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THE USE OF UNTRADITIONAL RATION CONSTITUENTS IN FEEDING OF GROWING DUCKS B- DRIED RUMEN CONTENTS

(With 7 Tables)

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إستخدام مكونات علائق غير تقليدية فى تغذية البط النامى
ب- محتويات الكرش الجافة

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تمت هذه الدراسة لقياس تأثير إضافة مستويات مختلفة من محتويات الكرش الجافة إلي علائق البط المسكوفي على كفاءة الأداء ومواصفات الذبيحة وبعض مكونات الدم فى البط المسكوفى. تم إستخدام عدد ٦٠ بطة من صغار البط المسكوفى فى عمر أسبوعين. قسمت عشوائيا الى ٥ مجموعات بكل منها عدد ١٢بطة. غذيت المجموعة الاولى على عليقة ضابطة لمدة عشرة أسابيع بينما غذيت باقى المجموعات الأربعة لنفس الفترة على علائق تحتوى ٥ ،١٠، ١٥ ، ٢٠٪ من محتويات الكرش المجفف. كانت جميع العلائق متساوية فى الطاقة (٣٠٠٠ كيلو كالورى طاقة ممثلة/كجم عليقة) والبروتين (١٦٪ بروتين خام) طبقا للاحتياجات الموصى بها فى الجداول القياسية ان آر سى ١٩٩٤. تم تقدير القياسات الخاصة بكفاءة الأداء وخواص الذبيحة وبعض التغيرات البيوكيميائية فى الدم وكذلك حساب معدل النفوق والكفاءة الاقتصادية. وقد سجلت النتائج عدم وجود نفوق فى كل من المجموعة الضابطة والمجموعات المغذاة على علائق تحتوى ٥ ،١٠، ١٥ ٪ من محتويات الكرش الجافة بينما سجلت المجموعة المغذاه على عليقة تحتوى على ٢٠٪ من محتويات الكرش الجافة نسبة نفوق تعادل ٨,٣٣٪. كما أوضحت النتائج انه لا توجد فروق معنوية لكل من وزن الجسم الحى ومقدار الزيادة المطلقة فى وزن الجسم ومعدل استهلاك الغذاء ومعدل التحويل الغذائى وكفاءة استخدام كل من البروتين والطاقة وكذلك نسبة التصافى ونسبة الأحشاء الداخلية للذبيحة (القلب والطحال) فى حين انه توجد فروق معنوية بين المجموعات المختبرة والمجموعة الضابطة فى نسبة الكبد ، القونصة، المعدة. كما أثبتت النتائج عدم وجود فروق معنوية فى كل من البروتين الكلى والالبيومين والجلوبيولين وحمض اليوريك فى مصل دم كل من المجموعات المختبرة والمجموعة الضابطة. وقد خلصت النتائج الى انه

يمكن اضافة محتويات الكرش المجفف حتى ٢٠٪ فى علائق البط المسكوفى النامى لما له من أثر فى خفض تكلفة العليقة وليس له أى أثر سلبى على الأداء.

SUMMARY

The present study was performed to study the effect of addition of dried rumen contents in the diet of growing ducklings on performance, carcass traits and some blood biochemical constituents. Sixty Muscovy ducklings of two weeks old were randomly distributed into 5 groups each of 12 ducklings. The first group was considered as a control and was fed *adlibitum* on a grower/ finisher diet. The other four groups were fed diets containing dried rumen content at levels of 5, 10, 15 and 20% respectively. All diets were formulated to be isocaloric (3000 kcal/kg ME), isonitrogenous (16% CP) as recommended by NRC (1994) for growing ducks. The experiment was extended for 10 weeks. Performance characteristics were assessed. In addition, some blood constituents, carcass traits, mortality rate and economical evaluation were also measured. The results showed that, there was no mortalities in control group and groups fed diets with 5, 10 and 15% dried rumen content, while group fed diet with 20% dried rumen content recorded 8.33% mortality rate. The inclusion levels (0, 5, 10, 15 and 20%) of dried rumen content to the duck diets did not significantly influence the live body weight, body weight gain, feed intake, feed conversion ratio, protein efficiency ratio and caloric efficiency ratio at any growth phase. There were no significant differences between control group and other treatments in carcass dressing percentage and relative percentage of internal organs (heart and spleen). While there were significant ($P < 0.05$) differences in relative percentage of internal organs (liver, gizzard and proventriculus) between control group and other treatments. Also, there were no significant differences in the level of serum total protein, albumin, globulin and uric acid between control group and other treatments. It could be concluded that, using DRC as untraditional feed ingredient in diets of growing ducks up to 20 % will share in decreasing environmental pollution and lowering the feed cost without any adverse effect on the duck performance.

