# THE USE OF THE MARKET–RETURN OF FOOD PRODUCTS AS RUMINANT FEEDS

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## SUMMARY

Six male Barki sheep were used for digestibility study and three females were fitted with permanent rumen fistulae for rumen fermentation studies. The animals were fed six mixed diets based on (33%) rice straw, (5-14%) meat products (M) as animal protein source and (11-17%) undecorticated cottonseed cake (C) as plant protein source. Replacement of a part of protein sources with 1% urea (U) was considered. Maize (Z) (27%) and bakery products (B) (24-37%) were used as sources of energy.

The results indicated that, there were significant differences in digestibility coefficients of CP, CF and EE among diets. However, there were no significant differences for DM, OM and NFE digestibility coefficients. The TDN values ranged between 68% and 77% for CZ-diet and MBU-diet, respectively, without significant differences. DCP was significantly higher with MBU-diet (9.74%) compared with the other diets. Nitrogen balance value (NB) was highest with MBU-diet (7.64 g/h/d) and lowest with CZ and CB diets; (2.73 and 3.59 g/h/d, respectively) with significant differences. Rumen ammonia-N concentrations (mg / 100 ml RL) were significantly different, ranging between 6.1 and 18.5 mg/100 ml RL for CB-diet and CBU-diet, respectively. However, rates of ammonia-N production values (mg/100 ml RL/hr) were significantly lower for MZ-diet (-0.2) and the significant highest rates were observed for CZ and CBU-diets (4.9 and 3.7, respectively). VFA concentrations were significantly different and ranged between 3.7 and 7.9 (meq/100 ml RL) for MB and CBU-diets, respectively. The same trend was observed for VFA production rates (meq/100 ml RL/hr). Rumen volume values ranged between 8.6 and 4.7 L for sheep fed CB-diet and CBU-diet, respectively, with significant differences. Rates of rumen out flow values were significantly lower for MZ-diet (7.8%/ hr) in comparison with other diets. Microbial protein synthesis showed values between 19.5 and 70.8 (g/d) for MB and CB diets, respectively.

From the economical point of view, the diets containing the market return of bakery products showed lower cost of diet than those containing corn. However the diet containing urea, bakery and meat products (MBU) showed the lowest cost of one ton TDN and one kg DCP.

***Keywords:*** *meat products, bakery products, Barki sheep, digestibility, rumen fermentation*

## INTRODUCTION

It is evident that the factor limiting animal production ability in Egypt and most of developing countries is the gap between the nutrients requirement of ruminants and the available amounts of feeds. It was estimated to be about 5

million tons of dry matter, equivalent to 3 million tons of TDN as reported by Abou Akkada (2000). This gap could be covered by the use of different sources of agricultural by-products and use of new feed sources.

Feed cost could be reduced by including locally and regionally crops and by-products into animal diets, especially ruminants. Numerous by-products are produced in Egypt, but their use is sometimes limited due to poor understanding of their nutritional and economic value.

In spite of the availability of non-conventional feeds at reasonable prices, the cost is not the only factor to consider. Therefore, most uncommon feeds should be used with caution and should be introduced into the ration gradually, even when low prices favor their use. The potential incorporation of by-products ingredients into ruminant rations requires careful planning, evaluation and study.

On the other hand, there is a problem in Egypt about how to get rid of the market return of food products i.e. meat (about 168,700 tons/year) and bakery products (about 1500 tons/year) without burning them to keep our environment safe. This idea also could save the pollution hazards of burning and/or burying these products. The market-return products may be used as animal feed resources. This idea was the aim of the present work.

The objective of this study was to examine the effects of inclusion of meat and bakery products in diets for ruminants on feed value, rumen function and dry matter and protein digestibility

## MATERIAL AND METHODES

This study is part of an extensive research program for maximizing the utilization of unconventional products and by-products, which was conducted at the Noubaria Experimental Units, Animal Production Research Institute, Ministry of Agriculture, in cooperation with the laboratories of Faculty of Agriculture, Alexandria University.

***Preparation of Meat and Bakery products:***

Meat products ; (contain 87% meat protein and 13% plant protein) and bakery products (cooked products contain about 75% from pizza, pate, croissant, Danish, pound cake, fetear, sovelada, Swiss roll and tutti frutti and 25% from bran bread, bran toast, white toast, petty-pan, bread sticks with or without sesame and black caraway and free from rancidity) were collected from market return. Bakery products (B) had moisture content ranging between 15 and 35%. They were dried at 100 $^{0}$C for 12 hours, then they were ground and packed. The moisture content of meat products (M) ranged from 50 to 65%. They were dried at 140 – 150 $^{0}$C for 4 hours under pressure 1.5 – 2 kg/cm$^{2}$, before packing. At the end of every process samples from both bakery and meat products were analyzed for chemical composition according to A.O.A.C. methods (1990), (Table 1).

