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# Effect of Formaldehyde and Urea Treatments on the Nutritive Value of Forages Fed to Sheep and Goats

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TWO digestion and nitrogen (N) - balance trials were conducted on sheep and goats to study the effect of formaldehyde on ration digestibility. In the 1st trial, four diets were tested : ($R_1$) concentrate feed mixture (CFM) + berseem hay; ($R_2$) CFM treated with formaldehyde (1% of CFM-CP) + berseem hay; ($R_3$) CFM + rice straw; ($R_4$) CFM treated with formaldehyde + rice straw. Rumen pH and blood serum urea-N (mg/100 ml serum) were higher ($P < 0.01$) in animals fed formaldehyde treated diets. The nutritive value of intake in terms of starch value or DCP ($g/kgw^{0.75}$), CP and cellulose digestibility, N-balance and rumen ammonia-N (mg/100 ml liquor) were lower ($P < 0.01$) than in animals fed diets without formaldehyde treatment. Sheep showed higher ($P < 0.01$) digestibility for cellulose and hemicellulose than goats within the four rations.

In the 2nd trial the effect of formaldehyde was studied in diets added with urea. Two diets were tested : ($RU_1$) CFM + rice straw + urea; ($RU_2$) CFM + rice straw + urea + formaldehyde. Rumen ammonia-N and blood serum urea-N (mg/100 ml) were higher ($P < 0.01$) in animals fed diet ($RU_1$). The nutritive value of diet ($RU_2$) as starch value or DCP ($g/kgw^{0.75}$), CP, hemicellulose & cellulose digestibility and N-balance were ($P < 0.01$) higher than diet ($RU_1$). Goats showed higher ($P < 0.05$) roughage intake ($g/kg^{0.75}$) and digestion in both diets.

**Key words :** Formaldehyde, Urea, Sheep, Goats.

It is know in domestic ruminants that when a nitrogen-deficient ration is ingested, urea does not pass into the urine, but is transferred to the digestive tract and converted into microbial protein to be re-utilized (Cocimano and leng, 1967). Ruminants fed undergradable proteins without sufficient source of soluble protein largely depend-upon urea re-cycling to maintain activity of rumen microbes (Redman *et al.*, 1980). Urea is transferred to the rumen through direct diffusion (Houpt and Houpt, 1968) or saliva (Nolan and Leng, 1972). Recycled urea seems insufficient to keep nitrogen requirement for rumen microbes at optimum level, since only 20%

of total recycled urea is transferred to the rumen (Harmayer and Martens, 1980). Supplementation of non-protein nitrogen substances (*i.e.* urea) on rations containing undegradable protein has been recommended to improve nutrients digestibility and dietary nitrogen utilization by ruminants (Preston and Leng, 1981 and Soliman *et al.*, 1985).

Based on results reported by El-Badawi (1986) that ruminants fed formaldehyde-treated diets without sufficient source of degradable nitrogen (*i.e.*, urea) have a poor feeding performance. Therefore, it was beneficial to find out the role of protected protein on the utilization of diets fed with or without urea supplementation and the pattern of rumen ammonia-nitrogen (N) and blood serum urea-N in goats and sheep.

## Material and Methods

### *Animals and their management*

Six digestibility and nitrogen balance (NB) trials were carried out on two groups of animals. Three mature healthy males of each of Baladi goats aged 3 years and weighed 40 kg each and Ossimi sheep age 5 years and weight 60 kg each, were used. Animals were fed sequentially six experimental rations each for a period of two months, during which animals were weekly weighed and individually pen-fed for six weeks. Animals were kept in metabolic crates for a preliminary period of two weeks followed by five days for faeces and urine collection. On the sixth day of the collection period, samples of rumen liquor and blood were individually obtained at 0, 2, 4 and 6 hr post feeding. A sample of 50 ml of rumen liquor was drained by a stomach tube and 20 ml blood sample was bleeded from the jugular vein at a time. By the end of sampling day animals were removed from metabolic crates and confined in the pen to start the adaptation period for next ration. Time of feeding was at 7.00 A.M. and animals were allowed to drink water twice daily.

