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BAKERY BY- PRODUCTS AS UNCONVENTIONAL ENERGETIC SOURCE IN LAMBS FATTENING RATIONS

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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; R_1 : yellow corn 50% and 0 % bakery by-products (control ration), R_2 : yellow corn 37.5 % and 12.5% DBP, R_3 : yellow corn 25% and 25% DBP, R_4 : yellow corn 12.5% and 37.5% DBP and R_5 : 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, R_3 recorded the higher intake value (1250 g/h/d) followed by R2 (1190 g/h/d), respectively.

3- R_5 (100 % DBP substitute) showed higher ($P<0.05$) TDN % and DCP % values followed by R_3 and R_4, 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, NH_3-N and TVFA`s concentrations in ruminal fluid. However, the control ration in general showed lower $NH_3$-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- R_4, (37.5 % DBP) was the most efficient feed utilization group among the different DBP groups, while R_5, (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).

Table (1): Composition of the tested rations used in the fattening trial.

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 significancy, 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:

$$\mathbf{Y_{IJ} = \mu + T_i + R_J + E_{iJ}}$$

Where :

Y_{IJ} = the observation of the parameter measured

μ = overall means
T_i = the effect of dietary treatment
R_j = the effect of replication
E_{iJ} = 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 the 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.

Rations	Chemical composition, % DM							N. values	
	DM	OM	CP	CF	EE	NFE	Ash	TDN	DCP
R1 control	90.40	92.01	11.50	10.01	6.1	64.40	7.99	75.30^{cd} ±0.30	9.43^{b} ±0.28
R2	90.30	92.45	12.10	8.78	6.24	65.33	7.55	73.28^{d} ±0.67	9.73^{b} ±0.20
R3	90.81	93.26	12.30	7.56	6.36	67.04	6.74	77.66^{b} ±0.86	9.69^{b} ±0.22
R4	91.12	92.09	12.45	6.55	6.56	66.53	7.91	76.91^{bc} ±0.34	10.48^{a} ±0.10
R5	91.42	92.81	13.00	6.27	6.7	66.84	7.19	79.61^{a} ±0.86	10.82^{a} ±0.03

a,b,c and d means with different letters in the same column are significantly ($p \leq 0.05$) 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 (R_5) and the higher digestibility coefficient values for different feed nutrients. On the other side, R_2 (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, R_5 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 (R_4) or (100% bakery by-product, R_5) *i.e.* (84.24%) and (83.23%), but without significant difference between them and R_1 and R_2. The lowest ($P<0.05$) CP digestibility value (78.78 %) was obtained by lambs fed diet contained 50% bakery by-product (R_3).

CF digestibilities indicated significant ($P<0.05$) differences among groups, while R_5 (100% bakery by-products) showed also the highest CF digestibility, while the lowest ($p<0.05$) CF digestibility was detected with the control group (R_1). 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.

Item	R_1 (control)	R_2	R_3	R_4	R_5
DM intake g/h/d					
	1021.6 ±172.30	1189.9 ±45.50	1250.0 ±5.80	1173.3 ±6.50	1167.70 ±0.030
Digestibility Coeff.%					
DM	69.47^{bc} ±0.14	67.13^{c} ±1.11	70.27^{b} ±0.85	69.25^{bc} ±0.40	73.74^{a} ±0.90
OM	75.85^{b} ±0.30	72.97^{c} ±.80	76.67^{b} ±0.85	76.65^{b} ±0.55	79.56^{a} ±0.99
CP	82.03^{ab} ±.2.40	80.39^{ab} ±1.60	78.78^{b} ±1.80	84.24^{a} ±.81	83.23^{ab} ±0.26
CF	52.86^{b} ±3.66	54.36^{b} ±2.12	56.29^{ab} ±1.60	56.25^{ab} ±3.40	60.43^{a} ±1.30
EE	72.81^{c} ±0.62	75.76^{abc} ±0.13	73.68^{bc} ±1.09	77.08^{ab} ±2.12	78.50^{a} ±0.18
NFE	78.80^{b} ±0.20	72.94^{c} ±0.90	81.58^{ab} ±0.90	80.08^{b} ±1.30	84.58^{a} ±1.23
Nutritive Values (%)					
TDN	75.30^{cd} ±0.30	73.28^{d} ±0.67	77.66^{ab} ±0. 86	76.91^{bc} ±0.34	79.61^{a} ±0.86
DCP	9.43^{b} ±0.28	9.73^{b} ±0.20	9.69^{b} ±0.22	10.48^{a} ±0.10	10.82^{a} ±0.03
C/P ratio	7.99^{a} ±0.27	7.54^{ab} ±0.23	8.02^{a} ±0.10	7.33^{b} ±0.04	7.36^{b} ±0.06

