Egypt. J. Anim. Prod. 25, No. 2, pp. 173-181 (1985)

Utilization of Urea as a Protein Supplement in Goat Rations

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THREE experimental rations were fed to three similar groups of pregnant and lactating does. These rations were iso-nitrogenous and iso-caloric. These rations only differed in the N source. Urea represented 0%, 30% and 60% of the total N content of these rations. This study lasted for two successive years. The effect of feeding levels of urea to pregnant and lactating does was investigated.

The low level of urea had no effect on feed intake, changes in body weight and reproductive performance of pregnant and lactating does. The high level of urea resulted in lower feed intake, less gain in weight, light birth weight, weak kids and increased incidence of abortion in the 1st year and stillbirth in the 2nd year.

Feeding low level of urea had no determinal effect on total milk protein and its fractions. High level of urea decreased the total protein content and whey protein in colostrum and milk. The whey protein was significantly decreased. The urea content of either colostrum or milk was not affected by feeding urea.

The overall results showed poor urea-N utilization reflected on the reproductive performance of pregnant and lactating does, specially those fed high urea ration.

Urea as a cheap source of nitrogen is widely used as a protein supplement in ruminant rations. This may raise some hazards due to high concentration of ammonia particularly if urea is fed at high concentrations and not properly fed. This may result in a lower utilization of N for both the rumen microbes and consequently the host animal. This, of course, will reflect on the animal performance and its productivity particularly pregnant and lactating animals.

There is a need for increased utilization of NPN in ruminant rations where there is a shortage in protein concentrates (Gihad, 1979). Lactating cows fed on concentrates containing 1.8, 2.0 or 3% urea showed no significant difference between groups in body weight changes (Knott, 1969). Feeding pregnant cows

on concentrates containing 4% urea did not affect birth and weaning weights. (Williams *et al.*, 1969). Virtanen (1968) stated that feeding urea increased milk protein content, while Polan *et al.* (1968) observed a decrease in milk protein yield. Feeding high levels of urea significantly decreased whey protein (albumin and globulin) in sheep milk. Feeding urea led to some increase in urea content of milk (Zakiene, 1964).

Despite the fact that the role of feeding urea for ruminants is well known, there is few specific work with goats. Therefore, a long term feeding experiment was conducted to study the reproductive performance of pregnant does fed on urea and its utilization during lactation.

Material and Methods

Two experiments in two successive years were conducted to investigate the effect of feeding urea-molasses (UM) mixture for pregnant and lactating does on feed intake, live body-weight, reproductive performance and milk parameters. Twenty seven pregnant Baladi does, (indigenous breed) starting week 10 of pregnancy, were randomly divided into three similar groups of 9 each. These groups were fed the three experimental rations shown in Table 1. These rations were approximately iso-nitrogenous and iso-caloric. Eght does in each group were fed their particular ration until the next mating season. Does in each group were mated by one fertile buck. Mating bucks were daily rotated between the three groups during the mating season to avoid buck confounding effects.

Housing and manegement were the same for all the groups. Rations were fed *ad-libitum* and the daily feed intake was measured. Does were allowed free access for water.

Daily colostrum samples were taken during the first two days after parturition, thenafter, weekly milk samples were taken. Milk protein and whey proteins were determined by using Biuret method which was described by Gornall *et al.* (1949).

Milk casein was calculated by difference as followes : Casein protenn = total proteins — whey proteins. Milk urea was de-

termined by using the method described by Coulombe and Favreau (1963).

Table 1 : Composition of the experimental rations

Item	Urea-N / Total N 0%	30%	60%
Ingredients, %			
Wheat straw	21.2	21.2	21.2
Yellow corn	35.4	35.4	35.4
Concentrate mixture[a]	42.4	24.0	5.7
Urea	-	1.4	2.8
Molasses	-	17.	33.9
Mineral-Vitamin premix	1.0	1.0	1.0
DM composition[b], %			
Crude protein	14.87	15.36	15.89
Crude fiber	17.39	14.73	10.25
Ether extract	4.05	3.19	2.27
Ash	7.18	7.62	7.76
Nutritive value (as fed)			
Starch equivalent,%	66.91	66.32	65.12
Dig. crude protein,%	9.09	9.60	9.85

a) A commercial concentrate feed consists of 42% undecocoticated cotton-seed meal, 25% wheat bran, 22% yellow corn, 5% rice bran, 3% molasses, 2% lime stone and 1% salt.
b) N-free extract was not calculated by difference because of feeding urea.