Key words: *Ducks, feeding, dried rumen content, performance.*

INTRODUCTION

The world today is suffering from a serious shortage of livestock feed ingredients such as wheat, corn, soyabean e.t.c., because of the rapid increase in human population and the competition for this feedstuff between the increased human population and livestock. The increase in price of feed ingredient in developing countries has greatly reduced the rate of expansion of the poultry industry. In order to arrest this trend, emphasis has been directed towards the use of economical and efficient feeds such as abattoir wastes. The current trend toward animal waste recycling is motivated by both economic and environmental considerations. The economic potential of utilizing animal wastes as a new feed resource is already of tremendous importance. It will however increase in the near future, because of the rapid accumulation of scientific knowledge and practical results from commercial applications, which will make nutrient recovery from animal wastes attractive for farmers. The abundant supply of this raw material could enhance production by reducing the cost of compounded feeds without reducing the nutritive quality of the ration.

Rumen content is a material from the rumen of cattle which is the first stomach compartment of the ruminant that has been utilized as a feedstuff in poultry and ruminant diets. It's a waste, relatively cheap, locally available and constituting disposal problem at the abattoir. It is account for about 80% of the capacity of the adult ruminant stomach (Church, 1993). The bulk digestion of the rumen content is an important source of energy, protein and vitamins especially vitamin B complex (Devendra, 1981). The proteins of rumen microorganisms contain a good concentration of essential amino acids (El-Deek, 1976). The nutritive value of dried rumen content and its fractions have been investigated with growing chickens, broilers, ducklings and rabbits (El-Deek *et al.*, 1975; Emmanuel, 1978; Reddy and Reddy, 1980; El-Shaarrawi *et al.*, 1988). Evaluation of performance, carcass traits and economic analysis of growing ducks fed dried rumen content were studied herein.

MATERIALS and METHODS

Birds and housing

A total number of 60 unsexed two weeks old Muscovy ducklings were weight and randomly distributed into 5 groups, each of 12

ducklings. Birds had similar initial average weight (456.33± 11.74 g). Ducks were reared under similar environmental and managerial conditions during the period from 2-12 weeks of age.

Preparation of dried rumen content

The rumen content was collected from the abattoir at slaughter time, immediately the rumen was split on. The rumen content was sun dried for 3-4 days depending on the intensity of the sun. The sun dried material was milled in a hammer mill to produce finely ground dried rumen digesta meal (Esonu *et al.*, 2006)

Diets and feeding

The first group was fed a diet free from DRC and considered as control. Dried rumen content (DRC) was added to the tested diets at the levels of 5, 10, 15 and 20% for the other four groups, respectively. The diets were formulated to be isocaloric, isonitrogenous as recommended by NRC (1994) for growing ducks. The ducklings in the five groups were fed *adlibitum* on the respective diets in mash form and given free access to fresh and clean water during the experiment. The composition and metabolizable energy value of the ingredients and the experimental diets are presented in tables 1 and 2.

Measurements

Performance characteristics including body weight (g), feed intake (g), feed conversion ratio, protein efficiency ratio and caloric efficiency ratio were calculated. Mortality rate was also monitored on group basis. The proximate analysis of the experimental feeds was performed using procedures detailed by the Official Analytical Chemistry (AOAC, 1990). The ME value of the feed ingredients and DRC were calculated on the basis of the chemical composition according to Carpenter and Clegg (1956) and Janssen (1989). Calcium in prepared samples was determined in g/kg using test kits (BIOGAMMA-ITALY Company) as described by (Kaplan and Pesce, 1996). Phosphorus was determined in g/kg using the test kits (LABKIT company) after the method described by (Young, 2001).

Carcass traits

At the end of the experiment, three birds from each group were randomly taken, individually weighed and slaughtered by severing the carotid artery and jugular veins. After four minutes of bleeding, each bird was dipped in a water bath for two minutes and feathers were removed by hand. After the removal of head, carcasses were manually eviscerated to determine some carcass traits including dressing % (eviscerated carcass without head, neck and legs) and giblets % (gizzard,

proventriculus, liver, spleen and heart). The organs weight was expressed as relative weight proportionate to pre-slaughter live body weight.

