EFFECT OF FORMALDEHYDE-PROTECTED DIETS ON MILK YIELD, COMPOSITION AND SOME BLOOD BIOCHEMICAL PARAMETERS IN KARADI EWES

K. N. S. Mustafa
Assist. Prof.
Dept. of Animal Production. College of Agricultural Engineering Sciences, Duhok University
kamal.noman@uod.ac

ABSTRACT

An experiment was conducted to study the effect of feeding formaldehyde-treated diets on milk yield, composition and some blood biochemical parameters of Karadi ewes in mid lactating period. Nine lactating Karadi ewes in their second lactation and weighing 43.42 ± 0.4 kg were used in this study. Following one-week adaptation period, the ewes were allocated into 3x3 Latin-square and fed three different diets, the 1st untreated basal diet (T1), the 2nd barley 75%, wheat bran 7% and soybean meal 10% treated with formaldehyde 9l/ton (T2) and 3rd group wheat bran7% and soybean meal 20% treated with formaldehyde (T3). The ewes were offered 1.750 kg/ewe of concentrate in addition to grazing for 5-6 hr per day. Results showed that the ewes fed T2 and T3 diets had a higher (P<0.05) daily milk yield as well as milk fat, protein and lactose yield than ewes fed control diet. Blood urea concentration was higher (P<0.05), but albumin, triglyceride and glucose was lesser (P<0.05) in ewes given T2 and T3 diets than those fed T1 diet. It can be concluded that feeding Karadi ewes formaldehyde-treated diet improved milk yield and increased milk's total solids.

Key words: **formaldehyde treated diet, Karadi ewes, milk production, blood biochemical, pasture condition.**

مجلة العلوم الزراعية العراقية -2021 :52 (5):1094-1100 مصطفى

تأثير العليقة المحمية بالفورمالديهايد في انتاج الحليب وبعض صفات الدم الكيموحيوية للأغنام الكرادية

كمال نعمان سيف الدين مصطفى

استاذ مساعد

قسم الإنتاج الحيواني كلية علوم الهندسة الزراعية – جامعة دهوك أقليم كوردستان العراق

المستخلص

اجريت هذه الدراسة لبيان تأثير تغذية العليقة المحمية بالفورمالديهايد 9لترات/ طن) في إنتاج الحليب ومكوناته وبعض صفات الدم الكيموحيوية في النعاج الكرادية. تم استخدام تسعة نعاج كرادية في موسم انتاج الحليب الثاني بمعدل وزن 43.42 ± 0.4 كغم وتمت تغذيتها على العلائق لفترة تمهيدية لمدة أسبوع واحد، بعدها غذيت على ثلاث علائق تجريبية مختلفة ضمن تصميم المربع اللاتيني 3 x 3. كانت العليقة الأولى غير معاملة (T1) وعدت مجموعة سيطرة، في حين تم معاملة العليقة الثانية المكونة من الشعير 75 %ونخالة الحنطة 7% وكسبة فول الصويا 10% بالفورمالديهايد (T2) في الوقت الذي عوملت في العليقة الثالثة المكونة من نخالة الحنطة 7% وكسبة فول الصويا 20% بالفورمالديهايد أيضا (T3). غذيت النعاج بكمية 1.750 كغم/ نعجة علف مركز فضلا عن الرعي لمدة 5–6 ساعات يوميا. أوضحت النتائج أن تغذية النعاج على العلائق T2، T3 زادت انتاج الحليب اليومي، ودهن الحليب والبروتين واللاكتوز معنويا (P <0.05) مقارنة بالنعاج التي غذيت على عليقة السيطرة بدون معاملة. كان تركيز اليوريا في الدم أعلى معنويا (P <0.05)، ولكن الألبومين، والدهون الثلاثية والكلوكوز كان أقل (P<0.05) في النعاج التي تناولت علائق T2 وT3 مقارنة بالنعاج التي تناولت عليقة السيطرة. يمكن الاستنتاج بان التغذية على العليقة المعاملة بالفورمالديهايد حسن من إنتاج الحليب وزاد من المواد الصلبة الكلية للحليب لدى النعاج الكرادية.

