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Utilization of Leftover Food Collected from Hotels in Rations of Crossbred Cow Calves

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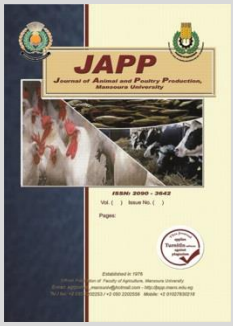

ABSTRACT

Aim of this study was to evaluate the effect of inclusion dried leftover food (DLF) in the ration of crossbred calves (Balady x Friesian), on their growth performance, rumen function and blood parameters through a comparative feeding trial. Fifteen male crossbred calves (258±1 kg), were randomly assigned into three similar groups (five in each) and fed the tested rations for 16 weeks, as an experimental period. The tested rations were formulated from concentrate feed mixture (CFM) that partially substituted by 0, 20 and 40% of DLF for CFM1, CFM2 and CFM3, respectively, plus bagasse as a roughage portion for formulate the experimental rations R1 (control), R2 and R3 as tested one, respectively. Results showed that most nutrient digestibility coefficients and feeding values were improved with the higher level of DLF (40%) in ration, than R2 and R1 (control). NH3-N and pH values in rumen liquor were decreased with increasing the level of DLF up to 40% (R3) in rations. The vice versa trend was found among dietary treatments respecting TVFA´s concentrations in the rumen. Insignificant differences among tested rations in respect of most blood metabolites were found. Total body weight gain and daily gain were significantly higher only with (R3) than those of R1 (control). Economic efficiency was improved by feeding ration that contained 40% DLF (R3) in comparison with R1. This study concluded that considerably to use dry leftover food up to 40% level could be recommended for formulation the rations of crossbred cow calves.

Keywords: calves, leftover food, growth performance, digestibility, ruminal, blood parameters and economic efficiency.

INTRODUCTION

There was a problem of inadequate quantity and quality of animal feeds in Egypt. This problem is due to the limited cultivable land and the high competition between human and livestock for high quality grains and the other agricultural products. The feeding cost represents about 60-70 % of the total production cost of the different animal products. Maertens *et al*.,(2002) suggested that the challenge for the feed formulation is to obtain the least cost rations that fully match with animal requirements. Therefore, efforts have been made towards the solution of feed shortage could continue favorably by improving the traditional sources and investigating for more untraditional feeds. Minimizing the feed cost could be achieved through the use of untraditional cheaper feed ingredients. FAO (2011) suggested that the one of the options to cope up with this problem is to partially replace the traditional concentrate feeds by cafeteria leftovers. With new technology, waste along the human food supply chain could be used as a partial substitute for cereal in animal feed. Leftover food is defined as any edible waste from food production, distribution, transportation, and consumption ; it is also referred as garbage, swill, hotel waste and/or, kitchen waste (Kornegay *et al.*, 1965 and Price *et al.*, 1985). Gustavsson *et al.*, (2011) reported that overall around 30-50% of produced food being end up uneaten and considered as waste. Feedstuffs such as kitchen leftovers can be used in Egypt, and could be invaluable feed resources for small and medium size holders of livestock. Leftover feed (food waste) are not fully utilized and substantial amounts of nutrients lost during preparation of food, especially from cafeterias of universities, hospitals and hotels. On the other hand, currently large amounts of food waste generated from household and industries have become one of the main factors to cause environmental pollution. To overcome this problem and challenge, the cutting edge technologies and research could be employed in which change the food leftover for being a useful ingredient for formulation ruminants rations in cost effective way. Kim *et al*.,(2001) reported that the best recycling way of food waste to decrease the pollution is used it to animal feed. Also, Kim, (1995), used dried leftover as a supplemental feed or a feed ingredient for swine and poultry, not only to decrease the use of expensive feed ingredients, such as imported feeds, but also to reduce environmental pollution (Yang *et al*., 2001). Large amounts of food waste (vegetables, fruits, meat, and breads) are produced daily in megacities. Results of the previous researchers suggest that food waste can be used successfully in diets of monogastric animals (Truong *et al.*, 2019). Today, calves have being use large amounts of corn grains and soybean meal for their rations; therefore, research should be conducted to evaluate the partial use of alternative feedstuffs to meet the growing demand for meat production. We proposed that food waste, occurring in all sectors of the food supply chain, could become a partial substitute for corn

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grains and soybean meal in calves' rations. So, the objective of this study was to evaluate the effect of inclusion leftover food that collected from hotels as non-traditional feed ingredient in growing calves rations on growth performance and economic efficiency.

