

**A STUDY OF THE EFFECT OF DIETARY
VITAMIN 'A' LEVEL ON THE GROWTH AND
PERFORMANCE OF BALADI WHITE CHICKS**

By

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Baladi White chicks used in this study were depleted from vitamin 'A' stored in their livers by feeding them on ground white corn for the first 3 weeks of age.

Chicks were fed the basal ration supplemented with the following vitamin 'A' levels in USP units per kg.: 2000 (gp. 1), 4000 (gp. 2), 5000 (gp. 3) and 6000 (gp. 4). Group 5 was fed the basal ration in addition to *ad libitum* feeding of green berseem. Group 1 to 4 included 30 chicks each while group 5 included 26 chicks.

Male chicks fed the basal ration supplemented with 6000 USP units vitamin 'A/kg' had the heaviest body weight at 15 weeks old. However, increasing the vitamin 'A' level from 2000 to 5000 USP/kg. of ration did not affect growth of chicks significantly. It was also found that *ad libitum* feeding of berseem produced good growth comparable to the group fed the 6000 USP units of vitamin 'A/kg'.

Body weight of female chicks at 15 weeks of age was not significantly different due to dietary supplementation of vitamin 'A' at levels from 2000 to 6000 USP units/kg. The growth of the berseem fed group although was numerically low but it was not significantly different from the other groups.

Comparing the growth of the males and females of the berseem fed group suggests possible sex difference in the ability to convert carotene to vitamin 'A'. This view-point is substantiated by the relatively high mortality rate encountered in the females of this group.

Chicks fed the berseem had poor feed efficiency as compared to the vitamin 'A' supplemented groups. Feed efficiency was best in the group fed the ration supplemented with 6000 USP units vitamin 'A/kg'.

The effect of vitamin 'A' on the growth rate of chicks is well recognized (Scott *et al.*, 1961). The poultry subcommittee of the American National Research Council (1960), has listed the minimum requirements for vitamin 'A' as 2640 USP units per kilogram of feed for starting and growing chickens. However, Hill *et al.* (1961), using Single Comb White Leghorn chicks, found that increasing the dietary vitamin 'A' from 1322 to 2644 USP units per kilogram produced no further weight gains. They concluded that the vitamin 'A' requirement of the chicks is approximately 1322 USP units/kg. of diet or about 50% of the present NRC estimate. Similarly Kurnick *te al.* (1964), reported that increasing the dietary vitamin 'A' from 1100 to 6600 USP units per kilogram of diet produced numerically but not statistically significant improvement of growth rate to 10 or 20 weeks of age in subtropical, semi-arid climate.

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In the U.A.R. very little is known about the vitamin 'A' requirements of poultry. Abou-Raya (1967), recommended the use of chopped green fodder, at an amount equal to that of the mash in feeding chicks, to supply vitamin 'A' necessary for production and reproduction of the birds. The adequacy of this procedure in supplementing the chick with the required vitamin 'A' necessary for growth and other vital metabolic and physiological processes has not yet been testified.

In this experiment, the effect of supplementing the ration with graded levels of vitamin 'A' on the growth, feed efficiency and mortality rate has been investigated. The vitamin supplementation was also compared with the *ad libitum* feeding of chopped green berseem in order to determine the adequacy and merits of this practice.

Material and Methods

Two hundred 1-day old Baladi White (B.W.) chicks were used in this study. Chicks were given only crushed white corn for the first three weeks to deplete the vitamin 'A' storage in their livers. Survivals were randomly distributed into 5 groups containing 30 chicks each (except group 5 which included 26 chicks).

Table 1 shows the composition of the basal ration. Vitamin A * supplementation was as follows : 2000, 4000, 5000 and 6000 units per kilogram for ration 1, 2, 3, and 4 respectively. In treatment 5, chicks were fed the basal ration in addition to *ad libitum* feeding of chopped green berseem. Chicks were individually weighed and feed consumed was recorded every two weeks. Feed and water were offered *ad libitum*. The experiment was terminated at 15 weeks of age. Analysis of variance and least significant difference were performed as outlined by Snedecor (1959).

Results and Discussion

Average Body Weight

A. Males :

From Figure 1 it may be noticed that the average body weight of all groups varied within a narrow range up to the age of 11 weeks (462—510 g.). At 13 and 15 weeks of age differences were more prominent. The average body weight of chicks at 15 weeks was 684.3 ± 13.19 , 697.8 ± 29.0 , 623.9 ± 26.8 , 768.3 ± 22.1 and $731.4 \pm$ for groups : 1, 2, 3, 4 and

* Stable, gelatin coated, all-trans vitamin 'A' supplied by Distillation Products Industries, Rochester, N.Y., USA.

