BAKERY BY-PRODUCTS AS UNCONVENTIONAL ENERGETIC SOURCE IN LAMBS FATTENING RATIONS
Salama, R.; Sh. M. Fouda and M. A. I. EL Sysy
Department of Animal Production, Faculty of Agriculture, Al-Azhar University, Nasr City, Cairo.

ABSTRACT

Twenty Finn-Ossimi crossbred male lambs with an average live body weight (14.50 Kg) were randomly assigned into five nutritional groups (each of 4 animals) to receive one of five complete mixed rations containing different percentages of dried bakery by-products (DBP) instead of ground yellow corn as unconventional energetic source. Experimental animals were allotted to one of the following rations in a fattening trial for 124 days; R1: yellow corn 50% and 0% bakery by-products (control ration), R2: yellow corn 37.5% and 12.5% DBP, R3: yellow corn 25% and 25% DBP, R4: yellow corn 12.5% and 37.5% DBP and R5: yellow corn 0% and 50% DBP. A digestibility and nitrogen balance trial were conducted to evaluate the nutritive values of the experimental rations. The effects of these rations on males fattening performance, rumen fluid parameters and economic efficiency were also investigated.

Results obtained showed that:
1- Unconventional energetic sources showed higher (P<0.05) effect on most of digestibilities coefficients of nutrients.
2- No significant differences in dry matter intake were observed, however, R3 recorded the higher intake value (1250 g/h/d) followed by R2 (1190 g/h/d), respectively.
3- R5 (100 % DBP substitute) showed higher (P<0.05) TDN % and DCP % values followed by R3 and R4, respectively.
4- Dried bakery by-products indicated similar positive effects on improving live body weight gain of the experimental animals, and without significant differences among them.
5- Ruminal pH, NH3-N and TVFA’s concentration had in general the normal distribution curve, since they increased at 3 hrs after feeding then decreased at 6 hrs later.
6- Dried bakery by products showed (P<0.05) effects on pH, NH3-N and TVFA’s concentrations in ruminal fluid. However, the control ration in general showed lower NH3-N and TVFA’s concentrations in comparison with the other experimental rations. On the contrary, the control ration recorded relatively higher pH value in compare with the other tested rations.
7- R4 (37.5 % DBP) was the most efficient feed utilization group among the different DBP groups, while R5 (50 % DBP) was the most economic one.
8- On the contrary, the control group was the most efficient feed utilization group in different feed terms.

INTRODUCTION

Lake of energy concentrates has emphasized the need for new sources of energy to minimize this lake on one hand, and partially spare imported yellow corn grains on the other hand. This can be achieve by using some energy by-products such as poultry fat (grease) or bakery by-products, which are potential sources of valuable nutrients of energy (Salama et al., 1996). Also, in the last few years, the world have unstable petrol price which are
reflected on grains price because of when the price of the petrol is high, corn grains was used to produce ethanol as an alternative car fuel.

Using bakery by-products, often (biscuit, also had high fat content) is a cheaper source of energy compared with corn grains. And although, dried bakery by-product (DBP) is often fed to farm livestock, little pertinent research is found in literature. Limited information has been reported on poultry (Arrington, 1965; Potter et al., 1971), swine (Arrington, 1965; Kornegay, 1974), cattle (Arrington, 1965; Kirk and Peacock, 1969) and sheep (Helal et al., 1998).

Consequently, knowledge of the composition of DBP fed to livestock is becoming more important and is necessary to use DBP more efficiently in animal diets. The variability in chemical composition of DBP was recently shown to be significant (Belyea et al., 1989; Arosemena et al., 1995), and methods to incorporate variable DBP into ration formula for economic evaluation are developed (St. Pierre and Harvey, 1986 a and b; Johnson et al., 1994). The use of rates of digestion and passage to calculate discount values for net energy in ruminant feeds (Van Soest and Fox, 1992) requires accurate estimates of these kinetic parameters and knowledge of factors that may affect these estimates.

The main objective of the present study was to evaluate the nutritive value of dried bakery by-products (DBP) as an energy source substitutes in sheep rations at different levels and its impact on crossbred male lambs daily gains, feed intakes, efficiency of feed utilization, nutrients digestibility, rumen parameters and economic efficiency for such rations.

**MATERIALS AND METHODS**

This experiment was conducted at the Experimental Animal Farm belongs to Faculty of Agriculture, Al-Azhar University for 124 days feeding period. Twenty crossbred local male lambs with an average live body weight (14.5 Kg) and 3 months age were randomly assigned into five nutritional treatments (each of 4 animals) to receive one of the experimental rations (Table 1). Animals were offered their diets ad lib, according to NRC requirements (1985) twice daily in two equal parts at 8.00 am and 5.00 pm. The amount of rations offered was adjusted every 2 weeks to ensure that rations were in excess of the voluntary intakes of the animals, while water and salt blocks were freely available to animals all the daytime.

Five experimental rations based mainly on yellow corn and biscuit residuals as (dried bakery by-product, DBP) different energy sources were tested in the study. The ingredients and chemical analysis of the experimental rations are presented in Table (1 and 2).
Orts were weighed every day before morning meal during the experimental period. Feed intakes were daily recorded, meanwhile, daily body weight gains were measured biweekly and feed conversions (kg feed intake/kg gain) were calculated. The cost of the experimental rations was also calculated according to the current market price for different feedstuffs in (2012).

Before initiating the fattening trial, digestibility trials were conducted (4 animals/ group), according to Abou Akkadda and El-Shazly (1958) to evaluate experimental rations nutrients digestibility and rations feeding values.

