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Effect of Urea on Food Compound Digestion Coefficient, Properties of Rumen Fluid and Some Biochemical of Blood in Awassi Lambs

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A B S T R A C T

This study was conducted in the sheep field of the Agricultural Technical College in Mosul to find out the effect of adding Urea to the concentrated diet with four levels (0.5, 1.0, 1.5, 2.0)% on the digestibility coefficient of food compounds characteristics of rumen fluid, weights of lambs and some blood characteristics. Four Awassi lambs with an average weight of 33 kg, an average age 4-6 months were used in the experiment. The experiment was carried out using (4x4) Latin Square Design in four periods of 20 days each.
The results showed significant differences in the digestibility coefficient of dry matter, protein and fiber, while no significant differences appeared in the digestibility coefficient of organic matter and ether extract. The results also showed that there were no significant differences in pH, ammonia Concentration and numbers of protozoa in rumen fluid before feeding, while significant differences appeared in pit, ammonia concentration and protozoa numbers in the rumen fluid after feeding, also in the preparation of bacteria before and after feeding. There were also significant differences in the average final weight (Kg), total weight gain (kg) and daily. weight gain (gm). In blood characteristics, no significant differences appeared in the Concentration of total protein, albumin, globulin, creatinine, cholesterol and triglycerides, while significant differences appeared in the concentration of urea and enzymes ALT and AST.

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Introduction

Nutrition is an important aspect in animal production projects as it constitutes alarg proporation of the production cost [1] especially in arid and semi-arid regions, including Iraq which suffer from a shortage of resources needed to feed agricultural animals, especially ruminants [2]. The shortage of fodder materials and field crops leads to an increase in their prices, especially field crop seeds, due to the limited production of these crops and the high prices of their imports, many studies have investigated the use of other cheap nitrogenous, non-protein alternatives [3], based on the ability of microorganisms present in the animals rumen to benefit from non protein nitrogen (NPN) Compounds in the formation of bacterial protein [4]. Urea the most widespread and least expensive, is a rich source of nitrogen [5], the limitation of the use of urea is due to its toxicity in case of excessive use [6], its high decompostion and its rapid conversion into ammonia, which works to increase the Concentration of ammonia rapidly during the first hour of consumption, which makes the rate of conversion of urea into ammonia faster than the abillity of rumen microbes to absorbit, therefor it passes from the rumen to the liver to be transformed into urea and is excreted, the majority of it passes through the kidneys by the (ornithine citrulline) circulline cycle, and the accumulation of ammonia high concentrations may lead to animal poisoning [7] and [8]. There for urea should not be added to the feed in high proportions and its addition should be gradual, because using high concentrations of urea leads to advanced ammonia toxicity, muscle disorders and contractions, excessive Saliva secretion frequent urination and stool, rapid breathing, imbalance and perhaps death in most cases [9] and [10].

This study aims to know the effect of adding urea to the feed on digestibility Coefficient of food compounds, characteristics of rumen fluid, lambs weight and Some blood characteristics.

Materials and Methods

This experiment was conducted in the sheep field of the Agricultural Technical College in Mosul, using four Awassi lambs whose ages ranged between 4-6 months and their average weight 33 Kg, they were divided into four coefficients using a Latin Square method (4x4) in four periods each period lasted 20 days according to [11] and [12] the diets used in the experimental treatments were as Shown in Table (1). The percentage of dry matter, crude protein and total energy shows the chemical and laboratory analysis according to (13), while the amount of metabolic energy was calculated on the basis of dry matter as stated in [14].

The samples of the experiment were taken in the last five days of each period, the samples of rumen fluid were taken before and two hours after feeding, by mouth using a rubber tube to the rumen of (100 ml) approximately and the pH was measured directly by PH meter and then filtered the liquid by medical gauze and took 20 ml and added to it 1 ml of hydrochloric acid concentration of 10% to estimate ammonia and according to [15], where the ammonia in rumen fluid was estimated according to the mode of action reported by [16], then take 6 ml of the sample and added 10 ml of formalin Concentration of 10% placed in plastic cans and kept by Cooling at (5°C) until the bacteria and protozoa are counted. Blood samples. were also with drawn from the jugular vein two hours after the evening feed, the blood serum was separated using a Centrifuge (3000 cycle/minute) for 10 minutes and kept at (-20°C) until analysis, and to estimate the Concentration of urea, total protein, albumin, globulin, Creatine, cholesterol, triglycerides, ALT enzyme and AST enzyme.

The experiment data was statistically analyzed using [14] program, by a Latin Square Design according to the mathematical model.

$Yij\ (k)=\mu+Pi+Yj + Tk + Eij(K)$

yij(K): The observation value of the experimental unit of the transaction which located in the row (i) or Column (j).

