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The Impact of Using Slow-Release Urea Instead of Fast-Release Urea in Feed on The Milk Production of Awassi Sheep and Some Blood Traits

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OUR study was Conducted in the sheep field of the (Kosar) company in the Kalk area / mosul/iraq to determine the effect of adding slow-release urea to the concentrated feed gradually instead of fast-release urea in an attempt to improve the efficiency of feed utilization and improve rumen conditions and reflect that on milk production of Awassi sheep using 24 heads of newly born ewes aged between 3 and 4 years distributed to four treatments fed on a concentrated feed close in its energy and protein content and different in its urea content, which was gradually replaced with slow-release urea (Minogen) where the 1st treatment took (1.5% urea only) and the 2nd treatment (1% urea and 0.6% slow-release urea) and the 3rd treatment (0.5% urea and 1.2% slow-release urea) and the 4th (1.8% slow-release urea only). The study lasted four months, from the birth of the ewes until the end of the milking season (their dryness), with a completely randomized design (Completely Randomized Design). The average total weight gain for ewes was (8.37, 9.72, 6.74 and 5.67 kg), and through the results it was observed that there is a positive effect of adding Minogen to Awassi ewe feed in average daily milk production and total as the 4th treatment excelled significantly ($P \leq 0.05$) on the rest of the treatments as average production reached (202.92, 286.40, 207.13 and 320.69 g/day) and total reached (1623.33, 2291.17, 1657.00 and 565.50 g/ewe), respectively, and fat and protein ratios also excelled in the 4th treatment significantly ($P \leq 0.05$) on the rest of the treatments as fat ratios reached (3.463, 3.366, 3.866 and .326%) and protein (4.763, 4.714, 4.769 and 4.928%), respectively, The milk lactose ratio did not record any significant differences, reaching (4.637, 4.525, 4.559 and 4.540%), while the total solid matter ratio decreased significantly ($P \leq 0.01$) in the 2nd and 3rd treatments compared to the 1st and 4th treatments, reaching (10.415, 10.043, 9.986 & 10.096%). As for the effect of slow-release urea on blood traits, no significant difference was observed in the concentration of total blood protein and albumin, but the concentration of blood urea was significantly increased ($P \leq 0.05$) for the 4th treatment compared to the other treatments, reaching (34.44, 38.72, 43.27 and 6.26 mg/100ml blood), and plasma cholesterol concentration increased significantly ($P \leq 0.05$) with increasing levels of slow-release urea in the 3rd treatment compared to other treatments as the concentration reached (68.16, 71.72, 80.22 and 2.60 mg/100ml blood), while the concentration of triglycerides in the blood decreased significantly ($P \leq 0.05$) with increasing levels of slow-release urea for the three treatments (2nd, 3rd and 4th) compared to the 1st containing fast-release urea as it reached (67.22, 57.38, 59.55 and 9.86 mg/100ml blood), as for blood enzymes ALT and AST there was a significant increase ($P \leq 0.05$) in the 3rd treatment in ALT enzyme concentration followed by the 4th treatment compared to the 1st and 2nd as the concentration reached (102.33, 98.05, 119.77 and 13.33 units/liter blood), while AST enzyme did not observe any significant differences between treatments.

Keywords: Awassi sheep, urea, milk production, albumin, AST, ALT.

Introduction

Raising small ruminants is an important agricultural sector in Iraq, where these animals are raised for meat and milk purposes. Iraq is distinguished by four breeds of sheep, including medium-sized Awassi sheep, which are raised on grazing and fed on concentrated supplementary feed when needed, especially during the birth period and milk production [1]. The concentrated feed must contain a source of protein in its component. Dietary proteins are important in the nutrition of ruminant animals because they are considered a source of amino acids and nitrogen for the formation of

