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Effect of Substitution of Corn Grains by Bakery Meal in Beef Calves Ration on Their Zootechnical Performance

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Abstract

An experiment was conducted to study the effects of partial and/or complete substitution of corn grains by bakery meal in beef calves ration on their zootechnical performance and productivity. A total of 56 calves with an average body weight of 260±12 kg were randomly assigned into four equal groups (14 calves each). Calves in the first group were fed on basal corn-soybean ration and calves in the second, third and fourth group were fed separately on three iso-nitrogenous and iso-caloric rations in which 25, 50 and 100% of corn were replaced by bakery meal (BM) respectively.

Results of the substitution of corn grains by BM in the third and fourth group significantly ($p<0.05$) improved the average body weight at 50 and 100% levels of substitution. The recorded data in the second group showed only numerical insignificant improvement of the final weight compared with the control group. Better feed conversion ratios were recorded in groups fed on BM as well. Blood parameters measured indicated that only 100% level of substitution significantly ($p<0.05$) affects ALT, AST, total serum proteins, serum albumin and globulin. Blood glucose levels were significantly ($p<0.05$) increased at all levels of substitution and the serum urea levels were decreased. In addition, BM improved some rumen parameters (Motility of rumen flora was increased while the ammonia concentration was decreased in the rumen). BM had positive and acceptable effects on rumen pH and total volatile fatty acids produced. In conclusion BM can be successfully incorporated into feedlot rations.

Key words: Corn, bakery meal, feedlot cattle, performance, rumen ecology

Introduction

In Egypt and other countries in Middle East corn is not grown widely and there is a shortage of its production to meet the higher demand. Corn represents the major source of energy in the animal rations. Therefore, it is imported from different countries which would add extra cost to the already expensive animal ration. In addition, there is a shortage in the world supply of corn, as its price is nearly tripled since 2006 which mark the increased production of ethanol from corn, wheat and sorghums. The increase in demand and low supply are the main causes of this problem that we are facing. Utilization of alternative feedstuffs may provide a mean to reduce diet cost and cost of gain in feedlots. Waste products from food production and feed processing are likely to be inexpensive sources of animal feed.

Bakery meal is stale bread and other pastry products from stores or bakeries can be fed to ruminants, mono-gastric animals and poultry as a high energy feed on the basis of economic and environmental advantages (Potter et al., 1971; Welch, 1995; Huntington, 1997; Passini et al., 2001). Unlike many other commercial feedstuffs bakery waste is constantly available due to the perishable nature of bread for consumer use. However very little information about the actual chemical composition and in turn, the exact nutritive value, the appropriate feeding levels, its impact on production and their economic effectiveness which are not fully documented. Many research activities reported that bakery meal (BM) could be successfully used as alternative source of energy in poultry diets (Damron et al., 1965; Potter et al., 1971; Radwan, 1995; Saleh et al., 1996; Abdullatif et al., 2004 and Al-Tulaihan et al., 2004). Some literature was also reported suitability of using BM in sheep and goats rations (Champe and Church, 1980; Lenget al., 1981; Throckmorton et al., 1981; Hetherington and Krebs, 2002; Morgante, 2002; Haddad and Ereifej, 2004; Afzalzadeh et al., 2007; Hindiyeh et al., 2011). Using BM in calves rations were also documented (Wallace and McConnell, 1965; Milton and Brandt, 1993; Spers et al., 1996; Guiroy et al., 2000; Passini et al., 2001; Milton and Brandt, 2012). It was proved that the inclusion of BM has positive impact on rumen ecology and fermentation characteristics, providing maximum activity of cellulolytic organisms (Smith et al., 1972; Van Soest, 1994). However, several studies have reported the existence of large differences in the chemical composition of the bakery waste used in animal feed

depending on the raw materials included in the BM (Champe et al., 1980; Dale, 1990; Saleh et al., 1996; Al-Tulaihan et al., 2004; Slominski et al., 2004).

The aim of the present work was carried out to study the effects of partial and/or complete substitution of corn grains by bakery meal in beef calves rations and to monitor the impact of BM on zootechnical performance and productivity of feedlot calves.

