UNTRADITIONAL SOURCES OF ENERGY IN DIETS FOR JAPANESE QUAILS : 1. GROWING QUAILS

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Abstract

A total number of 224 one-day old japanese quail chicks were distributed into 7 groups of 4 replicates of 8 chicks each (7x4x8) and reared under similar management conditions up to 6 weeks of age in electrically heated quail batteries. Seven growing diets were formulated in which the first one was corn-soybean diet and taken as a control (T1). In the other diets, 50% of corn in T1 was replaced by either tapioca (T2), or crushed macaroni only (T3). All corn in T1 was replaced (100%) by either 1:1 tapioca+crushed macaroni (T4), tapioca only (T5), crushed macaroni only (T6), or a mixture (1:1:1) of corn + tapioca + crushed macaroni (T7). All diets were nearly iso-nitrogenous of about 24% CP and iso-caloric of about 3000 Kcal ME/Kg and adjusted to satisfy nutrient requirements of quails.

The results obtained showed that T7 in which corn, tapioca and crushed macaroni (1:1:1) replaced corn in T1, gave the best values of growth performance in term of live body weight, weight gain, feed consumption, feed conversion and percentage od carcass yield, followed by T6, T3, T4, T1, T2 and T5 which resulted in the lowest values.

Generally, it could be concluded that, for feeding japanese quails from 0 to 6 weeks of age (the marketing age), crushed macaroni can successfully replace yellow corn up to 100%, while, tapioca can safely be used up to 50% of yellow corn in diets as untraditional sources of energy without any adverse effect on growth performance or carcass characteristics. In other words, crushed macaroni and tapioca can be considered as suitable sources of energy for feeding growing quail chicks.

INTRODUCTION

It is well known that the principal item in raising poultry is the price of the feed which forms about 70% of poultry production cost. Yellow corn (YC) is the main source of energy which forms about 60-70% of the ration. Its price is continu-

ously increasing owing to its universal use. Therefore, it is important to search for alternative cheap sources of energy to replace YC in poultry rations. Crushed macaroni (CM) and tapioca (TP) seemed to be such alternative cheap materials that can replace YC in poultry rations.

Crushed macaroni is the by-product of Macaroni Factories which forms about 3-5% of macaroni production. El-Gendy (1977), analyzed macaroni and found that it contains suitable amounts of constituents being 13% CP, 1.4% EE, 0.7% ash and 73.9% NFE. Abd-El Malak (1988) reported that, CM could successfully replace YC in starter, grower and finisher rations for turkeys. Ghazalah *et al.* (1993) found that, using CM to completely replace YC in starter, grower and finisher broiler diets resulted in superior chick growth performance than that of corn-soybean control diets. Recently, Abbas *et al.* (1994) showed that, CM might replace YC successfully in broiler rations up to 100% without any adverse effect on growth performance, carcass characteristics and economic efficiency.

In the last few years, tapioca had been used as alternative source of energy to substitute YC in poultry rations. Tapioca is the dried product of cassava root meal, and contains 2.72% CP, 0.37% EE, 5.1% CF, 6.32% ash and 85.49% NFE (Stevenson and Graham 1983). Abbas (1986) showed that, cassava root meal can replace 20, 40 or 60% of YC in starting, growing and finishing diets for broiler chicks (12,23 or 37% of the whole diet, respectively) without adverse effect on growth performance. He also reported that, the response of chicks to utilize cassava root meal was increased with the advancement of age. Mady and Fayek (1987) reported that, cassava root meal can be used safely at levels up to 10% in starter diets and up to 15% in finisher diets containing 0, 10, and 20% cassava root meal. He found that there are no differences in weight gain, feed convesion and carcass composition between all teatments. Gowdh *et al.* (1990) studied the effect of replacing corn by cassava root meal in broiler diets at 50 and 100% substitution levels. They found a significant growth deprssion at 100% level compared to 50% level. Abbas *et al.* (1991) decided that, tapioca can raplace 50% of YC in boiler rations without adverse effect on its performance.

The present work was conducted to study the possibility of using CM and TP each alone or in combination to substitute YC as untraditional source of energy in growing quail diets.