The bakery and meat products were collected, processed and stored until they were mixed with other components to be used for formulating the experimental diets. However, meat and bakery products were analyzed for rancidity according to Kreis test; (A.O.A.C. methods, 1990). Microbial analyses; total plate count, *Staphylococcus aureus*, *Coli form*, *Escherichia coli*, *Yeast* and *Mould* were carried out according to Oxoid, (1998). *Salmonella* was analyzed according to the rapid test as described by Oxoid, (1998) and aflatoxin according

to VICAM, Afla Test (1999). Microbial analyses of the products of meat and bakery are presented in Table (2).

***Experimental diets and animals:***

Mixed diets used in the present work were basically composed of chopped, (3-5 cm) rice straw; (33%) and formulated to be fairly isonitrogenous and isocaloric. Ingredients composition of the diets are listed in Table (3). The ingredients were mixed together in a feed mixer and the diets were in the mash form. Chemical composition of mixed diets were analyzed according to A.O.A.C. (1990).

Nine Barki sheep; (6 males and 3 females) of 45 ± 1.5 kg body weight; in average, were used throughout the present work. Male sheep were used for digestibility and nitrogen balance trials and the three female sheep fitted with permanent rumen fistulae were used for rumen activities and *in situ* degradability studies; (three animals were used for each diet).

The animals were fed their experimental diets, in such a way as to cover their maintenance requirements according to NRC (1985), twice daily (8 am and 16 pm). Drinking water was available at all times.

***Digestibility Trials:***

Three animals were individually housed in metabolic cages and beneath each, a stainless steel screen having 4 mm mesh to retain feces but allow free passage of urine which was collected through a funnel to be easily separated in order to collect the feces and urine separately. An experimental period included three weeks for adaptation followed by one week for collecting and sampling was carried out. Feed offered to animals and refusals by each sheep was recorded at every morning meal during the last week of each period.

Faeces and urine were collected quantitatively once a day before the morning meal and weighed fresh. Daily representative sample (10% of the fresh feces and urine) were stored at −10 $^{0}$C. The seven daily samples were combined, and samples were kept for analyses.

Fecal samples were dried at 60 $^{0}$C for 72 hours (partial drying) and ground through 1 mm screen on a Wiley mill grinder. The collected faeces (20 gm/sample/treatment/animal) and feed (either offered or refused) were analyzed according to A.O.A.C. (1990).

***Rumen fermentation and in-situ trials***

The pH values of the rumen fluid were determined by using a glass electrode, inserted in the rumen of animals through the fistulae. The values were recorded at zero (before feeding), 1,3 and 6 hr post feeding and overall mean was calculated. Rumen samples were withdrawn before feeding, 1, 3 and 6 hr after feeding (for *in vitro* incubation) in 500 ml jars using the zero rate technique as described by Carrol and Hungate; (1954). Rumen ammonia-N determinations were carried out using MgO distillation method; (Al-Rabbat et al., 1971). Total VFA's were determined by steam distillation as described by Warner, (1964). Rumen volume was determined by the calorimetric method using Cr-EDTA before, 3 and 6hr after feeding, (El-Shazly et al., 1976). Nylon bags technique was used to determine disappearance in the rumen of CP of the market return products according to Barrio et al. (1986).

***Statistical analysis***

Data were statistically analyzed using least square analyses of variances by general linear models (GLM) procedure (SAS, 1996). The model describing each trial was assumed to be:

$Y_{ijk} = u + D_i + T_j + DT_{ij} + e_{ijk}$

Where:

$Y_{ijk}$ = an observation on individual K.

$D_i$ = a fixed effect of the $i^{th}$ time.

$DT_{ij}$ = Interaction between diet and time of sampling.

