

THE EFFECT OF DIETARY SUPPLEMENTATION  
OF COTTON SEED OIL ON THE GROWTH  
AND PERFORMANCE OF BALADI WHITE  
CHICKS

By

M.I. EL-KOTOURY, M.R. EL-ABBADY, E.M. OMAR  
AND M.R. HAMADA\*

This experiment was carried out in the Poultry Nutrition Farm, Faculty of Agriculture, Cairo University, to study the performance of growing Baladi White (B.W.) chicks when fed rations containing graded levels of cotton seed oil (CSO) up to 17.5% of the ration. The total number used was 318 chicks of three of weeks old, the experiment lasted for 18 weeks. Comparative feeding study was undertaken in six groups offered different levels of CSO (0.0-17.5%) having approximately the same digestible protein level (15.1%). The oil level in the experimental rations was associated with an increase of the feeding value of the rations, expressed as starch value, (68.8 up to 94.7).

Results showed that the addition of CSO at a level up to 10% of the ration had no detrimental effect on growth, but higher levels, up to 17.5%, caused depression on growth. The efficiency of feed utilization of groups fed rations containing from 0.0 to 10% CSO (as judged from the G.M.) was practically the same, but groups fed rations containing higher level of CSO appeared to be less efficient in utilizing the feeds. The feed consumption was reduced as the starch value of the ration was increased by the addition of CSO. Mortality rate was high when chicks were given ration supplemented with CSO at level of 10.0% or higher. Therefore, CSO may be added to chick ration at level lower than 10%.

Some workers showed that the addition of fats in poultry rations improved growth and feed conversion, while others found different results. Henderson and Irwin 1940, as well as Fraps 1943, mentioned that rations containing higher than 10% oil level had a deleterious effect on the chick growth. Also, Kummerow *et al.*, 1949, found that 25% linseed oil depressed growth in chicks. Dam *et al.*, 1959, reported that 3-10% oil in the ration prompted growth, but higher levels did not affect it. Runnels 1955 and Siedler *et al.*, 1955, found that rations having 3-6% fat had no effect on growth rate. Isaack *et al.*, 1960, concluded that the growth response was correspondingly related to the percentage of soybean oil in the ration (10-30%). El-Abbadly *et al.*, 1968, showed that the addition of cotton seed oil at a level not more than 10% had no ill effect on the growth of B.W. chicks. Rand *et al.*, 1958, showed that the best overall performance was obtained when the fat contributed between 20-38% of the total metabolizable energy of the ration.

\* Animal Production Dept., Fac. of Agriculture, Cairo University, U.A.R.

This work was undertaken to investigate the maximum level of the cotton seed oil which can be added to rations of B. W. chicks without affecting their growth or performance.

#### Material and Methods

The initial number of B. W. chicks used was 318 of 3 weeks old. They were divided into 6 groups, equal in number and average body weight. The experimental rations were supplemented with cotton seed oil No. 3 (CSO) at the levels of : 0, 5, 10, 12.5, 15 and 17.5% for rations 1, 2, 3, 4, 5 and 6 respectively (Table 1). The digestible protein level was nearly constant in the 6 rations (ranged from 15.10 to 15.30%). The C/P ratios (calories of productive energy per kg. ration/crude protein %) were 106, 116, 127, 132, 138 and 143 for rations 1, 2, 3, 4, 5 and 6 respectively. Birds were individually weighed every two weeks and feed consumed was recorded. Feed and water were offered *ad libitum*.

TABLE 1.—COMPOSITION AND FEEDING VALUE OF THE EXPERIMENTAL RATIONS.