MATERIALS AND METHODS

A total number of 224 one-day old Japanese quail chicks were distributed into 7 groups of 4 replicates of 8 chicks each (7x4x8), housed in electrically heated quail battery brooders, and exposed to 24 hours of constant light. The quails were reared under similar management conditions from one day up to 6 weeks of age. Seven quail diets (Table1) were formulated, in which the first one (T1) was corn-soybean diet and taken as a control. In the other diets, 50% of YC in T1 was replaced by either TP (T2) or CM (T3), while, all YC in T1 was replaced (100%) by either 1:1 TP+CM (T4), TP only (T5), CM only (T6) or mixture (1:1:1) of YC+TP+CM (T7). All diets were nearly iso-nitrogenous of about 24% CP and iso-caloric of about 3000 Kcal ME/Kg and adjusted to satisfy nutrient requirements of quails as recommended by NRC (1984). Chemical analysis of the experimental diets were carried out according to the methods of A.O.A.C. (1990). Fresh water and feed were daily offered *ad. libitum*. Individual body weights were obtained at one-day, three weeks and six weeks of age. Feed consumption was weekly recorded throughout the experimental period. At the end of the experiment (6 weeks old), three male quails from each treatment were weighed, then, slaughtered, scalded, plucked and eviscerated. Liver, heart and empty gizzard were removed and the weights of these organs and dressing weight were expressed as a percentage of live weight. An economical study was carried out using the input-output analysis of costs. Data were subjected to statistical analysis using the general linear model programme of SAS (1985).

RESULTS AND DISCUSSION

Growth performance

Data of live body weight (LBW), body weight gain (BWG), feed consumption (FC) and feed conversion (FCN) are presented in Table 2.

The average values of initial LBW at one day of age were nearly similar for all treatments ranging from 8.12 to 8.19 g without any significant differences between them.

Results of growth performance for quail chicks revealed significant differences between the dietary treatments at either 3 or 6 weeks of age. At 3 weeks old, the quail chicks of T7 (YC+TP+CM in ratio of 1:1:1) attained the heaviest average LBW, being 72.87 g, followed by those of T6 (100% CM) being 71.38 g, T3 (YC+CM,

Table 1. Composition of the experimental diets.

Ingredients	T1	T2	T3	T4	T5	T6	T7
Yellow corn	59.50	28.68	29.20	-	-	-	19.00
Tapioca	-	28.68	-	28.50	55.25	-	19.00
Crushed macaroni	-	-	29.20	28.50	-	57.30	19.00
Soybean meal (44%)	21.00	21.25	21.35	23.00	21.50	21.70	21.00
Fish meal (72%)	4.00	4.00	4.00	4.00	4.00	4.00	4.00
Wheat bran	3.25	1.78	6.26	3.27	0.46	9.28	4.79
Corn gluten (62 %)	9.50	12.84	7.25	10.00	16.00	5.00	10.45
Bone meal	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Sodium chloride	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Vit. & Min. Mixture*	0.30	0.30	0.30	0.30	0.30	0.30	0.30
L-Lysin H C1	0.20	0.22	0.19	0.18	0.24	0.17	0.21
Total	100	100	100	100	100	100	100
Chemical analysis:							
Crude protein %	24.03	24.00	24.04	24.07	24.01	24.03	24.02
Crude fiber %	3.37	3.69	3.21	3.49	3.99	3.00	3.51
Ether extract %	3.17	2.23	2.15	1.21	1.35	1.17	1.88
Calculated values:							
ME Kcal/Kg	3009	3005	3008	3017	3001	3005	3000
Calcium%	0.76	0.80	0.77	0.81	0.83	0.78	0.79
Phosphorus %	0.71	0.68	0.73	0.69	0.65	0.75	0.71
Lysine %	1.30	1.30	1.30	1.30	1.30	1.30	1.30
Methionine %	0.52	0.53	0.47	0.47	0.54	0.46	0.50
Met. + Cys.%	0.90	0.90	0.84	0.84	0.91	0.78	0.86

* Each 2.5 Kg of Vit. & Min. Mixture contain: Vit. A 12 000 000 IU, Vit. D3 2 000 000 IU, Vit. E 10 000 mg, Vit. K3 2 000 mg, Vit. B1 1000 mg, Vit, B2 4000 mg, Vit. B6 1500 mg, Vit. B12 10 mg, Niacine 50 000 mcg, Pantothenic acid 10 000 mg, Cholin chloride 500 000 mg, Copper 10 000 mg, Iodine 1000 mg, Iron 30 000 mg, Manganese 55000 mg, Zinc 55 000 mg and Selenium 100 mg.