Samples of feedstuffs ingredients, complete mixed rations, residues and feces were analyzed for moisture, crude protein (CP), ether extract (EE), crude fiber (CF), nitrogen free extract (NFE), ash and urinary nitrogen according to A.O.A.C. (1990).

Rumen fluid samples were taken individually from three animals per each treatment at the end of field study, before feeding, and at 3 and 6 hrs after feeding using a stomach tube technique. The ruminal pH was measured immediately using the Orion 680 digital pH meter. Ammonia N concentrations were determined according to the method of Conway (1957), while TVFA’s concentrations were determined by steam distillation method as mentioned by Eadie et al. (1967).

Statistical analysis:
Data were analyzed using the general linear models procedure adopted by SAS (2009). Difference between means were tested for significance, using multiple range test, according to Duncan (1955). Analysis of variance of repeated measurement and least square means were applied using the following statistical model:

\[ Y_{ij} = \mu + T_i + R_j + E_{ij} \]

Where:
\[ Y_{ij} = \] the observation of the parameter measured
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\[ \mu = \text{overall means} \]
\[ T_i = \text{the effect of dietary treatment} \]
\[ R_j = \text{the effect of replication} \]
\[ E_{ij} = \text{the random error term} \]

**RESULTS AND DISCUSSION**

Chemical composition of experimental rations:

The chemical composition of the experimental rations is presented in Table (2). The chemical composition of the experimental rations showed almost similar DM content and OM contents.

Rations had almost similar chemical composition, however, rations contained dried bakery by-products (DBP) *i.e.* (2-5) showed relatively higher fat contents in compare with the control. Crude fiber values ranged between 6.27 to 10.01 % (Table 2) in an ascending order with the ratio of corn grains in the rations.

Table (2): Proximate chemical analysis and nutritive values of the experimental rations containing bakery by-products.

<table>
<thead>
<tr>
<th>Rations</th>
<th>Chemical composition, % DM</th>
<th>N. values</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>DM</td>
<td>OM</td>
</tr>
<tr>
<td>R1 control</td>
<td>90.40</td>
<td>92.01</td>
</tr>
<tr>
<td>R2</td>
<td>90.30</td>
<td>92.45</td>
</tr>
<tr>
<td>R3</td>
<td>90.81</td>
<td>93.26</td>
</tr>
<tr>
<td>R4</td>
<td>91.12</td>
<td>92.09</td>
</tr>
<tr>
<td>R5</td>
<td>91.42</td>
<td>92.81</td>
</tr>
</tbody>
</table>

a,b,c and d means with different letters in the same column are significantly (p≤ 0.05) different.

NFE values ranged between 64.40 to 67.04 %. It was of great interest to note that NFE in different experimental rations tended to increase with the higher portion of DBP included in the ration.

According to Champe and Church (1980) dried by-product is a variable mixture made up of surplus and unsaleable materials, collected from bakeries and other food processing plants. Such mixture is usually composed of about 10-12 % CP, 8 to 15 % EE and low levels of ash and fibers, the rest is starch and sugars. On the other hand, Arosemena et al. (1995) pointed out to considerable differences in bakery waste composition from corresponding values previously reported in the literature (NRC, 1999).

As a general conclusion incorporation of (DBP) in the ration in an ascending order, led to increase rations DM ,OM, CP,EE and NFE, and this result may be attributed to the proximate chemical composition of (DBP) which is relatively rich in such nutrients. On contrast, CF content for different experimental rations tended to decrease with the higher inclusion of DBP and
the lower proportions of corn grains. Ash content for different experimental rations tented to have almost similar values and ranged between 6.74% for R3 to as high as 7.99% for R1.

According to Kwak and Kang (2006), chemical composition of DBP was 89% DM; 98% OM; 9.5% CP; 9.3% EE; 1.3% CF and 2% ash.

The bakery by-product normally collected, ground, mixed and dried to a (DM) content of 90% or more. The mixture is usually composed of about 10 to 14% (CP), 8 to 15% (EE) and low levels of ash and fiber; the most of the rest are starch and sugars (Helal et al., 1998). Digestibility coefficients and nutritive values of the different experimental rations.

Results of nutrients digestibility (Table 3) showed significant differences (p<0.05) among different rations in all criteria. Dry matter digestibility showed significant differences (P<0.05) among the different experimental rations. Highest (P<0.05) DM digestibility coefficient was shown by lambs fed ration based mainly on 100% bakery by-products (R5) and the higher digestibility coefficient values for different feed nutrients. On the other side, R2 (12.5% DBP) recorded the lowest (p<0.05) DM digestibility value.

Similar results were obtained by Afzalzadeh et al. (2007), who pointed out to higher (p<0.05) DM degradability and digestibility values of the bakery waste (DBW) in compare with barley grains; (86.8% vs. 77.1% and 78.8% vs. 74.6%, respectively). This may be attributed to the high soluble material of bakery waste; about 85% of DBW was degraded within 24 hrs.

The same trend was also observed for OM digestibility. However, R5 recorded the highest (p<0.05) OM digestibility value. It was of interest to note that, including bakery by products improved (p<0.0) OM digestibility for rations in compare with the control group.

As for CP digestibility, values obtained pointed out to (p<0.05) differences among groups in favor of diets containing higher percentages of bakery by-products, while the highest (CP) digestibilities (p<0.05) were shown by lambs fed diet contained either 75% bakery by-product (R4) or (100% bakery by-product, R5) i.e. (84.24%) and (83.23%), but without significant difference between them and R1 and R2. The lowest (P<0.05) CP digestibility value (78.78%) was obtained by lambs fed diet contained 50% bakery by-product (R3).