Blood samples and biochemistry

Blood samples were collected from each group, allotted to clot at ambient temperature, centrifuged for 15 minutes at 3000 rpm and then extracted. The serum samples were kept at -20 ^{0}C till performing the biochemical analysis. Serum total protein and uric acid was determined using commercial kits (SGM Italia) based on the methods outlined by Kaplan and Pesce (1996). Serum albumin was determined using commercial kits (BIOCON Company) as described by Marshall (1989). Moreover, Serum urea was determined using commercial kits (DP International Company) as the methods outlined by Patton and Crouch (1977).

Statistical analysis:

The obtained data were analyzed using one way analysis of variances (ANOVA) followed by LSD TEST using Spss 11.0 statistical software (SPSS, Inc, Chicago, IL,2001), www.Spss.com.

Table 1: Chemical composition (%) and metabolizable energy value of the ingredients used in the experimental diets

Items \ Ingredients	Yellow corn	Soybean meal	Fish meal	Wheat bran	Dried fat	DRC*
Dry matter	88.50	91.12	95.00	91.00	96.25	94.25
Crude protein	8.60	45.00	39.50	14.51	4.68	12.50
Ether- extract	4.68	3.28	14.50	5.45	55.98	5.50
Crude fiber	2.22	6.55	0.81	11.00	3.36	32.15
Nitrogen free-extract	71.89	30.44	1.88	55.49	11.23	31.60
Ash	1.11	5.85	38.31	4.55	21.00	12.50
Calcium	0.03	0.36	5.36	0.18	2.75	0.96
Total phosphorus	0.31	0.66	2.25	1.35	0.42	0.85
Lysine	0.26	2.69	1.37	1.73	0.00	0.00
Methionine	0.18	0.62	0.50	0.50	0.00	0.00
ME (kcal/kg diet)	3390	2372	2712	1647	5271	2360

*DRC: Dried rumen content

Table 2: Composition of the experimental diets

Ingredients	Dried rumen content (%)				
	0	5	10	15	20
Physical composition (%)					
Yellow corn	43.02	58.21	59.69	59.76	57.57
Soybean meal	14.44	15.18	15.37	15.41	15.28
Fish meal	4.00	4.00	4.00	4.00	4.00
Wheat bran	24.96	12.01	6.77	2.64	0.00
Dried fat	12.90	4.60	2.96	1.95	2.00
Rumen content, dried	0.00	5.00	10.00	15.00	20.00
Sodium phosphate dibasic	0.00	0.00	0.20	0.24	0.24
Limestone, ground	0.00	0.32	0.32	0.30	0.18
Common salt	0.33	0.33	0.33	0.33	0.33
Lysine	0.00	0.00	0.00	0.00	0.02
Methionine	0.05	0.05	0.06	0.07	0.08
Premix*	0.30	0.30	0.30	0.30	0.30
Chemical composition (%):					
Dry matter	90.84	90.19	90.06	90.13	90.34
Crude protein	16.00	16.00	16.00	16.00	16.00
Ether- extract	11.64	7.31	6.45	5.94	5.60
Crude fiber	5.11	5.40	6.42	7.54	8.81
Nitrogen free-extract	51.38	56.26	55.92	55.15	53.95
Ash	6.71	5.22	5.27	5.50	5.98
Calcium	0.68	0.60	0.60	0.60	0.60
Total Phosphorus	0.71	0.60	0.60	0.60	0.60
Lysine	0.72	0.70	0.68	0.66	0.65
Methionine	0.30	0.30	0.30	0.30	0.30
ME (kcal/kg diet)	3000	3000	3000	3000	3000
Calorie/protein ratio	187.5	187. 5	187. 5	187.5	187.50

*Each 2.5 kg contains: Vit. A, 12000000 IU; Vit. D_3, 2000000 IU;Vit. E, 10 g; Vit. k_3, 2 g; Vit. B_1, 1 g; Vit. B_2, 5 g; Vit. B_6, 1.5 g; Vit. B_{12}, 10 g; Nicotinic acid 30 g; Pantothenic acid 10 g; Folic acid 1 g; Biotin 50 g; Choline chloride 5o % 250 g; Iron 30 g; Copper 10 g; Zinc 50 g; Manganese 60 g; Iodine 1g; Selenium 0.1.