### *Experimental rations and feeding system*

Experimental rations according to feeding sequence in the 1st trial were respectively; ($R_1$) concentrate feed mixture* (CFM) +

* Made of ; 38% undecordicated cotton seed meal, 30% wheat bran, 22% yellow corn, 4% rice bran, 3%, molasses, 2% limestone and 1 common salt, (55% starch value and 14% crude protein).

berseem hay, ($R_2$) formaldehyde (HCHO—) treated CFM + berseem hay, ($R_3$) CFM + rice straw (RS), and ($R_4$) HCHO-CFM + RS. In the 2nd trial rations ($Ru_1$) CFM+3% urea supplemented RS (URS) and ($RU_2$) HCHO-CFM + URS were fed. Treated or untreated CFM was offered in a mash form and either berseem hay or RS was chopped to approx. length of 10 cm. Urea supplementation was carried out by spraying a solution of 3 g urea/500 ml water on 1 kg rice straw. 1% HCHO-CFM was prepared by spraying formalin solution (1.4 g HCHO/500 ml water) on 1 kg CFM contained 14% crude protein, according to formaldehyde treated level suggested by Ferguson (1975).

The treated CFM was stored for two weeks in well tight plastic container under room temperature before being used. Fresh amount of HCHO-CFM were prepared for each experiment.

Treated or untreated CFM was fed in restricted amounts to provide half of the maintenance requirements of energy as starch value (SV) and 80% of crude protein/$kgw^{0.75}$ for confined goats and sheep. Feed allowances were calculated from NRC (1981) and ARC (1965) for goats and sheep, respectively. Good quality roughage (hay), poor quality roughage (RS) or URS were offered to appetite. During the collection period no feed residues were shown in the troughs.

*Analytical procedures*

Proximate analysis for samples of feeds, faeces and urine were carried out according to A.O.A.C. (1970) Nitrogen-free extract (NFE) was calculated by difference. Fiber tractions were determined according to Georing and Van Soest (1970) Tables 1 & 2. Samples of rumen liquor were strained through two layers of cheese cloth, pH was estimated by digital pH meter (Orion Research pH meter model 201) and a sample of 0.5 ml was immediately dropped in conway vailes to determine ammonia concentration by micro-diffusion method (Conway, 1957). Blood serum was obtained by centrifuging blood tubes for 20 min on 3500 r.p.m., urea-nitrogen (N) concentration was evaluated chemically by using urease solution (1 urease tablet of BDH (0.2 g) in 10 ml mineral solution on 37°C for 20 min) according to Abou-Akkada *et al.* (1968). All determinations of rumen and blood samples were carried out in triplicates.

TABLE 1. Chemical composition (%) for different feedstuffs used in the two experiments.

| Feedstuffs | CP | NFE | CF | EE | Ash |
|---|---|---|---|---|---|
| CFM | 15.9 | 59.7 | 12.9 | 6.0 | 5.5 |
| HCHO-CFM | 16.0 | 59.6 | 13.0 | 6.0 | 5.4 |
| Berseem hay | 16.9 | 40.3 | 27.7 | 3.0 | 12.1 |
| Rice straw | 3.8 | 38.4 | 39.6 | 1.3 | 16.9 |
| 3% urea-supp. rice straw | 13.0 | 31.1 | 38.4 | 1.2 | 16.3 |

CP = N × 6.25

TABLE 2. Fiber fractions (%) for different feedstuffs used in the two experiments.

| Feedstuffs | NDF | ADF | ADL |
|---|---|---|---|
| CFM | 44.1 | 7.2 | 4.4 |
| HCHO-CFM | 44.0 | 7.2 | 4.4 |
| Berseem hay | 43.8 | 30.1 | 8.7 |
| Rice straw | 66.4 | 43.0 | 6.1 |
| 3% urea-supp. rice straw | 66.2 | 43.0 | 6.1 |

Two-stage technique for the In-Vitro digestion of untreated and HCHO-treated CFM was used according to the method suggested by Tilley and Terry (1963) to detect difference in protein digestion, by using sheep and goats rumen liquor.

Statistical analysis was performed using the general Linear model procedure (SAS, 1982). L.S.D. between means was calculated according to Snedecor Cochran (1980).

## Results

Mean values of In-Vitro protein disappearance (%) for untreated and HCHO-treated CFM are presented in Table 3. Values showed

that, HCHO treatment decreased ($P < 0.001$) the protein disappearance of CFM from 68.4% to 23.5% in average, after 72 hr incubation period.