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microbial protein [2,3]. The use of non-protein nitrogen (NPN) can be used as a substitute for herbs, feeds, and concentrates with low nutritional value [4]. Urea is considered a source of non-protein nitrogen (NPN) due to its low cost compared to other NPN sources [5]. However, the level of urea inclusion is low due to the rapid hydrolysis of nitrogen (N) in NPN sources to ammonia (NH3). Rapid protein breakdown in the rumen is not desirable, especially with the availability of evidence that the ideal feed should benefit from its nitrogen to the maximum degree and must contain protein with good digestibility and low solubility in the rumen. Protein breakdown in the rumen and rapid release of ammonia causes rapid removal of its amines. It must coincide with a loss in a quantity that may be large from the released ammonia, and thus expect a decrease in the efficiency of using dietary protein and an increase in the amounts of nitrogen excreted in urination, which not only constitutes a material and functional loss but also constitutes a loss in energy expended by the body to get rid of excess ammonia toxicity over the needs of microorganisms. This led to resorting to using urea compounds in feeding ruminants [6]. Its nitrogen is slowly released inside the rumen, which reduces the peak of ammonia in the rumen [7], and using rumen bacteria for slow-release urea increases absorption inside the rumen [8]. (Menogen) is a Chinese product consisting of urea coated with palm oil, with 12% palm oil and 82% urea, and its nitrogen content reaches 38%, which is equivalent to 237.5% protein, and its decomposition rate is slow, reaching up to 8 hours inside the rumen compared to the usual urea that does not last an hour. The aim of the study is to know the results of using slow-release urea (Menogen) instead of fast-release urea in the production of milk and its components for newborn ewes and the efficiency of protein utilization and blood components [9].

Material and Methods

The experiment was carried out in the sheep field of the (Kosar) company in the Kalk area to determine the effect of adding slow-release urea to the concentrated feed gradually instead of fast-release urea in an attempt to improve the efficiency of feed utilization and improve rumen conditions and reflect that on milk production of Awassi sheep using 24 heads of newly born ewes aged between 3 and 4 years and an average weight of 7.95±49.36 kg, they were selected based on the proximity of the birth date, age, and milk production rate after monitoring them for several days, distributed to four treatments fed on a concentrated feed close in its energy and protein content and different in its urea content, which was gradually replaced with slow-release urea (Minogen) where the 1st treatment took (1.5% urea only) and the 2nd treatment (1% urea and 0.6% slow-release urea) and the 3rd treatment (0.5% urea and 1.2% slow-release urea) and the 4th (1.8% slow-release urea only). The study lasted four months until the ewes dried up, with a completely randomized design (CRD). The feed consisted mainly of barley, wheat bran, soybean meal, urea, hay, and close in its metabolic energy and protein content as shown in Table (1). The ewes were fed two meals, morning and evening, and the feed provided was calculated based on production needs. The weight of the ewes was taken at the end of each month before morning feeding, as well as blood samples were taken at the end of each month from the jugular vein two hours after serving the evening meal and serum was separated using a centrifuge (3000 rpm) for 10 minutes and stored under freezing (-20°C) until analysis, to estimate the concentration of urea, total protein, albumin, triglycerides, AST and ALT enzymes used ready-made French analysis kit (Biolabo) using a spectrophotometer (Spectrophotometer) of English origin. As for milk samples, they were milked two days in a row every two weeks and an average measurement of milk production was taken, as lambs were separated from their mothers for 12 hours before starting milking. This process continued until the ewes dried up approximately and their production reached less than 100 g /day. Where milk is weighed and samples are taken from it placed in plastic containers transferred directly to the nutrition laboratory at the Agricultural Technical College to read its components using TOTAL EKO Milk type LACTOSCAN where protein, fat, lactose ratios and non-fat solid matter ratios were estimated in milk.

Results and Discussion

Table (2) shows that there are no significant differences in the daily feed consumption, ranging between (1.484 - 1.511) kg/day, there is also no significant difference in the amount of protein consumed, reaching (26.45, 26.43, 26.17 and 25.97) g/day.

as it appears from Table (2) that there are no significant differences in the initial weights, ranging between (48.21 - 50.70) kg, as well as the final weight rate, reaching (56.58, 60.41, 53.20, 57.75) kg. The total weight gain rate is (8.37, 9.72, 6.74 and 5.67) kg and the daily weight gain rates are (69, 80, 56and 47) grams/day for the four treatments respectively. The results did not indicate the existence of significant differences. The lowest increase in body weight in the 4th treatment, which came in conjunction with the best efficiency of using food protein to produce milk, can give a conclusion that the need for energy to dispose of the excess quantity of decomposed protein to meet the requirements of milk production may have led to not building a larger mass of body weight to save energy and this may confirm recording the highest milk production in this treatment. The results of this study were similar to a number of other studies conducted on sheep, including [12-14], on calves when they used different levels of slow-degrading urea to no significant differences in growth rates. and weight gain.