Material and Methods

Preparation of bakery meal (BM) and its composition:

Dried bakery wastes (bread) not fit for human consumption were obtained from different local commercial bakeries in Egypt. The bread was dried at 75°C for 12 hours in oven then crushed and ground. Samples from prepared dried bakery meal were chemically analysed according to AOAC, 1990. Chemical composition of prepared BM which was used in experiment is illustrated in Table1.

Table 1. Proximate analysis of dried bakery meal used in the experiment (%)

Parameter	*Percent*
Moisture	10.5 ±0.92
Crude protein	10.2 ±0.42
Ether extract	2.5 ±0.23
Crude fiber	4.91 ±0.34
Total ash	5.51 ±0.41
NFE	65.38 ±2.8
Calcium	0.2 ±0.05
Phosphorus	0.3 ±0.02
Calculated (TDN)	80.33

Values are means ± SE

Animals, housing and management:

A total of 56 male crossbreed beef calves, with an average live body weight 260±12 kg were randomly assigned to four equal experimental groups (14 calves each). The calves in the different experimental groups

were provided with clean and ample supply of water. A routine pharmacological and vaccination schedule for all animals on each group was followed by the standard farm management. The experiment lasts for 105 days of which the first 15 days represented preliminary period not only to accustom animals for their assigned diets but also to estimate the level of forage intake beside the constant amount of concentrate mixture given (2.5% of LBW). During the course of the feeding trial, calves were housed in four free yards with sheds equipped with water and manger style feeders, each calf had a minimum of 80 cm of linear trough space and 7.5 square meters of yard space.

Rations and feeding regimen:

Along the whole experiment calves in the first group were fed on basal ration (BR) formulated from conventional corn-soy based rations and served as a control group. Calves in the second group were fed on ration in which 25% of corn was replaced by equal amount of locally prepared bakery meal, while calves in the third and fourth groups were fed on diets in which BM replaced either 50% (group 3) or 100% (group 4) of corn respectively. All rations were computed according to the nutrient requirements tabulated in NRC, 2000 for finishing calves. Calves in all groups were given three iso-energetic (70% TDN) iso-nitrogenous (14% CP) diets. Concentrate mixture (2.5% of LBW) was delivered twice daily at 8.00 AM and 16.00 PM together with constant amount of corn silage (10, 11 and 12 Kg/head /day during the first, second and third month of the experiment respectively) meanwhile rice straw was given free choice at evening.

Ingredients, nutrient composition, calculated analysis and proximate analysis of the all experimental diets are shown in Tables 2 and 3.

Measurements:

Growth performance parameters:

Calves in all experimental groups were weighed at the onset of the feeding trial, and every month thereafter and the amount of concentrate mixture for each group were adjusted accordingly. Weighing was done prior to feeding to minimize the effects of gut fill. There was a general observation of health and any behavioural changes of the calves that occurred during the feeding trial.

Monthly feed consumption and monthly gain were recorded and feed conversion ratios (FCR) in all groups were calculated Table 4

Table 2. Proximate analysis of all the ingredients used in the experiment on as fed basis

Nutrient content	Feed stuff					
	Soybean Meal 44%	Wheat Bran	Cotton Seed Meal	Corn	Corn Silage	Rice Straw
DM %	89 ±1.1	89 ±1.35	90 ±1.71	90 ±1.82	32±2.14	92±0.73
CP% as feed	43.5±0.6	14.5±0.7	25.4±0.5	7.7±0.3	2.4±0.3	1.8±0.3
EE %	1.6±0.2	1.9±0.13	1.7±0.15	3.7±0.2	1±0.3	0.33±0.1
Crude Fiber %	6.3±0.4	9.5±0.8	10±0.6	2.0±0.2	17±1.4	35.39±1.5
Total ash %	4.3±0.12	4.8±0.4	4.7±0.3	3.5±0.2	4.4±0.4	12.9±2
Calculated TDN %	75±2.19	63±2.3	60±1.24	82 ±2.1	20±0.6	38±1.6

Values are means ± SE

Blood and health parameters:

Blood samples were collected via jugular vein puncture from ten animals per group at the end of the feeding period. The collected blood samples were centrifuged at 3000 rpm for 10 min and the sera were decanted into aseptically treated vials and stored at -20 °C until further analysis. Serum samples were analysed for liver function tests (ALT and AST), kidney function test (urea), blood glucose, total protein and total albumin. Diagnostic kits supplied by Stainbio Laboratory, Texas, USA for Serum total proteins, urea, blood glucose and total albumin were used. Diagnostic kits supplied by Quimica Clinica Aplicada (QCA), Amposata, Spain for serum AST and ALT activity. All the analyses were performed according to the method described by Reitman and Frankel (1957).