الكلمات المفتاحية: العليقة المعاملة بالفورمالديهايد، اغنام الكرادي، انتاج الحليب، صفات الدم الكيموحيوية، ظروف المرعى

Received:15/8/2020, Accepted:11/11/2020

INTRODUCTION

It is known that inadequate rumen degradable protein (RDP) content of the diet could result in inefficient nutrient utilization (20), and supplementary rumen-undegradable protein (RUP) can improve animal performance by altering the protein/energy ratio of potentially absorbable nutrients (7;15). Under Iraqi conditions, it is important to add feed supplement to grazing ewes' diet to ensure high feeding value and to sustain economically efficient levels of sheep production (36). For owners adopting low-cost systems of raising sheep using home- grown feeds, barley has traditionally been used a supplement of choice, because of its availability and high energy content. However, barley has a well-recognized nutritional shortage arising from its suppressive effects on forage intake from its low protein content and its high rumen–degradability (1). A series of experiments has been done to investigate the effect of chemical treatment of barley on milk production. Hassan et al., (12) reported that treatment of barley grain with formaldehyde significantly increased milk yield in Awassi Ewes. Similarly, Kassem et al. (14) revealed that either barley, wheat or soybean meal fed lactating sheep under pasture conditions have a significant effect on milk production. Also, Kassem (15) studied the effect of the level of treated barley and wheat bran inclusion on milk yield and noticed that milk yield was increased significantly ($P<0.05$) in Awassi ewes. It is now known that feed stuffs containing protein may be utilized differently depending on the degradability of the protein in the feed (9). The utilization of amino acids required for milk protein synthesis depends on the quality and quantity of amino acids leaving the rumen. Efficiency of intestinal proteins absorption depends on the post- ruminal digestibility of protein, which varies between and among protein sources (24). In addition, feeding bypass protein to ruminant had reducing dietary amino acid loss as ammonia and urea, energy conservation through less urea synthesis, efficient protein synthesis and improvement in efficiency (33;34). In dairy cattle, supplementing RUP in the form expeller soybean meal increased the flow of non-ammonia, non-microbial nitrogen to the small intestine and increased milk yield by 10% (8). Therefore, balancing ruminant diet, for RDP and RUP may alter nitrogen utilization and increase milk yield. Several researches have pointed a significant response in milk yield and composition in ewes (21;25) and goats (28;35) when feeding formaldehyde-treated diets as a result of improvement feed utilization efficiency. Since very limited work has been conducted on the effect of treated ration with formaldehyde on milk yield of Karadi ewes in particular, therefore the present experiment was designed to investigate the effect of RDP and RUP content of rations treated with formaldehyde on milk yield, composition and some blood biochemical parameters of this breed.

MATERIALS AND METHODS

Nine lactating Karadi ewes in their second lactation and weighing 43.42 ± 0.4 kg were used in this study. Following one week adaptation period, the ewes were allocated into 3x3 Latin-square and fed three different diets, the 1st untreated basal diet (T1), the 2nd barley 75%, wheat bran 7% and soybean meal 10% treated with formaldehyde 9l/ton (T2) and 3rd group wheat bran 7% and soybean meal 20% treated with formaldehyde (T3) (Table1). The ewes were offered 1.750 kg/ewe of concentrate in addition to grazing for 5-6 hr. a day.At day 14 from each period, the ewes were separated from their lambs at evening for 24 hr. and milked to evacuate the udder, then were re-milked in the following morning and evening to find out the daily milk yield. Samples of milk (40ml) was collected for analysis for its composition. Blood venipuncture via jugular vein were also collected from each ewe (10 ml) on day 14, centrifuged and the serum was harvested and kept frozen at -20 C° for further analysis. Milk energy determination was carried out depending on the formula described by Economides (10), Caloric value (MJ/Kg) = 1.94 + 0.43x fat%. Serum total protein (g/dl), albumin (g/dl), triglyceride (mg/dl), and urea (mg/dl) levels were determined calorimetrically using standard commercial kits (Biolabo, SA, Laboratory reagent and products, France). Serum glucose (mg/dl) was determined calorimetrically using standard commercial kits (Olasmatec Laboratory