MATERIALS AND METHODS

This study was carried out during a period through the year 2019 at Shobramant Farm Animal Production, Giza Governorate, Egypt and the chemical analysis was carried out at laboratories of Animal Production Research Institute (APRI), Agriculture Research Center (ARC), Ministry of Agriculture, Dokki, Giza, Egypt.

Experimental animals and feeding:

Fifteen male crossbred calves (Balady X Friesian) were used in a comparative feeding trial with (258±1 kg weight), and 12 months of age, lasted 16 weeks an experimental period. Calves were randomly assigned into three similar groups (five/group) and they fed individually. Dried leftover (DLF) that mainly consisted of beans, grains, rice, pasta, tomato, apple and bread… etc. was collected from hotels in Cairo in fresh state (approximately 75% moisture) and directly sun air dried after collection, chopped and mixed consistently for being use in this experiment. Chopped leftover food were used incorporating in the concentrate feed mixture (CFM) at levels of 0, 20 and 40% in (CFM1, CFM2 and CFM3, respectively). The CFM was fed at the level of 2.0% of body weight of calves plus the roughage portion (bagasse) that was fed *ad libitum* level. Each group was assigned randomly to feeding one of tested rations where, R1 (control group) received (CFM1+bagasse), R2, (CFM2+bagasse) and R3, (CFM3+ bagasse). CFM was offered twice daily at 8.00 a.m. and 4.00 p.m. in two equal portions with the bagasse which was offered at the beginning of the feeding. In three shaded yards, animals were housed and they were weighed biweekly before drinking and feeding in the morning, then calculated the total gain of weight and daily gain for each animal. Daily feed intake was recorded and feed conversion ratio was calculated as the amounts of total DM, TDN and DCP required per 1kg ADG. The calves were in healthy condition and free from internal and external parasites. Ingredients (%) of the experimental CFMs in different tested groups are shown in Table (1).

Table 1. Ingredients (%) of the experimental CFMs in different tested groups.

Item	CFM1	CFM2	CFM3
Leftover Food	-	20.00	40.00
Yellow corn	48.50	33.00	24.00
Soybean meal	20.00	15.50	14.50
Wheat bran	25.00	25.00	15.00
Molasses	3.00	3.00	3.00
Limestone	2.00	2.00	2.00
Salt	1.00	1.00	1.00
Mineral Premix	0.50	0.50	0.50

CFM1 =concentrate feed mixture (control ration), CFM2= concentrate feed mixture contain 20% of dried leftover food and CFM3= concentrate feed mixture contain 40% dried leftover food.

Digestibility trials and rumen liquor parameters:

Digestibility trials were conducted simultaneously on the animals at the end of the feeding trial (3 calves / group) to estimate the feeding values and digestibility coefficients of the tested rations using Acid Insoluble Ash (AIA) method showed by (Van Keulen and Young, 1977). Two times daily with 12 hours interval for 5 days, feces samples were taken and composited for each animal and stored at -20o C until analysis. Feces samples were dried at 60o C for overnight. CFMs, bagasse, leftover and fecal samples were ground and analyzed for DM, CP, CF,EE and ash according to A.O.A.C (2007). Rumen liquor samples were taken at the end of the digestibility trials from three calves for each group at 0, 3 and 6 hrs after morning feeding. The rumen liquor samples were strained through 4 layers of cheese-cloth. By using digital pH meter (Orian 680), pH values were immediately determine. According to Conway and O'Mally (1957) concentrations of Ammonia nitrogen (NH3-N) were estimated. The estimation of TVFA's will be estimate according to Warner (1964).