Table 3. Composition and nutrient content of concentrate mixture as fed basis

Ingredient	Inclusion level (%)			
	0% BM (Control)	25% BM	50% BM	100% BM
Corn yellow	55.75	42.35	28.47	0.00
Soybean meal (44% CP)	9.50	8.50	8.00	6.00
Dried bakery products	0.00	13.80	27.78	57.70
Cotton seed cake (26% CP)	10.00	10.00	8.50	8.50
Wheat bran	20.00	20.60	22.50	23.05
Common salt	0.75	0.75	0.75	0.75
Sodium bicarbonate	0.90	0.90	0.90	0.90
Calcium phosphate dibasic	1.00	1.00	1.00	1.00
Limestone	1.80	1.80	1.80	1.80
Calf premix*	0.30	0.30	0.30	0.30
Proximate analyses**:				
Crude Protein (%)	14.06	14.06	14.04	14.05
Calculated TDN (%)	70.17	70.11	70.12	70.12
Crude Fiber (%)	6.40	6.24	5.89	5.47
Calcium (%)	0.95	0.95	0.94	0.94
Phosphorus (%)	0.66	0.62	0.60	0.51

* Per kg calf premix: Vitamin A 8 MIU, vitamin D3 2 MIU, vitamin E 20,000 IU, vitamin K 1 g, vitamin-B1 5 g, vitamin B2 4.5 g, vitamin B6 4 g, vitamin BI2 30 mg, Biotin 100 mg, calcium pantothenate 7.5 g, Folic acid 0.2 g, Niacin 12 g, Cobalt 0.5 g, Copper 14 g, Iodine 0.5 g, Iron 50 g, Magnesium 120 g, Manganese 50 g, Selenium 150 mg, Zinc 60 g and Antioxidant 100 g.

** Proximate analysis according to AOAC, 1990.

Table 4. Growth performance parameters of calves throughout the whole experimental period

Weight	Parameter			
	Group 1 0 % (Control)	Group 2 25 %	Group 3 50 %	Group 4 100 %
Initial weight (kg)	259.6 ±12.5 [a]	258.4 ±15.9 [a]	260.5 ±18.3 [a]	258.9 ±15.7 [a]
Final weight (kg)	391.7 ±12.3[a]	409.7 ±13.1[ab]	417.9 ±12.6[b]	425.0 ±14.1[b]
Live weight gain (kg)	132.1 ±4.0 [a]	151.4 ±4.7[b]	157.2 ±4.5[b]	166.1 ±5.1[b]
FCR	5.3	4.6	4.4	4.2

[a,b, c...etc] Values within the same row and having varying superscripts are significantly (P≤0.05) different

Values are means ± SE.

Rumen parameters:

Ruminal fluid samples were taken from 5 animals per group after one month from the onset of the experiment then at the end of experimental period. Samples of ruminal fluid were obtained directly from the rumen through the stomach tube at 5 hours post feeding for pH determination, analysis of total volatile fatty acids (TVFAs) and ammonia nitrogen (NH_3–N) were done on the spot after samples collection.

The samples were withdrawn through a stomach tube fitted with 50 ml syringe for suction. Each sample was strained through four layers of cheese cloth and used for determination of pH, total volatile fatty acids (TVFAs), ammonia nitrogen (NH_3–N).

Separate tubes were used for each animal. Approximately 100– 150 ml of ruminal contents were sampled and pH was measured within 5 min post aspiration using pH meter (Digi-Sense LED pH meter). Samples of ruminal contents (10 ml) were placed into screw-capped vials. The samples were further subjected to the NH_3–N and TVFAs analysis according to Conway (1957) and Warner (1964), respectively and after the addition of two drops of saturated $HgCl_2$ to stop fermentation immediately.