CF digestibilities indicated significant (P<0.05) differences among groups, while R5 (100% bakery by-products) showed also the highest CF digestibility, while the lowest (p<0.05) CF digestibility was detected with the control group (R1). Improvement in CF digestibilities with more bakery by products incorporated into the diets may be due to higher soluble carbohydrates and sugars, provided through such energy source or due to the lower fiber content of DBP (Table 2).
Table (3): Digestion coefficients and nutritive values of the experimental rations containing bakery by-products.

<table>
<thead>
<tr>
<th>Item</th>
<th>( R_1 ) (control)</th>
<th>( R_2 )</th>
<th>( R_3 )</th>
<th>( R_4 )</th>
<th>( R_5 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>DM intake g/h/d</td>
<td>1021.6 ±172.30</td>
<td>1189.9 ±45.50</td>
<td>1250.0 ±5.80</td>
<td>1173.3 ±6.50</td>
<td>1167.70 ±0.030</td>
</tr>
<tr>
<td>Digestibility Coeff.%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DM</td>
<td>69.47 ±0.14</td>
<td>67.13 ±1.11</td>
<td>70.27 ±0.85</td>
<td>69.25 ±0.40</td>
<td>73.74 ±0.90</td>
</tr>
<tr>
<td>OM</td>
<td>75.85 ±0.30</td>
<td>72.97 ±2.80</td>
<td>76.67 ±0.85</td>
<td>76.65 ±0.55</td>
<td>79.56 ±0.99</td>
</tr>
<tr>
<td>CP</td>
<td>82.03 ±2.40</td>
<td>80.39 ±1.60</td>
<td>78.78 ±1.80</td>
<td>84.24 ±0.90</td>
<td>83.23 ±0.26</td>
</tr>
<tr>
<td>CF</td>
<td>52.86 ±3.66</td>
<td>54.36 ±2.12</td>
<td>56.29 ±1.60</td>
<td>56.25 ±3.40</td>
<td>60.43 ±1.30</td>
</tr>
<tr>
<td>EE</td>
<td>72.81 ±0.62</td>
<td>75.76 ±0.13</td>
<td>73.68 ±1.09</td>
<td>77.08 ±2.12</td>
<td>78.50 ±0.18</td>
</tr>
<tr>
<td>NFE</td>
<td>78.80 ±0.20</td>
<td>72.94 ±0.90</td>
<td>81.58 ±1.50</td>
<td>80.08 ±1.30</td>
<td>84.58 ±1.23</td>
</tr>
<tr>
<td>Nutritive Values (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TDN</td>
<td>75.30 ±0.30</td>
<td>73.28 ±0.67</td>
<td>77.66 ±0.86</td>
<td>76.91 ±0.34</td>
<td>79.61 ±0.86</td>
</tr>
<tr>
<td>DCP</td>
<td>9.43 ±0.28</td>
<td>9.73 ±0.20</td>
<td>9.69 ±0.22</td>
<td>10.48 ±0.10</td>
<td>10.82 ±0.03</td>
</tr>
<tr>
<td>C/P ratio</td>
<td>7.99 ±0.27</td>
<td>7.54 ±0.23</td>
<td>8.02 ±0.10</td>
<td>7.33 ±0.04</td>
<td>7.36 ±0.06</td>
</tr>
</tbody>
</table>

a, b, c and d, means with different letters in the same row are significantly (\( p \leq 0.05 \)) different.

As for (EE) digestibility, values obtained pointed out to (\( p<0.05 \)) differences among groups in favor of the experimental groups which containing the bakery-by-product. In contrast, the lowest (\( p<0.05 \)) EE digestibility was detected with the control group. Such result may be related to source of energy incorporated onto rations formula i.e. biscuits and bread by-product which are rich in their fat contents.

Highest (\( p<0.05 \)) digestibility coefficient value of nitrogen free extract (NFE) was shown by lambs fed the fifth diet (100% bakery by-product) and without significant difference with \( R_5 \). Such higher NFE digestibility values may be attributed to source of energy used, being nonstructural carbohydrates i.e. 50 and 100 % biscuits, respectively.

El-Mahallawi (2009) found that the higher (\( p<0.05 \)) digestibility coefficient value of nitrogen free extract (NFE) was shown by lambs fed the control diet (100 % corn grains) and without significant difference with \( R_2 \) (100 % DBP).

According to Champ and Church (1980), utilization of bakery waste at 20 and 40 % of sheep ration led to increase (\( p<0.05 \)) rations digestibility.

Feeding values of the experimental rations expressed in terms of TDN and DCP are presented in (Table 3). Highest TDN value was observed with
diet contained 100% bakery by product, (79.61%) followed by R3 and R4 which contained 50 and 75% bakery by-product, but without significant differences between them. While the lowest TDN value was recorded by the diet contained 25% bakery by-product (R2) and the control group (73.28% and 75.30%, respectively). Similar results were reported by El-Mahallawi (2009) who pointed out to, higher TDN values for different rations containing bakery by products as an energetic source.

As for DCP value; R5 and R4 rations recorded higher values in comparison with the other experimental rations, (10.82 and 10.48%), respectively. The lowest DCP value (9.43%) was observed with the control diet. The high DCP content of both of R5 and R4 diets may be related to its higher DBP content i.e. 37.5 and 50%, respectively (Table 1) or/and its high CP content i.e. 12.45 and 13%, (Table 2), besides the higher (P< 0.05) digestibility of such rations (Table 3).

