# Influence of Guar Korma Meal Treated with Acetic Acid on Productive Performance of Dairy Cows

**Abbas, H. S.; M. H. M. Yacout and A. A. Hassan**
**Department of By-products Utilization, Animal Production Research Institute, Agricultural Research Center, Dokki, Giza, Egypt.**

## ABSTRACT

This study was conducted to evaluate the effect of Guar Korma Meal treated with acetic acid (GKMA) on chemical composition, digestibility coefficients, milk yield, degradation kinetics, and some blood parameters of lactating cows,, Guar Korma Meal (GKM) was mixed with 3% acetic acid (v/w), followed by drying at 105$^o$C. Treated Guar Korma Meal replaced with untreated GKM in the concentrate feed mixture (CFM) at the rate of 0, 35, 65 and 100% for the tested rations T1, T2, T3 and T4, respectively. Sixteen crossbred Friesian cows in their third or fourth lactation season were used in double 4x4 Latin squares design, whereas 4 cows fed each diet at a period of 28 days (21 as a preliminary period and 7 days as a collecting period)**.** Three rams were consigned for digestibility trials, while other three females with rumen fistula were used for the *in situ* trials. The obtained results showed that increase GKMA in the experimental rations significantly (P<0.05) increased all nutrients digestibility coefficients, being the highest for T4 (100% GKMA) compared with other experimental rations. Feeding values as TDN and DCP were significantly (P<0.05) higher with increasing GKMA in the experimental rations. Both T3 and T4 (containing 65 and 100% GKMA, respectively) had the highest feeding values, being 66.16 and 66.20% for TDN and 8.10 and 8.23% for DCP, respectively. Average daily milk production as actual or 4% fat corrected milk yield, fat and protein yields, and total solids content were significantly (P<0.05) higher in T3 and T4 than in T1 and T2, being the highest in T4. Average concentration of total VFA, acetic acid and microbial-N yield in rumen liquor significantly (P<0.05) by increasing level of GKMA, being the highest for T4. Concentration of total proteins and their fractions, glucose and urea and AST and ALT activity were at the normal range. Conclusion: Conclusively, it could be recommended that can be used guar korma meal treated with acetic acid in ration formulation of dairy cows at level of 100% as a source of protein which given the best result to highest nutrients digestibility, feeding values, milk production, and feed utilization and economic efficiency.
**Keywords:** Lactating cows, guar korma meal, acetic acid, digestibility, degradability, milk yield.

## INTRODUCTION

Guar korma meal (GKM), as the by-product of gum guar bean extraction, usually remains as a source of protein for use in animal feeds. The chemical composition of GKM includes CP (50%), EE (7%), CF (5%) and silica (1%). Therefore, it is considered as main dietary source of energy and protein for lactating cows (Srivastava *et al*., 2011). It is a mixture of germs and hulls at an approximate ratio of 25: 75 (lee *et al*., 2004). Organic acids (mainly acetic, propionic, butyric, valerian and lactic acid) are produced, while energy released by the bacteria is recovered in the form of ATP. About 3-5 kg organic acids are produced in the rumen of a 600 kg cow, which depending on the feed composition of 50-70% acetic acid, 15-30% propionic acid, 10-15% butyric acid and 2-5% valerianic and capric acids (Daniel *et al*., 2012).

Khorasani *et al*. (1992) studied the effects of 3% (v/w) acetic acid treatment of canola meal on rumen degradation of its protein, rumen fermentation, and post-ruminal digestion. They found that acetic acid treatment of canola meal reduced its *in situ* rumen DM and CP degradability by 17.0 and 28.6%, respectively, dependent upon the assumed rumen turnover rate. Treatment of proteins with acetic acid decreased ammonia production when treated proteins were incubated in rumen fluid (Ames *et al.*, 1976). Also, sheep fed protein treated with a mixture of volatile fatty acids (VFAs) had lower concentrations of ammonia in the rumen than did control animals (Atwal *et al*., 1974). It was reported that post-ruminal infusion of protein in ruminants increased milk and milk protein yields as well as efficiency of nitrogen utilization (Clark *et al*., 1977). Because of this response, researchers have attempted to increase the supply of amino acids reaching the abomasums by preventing degradation of dietary protein in the rumen. Chemical and heat treatments have been the most extensively investigate methods of protecting dietary proteins from ruminal degradation (Clark *et al*., 1975).