Ingredient	Ration No.					
	1	2	3	4	5	6
	%	%	%	%	%	%
Corn, ground . . . . .	46.8	40.8	34.8	31.8	28.8	25.8
Decorticated cottonseed meal . . . . .	20.0	21.0	22.0	22.5	23.0	23.5
Wheat bran . . . . .	10.0	10.0	10.0	10.0	10.0	10.0
Rice bran . . . . .	10.0	10.0	10.0	10.0	10.0	10.0
Dried skim milk . . . . .	10.0	10.0	10.0	10.0	10.0	10.0
Cottonseed oil No. 3 . . . . .	—	5.0	10.0	12.5	15.0	17.5
Cod liver oil . . . . .	1.0	1.0	1.0	1.0	1.0	1.0
Ca CO <sub>3</sub> . . . . .	1.5	1.5	1.5	1.5	1.5	1.5
Na Cl . . . . .	0.5	0.5	0.5	0.5	0.5	0.5
Vitamin (A-D <sub>3</sub> ) Mixture <sup>1</sup> . . . . .	0.2	0.2	0.2	0.2	0.2	0.2
Total . . . . .	100.0	100.0	100.0	100.0	100.0	100.0
Crude protein (calculated) . . . . .	18.53	18.43	18.33	18.28	18.28	18.18
Digestible protein (calculated) . . . . .	15.30	15.20	15.20	15.10	15.10	15.10
S.E. <sup>2</sup> . . . . .	68.80	76.20	83.60	87.30	91.00	94.70
P.E. (Cal./kg.) <sup>3</sup> . . . . .	1960	2143	2326	2418	2509	2601
C/P . . . . .	106	116	127	132	138	143

1. Vitamin (A-D<sub>3</sub>) mixture supplied each kilogram of ration by 5000 I.U. vitamin (A) and 1000 I.U. vitamin (D<sub>3</sub>).

2. Starch equivalent (S.E.) was calculated after Ghonein, 1957.

3. Productive energy (P.E.) was calculated after Fraps, 1946.

Results and Discussion

The average body weight of chick :

Fig. 1 shows that the average body weight of chicks of the six groups was nearly equal at the start of the experiment being  $53.3 \pm 0.2$  gm. The average body weight of group 1 (0.0% CSO) was the highest till the age of 19 weeks. At the end of the experimental period, the average body weight of this group was 909 gm. The average body weight of chicks of group 2 (5.0% CSO) was lower than that of group 1 till the age of 19 weeks then it showed a slight increase thereafter at the end of the experiment. The final average body weight of this group was 924 gm. The average body weight of chicks in group 3 (10.0% CSO) was nearly equal to that in group 2 during the period of 3—9 weeks old. Then the average body weight of chick in group 3 was lower than that of group 2 till the end of the experiment. At the end of the experiment, the average body weight of the chick was 909, 924, 824, 659, 505 and 411 gm. for groups : 1, 2, 3, 4, 5 and 6 respectively. This shows that retardation of growth was progressively related to the percentage of oil in the ration over 10%. Assuming that the average body weight of group 6 equals 100( it would be 221.2, 224.8, 200.5, 160.3, 122.9 and 100 for the six groups respectively.

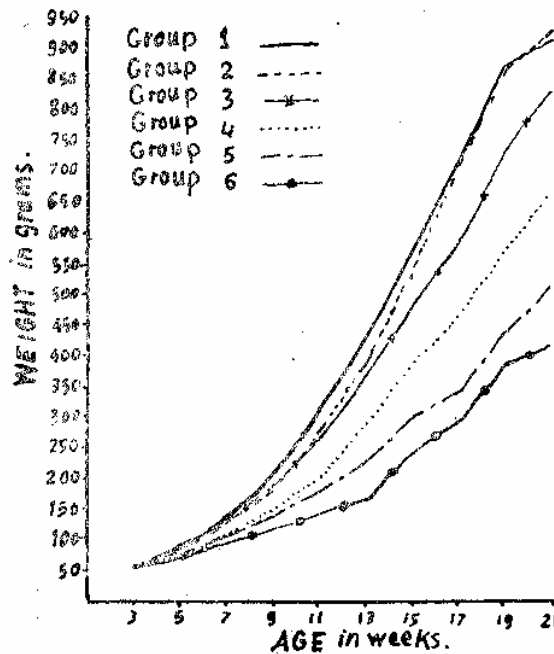


FIG. 1.—Average body weight of B W chicks fed 6 different levels of CSO.