TABLE 3. **In-vitro protein disappearance (%) for untreated or HCHO-treated CFM incubated in rumen liquor of goats and sheep for different times.**

| Ingredients | Rumen liquor | Incubation time (hrs) | | | ± SE |
|---|---|---|---|---|---|
| | | 24 | 48 | 72 | |
| CFM | goats | 34.0 | 47.2 | 69.1 | |
| | sheep | 32.4 | 44.6 | 67.6 | ± 0.54 |
| HCHO-CFM | goats | 12.0 | 19.3 | 22.8 | ± 0.41 |
| | sheep | 11.3 | 20.0 | 25.7 | |

(Average of 4 samples for each determination)

*In the 1st trial*

From the point of intake and nutritive value, Table 4, it shows that, the intake of diets contained high quality roughage (hay) with untreated or HCHO-treated CFM were higher ($P < 0.005$) for goats than sheep. It followed the same trend when they been fed low quality roughage (rice straw) instead of hay. Sheep, however, had higher positive NB than goats in all diets except the HCHO-treated + RS ration ($R_4$) which recorded sever negative NB for both species specially goats. Differences between species concerning NB did not attain significancy.

For rumen pH, the results presented in Table 6, showed an increase in pH values for diets treated with HCHO. Rumen pH values tended to be higher in goats than sheep. Results of rumen ammonia-N ($NH_3$-N) were lower in diets treated with HCHO regardless the type of roughage. Blood-serum urea-N values were significantly ($P < 0.01$) higher in animals fed HCHO untreated diets.

TABLE 4. Efficiency of goats (G) and sheep (S) in utilizing untreated or HCHO-treated rations.

| Item | $R_1$ G | $R_1$ S | $R_2$ G | $R_2$ S | $R_3$ G | $R_3$ S | $R_4$ G | $R_4$ S | ± SE of means |
|---|---|---|---|---|---|---|---|---|---|
| Intake (g/kgw$^{0.75}$) : | | | | | | | | | |
| Roughage(1) : | 40.0 | 32.0 | 36.0 | 29.3 | 18.0 | 13.0 | 22.7 | 11.7 | ± 2.24 |
| Digestibility (%) : | | | | | | | | | |
| CP(2) | 74.7 | 73.6 | 70.0 | 70.8 | 67.3 | 67.2 | 51.3 | 59.6 | ± 1.72 |
| Hemicellulose(3) | 85.1 | 88.5 | 84.8 | 88.5 | 84.5 | 85.3 | 88.8 | 95.3 | ± 0.87 |
| Cellulose(4) | 40.7 | 55.1 | 39.3 | 49.8 | 54.1 | 58.2 | 41.6 | 46.1 | ± 1.77 |
| Utilization of dietary N (g/d) : | | | | | | | | | |
| Intake of N (IN) | 25.4 | 29.3 | 24.6 | 28.8 | 9.8 | 12.5 | 9.9 | 12.6 | |
| Faecal N (FN) | 6.4 | 7.7 | 7.4 | 8.4 | 3.2 | 4.1 | 4.8 | 5.1 | |
| Urinary N (UN) | 11.1 | 12.8 | 16.1 | 18.8 | 6.2 | 7.6 | 7.5 | 8.9 | |
| N-balance | 7.9 | 8.8 | 1.1 | 1.6 | 0.4 | 0.8 | —2.4 | —1.4 | |
| % UN of IN (5) | 43.7 | 43.7 | 65.4 | 65.3 | 63.3 | 60.8 | 75.8 | 70.6 | ± 2.54 |
| % N-balance of IN (6) | 31.1 | 30.0 | 4.5 | 5.5 | 4.1 | 6.4 | —24.2 | —11.1 | ± 2.50 |
| Nutritive value (g/Kgwo. 75) : | | | | | | | | | |
| Starch value (7) | 30.5 | 28.3 | 28.2 | 26.8 | 19.2 | 18.2 | 16.9 | 17.5 | ± 1.17 |
| Digestible crude protein (8) (DCP) | 7.4 | 6.3 | 6.6 | 5.7 | 2.6 | 2.5 | 2.0 | 2.1 | ± 0.46 |

1) For roughage intake (g/kg wo. 75) : There were significant differences ($P < 0.05$) between species and rations.
2) For CP digestibility (%) : There was significant difference ($P < 0.01$) between rations.
3) For hemicellulose digestibility (%) : There were significant differences ($P < 0.01$) between species and rations.
4) For cellulose digestibility (%) : There was significant difference ($P < 0.01$) between species.
5) For % UN of IN : There was significant difference ($P < 0.01$) between rations.
6) For % N— balance of IN : There was significant difference ($P < 0.01$) between rations.
7) For nutritive value (g/kg wo. 75) starch value : There was significant difference ($P < 0.001$) between rations.
8) For nutritive value (g/Kg wo. 75) DCP : There was significant difference ($P < 0.01$) between rations.