**Table (1) : Chemical composition of ingredients used in the formulation of the mixed diets.**

| Items% | Meat products | Bakery products | U.C.S.M* | Yellow corn | Wheat bran | Rice straw |
|---|---|---|---|---|---|---|
| Dry matter | 87.95 | 87.95 | 88.42 | 88.03 | 88.47 | 88.78 |
| Organic matter | 90.21 | 90.32 | 89.62 | 89.72 | 89.94 | 89.93 |
| Crude protein | 11.84 | 11.89 | 11.97 | 11.76 | 11.81 | 11.74 |
| Crude fiber | 11.46 | 13.22 | 11.26 | 13.13 | 12.65 | 12.36 |
| Ether extract | 5.95 | 3.03 | 9.82 | 6.68 | 8.87 | 7.15 |
| Nitrogen free extract | 60.96 | 62.18 | 56.57 | 58.15 | 56.61 | 58.68 |

***U.C.S.M Undecortecated cottonseed meal**

**Table (2) : Microbiological analyses of the meat and bakery market-return products after processing.**

| Analysis | Meat products | Bakery products |
|---|---|---|
| Total plate count (T.C.) | 600 cell/gm | negative |
| Staphylococcus aureus | 180 cell/gm | negative |
| Coli form | negative | negative |
| Escherichia coli | negative | negative |
| Yeast | negative | 10 cell/gm |
| Mould | negative | 40.cell/gm |
| Salmonella | negative | negative |
| Aflatoxines (ug / Kg) | < LOQ's* | < LOQ's* |

- **LOQ's : (Limits of quantification = 1.5 ug/kg) in feeds.**

e = a random error assumed to be normally distributed with mean = (0) and variance $\delta^2 e$.

## RESULTS

***Microbial examination of meat and bakery products:***

It was observed that about 600 cell/gm (TC) and 180 cell/gm (*Staphylococcus aureus)* were found in meat products, while they were negative in the bakery products. However the acceptable count in products for human consumption in cooked meat are $10^4$cell/gm TC and $10^3$ cell/gm of *Staphylococcus aureus* in the frozen meat (EU, 2001). Counts for *Coliform, Escherichia coli, Yeast, Mould* and *Salmonella* are negative in meat and bakery products except for yeast and mould, which were 10 - 40 cell/gm in bakery products. These values were in the acceptable range (not more than 50 cell/gm). Aflatoxin (LOQ's) was less than 1.5 µg/kg, this agreed with Minster decree No. 1498 (1996) which mention that the content in feeds should not exceed 10 µg/kg and be free from rancidity and salmonella.

***Chemical composition of the mixed diets:***

Chemical composition of the mixed diets (Table 4) showed that, all diets had comparable crude protein (CP), crude fiber (CF), nitrogen free extract (NFE) and ash content. Diets containing meat and bakery products (MB) were noticed to have higher fat (EE) content, followed by those containing bakery products. Less fat content was found for diets containing meat or cottonseed cake with corn.

***Digestibility coefficients :***

No significant differences were found among diets for DM, OM and NFE digestibility coefficients (Table 5). The MBU diet showed the highest ($P<0.05$) digestibility coefficient for CP while the other diets had comparable values. Lower digestibility coefficients ($P<0.05$) of CF were noticed for the CZ diet.

Digestibility coefficient of EE was highest ($P<0.05$) for the MB diet , while lower ($P<0.05$) values were observed for CBU and MBU diets.

***Feed intake and nutritive values:***

Sheep fed diets containing bakery products as a source of energy with either meat products or cottonseed cake as protein sources had lower feed intake (gm DM/h/d) compared to those fed corn as a source of energy containing diets (Table 6). When the diets were supplemented with urea, the diet containing cottonseed meal and bakery resulted in a higher ($P<0.05$) feed intake than when meat and bakery was incorporated without urea.

The feeding values of the experimental diets were not significant different among diets if it is expressed as TDN (%). Lower DCP intake was recorded with sheep fed diet containing MB and CB. Diets containing corn either with meat or cottonseed meal had quiet similar DCP intake. DCP value was the highest ($P<0.05$) for diet contained MB supplemented with urea, while no significant differences were found for the rest of the diets.

***Nitrogen utilization:***

Animals fed MBU and CZ diets showed higher ($P<0.05$) nitrogen intake (NI). However, sheep fed other diets had comparable values. Supplementation with urea incorporated with meat and bakery products resulted in an increase in NI.

Higher ($P<0.05$) nitrogen retention (NR) was noticed with sheep fed MBU and CBU diets. Diets containing corn accompanied with cottonseed cake or meat products and that contained bakery with cottonseed cake had lower ($P<0.05$) NR values.