Nitrogen utilization:

Results obtained in (Table 4) indicated significant differences among different groups in different nitrogen balance (NB) criteria, except ND and NB. As for NI, R3 and R5 groups consumed the higher (P< 0.05) daily N value (24.60 and 24.47 g/h/d respectively). While the lowest (P<0.05) NI was shown by R1 diets (18.80 g/h/d). Both of R2 and R1 showed an intermediate values i.e. 23.04 and 23.37 g/h/d, respectively.

As for ND, R5 lambs digested more dietary N compared with different groups, while the control group recorded the lowest insignificant ND values i.e. (15.65 g/h/d). The lower ND by the control lambs may be referred to its lower NI for such ration (18.80 g/d/h, Table 4).

As for excreted fecal N, R3 recorded higher excretion. 5.22 g/h/d and without significant difference with R2 (4.54 g/h/d). The control group excreted lower (P<0.05) fecal N value (3.14g/h/d). Urinary excreted N exhibited significant differences among different experimental groups. Higher (P<0.05) excreted urinary N value were recorded by R4 (7.07 ml/h/day). Both of R2, R3 and R5 had almost similar urinary N values (3.72, 3.74 and 3.40 ml/h/day, respectively) and without significant differences among them. The lower urinary N value was detected with the control group. It was of interest to note that there were higher fecal and urinary N excretion for those lambs consumed higher NI, but lower one with the lower NI (control). This evidence may suggested that: (1) Incorporation of DBP in the experimental rations led to increase rations CP content, (Table 2). (2) Such higher N content due to DBP inclusion was more excess than the daily lambs requirements. (3) That excessive dietary N content might be excreted in both feces and urine to maintain normal and positive N balance for growing lambs.
Table (4): Nitrogen balance of different experimental rations containing bakery by-products.

<table>
<thead>
<tr>
<th>Item</th>
<th>R&lt;sub&gt;1&lt;/sub&gt; (control)</th>
<th>R&lt;sub&gt;2&lt;/sub&gt;</th>
<th>R&lt;sub&gt;3&lt;/sub&gt;</th>
<th>R&lt;sub&gt;4&lt;/sub&gt;</th>
<th>R&lt;sub&gt;5&lt;/sub&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Utilization of dietary N (g/h/d)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nitrogen intake NI</td>
<td>18.80&lt;sup&gt;b&lt;/sup&gt; ±3.16</td>
<td>23.02&lt;sup&gt;ab&lt;/sup&gt; ±0.88</td>
<td>24.60&lt;sup&gt;a&lt;/sup&gt; ±0.12</td>
<td>23.37&lt;sup&gt;ab&lt;/sup&gt; ±0.13</td>
<td>24.47&lt;sup&gt;a&lt;/sup&gt; ±0.003</td>
</tr>
<tr>
<td>Fecal N FN</td>
<td>3.14&lt;sup&gt;c&lt;/sup&gt; ±0.12</td>
<td>4.54&lt;sup&gt;ab&lt;/sup&gt; ±0.55</td>
<td>5.22&lt;sup&gt;a&lt;/sup&gt; ±0.42</td>
<td>3.68&lt;sup&gt;bc&lt;/sup&gt; ±0.21</td>
<td>4.1&lt;sup&gt;bc&lt;/sup&gt; ±0.06</td>
</tr>
<tr>
<td>Urinary N UN</td>
<td>2.35&lt;sup&gt;a&lt;/sup&gt; ±0.58</td>
<td>3.72&lt;sup&gt;ab&lt;/sup&gt; ±0.88</td>
<td>3.74&lt;sup&gt;ab&lt;/sup&gt; ±1.2</td>
<td>7.07&lt;sup&gt;a&lt;/sup&gt; ±1.80</td>
<td>3.40&lt;sup&gt;b&lt;/sup&gt; ±0.01</td>
</tr>
<tr>
<td>N digested ND</td>
<td>15.65 ±3.05</td>
<td>18.49 ±0.33</td>
<td>19.38 ±0.53</td>
<td>19.68 ±0.08</td>
<td>20.37 ±0.06</td>
</tr>
<tr>
<td>Nitrogen balance NB</td>
<td>13.31 ±2.81</td>
<td>14.77 ±0.55</td>
<td>15.64 ±0.67</td>
<td>12.61 ±1.74</td>
<td>16.98 ±0.58</td>
</tr>
<tr>
<td>NB/NI, %</td>
<td>69.93±3.38</td>
<td>64.68±4.88</td>
<td>63.66±3.04</td>
<td>53.86±7.14</td>
<td>69.36±0.23</td>
</tr>
<tr>
<td>NB/ND, %</td>
<td>84.80±3.13</td>
<td>80.13±4.43</td>
<td>81.17±5.70</td>
<td>64.21±9.10</td>
<td>83.32±0.02</td>
</tr>
</tbody>
</table>

a, b and c means with different letters in the same row are significantly (p≤0.05) different.

As for NB, it was evident that, all experimental rations showed positive NB, however, R<sub>5</sub> retained more insignificant dietary N values (16.98 g / h/d). Both of R<sub>2</sub> & R<sub>3</sub> lambs ranked second (14.77 and 15.64 g/h/d) and were higher than the control group. R4 lambs group indicated the lower insignificant NB (12.61 g / h/d). Similar results were reported by El-Mahallawi (2009). However, NB values reported herein are higher than those obtained by El-Mahallwi (2009), which might be referred to age of lambs used by the worker (12 months old) and heavier final market weight 65 kg on the average. A stage of life cycle which are mainly characterized by complete muscular growth and lower daily N retention.

Nitrogen balance / NI, % showed (P<0.05) differences among groups in favor of R1 and R5 due to either their lower NI or lower excreted N.