Table 2. Effect of dietary treatments on the performance of Japanese quails.

Item	T1	T2	T3	T4	T5	T6	T7
LBW at one day old g	8.12a	8.19a	8.16a	8.16a	8.12a	8.12a	8.16a
LBw at 3 wks of age g	68.53b	64.30c	69.00ab	68.56bc	60.81c	71.38ab	72.87a
LBW at 6 wks of age g	163.51bc	161.20c	165.37bc	164.12bc	155.24d	167.65ab	170.60a
BWG 0-3 wks of age g	60.41b	56.11c	60.81ab	60.40b	52.68c	63.26ab	64.71a
BWG 3-6 wks of age g	94.98a	96.90a	96.37a	95.56a	94.44a	96.27a	97.73a
BWG 0-6 wks of age g	155.39bc	153.01c	157.21bc	155.96bc	147.12d	159.53ab	162.44a
FC 0-3 wks of age g	169.71ab	157.66c	168.52b	167.92b	150.93c	177.09ab	179.27a
FC 3-6 wks of age g	479.63a	488.69a	486.71a	483.55a	477.66a	485.12a	490.79a
FC 0-6 wks of age g	649.34abc	646.35bc	655.23ab	651.47ab	628.65c	662.21ab	670.06a
FCN 0-3 wks of age g	2.81b	2.81b	2.77b	2.78b	2.86a	2.80b	2.77b
FCN 3-6 wks of age g	5.05a	5.04	5.05 a	5.06a	5.06a	5.04a	5.02a
FCN 0-6 wks of age g	4.18bc	4.22ab	4.17bc	4.18bc	4.27a	4.15bc	4.12c
Initial No. of quails	32	32	32	32	32	32	32
No. of quails at 3 wks	30	28	30	29	22	31	30
No. of quails at 6 wks	29	27	29	28	20	31	30
Total No. of dead quails	3	5	3	4	12	1	2
Mortality rate (%)	9.40	15.60	9.40	12.50	37.50	3.10	6.20

Means with different superscripts are significantly different (P>0.05)

the best value (2.77) during 0-3 weeks of age, followed by those of T4 (2.78), T6 (2.80), T1 (2.81), T2 (2.81) and T5 (2.86). Statistically, there were no significant differences between all treatments except T5 which recorded significantly the poorest FCN. Values of FCN during 3-6 weeks of age revealed no significant differences between all dietary treatments. However, the average FCN during the overall experimental period (0-6 weeks) showed that, the group of T7 recorded the best value, followed by T6, T3, T4, T1, T2 and T5 which recorded the poorest value. No significant differences were found between T7, T6, T3, T4 and T1; between T2 and those of T1, T3, T4, T5 and T6, and T6 , and except T2, there were significant differences between T5 and all treatments.

Generally, the previous results declared that, the combination of YC, TP and CM (1:1:1) improved growth performance of quail chicks as shown with T7. This, perhaps, is due to the synergetic effect of this mixture than the effect of each material alone. However, the quails of T6 which fed 100% CM gave similar results to those of T7 without significant differences between them. This could be attributed to the manufacturing process of macaroni in which it was partially cooked during production to facilitate digestibility, and hence, it was reflected appreciably on growth performance. The other mixtures (T2, T3 and T4) gave also good results, but in lower degree of success than that of T6 and T7, since, they gave results similar to or slightly higher than the control group (T1). Therefore, it could be suggested that, TP and CM can be used in quail rations on the expense of YC up to 50% for TP and 100% for CM without any adverse effect on quail growth performance. On the other hand, the quail chicks of T5 (100% TP) gave inferior growth performance, and this, perhaps, is due to the dusty form, unpalatability and /or other unknown factor (S) in TP which reduced feed consumption, and hence, it was reflected on growth performance. However, the descending ranking order of treatments is T7, T6, T3, T4, T1, T2 and T5, respectively.