TABLE 5. Efficiency of goats (G) and sheep (S) in utilizing urea-supplemented rations with or without HCHO-treatment.

| Item | $RU_1$ | | $RU_2$ | | ± SE of means |
|---|---|---|---|---|---|
| | G | S | G | S | |
| Intake (g/Kg wo. 75) : | | | | | |
| Roughage | 24.0ab | 11.0c | 26.0a | 12.0cb | ± 2.65 |
| Digestibility (%) : | | | | | |
| CP | 80.1A | 71.4B | 82.6A | 81.8A | ± 1.72 |
| Hemicellulose | 83.6 | 86.3 | 86.2 | 89.5 | ± 1.03 |
| Cellulose | 54.9AB | 49.0B | 63.0A | 63.0A | ± 2.20 |
| Utilization of dietary N (g/d) : | 16.0 | 15.9 | 16.8 | 16.5 | |
| Intake of N (IN) | | | | | |
| Faecal N (FN) | 3.2 | 4.5 | 2.9 | 3.0 | |
| Urinary N (UN) | 9.8 | 9.9 | 9.1 | 8.9 | |
| N-balance | 3.0 | 1.5 | 4.8 | 4.6 | |
| % UN of IN | 61.2 | 62.2 | 53.8 | 53.9 | ± 1.72 |
| % N-balance of IN | 18.8B | 9.3C | 28.7A | 27.7A | ± 2.46 |
| Nutritive value (g/Kg wo. 75) : | | | | | |
| Starch value | 20.8AB | 15.7B | 24.4A | 19.6AB | ± 1.19 |
| digestible crude protein (DCP) | 4.7AB | 3.1C | 5.2C | 3.8CB | ± 0.27 |

a,b,c Means with different superscripts in the same row are significantly ($P < 0.05$) different.

A,B,C Means with different superscripts in the same row are significantly ($P < 0.01$) different.

TABLE 6. Ruminal and serum characteristics for sheep and goats fed untreated or HCHO-treated rations.

| Item | $R_1$ | | $R_2$ | | $R_3$ | | $R_4$ | | ± SE of means |
|---|---|---|---|---|---|---|---|---|---|
| | G | S | G | S | G | S | G | S | |
| Rumen pH | 7.1 | 6.8 | 7.4 | 7.2 | 6.9 | 6.9 | 7.2 | 7.5 | ± 0.04 |
| $NH_3$-N (mg/100 ml liquor)(1) | 16.2 | 15.6 | 12.9 | 11.6 | 14.0 | 14.6 | 8.9 | 8.6 | ± 0.38 |
| Urea-N (mg/100 ml Serum)(2) | 13.7 | 13.2 | 17.8 | 14.7 | 12.1 | 12.2 | 14.1 | 12.3 | ± 0.32 |

1) For $NH_3$-N : There was significant difference ($P < 0.01$) between rations.
2) For Urea-N : There was significant difference ($P < 0.01$) between rations.

TABLE 7. Ruminal and serum characteristics for sheep and goats fed urea-supplemented rations with or without HCHO-treatment.

| Item | $RU_1$ | | $RU_2$ | | ± SE means |
|---|---|---|---|---|---|
| | G | S | G | S | |
| Rumen pH | 6.7 | 6.9 | 6.8 | 6.9 | ± 0.03 |
| $NH_3$-N (mg/100 ml liquor) | 15.7A | 16.0A | 13.3B | 12.2B | ± 0.53 |
| Urea-N (mg/100 ml serum) | 14.2AB | 15.7A | 10.4C | 11.4CB | ± 0.50 |

A,B,C Means with different superscripts in the same row are significantly ($P < 0.01$) different.

