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Effect of Feeding on High Levels of Cotton-seed Meal on the Egg Quality

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One hundred eighty B.W. (Baladi White) pullets of similar age and weight were divided randomly into four equal groups. One hundred sixty eight R.I.R. (Rhode Island Red) pullets of similar age and weight were divided also into four equal groups. Four rations contained U.D. C.S.M. (undecorticated cottonseed meal) a levels 0, 10, 20 and 30% were used respectively for feeding the four B.W. groups, while with the R.I.R. breed, other four rations containing D. C.S.M. (decortiated cottonseed meal) at levels, 0, 10, 20 and 30% were used respectively for feeding the four groups.

The results showed that the eggs which were stored for eith 21 or 28 days in the room became distorted. After the storage the egg yolks produced from the B.W. and the R.I.R. hens fed the rations containing 20 and 30% C.S.M. showed very light brown colorr. The albumins were normal and did not give any pink color at the different storage periods. The degree of egg yolk discoloration achieved by the ammonia test at any storage period was positively associated with the level of cottonseed meal in the ration. There was no difference in the pH of yolks and albumins between treatments within each storage period. It was found that within each storage period, there was no appreciable difference between the four treatments as regards to the calculated calorific value of the whole eggs.

It has been concluded by many workers that a large proportion of stored shelled egg produced by hens fed rations containing cotton seeds meal are of poor quality.

Stephenson and Smith (1952) found that cottonseed meal results in yolk and albumin discoloration. Heuser (1955) reported that cotton-seed meal is useful for the production of eggs when the eggs are to be used fresh but it has an adverse effect on stored eggs.

Heywang and Lowe (1959) indicated that feeding cottonseed meal to laying hens resulted in dark yolk and pink white discoloration.

Kemmerer *et al.* (1962) stated that cottonseed oil and gossypol had the same effect on egg discoloration. Cottonseed oil raised pH yolks in stored eggs.

Kemmerer *et al.* (1963) demonstrated that cottonseed oil unlike maize oil increased the pH and caused discoloration in the stored egg yolk.

Lipstein and Bronstein (1966) repoted that individulas differed in sensitivity or reistance to cottonseed products in causing discoloration in white and yolk of eggs.

Material and Methods

One hundred eighty B.W. (Baladi White) and one hundred sixty eight R.I.R. (Rhode Island Red) pullets of similar age and weight were used in this study. Hens within each breed were divided into equal groups, each was confined in an earth floor pen.

Four rations of nearly isonutritive values contained U.D.C.S.M. (undecorticated cottonseed meal) at levels 0,10,20 and 30% were used respectively for feeding the four groups of the B.W. birds, while with the R.I.R. breed, other four rations similar in their nutritive values contained D.C.S.M. (decorticated cottonseed meal) at levels 0,10,20 and 30% were used respectively for feeding the four groups. The crude fat of the different rations was within the limits recommended by Titus (1961) while the crude fiber were within the possible limits after Ibrahim (1969). The allowances of starch value and digestible protein for the B.W. and R.I.R. layers rations were taken after Ghoneim (1957). The starch values of the different ingredients of the rations were calculated after Abou-Raya (1967). The sumative chemical analysis of the rations was done according to Raafat (1969). Total and free gossypol of cottonseed meal were determined according to Smith (1958) and (A.O.C.S., 1957) respectively.

Each group of the B.W. and R.I.R. hens was given its diet ad libitum and the actual amount of feed consumed was recorded monthly throughout the experiment period which lasted for six months (Dec., 1967 to May 1968). Eggs were collected from each group, weighed and recorded daily at 4 P.M.

Chemical analysis of eggs

Chemical analysis were conducted on eggs produced from each treatment in both the two breeds of layers. The following items of chemical analyses were done on one day old eggs and on eggs stored for 7,14,21 and 28 days in the room temperature and on eggs in the refrigerator at 7C for the same four periods. The room temperature during storage ranged between 19-42C.

The degree of yolk discoloration was evaluated according to an arbitary visual standard ranging from "O" for none, "1" for very light brown, to "5" for black, (Frampton *et al.* 1961). The whites were visually examined for the appearance of pink coloration.

For the prediction of olive yolk discoloration, two eggs from each treatment were used for the visual estimation of yolk and albumin colors were tested.

The ammonia atmosphere test was conducted after Gran *et al.* (1954). The intensity of coloration in the yolks was graded from "O" to "5".

In determining the pH of yolk and albumins, four aggs from each treatment were used. The yolk and albumins of the eggs were separated alone into two small beakers. The content of each beaker was mixed thoroughly and the pHof both yolks and albumins was obtained by dipping the electrodes of the pH-meter in each beaker. Acid potassium phthalate was used as a buffer solution in the course of the pH measurements (A.O.A.C., 1955).