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_3. 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_4 (100 % DBP).

According to Champe 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 R_3 and R_4 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 (R_2) 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; R_5 and R_4 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 R_5 and R_4 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, R_3 and R_5 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 R_1 diets (18.80 g/h/d). Both of R_2 and R_4 showed an intermediate values i.e. 23.04 and 23.37 g/h/d, respectively.

As for ND, R_5 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, R_3 recorded higher excretion. 5.22 g/h/d and without significant difference with R_2 (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.

Item	R_1 (control)	R_2	R_3	R_4	R_5
Utilization of dietary N (g/h/d)					
Nitrogen intake NI	18.80^{b} ±3.16	23.02^{ab} ±0.88	24.60^{a} ±0.12	23.37^{ab} ±0.13	24.47^{a} ±0.003
Fecal N FN	3.14^{c} ±0.12	4.54^{ab} ±0.55	5.22^{a} ±0.42	3.68^{bc} ±0.21	4.1^{bc} ±0.06
Urinary N UN	2.35^{b} ±0.58	3.72^{ab} ±0.88	3.74^{ab} ±0.1.2	7.07^{a} ±1.80	3.40^{b} ±0.01
N digested ND	15.65 ±3.05	18.49 ±0.33	19.38 ±0.53	19.68 ±0.08	20.37 ±0.06
Nitrogen balance NB	13.31 ±2.81	14.77 ±0.55	15.64 ±0.67	12.61 ±1.74	16.98 ±0.58
NB/NI, %	69.93^{a} ±3.38	64.68^{ab} ±4.88	63.66^{ab} ±3.04	53.86^{b} ±7.14	69.36^{a} ±0.23
NB/ND, %	84.80^{a} ±3.13	80.13^{ab} ±4.43	81.17^{ab} ±5.70	64.21^{b} ±9.10	83.32^{a} ±.02

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

As for NB, it was evident that, all experimental rations showed positive NB, however, R_5 retained more insignificant dietary N values (16.98 g / h /d). Both of R_2 & R_3 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 R1and R5 due to either their lower NI or lower excreted N.

NB / ND, % revealed similar trends, as R_1 followed by R_5 showed the higher ($P<0.05$) percentages in this criterion, but without significant differences with R_2 and R_3, lambs of R_4 recorded the lower percentage value (64.21 %).

Effect of experimental rations on some ruminal parameters:

The effect of experimental rations on some ruminal liquior 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_1 and 100% corn grains) and R_5 (100%

DBP) indicted higher ($p<0.05$) values in compare 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 R_2, R_3 and R_4 (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.

NH_3-N (mg/100 ml):

Data presented in (Table 5) indicated significant differences ($p<0.05$) among different experimental groups before feeding. NH_3-N at 0 time; ranged between 24.86 for R_2 to 40.80 mg/ 100 ml. for R_5. At 3 hrs after feeding, different experimental groups showed higher ($p<0.05$) NH_3-N values and ranged between 36.06 mg/100 ml. for the control group (R_1) to as high as 57.06 mg/100ml. for R_3 (50% corn grains and 50 % DBP).