product, U.K). The globulin (g/dl) values were determined by subtracting albumin value from total protein values. The ME content of the diet was estimated from the sum of ME content of individual feed ingredients using the standard tables by Al-Khawaja (4). The MP content of the diet was calculated by the sum of microbial true protein (MTP) synthesized in the rumen plus dietary digestive protein escaping rumen degradation. MTP was estimated by assuming: 9.6g microbial crude protein/MJ ME, 0.75g true protein in microbial protein and 0.85 true small intestinal amino acids digestibility (2). Dietary RUP of feed was estimated from sum of the RUP content of individual feed ingredient, SBM ingested by an animal using the standard nutrient composition table by Ensminger (11), treated barley and wheat bran was 72%, (15).

Table 1. Components of concentrate diet and its chemical composition, calculated metabolizable protein (MP) content (units: g/kg DM unless stated).

Ingredients %	Treatments		
	T1	T 2	T 3
Ground barley	75	75 T	65
Wheat bran	7	7 T	7 T
Soybean meal	10	10 T	20 T
Yellow corn	5.25	5.25	6.5
Urea	1.75	1.75	0.5
NaCl	0.5	0.5	0.5
Limestone	0.5	0.5	0.5
Chemical composition %			
Dry matter	92.73	91.82	92.17
Organic matter	94.77	94.61	94.26
Crude protein	18.84	18.25	18.03
Ether extract	4.75	4.48	4.26
Crude fiber	4.38	4.75	4.84
NFE	66.8	66.7	67.13
RDP – RUP Ratio	14.6 - 4.2	9.1 – 9.1	9.0 – 9.0
Estimated ME (MJ/kg DM) *	13.30	13.15	13.12
Estimated RDP (gm/MJ ME) in concentrate	13.24	8.07	8.30
Estimated MP (g/day)	190	254	253

T= treated with formaldehyde. *EME (MJ/100gmDM=0.012 CP+0.031 EE + 0.005 CF + 0.014 NFE (19)

The data were statistically analyzed using SAS, (23) software as in the following model

$Yij(k) = \mu + Pi + Yj + tK + \sum ij(k)$

Where Yij is the observed value of trait;
μ is the overall mean;
Pi is the effect of the row (periods);
Yi is the effect of the column (replicate);
tk is the effect for treatments,
∑ij(k) is the value of the experimental error
Significant differences among means were tested according to Duncan (25).

RESULTS AND DISCUSSION

Supplementing of the grazing local Karadi ewes and their lambs with restricted amount of experimental rations (1.75 kg/ewe/day) of formaldehyde treated T2 and T3 resulted in a lesser of estimated RDP to 8.07 and 8.30 compared to T1 (13.24 gm/MJ ME). It's too clear that RDP content was higher in T1 by 69% (Table 1) as compared with those reported by ARC (1) recommendations (7.81gm RDP/ MJ ME). The ewes fed T2 and T3 diets had higher ($P<0.05$) daily milk yield (825.56, 922.22 ml) by 39% and 55%, respectively; compared to the ewes given T1 diet (Table 2). Such increase in milk yield in the current study could may due to an increase of estimated MP availability in formaldehyde treated T2 and T3 rations, while the greater yield of milk observed in the group of ewes fed T3 diet than those fed diet T2 might returns to the greater flow of limiting amino acid, which were not consistently increased at intestine, while their where differences in sources of rumen degradable protein absorption ranged from 22 to 67 % (22). Current result suggested that treating barley and wheat bran with formaldehyde may increase milk yield through increasing the MP. This may confirm that increasing the crude protein percentage using formaldehyde of most dietary contents (Barley, wheat bran and SBM) that may result in a high increase in milk yield in Karadi ewes under pasture conditions at mid stage of lactation (16). Similarly, other workers observed that feeding