The linear regression equations of the six groups were calculated as outlined by Snedecor (1956) as follows :

$$\begin{aligned} \text{Group 1 } \hat{Y} &= 52.1 \times - 198.2 \\ \text{,, 2 } \hat{Y} &= 52.5 \times - 218.5 \\ \text{,, 3 } \hat{Y} &= 44.5 \times - 166.6 \\ \text{,, 4 } \hat{Y} &= 34.7 \times - 121.1 \\ \text{,, 5 } \hat{Y} &= 24.9 \times - 63.4 \\ \text{,, 6 } \hat{Y} &= 20.4 \times - 48.9 \end{aligned}$$

Therefore, it was possible to study the differences in the rate of growth in groups : 2, 3, 4, 5 and 6 each compared with group 1 (0.0% CSO). This was done by calculating "t" for each two regression coefficients as outlined in the following table :

Groups compared	Calculated "t"
1 vs. 2	0.03
1 ,, 3	0.78
1 ,, 4	2.14 ×
1 ,, 5	4.72 × ×
1 ,, 6	5.39 × ×

× P < 0.05      × × P < 0.01

From the previous table it can be seen that the weekly average growth rate of chicks of groups fed 5 and 10% CSO was not significantly different from that of the control group (0.0% CSO). However, groups 4, 5 and 6 (fed 12.5, 15 and 17.5% CSO respectively) had significantly lower average weekly growth rate than the control group. Thus it may be concluded that the addition of CSO up to 10% had no effect on growth of B.W. chicks. Higher levels than 10% CSO caused significant growth retardation. It may also be concluded that 10% would be considered as the maximum level of CSO to be added to ration of B.W. chicks up to 21 weeks of age.

These results are similar to those found by Henderson and Irwin, 1940; and Fraps, 1943. Also, Kummerow *et al.*, 1949, found that ration contained 25% raw linseed oil depressed the growth. Similarly, Dam *et al.*, 1959, mentioned that using maize oil at levels over 10% did not increase the growth.

*The gain in body weight :*

The total body gain during the entire experimental period was : 855, 871, 771, 606, 451 and 358 gm. for groups :1,2,3,4,5 and 6 respectively (Table 2). Assuming the gain in weight of group 6 (17.5% CSO) equals 100, it would be 238.8, 243.3, 215.4, 169.3 and 126.0 for groups supplemented with 0.0, 5.0, 10.0, 12.5 and 15.0% CSO respectively. Therefore, it may be concluded that the total body gain in weight of group 1 (0.0% CSO), 2 (5.0%CSO) and 3 (10.0%CSO) was nearly equal. While that of groups 4,5 and 6 was less than that of group 1.

*Feed consumption :*

The average feed consumed by the chick during the entire period was: 5.172, 4.755, 4.310, 3.610, 2.987 and 2.805 kg. for groups : 1, 2, 3, 4, 5 and 6 respectively (Table 2). Assuming that the average feed consumed per chick in group 6 equals 100, it would be 184.3, 169.5, 153.7, 128.7 and 106.5 for groups : 1, 2, 3, 4 and 5 respectively. This shows that feed consumption is inversely related to the level of cotton seed oil in the ration. It seems that the chick had restricted the amount of feed consumed according to its energy content.

*Starch equivalent consumed :*

The average starch equivalent consumed by the chick during the entire period in the six groups :1, 2,3, 4, 5 and 6 respectively was : 3.558, 3.624, 3.603, 3.152, 2.717 and 2.656 kg. (Table 2). This indicates that inspite of the fact that groups :1,2 and 3 were fed on rations which contained different levels of starch value, chicks consumed nearly equal amount of starch value. This may be due to the self control practiced by the chick to reduce the amount of feed consumed as the oil percentage increased in the ration. In group 4, the starch equivalent consumed by the chick was 3.152 kg. during the entire experimental period. It was less than that in group 1 (the control). In group 5 and 6, the chick consumed nearly equal amounts of starch equivalent (2.717 and 2.656 kg respectively). The amount of starch consumed per chick in the last two groups was less than that in the control. Starting at the level of 12.5% CSO there appeared a corresponding depression of starch equivalent consumed. This trend became more evident in the groups fed higher levels i.e., groups 5 and 6.