The objective of this work was to study the effect of guar korma meal (GKM) treatment with 3% acetic acid (v/w) at levels of 35, 65 and 100% of GKM in concentrate feed mixtures (CFM) in ration of Friesian dairy cows on milk production, some blood and rumen parameters. In addition, nutritive values, digestibility coefficients, degradation kinetics, feed utilization and economic efficiency were studied

## MATERIALS AND METHODS

The experiments were conducted in this study was carried out at El-Noubari Research Station. Animal Production Research Institute, Egypt. Sixteen lactating crossbred Friesian cows (550±25 kg LBW) with 3-4 parities were used after the first week of lactation. The experimental animals were allocated into 4 similar experimental groups based on their average body weight and average daily milk production (8-10 kg). Duplicated Latin Squares design (4 cows x 4 diets) was used. Four cows fed each tested diet for feeding period of 28 d (21 d a preliminary interval and 7 d collection interval).

Cows were fed four experimental rations formulated as the following: T1 (control) was composed of concentrate feed mixture (CFM) contained untreated GKM plus rice straw (RS); T2 contained 65% untreated GKM + 35% GKM treated with acetic acid (GKMA)plus RS; T3 contained 35% untreated GKM + 65% GKMA plus RS; T4 contained 100% GKMA plus RS (Table 1).

Cows were individually fed according to the station feeding system on a basal ration consisting of 60% CFM and 40% RS on DM basis to cover the recommended requirements for dairy cows according to NRC (1990).

Guar Korma Meal (GKM) was mixed with 3% (vol / wt) acetic acid in a mixer, followed by drying at 105$^o$C..

Milk yield was collected twice daily from each cow at evening and morning, recorded individually on two successive days. Milk samples (100 ml) were taken from two consecutive milking according to Galatov (1994). Milk samples were chemically analyzed for fat, protein, total solid (TS), and ash according to AOAC (1995). Fat correct milk (4%) was calculated according to Gaines (1923) using the following equation: 4% FCM was calculated as: 4 % FCM was calculated as: 0.4 X milk yield (kg) + 15 X fat yield (kg) Gaines (1923).

Digestibility trials were conducted to determine the digestibility coefficients of the nutrients. Three male Barki sheep were individually allotted in metabolic cages for 3 weeks adaptation and one week for urine and feces collection. Feces and urine were collected quantitatively once/day pre-morning feeding (8.00 a.m.), and daily samples representing 20% of feces and urine for seven days were frozen (-20°C) till analyses. In the laboratory, samples of feces were partially dried (60°C) for 72 hours. Samples of feeds and feces were ground (through 1 mm screen) by Wiley mill grinder, then samples of 20 g/treatment/sheep were analyzed for crude protein (Kjeldahl), crude fiber, ether extract and ash. Urine samples output/ sheep were analyzed for nitrogen. Metabolizable energy (ME, kcal/kg) was calculated after the method of Pantha (1982). Total digestible nutrients (TDN) was determined on a dry matter basis (DM) by classic formula according to Maynard *et al.* (1978). Cell wall content was analyzed using Tecator Fibretic system for determination of neutral detergent fiber (NDF), acid detergent fiber (ADF) and acid detergent lignin (ADL). Hemi-cellulose and cellulose contents were calculated by the difference between NDF and ADF, and ADF and ADL, respectively (Van Soest, 1982).

At end of the experiment, blood samples were taken from the Jugular vein of each cow before the morning feeding. Concentration of glucose (Trinder, 1969), total proteins (the biuret method of Henry *et al.*, 1974), albumin (Doumas *et al.*, 1977) and urea (Henry and Todd, 1974) were determined in blood serum. Also, aspartate amino-transferases (AST) and alanine amino-transferases (ALT) activities were determined in blood serum (Reitman and Frankel, 1957) using commercial kits.