ewes with formaldehyde treated barley led to a significant increase in milk yield compared to those fed control diet (6;12;21;25). Ewes fed T2 or T3 diets had a higher (P<0.05) fat percentage (5.36 ± 0.21 and 5.73 ± 0.32) and fat yield (44.28 ± 3.43 and 51.88 ± 2.01 gm/day) compared to ewes fed T1 diet (Table 2). This could be attributed to increase digestibility of the most nutrient and TDN as a result of protein protection (13) including crude fiber (5).

Table 2. Effect of formaldehyde-treated diets on milk yield, composition and milk energy in Karadi ewes (Means ± SE).

ID	Treatments			Overall means ±SE
	T1	T 2	T 3	
Daily Milk Yield (ml)	595.56±29.63 c	825.56±54.19 b	922.22±50.02 a	781.32±37.01
Fat (%)	4.69±0.15 b	5.36±0.21 a	5.73±0.32 a	5.26±0.16
Fat yield (ml/d)	27.76±1.29c	44.28±3.43b	51.88±2.01a	41.31±2.39
Protein (%)	6.19±0.07	6.32±0.14	6.54±0.22	6.35±0.09
Protein yield (ml/d)	36.81±1.77c	52.32±3.44b	60.29±3.61a	49.81±2.55
Lactose (%)	4.58±0.02	4.54±0.04	4.57±0.03	4.56±0.02
Lactose yield (ml/d)	27.31±1.35b	37.52±2.51a	40.17±2.06a	35.01±1.57
Milk energy (MJ/kg)	3.96±0.2 b	4.25±0.27 a	4.41±0.42 a	4.2±0.07

*** Means with different superscripts within each rows differ significantly (p<0.05).**

Similarly, others noticed that protected protein increased the fat percentage of Awassi ewes (16). The effects of dietary treatments on milk protein and lactose percentage lacked significance. However, there was a trend of increased milk protein percentage, as a consequences milk protein yields increased (P<0.05) in the ewes fed T2 and T3 rations compared to those fed T1 diet. This could be due to the increase in milk yield as a result of RUP and rising in the rumen microbial protein synthesis (1). Since ewes given T2 and T3 rations had higher (P<0.05) milk yield therefore, an increase of milk lactose was expected compared to ewes given T1 diet. Despite a strong relationship between protein supply which is known to increase whole body rate of appearance (WB Ra) of glucose and lactose yield in ruminants (18). Increased WB Ra of glucose does not seem to be the driving force stimulating lactose yield. Increased lactose yield is only observed when the increment in WB Ra of glucose is due to increased protein supply; the same relationship does not exist when glucose Ra is increased through energy supply (17). It may be that some of the essential amino acids are playing a key role in some metabolic pathways or are simply stimulating protein synthesis. The latter hypothesis might result in increased milk protein synthesis, 'pulling' lactose synthesis due to its osmotic role, or in stimulating 'enzyme machinery' involved in gluconeogenesis, milk protein and/or lactose synthesis (17). Ewes fed diets T2 and T3 diets had higher daily milk energy than those fed T1 diet (4.25 and 4.41 vs 3.96 MJ/kg, respectively). Thus, milk energy secreted in daily milk increased by 47% and 70% in ewes fed T1 and T2 compared to those fed T1 diet (Table 2). Similar results were reported by Kassem and Abdullah, (16) who found that protected protein increased net energy (NE) content of milk at early stage of lactation. Kassem et al. (14) found a significant increase in milk NE secretion of Karadi ewes when fed formaldehyde treated concentrate at mid-stage of lactation. Blood urea concentration was significantly higher (P<0.01) in ewes fed T2 (55.5 mg/d) and T3 (55.7 mg/d) as compared to control (46.9 mg/d) (Table 3). The present values of serum urea are within the normal range (27-64 mg/100 ml) reported by Hayrettin (26). As noted by Kassem et al. (14) the difference among treatments could be attributed to the differences in RDP in the rations. Similarly, Al-Dabagh (25) found a higher urea concentration in Awassi ewes fed diets treated with formaldehyde. On the other hand, serum triglyceride and glucose concentrations were significantly (P<0.01) lower in ewes fed T2 and T3 diets compared to those fed T1 diet, being 58.44, 57.94 and 62.73 mg/dl, respectively for triglyceride and 67.09, 66.41 and 68.69 mg/dl, for glucose in the same order (Table 3). In contrast; Shamoon *et al*. (28) reported that blood triglycerides were significantly (P<0.01) increased in