*In the 2nd trial*

Supplementation of urea to low quality roughage diets significantly ($P < 0.01$) improved the intake in terms of starch value (SV) per $kgW^{0.75}$ for goats than sheep. The same trend been noticed for diet $RU_2$ (contained HCHO-CFM), however differences between species were eliminated than those recorded when animals fed $RU_1$ diet (Table 6). N-balance calculated as % of IN was positively higher ($P < 0.01$) for goats than sheep in untreated diet, while no significant difference was obtained between species when fed HCHO-treated ration.

Rumen pH values shown in Table 7, indicate no difference was regarded to diets. However, sheep in both diets had higher values than goats. As evidenced in the 1st trial, HCHO treatment lowered ($P < 0.01$) rumen $NH_3$-N in both species, (Table 7). It is of interest to note that although $NH_3$-N concentration (mg/100 ml liquor) lowered to 13.3 (goats) and 12.2 (sheep) due to HCHO treatment, such level seems enough to insure ruminal activity for animals fed high roughage diets (NRC, 1985). On the contrary to results obtained for urea-free diets fed in the 1st trial, HCHO treatment significantly ($P < 0.01$) decreased the blood-serum urea-N in goats and sheep. This decrease was associated with highly positive NB for both species (see Table 5). Highly positive correlation was detected between urinary-N% of IN and blood-serum urea-N concentration (mg/100 ml serum) being; 0.64 (goats) and 0.58 (sheep) for HCHO-treatmented diets without urea supplementation, while corresponding correlation coefficients in HCHO-treated diet + urea supplementation ($RU_2$) were ; —0.69 and —0.61 for goats and sheep, respectively.

## Discussion

The degradibility of decorticated cotton seed meal treated with 1% HCHO reached 60-75% after 12 to 24 hr of incubations through In-Vitro study by Abou Ward (1984). Also, Ferguson (1975) reported that 1 g HCHO/100 g CP, was sufficient for maximum protection and above this level there was a progressive decline in apparent CP digestibility, however, non-protein organic matter was not affected up to 6 g HCHO/100 g CP equivalent.

The intake of roughage was positively affected by its quality goats were better than sheep in consuming the two roughages (good or poor), however, superiority of goats was more pronounced when fed the poor quality roughage. Studies carried out under sub-tropical conditions (Gihad, 1976; Dehority and Grubb, 1977; Gihad *et al.*, 1980 and Devendra, 1981) reported higher intake of roughage by goats than sheep, furthermore, De Simiane *et al.* (1981) noted that dry matter intake was generally higher in goats than sheep and the difference was more pronounced for low protein roughages (less than 5% cp).

Similar results have been reported (Faichney and Weston, 1971; Sharma *et al.*, 1972; Schoeman *et al.*, 1973; Faichney and Davis, 1973, Sharma and Ingalls, 1974; Bharagava *et al.*, 1975; Williams and Smith, 1976 and Amos *et al.*, 1979). Hume (1970) and Maeng *et al.* (1976) indicated that protein quality is limiting factor for rumen activity, since rumen microbes need such amino acids which increased considerably microbial yield and consequently animal performance.

Campling *et al.* (1962); Hemsly and Moir (1963); Ammerman *et al.* (1972); Swingle and Waymach (1977); Kempton and Leng (1979); Kempton *et al.* (1979); El-Shinnawy and Abou-Raya (1983) and Abou Ward (1984) reported that raising nitrogen content of poor quality roughages by suitable supplementation level of urea increased intake owing to stimulation of microbial activity. The promotive effect of urea on consumption of poor quality roughage is however, questionable in sheep since urea supplementation decreased their ability to consume the poor roughage in this research.

Kempton and Leng (1979) explained that utilization of rouhages (intake and digestion) is a function of active rumen microbes which are mostly affected by the level of dietary N, more than energy. This assumption was supported by the results reported by Dolberg *et al.* (1981); Preston (1981) and Orskov (1981), which may explain why the intake of poor quality roughage was significantly decreased (in both species) than good quality roughage, although on both rations goats and sheep showed positive N-balance. On the other hand, utilization of dietary N (as NB) increased more in goats than sheep when roughage source was changed from poor to good. This may indicate that utilization of dietary N is not only influenced by N

level but also by N source. Also, Sriskandarajah *et al.* (1982) illustrated that N is drived from body tissues through fast gluconeogensis process when animals fed low N diets. In goats, N becomes available in their rumens through efficient recycled urea process (Obara and Shimboyashi, 1980) followed by a reflux of urea to the rumen through mainly saliva in goats (Harmeyer and Martens, 1980), which may explain the reason for the habit of consuming roughages by goats more than other ruminants.