TABLE 2.—TOTAL BODY GAIN, FEED CONSUMED, S.E. CONSUMED AND G.M. OF B.W. CHICKS.

Item	Group					
	1 (0.0% CSO)	2 (5.0% CSO)	3 (10% CSO)	4 (12.5% CSO)	5 (15.0% CSO)	6 (17.5% CSO)
Total body gain (gm.) . . . . .	855	871	771	606	541	358
Total feed consumed per chick (kg.) . . . . .	5.172	4.755	4.310	3.610	2.987	2.805
Total S.E. consumed per chick (kg.) . . . . .	3.558	3.624	3.603	3.152	2.717	2.656
S.E. required to produce one kg. growth (G.M.)	4.161	4.160	4.673	5.201	6.024	7.418
G.M. assuming the control = 100 . . . . .	100	100	112	125	145	178
Calculated C/P . . . . .	106	116	127	132	138	143

*The growth measure (G.M.) :*

Table 2 shows that the G.M. (kgs of starch/kg. of weight gain) during the whole experimental period was : 4.161, 4.160, 4.637, 5.201, 6.024 and 7.418 for groups : 1, 2, 3, 4, 5 and 6 respectively. This indicates that it was nearly equal within groups 1 and 2. Then the G.M. began to increase as the level of CSO increased in the ration. For comparison, these figures would be : 100, 100, 112, 125, 145 and 178 units for groups : 1,2,3,4,5 and 6 respectively, showing that increasing the energy level without increasing the protein content of the ration may lead to higher G.M.

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

Groups 1, 2, 3, 4, 5 and 6 were fed rations of calculated C/P : 106, 116, 127, 132, 138 and 143 respectively per kg. of the ration. Group 1, 2 and 3 which were fed rations of C/P : 106, 116 and 127 respectively showed no significant difference in growth rate. When the C/P of the rations fed to groups 4, 5 and 6 was widened being 132, 138 and 143 respectively, the body gain was reduced as the C/P increased. When the average body weight of chicks within groups 4, 5 and 6 was compared with that of group 1 the difference was significant. Thus it may be concluded that increasing C/P from 106 up to 127 did not affect the growth of chicks, but rations having C/P over 127 had caused deleterious effect on growth under conditions of this experiment.

*Mortality rate :*

From the following Table, it can be seen that increasing the level of CSO in the ration to 10% or higher was associated with high mortality. Although the 10% CSO level is not detrimental to the growth of chick, yet it is correlated with high mortality rate. Therefore, for best performance, CSO may be used at levels lower than 10% of the ration.

Period	Group					
	1 (0.0% CSO)	2 (5.0% CSO)	3 (10.0% CSO)	4 (12.5% CSO)	5 (15.0% CSO)	6 (17.5% CSO)
3--7 weeks . . . . .	11.32	7.69	18.87	22.64	5.66	11.32
8--11 weeks . . . . .	1.89	0.00	5.66	7.55	9.43	33.96
12--15 weeks . . . . .	0.00	0.00	7.55	0.00	13.21	11.32
16--19 weeks . . . . .	0.00	1.92	0.00	1.89	0.00	0.00
20--21 weeks . . . . .	0.00	1.92	0.00	0.00	0.00	0.00
Total . . . . .	13.21	11.53	32.08	32.08	28.30	56.60