No publications are available on the use of TP and CM each alone or together in feeding guails, however, the results herein are on line with those of Abd-el Malak (1988), Ghazalah *et al.* (1993) and Abbas *et al.* (1994). They reported that, CM could successfully replace all YC in poultry rations. Gowdh *et al.* (1990) found a significant depression in broiler growth performance when TP completely replaced YC compared to 50% replacement level.

Abbas *et al.* (1991) decided that, TP could replace 50% of YC in broiler rations without any adverse effect on its performance.

Mortality rate

It could be noticed that, the quails of T5 (100% TP) recorded the highest mortality rate, while, those of T6 (100% CM) recorded the lowest one. The dusty form and/or the presence of hydrocyanic acid in TP might be the reason (s) causing high mortality rate. It was clearly found that mortality rate of the dietary treatments was distributed according to the inclusion rate of TP and CM. It is worthy to note that, the effect of T5 on mortality was higher during the first 3 weeks of age than that from 3-6 weeks of age. This could be explained on the basis that, with the advancement of age, quail chicks tried to adapt themselves on this type of treatments. However, T6 and T7 gave the lowest mortality in the two periods of growth .

Age at sexual maturity

Quails of T7 laid the first egg at 38 days of age, followed by those of T6 at 40 days, T4 at 42 days, T3 at 43 days, T1 and T2 at 45 days and later, T5 which laid the first egg at 48 days of age. It seemed likely that, higher growth performance during the growing period made chicks reach early sexual maturity. The dietary treatments did not affect the weight of the first egg which ranged from 9.5 to 10 g for all treatments.

Slaughter test

Data of slaughter test are presented in Table 3, from which it is clear that, the values of LBW of the slaughtered quails are statistically in harmony with those of growth performance, and followed the same trend. This means that, the birds which were taken for slaughter (3 males from each treatment) were representative samples, and the slight differences might be due to sex and the number of slaughtered quails.

The quails of T7 attained significantly the highest carcass percentage, followed by those of T6, T4, T1, T1, T3, T2 and T5 which recorded the lowest value. However, no significant differences were found between T6, T1, T3 and T4; between T1, T2, T3 and T4 and between T2, T3 and T5.

Concerning giblets, although there were some difference between treatments in gizzard percentages, nevertheless, the values of gilblets (liver, heart and gizzard) did not significantly differ within all treatments.

The results of total edible parts (carcass + giblets) showed that, the quails of

Table 3. The effect of dietary treatments on carcass quality of male Japanese quails.

Item	T1	T2	T3	T4	T5	T6	T7
Live body weight g	158ab	156c	160bc	159bc	150d	162ab	165
Blood %	3.12ab	3.17ab	3.24a	3.12ab	3.04b	3.25	3.19
Feather %	4.10ab	4.06ab	3.24a	3.12ab	3.04b	4.02	4.09
Carcass %	69.72bc	69.28cd	69.67bcd	69.77bc	68.89d	70.27b	71.19
Liver %	1.90a	2.00a	1.77a	2.02a	2.15a	2.01	1.97
Gizzard %	2.36ab	2.30bc	2.42ab	2.34ab	2.15c	2.49	2.43
Heart %	1.10a	1.06a	1.12a	1.09	1.08a	1.08	1.22
Giblets %	5.36a	5.36a	5.31a	5.45	5.38a	5.57	5.61
Total edible parts %	75.08bc	74.64cd	74.98cd	75.22bc	74.26d	75.84	76.80

Means with different superscripts are significantly different (P>0.05).

Table 4. Effect of dietary treatments on the economic efficiency of Japanes quails.