The eggs from each treatment were used for obtaining the calculated calorific value of the whole eggs. The edible parts of the two eggs were mixed thoroughly by an electric blender. Moisture, crude protein, crude fat, ash and nitrogen free extract were determined (A.O.A.C., 1955). The calorific value was calculated on the basis of the conventional physiological value, *i.e.*, 4 Kcal. per one gram of carbohydrate, 4 Kcal. per one gram of protein and 9 Kcal. per one gram of fat (U.S.D.A., 1940).

TABLE 1. **The composition of the experimental rations**

Ingredients, kg	B.W. rations				R.I.R. rations			
	1	2	3	4	5	6	7	8
Corn (White)	15	15	20	45	10	13	20	24.5
Barley	15	15	20	—	6	10	10	20
Wheat bran	20	25	15	10	15	15	10	10
Rice bran	38	25	15	8	25	22	25	10
Undecorticated C.S.M.	—	10	20	30	—	—	—	—
Decorticated C.S.M. .	—	—	—	—	—	10	20	30
Bens (Vicia Faba) . .	8	5	6	3	38.5	24.5	9.5	—
Dried skim milk . . .	4	4	4	4	5.5	5.5	5.5	5.5
Starch value (Calculated) . . .	67.89	66.16	65.01	64.39	69.15	69.67	70.05	71.72
Chemic alanalysis								
Crude rotein, % . .	15.41	14.63	16.09	15.51	18.9	18.46	19.83	19.69
Crude Fiber, % . . .	10.36	11.66	11.93	11.58	9.05	9.46	8.83	7.68
Crude Fat, %	4.96	4.95	4.10	3.62	3.69	3.36	4.49	4.01
Crude sh, %	9.06	8.27	8.64	7.44	9.15	8.87	8.95	8.43
Nitrogen-Free extract, %	50.01	49.92	48.90	51.34	48.36	49.02	47.22	49.79
Total gossypol, % . .	0.000	0.104	0.208	0.312	0.000	0.137	0.275	0.412
Free gossypol, % . .	0.000	0.009	0.018	0.027	0.000	0.011	0.022	0.032
Bound ,gossypol. %	0.000	0.095	0.190	0.285	0.000	0.126	0.253	0.380

Each ration was supplied by 0.2 kg Vit. A+D_3 powder, 0.5 kg sodium chloride and 1.5 kg. calcium carbonate. Mineral mixture was added (Titus, 1961). Excess of Ca $CO_3$was available for hens at apetite in seperate containers .

Results and Discussion

The eggs stored in the room temperature for 21 and 28 days became distorted.

1. *Visual estimation of yolk and albumin colors*

The yolks produced from both the B.W. layers fed rations containing 20 and 30% of U.D.C.S.M. (0.018 and 0.027% free gossypol of the ration) and the R.I.R. hens fed rations containing the same levels but of D.C.S.M (0.022 and 0.032% free gossypol of the ration) showed very light brown color, *i.e.* the discoloration was evaluated to be "1" after the storage for 28 days in the refrigerator.

The whites of eggs produced by both the two breeds of layers, fed the different levels of C.S.M. were normal and did not give any pink color after the storage for either 14 days in the room or 28 days in the refrigerator.

In this connection Heywang *et al.* (1955) demonstrated that the degree and incidence of both olive yolk and pink white discoloration increased with increasing the storage time.

2. *Prediction of olive-yolk diesoloration*

It is clear that with eggs produced by both the B.W. and the R.I.R. hens, the degree of discoloration achieved by the ammonia test at any stage of storage was positively correlated with the level of C.S.M. in the ration. The all over average degrees of egg yolks discoloration was 0,12 and 3.5 for the B.W. hens fed on rations containing U.D. C.S.M. at levels 0, 10,20 and 30% respectively. The corresponding figures for the eggs produced from the R.I.R. hens fed on the same levels of D.C.S.M. were 0,1,3 and 4.

In this connection Heywang and Vavich (1965) showed that eggs from birds given glandless cottonseed meal had no discoloration when tested with ammonia test unlike that of birds given glanded cottonseed meal.

3. *pH of yolks and Whites*

With the B.W and the R.I.R. eggs there was no difference in the pH of yolks and whites between treatment within each storage period.

The storage periods had a slight effect on the pH of either yolks or whites produced by the layers fed on the different rations (Table 2).