RESULTS

Body weight development, mortality rate and performance characteristics (feed consumption, body weight gain, feed conversion ratio, protein and energy efficiency ratios) of ducks in the different groups are presented in tables 3 and 4. Groups fed diets with 20% DRC had a mortality percentage 8.33. The results indicated that, the inclusion levels (0, 5, 10, 15 and 20%) of dried rumen content to the duck diets did not significantly (P>0.05) influence body weight development or performance characteristics at any growth phase.

Table 3: Body weight development (g/duck) and moratality (%) of ducks in the experiment

Age (weeks)	Dried rumen content (%)				
	0	5	10	15	20
2*	450 ± 26.8	450.4±26.0	458.3 ± 24.5	460.4±34.47	462.5±22.3
4	1170.4 ± 52.2	1214.2 ± 50.6	1192.9 ± 39.2	1222.1 ±71.59	1205 ± 47.2
6	2070.3 ± 69.2	2104.2 ± 80.7	2082.9 ± 58.1	2097.9 ± 83.68	2095 ± 100.0
8	2830 ± 138.0	2789.2 ± 153.5	2827.9 ± 121.9	2820.8 ± 189.1	2835 ± 173.9
10	3414.8 ± 239.2	3360.8 ± 240.5	3437.9 ± 213.2	3392.9 ± 292.6	3405 ± 275.2
12	3808 .3 ± 272.7	3813.8 ± 255.7	3840 ± 252.2	3812.9 ±309.4	3785 ± 287.2
Mortality %	00.00	00.00	00.00	00.00	08.33

*Intial age

Table 4: Stage performance of duck fed different levels of dried rumen content

Item		Dried rumen content (%)				
		0	5	10	15	20
Feed intake (g)	2-4	1734	1768	1805	1791	1737
	4-6	2727	2819	2895	2947	3107
	6-8	3042	2787	2663	2968	3365
	8-10	2821	2768	3235	3073	3043
	10-12	2242	2548	2364	2600	2368
	2-12	12557	12690	12962	13379	13620
Weight gain(g)	2-4	720± 35.6	764±32.5	736±35.4	762±30.7	743±41.2
	4-6	900±42.9	890±38.3	890±39.6	876±38.6	884±32.7
	6-8	760±31.2	685±29.2	745±28.4	723±27.3	740±2.37
	8-10	585±29.7	572±17.9	610±19.9	572±21.2	570±20.5
	10-12	394±19.6	453±21.6	402±22.7	420±18.6	380±19.8
	2-12	3359±79.8	3364±72.8	3383±69.1	3353±71.6	3317±68.7
Feed conversion	2-4	2.41	2.31	2.45	2.35	2.34
	4-6	3.03	3.17	3.25	3.36	3.51
	6-8	4.00	4.07	3.57	4.11	4.55
	8-10	4.81	4.84	5.30	5.37	5.32
	10-12	5.69	5.62	5.88	6.19	6.23
	2-12	3.74	3.77	3.83	3.99	4.10
Protein eff. Ratio	2-4	2.60	2.70	2.55	2.66	2.67
	4-6	2.06	1.97	1.92	1.86	1.78
	6-8	1.56	1.54	1.75	1.52	1.38
	8-10	1.30	1.29	1.18	1.16	1.18
	10-12	1.10	1.11	1.06	1.01	1.00
	2-12	1.67	1.66	1.63	1.57	1.52
Caloric effi. ratio	2-4	0.14	0.14	0.14	0.14	0.14
	4-6	0.11	0.11	0.10	0.10	0.09
	6-8	0.08	0.08	0.09	0.08	0.07
	8-10	0.07	0.07	0.06	0.06	0.06
	10-12	0.06	0.06	0.06	0.05	0.05
	2-12	0.09	0.09	0.09	0.08	0.08

Serum biochemical parameters (total protein, albumin, globulin, albumin/globulin ratio and uric acid) are presented in table 5. The results indicated that, the inclusion levels (0, 5, 10, 15 and 20%) of dried rumen content to the duck diets did not significantly ($P>0.05$) influence the serum parameters.