**Table 1.Composition of different types of concentrate feed mixtures (on dry matter basis) used for cow feeding.**

| Item (%) | Experimental CFM | | | |
|---|---|---|---|---|
| | T1 (0% GKMA) | T2 (35% GKMA) | T3 (65% GKMA) | T4 (100% GKMA) |
| Yellow corn | 29.0 | 29.00 | 29.00 | 29.00 |
| Wheat bran | 30.0 | 30.00 | 30.00 | 30.00 |
| Sugar beet pulp | 14.8 | 14.80 | 14.80 | 14.80 |
| Untreated guar korma meal | 17.2 | 11.18 | 6.02 | - |
| Treated guar korma meal | - | 6.02 | 11.18 | 17.20 |
| Molasses | 5.0 | 5.0 | 5.0 | 5.0 |
| Salt | 1.5 | 1.5 | 1.5 | 1.5 |
| Limestone | 2.0 | 2.0 | 2.0 | 2.0 |
| Premix* | 0.5 | 0.5 | 0.5 | 0.5 |

*** One kilogram of premix contain: 12000 000 IU, 2200 00 IU, 1000 mg, 1000 mg, 4000 mg, 100 mg and 10 mg from vitamins A, D3, E, B1, B2, B6, B12, and pantothenic acid, biotin, folic acid, Zn, Mn, Fe, Cu, Se and Mg, being 3.33 g, 33 mg, 0.83 g, 11.79 g, 5 g, 12.5 g, 0,5 g, 16.6 mg and 66.7 g, respectively**

***The substitution of treated with acetic acid (GKMA) on the expense 0, 35.65 and 100% of concentrate for T1, T2, T3andT4, respectively.**

Rumen liquor samples were taken at 0, 1, 3 and 6 h after the morning meal from three fistulated female Barki ewes (weighing 42.00±1.5 kg B.W.). The collected rumen liquor was directly tested for pH using Orian 680 digital pH meter. Samples were strained through four layers of chesses cloth for each sampling time, while ammonia nitrogen ($NH_3$-N) was determined using magnesium oxide (MgO) as described by Al-Rabbat *et al*. (1971). Total volatile fatty acid (VFAs) concentration was estimated using steam distillation methods (Warner, 1964). The microbial nitrogen synthesized (g MN/d) in the rumen of sheep fed the experimental diets was calculated using the model equation for the Purine method justified by Chen *et al*. (1991).

According to Mehrez and Ørskov (1977), nylon bag technique was performed to measure DM and CP degradability in the experimental diets. About 6 g of samples from air-dried tested diets ground to 2 mm were placed in two bags (7 x 15 cm for each) of polyester material (pore size of 45 µm) were placed in cumulated sheep rumen and incubated for 3, 6, 12, 24, 48, 72 and 96 h. All bags were washed and cleared in tap water, then squeezed gently and frozen (-20°C) for elimination of microorganisms attached to the residual samples (Kamel *et al*., 1995). After 15 min of washing by running water, zero-time washing losses (a) were determined in 2 bags. The DM and CP degradation kinetics were measured in each bag by fitting the disappearance values according to the equation of Ørskov and McDonald (1979) as the following:

$$P = a + b\,(1 - e^{-Ct}).$$

where **P = the disappearance after time (t). Least-squares estimated of soluble fractions are defined as the rapidly degraded fraction (a), slowly degraded fraction (b) and the rate of degradation (c).**

The effective degradability (ED) of the experimental diets were estimated from the equation:

$$ED = a + bc/\,(c + k),$$

where **k is the rate of out flow (McDonald, 1981).**

Data were subjected to statistical analysis as one way design (ANOVA) using the General Linear Models procedures (SAS, 2000). The significant differences were tested by least significant difference test.