**Table 3 : Composition of the mixed diets (%).**

| Ingredients | Experimental diets | | | | | |
|---|---|---|---|---|---|---|
| | MZ | CZ | MB | CB | MBU | CBU |
| Rice straw | 33 | 33 | 33 | 33 | 33 | 33 |
| Bakery products | - | - | 24 | 29 | 31 | 37 |
| Meat products | 11 | - | 14 | - | 5 | - |
| U.C.S.M. | - | 11 | - | 17 | - | 11 |
| Wheat Bran | 26 | 26 | 23 | 10 | 20 | 7 |
| Maize | 27 | 27 | - | - | - | - |
| Urea | - | - | - | - | 1 | 1 |
| Molasses | - | - | 3 | 8 | 7 | 8 |
| Salt | 1 | 1 | 1 | 1 | 1 | 1 |
| Limestone | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 |
| Mineral premix | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 |
| Total | 100 | 100 | 100 | 100 | 100 | 100 |

**MZ : Meat and maize diet. MB : Meat and bakery diet.**
**CZ : Undecortecated cottonseed cake and maize diet.**
**CB : Undecortecated cottonseed cake and bakery diet.**
**MBU : Meat, bakery and urea diet.**
**CBU : Undecortecated cottonseed cake, bakery, and urea diet.**

**Table (4): Chemical composition (% on DM basis) of the mixed diets (including rice straw).**

| Ingredients (%) | Experimental diets | | | | | |
|---|---|---|---|---|---|---|
| | MZ | CZ | MB | CB | MBU | CBU |
| Dry matter | 87.95 | 87.95 | 88.42 | 88.03 | 88.47 | 88.78 |
| Organic matter | 90.21 | 90.32 | 89.62 | 89.72 | 89.94 | 89.93 |
| Crude protein | 11.84 | 11.89 | 11.97 | 11.76 | 11.81 | 11.74 |
| Crude fiber | 11.46 | 13.22 | 11.26 | 13.13 | 12.65 | 12.36 |
| Ether extract | 5.95 | 3.03 | 9.82 | 6.68 | 8.87 | 7.15 |
| Nitrogen free extract | 60.96 | 62.18 | 56.57 | 58.15 | 56.61 | 58.68 |
| Ash | 9.79 | 9.68 | 10.38 | 10.28 | 10.06 | 10.07 |

Higher (P<0.05) nitrogen utilization values; expressed as index of NR/NI was found in sheep fed MBU and CBU diets. However, sheep fed CZ diet had the lowest (P<0.05) NR/NI value. When the utilization was expressed as index of NR/NA, diets supplemented with urea (MBU or CBU) had higher values followed by MB diet without significant differences. Lower utilization was observed in sheep fed CZ diet without significant differences with MZ and CB diets.

***Rumen fermentation:***

***Rumen ammonia-N concentrations and rates of production:***

Mean of $NH_3$-N concentrations ranged between 6.1 and 18.6 mg/100 ml RL for CB and CBU, respectively. The diet contained cottonseed cake showed higher $NH_3$-N concentrations than that with meat products when corn was used as source of energy. The same trend was observed when supplemented with urea which resulted in a higher $NH_3$-N concentration for the diet CBU than that of MBU. The rates of ammonia production in the rumen of sheep fed cottonseed cake either with corn or with bakery products supplemented with urea showed significantly higher rates of ammonia production. However, rates of production were lower with the diets containing meat products with corn or with bakery and urea. It could be explain this point b assuming that cottonseed cake is more degradable in the rumen than meat products (Table 7).

***Rumen volatile fatty acids (VFA's) concentrations and rates of production:***

Sheep fed CBU diet showed highest values (P<0.05) of overall mean of VFA's concentrations. Lowest (P<0.05) overall mean of VFA's concentrations was noticed for MB diet. Other diets showed comparable concentrations. When bakery products were used as a source of energy; higher concentrations of VFA's were observed with cottonseed cake than with meat products. The rates of VFA's production showed the same trend as VFA's concentrations as affected by sources of protein and energy in the rumen (Table 7).

***Rumen pH:***

The overall mean pH values (Table 7) ranged from 5.43 to 6.68 for diets CZ and MB with significant differences (P<0.05). The diets containing meat, meat and bakery or both with urea showed high pH values nevertheless the energy source, however cottonseed cake diet has almost the same pH values.

***Rumen volumes and rates of rumen outflow:***

Rumen volume values showed no significant differences between the experimental diets (Table 7). The overall mean revealed that high (P<0.05) rates of outflow from the rumen was obtained with sheep fed the MBU diet, while low (P<0.05) rates of outflow from the rumen was obtained with the MZ diet.

***Microbial protein synthesis:***

Microbial protein (MP) synthesis in the rumen of sheep fed the experimental diets is presented in (Table 7). Average values ranged from 19.5 to 70.8 g/d, for MB and CB diets, respectively. It was noticed that MP increased from 19.5 to 32.7 g/d as MB diet was supplemented with urea. On the other hand, when the CB diet was supplemented with urea, the MP decreased from 70.8 to 56.6 g/d. The cottonseed cake as a source of protein enhanced MP synthesis more than meat protein irrespective of the energy source (Table 7).

