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EFFECT OF DIETARY SUPPLEMENTATION OF RICE OIL ON THE GROWTH, PERFORMANCE AND CARCASS COMPOSITION OF CROSSBRED PULLETS

By

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Owing to its high acidity, rice oil (R.O.) is not used for human consumption. A comparative feeding study was undertaken to investigate the effect of adding rice oil to broiler finishing rations on the growth and performance of pullets and the chemical composition of their carcasses. This research included 160 crossbred female chicks (Rhode Island Red × Fayoumi) at 14 weeks of age. Birds where divided into 4 similar groups fed four rations having appoximately the same level of digestible protein (15.5%). Rice oil was added at levels of 0.0, 5, 10 and 15%. The experiment lasted for six weeks *i.e.* from 14 to 20 weeks of age. Birds were individually weighed at weekly intervals and feed consumption and mortality rate were recorded. Feed and water were offered *ad-libitum*. At the end of the experiment (20 weeks old) one representative pullet from each experimental group was slaughtered and its carcass was chemically analyzed.

Results showed that the addition of RO at a level not more than 10.0% had no deleterious effect on the growth of pullet, but 15% level, significantly retarded the growth. Pullets utilized the rations supplemented with rice oil up to 10% with almost the same efficiency. The group fed ration containing 15% R.O. showed the ghihest growth measure. Mortality rate increased as the oil level increased in the ration. Symptoms of avitaminosis A were observed in the group fed the 15% R.O. Adding R.O. to broiler finishing rations at the level of 10% did not affect the growth of the pullets while mortality was moderately elevated. Therefore, it is conculded that R.O. may be added to broiler finishing rations at a level from 5 to 10%.

Chemical analysis of carcass revealed that adding R.O. to the ration at the level of 10–15% resulted in lower carcass ash percentage. Carcass ether extract percentage was significantly increased when the ration contained 10–15% R.O. Crude protein percentage of the carcass was not significantly affected by the dietary supplementation of R.O.

The annual production of rice bran and rice germs in U.A.R. is about 170,000 tons. This amount can yield approximately 20,000 tons of extracted R.O. However, owing to its high acidity, R.O. is not used for human consumption, but is usually used for industrial purposes such as paints and soap manufacturing (Abo-El-Soaoud, 1967).

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The suitable level of oils or fats to be added to chick ration lies between a range from 5.0 to 12.0% (Yacowitz, 1953, Siedler *et al.*, 1955, Arscott and Sather, 1958, Lewis and Payne, 1963, and El-Kotoury *et al.*, 1969). However, Donaldson *et al.*, 1957 and Isaacks *et al.*, 1960 reported that up to 30% fat or oil can be used in chick ration with no bad effect on growth or feed conversion. Many factors are involved in the supplementation of fat to ration i.e. protein content of the diet, caloric : protein, type of fat as well as sex, breed and age of the bird (Hamada, 1969).

Although much work has been done in the U.S.A. to develop rations to finish chickens, there is little information avaiable on the influence of diet on carcass composition at time of marketing (Summers *et al.*, 1965). Results of Summers *et al.*, 1965 indicated that increasing level of dietary energy resulted in decreased carcass protein and increased carcass fat. Similarly, Miller *et al.*, 1962, reported that supplementing the ration with fat up to 17.5% significantly increased that fat content of the breast and thigh muscles. However, Essary *et al.*, 1960, found that adding fat to chick ration at level from 0.0 to 8.0% did not affect the crude protein of the carcass while there was an inverse relationship between the level of added fat and the moisture content of the carcass.

In a previous report (El-Kotoury *et al.*, 1969) it was found that up to 10% cotton seed oil can be used in rations for chicks without ill-effect on growth of the bird. In the present experiment, chicks were raised up to 14 weeks old on practical type ration and the experiment was carried out during the period 14-20 weeks. In the U.A.R., chicks of 14 weeks old weighing about 0.5 kg. are fed finishing ration before being sold to the market when their weight reach about 0.75 kg (Ghoneim, 1957).