## RESULTS AND DISCUSSION

### Chemical composition:

Chemical composition of GKM, RS, different CFM containing GKM (Table 2) and the experimental rations (Table 3) used in this study revealed high CP content in GKM, so it can be used as good protein source for animal feed. Also, GKM contained high NDF and ash contents which indicating for high content of micro and macro elements (Mishra *et al*., 2013). Generally, increasing level of treated GKM-CFM slightly increased DM, CP and EE, while slightly decreased OM, CF and NFE. It is of interest to note that increasing proportion of treated GKM in the experimental diets slightly increased DM, CP, EE and ash contents, while slightly decreased OM, CF, NFE and hemicelluloses contents.

**Table 2. Chemical composition (%) of guar korma meal, different concentrate feed mixtures and rice straw (on dry matter basis).**

| Item (%) | GKM | Concentrate feed mixture | | | | Rice Straw |
|---|---|---|---|---|---|---|
| | | T1 (0% GKMA) | T2 (35% GKMA) | T3 (65% GKMA) | T4 (100% GKMA) | |
| DM | 89.64 | 88.59 | 88.63 | 88.68 | 88.72 | 89.67 |
| OM | 92.07 | 91.44 | 91.42 | 90.77 | 90.44 | 87.09 |
| CP | 49.17 | 16.15 | 16.17 | 16.25 | 16.47 | 3.91 |
| CF | 7.54 | 9.77 | 9.80 | 9.03 | 8.26 | 34.62 |
| EE | 6.27 | 5.00 | 5.14 | 6.15 | 6.25 | 1.48 |
| NFE | 29.09 | 60.52 | 60.31 | 59.34 | 59.46 | 47.08 |
| Ash | 7.93 | 8.56 | 8.58 | 9.23 | 9.56 | 12.91 |
| NDF | 38.76 | 31.22 | 31.22 | 31.22 | 31.22 | 71.33 |
| ADF | 21.13 | 16.98 | 16.98 | 16.98 | 16.98 | 49.18 |
| ADL | 6.32 | 5.11 | 5.11 | 5.11 | 5.11 | 12.16 |
| Cellulose | 14.81 | 11.87 | 10.87 | 10.47 | 11.57 | 22.15 |
| Hemicellulose | 17.63 | 14.24 | 13.24 | 13.75 | 13.20 | 37.02 |

**Table 3. Chemical composition (%) of guar korma meal, different concentrate feed mixtures and rice straw (on dry matter basis).**

| Item | Experimental ration | | | | |
|---|---|---|---|---|---|
| | T1 (control) | T2 | T3 | T4 | SEM |
| Chemical analysis (% DM basis): | | | | | |
| DM | 88.99 | 89.01 | 89.03 | 89.06 | 0.45 |
| OM | 89.85 | 89.83 | 89.46 | 89.26 | 0.33 |
| CP | 11.67 | 11.67 | 11.84 | 12.03 | 0.42 |
| CF | 18.86 | 18.90 | 18.17 | 17.58 | 0.44 |
| EE | 3.71 | 3.80 | 4.46 | 4.56 | 1.74 |
| NFE | 55.60 | 55.46 | 54.96 | 55.08 | 0.24 |

**Feed intake and digestibility trials:**

Sheep fed T1 showed significantly (P<0.05) the lower values to CFM intake, while those fed T2 and T3 showed significantly (P<0.05) the higher values to RS intake, reflecting significantly (P<0.05) the lower total feed intake for sheep fed T4 (Table 4).

In accordance with the present results of sheep fed 100% treated GKM (T4), Salehpour and Gazvinian (2011) and Turki *et al.*( 2011) recorded that feed intake was remained lower when guar meal containing diet was fed as compared to the control diet (cottonseed meal). Also, Vatandousti and Boldajei (2010) demonstrated that increasing GKM level in the diet significantly depressed the dry matter intake. However, in growing dairy calves, flavored guar meal and toasted guar meal was gave slightly better rates of feed intake and weight gain than raw guar meal during the first month. These findings may explain decreasing GKM intake in T4 for palatability of treated GKM.

Results in Table (4) showed that significant (P<0.05) differences in nutrient digestibility among different experimental rations to DM, OM, CP, CF, EE and NFE, being the highest in T4. These results indicated that increasing level of GKM treated with acetic acid significantly (P<0.05) improved most nutrients digestibility in T4 which containing 100% treated GKM compared with other treatment levels.