TABLE 1.—COMPOSITION OF THE BASAL RATION

Item	%
White corn, ground	56.5
Decorticated cotton seed meal	20.0
Rice bran	10.0
Skim milk	5.0
Fish meal	5.0
Bone meal	1.0
Ca CO ₃	2.0
Na Cl	0.5
Vitamin D ₃	400.0 ICU/kg.
Total	100.00
Crude Protein	19.85
T D N	68.70

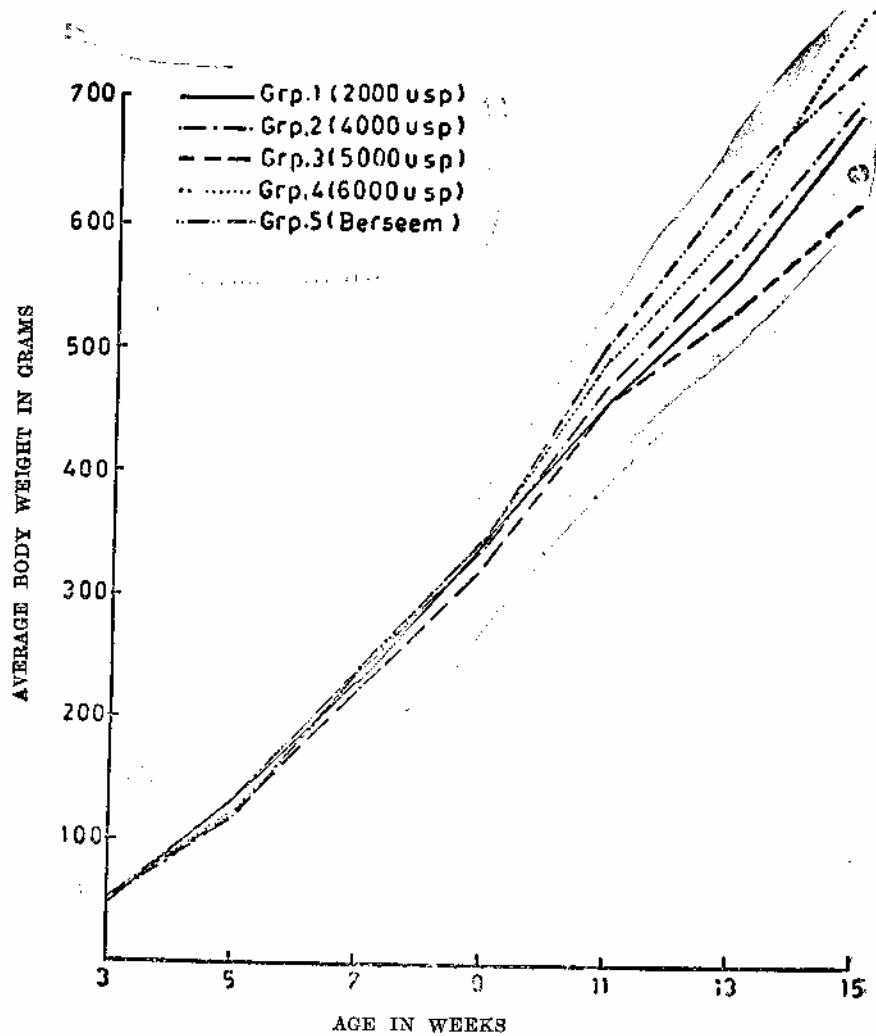


FIG. 1.—Average Body Weight of Male Baladi White Chicks.

5 respectively (Table 2). Analysis of variance revealed significant difference ($P < 0.01$) among treatments in their average body weight at 15 weeks of age. Calculating the least significant difference (LSD) showed that group 4 (6000 USP) had significantly heavier body weight than group 1 (2000 USP) and group 3 (5000 USP) at the 5% and 1% level of probability, respectively as shown in the following table :

Group compared	L. S. D.		
	Observed	Calculated	
		0.05	0.01
1 vs. 2	13.5	75.0	99.8
1 „ 3	60.4	79.6	105.9
1 „ 4	84.3*	82.8	110.1
1 „ 5	47.1	97.6	129.8
2 „ 3	73.9	75.0	99.8
2 „ 4	70.5	78.6	104.5
2 „ 5	33.6	93.8	124.8
3 „ 4	144.4**	82.8	110.1
3 „ 5	107.5*	97.6	129.8
4 „ 5	36.9	100.2	133.3

* $P < 0.05$ ** $P < 0.01$

This indicates that the growth of the group fed 6000 USP units of vitamin 'A/kg'. ration was superior than the growth of groups supplemented with lower levels of vitamin 'A'. Although group 4 (6000 USP) did not differ significantly from group 2 (4000 USP) however, there was numerical difference in favour of the high vitamin fed group. Chicks fed the berseem (gp. 5) had average body weight comparable to that of the group fed the 6000 USP units of vitamin 'A/kg'. ration. The average body weight of the berseem fed group was significantly higher than that of group 3 ($P < 0.05$). However, groups fed 2000, 4000 or 5000 USP units of vitamin 'A/kg'. ration showed no significant differences among them.