NB / ND, % revealed similar trends, as R<sub>1</sub> followed by R<sub>5</sub> showed the higher (P<0.05) percentages in this criterion, but without significant differences with R<sub>2</sub> and R<sub>3</sub>, lambs of R<sub>4</sub> recorded the lower percentage value (64.21 %).

Effect of experimental rations on some ruminal parameters:

The effect of experimental rations on some ruminal liquor parameters are shown in (Table 5).

**pH value:**

pH values showed significant differences (P<0.05) among different nutritional groups at different measuring times. However, pH values at 0 time indicated, in general lower (p<0.05) values and increased (p< 0.05) at 3 hrs post feeding and tended to decrease again, at 6 hrs post feeding.

Data presented in (Table 5) pointed out to significant differences (p<0.05) among different experimental groups as a general evidence. However, both of the control group (R<sub>1</sub> and 100% corn grains) and R<sub>5</sub> (100%
DBP) indicated higher (p<0.05) values in comparison with the other experimental rations (combined mixed energy sources).

It was also noticeable that, pH values as a general means tended to increase linearly (p<0.05) as the incorporated proportion of DBP in the ration increased i.e. (25, 50, 75 and 100 % DBP). Values were 6.32, 6.34, 6.38 and 6.57 respectively.

The lower ruminal pH values for R3, R5 and R4 (25, 50 and 75% bakery by-product) might be due to the highly fermentable carbohydrate in such rations (starch and sugars) which led to decrease the ruminal pH.

**NH3-N (mg/100 ml):**

Data presented in (Table 5) indicated significant differences (p<0.05) among different experimental groups before feeding. NH3-N at 0 time; ranged between 24.69 for R2 to 40.80 mg/100 ml. for R5. At 3 hrs after feeding, different experimental groups showed higher (p<0.05) NH3-N values and ranged between 36.06 mg/100 ml. for the control group (R1) to as high as 57.06 mg/100ml for R3 (50% corn grains and 50 % DBP).

**Table (5): Effect of experimental rations on some ruminal parameters.**

<table>
<thead>
<tr>
<th>Item</th>
<th>sampling time (hours)</th>
<th>R1 (control)</th>
<th>R2</th>
<th>R3</th>
<th>R4</th>
<th>R5</th>
<th>Means SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>0</td>
<td>6.60</td>
<td>6.10</td>
<td>6.36</td>
<td>6.46</td>
<td>6.56</td>
<td>6.42b±0.76</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>7.70</td>
<td>7.46</td>
<td>6.90</td>
<td>7.00</td>
<td>7.26</td>
<td>7.26a±0.76</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>5.66</td>
<td>5.40</td>
<td>5.76</td>
<td>5.66</td>
<td>5.86</td>
<td>5.67c±0.76</td>
</tr>
<tr>
<td>Means SE</td>
<td></td>
<td>6.65±0.169</td>
<td>6.32±0.169</td>
<td>6.34±0.169</td>
<td>6.38±0.169</td>
<td>6.57±0.169</td>
<td>5.45±0.98</td>
</tr>
<tr>
<td>NH3-N (mg/100ml)</td>
<td>0</td>
<td>26.69</td>
<td>24.86</td>
<td>25.56</td>
<td>29.66</td>
<td>40.80</td>
<td>29.57±1.62</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>36.06</td>
<td>53.9</td>
<td>57.06</td>
<td>48.30</td>
<td>52.5</td>
<td>49.56a±1.62</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>33.56</td>
<td>28.66</td>
<td>33.6</td>
<td>39.56</td>
<td>39.2</td>
<td>34.92b±1.62</td>
</tr>
<tr>
<td>Means SE</td>
<td></td>
<td>32.20±3.63</td>
<td>35.81bc</td>
<td>38.74ab</td>
<td>39.18ab</td>
<td>44.17a</td>
<td>38.02±2.98</td>
</tr>
<tr>
<td>TVFA’s (meq/100ml)</td>
<td>0</td>
<td>31.00</td>
<td>35.50</td>
<td>28.00</td>
<td>23.26</td>
<td>26.76</td>
<td>28.90c±0.97</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>39.00</td>
<td>43.50</td>
<td>35.76</td>
<td>42.26</td>
<td>38.00</td>
<td>39.70a±0.97</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>31.50</td>
<td>35.76</td>
<td>34.26</td>
<td>39.00</td>
<td>33.00</td>
<td>34.70b±0.97</td>
</tr>
<tr>
<td>Means SE</td>
<td></td>
<td>33.83b±2.17</td>
<td>38.25a±2.17</td>
<td>32.68±2.17</td>
<td>34.84ab±2.17</td>
<td>32.59b±2.17</td>
<td>34.44b±1.25</td>
</tr>
</tbody>
</table>

a, b and c means with different small letters in the same row are significantly (p≤0.05) different, while different capital letters in the same column indicated significance at (p≤0.05).
At 6 hrs after feeding, different experimental groups tended to have lower NH₃-N concentrations (34.92 mg/100ml on the average), but higher than the corresponding values at 0 time. The lower or higher (p<0.05) ruminal NH₃-N values may be related to the synthesized microbial protein in the rumen and both the two values were greatly affected by nitrogen intake level and its source. It was of great interest to note that ruminal NH₃-N concentration showed lower (p<0.05) value (32.20 mg/100ml), for R1 group (100% corn grains), and tended to increase (p<0.05) linearly as the proportion of corn grains in the ration decreased.