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

Item	sampling time (hours)	R_1 (control)	R_2	R_3	R_4	R_5	Means SE
pH	0	6.60	6.10	6.36	6.46	6.56	6.42^B ±0.76
	3	7.70	7.46	6.90	7.oo	7.26	7.26^A ±0.76
	6	5.66	5.40	5.76	5.66	5.86	5.67^C ±0.76
Means SE		6.65^a ±0.169	6.32^b ±0.169	6.34^b ±0.169	6.38^{ab} ±0.169	6.57^a ±0.169	5.45 ±0.98
NH_3-N (mg/100m)	0	26.69	24.86	25.56	29.66	40.8	29.57^C ±1.62
	3	36.06	53.9	57.06	48.30	52.5	49.56^A ±1.62
	6	33.56	28.66	33.6	39.56	39.2	34.92^B ±1.62
Means SE		32.20c ±3.63	35.81^{bc} ±3.63	38.74^{ab} ±3.63	39.18^{ab} ±3.63	44.17^a ±3.63	38.02 ±2.98
TVFA's (meq/100ml)	0	31.00	35.50	28.00	23.26	26.76	28.90^C ±0.97
	3	39.00	43.50	35.76	42.26	38.00	39.70^A ±0.97
	6	31.50	35.76	34.26	39.00	33.00	34.70^B ±0.97
Means SE		33.83^b ±2.17	38.25^a ±2.17	32.68^b ±2.17	34.84^{ab} ±2.17	32.59^b ±2.17	34.44^B ±1.25

a, b and c means with different small letters in the same row are significantly (p≤o.o5) different, while different capital letters in the same column indicated significancy at (p≤o.o5) .

At 6 hrs after feeding, different experimental groups tended to have lower NH_3-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 NH_3-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 NH_3-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 NH_3-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, NH_3-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 R_5 diet, but lower ($P<0.05$) one (32.20 mg /100 ml) with R_1 (100 % corn grains). Different (DBP) incorporation in the experimental rations (from 2-5) led to increase ruminal NH_3-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 NH_3-N release accompanied with an abundance of highly soluble carbohydrates. Such above results regarding ruminal NH_3-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 NH_3-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 tended to increase at 3 hrs post feeding and to decline again at 6 hrs post feeding. While R_2 recorded the highest value (38.25 meq / 100 ml) followed by R_4 (34.84 meq /100 ml), but without significant difference between them. While R_1, R_3 and R_5 diets ranked second, and without significant differences with R_4.

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 ration.

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 R_1 and R_4 indicated relatively higher daily gains *i.e.* 202 g/h/d. While R_2 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 , R_3 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. R_5 and R_3 recorded higher ($p<0.05$) TDNI/h/ day. This result might be referred to either the higher DMI of the ration (R_3) or to the higher TDN value of ration R_5 (79.61 % TDN, Table 3).

As for DCPI /h /day, significant differences were detected among groups. Both of R_4 and R_5 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, (Table3) *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 R_1 to 6.57 DMI / kg gain for R_2.

Table (6): Means ± SE body weight gain, feed intake, feed conversion and economic efficiency for crossbred local male lambs during the field study.