formaldehyde treated ration as compared with untreated rations by about 10 Mg/100ml. Dosky et al. (31), noticed that heat treated soybean meal diet increased significantly (P<0.05) blood serum glucose concentration (76.33 mg/dl) as compared to control (72.89 mg/dl), while this increase was not significant in formaldehyde treated soybean meal diet, the increase in blood glucose may be due to the positive effect of protein protection methods on the nutritive values. There were no significant effects of dietary treatments on blood serum total protein and globulin concentrations (Table 3). Similarly, Shamoon et al. (29), Ali et al. (30), Salih (21) and El-Moghazy (32) noticed that treated rations with formaldehyde had no significant effect on these parameters. However other studies (25;21;29) found a significant increase in the blood albumin concentration when fed a diet high in protein unlike the result observed in the current study which could be due to the breed of the ewes used in the current study as well as the differences in assay method used. Serum albumin decreased in the ewes fed T3 diet than those fed T1 diet for unknown reason.

Table 3. Effect of formaldehyde-treated diets on some blood biochemical parameters of Karadi ewes

ID	Treatments			Overall means ±SE
	T1	T 2	T 3	
Urea mg/dl	46.87±1.12b	55.5±0.86a	55.7±0.45a	52.69±0.94
Total protein g/dl	6.58±0.08	6.63±0.08	6.55±0.07	6.59±0.04
Albumin g/dl	2.66±0.07a	2.54±0.05ab	2.39±0.08b	2.53±0.04
Globulin g/dl	3.94±0.1	4.09±0.09	4.15±0.12	4.06±0.06
Triglyceride mg/dl	62.73±0.61a	58.44±0.28b	57.94±0.32b	59.70±0.48
Glucose mg/dl	68.69±0.23a	67.09±0.27b	66.41±0.48b	67.40±0.27

Means with different superscripts within each rows differ significantly (P<0.01).

CONCLUSION

According to the present results, it seems that there is an improvement in milk production and some of its components as a result of formaldehyde treatment and also an increase in the response due to an improvement in the quality of bypass amino acids compared with untreated control ration fed to local Karadi ewes under pasture condition.

Acknowledgment: The author gratefully thanks Professor Dr. Jalal E. AlKass for reading the manuscript. Mr. Shivan A. Atrushy for providing the experimental animals.