Table (3) shows the average daily and total milk production during the 14-week study period. The 4th treatment witnessed a significant increase ($P \leq 0.05$), followed by the 2nd and 3rd treatments, and the 1st at the end. The average production reached (202.92, 286.40, 207.13 and 320.69) g/day and the total reached (1623.33, 2291.17, 1657.00 and 2565.50 g/ewe), respectively. This shows the superiority of the 4th treatment over the rest of the treatments and the efficiency of using slow-release urea (Minogen) in the diets of milk-producing ewes. Perhaps the reason for this increase is due to its association with improved feed conversion factor and protein utilization efficiency in the 4th treatment, which is due to the slow decomposition of Minogen. Due to the scarcity of research on the use of slow-release urea in sheep, research on dairy cows was directed, which is not consistent with the current study as recorded by several authors [13,15-20], indicated that there were no significant differences in milk quantity produced.

As Table (3) shows, the 4th treatment significantly increased ($P \leq 0.05$) in milk fat percentage, surpassing the rest of the treatments as it reached (3.463, 3.366, 3.866 and 4.326%), respectively. The reason for the increase in milk fat percentage during the milk production season until the ewes dry off is the source of slow-release urea (Minogen) in the 4th treatment, which played a role in increasing the number of fiber-degrading bacteria in the rumen and improving fiber digestion coefficient, which resulted in an increase in milk fat percentage. Similar studies conducted in this field on cows pointed to results similar to this study. Some authors[16,17] observed a significant increase in cow's milk fat percentage when increasing the level of slow-release urea in their feeds, while it differed with the results of the study by many studies[13, 15,18-22], as they pointed out that there were no significant differences in cow's milk fat percentage when increasing the level of slow-release urea.

The results in Table 3 indicate that the 4th treatment significantly outperformed ($P<0.05$) the rest of the treatments, with values reaching (4.763, 4.714, 4.769, 4.928%), respectively. This increase in milk protein percentage may be due to the source of protein in the feed, which is Minogen (slow-release urea), which played a role in increasing the efficiency of its slow-release nitrogen utilization, which was reflected in an increase in production level. This result is consistent with the study by[19] on the significant increase in cow's milk protein percentage when increasing the level of slow-release urea in the feed. However, it did not agree with several studies [13,15,16,18,20,21] and who pointed out that there were no significant differences when increasing the level of slow-release urea in cow feeds.

As for the average milk lactose percentage, Table (3) shows that there is no significant difference between the treatments in its percentage, as it reached (4.637, 4.525, 4.559, 4.540%), respectively. As mentioned in many studies, the percentage of milk lactose is rarely affected by ruminant nutrition. The results of this study are consistent with similar studies conducted on cows, [13,15,16,18-22], and pointed out that there was no significant difference in milk lactose percentage when increasing the level of slow-release urea in feeds.

As for the average total solid's percentage, Table (3) shows that there is a significant decrease ($P<0.05$) in the 2nd and 3rd treatments compared to the 1st and 4th treatments, with values reaching (10.415, 10.043, 9.986 & 10.096%), respectively. This explains that the total solids percentage is inversely related to its quantity, as the lower the quantity of milk produced, the higher its component percentages, and water constitutes 80-90% of milk components and is calculated based on the quantity of milk produced. Milk production after weaning lambs begins to decrease, but this decrease did not affect the 4th treatment containing Minogen in the feed composition, which played a role in increasing the percentage and quantity of milk protein resulting from increased efficiency of utilizing feed protein whose source is slow-release urea (Minogen).

The results of this study differ from the results of studies conducted on cows [13,16,18], who pointed out that there were no significant differences in the percentage and quantity of total milk solids when increasing the level of slow-release urea in feed rations, while Hallajian et al.[17] pointed out a significant increase in the percentage of total solids when increasing the level of slow-release urea in cow milk rations.

The results in Table (4) indicate that there are no significant differences between the four treatments in the average concentration of total protein, as it ranged between (5.46-5.66 g/100 ml of blood). Similarly, for the concentration ratio of albumin to globulin, there were no significant differences in the average concentration of albumin, as it ranged between (3.96-4.26). There are many factors that affect blood protein concentration, the most important of which are the level of nutrition and the physiological condition of the animals. Observing these results, which indicated that there were no clear effects of slow-release urea levels on total blood protein concentrations, as well as no differences in albumin concentrations, which is one of the main components of total blood protein. The results of this study are consistent with many researchers [13,15,18,22]. Similarly, for albumin results, they agreed with the results of some authors[23,24,25] that there were no significant differences in sheep blood albumin.