This result may lead to suggest that corn grains as a highly fermentable carbohydrate source was intensively utilized by ruminal microorganisms to synthesis more microbial protein, hence led to decrease NH₃-N appearance in rumen liquor. And as the proportion of such fermentable carbohydrates in the ration (corn grains) decreased i.e. (rations from 2-5) the amount of ruminal microbial NH3-N synthesized tended to be decrease and that detected in rumen liquor was apparently increased (p<0.05), as it becomes more excess and capable to be synthesized and withdrawn by ruminal microflora.

In general, NH₃-N concentrations indicated significant differences among different experimental groups at different measuring times, tended to show a normal distribution curve. Higher (P<0.05) value (44.17 mg /100 ml) was detected with R5 diet, but lower (P<0.05) one (32.20 mg /100 ml) with R1 (100 % corn grains). Different (DBP) incorporation in the experimental rations (from 2-5) led to increase ruminal NH₃-N value, suggesting lower microbial protein synthesis in compare with the control ration (100 % corn grains).

Many different studies pointed out to an appropriate microbial protein synthesis in condition of; an abundant NH₃-N release accompanied with an abundance of highly soluble carbohydrates. Such above results regarding ruminal NH₃-N concentrations might lead to suggest also that fat and oil included in DBP manufacture led to inhibit to somehow the available fermentable carbohydrate needed by ruminal microorganisms to synthesis the microbial protein. Hence, rations contained higher proportion of DBP tended to exhibit higher ruminal unsynthesised NH₃-N, indicating higher apparent ammonia values.

**Total VFA's concentrations (meq / 100 ml):**

Data presented in (Table 5) indicated significant differences (P<0.05) among different experimental groups in TVFA's concentration, at different measuring times.

However, different groups tended to have lower TVFA's concentration at 0 time (before feeding) which tend to increase at 3 hrs post feeding and to decline again at 6 hrs post feeding. While R2 recorded the highest value (38.25 meq / 100 ml) followed by R4 (34.84 meq /100 ml), but without significant difference between them. While R1, R3 and R5 diets ranked second, and without significant differences with R4.

The higher significant and/or insignificant TVFA's values recorded by DBP groups in the present study in compare with the control group, might be referred to the higher soluble sugars in bakery wastes, which might in turn
lead to significant differences in volatile fatty acids synthesis by ruminal microorganisms. Similar results were reported by Afzalzadeh et al. (2007).

Growth performance of Finn-Ossimi crossbred male lambs fed different dietary energy sources.

Data presented in (Table 6) showed growth performance of Finn–Ossimi crossbred male lambs fed the different experimental rations.

As shown, there were insignificant differences among different experimental groups neither in final live body weight nor in total body weight gain (kg). The similar trend was also noticed in different daily gain terms in (gm); however, both of R₁ and R₄ indicated relatively higher daily gains i.e. 202 g/h/d. While R₂ group recorded the lower insignificant gain (181 g/h/day). Such results may pointed out to; 1- satisfied performance of the local fattened male lambs at such age (3-7 months age); 2- an appropriate ration formula which led to satisfy growing lambs daily requirements, 3- the importance of bakery by products as unconventional energy source might performed to corn grains in covering fattened male lambs daily energy requirements, but at more economic price. As shown in (Table 6), growth rate for different DBP didn’t differ significantly from that of the corresponding control one. Results of feed intake for different experimental groups indicated also insignificant intake values in term of DMI/h/day, however, R₅ recorded higher insignificant intake value (1250 g/h/day and 22% higher than that of the control group intake).

Feed intake for different experimental groups in term of TDN, indicated significant differences among groups. R₅ and R₆ recorded higher (p<0.05) TDNI/h/day. This result might be referred to either the higher DMI of the ration (R₅) or to the higher TDN value of ration (79.61 % TDN, Table 3).

As for DCPI/h/day, significant differences were detected among groups. Both of R₄ and R₆ indicated higher (p<0.05) DCPI/h/day (122.9 and 127 g/h/day, respectively). This result might be also referred to the higher DCP content of such rations, (Table 3) i.e.10.48 and 10.82 % DCP, respectively.

Feed conversion for different experimental groups as a good indicator to animal performance indicated insignificant differences among groups as kg DMI/kg gain. Feed conversion ratio ranged between 5.06 for R₁ to 6.57 DMI/kg gain for R₂.
Table (6): Means ± SE body weight gain, feed intake, feed conversion and economic efficiency for crossbred local male lambs during the field study.