Item	T1	T2	T3	T4	T5	T6	T7
Total feed consumption g	649.34	646.35	655.23	651.47	628.65	662.21	670.06
Price of Kg fed PT	84.00	82.44	77.82	76.15	81.05	71.63	78.93
Total feed cost PT	54.54	53.28	51.00	49.61	50.95	47.43	52.89
Total weight gain g	155.49	153.01	157.21	155.96	147.12	159.53	162.44
Price of 1 g LBW	1.03	1.03	1.03	1.03	1.03	1.03	1.03
Total price of LWG	160.05	157.60	161.93	160.64	151.53	164.32	167.31
Net revenue	105.51	104.32	110.93	111.03	100.58	116.89	114.42
Economic efficiency (EEF)	1.93	1.96	2.18	2.24	1.97	2.46	2.16
Relative EEF* (%)	100.00	102.00	113.00	116.00	102.00	127.00	112.00

* Assuming that EEF of the control equals 100.

T7 and T6, respectively recorded significantly higher percentage of the total edible parts than those of the other treatments. No significant differences were detected between T1 and T4; between T1, T2, T3 and T4; between T2, T3 and T5 which recorded the lowest value. It is worthy to note that, the results of carcass characteristics are in harmony with those of growth performance idicating that the dietary treatmentts affected carcass characteristics in similar trend as growth performance.

Economic efficiency (EEF)

Data of input-output analysis are presented in Table 4 in which costs of the experimental rations were calculated according to the market prices of the materials used in formulating such diets at the experimental time. The price of 1 g LBW of quails was determined on the basis that the price of two quails (of about 340 g, the average marketing weight) was 350 (PT).

The results showed that the quails of T6 gave the highest EEF followed by those of T4, T3, T7, T5, T2 and T1 which recorded the lowest EEF value. This finding indicates that, all dietary treatments economically surpassed the control since the relative EEF of them (assuming the control EEF equals 100) were higher than 100. This is logic because the prices of TP and CM are lower than those of YC. Therefore, increasing of such materials in diets is on the expense of YC followed by a decrease in its costs. However, values of BWG also are associated with increasing EEF of the dietary treatments.

Since the quails of T6 and T7 gave the best growth performance values and economically surpassed the control, therefore, the formulas of T6 and T7 are considered the most profitable diets for growing quails. In conclusion, CM could completely replace YC in quail diets, while, TP could replace YC up to 50% without any adverse effect on its performance. It must be taken in consideration that, the mixture of such materials (YC, TP & CM in ratio of 1: 1: 1) gave the best results.

REFERENCES

1. Abbas, A.M. 1986. Evaluation of cassava meals and the effect of replacing yellow corn with the root on broiler performance. Thesis, Ph. D., Fac. Agric., Cairo Univ .
2. Abbas, A.M., N.E. Omar and M.A.H. Radwan. 1991. Efffect of some dietary sources of energy and protein on broiler performance. J. Agric., Mansoura Univ., 16 (2): 310-320 .
3. Abbas, A.M., N.Y. Abd-El Malak, M.S. Abd-El Malak and M.A. El-Sheikh. 1994. Using untraditional sources of energy and protein in broiler rations. Egypt. J. Appl. Sci., 9 (12): 335 .
4. Abd-El Malak, M.S. 1988. Studies on the energy and protein requirements of turkey broiler and using some unclassical feedstuffs. Thesis, Ph.D. Fac. Agric. Minia Univ .
5. A.O.A.C. Association of Official Agricultural Chemists. 1990. Official Methods of Analysis. 15th Ed. published by the A.O.A.C. Washington, D.C.
6. El-Gendy, M.M. 1977. Feed and feeding. Text Book, published by Dar El-Feker El-Araby, Cairo, Egypt.
7. Ghazalah, A.A., M.R. El-Abbady, A.M. Abbas and K.M. El-Sayed. 1993. Evaluating some non-conventional feedstuffs for feeding broilers. Egypt. Poul. Sci., 13: 521-549.
8. Gowdh, C.V., C.V. Reddy and V.R. Reddy. 1990. Utilization of tapioca (Manihot esculenta crantz) meal in broiler rations. Ind. J. Anim. Sci., 60: 1491.
9. Mady, Y.A. and H.M. Fayek. 1987. Utilization of cassava root meal in poultry diets. Agric. Res. Rev., 65 (5): 843-856.
10. N.R.C. National Research Council. 1984. Nutrient requirements of poultry. 8th Rev. Ed., Nat. Acad., Washington, D.C .
11. SAS. 1985. User, Guide: Statistics, Version 5, Edition. 1985. Inst., Inc. Cary, N.C. Scholtyssek, S. 1989. Tapioca in poultry feeds. Kraftfutter, 72: 294.
12. Stevenson, M.H. and W.D. Graham. 1983. The chemical composition and true metabolizable energy content of cassava root meal imported into Northern Ireland as poultry diets. J. Sci. Food Agric., 34 : 1105.