Examination of the motility of the protozoa in rumen liquor:

The motility of the protozoa were examined in a drop of rumen liquor in a fresh film under low power magnification, and indicated as follow:

+++ Highly mobile and very crowded.

++ Motile and crowded.

+ Sluggish motility and low number.

0 No or sporadic alive infusorians.

Determination of the total volatile fatty acids in rumen liquor:

The total VFA was determined by steam distillation method as described by (Warner, 1964).

Determination of ammonia-nitrogen concentration

Ammonia-nitrogen concentrations were determined immediately after collection of the rumen fluid samples according to the method described by Conway 1957.

Statistical analysis:

All data were statistically analysed using IBM SPSS® version 21 software for personal computer (2013). Means were compared by one way ANOVA ($p<0.05$) using Post Hoc test according to Sndecor and Cochran (1980).

Results and Discussion

Composition bakery meal:

The result of the chemical composition of prepared bakery meal (BM) is illustrated in Table 1. It was obvious that dried bakery meal, collected from the local bakeries in Egypt, was in close proximity, in some aspects, to those reported in available literatures. Several studies have reported the existence of large differences in the chemical composition of the bakery waste used in animal feed (Champe & Church, 1980; Dale, 1990; Arosemena et al., 1995; Saleh et al., 1996; Huntington, 1997, Medel et al., 1999, Al-Tulaihan et al., 2004; Slominski et al., 2004; Champe and Church, 2013). Authors attributed these differences to the grate variation in the composition of raw materials included and the methods adopted during the preparation of the by-product. It is a well-established fact that there is a wide variation in the literature about the chemical composition of bakery meal, mainly in relation to the EE values. Such variation makes it

difficult to compare these values to those obtained by other authors. This variation is attributed to the diversity of ingredients that can compose the bakery meal (bread, cakes, cookies, flour, among others), their origin (factory, region), the storing and the processing before the use in animal nutrition.

Zootechnical performance of beef calves:

Growth performance parameters:

The effect of partial and/or complete substitution of corn grains by (0, 25, 50 and 100%) of bakery meal on growth performance traits of intact beef calves along the whole experimental period is shown in (Table 4). It was noticed that the partial and/or complete substitution of corn grains by bakery meal (BM) significantly ($p \leq 0.05$) improved the average final body weights at 50 and 100% levels of substitution (391.7 ±12.31 vs. 417.9 ±12.6 and 425.0 ±14.1 Kg) and the average weight gain (132.1 ±4.0vs. 157.2 ±4.5 and 166.1±5.1 kg) for control, third and fourth groups respectively. However, the 25% level of substitution resulted in only numerical non-significant ($p \leq 0.05$) improvement of final weight (391.7 ±12.31 vs. 409.7 ±13.1) and the average weight gain was (132.1 ±8.0vs. 151.4 ±8.7) kg. Regarding the feed conversion ratios, results showed the partial and/or complete substitution of corn grains by bakery meal resulted in better feed conversion ratios regarding to the amounts of concentrated feed consumption at all levels of incorporation (5.3, 4.6, 4.4 and 4.2) in the control, second third and fourth groups respectively. The positive impact of partial and/or complete substitution of corn with BM on growth performance traits (body weight, body weight gain and FCR) could be attributed to the fact that processing of the BM (baking) has changed both the physical and chemical nature of the nutrients (contained in the bread), effectively increasing the level of bypass nutrients (as protein and carbohydrates) as cited by Preston and Leng (1987). In addition to the above cited modality of action the improved growth performance traits occurred as a sequence of BM substitution of corn could be attributed to the overall improvement in many of the rumen parameters supported by the improvement in the motility of rumen flora and the positive changes in the volatile fatty acids profile (the main energy source for ruminants, supplying up to 80% of the daily requirements) and the stability of ruminal pH values. More or less similar findings in calves were reported by Wallace and McConnell (1965) and in sheep Champe & Church (1980)