***Crude protein degradability of ingredients:***

Degradation of CP in the rumen of the ingredients used in this study (Table 8) showed that wheat bran, cottonseed cake and bakery products had higher values of rapid degradable fraction (*a*) in

**Table (5): Digestibility coefficients of the experimental diets fed to sheep.**

| Items | Experimental diets | | | | | |
|---|---|---|---|---|---|---|
| | MZ | CZ | MB | CB | MBU | CBU |
| Dry matter (DM) | 69.90 | 71.78 | 72.16 | 69.94 | 76.39 | 72.05 |
| Organic matter (OM) | 71.78 | 72.82 | 72.87 | 70.29 | 76.23 | 71.53 |
| Crude protein (CP) | $60.81^{b}$ | $64.57^{b}$ | $63.91^{b}$ | $60.45^{b}$ | $76.92^{a}$ | $68.56^{a}$ |
| Crude fiber (CF) | $47.90^{b}$ | $23.41^{d}$ | $59.83^{ab}$ | $65.83^{ab}$ | $72.70^{a}$ | $64.28^{ab}$ |
| Ether extract (EE) | $79.27^{b}$ | $85.64^{b}$ | $94.24^{a}$ | $82.11^{b}$ | $76.41^{bc}$ | $68.62^{c}$ |
| Nitrogen free extract | 77.05 | 82.66 | 73.62 | 71.87 | 76.72 | 74.07 |

$^{a-c}$ = Means in the same raw with different superscript are significantly differ (P<0.05)

**Table (6) : Nutritive values and nitrogen utilization in sheep fed on the experimental diets.**

| Items | Experimental diets | | | | | |
|---|---|---|---|---|---|---|
| | MZ | CZ | MB | CB | MBU | CBU |
| Nutritive values | | | | | | |
| Feed intake (gm DM/h/d) | $1056^{c}$ | $1046^{c}$ | $865^{d}$ | $950^{d}$ | $1127^{b}$ | $1238^{a}$ |
| TDN (%) | 71.69 | 67.9 | 76.80 | 69.85 | 76.91 | 70.96 |
| DCP (%) | $7.69^{b}$ | $8.12^{b}$ | $7.64^{b}$ | $7.11^{b}$ | $9.74^{a}$ | $8.28^{b}$ |
| Nitrogen utilization (g/h/d) : | | | | | | |
| N-Intake | $20.0^{b}$ | $21.0^{ab}$ | $15.8^{b}$ | $16.5^{b}$ | $22.7^{a}$ | $18.1^{b}$ |
| N-Absorbed (NA) | $11.1^{bc}$ | $13.5^{b}$ | $10.1^{c}$ | $10.1^{c}$ | $16.9^{a}$ | $12.6^{b}$ |
| N-Retention (NR) | $3.0^{bc}$ | $2.7^{c}$ | $4.5^{b}$ | $3.6^{c}$ | $7.6^{a}$ | $5.9^{ab}$ |
| NR % of NI | $10.0^{d}$ | $13.0^{d}$ | $28.7^{b}$ | $22.4^{c}$ | $33.5^{a}$ | $30.5^{ab}$ |
| NR % of NA | $27.0^{bc}$ | $20.1^{c}$ | $44.6^{a}$ | $34.9^{bc}$ | $44.5^{a}$ | $43.8^{a}$ |

$^{a-c}$ = Means in the same raw with different superscript are significantly different (P<0.05)

**Table (7): Overall mean of rumen parameters of sheep fed on the experimental diets.**

| Items | Experimental diets | | | | | |
|---|---|---|---|---|---|---|
| | MZ | CZ | MB | CB | MBU | CBU |
| $NH_3$-N concentrations (mg-N/100ml) | $9.2^{c}$ | $15.0^{a}$ | $8.6^{c}$ | $6.1^{d}$ | $11.4^{b}$ | $18.5^{a}$ |
| Rates of $NH_3$-N production (mg/100ml/hr) | $-0.2^{d}$ | $3.7^{a}$ | $1.3^{b}$ | $0.3^{c}$ | $0.5^{c}$ | $4.9^{a}$ |
| VFA's concentrations (m.eq/100ml) | $6.1^{b}$ | $6.9^{b}$ | $3.7^{d}$ | $6.6^{b}$ | $5.2^{c}$ | $7.9^{a}$ |
| Rates of VFA's production (m.eq/100ml/hr) | $1.3^{b}$ | $1.5^{b}$ | $0.8^{c}$ | $2.3^{a}$ | $1.2^{b}$ | $2.4^{a}$ |
| Rumen pH | $6.22^{c}$ | $5.43^{e}$ | $6.68^{a}$ | $5.95^{d}$ | $6.38^{b}$ | $5.44^{f}$ |
| Rumen volumes (L) | 5.4 | 6.3 | 5.2 | 8.6 | 5.3 | 4.7 |
| Rates of outflow ( %/hr) | $7.8^{a}$ | $15.8^{b}$ | $12.1^{c}$ | $12.8^{bc}$ | $18.7^{ab}$ | $13.4^{bc}$ |
| Microbial protein synthesis (g/h/day) | 34.3 | 48.8 | 19.5 | 70.8 | 32.7 | 56.6 |