<table>
<thead>
<tr>
<th>Item</th>
<th>R1</th>
<th>R2</th>
<th>R3</th>
<th>R4</th>
<th>R5</th>
<th>R6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Av. b w gain ± SE</td>
<td>14.25 ± 0.75</td>
<td>14.5 ± 1.5</td>
<td>14.25 ± 1.30</td>
<td>14.5 ± 1.55</td>
<td>14.5 ± 1.19</td>
<td></td>
</tr>
<tr>
<td>Av. Initial B.W (kg)</td>
<td>39.25 ± 2.25</td>
<td>37.00 ± 3.00</td>
<td>38.75 ± 0.95</td>
<td>39.50 ± 2.33</td>
<td>39.25 ± 0.29</td>
<td></td>
</tr>
<tr>
<td>Av. Final B.W (kg)</td>
<td>25.00 ± 1.73</td>
<td>22.50 ± 1.71</td>
<td>24.50 ± 0.86</td>
<td>25.00 ± 2.27</td>
<td>24.75 ± 1.40</td>
<td></td>
</tr>
<tr>
<td>Daily gain (g)</td>
<td>202 ± 13.96</td>
<td>181 ± 13.77</td>
<td>198 ± 6.98</td>
<td>202 ± 16.23</td>
<td>200 ± 11.10</td>
<td></td>
</tr>
<tr>
<td>Growth rate (%)*</td>
<td>175 ± 10.65</td>
<td>155 ± 10.53</td>
<td>172 ± 21.1</td>
<td>172 ± 25.03</td>
<td>171 ± 14.15</td>
<td></td>
</tr>
<tr>
<td>Growth rate/ control</td>
<td>100 ± 0.07</td>
<td>89 ± 7.12</td>
<td>101 ± 13.63</td>
<td>102 ± 16.62</td>
<td>100 ± 11.73</td>
<td></td>
</tr>
<tr>
<td>Daily feed intake ±SE</td>
<td>1022 ± 172</td>
<td>1190 ± 45.50</td>
<td>1250 ± 6.80</td>
<td>1173 ± 5.50</td>
<td>1177 ± 3.00</td>
<td></td>
</tr>
<tr>
<td>DMI / control</td>
<td>100 ± 6.7</td>
<td>116 ± 15.67</td>
<td>122 ± 6.43</td>
<td>115 ± 12.19</td>
<td>115 ± 10.00</td>
<td></td>
</tr>
<tr>
<td>TDNI, g/h/d</td>
<td>769 ± 1.90</td>
<td>872 ± 4.25</td>
<td>970 ± 5.38</td>
<td>902 ± 2.07</td>
<td>937 ± 5.27</td>
<td></td>
</tr>
<tr>
<td>DCPI, g/h/d</td>
<td>96 ± 1.70</td>
<td>115.8 ± 1.37</td>
<td>121 ± 1.37</td>
<td>122.9 ± 0.62</td>
<td>127 ± 0.80</td>
<td></td>
</tr>
<tr>
<td>Feed conversion (FC) ± SE</td>
<td>5.06 ± 0.00</td>
<td>6.57 ± 0.39</td>
<td>6.32 ± 0.39</td>
<td>5.81 ± 0.14</td>
<td>5.89 ± 0.02</td>
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</tr>
<tr>
<td>DMI/kg gain (kg)</td>
<td>100 ± 0.00</td>
<td>129 ± 14.40</td>
<td>124 ± 6.43</td>
<td>115 ± 7.19</td>
<td>116 ± 6.85</td>
<td></td>
</tr>
<tr>
<td>TDNI/kg gain (kg)</td>
<td>3.80 ± 0.26</td>
<td>4.82 ± 2.29</td>
<td>4.90 ± 0.11</td>
<td>4.47 ± 0.42</td>
<td>4.69 ± 0.34</td>
<td></td>
</tr>
<tr>
<td>DCPI/kg gain (g)</td>
<td>477 ± 3.43</td>
<td>639 ± 3.92</td>
<td>611 ± 1.41</td>
<td>608 ± 5.87</td>
<td>636 ± 4.76</td>
<td></td>
</tr>
<tr>
<td>Economical efficiency± SE</td>
<td>9.19 ± 0.74</td>
<td>11.33 ± 0.80</td>
<td>10.51 ± 0.28</td>
<td>8.95 ± 0.39</td>
<td>8.53 ± 0.65</td>
<td></td>
</tr>
<tr>
<td>Feed cost /kg gain (LE)</td>
<td>18.81 ± 0.74</td>
<td>16.67 ± 0.80</td>
<td>17.49 ± 0.28</td>
<td>19.05 ± 0.39</td>
<td>19.47 ± 0.65</td>
<td></td>
</tr>
</tbody>
</table>

a,b,c and d means with different superscripts in the same row are significantly (p≤0.05) different

*Growth rate%=total BW gain (kg) /Initial LBW (kg) ×100
**Selling market price in 2011= 28 L.E /kg live body weight.

However, different feed conversion ratios for different experimental groups were more satisfying from the nutritional and economic point of view. And as general evidence, most of bakery by-products groups exhibited an equal or might have more efficient feed utilization values in compare with the
control group (R1); a result which might favored DBP to substitute corn grains as a comparable substitute energy source, but at more economic feed costs.

Feed conversion in terms of TDNI and DCPI/kg gain, was shown to differ significantly among groups, and the significant difference in feed utilization in such terms might be referred to the nutritive value of the ration, not more.

Reverse results were reported by Guiroy et al. (2000), who found that incorporation of bread by-products at 55% of the diet (substituted for 75% of corn) significantly improved feed efficiency by 8.1% although ADG was not statistically affected. Similarly, Milton and Brandt (1994), pointed out to linear depression in DM intake without differences in ADG when corn was replaced with dried bakery product (0, 15 and 30% replacement of corn).

Such contrary results with that recorded herein our study might be attributed to the considerable differences in such variable by-product, animal species (poultry, pigs, sheep, cattle, etc…), finishing stage and percent of ration substitution.

Economic efficiency for different experimental groups differed significantly in terms of feed cost and net profit value/group. And in different cases and as a general evidence, bakery by-products groups were more economic or and indicated comparable or higher net profit values in compare with the control group one, (9.19 LE/kg feed cost and 18.81 LE net profit value). On contrast, lambs of R2 recorded the lower daily gain (181 g/h/day), the poorest feed conversion ratio, the higher (p<0.05) feed cost and the lower net profit value (16.67 LE/kg gain) and without significant difference with both of (R1 & R3) groups, respectively.

On the light of the present results, it could be recommended to incorporate DBP in lambs fattening rations up to 100% as a complete replacement of yellow corn; and for more economic substitution.

In corporation of DBP in fattening rations of the ruminants might contribute to the marginal field of ruminants energy resources and spare corn grains to more necessities i.e. human feeding and poultry nutrition.

REFERENCES


Salama, R. et al.