Table 5: Blood parameters of ducks in the experiment

Item	Dried rumen content (%)				
	0	5	10	15	20
Total protein g/dl	3.87±0.04	3.03±0.05	3.00±0.06	2.54±0.03	2.35±0.03
Albumin g/dl	1.05±0.02	0.66±0.03	0.49±0.02	0.63±0.02	0.66±0.03
Globulin g/dl	2.82±0.04	2.38±0.02	2.51±0.03	1.91±0.04	1.69±0.01
Alb/Glob ratio	0.37±0.01	0.28±0.01	0.20±0.01	0.33±0.02	0.39±0.02
Uric acid mg/dl	2.70±0.03	3.55±0.04	3.72±0.04	2.80±0.02	2.25±0.03

Carcass traits including carcass weight, dressing percentages, weights of internal organs proportionate to pre-slaughter live body weight are revealed in table (6). The level of DRC had no significant (P>0.05) effect on the percentages of dressing and internal organs.

Table 6: Carcass traits parameters of ducks in the experiment

Items	Dried rumen content (%)				
	0	5	10	15	20
Preslaughter, wt.(gm)	3833.3±633	3833.3±589	3900±513	3933.3±688	3700±709
Evacerated carcass, weight (gm)	2798.3±464.	2785±435	2913.3±374	2888.3±506	2721.7±535
Carcass (%)	73.00±1.19	72.60±0.35	74.80±0.92	73.43±0.09	73.44±0.38
Dressing weight (gm)	2965.7±495	2963.3±460	3107.7±396	3093.67±538	2915.33±569
Dressing (%)	77.52±1.12	77.28±0.35	79.75±1.07	78.68±0.08	78.70±0.34
Liver, %	1.55±0.01^{c*}	1.89±0.05^{a}	1.65±0.02^{c}	1.86±0.08^{ab}	1.72±0.08^{bc}
Heart, %	0.78±0.003	0.76±0.003	0.80±0.02	0.78±0.003	0.84±0.01
Proventriculus, %	0.28±0.01^{d}	0.32±0.01^{c}	0.34±0.01^{c}	0.49±0.003^{a}	0.43±0.01^{b}
Gizzard, %	2.18±0.04^{b}	2.02±0.02^{b}	2.54±0.10^{a}	2.65±0.06^{a}	2.67±0.05^{a}
Spleen, %	0.08±0.00	0.09±0.01	0.09±0.01	0.08±0.01	0.07±0.00

* Means within the same row with different superscripts are significantly different (P < 0.05).

Economical evaluation of duck performance in the different experimental groups are presented in table (7). Groups fed diets with DRC had more economic feed efficiency and relative feed efficiency than those fed control one.

Table 7: Economical evaluation of ducks in the experiment

Item	Dried rumen content (%)				
	0	5	10	15	20
Average feed intake (kg/bird)	12.56	12.69	12.96	13.38	13.61
Price/kg feed (L.E)	2.75	2.11	1.94	1.81	1.75
Total feed cost (L.E)	34.54	26.78	25.14	24.22	23.82
Total production cost (L.E)	57.04	49.28	47.64	46.72	48.37
Body weight (kg/bird)	3.81	3.81	3.84	3.81	3.79
Price/kg body weight (L.E)	18.00	18.00	18.00	18.00	18.00
Total revenue (L.E)	68.58	68.58	69.12	68.58	68.22
Net revenue (L.E)	11.54	19.30	21.48	21.86	19.85
Economic feed efficiency (%)	20.23	39.16	45.09	46.79	41.04
Relative economic feed efficiency	100	194	223	231	203

DISCUSSION

Growth performance

Recorded values of mortality rates in table 3 appeared to be within normal limits, so it could be said that feeding of dried rumen content at level up to 20% for growing ducks had no effect on their mortality during the experiment. The percentage of mortality recorded with ducks was considered as indication that the dried rumen content is not toxic for birds. The mortality rate registered also cleared- that, the processing method used for drying of rumen content was suitable. In this connection, Adeniji and Jimoh (2007) reported that, no adverse effects were recorded when they fed pullet chicks on diet containing 0, 10, 15 and 20% dried rumen content.