Blood analysis:

Blood samples were withdrawn from jugular vein in heparinized tubes from each calve and centrifuged for 20 min. at 3000 r.p.m, at the end of the digestibility trial. At -18°C plasma samples were frozen and stored until the time of analysis. According to Henry and Davidsohn (1974), plasma total proteins were estimated as described by the Biuret method. Plasma albumin was assayed according to Doumas et al. (1971). By subtracting the albumin value from total protein value plasma globulin was calculated. Triglyceride was estimated according to young (1995); according to Stein (1986), the total cholesterol will be estimated. Aminotransferase (AST) and alanine aminotransferase (ALT) determine according to Reitman and Frankel (1957); Barham and Trinder (1972) showed that estimation of uric acid ; according to Faulkner and King (1976), creatinine was measured in plasma.

Statistical analysis:

By using the general linear models procedure of SAS (2004) all data were analyzed. Data of percentages were subjected to arc-sin transformation to approximate normal distribution before being analyzed. According to Duncan's multiple range tests (Duncan, 1955), the differences between means were statistically estimated for significant at ($P<0.05$) for the comparison among tested group means of the tested rations when the main effects were significant.

The model used was: $\mathbf{Y_{ij} = \mu + T_i + e_{ij}}$

Where:

Y_{ij} = the observation of ij, μ=overall mean of Y_{ij}, T_i = effect of i (treatments), e_{ij} = the experimental random error.

RESULTS AND DISCUSSION

Chemical composition:

Chemical analysis of feedstuffs, CFMs and calculated chemical composition of tested rations are presented in Table (2). The chemical composition of CFM1, CFM2 and CFM3 were nearly comparable to those using commonly in practical field of growing calves feeding. Also, the nutrient values of bagasse are within the normal range that widely recorded in the literature. The chemical analysis of DLF was recorded (16.78, 13.52, 16.50, 47.49 and 5.71% for CP, CF, EE, NFE and ash, respectively). The value of CP is close to the range that reported by Kim (1995) who concluded that the approximate analysis of leftover foods was 20-28% for CP, 2-4% CF , 10-14% for EE, and 6-12% for ash with its moisture content was below 5%. The differences of chemical analysis may be due to the content of DLF. While, Cho et al. (2004) reported that the chemical

analysis of DLF was as follows: 93.70% DM, 20.62% CP, 8.87% CF, 9.99% EE, and 13.67% ash. In general, DLF is rich in most nutrients and could be used as an effective ingredient and mostly considering as an excellent feed supplement in the rations of growing calves. The tested rations appeared some differences in its chemical composition as a result of increasing the level of DLF up to 40% in the CFM.

Table 2. Chemical analysis of feedstuffs and calculated chemical composition of concentrate feed mixtures and experimental rations (on DM basis, %).

Item	DM	OM	CP	CF	EE	NFE	Ash
Feedstuffs:							
Dried leftover food (DLF)	90.38	94.29	16.78	13.52	16.50	47.49	5.71
Bagasse	95.12	93.89	3.90	32.29	2.06	55.64	6.11
Concentrate feed mixtures (CFMs):							
CFM_1	91.29	92.13	16.86	5.62	4.12	65.54	7.87
CFM_2	92.66	91.25	16.40	7.17	5.54	62.15	8.75
CFM_3	89.14	90.35	16.88	8.36	8.23	56.88	9.65
Experimental rations:							
R1	92.42	92.67	12.90	13.77	3.49	62.51	7.33
R2	93.40	92.05	12.60	14.82	4.86	59.78	7.95
R3	92.83	91.49	12.69	16.08	6.92	55.80	8.51

R1: CFM1 + bagasse (control ration), R2: CFM2 contain 20% of DLF + bagasse, R3: CFM3 contain 40% of DLF+ bagasse.