M: General average value.

Pi: The true impact value of the class.

TK: The value of the real impact of the transaction.

Yj: The tru impact value of the column.

Eij(K): Experimental error of experimental units.

Means were compared using Duncan's multiple range test [17].

Reseults and Discussion

Table (2) indicates the emergence of significant differences ($P\leq0.05$) in the digestibility Coefficient of dry matter (74.98, 76.24, 77.25, 77.40)%, protein (84.30, 85.70, 88.10, 89.19)% and fiber (37.71, 38.95, 39.22, 39.96)% these results agreed with the results of [18] and did not agree with the results of [19] This improvement may be due to the effect of urea in improving the rumen environment necessary for the growth of microorganisms ,while no significant differences appeared in the digestibility coefficient of organic matter (77.90, 78.09, 80.26, 79.19)% and ether extract (56.63, 57.04, 57.88, 58.97)% these results agreed with results of [20] and did not agree with the results of [21].

Table (3) showed that there no significant differences in the pH of rumen fluid before feeding (6.85, 6.83, 6.82, 6.82), and significant differences appeared ($p\leq0.05$) after feeding (5.64, 5.78, 5.47, 5.44), these results agreed with the results of [22] while they did not agree with the results of [23] The reason may be due to the effect of adding urea on reducing rumen acidity , as shown in Table (4) there were no significant differences in ammonia concentration before feeding (5.87, 5.68, 6.07, 5.99) mg/100ml, while significant differences appeared ($p\leq0.05$) after feeding (7.00, 6.90, 7.29, 7.56) mg/100ml these results agreed with the results of [23] the results did not agree with the results of [24] The reason may be due to the addition of urea and its decomposition directly inside the rumen, leading to an increase in concentration, depending on the percentage added, the results showed significant differences ($P\leq0.05$) in the numbers of bacteria in the rumen fluid before feeding (20.000, 21.500, 21.750, 21.375)$\times10^6$ and after Feeding (30.750, 37.250, 43.250, 45.500)$\times10^6$ these results agreed with results of [25] and did not agree with the results of [26] this effect may be due to the nature of the rumen in the animal itself, Urea may also affect the number of bacteria after feeding, the results indicated that there were no significant differences in the rumen fluid before feeding (5.25, 5.75, 5.50, 5.25) $\times10^3$ and significant differences ($p\leq0.05$) appeared in the numbers of protuzoa after feeding (6.375, 6.500, 7.225, 6.750) $\times10^3$, these results aggreed with the results of [25] and did not agree with the results. of [27] This numerical increase may be due to the effect of urea in improving the rumen environment after feeding.

Table (4) shows the initial body weight of the experimental lambs (31.0, 35.0, 31.5, 34.5) kg, the final weight (34.5, 37.5 ,35.0, 38.0) kg, the total weight gain (3.5, 2.5, 4.0, 3.5) kg and the daily weight gain (233.33, 178.57, 266-66, 233.33) gm, these results indicate the emergence of significant differences ($p\leq0.05$) in total weight gain and daily weight gain, these results agreed with the results of [28] while they did not agree with the results of [29] This is maybe belong to the effect of urea in improving the rumen environment of the animal as well as increasing protein intake .

The results in Table (5) indicated that there were no significant differences in the Concentration of total protein in blood serum (6.42, 6.38, 6.44, 6.39) gm/l00 ml, albumin (3.53, 3.55, 3.55, 3.53) gm/100ml, globulin (2.82, 2.78, 2.84, 2.77) gm/100ml, cholesterol (96.28, 86.27, 86.77, 84.67) mg/100ml and triglycerides (40.47, 40.78, 40.60, 39.25) mg/100ml, this results is consistent with results of [30] and [25], also there were no significant differences in creatine concentration)1-60 1.70 ,1.70 و 1067 و mg/100ml, this result agree with the result of (24) et 2019) and differs with the result of (19) while significant differences ($p<0.05$) appeared in the concentration of urea (1.60, 1.67, 1.70, 1.70) mg/100ml, the results agreed with the results of (24) and differed with the result of (19), While significant differences ($P\leq0.05$) appeared in the concentration of urea (42.24, 43.93, 47.83, 47.65) mg/100ml, the results agreed with the results of [2] and differed with the results of [25], there were also significant differences ($p\leq0.05$) in the concentration of enzyme ALT (19.14, 18.11, 17.12, 15.11) unit/L and enzyme AST (55.24, 52.06, 45.29, 52.71) unit/L, these results did not agree with the results of [24] and [19] This effect may be due to the addition of urea, which led to it passing through the rumen wall into the blood, which led to some stress on the animal, especially when it was added in a high percentage. .