This research was carried out to investigate the effect of supplementing R.O. at level up to 15% of broiler finishing rations, on the performance of pullets during the period 14-20 weeks of age. The effect of the oil addition to the ration on the carcass composition was another objective of this study.

Meterial and Methods

In this experiment 160 female crossbred chicks (Rhode Island Red × Fayoumi) were randomly chosen from the Poultry Nutrition Farm, Animal were divided into 4 groups of equal number and average body weight. The production department, faculty of agriculture, Cairo Univversity. Pullets experimental rations (Table 1) were supplemented with raw rice oil at levels 0, 5, 10 and 15% of rations 1, 2, 3 and 4 respectively. The digestible protein content of the rations was nearly 15.5%. The C/P ratios were 109, 115, 121 and 126 for rations 1, 2, 3 and 4 respectively. Chicks were fed practical type ration used in the Poultry Farm from hatching until the age of 14 weeks when they were placed on the experimental rations. Birds were individually weighed every week. Feed consumption and mortality were also recorded at the same intervals. Feed and water were offered *ad-libitum*. At the end of the experiment on pulet per group was chosen so that its

average body weight is close to that of the respective group. Feed was withheld for 12 hours before pullets were slaughtered. Then pullets were dressed and their carcasses placed in air-dried oven. After the carcasses were dried, they were finely milled with a suitable mill to pass through a sieve 1 mm. Representative samples were taken to determine the moisture, crude protein, crude ether extract and ash as outlined by the A.O.A.C., (1950).

TABLE 1.—Compositions of the Experimental Rations

Ingredient	Rations			
	1	2	3	4
	%	%	%	%
Corn, ground	48.8	35.8	22.0	8.0
Decorticated cottonseed meal.	20.0	20.0	20.0	20.0
Rice bran	25.0	34.0	42.8	51.8
Dried skim milk.	5.0	5.0	5.0	5.0
Raw rice ail	—	5.0	10.0	15.0
Ca Co_3	1.5	1.5	1.5	1.5
Na Cl	0.5	0.5	0.5	0.5
Vitamin A D_3 mixture[1]	0.2	0.2	0.2	0.2
Total	100.0	100.0	100.0	100.0
Crude protein (calculated).	18.40	18.50	18.60	18.70
Digestible protein (calculated).	15.20	15.40	15.60	15.80
S.E.[2]	69.20	75.30	81.4	87.50
P.E.[3] (Cal./kg.).	2015	2131	2248	2365
C/P[4]	109	115	121	126

1. The vitamin mixture supplied each kilogram of the ration with 5000 I.U. vitamin A and 1000 I.U. vitamin D_3.
2. Starch equivalent (S.E.) was calculated using figures reported by Ghoneim (1957).
3. Productive energy (P.E.) was calculated using figures reported by Fraps (1946).
4. Calorie protein ration (calories of P.E. per kg of ration % crude protein).

Results and Discussion

Average body weight

Fig. 1 shows the average body weight of the 4 groups during the experimental period (14—20 weeks of age). At the start of the experiment, the pullets in the different groups had the same average body weight, being 512 gm. During the period 14—16 weeks of age, the average body weight of the 4 different groups were nearly of the same value. At 17 weeks old, groups 1 and 3 had nearly equal average body weights being 635 and 632 gm. respectively. The other two groups had nearly equal average body weights, *i.e.* gp. 2 : 611 gm. and gp. 4 : 605 gm. During the period 18—20 weeks of age, gp. 2 (5% R.O.)grew at a relative faster rate approaching group 1 and 3 in the final average body weight. However, group 4 (15.0% R.O.) grew at a slow rate and had the lowest average body weight at 20 weeks of age. The final average body weight was : 707 gm. (gp. 1 : 0.0% R.O.), 705 (gp. 2 : 5% R.O.), 725 gm. (gp. 3 : 10% R.O.) and 654 gm. (gp. 4 : 15% R:O:) as shown in Table 2. Assuming the final average body weight of gp. 4 equals 100, it would be 108.1, 107.3 and 110.8 for gps. 1, 2 and 3 respectively.