REFERENCES

1. ARC, 1984. The nutrients requirement of ruminant livestock. Common Wealth Agricultural Bureaux, Slough

2. Agricultural and Food Research Council, 1998. (AFRC). The Nutrition of Goats. CAB International, Wallingford, U.K

3. Agricultural Research Council (A.R.C.), 1980. The nutrient requirement of ruminant livestock. Commonwealth Agricultural Bureau, Slough, England

4. Al-Khawaja, A. K., S. A. Matti, R.F. Asadi, K.M. Mokhtar, and S.H. Aboona, 1978. The composition and nutritive value of Iraqi feedstuffs. Nutrition division publication, Ministry of Agriculture, Iraq

5. Almallah, O. D., 2007. Effect of Protein levels in Formaldehyde treated rations on coefficient of digestion and performance in Awassi Lambs. Ph D Dissertation University of Mosul, Coll. Agri. Iraq

6. Almallah, O. D., M. N. Abdullah, N.Y. Abbo, and G. K. Khattab, 2018. Effect of feeding formaldehyde treated barley on producing colostrum and milk and their components and some blood parameters in Damascus goats. Mesopotamia J. Agri. 46 (2): 148-157

7. Braud, T.W., 2005. Effect of protein sources with differing ruminal degradation characteristics on nutrient digestibilites and flows through various segments of the gastrointestinal tract of non-lactating Holstein cows. M.Sc. Faculty of the Graduate School of the University and Agricultural and Mechanical College.

8. Broderick, G.A.; D.R. Mertens and R. Simons, 2002. Efficacy of carbohydrate sources for milk production by cows fed diets based on alfalfa and corn silage. J. Dairy Sci. 85. 1767-1776

9. Chowdhury, S. A., H. Rexroth. C. Kijora, and K. J. Peters, 2002. Lactation performance of German fawn goat in relation to feeding level and dietary protein protection. Asian-Aus. J. Anim. Sci., 15: 222-237
10. Economides, S., 1986. Comparative studies of sheep and goat milk yield, composition and growth rate of lambs and kids. J. Agric. Sci. (Camb), 106: 477-484.
11. Ensminger, M. E., J. E. Oldfield and W. W. Heinemann, 1990. Feed and Nutrition 2nded. The Ensminger Publishing Company 648 West Siera Avenue. Clovis, California, J. E. Heinemann W. W
12. Hassan, G. H., O. D Almallah, N. Y. Abo and M. N. Abdullah, 2018. Effect of formaldehyde treated barley in Awassi ewes' rations in milk production and some chemical and microbial traits of yogurt. Mesopotamia J. Agri. 28 (3): 17-23
13. Kassab, A. Y., A. A. Abdel-Ghani, G. M. Solouma, E. B. Soliman and A. K. Abd El Moty, 2009. Lactation performance of Sohagi sheep as affected by feeding canola protected protein. Egyp. J. Sheep and Goat Sci. 4: 65-78
14. Kassem, M. M, K. N. S. Dosky and A. Abd El-Ghany, 2009. Effect of using reduced ruminal degradability concentrated ration on milk secretion and some biochemical blood measurements in Karadi ewes under pasture condition. Egyp. Soc. Nutr. Feed. Special Issue12 (3): 337-348.
15. Kassem. M. M., 2010. Effect of using barley grain and wheat bran of reduced ruminal degradability on milk production and composition by Awassi ewes under pasture condition. Jordanian J. Agri. Sci. 6. (2) 295-306
16. Kassem M.M and M.N. Abdullah, 2013. Effect of estimated by-pass protein level in concentrated rations on performance of lactating Awassi ewes pre- weaning. Mesopotamia J. Agric. 41: (1) 154-163
17. Lapierre, H., C. E. Galindo, S. Lemosquet, I. Ortigues-Marty, L. Doepel and D. R. Ouellet, 2010. Protein supply, glucose kinetics and milk yield in dairy cows. EAAP Scientific Series 127 (1): 275-286
18. Lemosquet, S., G. Raggio, H. Lapierre, J. Guinard-Flament and H. Rulguin, 2007. Effect of protein supply on whole body glucose rate of appearance and mammary gland metabolism of energy nutrients in ruminants. EAAP publication No. 124, I. Ortigues-Marty (ed), Wageningen Academic Publishers, the Netherlands: 581-582
19. Maff, 1977. Ministry of Agriculture, Fisheries and Food Department of Agriculture and Fisheries for Scotland. Energy Allowance and Feeding System for Ruminants, Technical Bulletin ;33
20. National Research Council., 2007. Nutrient requirements of small ruminants. National Academy Press, Washington DC
21. Salih, M.N. 2009. Effect of using reduced degradability fodder on reproductive and productive performance of super Awassi sheep. Ph. D. Thesis, College of Agriculture and Forestry, University of Mosul
22. Santos, F.A.P., J. E.P. Santos, J.T. Huber and C.B. Theurer, 1998. Effects of rumen-undegradable protein on dairy cow performance: A 12- year literature review. J. Dairy Sci. 81: 3182-3213
23. SAS., 2001. SAS/STAT Users Guide for personal computer. Release 6.12. SAS Institute Inc., Cary, NC, U.S.A
24. Stern, M.D., A. Bach and S. Calsamiglia, 1997. Alternative techniques for measuring nutrient digestion in ruminants. J. Anim. Sci. 75:2256-2276.
25. Duncan, D.B, 1955. Multiple range and multiple F-test biometrics, 11: 1-24.
26. AL-Dabagh R. H. A., 2011. Effect of Urea Supplementation Formaldehyde Treated Rations on Productive Performance and Lambs Growth of Awassi Ewes. MSc. Thesis. University of Mosul, College of Agriculture and Forestry, Iraq
27. Hayrettin, C., 2005. Investigation of antioxidant enzymes and some biochemical parameters in ewes with gangrenous mastitis. Turk J. Vet. Anim. Sci., 29: 303-308.
28. Dosky, K. N., O. D., Al-Mallah, and N. H. Sulaiman, 2011. Effect of feeding urea treated wheat straw and formaldehyde treated barley grains on milk composition and some blood metabolites of Meriz does. Research opinions in animal and veterinary sciences. 1(11): 700-703
29. Shamoon, S. A., M. N. Saleh, and N. Y. Abbo, 2009. Effects of different levels of protein treated with formaldehyde on nutrients digestibility and some rumen and blood