Feeding values and Nutrient digestibility :

Feeding values and digestion coefficients and of tested rations are showed in Table (3). The obtained results indicated that the digestibility of most nutrients of DM, OM, CP, EE and NFE were insignificantly increased with increasing the level of DLF in rations and the higher values mostly were obtained with animals fed ration contained 40% DLF (R3) and then that having 20% DLF (R2) compared with that of 0% DLF (R1, control group). While, digestibility of CF were significant ($P<0.05$) improved as increasing the level of DLF up to 40% in (R3).

Table 3. Digestibility coefficients (%) and feeding values of the tested rations.

Item	R1	R2	R3	±SE
Digestibility coefficients, %				
DM	65.64	67.78	68.45	±0.54
OM	68.19	68.55	69. 16	±0.48
CP	66.90	68.57	70.73	±1.54
CF	45.77^b	46.36^b	52.59^a	±1. 51
EE	76.13	77.08	81.87	±1.84
NFE	72.95	73.33	71.99	±1.03
Feeding values, %				
TDN	66.52^b	67.78^b	70.36^a	±0.44
DCP	8.630	8.633	8.987	±0.28

a and b means in the same row with different superscripts are significantly (P≤0.05) different. SE=standard error.

R1: CFM1 + bagasse (control group), R2: CFM2 contain 20% of DLF + bagasse, R3: CFM3 contain 40% of DLF+ bagasse.

The positive effect of DLF on nutrient digestibility could be related to its high content of CP and EE that potentially needed to enhance rumen microbial activity. Williams (1988) and Dawson *et al.,* (1990) they reported that the increasing of nutrient digestibility could be attributed to the enhancement of microbial efficiency via stimulating rumen proteolytic bacteria and increasing the activity of cellulytic bacteria. In further explanation, Ojokoh (2007) suggested that microorganism in rumen can be playing an important role that had either negative or positive effect according to the balanced between macro and micro nutrients that released from the dietary ingredients of the offered rations. The positive effect of microorganism is generally regarded as part of the fermentation and increases the availability of nutrients, vitamins, essential amino acids by increasing digestibility of curd protein and curd fiber. Feeding value as TDN was higher significantly only with 40% DLF ration (R3) than that of control one (R1), however DCP value did not significant affected as increasing the level of DLF in rations. Amene et al. (2016) showed that the digestibility of CP is not affected by the different levels of dried Cafeteria leftover that inclusion in the rations of growing pigs but the DM, CF and EE were improved with increasing levels of leftover in the dietary mix. While Chae et al. (2000) showed that the digestibility of CP and EE were improved with increasing the different levels of dried food waste in the diets of growing pigs.

Rumen parameters:

Ruminal pH , NH3-N and TVFA´s means are shown in Table (4). Data indicated that pH means were insignificantly decreased with increasing the level of DLF up to 40% in ration (R3). Odetokun (2000) reported that the decreasing in pH values in generally due to the production of TVFA´s. Which, depending on protein-based fermentation (Adenik *et al.,* 2007). On the other hand, there were significant differences in concentrations of ruminal NH3-N or TVFA´s mostly 3 hrs after feeding among the tested rations where the highest value was observed with R1 respecting NH3-N, while the value of TVFA´s was the highest with R3 ration. Decreases in means of ruminal NH3-N with increasing DLF level may be related to the lower degradability of DLF ingredient that consequently decreased ammonia releasing in the rumen. Ammonia and amines production is quite common end products that released during ruminal fermentation processes as a result hydrolysis of protein. While, insignificant decrease of NH3-N and insignificantly increases of TVFA´s at 6 hrs after feeding were found in comparison with control group (R1) and that is might be due to the well balanced all dietary nutrients required for calves and ruminal organisms as well. Such slightly increases of TVFA´s means may be due to the increase of digestibility coefficients of organic matter (El-Ashry *et al.,* 2003). Doane *et al.* (1997), reported that the higher digestibility of curd fiber resulted from altered microbial population and its activities. Also, Allam *et al.* (1984) suggested that the TVFA´s levels in rumen could be affected by dry matter digestibility, rate of absorption, pH values and activity of microbial population.