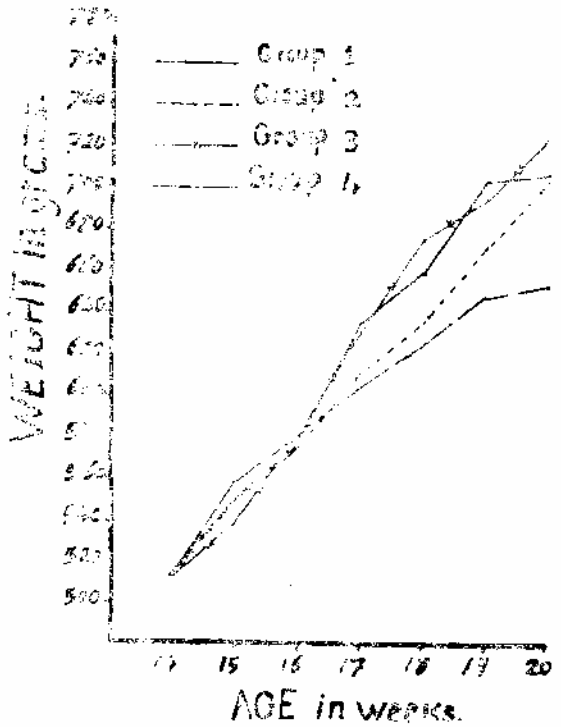

Fig. 1.—Average body weight of crossbred chicks fed 4 different levels of R. O.

The linear regression equations of the four groups were calculated (Snedecor, 1956) as follows :

$$\text{Group 1} \quad \hat{Y} = 34.9 \times + 27.1$$

$$\text{,, 2} \quad \hat{Y} = 31.8 \times + 68.2$$

$$\text{,, 3} \quad \hat{Y} = 37.6 \times - 16.4$$

$$\text{,, 4} \quad \hat{Y} = 23.1 \times +204.9$$

It was possible to study the differences in the rate of growth in groups 2, 3 and 4 each compared with group 1 (0.0% R.O.). This was done by calculating the "t" for each two regression coefficients under comparison as follows :

Groups Compared	Calculated "t"
1 vs. 2	1.97
1 vs. 3	0.55
1 vs. 4	2.32@

$P<0.05$

The differences were insignificant between gp. 1 and each of gp. 2 and 3. However, group 4 had significantly ($P < .05$) lower average rate of growth when compared with group 1. This shows that, from the body weight point of view, rice oil can be added to broiler finishing ration at level up to 10%.

In this connection, Sielder *et al.*, 1955 noticed no significant effect on growth when they used rations supplemented with 3 or 6% animal fat in feeding chicks. While Lewis and Payne, 1963, found a slight increase in live weight when fat was added at levels up to 12%.

The gain in body weight :

The total gain in body weight was : 195, 193, 213 and 142 gm. for groups 1, 2, 3 and 4 respectively (Table 2). For comparison, these weight gains would be : 137.3, 135.9, 150.0 and 100 for groups 1, 2, 3 and 4 respectively. This shows that the addition of R.O. to broiler finishing rations at levels up to 10% did not affect the total gain in body weight but the addition of 15% caused remarkable depression.

Feed consumption :

The total feed consumed per pullet during the experimental period was : 2.008, 1.911, 1.838 and 1.573 gk. for groups 1, 2, 3 and 4 respectively (Table 2). Assuming that the feed consumed per pullet in group 4 equals 100, it would be 127.6, 121.5, 116.8 for groups 1, 2 and 3 respectively. This shows that the pullet seems to restrict its feed consumption as the percentage of R.O. increased in the ration.