In this connection Schiable *et al.* (1946) and Deutschman *et al.* (1964) reported that defects in eggs associated with pink white discoloration include increased yolk and decreased white pH.

4. *Calculated calorific value of unshelled whole eggs*

With the B.W. and the R.I.R. eggs there was no appreciable difference in the calorific value of eggs among treatments within each storage period.

The storage periods had no appreciable effect on the calorific value of the whole eggs (Table 2).

In this connection Ministry of Agriculture, Northen Ireland (1958) demonstrated that, changes in feeding appear to have little or no effect on the energy value of eggs. Heuser (1955) demonstrated that as far as the hen is concerned, she will endeavor to produce a complete egg which is capable of reproducing herself and production is always full and complete or there is none.

TABLE 2. pH and calorific value of eggs stored for different intervals produced by B.W. and R.I.R. layers fed on rations containing different levels of cottonseed meals.

Breed	Rations	Av. of the pH		calorific % value
		Yolk	White	
B.W.	Contained no C.S.M.	6.23	8.63	Kcal. 159.86
	Contained 10% U.D. C.S.M.	6.25	8.65	152.61
	Contained 20% U.D. C.S.M.	6.27	8.62	154.06
	Contained 30% U.D. C.S.M.	6.35	8.64	159.50
Av.		6.28	8.64	156.51
R.I.R.	Contained no C.S.M.	6.24	8.65	156.70
	Contained 10% D. C.S.M.	6.32	8.65	154.88
	Contained 20% D. C.S.M.	6.35	8.61	155.45
	Contained 30% D. C.S.M.	6.30	8.62	155.71
Av.		6.30	8.63	155.69

% Calculated for 100 g unshelled whole eggs.

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بعض الدراسات الكيماوية للبيض الناتج من الدجاج المغذى على علائق محتوية على مستويات مختلفة من كسب بذرة القطن

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أجريت هذه الدراسة على ١٨٠ دجاجة بلدى أبيض ، ١٦٨ دجاجة رود ايلاند أحمر ، كانت طيور كل نوع متماثلة العمر والوزن عند بداية التجربة . وقد قسم دجاج كل نوع الى أربع مجاميع متماثلة . وضعت كل مجموعة فى حظيرة مستقلة . غذيت مجاميع الدجاج البلدى الأبيض على علائق متماثلة فى قيمتها الغذائية ولكنها اختلفت فى مستويات كسب بذرة القطن غير المقشور حيث كان للمجاميع الأربعة على الترتيب صفر ، ١٠ ، ٢٠ ، ٣٠٪ . وعلى نفس النمط كونت علائق لتغذية مجاميع الدجاج الرود ايلاند الأحمر ، متماثلة فى قيمتها الغذائية ولكنها اختلفت فى مستويات كسب بذرة القطن المقشور حيث بلغ على الترتيب للمجاميع الأربعة صفر ، ١٠ ، ٢٠ ، ٣٠٪ . ولقد استمرت التجربة لمدة ستة شهور . وقد أجرى التحليل الكيماوى للبيض الناتج من مجاميع التجربة بحالة طازجة وبعد التخزين لمدة ٧ ، ١٤ ، ٢١ ، ٢٨ يوم فى كل من الغرفة والثلاجة .

وقد أظهرت نتائج هذه التجربة أن تخزين البيض لمدة ٢١ أو ٢٨ يوم فى جو الغرفة قد سبب تلفه . تبين أن البيض الناتج من الدجاج الأبيض والرود ايلاند الأحمر المغذى على علائق بها كسب بذرة قطن بمستوى ٢٠ ، ٣٠٪ قد أعطت لونا بنيا حفيفا للصفار وذلك بعد التخزين لمدة ٢٨ يوما بالثلاجة ، ولم يشاهد ظهور أى لون قرنفلى للبياض فى فترات التخزين المختلفة . باجراء اختبار الاموتيا لصفار البيض الناتج من مجاميع التجارب فى كل من النوعين فى الفترات المختلفة للتخزين لوحظ أن توقع ظهور اللون الغير مرغوب يتناسب طرديا مع مستوى كسب بذرة القطن فى العليقة المستهلكة . وجد أنه فى حالة البيض الناتج من الدجاج البلدى الأبيض والرود أيلاند الأحمر أنه فى فترات التخزين المختلفة لم توجد فروق ذات قيمة بين معاملات التغذية المختلفة بالنسبة لتركيز أيون الايدروجين لكل من الصفار والبياض . لم يسبب اختلاف طول فترات التخزين ، أو اختلاف المعاملات الغذائية أى فروق عملية فى القيمة الحرارية للبيض البلدى والبيض الرود أيلاند الأحمر الناتج .