## REFERENCES

- DAM, R., LEACH, R.M. (JR), NELSON, T.S., NARRIS, L.C. and HILL, F.W. (1959). Studies on the effect of quantity and type of fat on chick growth. *J. Nutrition*, **68** : 615-632.
- EL-ABBADY, M.R., EL-KOTOURY, M.L., OMAE, E.M. and HAMADA, M.R. (1968). A nutritional study on the effect of supplying different levels of cotton seed oil in rations for broilers. (In Press).
- FRAPS, G.S. (1943). Relation of the protein, fat and energy of the ration to the composition of chickens. *Poultry Sci.*, **22** : 421-424.
- FRAPS, G.S. (1946). Composition and productive energy of poultry feeds and rations. *Texas Agricultural Experiment Station*, Bulletin No. 678.
- GHONHEM, A. (1957). "Feeding domestic poultry". 3rd edition, Anglo Egyptian bookshop, Cairo. (Arabic text book).
- HENDERSON, E.W., and IRWIN, W.E. (1940). The tolerance of growing chicks for soybean oil in their ration. *Poultry Sci.*, **19** : 389-395.
- ISAACKS, R.E., DAVIES, R.E., DEYOE, C.W. and COUCH, J.R. (1960). Growth stimulating effect of high levels of vegetable oils. *Poultry Sci.*, **39** : 1262.
- KUMMEROW, F.A., WEAVER, R., and HONSTEAD, H., (1949). The choline replacement value of ethanol amine in chickens kept on high fat ration. *Poultry Sci.*, **28** : 475-478.
- RUNNELS, T.D. (1955). Animal fat in combination with various other ingredients in broiler rations. *Poultry Sci.*, **34** : 140-144.
- SIEDLER, A.J., SCHEID, H.E. and SCHWEIGERT, B.S. (1955). Effects of different grades of animal fats on the performance of chicks. *Poultry Sci.*, **34** : 411-414.
- SNEDECOR, G.W. (1956). "Statistical Methods". 5th Ed. Iowa State College Press, Ames, Iowa, U.S.A.

## تأثير استعمال مستويات مختلفة من زيت بذرة القطن على نمو كتاكيت البلدى الأبيض

(\*) محمد ابراهيم القظورى - محمود رشدى العبادى - عصمت محمد عمر -

محمد رشاد حماده

### الملخص

تمت هذه التجربة في محطة أبحاث تغذية الدواجن بكلية الزراعة - جامعة القاهرة بفرض دراسة تأثير تغذية الكتاكيت على علائق تحتوى على مستويات متدرجة من زيت بذرة القطن رقم ٣ ( من صفر الى ١٧.٥ ٪ من العليقة ) . وقد استخدم في هذه التجربة ٣١٨ كتكوت في عمر ثلاثة أسابيع واستمرت التجربة لمدة ١٨ اسبوع . قسمت هذه الكتاكيت الى ٦ مجاميع متماثلة وغذيت كل مجموعة على عليقة بها نسبة معينة من زيت بذرة القطن وكانت نسبة البروتين المهضوم في علائق التجربة ثابتة ( ١٥.١ ٪ ) والقيمة الغذائية للعلائق مقدره بمعادل النشا كانت تزداد بزيادة نسبة الزيت في العليقة وتراوح بين ٦٨٨ - ٩٤٧ .

وقد اوضحت نتائج هذه التجربة ان اضافة زيت بذرة القطن حتى مستوى ١٠ ٪ من العليقة لم يكن له تأثير سيىء على النمو ولكن زيادة نسبة الزيت عن هذا المستوى وحتى ١٧.٥ ٪ من العليقة تسبب انخفاض معدل النمو كما ان كفاءة التحويل الغذائى معبرا عنها بمقياس النمو في المجاميع التى تغذت على علائق بها زيت حتى ١٠ ٪ كانت من الوجة العملية واحدة . وكانت كميات الغذاء التى تتناولها الكتاكيت تقل كلما زادت نسبة الزيت في العليقة وارتفعت تبعاً لذلك قيمتها النشوية . أما نسبة النشوق فانها ازدادت في المجاميع التى تغذت على نسب زيت ١٠ ٪ أو اعلى .

ويوصى من نتائج هذه التجربة أنه عند استخدام زيت بذرة القطن رقم ٣ كمصدر للطاقة في غذاء الكتاكيت أن تقل نسبته عن ١٠ ٪ من العليقة .

(\*) قسم الانتاج الحيوانى « فرع تغذية الحيوان » بكلية الزراعة - جامعة القاهرة - بالجيزة .