مخلفات المخابز كمصدر غير تقليدى للطاقة فى علائق التسمين لذكور الحملان
رضاء رضوان محمد، شوقي مصباح فوده و محمود عبد الفتاح السيسى
قسم الإنتاج الحيواني - كلية الزراعة - جامعة الأزهر – مدينة نصر – القاهرة.

استخدمت هذه الدراسة 20 من حملان الذكور خليط فلتيندسي أسيسي متوسط وزن 14.5 كجم وزن حي ونسمة ثلاثة أشهر - تم تقسيمها عشوائياً إلى خمس مجموعات متساوية (أربعة مجموعات / مجموعة). - حيث تم تغذيتها على خمسة علاقات متناوبة (أحيانًا على كسر البيسكيت كمصدر للطاقة بSeleccione كمصدر غير تقليدي للطاقة استبدالًا من النسب المقابلة من الأذية الصفراء (كمسودة تقليدي لطاقة العلاقات) وكانت نسب الإحلال بين كسر البيسكيت والأذية الصفراء كمصدر للطاقة في العلاقات الجريبية كما يلي:

- علبة المقارنة 100% أذية صفراء (حيث تمثل الأذية 50% من العلبة الكلية) + كسر بيسكيت، العلبة الثانية 75% أذية صفراء + 25% كسر بيسكيت، العلبة الثالثة 50% أذية صفراء + 50% كسر بيسكيت، العلبة الرابعة 25% أذية صفراء + 75% كسر بيسكيت – واستمرت التجربة لمدة 124 يومًا، حيث تم إجراء تقييم غذائي لمعالات اليم أذية العلاقات قبل بداية التجربة، كما جرى تقييم ميزان الأذية للعلاق وكذا التعرف على صفات التخمر لسائل الكرش (الأم الهيدروجيني، تركز الأمليكونيا، والإحماض الدهنية الطيارة الكلية).

وقد أظهر النتائج المتصل عليها ما يلي:

1- أظهرت العلاقات المتحولة على كسر البيسكيت (العلبة من 5-2) قيمةً محسنة أعلى بالمقارنة بمعملة المقارنة (100% أذية صفراء) .
2- لم تكون هناك اختلافات معنوية بين العلاقات المختلفة علماً في معدل المكمل البولي لرواس وإن أظهرت العلامة رقم 3 معالات أعلى للعلاقة (بدون مغلفة) وتبعها معاملة رقم 2 (المحرة 75% أذية صفراء + 25% كسر بيسكيت).
3- أظهرت العلامة رقم 5 (100% كسر بيسكيت) أعلى قيمةً محسنة عليها بالمركبات المتميزة الكلية للعلاق والمحتوى من البروتين الكل。”

- لم يتضح أي فرق معنوي بين علاقات المحتجزة على معدلات نمو الحملان المختارة
- أظهرت العلاقات المحتجزة مع فرق معنوي في صفات التخمر لسائل الكرش لـ pH، pH (الأمليكونيا، كمية الأحماض الدقيقة (كالكلي) بين العلاقات المختلفة، وإن سجلت علبة المقارنة (100% أذية صفراء) أعلى درجة أس هيروجيني بين العلاقات وأقل درجة تركيز أمليكونيا في سائل الكرش، كما كانت هناك فرق معنوي بين أزمة القئس - حيث أرتفعت معدلات الفصل الأكيل خلف الالك.

وتانتقى بعد 3 ساعات ثم زادات بعد 6 ساعات ولكن بصورة أقل من القيم المقابلة عنها قبل الأكيل.
- لم تكن هناك فروق معنوية بين المعاملات في معلمات التحويل الغذائي على صورة كجم مادة جافة مكملة. فإن ظهرت فروق معنوية بين المعاملات الغذائية المختلفة باستخدام مقاييس البروتين، مهضمومية الكركميات، مهضمومية الكلي، كجم زيادة في الوزن لصالح مجموعة المقارنة،火花 سجلت جميع المجموعات قيمًا تحويلية مرتفعة بالقياس للقيم المدارجة والمتطرف على حسباً

7- سجلت المجموعين الرابع والخامسة أفضل معدلات تحويل غذائي عموديًا بين المجموعات التي استخدم فيها كسر البلسويك كمعدل استبديال بنسبة 75% 200% من الأذرة الصفراء, وكانت قيمة التحويل الغذائي كالآتي للمجموعتين الرابعة والخامسة 5.89 5.81 على الترتيب كجم مادة جافة مكملة ككجم زيادة في الوزن (4.47 4.46 كجم مهضمومات مكملة و 522% كجم زيادة في الوزن في الوزن وإن كانت بمجموعة المقارنة عموماً هي الأفضل في قيم التحويل الغذائي على أساس الماداة الجافة والمركبات المهيمنة الكلية والبروتين المهيمن.

8- سجلت المعاينة الخامسة (200% إحلال للأذرة الصفراء بكم بلسويك) أقل كلفة وأفضل عند مادة / كجم زيادة وزنية مقارنة بالعديد المعاين الجيد على كسر البلسويك. وعلى ضوء النتائج المتغيرة يمكن استنتاج أن زيادة في علاج الجسم من المسمى 100% كسر البلسويك كمصدر غذائي تلقائي للطاقة وتكلفة أقل مما يساعد في مساعدة مصادر الطاقة المتاحة لتسهيل المجيترات، وكذا توفير الأذرة الصفراء كمصدر طاقة تلقائي لغذاء الإنسان والطيور.

قام بتحكيم البحث

كلية الزراعة – جامعة المنصورة
المركز القومي للبحوث

أ.د. محمد محمد الشناوى
أ.د. محسن محمود شكري