The results in Table (4) indicate that there is a significant increase ($P<0.05$) in blood urea concentration in favor of the 4th treatment compared to the other treatments, reaching (34.44, 38.72, 43.27, 46.26 mg/100 ml of blood), respectively. The reason for the increase in blood urea may be due to the source of protein consumed (Minogen), which is slow to decompose, leading to its presence in the blood, especially in the 4th treatment, which gave high milk production compared to the other treatments and may be related to it. The results of this study are consistent with some studies [12,23,24], but differ from the results of other studies[25,26], and that there were no significant differences when increasing the level of slow-release urea in sheep rations, while Al-Jundil [27] indicated a significant decrease in blood urea concentration when increasing the level of slow-release urea in sheep rations.

Table (4) shows that there is a significant increase ($P<0.05$) in plasma blood cholesterol concentration with an increase in the level of slow-release urea in the 3rd treatment compared to the other treatments, with concentrations reaching (68.16, 71.72, 80.22, 72.60 mg/100 ml of blood), respectively. The reason for the increase in cholesterol in the plasma blood of ewes in the 3rd treatment may be due to an increase in milk fat percentage and, conversely, a low milk quantity compared to the other treatments, or it may be due to genetic or health factors, as slow-release urea has no direct effect on plasma blood cholesterol. Therefore, the results of the current study did not agree with what was mentioned by some researchers [12,23,27], that there were no significant differences and that the normal level of plasma blood cholesterol in sheep ranged between (35-64 mg/100 ml blood), while the study by Corte et al. [15] on cows agreed with the results of the current study as it mentioned a significant superiority in plasma blood cholesterol when adding slow-release urea, reaching (78.8, 112.7 mg/100 ml blood) .

The results in Table (4) indicate that there is a significant decrease ($P>0.05$) in the concentration of triglycerides in the blood with an increase in the level of slow-release urea for the three treatments (2nd , 3rd , and 4th) compared to the 1st containing fast-release urea, reaching (67.22, 57.38, 59.55&59.86 mg/100 ml blood) for the four treatments, respectively. This decrease in triglycerides falls within the normal ranges mentioned in several studies. Kubesy [28] stated that fat-treated urea does not affect the concentration of triglycerides in the blood. The results of this study show that they do not agree with the results of studies in some reports [12,23,27], and that there were no significant differences in the concentration of triglycerides in sheep blood, while Corte et al., 2018 [15], found that normal triglyceride concentrations are (63.2-67.8 mg/L blood) in cows. In contrast to the results obtained by Ravi Kanth Reddy et al. [26], there was a significant increase in the concentration of triglycerides in sheep blood and El-Zaiat et al.[16] in cows.

The results in Table (4) indicate that there is a significant increase (P<0.05) in the concentration of the ALT enzyme in the 3rd treatment, followed by the 4th treatment compared to the 1st and 2nd treatments, with concentrations reaching (102.33, 98.05, 119.77 and 113.33 units/liter blood), respectively. The reason for this increase in the 3rd treatment may be due to the low milk production compared to the treatments containing slow-release urea and the ewes working at their maximum capacity to increase production because they are in the postpartum period until weaning and need energy. As for the AST enzyme, the statistical analysis results indicate that there are no significant differences in the concentration of the AST enzyme, as it ranged between (17.83-18.88 units/liter), which is an indication of the ewes' response to the addition of slow-release urea that improved the performance of blood enzymes as mentioned by some researchers in their studies[22,25]. However, it did not agree with the results of some studies[29,30], who indicated a significant decrease in the ALT enzyme while there were no significant differences for the AST enzyme.

Conclusions

The results of the current study showed that the replacement of rapidly degradable urea (RDU) with slow- release urea (SRU) completely led to an improvement in the nutritional conversion factor of diets as well as the efficiency of utilization of protein intake, In addition to increasing the average daily and total milk production and the proportions of its components, as for the blood characteristics, a significant increase was observed in the concentration of blood plasma urea for the fourth treatment containing slow- release urea (SRU) compared to other treatments due to its slow decomposition, which takes 8 hours completely, while other blood characteristics were low in the fourth treatment compared to other treatments.

Conflicts of interest

There is no conflict of interest.

Formatting of funding sources

There is no funding entity

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TABLE 1. Components and chemical composition of experimental diets.