The data were analyzed by analysis of variance (Steel and Torrie, 1960) and means were tested for differences using Duncan's Multiple Range Test (Duncan, 1955).

Results and Discussion

The live weights of does before pregnancy were nearly equal (Table 2). In the first year no obvious changes were detected between the initiial live weight before pregnancy and the final weight after the *7th* week of lactation within the three groups. In the second year the average body weights of does fed 0% UM and 30% UM rations increased by 2.82 and 3.13 kg, respectively, does fed 60% UM ration showed a slight decrease of .17 Kg. This result indicates that high urea intake decreases N utilization of pregnant and lactating does. Similar results were obtained by Rust *et al.* (1956) and Patel, *et al.* (1970) using lactating cows.

Table 2 : Effect of feeding urea-molasses on live weight and daily feed intake of pregnant and lactating does during 1st and 2nd experimental years .

Item	Urea-N level					
	0 %		30 %		60 %	
	1st	2nd	1st	2nd	1st	2nd
No. of does	9	8	9	8	9	8
Intial wt, Kg[a]	16.92	17.10	16.29	17.00	17.00	17.01
Final wt, Kg[b]	17.17	19.92	16.29	20.13	16.63	16.84
Changes in wt, Kg	+ .25	+2.82	±	+3.13	- .37	- .17
Feed intake, g	634	685	631	715	637	653
DM intake, $g/Kg^{.75}$	70.2	71.3	70.0	71.8	66.6	67.9
SE intake, $g/Kg^{.75}$	50.6	51.4	51.6	53.0	49.9	50.9
DCP intake, $g/Kg^{.75}$	6.9	7.0	7.5	7.7	7.5	7.7
Urea intake, %	--	--	8.9	10.1	18.0	18.5
Urea intake, g/doe	--	--	1.4	1.4	2.8	2.8

[a] weight before pregnancy

[b] weight after the 7th week of lactation .

The DM intake g/Kg $W^{.75}$ were almost similar with does fed 0% UM and 30% UM rations, while does fed 60% UM ration consumed lower values (Table 2). This result was in line with the

findings of Helmer *et al.* (1970), Wilson *et al.* (1975) and Fontenot *et al.* (1977). They found that feeding high levels of urea depress the DM intake.

Feeding urea for does at the two levels did not affect the fertility of does. Oltjen (1969) found similar results.

Replacing 60% of the total protein intake by urea for 10 week pregnant does in the 1*st* year intensified the abortion rate (Table 3) Six abortion cases occurred in nine pregnant does. The other two groups recorded two abrotion cases. No still birth cases were observed in the 1*st* year among the three groups. In the 2*nd* year where does were fed their specific diets before mating, feeding urea intensified the incidence of stillbirth and no abortion cases were observed. Two and five cases out of 8 gestating does were recorded for the does fed 30% UM and 60% UM rations.

Table 3 : Effect of feeding urea on the reproductive performance of does through two successive years .

Item	Urea-N level					
	0%		30%		60%	
	1st	2nd	1st	2nd	1st.	2nd
No. of Mated does	-	8	-	8	-	8
Pregnant does	9	8	9	8	9	8
Fertility, %	-	100	-	100	-	100
Abortion cases	2	1	2	-	6	-
Stillbirth cases	-	-	-	2	-	5
Single kidding	7	6	4	5	2	2
Twins kidding	-	1	3	3	1	6
Born kids	7	8	10	11	4	14
Kidding rate, %	-	114	-	138	-	175
Av. birth wt.,Kg.	2.44	2.48	2.05	2.17	2.22	1.58
Stillbirth kids	-	-	-	3	-	11
Alive kids	7	8	10	8	4	3

respectively. Does fed 0% UM ration recorded only one abortion case. These results proved that feeding urea specially at high levels intensified poor kidding performance. This ill effect of feeding urea reflected in either increasing the incidence of abortion by acute feeding of urea to late pregnant does (1*st* year) or increasing the incidence of stillbirth when does were tolerated (chronically exposured) to urea before pregnancy. Two thirds of pregnant does showed either abortion or stillbirth cases when they were fed 60% of their N intake from urea. This result was in agreement with the findings of Fontenot *et al.* (1977), Oltjen *et al.* (1977) and Rumsey (1979).

The 2*nd* year results showed that does which have been fed urea between the end of lactation and the beginning of the breeding season, flushing period, are more inclined to have multiple ovulations and hence to bear twins. The kidding rate increased by high urea intake (Table 3). Does fed urea gave birth to small, lighter and less vigorous kids at birth. This result agrees with those of Fontenot *et al.*, (1977) and Rumsey (1979).

