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The Role of Amino Acids in Egg Production

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240 FEMALES and 60 males were divided into 6 equal groups. All the birds were 16 week of age at the beginning of the study. They were managed and treated alike. Six ratoins were fed, two of them served as control and fed 19% total protein ration irrespective to the ratio of amino acids. The other 4 groups received ration containing ingredients balanced to contain the 10 essential amino acids, in a ratio similar, as far as possible, to the ratio of these amino acids in eggs, with almost the same total protein per cent. Two of the experimental groups fed rations of high balanced levels of amino acids, and the other received low level. Each two similar groups received two sources of animal protein, the first drink liquid skin milk, while the second fed Sardin meal.

The two groups that received rations containing high balanced amino acids, matured sexually month earlier than the other groups. The average age at first egg, in these two groups, was earlier than the other groups with a period that ranged between 36 and 53 days. Also, these two groups, surpassed all the other groups, in the average production of hen per month. The total number of eggs produced until the end of the study, was twice that of any of the other groups. This supports the fact that the balancing of amino acids in the ration containing larger quantity of animal protein, increased egg production. Less food was consumed by these two groups to produce dozen eggs than the other groups. Also, the other two groups that fed balanced ratio of amino acid in low level consumed less food per dozen eggs than the control groups.

Methionine

It was found that the level of methionine required for supporting maximum egg production and egg size appeared to be about 0.28 % in the presence of 0.25 % cystine (Leogn and Ginis, 1952). Also, methionine hydroxy analoge, significantly increased egg production at all levels of protein, and improved the efficiency of feed utilization per dozen of eggs in cage hens, but not in floor pens (Harms *et al.*, 1962). On the other hand, when basal diets containing 0.27 to 0.29%, methionine were used it was found that supplemental methionine, had little, if any, effect on egg production, feed consumption per dozen eggs laid, egg weight, shell thickness and hatchability (Heywang *et al.*, 1963). Pengel (1963), however, found that when a diet calculated to attain 0.15 methionine was supplemented with another 0.15 %, egg production, and feed conversion were better but the differences were not significant.

Leucine

It was found that the addition of 3.0 % leucine to high wheat ration, increased egg production 3 % while feed consumption per dozen eggs was reduced (Anderson and Droper 1956).

Arginine

The arginine requirements of laying hen is greater than 0.44% of the diet containing 12% protein (Fisher and Griminger, 1960). Giving White Leghorn laying pullets, a diet containing 10.8 to 20.9% protein, the arginine requirement was found to be between 0.6 and 0.7 % of the diet. The requirements did not increase with the increase in protein content of the diet (Adkins *et al.*, 1958).

Lysine

Comparing a basal diet containing 14 % protein, alone or supplemented with 0.25 % lysine or 0.25 % methionine respectively, or supplemented with 0.25 % lysine plus 0.25 % methionine with a diet containing 16 % protein, it was found that the birds fed the 16 % protein diet laid larger eggs than those given 14 % protein without supplement, lysing and methionine together increased egg weight to a greater extent than either of the amino acids alone (Bielly and March, 1964).

Threonine

Using crude casein supplemented with crystalline amino acids as the source of protein in the ration, it was found that the requirements for threonine for the laying hen was about 0.42 % of the diet for egg production, feed consumption and egg size (Adkins *et al.*, 1958).

However, no studies were done concerning the relation between egg production and the essential amino acids as a group.

Material and Methods

At 16 weeks of age 60 males and 240 females were divided into 6 groups and kept in laying houses for each group. All the birds were treated alike. Each group recevee different ration as shown in Table 1. The liquid skim milk was offered to the chick drink. The 324 kg of liquid skim milk support 0.98 % digestable protein, while the 180 kg of liquid skim milk provide 5.1 % digestable protein. The amino content of each ingredient was calculated according to the tables of amino acids in food and feeding stuffs found in the technical communication No. 19 published by the common wealth agricultural Bureau (Bureau of Animal Nutrition in 1959.