Total starch equivalent consumed :

The total S.E. consumed per bird was : 1.389, 1.441, 1.497 and 1.377 kg. for groups 1, 2, 3 and 4 respectively (Table 2). Assuming that the S.E. consumed by the pullet in group 4 equals 100, it would be 100.9, 104.6 and 108.7 for groups 1, 2, and 3 respectively. This shows that the addition of R.O. at 15% level did not cause an increase in the starch equivalent consumed by the pullet as a result of the reduction of feed consumption when the ration contains high levels of R.O.

TABLE 2.—AVERAGE BODY WEIGHT, TOTAL BODY GAIN, FEED CONSUMED, S.E. CONSUMED, AND G.M. OF CROSSBRED PULLETS.

Item	Groups			
	1 (0.0% R.O.)	2 (5.0% R.O.)	3 (10.0% R.O.)	4 (15.0% R.O.)
Initial body weight (gm.)	512	512	512	512
Final body weight (gm.)	707	705	725	654
Total body gain (gm.)	195	193	213	142
Total feed consumed per pullet (kg.)	2.008	1.911	1.838	1.573
Total S.E. consumed per pullet (kg.)	1.389	1.441	1.497	1.377
S.E. required to produce one kg. growth (G.M.)	7.123	7.466	7.028	9.697
G.M. assuming the lowest = 100	101.3	106.2	100.0	138.0
Calculated C/P	109	115	121	126

Growth measure (G.M.) :

The G.M. during the entire experimental period was : 7.123, 7.466, 7.028 and 9.697 for groups 1, 2, 3 and 4 respectively (Table 2). Assuming the G.M. of grouv 3 equals 100, it would be 101.3, 106.2, and 138.0 for groups 1, 2 and 4 respectively. Therefore it may be concluded that the addition of R.O. at levels up to 10% of the ration had no effect on G.M., but 15% R.O. level increased it.

The effect of calorie — protein ratio (C/) :

The rations used in this experiment were similar in their crude protein content (18.40 — 18.70%) and had different calorie — protein ratios (Table 1). It was found that groups 1, 2 and 3 which were fed on rations of C/P, 109, 115 and 121 respectively, had no significant difference on growth, but ration of C/P 126 (15% R.O.) had caused retardation of the chick growth (Table 2).

Mortality rate :

From the following table it may be noticed that mortality increased moderately as the percentage of R.O. increased in the ration up to 10.0% level, but with 15% R.O., the mortality was much higher. Therefore, the level of R.O. to be used in broiler finishing rations may be lower than 10% unless antioxidant agents were added.

Period	Group			
	1 (0. 0% R.O.)	2 (5. 0% R.O.)	3 (10.0% R.O.)	4 (15. 0% R.O.)
	%	%	%	%
14 - 16 weeks . .	2.5	2.5	7.5	7.5
17 - 18 weeks . .	10.0	10.0	12.5	25.0
19 - 20 weeks . .	15.0	20.0	17.5	35.0
Total . . .	27.5	32.5	37.5	67.5

Symptoms of avitaminosis A were observed in chicks of group 4 (15% R.O.) and this may explain the high mortality in this group. The rice oil has relatively high free fatty acids content and these fatty acids are subjected to quick rancidity, causing loss of vitamin A as well as the other fat soluble vitamins. So, it is advisable that rations containing R.O. must be supplied with antioxidant agents, such as butylated hydroxytoluene (BHT).

The effect of feeding rations supplemented with R.O. on the carcass composition of chicks :

The following table shows the chemical analysis of pullet carcasses fed on the mentioned levels of R.O., on dry matter basis :

Item	Group			
	1 (0. 0% R.O.)	2 (5% R.O.)	3 (10. 0% R.O.)	4 (15% R.O.)
Ash	15.39	15.22	14.05	13.91
Crude protein . . .	68.28	74.78	63.65	64.38
Ether extract . . .	16.33	10.00	22.30	21.71
Total . . .	100.00	100.00	100.00	100.00

Ash :

Adding R.O. to broiler finishing rations at a level of 5% did not seem to affect the ash percentage of the carcass. However, addition of this oil at 10 and 15% of the ration was related with lower ash percentage in the carcass.