who observed an increase in DM, EE apparent digestibility with the BM inclusion. In addition our findings are in agreement with those reported by Leng et al., (1981), Throckmorton et al., (1981), Preston and Leng (1987) and Easton (1994) who stated that the main effects of bypass nutrients on ruminant production include; (1) stimulating feed intake; (2) increasing the efficiency of utilization of absorbed nutrients; and (3) providing amino acids and energy post-ruminally. Also my observations agree to large extent with those of Guiroy et al., (2000) who concluded that BM can substitute corn up to 75% of the diet DM for growing finishing steers without any reduction in performance. However Brandt (1993), Passini (2001), França et al., (2012) and Milton & Brandt (2012) stated that there was no statistically significant difference in feed intake as well as body weight of steers at higher rates of replacement of corn by bakery meal, Hetherington and Krebs (2002) who found that in sheep bakery waste could be successfully incorporated into a production ration for intensively fed sheep up to 50% level with no significant differences in live weight gain in addition no clinical signs associated with digestive upsets were evident and thus bread can be successfully incorporated into feedlot rations for sheep.

In contrast, Hindiyeh et al., (2011) found that DM, and CP intakes were decreased in Awassi lambs fed diets contained various levels of bakery meal. Furthermore our findings are in contrast with those of Spers et al., (1996); who reported a reduction in average daily weight gain of buffaloes when corn was replaced by bakery meal by 66% and 100%, suggesting that the increased energy density of the diets caused a reduction in feed intake and, consequently, the weight gains. However, the same authors reported that the inclusion of 33% of the BM showed beneficial effects on average daily gain effect, while altering feed intake, whereas the feed conversion deteriorated at all levels of inclusion of the BM of the baking diet. There was improvement in apparent digestibility of dry matter with increasing the levels of substitution of corn by bakery meal in the diets.

Blood parameters:

The effect of partial and/or complete substitution of corn grains by (0, 25, 50 and 100%) of bakery meal on some blood parameters of intact cow beef calves along the whole experimental period is shown in (Table 5). The results indicated that only the complete substitution of corn grains by bakery meal (BM) significantly ($p \leq 0.05$) affects ALT concentration (51.4

±1.4 vs. 61.6 ±1.7), AST (41.2 ±3.2 vs. 53.6 ±1.9), total serum proteins (4.32 ±0.21 vs. 6.16 ±0.44), serum albumin (2.24 ±0.19 vs. 3.06 ±0.12) Globulin (2.06 ±0.09 vs. 2.99 ±0.08), however, none of the two lower levels had any significant effects on these parameters. Meanwhile the blood glucose levels were significantly ($p \leq 0.05$) increased at all levels of substitution (50.2 ±2.7, 52 ±1.2 and 55.2 ±1.2 vs. 39.4 ±1.6) in second, third and fourth groups respectively compared to the control. The serum urea levels decreased with increasing the level of substitution) the blood urea levels in different groups were (25.8 ±1.2 vs. 23.8 ±1.4, 20.6 ±1.0 and 18.4 ±1.9) for control second, third and fourth groups respectively.

Table 5. Effect of BM substitution on some selected blood and parameters at the end of the experiment

Blood parameters	Treatments			
	Group 1 0 % (Control)	Group 2 25 %	Group 3 50 %	Group 4 100 %
ALT u/l	51.4 ±1.4 ^{a}	52 ±1.8 ^{a}	54 ±2.4 ^{a}	61.6 ±1.7 ^{b}
AST u/l	41.2 ±3.2 ^{a}	43.8 ±4.2 ^{a}	48.2 ±3.7 ^{b}	53.6 ±1.9 ^{b}
Urea g/100ml	18.4 ±1.9 ^{a}	20.6 ±1.0 ^{ab}	23.4 ±1.4 ^{b}	25.8 ±1.2 ^{b}
Glucose mg/100ml	39.4 ±1.6 ^{a}	50.2 ±2.7 ^{b}	52 ±1.4 ^{b}	55.2 ±1.2 ^{c}
Total serum Protein g/100ml	4.32 ±0.21 ^{a}	4.66 ±0.41 ^{ab}	5.14 ±0.37 ^{b}	6.16 ±0.44 ^{c}
Albumin g/100ml	2.24 ±0.19 ^{a}	2.4 ±0.11 ^{a}	2.65 ±0.07 ^{b}	3.13 ±0.12 ^{c}
Globulin g/100ml	2.06 ±0.09 ^{a}	2.23 ±0.11 ^{a}	2.47 ±0.13 ^{a}	2.99 ±0.08 ^{b}
A/G ratio %	108.7	107.6	107.2	104.7