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Table 1. The percentage of dry matter, crude protein and total energy

Ingredients %	T1	T2	T3	T4
Barley	57.5	57	56.5	56
Wheat Bran	20	20	20	20
Yellow Corn	10	10	10	10
Wheat Straw	10	10	10	10
Urea	0.5	1	1.5	2
Salt	1	1	1	1
Limestone	1	1	1	1
Crude Protein	12.98	14.03	15.57	16.96
Degradable Energy	2640	2630	2581	2570

Table 2. The effect of rapidly degrading urea on the digestibility coefficient of food compounds for Awassi lambs ± standard error is shown.

Treatment	T1 0.5% urea	T2 1% urea	T3 1.5% urea	T4 2% urea
Dry matter digestibility	74.98 b	76.24 ab	77.25 a	77.40 a
coefficient %	0.37±	0.87±	0.10±	0.38±
Organic matter digestibility	77.90	78.09	80.26	79.19
coefficient %	0.04±	0.90±	0.53±	0.31±
Protein digestibility	84.30 c	85.70 bc	88.10 ab	89.19 a
coefficient %	1.88±	0.04±	0.15±	0.31±
Ether extract digestibility	56.63	57.04	57.88	58.97
coefficient %	1.64±	0.39±	0.33±	0.33±
Fiber digestibility	37.71 b	38.95 ab	39.22 ab	39.96 a
coefficient %	0.29±	1.11±	0.42±	0.25±

Table 3. Effect of rapidly degradable urea on the nature of a number of rumen fluid characteristics of Awassi lambs ± standard error

Treatment		T1 0.5% urea	T2 1% urea	T3 1.5% urea	T4 2% urea
pH of rumen fluid	Before feeding	6.85 0.028±	6.83 0.014±	6.82 0.007±	6.82 0.007±
	After feeding	5.64 ab 0.318±	5.78 a 0.007±	5.47 b 0.028±	5.44 b 0.035±
Ammonia concentration of rumen fluid mg/100 ml	Before feeding	5.87 0.46±	5.68 0.38±	6.07 0.49±	5.99 0.17±
	After feeding	7.00 b 0.45±	6.90 b 0.47±	7.29 ab 0.46±	7.56 a 0.20±
Bacterial counts in rumen fluid *10^6	Before feeding	20.000 b 1.76±	21.500 ab 3.18±	22.750 a 4.94±	21.375 ab 2.65±
	After feeding	30.750 c 3.18±	37.250 b 1.86±	43.250 ab 1.41±	45.500 a 2.82±
Protozoa counts in rumen fluid *10^3	Before feeding	5.25 0.70±	5.75 5.34±	5.50 5.54±	5.25 0.70±
	After feeding	6.375 b 0.17±	6.500 b 0.35±	7.225 a 0.53	6.750 ab 0.88±

Table 4. Effect of rapidly degradable urea on the weight of ewes during the experiment period ± standard error

Treatment	T1 0.5% urea	T2 1% urea	T3 1.5% urea	T4 2% urea
Initial weight kg	31.000 1.24±	35.000 0.82±	31.500 1.18±	34.500 0.84±
Final weight rate kg	34.500 0.84±	37.500 0.94±	35.000 1.22±	38.000 0.92±
Total weight gain kg	3.5 ab 0.034±	2.5 b 0.025±	4 a 0.043±	3.5 ab 0.0034±
Daily weight gain kg	233.33 ab 0.021±	178.57 b 0.018±	266.66 a 0.054±	233.33 ab 0.021±

Table 5. Effect of slow-release urea on some blood traits of Awassi lambs ± standard error

Treatment	T1 0.5% urea	T2 1% urea	T3 1.5% urea	T4 2% urea
Total protein g/100 ml	6.42 0.17±	6.38 0.09±	6.44 0.14±	6.39 0.23±
Albumin g/100 ml	3.53 0.12±	3.55 0.09±	3.55 0.11±	3.57 0.07±
Globulin g/100 ml	2.82 0.16±	2.78 0.43±	2.84 1.08±	2.77 0.26±
Creatin g/100 ml	1.60 0.11±	1.67 0.06±	1.70 0.04±	1.70 0.02±
Urea mg/100 ml	42.24 b 1.52±	43.93 b 0.35±	47.83 a 0.70±	47.65 a 0.21±
Cholesterol mg/100 ml	86.28 5.03±	86.27 1.49±	86.77 3.08±	84.67 4.89±
Triglycerides mg/100 ml	40.47 0.49±	40.78 0.12±	40.60 0.38±	39.25 1.89±
ALT enzyme concentration unit/L blood	19.14 a 0.50±	18.11 a 0.29±	17.12 ab 0.28±	15.11 b 1.64±
AST enzyme concentration unit/L blood	55.24 a 2.15±	52.06 b 1.63±	45.29 c 0.43±	52.71 b 3.52±