$^{a-c}$ = Means in the same raw with different superscript are significantly differ (P<0.05)

the rumen, followed by corn and meat products. The lowest value was for rice straw. Corn showed the highest value ($P<0.05$) for fraction (*b*) being 63.54%. The lowest value ($P<0.05$) for fraction (*b*) was recorded for meat products and rice straw. The effective degradability calculated with an outflow rate of 5 % per hour (ED) of the protein in the corn, bakery and bran used as energy sources showed similar values. However, the cottonseed cake showed higher degradability (ED) value of protein than that of protein in meat products (Table 8).

***Economical evaluation:***

The free market price (LE/Ton) of the different mixtures used in the experiment is presented in (Table 9).

One ton of diet containing CZ was the most expensive one. Lower cost was obtained with diets containing urea. The same trend was observed when cost of kg of TDN or DCP was considered.

The diet contained meat, bakery and urea (MBU) showed higher cost of feed intake than those diets containing meat with bakery or cottonseed cake with bakery products.

## DISCUSSION

The meat and bakery products; market return, which would be considered in this work as meat and bakery products; differ from the processing wastes. The meat and bakery produced for human consumption is suitable for a definite period of time after which it is expired. In most cases after expiration date, these products are returned to their production sources and factories. If these products, were treated in different processing methods and reanalyzed for physical, chemical and microbiological factors they could be used as animal feed. This idea was the aim of the present work. The products used in the present work have constraints and some problems regarding moisture content, rancidity and microbial effects. These problems have been dealt with before using these products in formulating the diets used in the present work.

For moisture contents; the bakery products were dried at 100 $^0$C for 12 hrs. The meat products were dried at 140 – 150 $^0$C for 4 hrs under pressure 1.5 – 2 Kg/cm$^2$. The products were analyzed to assure that they are rancidity free.

Regarding the microbial analyses including; Total plate count, *Staphylococcus aureus, Coli form, E. Coli, Yeast, Salmonella* and *Moulds* have been examined. The results showed that most of these microorganisms were absent or within the safety range. Aflatoxins were (LOQ's) i.e. within permissible limits of quantification = 1.5 µg/ kg feed, which is within the level recommended by the Minister decree No. 1498/1996, FAO (1996) Feed and Nutrition paper No. 1380.

Special focus for meat products was primarily examined for human consumption. European Communities (EU, 2001) mentioned that it would mainly be required to move specific risk materials. The meat products; prepared primarily for human consumption were controlled by that decision i.e. deboned and haven't either spinal cord or brain. When these products were market-return, they had been used in formulating the present diets after being examined as previously mentioned. So they are free from BSE disease (Bovine Spongiform Encephalopathy).

The results obtained in the present work showed that bakery products are more suitable as energy source for animal feeding. Feed intake values increased as bakery products increased in the diet. The high concentration of the bakery products resulted in a significantly higher

**Table (8): Estimates of effective degradability of ingredients protein incubated in the rumen of sheep fed the experimental diets.**

| Ingredients | ( a ) | ( b ) | ( c ) | ( u ) | ED% |
|---|---|---|---|---|---|
| Meat products | $17.84^{d}$ | $29.75^{c}$ | $0.06^{c}$ | $52.41^{b}$ | $34.16^{d}$ |
| Bakery products | $19.87^{c}$ | $53.24^{b}$ | $0.08^{a}$ | $26.89^{d}$ | $52.80^{b}$ |
| U.C.S.M. | $25.03^{b}$ | $39.87^{c}$ | $0.06^{b}$ | $35.09^{c}$ | $48.28^{c}$ |
| Yellow corn | $18.23^{d}$ | $63.54^{a}$ | $0.08^{b}$ | $18.23^{e}$ | $56.95^{ab}$ |
| Wheat bran | $38.70^{a}$ | $53.60^{b}$ | $0.02^{e}$ | $7.70^{f}$ | $53.35^{b}$ |
| Rice straw | $6.13^{e}$ | $32.30^{d}$ | $0.03^{d}$ | $61.57^{a}$ | $19.09^{e}$ |