Crude Protein

From the previous table it may be concluded that adding R.O. at a level of 0.0 — 15% of the ration did not affect the percentage of crude protein in the carcass. This conclusion is in accordance with findings of Essary *et al.*, 1960.

Ether Extract

The addition of R.O. to broiler finishing rations at 10 — 15% was associated with a significant increase in the carcass ether extract. Similar results were reported by Summers *et al.*, 1965.

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« استخدام زيت الأرز فى علائق الكتاكيت الخليطة وتأثيره على نموها والتحليل الكيماوى للذبيحة »

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الملخص

نظرا لاحتواء زيت رجيع الأرز على نسبة عالية من الأحماض الدهنية المنفردة فانه لا تستعمل عادة فى الاستهوك الآدمى ويقتصر استعماله فى صناعة البويات والصابون . وقد تم فى هذه التجربة اضافته لعلائق تهيئة بدارى ودرس تأثيره على نموها والتركيب الكيماوى للحمها .

وقد استخدم فى هذا البحث ١٦٠ كتكوت اناث خليط رود ايلاند احمر × فيومى فى عمر ١٤ اسبوع . وقسمت هذه الطيور الى أربعة مجاميع متساوية العدد ومتوسط الوزن الحى . وغذيت هذه المجاميع على ٤ علائق لها نفس المستوى من البروتين المهضوم تقريبا (٥ر١٥٪) . واضيف الزيت للعلائق بنسب صفر : ١٠ ، ١٥٪ . واستمرت التجربة لمدة ٦ أسابيع (حتى عمر ٢٠ اسبوع) . وقد تم وزن الطيور فرديا على فترات أسبوعية وكذلك حسبت كميات الغذاء المستهلكة ونسبة النفوق كل أسبوع أيضا . وكان الغذاء والماء امام الطيور بصفة مستمرة . وفى نهاية التجربة اخذ من كل مجموعة كتكوت يمثلها وذبح وحلل لحمه كيماويا .

وتبين نتائج هذه التجربة أن اضافة زيت الأرز حتى مستوى ١٠٪ من العليقة لم يكن له تأثير سيىء على النمو ولكن العلائق المحتوية على ١٥٪ منه أعاقت النمو . وكان معدل الاستفادة من الغذاء (كما يبينه مقياس النمو) واحدا فى المجاميع التى غذيت على علائق بها زيت حتى ١٠٪ من العليقة ، ولكن العليقة المحتوية على ١٥٪ زيت كان معدل الاستفادة منها أقل من

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العلائق الاخرى . كما لوحظ أن نسبة النفوق كانت تزداد بزيادة نسبة الزيت فى العليقة وظهرت أعراض نقص فيتامين أ على المجموعة التى تغذى على عليقة بها ١٥ ٪ زيت وربما يرجع ذلك الى سرعة تزنخ هذه العليقة لارتفاع نسبة الأحماض الدهنية المنفردة بها وتلف ما تحتويه من فيتامين أ نتيجة هذا التزنخ . وينصح باضافة مواد مضادة للأكسدة للعلائق المحتوية على الزيت لتفادى هذا التأثير الضار .

ويبين التحليل الكيماوى للحم الطيور أن العلائق المحتوية على ١٠ — ١٥ ٪ زيت كانت نسبة الرماد فى لحم الطيور التى غذيت عليها اقل من نسبته فى لحم الطيور المغذاه على العلائق الأخرى أما نسبة الدهن فى لحم الطيور التى غذيت على علائق بها ١٠ — ١٥ ٪ زيت فكانت أعلى من مثيلتها فى لحم الطيور التى غذيت على علائق بها نسبة أقل من الزيت . أما نسبة البروتين الخام فى اللحم فلم تتاثر بالمستويات المختلفة من الزيت فى العليقة .