$^{a,b,c,...etc}$ Values within the same row and having varying superscripts are significantly ($P \leq 0.05$) different. Values are means ± SE

Serum parameters measured show that increasing the inclusion percent of BM revealed positive results on blood total protein, albumin and globulin. The highest percent of globulin was recorded in the group 100% bakery meal (2.99 ±0.08) followed by the 50% and 25% (2.47 ±0.13 and 2.23 ±0.11), while the control group showed the lowest globulin level (2.06 ±0.09). However, there was a significant increase in ALT, AST, serum protein and blood glucose levels in the blood which might indicate the

increasing rate of metabolism due to increasing the efficiency of nutrients utilization and increased rate of bypass protein due to partial and/or complete substitution of corn grains by (0, 25, 50 and 100%) of BM of intact beef calves along the whole experimental period. The increased blood glucose level could be attributed to the change in fermentation associated with BM feeding which resulted in higher molar percentage of propionic acid in the rumen. The observed effect of supplementation of BM on elevating blood glucose level could be due to increased propionic acid production as a result of improved fermentation. About 20-50% of glucose in ruminants is formed from propionate which is transported from rumen to liver where it is actively transferred to glucose by gluconeogenesis as cited by França et al., 2012.

Rumen ecology parameters:

Ammonia concentration in the rumen:

The effect of partial and/or complete substitution of corn grains by (0, 25, 50 and 100%) of BM on some on rumen fluid parameters (Score, pH, ammonia nitrogen and total volatile fatty acid concentration) of intact beef calves along the whole experimental period is shown in (Table 6). It was noticed that the partial and/or complete substitution of corn grains by BM improved both the number and motility of rumen flora especially at 100% level of substitution as compared to the control group. In addition the substitution of corn with BM at all replacement levels significantly ($p \leq 0.05$) decreased the ammonia concentration in the rumen at all levels of substitution at 30 days after the start of the experiment (283.3 ±1.3vs. 268.7 ±2.4, 261.3 ±1.8and 246.7 ±3.5) and at the end of experimental period (309.3 ±1.2vs. 277.3 ±5.1, 268.1 ±3.5and 256.1 ±5.8) for control, second, third and fourth groups respectively, a situation that indicated a negative linear response of the ruminal NH_3-N concentration with the increase in bakery meal levels.

Table 6. Impact of BM substitution on rumen fluid parameters of fattening calves at the end of the experiment

Parameter	Treatment			
	Group 1 0 % (Control)	Group 2 25 %	Group 3 50 %	Group 4 100 %
Score (motility)	+	++	+++	+++
pH:				
-after 30 days of start of experiment	7.07 ±0.09 [a]	7.01 ±0.08 [a]	7 ±0.1 [a]	6.8 ±0.11 [a]
-At the end of experiment	6.98 ±0.1 [a]	6.88 ±0.09 [a]	6.8 ±0.06 [a]	6.64 ±0.14 [a]
Ammonia–Nitrogen (mg\100ml)				
-after 30 days of start of experiment	10.12 ±0.11 [a]	9.6 ±0.05 [b]	9.33 ±0.07 [c]	8.81 ±0.04 [d]
-At the end of experiment	11.05 ±0.18 [a]	9.9 ±0.11 [b]	9.57 ±0.16 [c]	9.14 ±0.04 [d]
VFAs (total) (meq\100ml)				
-after 30 days of start of experiment	11.5 ±0.3 [a]	19.5 ±1.3 [b]	21.8 ±0.9 [c]	23.5 ±1.1 [d]
-At the end of experiment	19.2 ±0.6 [a]	29.5 ±1.1 [b]	32.8 ±0.6 [c]	41 ±1.5 [d]

+++ Highly mobile and very crowded. ++ Motile and crowded. + Sluggish motility and low number.

Values are means ± SE

[a,b, c...etc] Values within the same row and having varying superscripts are significantly ($P \leq 0.05$) different.