Beever and Thomson (1977) found that, formaldehyde reduced ruminal ammonia level. Also, formaldehyde increased NPN flow by between 17 to 30% compared with the respective control diets, the higher digestibility of urea-treated diets could result from a sustained release into the rumen of added nitrogen a more intense microbial fermentation.

The results of NB also indicate that faecal-N losses were not affected by formaldehyde treatment, particularly, for good roughage ration, which great N-losses were obtained through urine. This may be due to :

1) Protein denaturation due to aldehyde-amino group linkage, which prevent body tissue to build up its protein.
2) Fast deamination process to provide structural carbohydrate needed to supply energy for body tissue.
3) Over flow rate of amino acids more than tissue demands.
4) Deficiency of some essential amino acids needed for body tissue.

It could be possible to note that goats are more efficient than sheep in preventing the expected drastic fall in their rumen activity due to lack of N availability for rumen microbes when fed HCHO plus poor roughage. This result is evidenced from the decrease of NB in goats than sheep. The results of NB indicate that formaldehyde treatments improved significantly utilization of urea-N by goats and sheep. This means that formaldehyde could prevent extra ammonia in the rumen from CFM above that supplied by urea. Formaldehyde could regulate the release of extra ammonia drived from urea on poor roughage rations without need for extra energy supply.

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# تأثير المعاملة بالفور مالدهيد واليوريا على القيمة الغذائيـة للاعلاف الخشنة المغذاة للاغنام والماعز

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تم اجراء عدد ست تجارب هضم وميزان ازوت خلال مرحلتين تجريبيتين على مجموعتين من ذكور الاغنام والماعز . خلال المرحلة التجريبية الاولى تم دراسة تأثير المعاملة بالفورمالدهيد ( ١ ٪ من بروتين العليقة المركزه) على معدلات الاستفادة من العلائق المحتوية على مواد علف خشنة جيـدة ( دريس ) أو فقيرة ( قش أرز ) وقد كان ترتيب التغذية على العـلائق كما يلى : ـ ١ ـ علف مصنع + دريس ، ٢ ـ علف مصنع معامـل بالفورمالدهيد + دريس ، ٣ ـ علف مصنع + قش أرز ، ٤ ـ علف مصنع معامل بالفورمالدهيدر + قش أرز .

وقد اوضحت نتائج المرحلة التجريبية الاولى ان المعاملة بالفورمالدهيد نجم عنها انخفاض معاملات هضم البروتين الخام ، الالياف الخـام ومكونات الالياف ( الهيمسليولوز والسليولوز ) وكذلك قيمة ميـزان الازوت لكل من الاغنام والماعز . كذلك وجد ان التغذية علـى العـلائق المعاملة بالفورمالدهيد تزيد معنويا ($P < 0.01$) تركيز أزوت اليوريا فى الدم ( مليجرام ٪ ١٠٠ ملل سيرم ) وكانت الزيادة مصاحبة لارتفـاع فقد الازوت فى البول ، وقد وجد ان تركيز ايون الايدروجين قد ارتفع نتيجة المعاملة بينما تناقص تركيز الامونيا ($P < 0.01$) فى كرش الحيوانات المغذاه على العلائق المعاملة .

خلال المرحلة التجريبية الثانية ، تم اختبار عليقتين على مجموعتين الحيوانات ( أغنام وماعز ) تكونت العليقة الاولى من العلف المصنع + قش الارز المضاف اليه ٣ ٪ يوريا بينما العليقة الثانية تكونت من العلف المصنع المعامل بـ ١٪ فورمالدهيد + قش الارز المضاف اليه ٣٪ يوريا . أوضحت النتائج أن المعاملة بالفورمالدهيد بالاضافة الى اضافة اليوريا قد حسنت معنويا معاملات هضم الالياف الخام ومكوناتها ($P < 0.01$) كذلك تحسنت معدلات الاستفادة من أزوت العليقة ($P < 0.01$) لكـل من الاغنام والماعز . لم يلاحظ تغير فى قيم تركيز أيون الايدروجين عند التغذية على العليقتين ، بينما انخفض تركيز كل من امونيا الكـرش وآزوت يوريا سيرم الدم عند التغذية على العليقة الثانية .