The treatments in this experiment were designed to contain amino acids in a ratio simulating that found in the chicken meat. This ratio was also calculated in the light of recommended ratios by Klain *et al.* (1958 and 1960) and Dobson *et al.* (1964). The ration contents of amino acids was given once in a high level and the other in a lower level than the ratio found in chicken eggs. Liquid skim milk was supplied for half of the treatments, while the other half was fed fish meal with different levels. All the groups were fed Egyptian clover at winter and chopped grain maize leaves at summer. Trapnests were used to record the eggs laid by each pullet.

TABLE 1. The compositions and ingredients used in the different treatments.

Ingredients % and composition		Control			Treatments		
		1	2	3	4	5	6
Corn		12	12	38	38	16	16
Rice pollishings		12	12	02	0	17.5	17.5
Wheat bran		12	12	1	1	15	15
Horse beans		16	16	4	4	16	16
Cotton seed cake		20	20	0	0	22	22
Seasam cake		0	0	16	16	0	0
Barley mault		25	25	30	30	10	10
Bone meal		1	1	1	1	1	1
Salt		0.5	0.5	0.5	0.5	0.5	0.5
Liquid skim milk kg		32.4	0	180	0	32.4	0
Fish meal		0	2	0	11	0	2
Crude protein		19.22	19.22	18.71	18.71	19.30	19.30
Starch equivalent		57.34	37.34	49.40	49.40	63.70	83.70
Methionine	1	0.23	0.23	0.38	0.43	0.24	0.25
	2	1.21	1.19	2.05	2.32	1.30	1.31
Arginine	1	1.16	1.17	1.03	1.09	1.35	1.36
	2	6.28	6.11	5.51	5.83	7.00	7.50
Histidine	1	0.43	0.42	0.51	0.49	0.48	0.48
	2	2.23	2.18	2.71	2.60	2.50	2.50
Leucine	1	1.12	1.07	1.55	1.44	1.32	1.29
	2	5.83	5.59	8.27	7.70	6.80	6.70
Isoleucine	1	0.88	0.84	1.01	0.89	0.84	0.82
	2	4.57	4.35	5.37	4.74	4.30	4.20
Lysine	1	0.83	0.81	0.85	0.95	0.86	0.87
	2	4.34	4.21	4.52	5.07	4.40	4.50
Cystine	1	0.30	0.29	0.37	0.40	0.33	0.33
	2	1.56	1.50	1.96	2.13	1.70	1.70
Phenylalanine	1	0.76	0.73	0.86	0.76	0.82	0.80
	2	3.98	3.79	4.60	4.06	4.20	4.10
Threonine	1	0.57	0.47	0.65	0.64	0.55	0.55
	2	2.97	2.47	3.44	3.44	2.80	2.80
Valine	1	0.99	0.93	0.89	0.90	0.95	0.95
	2	5.13	4.84	4.73	4.81	4.90	4.90

1. % of amino acids to the total ration.
2. % of amino acids to the protein in the ration.

Results and Discussion

Date and age at sexual maturity

The average date at the first egg was on the 12*th* to 15*th* of June for for the groups 3 and 4, which was almost one month earlier the than other four goups that matured sexually at an average date on the 11*th* to 20*th* of July (Table 2). That means that the two groups that fed rations containing balanced essential amino acids in a high level began to lay one month earlier than all the other treated or control groups.

TABLE 2. The effect of different amino acids treatments on date and age at sexual maturity.

Item	Treatments					
	1	2	3	4	5	6
Date at first egg						
Mean	July 15	July 20	June 12	June 15	July 19	July 11
Range	June 2- Aug. 27	June 9- Aug. 30	May 24- June 30	May 28- July 3	June 8- Aug. 30	May 27- Aug. 25
Age at first egg						
days Mean . . .	186.8	191.6	138.6	147.0	186.8	182.8
Range	137-218	144-220	128-162	132-168	143-226	131-221

N.B. All the pullets were hatched at the 16th of January.

The age at first egg of the hens of group 3 was less 48 days than the hens of both the groups 1 and 5.53 days less than the hens of group 2 and 44 days less than the hen of the group 6. The age at first egg of the hens of the group 4 was 40 days less than the hens of both the groups 1 and 5,45 days less than the hens of the group 2 and 36 days less than the hens of the group 6. The average ages at sexual maturity recorded in that study for either group 3 and 4 also about one month earlier than the age previously observed in this respect for the same breed at the same from (Hafez and Kamar, 1955 and Kamar and Mostageer, 1959).