This decrease in the level of ammonia could be due to the increase in energy availability for microbial protein synthesis, provided by the bakery meal inclusion in the diet; or associated to the lower inclusion of soybean meal in diets due to the higher CP content in the BM when compared with the corn. In addition to the abovementioned mode of action the decreased ruminal NH_3-N concentration may be explained on the basis of the changes occurred in either the physical or chemical nature of the nutrients (contained in the bread), b increasing the level of bypass nutrients (as protein). In addition, the reduction in ruminal NH_3-N concentration may be explained in considering that the ability of bacteria to use ammonia and in turn to synthesize protein depends on the fermentation of carbohydrates rate and it is a well-established fact that bakery meal was able to enhance the CHO fermentation process in the rumen. As carbohydrate availability in the rumen is a key factor for efficiency of ruminal ammonia and dietary N utilization. More or less these results coincides with the findings reported by França et al., 2012

who stated that for each 1% of bakery meal inclusion promoted reduction of 0.11 mg/dL in ruminal NH_3-N concentration, they reported that the reduction in ruminal NH_3-N concentration may be related to the increase in energy availability for microbial protein synthesis, provided by the bakery meal inclusion in the diet. Also, Van Soest (1994) found that the increase in N intake is associated with the increase of the urea production in the liver and, consequently, of its excretion in urine, while the low N intake leads to a reduction in the excretion of urea in urine for maintenance of the pool of urea in the plasma, which is under homeostatic physiological control. In addition Cole and Todd (2008) stated that ammonia is utilized for microbial protein synthesis and the extent of ammonia utilization in the rumen depends on the several factors such as rate of ammonia release, the type and availability of carbohydrates, ruminal microbial flora and N availability.

Ruminal pH values:

Concerning the effect of the dietary treatments on ruminal pH values results (Table 6) showed that none of the levels of substitution of corn grains by bakery meal (BM) has no statistically significant effect on PH value ($p \geq 0.05$) there were a numerical decrease in pH values as the level of BM substitution increase (7.07 ±0.09 vs. 7.01 ±0.08, 7 ±0.1and 6.8 ±0.11) at 30 days after the start of the experiment and (6.98 ±0.1 vs. 6.88 ±0.1, 6.8 ±0.06and 6.64 ±0.14) at the end of experiment for control, second, third and fourth groups respectively after three months, but there were a mild decrease in PH value as the inclusion of BM increased. These findings suggest that the inclusion of bakery meal in the rations did not affect the rate of microbial growth and activities in a negative manner. Similar results were also reported by Smith et al., (1972) who found variations between 6.0 (control) and 6.8 (with BM) in ruminal pH provide maximum activity of rumen organisms.

The Total VFAs concentration in the rumen:

Data shown in (Table 6) indicate that partial and/or complete substitution of corn grains by BM significantly ($p \leq 0.05$) improved the volatile fatty acids production at all levels of substitution, since (11.5 ±0.6 vs. 19.5 ±2.6, 21.8 ±1.9and 23.5 ±2.1) at 30 days after the start of the experiment and (19.2 ±1.2 vs. 29.5 ±2.1, 32.8 ±1.2 and 41.1 ±3.2) at the end of experiment, for control, second, third and fourth groups, respectively. This elevation in the concentration of the VFAs in the rumen fluids could

be due to the improved rumen ecology that positively affects the activities of rumen flora and consequently the overall metabolic activities of the calves that reflected to their growth performance. Kononoff &Varga (1999) stated that the volatile fatty acids supplying up to 80% of the daily requirements. Therefore, changes in the volatile fatty acids profile can affect the animal performance. In contrast França et al., (2012) reported that the inclusion of bakery meal in concentrate had no effect on ruminal volatile fatty acids concentration of the rumen. They reported that the molar ratios of acetate: propionate: butyrate produced in the rumen of sheep fed diets with bakery meal: corn ratios of 0, 25, 50, 75 and 100%, were 77:16:7 vs. 76:16:8 vs. 74:17:9 vs.74:17:9 and 73:17:10, respectively.

Cost effectiveness of corn substitution by BM at different levels:

The cost of a kilogram of diet decreased as the BM was added to the diet, however, the higher the price of corn, becomes more profitable replacement of the residue by BM. Replacing corn with BM caused a reduction in the cost of one kilogram of feed 26.4%, 12.90% and 6.44% respectively in diets containing 100%, 50% and 25 % of BM in relation to the control diet.