Item	R_1	R_2	R_3	R_4	R_5
Av. b w gain ± SE					
Av. Initial B.W (kg)	14.25 ±0.75	14.5 ±1.50	14.25 ±1.30	14.5 ±1.55	14.5 ±1.19
Av. Final B.W (kg)	39.25 ±2.25	37.00 ±3.00	38.75 ±0.95	39.50 ±2.33	39.25 ±2.09
Total B.W. gain (Kg)	25.00 ±1.73	22.50 ±1.71	24.50 ±.86	25.00 ±2.27	24.75 ±1.40
Daily gain (g)	202 ±13.96	181 ±13.77	198 ±6.98	202 ±18.23	200 ±11.10
Growth rate (%)*	175 ±10.65	155 ±10.53	172 ±21.1	172 ±25.03	171 ±14.15
Growth rate/ control	100 ±0.07	89 ±7.12	101 ±13.63	102 ±16.62	100 ±11.73
Daily feed intake ±SE					
DMI , g/h/d	1022 ±172	1190 ±45.50	1250 ±5.80	1173 ±6.50	1177 ±0.30
DMI /control	100 ±0	116 ±15.67	122 6.43	115 ±12.19	115 ±0
TDNI, g/h/d	769^{c} ±1.90	872^{bc} ±4.25	970^{a} ±5.38	902^{b} ±2.07	937^{b} ±5.27
DCPI, g/h/d	96^{b} ±1.70	115.8^{b} ±1.37	121^{b} ±1.37	122.9^{a} ±0.62	127^{a} ±0.80
Feed conversion (FC) ± SE					
DMI/kg gain (kg)	5.06 ±0.00	6.57 ±.39	6.32 ±.39	5.81 ±.14	5.89 ±0.52
kg DMI/kg gain FC/ control	100 ±0.00	129 ±14.40	124 ±.6.43	115 ±7.19	116 ±6.85
TDNI/kg gain(kg)	3.80^{c} ±0.26	4.82^{a} ±.29	4.90^{a} ±0.11	4.47^{b} ±.0.42	4.69^{b} ±.0.34
DCPI/kg gain(g)	$.477^{c}$ ±3.43	$.639^{a}$ ±3.92	$.611^{a}$ ±1.41	$.608^{a}$ ±5.87	$.636^{a}$ ±4.76
Economical efficiency± SE					
Feed cost /kg gain (LE)	9.19^{ab} ±0.74	11.33^{a} ±0.80	10.51^{abc} ±0.28	8.95^{bc} ±0.39	8.53^{c} ±0.65
Net profit (LE)**	18.81^{bc} ±0.74	16.67^{c} ±0.80	17.49^{abc} ±0.28	19.05^{ab} ±0.39	19.47^{a} ±0.65

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 (R_1); 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 R_2 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.

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مخلفات المخابز كمصدر غير تقليدى للطاقة فى علائق التسمين لذكور الحملان

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استخدم فى هذه الدراسة ٢٠ من الحملان الذكور خليط فنلندى أوسيمى بمتوسط وزن ١٤,٥ كجم وزن حي وعمر ثلاثة أشهر – تم تقسيمها عشوائياً إلى خمسة مجاميع غذائية متجانسة (أربعة حملان / مجموعة) – حيث تمت تغذيتها على خمسة علائق متكاملة (احتوت على كسر البسكويت كمصدر للطاقة بنسب مختلفة كمصدر غير تقليدى للطاقة استبدالاً من النسب المقابلة من الأذرة الصفراء (كمصدر تقليدى لطاقة العلائق) وكانت نسب الإحلال بين كسر البسكويت والأذرة الصفراء كمصادر للطاقة فى العلائق التجريبية كما يلى:

عليقة المقارنة ١٠٠٪ أذرة صفراء(حيث تمثل الأذرة ٥٠ % من العليقة الكلية) + صفر كسر بسكويت ، المعاملة الثانية ٧٥٪ أذرة صفراء + ٢٥٪ كسر بسكويت ، المعاملة الثالثة ٥٠٪ أذرة صفراء + ٥٠٪ كسر بسكويت ، المعاملة الرابعة ٢٥٪ أذرة صفراء + ٧٥٪ كسر بسكويت ، المعاملة الخامسة صفر أذرة صفراء +١٠٠٪ كسر بسكويت – واستمرت التجربة لمدة ١٢٤ يوماً ، حيث تم إجراء تقييم غذائي لمعاملات الهضم للعلائق قبل بداية التجربة، كما جري تقييم لميزان الأزوت للعلائق وكذا التعرف على صفات التخمر لسائل الكرش (الأس الهيدروجينى، تركيز الأمونيا ، والأحماض الدهنية الطيارة الكلية) .