Feeding values expressed as TDN and DCP (Table 4) revealed that, ration containing all levels of treated GKM had significantly (P<0.05) higher feeding values as TDN and insignificantly higher DCP than in ration containing untreated GKM, being the highest in T4.

**Table 4. Effect of experimental rations on feed intake, coefficients of nutrient digestibility and feeding values**

| Item | Experimental ration | | | | |
|---|---|---|---|---|---|
| | T1 (control) | T2 | T3 | T4 | SEM |
| Feed intake (g/d/head): | | | | | |
| CFM | 800.57$^{a}$ | 812.90$^{a}$ | 818.80$^{a}$ | 824.63$^{b}$ | 12.49 |
| RS | 461.94$^{b}$ | 470.60$^{a}$ | 454.93$^{a}$ | 450.85$^{b}$ | 10.26 |
| Total | 1262.51$^{a}$ | 1283.50$^{a}$ | 1273.73$^{a}$ | 1275.48$^{b}$ | 67.85 |
| Nutrient digestibility coefficients: | | | | | |
| DM | 83.15$^{b}$ | 83.64$^{ab}$ | 84.35$^{a}$ | 85.20$^{a}$ | 0.45 |
| OM | 90.56$^{b}$ | 90.84$^{ab}$ | 92.23$^{a}$ | 93.15$^{a}$ | 0.33 |
| CP | 68.38$^{b}$ | 70.48$^{a}$ | 70.82$^{a}$ | 74.25$^{a}$ | 0.42 |
| CF | 61.15 | 62.32 | 64.28 | 65.16 | 0.44 |
| EE | 69.12 | 69.52 | 70.04 | 70.82 | 1.74 |
| NFE | 72.87 | 76.06 | 76.14 | 76.10 | 0.24 |
| Feeding value (%): | | | | | |
| TDN | 65.80$^{b}$ | 65.86$^{a}$ | 66.16$^{a}$ | 66.20$^{a}$ | 0.37 |
| DCP | 7.98 | 7.98 | 8.10 | 8.23 | 0.15 |

**a and b: Means with different superscripts in the same row are significantly different at P<0.05. T1 = 0% Guar Korma, T2 = 35% treated Guar Korma, T3 = 65% treated Guar Korma and T4 = 100% treated Guar korma.**

**Ruminal fermentation:**

Results of ruminal parameters showed that both pH value and $NH_3$-N concentration were not affected significantly by the tested rations (Table 5). Similarly, some authors reported insignificant effect of protein level or source on pH value in the rumen (Bargo *et al.,* 2001). Yet, the obtained level of $NH_3$-N in the rumen was sufficient for growth of ruminal micro-flora (Lu *et al.,* 1990). Sheep fed on T3 and T4 recorded significantly (P<0.05) higher volatile fatty acids concentration and microbial-N yield than those fed on T1 and T2. These mean that the energy and ammonia releases are nearly synchronized and enhance microbial production. However, acetic acid concentration was significantly (P<0.05) higher in all treatment groups, being the highest T4. This may indicate that 100% treated GKMA could be reasonable for good microbial protein synthesis in the rumen. Subsequently, the limitation upon the cellulolytic bacteria could influence on fiber fermentation, digesta outflow, and forage intake (Gilbery *et al.*, 2006). Ultimately; this alteration of bacterial functionality may affect the amount of energetic substrates (VFA) and amino acid available to the ruminants.

**Table 5. Some rumen parameters of sheep fed the experimental ration**

| Item | Experimental ration | | | | |
|---|---|---|---|---|---|
| | T1 | T2 | T3 | T4 | SEM |
| Ruminal pH value | 6.33 | 6.38 | 6.41 | 6.61 | 0.17 |
| Ammonia-N (mg/100 ml R.L.) | 13.31 | 13.53 | 13.48 | 13.95 | 0.32 |
| Total VFAs (meq/100 ml R.L.) | 11.53$^{b}$ | 11.59$^{b}$ | 12.44$^{a}$ | 13.26$^{a}$ | 0.29 |
| Acetic acid, % | 56.49$^{b}$ | 61.52$^{a}$ | 64.06$^{a}$ | 64.16$^{a}$ | 0.48 |
| Propionic acid, % | 25.88 | 25.56 | 25.49 | 25.59 | 0.32 |
| Butyric acid, % | 12.96 | 12.65 | 12.70 | 12.80 | 0.22 |
| Microbial-N yield (g/d). | 17.48$^{b}$ | 17.56$^{b}$ | 19.85$^{a}$ | 20.55$^{a}$ | 0.36 |