parameters in Awassi sheep. Iraqi Journal of Veterinary Science. 23: 169-173.

30. Ali, M. F., B. E. El-Saidy. M. K. Mohsen and M. M. E. Khalafalla, 2005. Performance of lambs fed on ration containing soybean meal treated with formaldehyde and probiotics. ii. Productive and reproductive performance. Egyptian Journal Nutrition Feed. 8(1): 511-527.

31. Dosky, K. N., A. O., Bamerny, and G. I. Ameen, 2012. Nutrient Digestion, Rumen and Blood Parameters of Karadi Lambs Fed Treated Soybean Meal. Adv Nutr. Res, 1(1): 6-9

32. El-Moghazy M. M., M. Y. El-Ayek and H. A. Areda, 2020. Effect of protected soybean meal protein on rumen parameters, blood parameters and carcass characteristics of growing Rahmani lambs. *Int. J. Modern Plant & Anim. Sci*. 7(1): 16-32

33. Tandon, M., R. A. Siddique, and T. Ambwani, 2008. Role of bypass proteins in ruminant production. *Dairy Planner*, 4(10): 11-14

34. Kumar, S., R. Kumari. K. Kumar, and T.K. Walli, 2015. Roasting and formaldehyde method to make bypass protein for ruminants and its importance: A review. *The Indian Journal of Animal Sciences*, 85(3).

35. Dosky, K. N., S. S. Jaaf, and L. T. Mohammed, 2012. Effect of protected soybean meal on milk yield and composition in local Meriz goats. Mesopotamia Journal of Agriculture. 40 (1): 1-10

36. Majid, S. A., W. K. Al-Murrani, J. E. Alkass, and A. A. Al-Rawi, 2003. IRAQ Country Report to the Iraq for the State of the Words Animal Genetic Resources. Ministry of Agriculture. Baghdad.