Egg production

The total number, of eggs produced by each hen until 350 days of age was available (Table 3). The groups 3 and 4, which received rations containing high balanced level of aminol adids produced nearly double the number produced by any of the other four groups, in the same period, although all the hens were hatched at the same data and managed under similar conditions.

Also, both the average number of eggs produced by each hen per month, and the mean of the six months were available. The groups that received rations containing high balanced levels of amino acids, gave more eggs per hen per month along the experimental time than the other four groups. This may indicate that egg production can be improved by raising the ration content of animal protein, putting in consideration the amino acid balance. However, the balancing of amino acids in the ration without increasing the animal protein level did not improve egg production and it was almost

the same like the control. This was in contrary to that observed in meat production (Kamar *et al.*, 1971), where the balancing of the amino acids in any level of animal protein improved growth and meat production. It can be concluded or suggested that egg production requires high levels of animal protein than that required for growth period. There were no considerable differences, in production, between the groups that received fish-meal as the source of animal protein and the similar groups that received liquid skim milk as the source of animal protein.

TABLE 3. Average egg number per month per hen for the different treatments.

Mean of hen/month / Month	Treatments					
	1	2	3	4	5	6
June	1.60	1.11	2.35	2.12	1.42	1.60
July	1.65	1.65	2.65	2.62	2.08	2.20
August	2.02	2.12	3.32	3.48	2.02	2.20
September	2.55	2.85	4.50	5.20	2.85	2.90
October	4.15	4.45	7.35	7.75	3.25	3.60
November	4.45	6.05	9.65	10.01	4.35	4.75
December	6.55	7.25	12.0	12.90	4.85	5.95
Mean of 6 months	2.93	3.17	5.02	5.24	2.63	2.92
Total/bird*	24	25	41	44	21	23

* Total eggs produced until 350 days of age.

The production of eggs was low at the beginning of the six months of egg recording especially during June and July when almost most of the pullets were in their course of sexual maturity and the majority were not sexually mature yet. When the pullets were all sexually matured and began their production they were faced by the hottest of the year in Egypt, namely ; August and September. When these hot months ended, production began to increase. However, the levels of production in the subsequent months (October and November) were not satisfying because this period coincides with the period of annual moult and rest. On the last month, the level of production in general, approached the normal level, that was when the weather and environmental conditions became suitable. The data of

hatch of these pullets was tthe mojor factor that reduced their number of eggs as previously observed by Hafez and Kamar (1955). However, the average egg number per month per hen at December was similar to other results in this respect in the same locality and that number for groups 3 and 4 was larger than that recorded for this month for the same breed (Kamar and Mostageer 1959).

Food consumption per dozen eggs

The food consumed in kg per dozen eggs by the birds of the groups that received rations containing high balanced levels of amino acids was less than that consumed by any of the other four groups, along the period between sexual maturity and the end of the experiment (Table 4).

TABLE 4. Kg of food used to produce one dozen of eggs at different treatments.

Month	1	2	3	4	5	6
June	12.050	16.810	8.783	9.826	15.520	14.025
July	14.000	14.601	8.409	8.503	11.242	10.789
August	12.053	11.031	7.232	6.959	11.494	11.731
September	12.038	10.947	5.899	6.242	11.813	11.227
October	8.776	8.135	4.258	4.974	11.712	10.706
November	7 205	6 496	3 511	3.397	9 440	8.774
December	6.447	5.823	3.035	2.864	9.120	7.654

The food consumed per dozen eggs at this period, was somewhat large because of the needs of growth besides the egg production, also the number of eggs laid during the period was low. However, the growth, and egg production of group 3 and 4 were higher than any of the other groups, in spite of their less food consumption. This may indicate that the balancing of amino acid content of the ration, raised the efficiency of the hens.