*,c Means in the same column with different superscript are significantly different (P<0.05)
( a ) : Rapidly soluble fraction; ( b ) : Slowly degradable fraction;
( c ) : The rate of degradation per hour of fraction ( b ); ( u ) : non degradable fraction;
ED : Effective degradability. $ED = a + \{bc / (c + k)\}$. K = 0.05

**Table (9): Cost of the mixed diets, cost of TDN and cost of DCP in diets fed to sheep (L.E.) .**

| Items | Experimental diets | | | | | |
|---|---|---|---|---|---|---|
| | MZ | CZ | MB | CB | MBU | CBU |
| Cost of feed mixtures (LE./ton) | 542.6 | 581.1 | 382.5 | 392.0 | 371.7 | 370.6 |
| Cost of TDN (LE/ton) | 772.7 | 855.3 | 498.0 | 561.2 | 483.3 | 526.0 |
| Cost of DCP (LE/Kg) | 7.23 | 7.15 | 5.00 | 5.9 | 3.81 | 4.64 |
| Cost of feed intake (p/d) | 57.0 | 61.0 | 33.0 | 37.0 | 44.0 | 46.0 |

Prices were as follow (L.E./ton): rice straw, 70; bakery products, 350; meat products, 450; U.C.S.C., 800; wheat bran, 700; yellow corn, 940; urea, 560; molasses, 340; salt, 120; limestone and mineral mixture, 2000.

feed intake. Sutton et al. (1987) showed that increasing concentrates up to 60% of dietary dry matter, increased feed intake, however, diets containing more concentrates over that level, generally depress dry matter intake (DMI). Urea supplements to both meat or cottonseed cake containing diets with bakery products (MBU or CBU) enhanced the feed intake to a significantly higher level than those containing no urea supplements; (MB, CB, MZ or CZ). The effect of urea supplement to the diets on DMI is not clear. Zinn (1995) reported an increase in DMI with urea supplementation in Holstein steers fed steamed flaked barley diets; stating that urea may serve as a buffer for high starch diets. However, Broman et al. (1973) and Shain et al. (1994) showed no effects on DMI due to urea supplementation. On the other hand Polan et al. (1976) and Thomas et al. (1984) showed a depressed DMI with urea supplementation. Urea effects may be dependent on the components of the diet.

Regarding the TDN values it seems that the diet containing meat, bakery products and urea (MBU) had higher digestibility coefficients for CP, CF, EE and NFE which lead to higher nutritive value than the diet containing cottonseed cake, bakery products and urea (CBU). These results could be due to high fat content of the meat products. The bakery products had the same effect, which improved the nutritive value of meat products or cottonseed cake containing diets than those containing corn. However, the improvement of the diets containing meat and bakery products were pronounced. This phenomena seems clear in the diet MBU that showed the highest value of TDN and digestible crude protein and a high feed intake.

Rumen fermentation results showed that meat products as source of protein are less degradable than cottonseed cake. The suitable rumen ammonia concentration for maximum microbial protein rate of synthesis as mentioned by Satter and Slyter, (1974); were to be between 5 to 8 mg N/100 ml rumen liquor, however, those mentioned by Leng and Nolan, (1984) were between 15 and 20 mg N/ml rumen liquor. Stock et al. (1995) illustrated a lower value for cottonseed meal (solvent) and soybean (solvent) by-pass proteins than that of meat by-pass protein. The present results verified this phenomenon since the data showed that the by-pass protein of meat products was higher than that of cottonseed cake. Maeng and Baldwin (1976) concluded that the shortage of N in the rumen media; ($NH_3$, amino acids or peptides) limited microbial growth and synthesis especially when diets containing a high concentration of ruminally non-degradable proteins are fed. The low ruminal degradability of protein may lead to a reduction in the available amount of energy, which is used for rumen microbial growth (Zerbini et al., 1988). Synchronization of ammonia and energy release for microbial protein synthesis in the rumen of sheep fed cottonseed cake diets had higher values than those fed meat products.