Table 4. Ruminal parameters of growing calves fed the tested rations.

Item	pH			NH3-N (mg/100 ml RL)			TVFA´s (meq/ 100 ml RL)		
	0 hrs	3 hrs	6 hrs	0 hrs	3 hrs	6 hrs	0 hrs	3 hrs	6 hrs
R1	6.84	5.81	6.72	29.87^{a}	64.57^{a}	42.20	21.43	18.00^{b}	12.53
R2	6.81	5.58	6.63	25.20^{ab}	36.60^{b}	38.93	21.73	21.50^{ab}	13.00
R3	6.75	5.03	6.32	20.90^{b}	27.27^{b}	38.70	22.13	24.00^{a}	13.37
±SE	±0.13	±0.25	±0.24	±2.33	±6.32	±4.05	±1.21	±1.64	±2.36

a and b means in the same column with different superscripts are significantly (P≤0.05) different. SE=standard error.
R1: CFM1 + bagasse (control group), R2: CFM2 contain 20% of DLF + bagasse, R3: CFM3 contain 40% of DLF+ bagasse.

Blood parameters:

Blood parameters of calves fed the tested rations are shown in Table (5). Data indicated that the level of DLF had insignificant effects on the levels of all parameters of blood (total proteins, globulin, total cholesterol, triglyceride, AST, ALT, creatinine and uric acid) except for albumin level that increased significantly only with 40% DLF-ration (R3) compared with control one (R1). The means of total proteins was increased slightly with increasing the level of DLF in tested rations. These increases in plasma total proteins and albumin levels may be due to indirect response to protein intake and quality of DLF. Cho *et al.* (2004), found that feeding DLF to broilers slightly increased total cholesterol levels in plasma with insignificant differences. Also, Mousa *et al.* (2018) reported that ducks fed DLF (0, 10, 20 and 30%) the triglycerides levels were increased significantly while, there were insignificant effect on serum total cholesterol. While, Chen *et al.* (2007) reported that chickens fed dehydrated food waste product (0, 5, 10, or 20%) had increased ($p<0.05$) the value of serum AST with increasing dehydrated food waste product in their diets.

Table 5. Blood parameters of growing calves fed the tested rations.

Item	R1	R2	R3	±SE
Total proteins, g/dl	6.06	6.11	6.18	±0.14
Albumin, g/dl	3.27^{b}	3.34^{b}	3.58^{a}	±0.05
Globulin, g/dl	2.79	2.77	2.60	±0.18
Triglyceride, mg/dl	58.08	62.23	64.62	±4.26
Cholesterol, mg/dl	98.43	100.44	102.53	±3.55
AST, U/L	34.35	32.52	33.70	±1.34
ALT, U/L	26.54	26.34	24.14	±2.05
Uric acid, mg/dl	3.51	3.18	3.12	±0.22
Creatinine, mg/dl	1.05	1.03	1.01	±0.07

a and b means in the same row with different superscripts are significantly (P≤0.05) different. SE=standard error. R1: CFM1 + bagasse (control group), R2: CFM2 contain 20% of DLF + bagasse, R3: CFM3 contain 40% of DLF+ bagasse.

Growth performance, feed intake and economic efficiency:

The means of growth performance, feed intake and conversion and economic efficiency are shown in Table (6). Average daily dry matter intake was nearly comparable among treatments, being slightly improved with increasing the proportion of DLF up to 40% in growing calves' rations. There were agreement between these results and those reported by Maeng *et al.* (1997), who found that increasing substitution levels of fermented DLF in the ration for laying hens resulted in improved feed intake. More recently, Amene *et al.* (2016) found that daily feed intake in all groups increased with increase in proportion of dried Cafeteria leftover (DCLO) in the rations of growing pigs. Averages of total body weight gain and daily gain were insignificantly increased with 20% DLF (R2) and significant increased with 40% DLF (R3) based on control group (R1). By the other words, total weight gain of growing calves in R2 and R3 groups were increased by 1.29 and 4.63%, respectively based on those in R1. The observed improvements in daily gain of growing calves in 40% DLF-ration might be due to higher intake of TDN and DCP from this ration (Table 6). In relation with this point, McClure *et al.* (1970) found that when 50% of DLF was proportion for commercial diets in ruminant, nutritional quality of final feed was good enough to meet nutrient requirement. Further study achieved by Paek *et al.* (2005) reported that average daily gain was not affected by (DLF) substitution level up to 75% of formula feed. While, the daily gain markedly decreased at 100% substitution level. The daily DMI was similar among the experimental treatments and likewise the amount of each DMI, TDN and DCPI per 1 kg gain was comparable among the dietary treatments (R1, R2 and R3). Amene *et al.* (2016) showed that the final weight, total gain and average daily gain of the pigs were improved with increasing the levels of dried Cafeteria leftover in their diet, and usually FCR was in reverse trend with average daily gain. Concerning feed conversion parameters in this study, the quantities (kg) of DM, TDN and DCP per 1 kg gain had insignificant affect by the dietary groups, being its values were closely similar among them. Otherwise results obtained by Saikia and Bhar (2010) indicated that feed conversion was higher in pigs fed on food waste based diets than that of those fed diets free from such food waste. Means of economic efficiency in Table (6) showed that means of daily feed cost (LE) and cost of feed / kg gain (LE) were significantly ($P<0.05$) decreased with increasing DLF level in CFM up to 40% (R2 and R3). While the price of daily gain was significantly ($P<0.05$) increased by increasing level of DLF in both tested rations (R2 and R3). The favorable economic values were occurred with R3, followed by R2 in comparison with the poorest one (R1). These results were reflected on economic efficiency, where the highest values being associated with R3 and the moderate one were resulted with the R2, while the lowest values were outputted by control group. These findings indicated that economic efficiency of growing calves increased with increasing DLF level in CFM up to 40% (R3). In turn the daily profit (L.E.) and relative daily profit (LE) were markedly increased with the increasing the level of DLF in CFM (R3) compared with

the other ones. Economic efficiency were higher with 40% DLF (R3) than that of the other groups. The present results are in harmony with those recorded by Paek *et al.* (2005) who reproted that income per head was highest in 50% substitution level of DLF. Ration containing different levels of DCLO was economically feasible than that free from it respecting cost effective diet for pigs. Additionally, the economic return was more promising for pig fed 67% DCLO containing ration (Amene *et al.,* 2016). Generally, the unutilized wasted food after processed by potential suitable methods, should be using potentially in formulation of rations for all classes of livestock. It is unimpeachable have a great added value on nutritional and economical scall.

According to prices of the Egyptian market during the experimental period (2019). The price of one ton of soybean meal, yellow corn, wheat bran, molasses, lime stone, salt and minerals mix. were 6400, 4500, 4000, 900, 500, 1000 and 20000 LE, respectively. Prices of one ton dry leftover food, bagasse and live body weight were 700, 1200 and 52 LE, respectively. Price of one ton of CFM1, CFM2, CFM3= 4587, 3764 and 3035 L.E., respectively.

Table 6. Growth performance, feed intake and conversion and economic efficiency of growing calves fed the tested rations.