The results in tables 3 and 4 indicated that, the inclusion levels (0, 5, 10, 15 and 20%) of DRC to the duck diets did not significantly ($P>0.05$) influence body weight development, weight gain and feed conversion ratio at any growth phase. These results

were in line with that reported by previous studies (Emmanuel, 1978; El-Shaarrawi *et al.*, 1988; Das *et al.*, 1997; Adeniji and Balogun, 2001 and 2002 ; Esonu *et al.*, 2006 and 2007 and Adeniji, 2008) who reported that, broilers fed on diets containing dried rumen content recorded higher body weight and feed conversion than the control birds. On the contrary, these results disagreed with those reported by El- Deek *et al.* (1995) and Adeniji and Oyeleke (2008) who reported that, including over 6% sun dried rumen content in Muscovy duckling diets hinder growth and decreased feed conversion ratio as compared to those fed the control diet. Our finding indicated that, birds on the diets with

DRC performed generally similar or better than the control group. This improved performance could be attributed to higher protein component of the test undigested starchy and fibrous carbohydrates, long chain fatty acids and partially digested feed protein. The improved performance could also probably be due to adequate dietary crude fibre level. Crude fibre activates the intestine and more occurrence of peristaltic movement, more enzyme production resulting in efficient digestion of nutrients (Esonu *et al.*, 2006).

The results showed that, the feed intake by ducks fed on diets contained dried rumen content was not significantly (P>0.05) differed compared to control one. These results were agreed with that found by (Adeniji and Balogun, 2001; Esonu *et al.*, 2007 and Adeniji, 2008) who showed that, the inclusion of rumen content was not significantly (P <0.05) increased feed consumption. On the contrary, Esonu *et al.* (2006) and Adeniji and Oyeleke (2008) concluded that feed intake of the birds fed on varying dietary levels of dried rumen content were significantly (P<0.05) higher than that of the control group.

The data obtained in table 4 showed that, there were no significant (P>0.05) differences in protein efficiency ratio between the control and other treated groups. These results are in agreement with that found by El - Deek *et al.* (1995) who reported that, there were no significant (P>0.05) differences in crude protein intake and protein efficiency ratio in Muscovy ducklings fed diets with sun dried rumen content and sun dried laying hens manure. The results also indicated that, there were no significant (P >0.05) differences in caloric efficiency ratio between the control and the other treated groups at any growth phase of the experiment. The slight decrease in protein and energy efficiency ratios as DRC level increased in the diets may be attributed to poor utilization of the nutrients as a result of increasing fibre content of the diets.

Blood parameters

Data of serum total protein, albumin, globulin, albumin/globulin ratio and uric acid of Muscovy ducklings were not significantly affected by using the different dietary levels of dried rumen content as shown in table 5. These findings were disagreed with that found by Sadhukhan *et al.* (1993) who reported that serum protein increased with increasing the level of dietary rumen content.

Carcass trait parameters

Data presented in table 6 indicated that, there were no significant (P> 0.05) differences in preslaughter weight, carcass weight and

percentage, dressing weight and percentage and relative percentage of internal organs (heart and spleen) between different treated groups. Ducks groups fed on diet contained 5% & 15% dried rumen content had significantly (P<0.05) higher liver percentage than those fed diets with 0, 10 and 20% dried rumen content. Also, group fed diet with 15% dried rumen content had significantly (P<0.05) higher relative proventriculus percentage than the other treated groups. In addition, significant (P<0.05) higher relative gizzard percentages were found with duck groups fed on diets contained 10, 15 and 20% dried rumen content compared to other group. On the contrary El-Deek *et al.* (1995) found that, there were no significant differences among ducks fed 10% sun dried rumen content in liver, heart, gizzard and dressing percentage, although spleen weight percentage exhibited significant differences. Petek *et al.* (2000) reported that, weights of carcass, gizzard and liver as percentage of live body weight were significantly differ among birds fed broiler diets with 10 and 20% dried rumen content. Esonu *et al.* (2006) found that, relative organ weights of the broilers fed different dietary levels of DRC were not differ significantly than the control one.

Economical evaluation

Data in table 7 showed that, the price / kg feed decreased with increasing the level of dried rumen content. It was observed that, ducks fed diet containing dried rumen content had higher economic efficiency (EFE) when compared with those received the control diet. The reduction in the price of feed with increasing the level of rumen content in the diet was attributed to that the dried rumen content is a cheap abattoir waste which could be collected freely and the only cost is that used in transportation and processing of the rumen content. It could be concluded that, incorporation of DRC in the duck diets up to 20% will share in decreasing environmental pollution and lowering the feed cost without any adverse effect on the duck performance.

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