Conclusion

On the basis of the results obtained throughout this study it is to be concluded that:

The composition of (BM) collected from the local bakeries in Egypt was approximately close to those reported in available literatures. BM significantly ($p \leq 0.05$) improved the average final body weights and weight gain and achieved better feed conversion ratios at 50 and 100% levels of substitution. Blood parameters indicated that only 100% level of substitution significantly ($p \leq 0.05$) affects ALT, AST total serum proteins, serum albumin Globulin, Meanwhile, the blood glucose was significantly ($p \leq 0.05$) increased at all levels of substitution, although urea levels were significantly ($p \leq 0.05$) decreased. BM substitution improved the rumen ecology regarding motility of rumen flora and decreased the ammonia concentration in the rumen and has a positive and acceptable effect on rumen pH and total volatile fatty acids produced. Local Egyptian bakery Meal (BM) can be successfully incorporated into feedlot rations up to 100% level on the expense of corn without adversely affecting production and/or the health status of the feedlot animals.

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تأثير بعض الاعلاف الغير تقليدية علي الكفاءة الإنتاجية لعجول التسمين

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أجريت هذه الدراسة في تجربتين استهدفت التجربة دراسة تأثير إحلال مسحوق مخلفات الخبز جزئيا أو كليا محل حبوب الذرة فى علائق عجول الأبقار الهجين على كفاءتها الإنتاجية من حيث معدلات النمو وكفاءة إستخدام الغذاء وكذلك التغيرات المصاحبة لذلك فى بعض مكونات مصل الدم بالإضافة إلى التغيرات المصاحبة التى تحدث فى الكرش من جراء هذا الإحلال.

ولما كان ذلك فقد استخدمنا فى التجربة الأولى عدد 56 من العجول البقرى الهجين ذات وزن متوسط (260± 12 كجم) تم تقسيمها بصورة عشوائية إلى أربع مجموعات متساوية (بكل منها 14 عجل). المجموعة الأولى استخدمت كمجموعة ضابطة غذيت على عليقة مركزة مصنعة من مواد علف تقليدية وذات محتوى 14 % من البروتين الخام و 70%TDN(الطاقة) .

في حين تم تغذية العجول في المجموعات الثلاث الأخرى بشكل منفصل على ثلاثة علائق تم فيها استبدال 25 و 50 و 100٪ من حبوب الذرة بواسطة بواسطة مسحوق مخلفات الخبز المصنع محليا للمجموعات (2 و 3 و 4) على الترتيب مع الحفاظ على نفس المستوى من البروتين والطاقة . هذا وقد استمرت هذه التجربة لمدة. 105 يوما منها 15 يوما تمثل فترة أولية تمهيدية ليس فقط تعويد الحيوانات على العلائق تحت الدراسة ولكن أيضا لتقدير كمية الأعلاف المالئة االمستهلكة إلى جانب كمية ثابتة من الأعلاف المركزة التى أعطيت بمعدل ثابت (2.5 ٪ من الوزن الحى) طوال فترة التجربة مع ضبط الكميات شهريا تبعا للأوزان الجديدة .

وقد أظهرت النتائج أن الإستبدال الجزئي أو الكامل لحبوب الذرة بمسحوق الخبز وجبة الخبز قد أدى إلى تحسن معنوى فى متوسط وزن الجسم النهائي وكذلك فى معدلات الزيادة فى الوزن الوزن المتوسط إضافة إلى تحسن ملحوظ فى نسب التحويل الغذائى، كما أوضحت النتائج أن هذا الإستبدال قد أثر بصورة إيجابية ومعنوية على بعض مكونات مصل الدم مثل خمائر ALT ، AST والبروتين الكلى والزلال الجلوبيولين ، وفي الوقت نفسه على مستويات السكر في الدم فى جميع مستويات الإحلال وأيضا قلة فى مستوى اليوريا في مصل الدم.وبالإضافة إلى ذلك فقد تحسنت بصورة كبيرة بيئة الكرش فى المجموعات المعالجة مقارنة بالمجموعة الضابطة فيما يتعلق بعدد وحركة الكائنات الحية الدقيقة بالكرش وانخفاض تركيز الأمونيا في الكرش مع حدوث آثارإيجابية مقبولة على الكرش درجة الحموضة والمجموع الكلى للأحماض الدهنية المتطايرة المنتجة.