إستخدام مصادر غير تقليدية للطاقة فى تغذية السمان الياباني ١ - السمان النامى

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إستخدم فى هذا البحث عدد ٢٢٤ كتكوت سمان ياباني عمر يوم قسمت عشوائياً إلى سبعة مجموعات لكل مجموعة أربعة مكررات يحتوى كل مكرر على ٨ كتاكيت (٧ x ٤ x ٨) نميت الكتاكيت تحت ظروف تربية ورعاية واحدة فى بطاريات خاصة بالسمان ومزودة بدفايات كهربائية وذلك لمدة ٦ أسابيع فترة التجربة غذيت خلالها على علائق التجربة السبع التى تم تركيبها كالاتى:

المجموعة الاولى م١ : عليقة المقارنة أستخدم فيها الذرة الصفراء وكسب الصويا كمصادر رئيسية للطاقة والبروتين.

المجموعة الثانية م٢ : عليقة مقارنة أستبدل فيها ٥٠٪ من الذرة الصفراء بالتبيوكا.

المجموعة الثالثة م٣ : عليقة مقارنة أستبدل فيها ٥٠٪ من الذرة الصفراء بكسر المكرونة.

المجموعة الرابعة م٤ : عليقة مقارنة أستبدل فيها ١٠٠٪ من الذرة الصفراء بالتبيوكا وكسر المكرونة (١: ١).

المجموعة الخامسة م٥ : عليقة مقارنة أستبدل فيها ١٠٠٪ من الذرة الصفراء بالتبيوكا.

المجموعة السادسة م٦ : عليقة مقارنة أستبدل فيها ١٠٠٪ من الذرة الصفراء بكسر المكرونة.

المجموعة السابعة م٧ : عليقة مقارنة أستخدم فيها الذرة الصفراء والتبيوكا وكسر المكرونة كمصادر للطاقة (١: ١: ١).

وكانت العلائق متماثلة تقريباً فى محتواها من الطاقة (٣٠٠٠ كيلو كلورى / كجم علف) والبروتين (٢٤٪ بروتين خام) كما ضبطت غذائياً لتفى بالاحتياجات الغذائية للسمان.

أخذت قياسات وزن الجسم وأستهلاك العلف لحساب الوزن المكتسب والكفاءة التحويلية كما أخذت بعض مواصفات الذبيحة لعينة من السمان فى نهاية التجربة.

أظهرت النتائج أن م٧ (ذرة صفراء + تبيوكا + كسر المكرونة) أعطت أفضل مظاهر أنتاجية تلاها على الترتيب م٦ ، م٣، م٤، م١، م٢ وأخيرا م٥ التى أعطت أقل قيم للمظاهر الانتاجية. كما أظهرت الدراسة الاقتصادية أنه يمكن أستخدام كسر المكرونة والتبيوكا معاً أو كلّ على حده كبدائل للذرة الصفراء فى علائق السمان النامى خاصة إذا كان سعر هما أقل من سعر الذرة الصفراء.

وعموماً فأن البحث يخلص إلى أن كسر المكرونة والتبيوكا يعتبران من المصادر غير التقليدية للطاقة يمكن استخدامها بدلاً من الذرة الصفراء بنسب ١٠٠٪ (كسر المكرونة) أو ٥٠٪ (تبيوكا) أو مخلوط منهما معاً فى علائق السمان النامى دون أى تأثير معاكس على المظاهر الانتاجية ومواصفات الذبيحة.