**a and b: Means with different superscripts in the same row are significantly different at P<0.05. T1 = 0% Guar Korma,T2 = 35% treated Guar Korma, T3 = 65% treated Guar Korma and T4 = 100% treated Guar korma.**

**Degradation kinetics:**

Results presented in Table (6) cleared that each of soluble fraction (a), degradable fraction (b), rate of degradability (c) and effective degradability (ED) of dry matter (DM) and crude protein (CP) for $T_4$ were significantly ($P<0.05$) the highest compared with other rations. This could be related to the highest digestibilities in the rumen. These results are agreement with those reported by Aufrere *et al*. (1991). Also, Jahani-Azizabadi *et al.* (2010) indicated that heat processing of guar meal caused a decrease in the amount of materials available to rumen microbes. Acetic acid may prove to be an effective agent for increasing the supply of absorbable dietary amino acids. Treatment of proteins with acetic acid decreased ammonia production when treated proteins were incubated in rumen. However, the mode of action of acetic acid in preventing protein degradation is not clear.

**Table 6. Effect of the experimental rations on DM and CP degradation kinetics in sheep.**

| Item (%) | Experimental ration | | | | |
|---|---|---|---|---|---|
| | T1 | T2 | T3 | T4 | SEM |
| DM | | | | | |
| a, % | 30.21[b] | 30.53[b] | 34.87[a] | 34.90[a] | 0.31 |
| b, % | 43.25[b] | 43.78[b] | 46.89[a] | 47.22[a] | 0.46 |
| c, % | 0.050[b] | 0.050[b] | 0.057[a] | 0.058[a] | 0.002 |
| EDDM, % | 48.47[b] | 48.95[b] | 51.35[a] | 52.63[a] | 0.29 |
| CP | | | | | |
| a, % | 32.98[b] | 33.13[b] | 37.64[a] | 38.69[a] | 0.27 |
| b, % | 44.98[b] | 45.05[b] | 48.85[a] | 49.78[a] | 0.33 |
| c, % | 0.055[b] | 0.055[b] | 0.060[a] | 0.065[a] | 0.001 |
| EDCP, % | 49.66[b] | 49.99[b] | 53.66[a] | 55.01[a] | 0.37 |

**a and b: Means with different superscripts in the same row are significantly different at P<0.05.**
**a= Soluble fraction (%). b=potentially degradable fraction (%). c=rate of degradability (% h-1). ED=Effective degradability (%). a+ [bc/c+k], where k is the out flow rate assumed to be 0.05/h.**
**T1 = 0% Guar Korma without acetic acid, T2 = 35% acetic acid Guar Korma, T3 = 65% acetic acid Guar Korma and T4 = 100% acetic acid Guar korma.**

**Milk yield and composition:**

Average daily milk yield as actual or fat corrected milk (4%), and yield of fat and protein milk significantly ($P<0.05$) increased for cows fed T3 and T4 compared with T1 (control diet) and T2. However, only total solids content was significantly ($P<0.05$) higher in T3 and T4 than in T1 and T2 (Table 7).