Feed material	SRU 0%	SRU 0.6%	SRU 1.2%	SRU 1.8%
Cracked barley	66.5	66.5	66.5	66.5
wheat bran	25	25	25	25
Soybean meal	5	5	5	5
Urea	1.5	1	0.5	-
Menogen (SRU) *	-	0.6	0.2	1.8
Calcify	1	1	1	1
Salt	1	1	1	1
Chemical composition of experimental diets				
Dry matter	90.17	90.11	90.30	90.25
Organic matter	94.38	94.41	94.18	94.26
Crude protein	18.14	18.13	18.12	18.11
Crude fat	2.66	2.72	2.86	2.92
Crude fiber	9.31	9.26	9.28	9.21
Metabolic Energy Kilo Kcal/kg feed **	2.713	2.710	2.712	2.714

* It was calculated in the laboratory

** The metabolic energy was calculated from the chemical analysis tables of Iraqi feed materials as stated in [10].

The data was analyzed using the Completely Randomized Design (CRD) using the statistical Analysis system [11] by computer, and using the mathematical model equation:-

Yij = μ +Ti+eij

Yij = the value of observation

μ = the overall average.

Ti = the effect of experimental treatments.

eij = the experimental error of the observation.

The averages were compared using Duncan's multiple range test [12] to determine significant differences between the averages.

TABLE 2. The effect of experimental diets on the digestion coefficient of dietary compounds.

Parameters	SRU 0%	SRU 0.6%	SRU 1.2%	SRU 1.8%
Matter intake kg/day	1.511 ± 0.99	1.510 ± 0.36	1.495 ± 0.87	1.484 ± 0.52
protein consumed g/day/ewe	26.45 ± 2.99	26.43 ± 3.51	26.17 ± 3.08	25.97± 2.98
Initial weight (kg)	48.21 ± 3.99	50.70 ± 2.36	48.46 ± 1.87	50.07 ± 2.52
Finished weight (kg)	56.58 ± 2.90	60.41 ± 2.60	53.20 ± 2.09	57.75 ± 2.01
Total weight gain (kg)	8.37 ± 1.75	9.72 ± 0.40	6.74 ± 0.55	5.67 ± 0.23

SRU - slow-release urea

TABLE 3. Shows the effect of slow-release urea on daily and total milk production.

Parameters	SRU 0%	SRU 0.6%	SRU 1.2%	SRU 1.8%
mean milk yield g/day	202.92 ± 9.02^{c}	286.40 ± 7.61^{b}	207.13 ± 7.01^{c}	320.69 ± 8.82^{a}
fat (%)	3.463 ± 0.14^{c}	3.366 ± 0.11^{c}	3.866 ± 0.18^{b}	4.326 ± 0.14^{a}
protein (%)	4.763 ± 0.10^{b}	4.714 ± 0.13^{b}	4.769 ± 0.12^{b}	4.928 ± 0.08^{a}
lactose (%)	4.637±0.09	4.525±0.08	4.559±0.13	4.540±0.07
S.N.F (%)	10.415 ± 0.36^{a}	10.043 ± 0.39^{b}	9.986 ± 0.19^{b}	10.096 ± 0.13^{b}
Milk Total Product gm/ewe	1623.33 ± 72.17^{c}	2291.17 ± 60.94^{b}	1657.00 ± 56.12^{c}	2565.50 ± 70.57^{a}

Different letters horizontally indicate differences ($P \leq 0.05$)

TABLE 4. Effect of experimental diets on some blood measurements.

Parameters	SRU 0%	SRU 0.6%	SRU 1.2%	SRU 1.8%
Total protein gm/ dl	5.52±0.07	5.66±0.17	5.52±0.14	5.46±0.33
Albumin g/ dl	3.96±0.10	4.08±0.25	4.26±0.20	4.10±0.19
Urea mg/ dl	34.44±0.93^{d}	38.72±1.06^{c}	43.27±1.45^{b}	46.26±2.03^{a}
Cholesterol g/100ml	68.16±1.94^{c}	71.72±2.19^{b}	80.22±3.11^{a}	72.60±1.93^{b}
Triglyceride mg/ dl	67.22±2.21^{a}	57.38±2.22^{b}	59.55±1.16^{b}	59.86±2.26^{b}
AST enzyme IU/L	18.88±0.88	17.83±0.69	17.83±1.61	18.06±0.95
ALT enzyme IU/L	102.33±2.48^{c}	98.05±2.55^{d}	119.77±1.39^{a}	113.33±2.65^{b}

Different letters horizontally indicate differences (P≤0.05)

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تأثير استخدام اليوريا البطيئة بدلاً من اليوريا السريعة في الأعلاف على إنتاج حليب الأغنام العواسي وبعض سمات الدم