The groups that received fish meal as the source of animal protein consumed less food than the similar groups that were fed liquid skimmilk. The control groups that were fed normal rations without any consideration of amino acid balance, consumed more food than the groups fed rations containing low balanced levels of amino acids (groups 5 and 6) during June and July. However, this trend was reversed during the remaining part of the experimental period.

The standards recorded here with respect to food utilization for egg production were high as far as the months of June, July, August, September and October were concerned. This was due to the low level of egg production recorded during this period which was discussed previously. However, the levels observed in the last two months, namely; November and December were normal Moreover, the levels of groups 3 and 4 that received balanced amino acids in high levels were low and reached these levels of the standard breeds and crosses. When the balancing of amino acids is combined with the increase of animal protein, without the increase in total protein, egg production is improved. The beneficial effect of balancing the amino acid content of the ration, may be due to the direction of the greatest part of the available protein to the production of eggs. This is accompanied by the decrease of the waste, because none of the amnio acids can be limited to the use of the others, as all of them are available almost in the ratio needed to compose the protein produced. That also, may decrease the energy needed to select the suitable amino acid ratio to compose egg protein, and excrete unneeded excess, from the unbalanced ratio. Accordingly, the saved energy is directed to encourage other productive aims.

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دور الأحماض الأمينية فى انتاج البيض

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لدراسة كيفية تأثير انتاج البيض بموازنة الأحماض الامينية الأساسية فى العليقة بحيث تماثل اتزانها فى اللحم والبيض ، **وضعت تحت الدراسة ٢٤٠ دجاجة ، ٦٠ ديكا فى عمر ١٦ أسبوع من ستة مجموعات متساوية العدد.**

وقد **كانت جميع المعاملات والخدمة موحدة فيما عدا تركيب العلائق حيث** كانت تغذية مجموعتا المقارنة على عليقتين متماثلتين تحويان ١٩٪ بروتين كلى مصدر البروتين الحيوانى فى احداها السمك المجفف وفى الأخرى اللبن الفرز ، دون النظر لتوازن الأحماض الامينية .

أما المجموعات التجريبية الأربعة الأخرى فقد كانت علائقها مركبة من مواد **مختلفة بحيث تضمن احتوائها على الاحماض الامينية العشرة الاساسيةموضوع الدراسة – بنسبة الى بعضها تماثل بقدر الأمكان توازنها فى اللحم والبيض، اثنتان منهما مرتفعة المحتوى من الاحماض الامينية المتوازنة والاخريانمنخفضة** المحتوى ، **وفى كل مجموعتين متماثلتى المحتوى ، استعمل السمك المجفف مصدرا للبروتين الحيوانى فى احداها واللبن الفرز فى الاخرى ، وقد كانت نسبة البروتين الكلى ثابتة تقريبا فى جميع العلائق .**

وظهر من نتائج الدراسة أن المجموعات المغذاه على علائق مرتفعة المحتوى من الأحماض الأمينية المتوازنة ، بكرت شهرا فى تاريخ تضجها الجنسى عن المجموعات الأخرى ، وكان متوسط العمر عند أول بيضة فى نفس المجموعتين **يقل بمتوسط ٣٦ – ٥٣ يوما عن المجموعات الاخرى ، وتفوقت أيضا هذه المجموعات فى معدل أنتاج البيض للدجاجة الواحدة فى الشهر ، وكان** أنتاجها الكلى من البيض حتى نهاية الدراسة ضعف انتاج المجموعات الأخرى. وقد يرجع هذا الى أن توازن الأحماض الأمينية فى العليقة التى بها نسبة مرتفعة من البروتين الحيوانى يزيد انتاج البيض .

كمية الغذاء المأخوذ لأنتاج دستة من البيض كانت أيضا أقل فى تلك المجموعات عن الأخرى وأيضا فان المجموعات المغذاه على علائق منخفضةالمحتوى من الأحماض الأمينية المتوازنة كانت كمية الغذاء لانتاج (دستة البيض) **أقل من المجموعات المقارنة .**

ملحوظة

الأحماض الأمينية العشرة موضوع الدراسة هى :

مثيونين – أرجنين – هستدين – ليوسين – أيزوليوسين – لايسين – سيستين – فينايل آلانين – تريونين – فالين .