**Table 7. Effect of experimental rations on milk yield and composition of lactating cows (mean ± SE)**

| Item | Experimental ration | | | | |
|---|---|---|---|---|---|
| | T1 (control) | T2 | T3 | T4 | SEM |
| Daily milk yield, kg/d | 13.31[b] | 13.98[b] | 14.19[a] | 14.98[a] | 0.12 |
| Daily 4% FCM* | 11.32[b] | 11.93[b] | 13.18[a] | 13.28[a] | 0.38 |
| Fat yield, kg/d | 0.40[b] | 0.44[b] | 0.50[a] | 0.52[a] | 0.02 |
| Protein yield, kg/d | 0.45[b] | 0.45[b] | 0.49[a] | 0.50[a] | 0.01 |
| Milk composition (%): | | | | | |
| Fat | 3.4 | 3.5 | 3.8 | 3.9 | 0.19 |
| Protein | 3.36 | 3.39 | 3.46 | 3.42 | 0.22 |
| Lactose | 4.55 | 4.55 | 4.58 | 4.59 | 0.39 |
| Total solids | 11.82[b] | 12.22[b] | 12.44[a] | 12.48[a] | 0.15 |
| Solids not fat | 8.82 | 8.92 | 8.94 | 8.98 | 0.22 |
| Ash | 0.91 | 0.94 | 0.97 | 0.97 | 0.05 |

**a and b: Means with different superscripts in the same row are significantly different at P<0.05.**
**T1 = 0% Guar Korma,T2 = 35% treated Guar Korma, T3 = 65% treated Guar Korma and T4 = 100% treated Guar korma.**
***4 % FCM was calculated as: 0.4 x milk yield (kg) + 15 x fat yield (kg) according to Gaines (1923).**

**Feed intake, feed conversion and economic feed efficiency:**

Average daily feed intake (kg/h/d) from feedstuffs, as fed and on DM basis, are shown in Table (8). There were no significant differences among the different groups in DM intake. Also, Feed conversion expressed as the amount of feed units in kg of DM required for producing one kg milk indicated that T4 represented the significantly ($P<0.05$) the best feed conversion.

Results of economic feed efficiency of GKMA treatment indicated that increasing level of GKMA in the diet increased feed cost, but the economical feed efficiency was the best for cows in T4.

**Table 8. Feed intake, feed conversion and economical feed efficiency of the tested rations fed to lactating cows**

| Item | Experimental ration | | | |
|---|---|---|---|---|
| | T1 (control) | T2 | T3 | T4 |
| Feed intake, kg/h/d (as fed): | | | | |
| CFM | 8.00 | 8.00 | 8.00 | 8.00 |
| RS | 6.75 | 7.00 | 7.25 | 7.29 |
| Total | 14.75 | 15.00 | 15.25 | 15.29 |
| Feed intake, kg/h/d (on DM basis) | 13.14 | 13.37 | 13.59 | 13.64 |
| Milk yields, kg/d | 13.31 | 13.98 | 13.59 | 14.98 |
| Feed conversion (kg DM/kg milk) | 0.99 | 0.96 | 0.96 | 0.91 |
| Economic feed efficiency: | | | | |
| Milk price, LE/h/d | 39.90 | 40.11 | 42.57 | 44.94 |
| Feed cost, LE,/h/d | 22.70 | 22.80 | 22.90 | 22.92 |
| Economic efficiency, % | 1.76 | 1.76 | 1.86 | 1.96 |

**T1 = 0% Guar Korma, T2 = 35% treated Guar Korma, T3 = 65% treated Guar Korma and T4 = 100% treated Guar korma.**
**Price of CFM = 2500 LE/ton RS = 400 LE/ton Cow milk = LE /kg (2015)**

**Blood serum metabolites:**

Concentration of serum total proteins, albumin, globulin, glucose, urea as well as activity of AST and ALT showed insignificant differences among experimental groups. All values are within the normal average as described by Stanek *et al.* (1992), indicating that feeding lactating cows on diets containing guar korma had no adverse effects on carbohydrate metabolism, and kidney/liver function.