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أجريت دراستنا في حقل الأغنام التابع لشركة (كوسار) في منطقة كالك / الموصل / العراق لتحديد تأثير اضافة اليوريا بطيئة المفعول للعلف المركز تدريجيا بدلا من اليوريا سريعة الإطلاق في محاولة لتحسين كفاءة استخدام الأعلاف وتحسين ظروف الكرش وعكس ذلك على انتاج حليب اغنام العواس باستخدام 24 رأس نعاج حديثة الولادة تتراوح أعمارهم بين 3 و 4 سنوات موزعة على اربع معاملات تتغذى على علف مركز قريب في محتواه من الطاقة والبروتين ومختلف في محتواه من اليوريا ، والذي تم استبداله تدريجيا باليوريا بطيئة الإطلاق (Minogen) حيث استغرق العلاج الأول (1.5٪ يوريا فقط) والمعالجة الثانية (1٪ يوريا و 0.6٪ يوريا بطيئة الإطلاق) والمعالجة الثالثة (0.5٪ يوريا و 1.2٪ يوريا بطيئة الإطلاق) والرابع (1.8٪ يوريا بطيئة الإطلاق فقط). استمرت الدراسة أربعة أشهر ، من ولادة النعاج حتى نهاية موسم الحلب (جفافها) ، بتصميم عشوائي تماما (تصميم عشوائي بالكامل). بلغ متوسط زيادة الوزن الكلي للنعاج (8.37، 9.72، 6.74 و5.67) كجم، ومن خلال النتائج لوحظ أن هناك تأثيرا إيجابيا لإضافة المينوجين إلى علف نعجة العواس في متوسط إنتاج الحليب اليومي والكلي حيث تفوقت المعالجة الرابعة معنويا (P≤ 0.05) على باقي العمليات حيث بلغ متوسط الإنتاج (202.92، 286.40 ، 207.13 ، 320.69) جم / يوم وبلغ الإجمالي (1623.33 ، 2291.17 ، 1657.00 و 565.50) جم / نعجة على التوالي ، كما تفوقت نسب الدهون والبروتين في المعاملة الرابعة بشكل ملحوظ (P≤0.05) على بقية المعاملات حيث بلغت نسب الدهون (3.463 ، 3.366 ، 3.866 ، .326)٪ والبروتين (4.763 ، 4.714 ، 4.769 ، 4.928)٪ على التوالي ، لم تسجل نسبة الاكتوز الحليب أي فروق ذات دلالة إحصائية ، بلغت (4.637، 4.525، 4.559، 4.540)٪، في حين انخفضت نسبة المادة الصلبة الكلية معنويا (P ≤0.01) في المعاملتين الثانية والثالثة مقارنة بالمعالجة الأولى والرابعة، لتصل إلى (10.415، 10.043، 9.986، 10.096)٪. أما بالنسبة لتأثير اليوريا بطيئة الإطلاق على صفات الدم فلم يلاحظ فروق ذات دلالة إحصائية في تركيز البروتين الكلي في الدم والألبومين، ولكن زاد تركيز اليوريا في الدم بشكل معنوي (P≤ 0.05) للمعاملة الرابعة مقارنة بالعلاجات الأخرى، حيث بلغت (34.44، 38.72، 43.27 و6.26) ملغم/100 مل في الدم، وزاد تركيز الكوليسترول في البلازما معنويا (P≤ 0.05) مع زيادة مستويات اليوريا بطيئة الإطلاق في المعالجة الثالثة مقارنة بغيرها حيث وصل التركيز إلى (68.16 و 71.72 و 80.22 و 2.60) ملغم / 100 مل في الدم ، بينما انخفض تركيز الدهون الثلاثية في الدم بشكل ملحوظ (P≤0.05) مع زيادة مستويات اليوريا بطيئة الإطلاق للمعاملات الثلاثة (2 و 3 و 4) مقارنة ب 1 التي تحتوي على اليوريا سريعة الإطلاق حيث وصلت إلى (67.22 و 57.38 و 59.55 و 9.86) ملغم / 100 مل دم ، أما بالنسبة لإنزيمات الدم ALT و AST فقد حدثت زيادة معنوية (P≤ 0.05) في المعالجة الثالثة في تركيز إنزيم ALT تليها المعالجة الرابعة.

الكلمات المفتاحية: الأغنام العواسية ، اليوريا ، إنتاج الحليب ، الألبومين ، AST، AlT.