Nitrogen utilization was considered as the nitrogen balance index for absorbed nitrogen in sheep. Deif et al. (1968) suggested an advantage of comparing the biological value of proteins on the basis of the nitrogen balance index for absorbed nitrogen. This index is superior to N balance (as gm/d) for assessing the nutritive value of protein, because it is a measure of the extent to which the absorbed nitrogen is utilized by the animal. Borhami et al. (2002) showed that when the microbial protein synthesis in the rumen was low and rumen undegradable proteins were high in the diets; the nitrogen utilization

was high. The present results of rumen microbial protein synthesis and nitrogen utilization; (nitrogen balance as a percentage of nitrogen absorbed) verified this phenomenon.

Gado et al. (unpublished data; personal communication) found a better performance of lambs fed a diet containing MB with ZAD compound (a dried rumen bacteria) than the other diets.

## CONCLUSION

It could be concluded that bakery products could be used as a source of energy (up to 30%) of the diet with a supplement of meat products (5%) plus urea (1%) to give an economical and balanced diet for ruminants. This also could save the pollution hazards of burning and/or burying these products as market return materials.

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# إستخدام مرتجعات السوق من المنتجات الغذائية كأغذية للمجترات

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في تجربة لدراسة استخدام مرتجعات الأغذية في السوق كغذاء للمجترات، تم تكوين ستة علائق متكاملة اعتمدت على قش الأرز كأساس (٣٣%) مع أضافه مرتجعات اللحوم (٥ – ١٤% ) كمصدر للبروتين الحيواني وكسب القطن (١١ – ١٧% ) كمصدر للبروتين النباتي مع استخدام الذرة (٢٧%) ومرتجعات المخابز ( ٢٤ – ٣٧% ) كمصدر للطاقة وتم أضافه اليوريا بنسبة ١% لتحل محل جزء من البروتين. وقد غذيت العلائق الستة ل ٦ كباش برقى لتقدير معاملات الهضم والقيمة الغذائية وميزان الأزوت في حين استخدمت ٣ نعاج مزودة بفتحة مستديمة بالكرش لتقدير نشاط الكرش.

وقد أظهرت النتائج وجود فروق معنوية في معاملات هضم البروتين والألياف والدهن بينما لم تكن الفروق معنوية في معاملات هضم المادة الجافة والعضوية والكربوهيدرات الذائبة كما لم تكن هناك فروق معنوية في القيمة الغذائية للعلائق على صورة مجموع مواد غذائية مهضومة كلية حيث تراوحت بين ٦٨% لعليقه كسب القطن مع الذرة و٧٧% لمرتجعات المخابز واللحوم مع اليوريا في حين كانت الفروق معنوية في قيم البروتين الخام المهضوم حيث كان أعلاهم مع عليقه مرتجعات اللحوم والمخابز مع اليوريا (٩,٧٤%) مقارنا بباقي العلائق وسجلت نفس العليقه أعلى ميزان ازوت (٧,٦٤ جم/يوم) وأقل ميزان مع كسب القطن مع كلا من الذرة ومرتجعات المخابز (٢,٧٣ ، ٣,٥٩ جم/يوم على الترتيب).

تراوح تركيز الامونيا بالكرش بين ٦ – ١٨ ملليجرام/ ١٠٠ مل سائل كرش لعليقتى الكسب مع مرتجعات المخابز والمضاف إليها اليوريا بينما كان أعلى معدل لإنتاج الأمونيا مع عليقه الكسب مع الذرة (٤,٩٢ ملليجرام / ١٠٠ مل سائل كرش / ساعة) بينما أقل معدل (– ٠,٢ ملليجرام) فقد وجد مع عليقه مرتجعات اللحوم مع الذرة. بالنسبة لتركيز الأحماض الدهنيه الطيارة فكانت ٣,٦٧ ملليمكافئ/١٠٠ مل سائل كرش لعليقه مرتجعات اللحوم ومرتجعات المخابز أما عليقه الكسب مع مرتجعات المخابز واليوريا فكانت ٧,٩٢ ملليمكافئ/١٠٠ مل سائل كرش وقد لوحظ نفس الاتجاه مع معدل إنتاج الأحماض الدهنيه الطيارة. أوضحت النتائج أن أعلى أنتاج يومي للبروتين الميكروبي كان مع عليقه الكسب مع مرتجعات اللحوم (٧٠,٧٦ جم) وأقله مع عليقه مرتجعات اللحوم مع مرتجعات المخابز (١٩,٤٦ جم).

من هذه الدراسة يمكن الاعتماد على مرتجعات المخابز كمصدر جيد واقتصادي للطاقة وأن استخدامه مع مرتجعات اللحوم وأضافه اليوريا يمكن أن تحقق معه نتائج جيدة واقتصادية في تغذية الأغنام.