**Table 9. Concentration of some blood biochemicals and enzyme activity in blood serum of lactating cows fed experimental ration**

| Item | Experimental ration | | | | |
|---|---|---|---|---|---|
| | T1 | T2 | T3 | T4 | SEM |
| Blood biochemicals: | | | | | |
| Total proteins (g/dl) | 8.28 | 8.35 | 8.56 | 8.87 | 0.52 |
| Albumin (g/dl) | 4.80 | 4.85 | 4.94 | 4.98 | 0.33 |
| Globulin (g/dl) | 3.40 | 3.49 | 3.62 | 3.82 | 0.41 |
| Glucose (mg/dl) | 87.78 | 89.68 | 89.86 | 89.96 | 0.75 |
| Urea (mg/dl) | 39.22 | 40.11 | 39.69 | 39.49 | 0.88 |
| Enzyme activity (U/l): | | | | | |
| AST | 44.75 | 44.37 | 43.99 | 43.79 | 1.16 |
| ALT | 13.43 | 13.85 | 13.55 | 13.65 | 0.47 |

**T1 = 0% Guar Korma, T2 = 35% treated Guar Korma, T3 = 65% treated Guar Korma and T4 = 100% treated Guar korma.**

## CONCLUSION

It could be concluded that inclusion of 100% of guar korma meal treated with acetic acid can be used as a source of protein in ration of dairy cows improved nutrient digestibility and degradability, feeding values, milk production, feed utilization efficiency and the highest economical feed efficiency.

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## تأثير كسب الجوار كورما المعامل بحمض الخليك على تغذية الأبقارالحلابه

**حسن السيد عباس ، محمد حلمي ياقوت و أيمن عبد المحسن حسن**
**معهد بحوث الإنتاج الحيوانى - مركز البحوث الزراعية - الدقى -الجيزه - مصر**

أجريت هذة الدراسة لمعرفة تأثير معدل معاملة كسب الجوار كورما بحمض الخليك على تغذية الأبقار الحلابه من حيث التركيب الكيماوى - معاملات الهضم - معدل تحلل الماده الجافه والبروتين بكرش الأغنام - بعض مكونات الدم وأنتاج اللبن للابقار. استخدم عدد 3 كباش لتجارب الهضم و3 نعاج مزودة بفستيولات بالكرش لقياس نشاط التخمر وتقدير معدل تحلل المادة الجافة والبروتين بالكرش. تم عمل 4 مركزات الإولى مقارنه بدون معامله والثانيه 35% جوار معامل بحمض الخليك والثالثه 65% جوار معامل بحمض الخليك الرابعه 100% جوار معامل بحمض الخليك. تم إحلال الجوار بنسبه 50% من بروتين العليقه حسب إنتاجيه الحيوان بمعدل 60% ماده مركزه وفقا لمقررات NRC ويقدم قش الأرز للحيوانات بحريه . وقد استخدام 16 بقرة فريزيان خليط فى الموسم الثالث أو الرابع بتصميم المربع اللاتينى فى تجارب اللبن بواقع 4 بقرات لكل عليقة لفترة 28 يوم منها 21 يوم كفترة تمهيدية و 7 ايام لفترة الجمع. وقد أظهرت النتائج ما يلى: ان العليقة المحتوية على كسب الجوار بنسبه 50 %والمعامله بحمض الخليك بنسبه 100% حسنت فى معاملات الهضم والقيمة الغذائية مع ارتفاع فى تركيز الأمونيا بالكرش وكذا الأحماض الدهنية الطيارة مع زيادة فى معدل تحلل كلا من المادة الجافة بالكرش مقارنة بنسب الأستبدال الأخرى. هذا وقد أدى ذلك الى زيادة معدل انتاج اللبن وأعلى فى الكفاءة الأقتصادية علما بأن نتائج الدم كانت فى معدلاتها الطبيعية ودون اى تأثير صحي سلبى على الحيوانات. وبصفة عامة يمكن القول انه يمكن النصح بأضافة كسب الجوار كورما بنسبه 50% من بروتين العلف المركز والتى تمثل 17.20% كسب جوار كورما والمعامل بحمض الخليك بنسبه 100% لعلائق الأبقار الحلاب والمعامله بحمض الخليك لتحسين القيمة الغذائية ة واداء الحيوانات دون حدوث أى ضرر على انتاجية وصحة الحيوانات على ان يوصى بمزيد من الدراسات على المدى الطويل على كلا من حيوانات اللحم واللبن لتأكيد النتائج المتحصل عليها فى الدراسة الحالية.