Item	R1	R2	R3	±SE
Growth performance:				
Initial body weight, kg	258.4	257.0	259.0	±2.87
Final live body weight, kg	411.0	410.0	418.6	±3.83
Total body weight gain, kg	152.6^{b}	153.0^{b}	159.6^{a}	±2.08
Daily body weight gain, kg	1.362^{b}	1.366^{b}	1.425^{a}	±0.02
Relative daily body weight gain%	100	100.29	104.63	
Daily feed intake (as fed):				
CFMI, kg	6.31	6.49	6.42	±0.08
Bagasse/kg	3.40	3.19	3.43	±0.15
DMI, kg	9.72	9.68	9.85	±0.14
TDNI, kg	6.46^{b}	6.56^{b}	6.93^{a}	±0.09
DCPI, kg	0.838^{b}	0.836^{b}	0.885^{a}	±0.11
Feed conversion:				
DMI, kg/ gain, kg	7.13	6.98	7.01	±0.11
TDN, kg/ gain, kg	4.74	4.73	4.93	±0.08
DCP, kg/ gain, kg	0.62	0.60	0.62	±0.009
Economic efficiency:				
Price of daily gain, L.E.	70.85^{b}	71.04^{b}	74.10^{a}	±0.968
Concentrate feed mixture (CFM), L.E.	28.96^{a}	24.42^{b}	19.48^{c}	±0.302
Bagasse, L.E.	4.02	3.83	4.11	±0.185
Average daily feed cost, L.E.	32.98^{a}	28.25^{b}	23.59^{c}	±0.274
Feed cost / kg gain, L.E.	24.25^{a}	20.17^{b}	16.56^{c}	±0.272
Daily profit, L.E.	46.59^{c}	50.32^{b}	57.54^{a}	±1.184
Economic efficiency (%)	2.92^{a}	3.52^{b}	4.47^{c}	±0.084
Relative feed cost (%)	100	88.98	71.14	
Relative daily profit (%)	100	105.78	120.95	

a, b and c means in the same row with different superscripts are significantly (P≤0.05) different. SE=standard error.
R1: CFM1 + bagasse (control ration), R2: CFM2 contain 20% of dried leftover food + bagasse, R3: CFM3 contain 40% of dried leftover food + bagasse

CONCLUSION

In conclusion, leftover food collected from Hotels could be used as a beneficial matter in formulation of diets of growing calves with positive effect on nutrient digestibility coefficients, some parameters of blood, performance of growth and economic efficiency, in particularly with the tested ration that contained 40% level of DLF.

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الإستفادة من بقايا الطعام المجمعة من الفنادق في علائق العجول البقري الخليط

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تهدف هذه الدراسة إلي تقييم تأثير استخدام بقايا الطعام المجففة في علائق العجول البقري الخليط (بلدي x فريزيان) علي أداء النمو ونشاط الكرش وخصائص الدم من خلال تجربة التغذية. أستخدم خمسة عشر ذكر من عجول البقري الخليط بمتوسط وزن ٢٥٨±١ كجم حيث قسمت عشوائيا إلي ثلاث مجموعات متماثلة. تم تغذية العجول علي العلائق لمدة ١٦ أسبوع كفترة تجريبية. تم تكوين العلائق التجريبية المركزة مع الإستبدال الجزئي بنسبة ٠ , ٢٠ , ٤٠٪ من بقايا الطعام المجففة للعليقة المركزة ١ و العليقة المركزة ٢ والعليقة المركزة ٣، علي التوالي، بالإضافة إلى مكون الباجاس كجزء خشن لتكوين العلائق التجريبية المختبرة ر١ (كنترول)، ر٢، ر٣ علي التوالي . أظهرت النتائج تحسن معظم معاملات الهضم والقيم الغذائية مع ارتفاع مستوي بقايا الطعام المجففة (٤٠٪) بالعليقة مقارنة بالعلائق ر٢، ر١ (كنترول). وقد أظهرت النتائج انخفاض قيم الأمونيا و درجة الحموضة لسائل الكرش مع زيادة مستوي بقايا الطعام المجففة حتي ٤٠٪(ر٣) في العلائق وعلي العكس في تركيز الأحماض الدهنية الطيارة الكلية بسائل الكرش. لم يوجد اي فروق معنوية بين المعاملات في معظم خصائص الدم. إرتفاع معدل الزيادة الكلية في وزن الجسم ومعدل النمو اليومي بصورة معنوية مع ر٣مقارنه ر١ (كنترول). كما أدي استخدام بقايا الطعام المجففة في العلائق حتى مستوى ٤٠٪ (ر٣) الي تحسن ملحوظ للكفاءة الاقتصادية مقارنة مع ر١. وخلصت هذه الدراسة إلي التوصية بإستخدام بقايا الطعام المجففة حتى مستوى ٤٠٪ في تركيب علائق العجول البقرى الخليط.