Preliminary data of total protein and its fractions in colostrum and milk produced by goats fed the different tested rations are shown in Table 4. The differences in colostrum and milk total protein among goats fed different levels of urea were not significant, with groups 0% and 30% UM. Does fed 60% UM ration showed seemingly lower values. Protein fractions followed a similar trend to total protein. The whey protein in colostrum was the only constituent which showed significantly lower values by does fed 60% UM ration. Urea content in milk as not affected by dietary urea. This result agrees with that of Tanev (1971) and contradict with that of Zakiene (1964).

The whey protein in colostrum through the first two days of lactation was the highest protein content and gradually decreased to reach its normal level in milk by the end of the 1*st* lactation week. Ganguli (1974) reported that several colostrum proteins are identical to serum proteins. Serum albumin and immunoglubolin are major members contributing to the soluble proteins present in milk whey. The immunological aspects of colostrum proteins are related to these fractions.

Table 4 : Effect of feeding urea on colostrum and milk proteins in goats .

Item	Days after parturition				
	1	2	7	28	49
0 % UM ration :					
Total protein, %	10.72	8.85	3.88	3.22	3.07
Casein , %	3.24	3.21	3.21	2.57	2.42
Whey protein, %	7.48[a]	5.64	.67	.65	.65
Urea mg/100 ml	30	28	30	28	30
30% UM ration :					
Total protein	10.70	7.92	4.07	3.17	3.30
Casein, %	2.83	2.71	3.36	2.49	2.67
Whey protein, %	7.87[a]	5.21	.71	.68	.63
Urea , mg/100 ml	30	31	28	32	29
60% UM ration :					
Total protein, %	9.70	7.15	3.68	3.48	3.23
Casein, %	3.77	3.06	3.03	2.95	2.62
Whey protein, %	5.93[b]	4.09	.65	.53	.61
Urea, mg/100 ml	28	29	27	29	29

a,b Means on the same colum having unlike superscripts differ segnificintly ($P < .01$) .

The overall results showed an adverse effect of feeding urea to gestating does, specially with high urea levels on the reproductive performance. Another adverse effect could be detected on the colostrum and milk protein quality. The effect of high urea intake on the colostrum immunity is a subject of further investigations.

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الاستفادة من اليوريا كاضافة بروتينية فى علائق الماعـــز

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استخدمت ثلاثة علائق تجريبية لتغذية ثلاثة مجاميع متساوية من اناث الماعز الحوامل والحلابة وكانت هذه العلائق متشـــابهة فى محتواها من الطاقة والبروتين ولكنها تختلف فقط فى مصدر البروتين حيث كانت اليوريا تمثل صفر٪ ، ٣٠٪ ، ٦٠٪ من النيتروجين الكلى فى هذه العلائق وقد استمرت هذه الدراسة لمدة عامين متتاليين تم خلالهما دراسة تأثير مستويات التغذية على اليوريا على اناث الماعز أثناء فترتى الحمل وانتاج اللبن .

لم يؤثر المســتوى المنخفض من اليوريا على كل من كمية الغذاء المأكـول والتغير فى وزن الجسم والصفات الانتاجية لاناث الماعز الحوامل والحلابة وقد ادى المستوى العالى من اليوريا الى انخفاض كل من كمية المأكول من الغذاء ومقدار الزيادة فى وزن الجسم وانخفاض وزن الميلاد وضـــعف المواليد كما ادت الى زيادة حدوث الاجهاض فى السنة الاولى وارتفـاع نسـبة المواليد النافقة بعد الولادة فى السنة الثانية .

لم تؤد التغذية على المستوى المنخفض من اليوريا الى حدوث تأثير واضح على نسبة البروتين الكلى فى اللبن ومكوناته بينما أدت التغذية علىالمستوى العالى من اليوريا الى انخفاض البروتين الكلى وبروتينات الشرش فى كل من السرسوب واللبن الكامل وكان الانخفاض فى بروتينات الشرش انخفاضا معنويا ولم يتأثر محتوى السرســـوب أو اللبن من اليوريا بالتغذية على اليوريا .

اوضحت نتائج هذه الدراسة انخفاض الاســـتفادة من نيتروجين اليوريا منعكسة على الصفات الانتاجية لاناث الماعز الحوامل والحلابة خاصة المغذاة على مستوى عال من اليوريا .