وقد أظهرت النتائج المتحصل عليها ما يلي:

١- أظهرت العلائق المحتوية على كسر البسكويت (العلائق من ٢-٥) قيماً هضمية أعلى بالمقارنة بمجموعة المقارنة (١٠٠٪ أذرة صفراء) .
٢- لم تكن هناك إختلافات معنوية بين العلائق المختبرة عموماً فى معدل المأكول اليومى للرأس وإن أظهرت المعاملة رقم ٣ معدلات أعلى للإستهلاك (بدون معنوية) وتبعتها المعاملة رقم ٢ (المحتوية ٢٥٪ أذرة صفراء +٧٥٪ كسر بسكويت) .
٣- أظهرت العليقة رقم ٥ (١٠٠٪ كسر بسكويت) أعلى قيم غذائية معبراً عنها بالمركبات المهضومة الكلية للعليقة والمحتوى من البروتين الخام المهضوم- تبعتها العليقة رقم ٣ ثم رقم ٤ على الترتيب .
٤- لم تكن هناك أى فروق معنوية بين العلائق المختبرة على معدلات النمو للحملان المسمنة .
٥- أظهرت المعاملات وجود فروق معنوية في صفات التخمر لسائل الكرش (pH ، الأمونيا ، كمية الأحماض الدهنية الطيارة الكلية) بين المعاملات المختلفة ، وإن سجلت عليقة المقارنة (١٠٠٪ أذرة صفراء) أعلى درجة أس هيدروجينى بين المعاملات وأقل درجة تركيز أمونيا في سائل الكرش ،كما كانت هناك فروق معنوية بين أزمنة القياس – حيث ارتفعت معظم القيم قبل الأكل وتناقصت بعد ٣ ساعات ثم زادت بعد ٦ ساعات ولكن بصورة أقل من القيم المقابلة عنها قبل الأكل .

٦- لم تكن هناك فروق معنوية بين المعاملات فى معدلات التحويل الغذائى على صورة كجم مادة جافة مأكولة وإن ظهرت فروق معنوية بين المعاملات الغذائية المختلفة باستخدام مقاييس البروتين الخام المهضوم والمركبات المهضومة الكلية المأكولة / كجم زيادة في الوزن لصالح مجموعة المقارنة ، وقد سجلت جميع المجاميع قيماً تحويلية مرتفعة بالقياس للقيم المتداولة والمتعارف عليها محلياً .

٧- سجلت المجموعتان الرابعة والخامسة أفضل معدلات تحويل غذائي عموماً بين المجاميع التي استخدم فيها كسر البسكويت كمعدل استبدال بنسبة ٧٥ ، ١٠٠ % من الأذرة الصفراء، وكانت قيم التحويل الغذائي كالاتي للمجموعتين الرابعة والخامسة ٥,٨١ ، ٥,٨٩ على الترتيب كجم مادة جافة مأكولة /كجم زيادة في الوزن ، (٤,٤٧ ، ٤,٦٩) كجم مركبات مهضومة كلية و ٠,٦٠٨ ، ٠,٦٣٦ كجم بروتين خام مهضوم/ كجم زيادة في الوزن وإن كانت مجموعة المقارنة عموما هي الأفضل في قيم التحويل الغذائي على أساس المادة الجافة والمركبات المهضومة الكلية والبروتين المهضوم.

٨- سجلت المعاملة الخامسة (١٠٠ % إحلال للأذرة الصفراء بكسر البسكويت) أقل تكلفة وأفضل عائد مادى / كجم زيادة وزنية مقارنة بباقي المجاميع المغذاه على كسر البسكويت.

وعلى ضوء النتائج المتحصل عليها يمكن إستنتاج إمكانية استبدال الأذرة الصفراء كمصدر تقليدى للطاقة فى علائق الحملان المسمنة وحتى نسبة ١٠٠٪ بكسر البسكويت كمصدر غير تقليدي للطاقة وبتكلفة أقل مما يساعد فى توسيع قاعدة مصادر الطاقة المتاحة لتسمين المجترات، وكذا توفير الأذرة الصفراء كمصدر طاقة تقليدي لغذاء الإنسان والطيور.

قام بتحكيم البحث

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57 58 59 60 61 62 63 64 65 66 67 68 69 70 71

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