes associated with yeast supplementation.

Regarding the blood concentration of urea nitrogen (BUN), results of a current study showed a significant decrease ($P<0.05$) in this blood parameters from 43.17 in the control treatment to 35.70 mg/100 ml as a result of addition of the Super Maya CPBY to the concentrate feed. This result is in agreement with the study by carried out by Hassan and Saeed (22) in which, they indicated that addition of CPBY at a level of 0.5% to the concentrate diet offered to the Awassi lambs led to a significant decrease ($P<0.01$) in BUN from 44.88 to 41.01 mg/100 ml.

Khalif, et. al., (27) confirmed that using baker's yeast in ruminant diets would reduce BNU concentration, indicating that there was an improvement in protein utilization. Roseler, et. al., (38) suggested that BUN could be an evidence of rumen protein degradation and protein quantities reaching post-ruminally.

Results of a current study also revealed that the blood concentration of

triglycerides (BTG) was not significantly affected by the addition of both types of CPBY, Angel, Super Maya or their mixture, the mean BTG concentrations were 21.69, 22.92 and 22.31mg/100 ml respectively, as compared with 20.50 mg/100 ml in control treatment. This result agrees with the result obtained by Tayeb (40) in which the absence of the significant effect of introducing CPBY into ewes diets at a level of 0.3% on BTG concentration of was noticed, the mean values were 97.59 and 96.31 mg/100 ml for addition and control treatments, respectively.

Although BTG was not significantly affected by addition of CPBY to concentrate diet of Awassi lambs in a current study, Alsalami, et. al., (8) showed that feeding CPBY to ewe at a level of 3 g/day significantly increased ($P<0.05$) BTG concentration from 37.2 to 57.8 mg/100 ml, while feeding yeast at levels of 1 and 2 g/day associated with insignificant increase to 50.1 and 48.4 mg/100 ml, respectively. Kowalik, et. al., (29) observed that addition of yeast culture (Diamond) at a level of 2 g/day to the concentrate diet of rams significantly decreased ($P<0.01$) the concentration of BTG by 16%.

2- The effect of sampling time on blood parameters

Table 3 shows the effect of the time of sampling time on blood parameters. The diurnal changes in these parameters was adopted in the current study. Regarding the concentration of BG, statistical analysis showed that there was a significant increase ($P<0.05$) from 63.63 in the samples withdrawn from the lambs before feeding to 71.29 mg/100 ml in the samples withdrawn from them 3 hours post feeding. This result agrees with that obtained by Baiee (11), in which it was indicated that there was a significant increase ($P<0.01$) by 7.75 mg/100 ml in BG concentration in samples withdrawn 3 hours post feeding as compared with samples withdrawn before feeding. In the current study, this difference between those samples in BG concentration was 7.66 mg/100 ml. The high BG concentration three hours post feeding may be due to the effect of consuming concentrate diet, where chemical composition includes high level of readily fermented carbohydrates and the high molar proportions of volatile fatty acids are rapidly absorbed through the rumen wall into the bloodstream to provide the energy necessary for the function of body organs and systems in the fermentation peck that usually occurs during that period (12).

Membrive (31) reported that 50-70% of the energy available to ruminants derived from

 ISSN 2072-3875

Table 3- Effect of time of sample draw on blood biochemical parameter (mean ± SE)

Time of withdrawing blood samples	Before feeding	After feeding, hours		*P*
	0 time	3	6	
Glucose, mg/100 ml	63.63^{b} ±0.83	71.29^{a} ±1.17	64.90^{b} ±1.08	**
TP, g/100ml	5.36^{b} ±0.05	5.72^{a} ±0.04	5.73^{a} ±0.06	**
BUN, mg/100 ml	41.08^{b} ±1.60	45.40^{a} ±1.37	32.83^{c} ±1.16	**
TG, mg/100 ml	19.15^{b} ±1.89	24.91^{a} ±2.09	21.50^{ab} ±1.27	*

Means in the same row with different superscripts are significantly different

*** (P<0.01), ** (P<0.01)**

the metabolism of volatile fatty acids produced in the rumen and absorbed into the bloodstream. Concentrate diets increase ruminal concentration of propionic acid, the main glucogenic metabolite in ruminants (33).

Regarding BTP concentration, results of a current study showed that there was a significant increase (P<0.01) from 5.36 in blood samples withdrawn before feeding to 5.72 and 5.73 g/100 ml in the samples withdrawn 3 and 6 hours post feeding, respectively. This result agrees with the findings of Al-Husseini (4), BTP concentration was significantly increased (P<0.01) from 6.81 in blood samples withdrawn from lambs before feeding to 8.06 and 7.10 g/100 ml in samples withdrawn 3 and 6 hours post feeding, respectively.

The increase in BTP concentration in the samples withdrawn three hours post feeding may be due to the improvement in the metabolism processes as influenced by the addition of baker's yeast. Similar conclusion was mentioned by Areeg, et. al., (10). In addition to the release of protein substances activated by the presence of yeast in the diet as indicated by Galip (18). Results of a current study indicated that the effect of CPBY was associated with the peak of rumen fermentations. Moreover, Allison (6) considered the increase in TP concentration a sign for of body deposit of protein.

Results of a current study also showed that there was a significant increase (P<0.01) in BUN concentration from 41.08 in the blood samples with drawn

 ISSN 2072-3875

before feeding to 45.40 mg/100 ml in those withdrawn 3 hours post feeding. This result is consistent with that obtained by Al-Shemary (3), where BUN concentration recorded significant (P<0.01) increase from 15.44 in blood samples drawn from lambs before feeding to 18.61 mg /100 ml in those withdrawn 3 hours thereafter. Saeed (39) and Hassan (23) reported similar results.

The increase (P<0.01) of BUN concentration in the blood samples withdrawn three hours post feeding in a current study may be due to the increased activity of rumen microorganism at the peak of the fermentation of the consumed feed. Iwanska, et. al., (26) demonstrated that the increase in the concentration of ammonia in the rumen in excess of utilization by ruminal bacteria may lead to increase in the concentration of urea nitrogen in blood. Roseler, et. al., (38) suggested that BUN may be an indicator for ruminal degradation and post-ruminally supply of protein.

Regarding BTG concentration, results of the current study showed that there was a significant (P<0.05) increase from 19.15 in the blood samples withdrawn before feeding to 24.91 mg/100 ml in those withdrawn 3 hours post feeding. This is in agreement with the findings of Alsalami, et. al., (8), they found that BTG concentration was significantly increased (P<0.05) in blood samples withdrawn from Awassi ewes 3 hours post feeding to 57.8 as compared with 37.2 mg/100 ml in blood samples withdrawn before feeding. This might be related to the enhancement of lipolytic enzymes activity and the utilization of dietary fats (28).

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 ISSN 2072-3875