Thus, it may be concluded that feeding male B. W. chicks 6000 USP units of vitamin 'A/kg'. ration or *ad libitum* feeding of berseem produced the best growth but increasing the vitamin 'A' level from 2000 to 5000 USP units/kg. ration did not affect growth of chicks significantly.

B. Females :

Figure 2 shows the growth of female chicks during the period from 3 to 15 weeks of age. From this figure it may be seen that up to 11 weeks of age, group 1 (2000 USP) had the highest average body weight while group 5 (berseem fed) had the lowest body weight. The other three groups were intermediate between these two groups. At 15 weeks of age group 1 was still leading in its average body weight (680.3 ± 18.5), followed by group 4 (668.0 ± 17.0) while the other three groups i.e. 2, 3 and 5 had lower average body weight (being 630.0 ± 26.6 , 618.4 ± 16.4 and 612.0 ± 18.1 respectively) as indicated in Table 2.

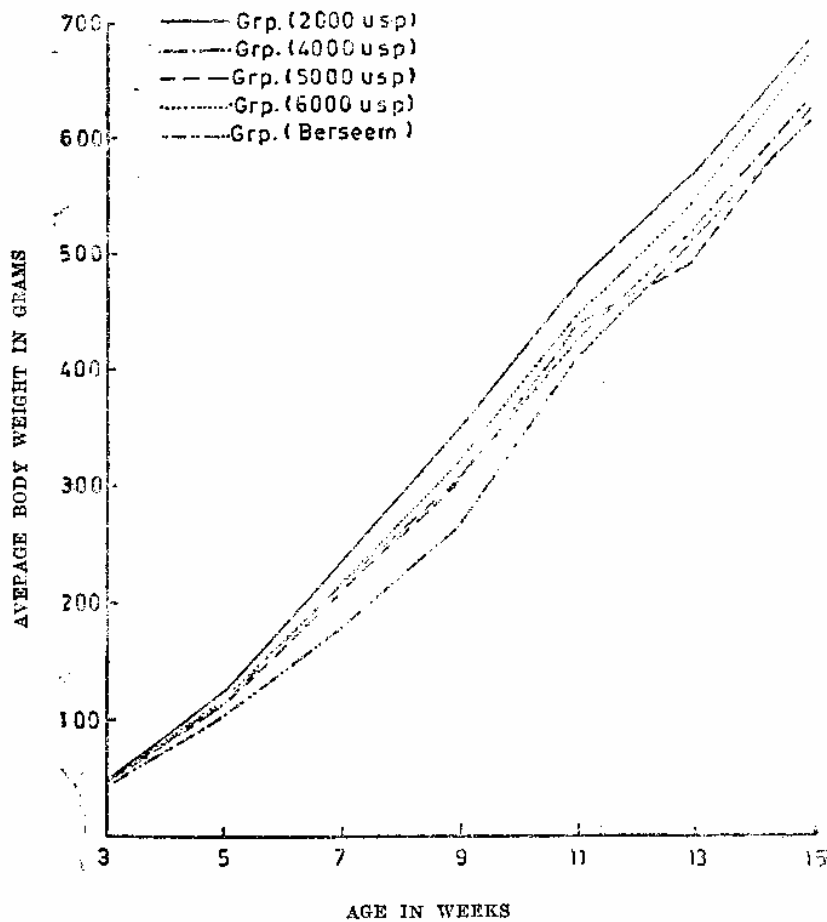


FIG. 2.—Average Body Weight of Female Baladi White Chicks.

TABLE 2.—AVERAGE BODY WEIGHT, FEED EFFICIENCY
AND MORTALITY RATE OF B. W. CHICKS

Item	3 weeks			15 weeks		
	Male	Female	Average	Male	Female	Average
<i>Gp 1 : 2000 USP units Vit. A/kg :</i>						
Average body weight, g.	45.1	46.9	46.1	684.3	680.3	682.2
$S_{\bar{x}}$	2.0	0.5	1.3	13.9	18.5	11.7
Feed efficiency	—	—	—	—	—	5.50
Mortality %	—	—	—	0.00	0.00	0.00
<i>Gp 2 : 4000 USP units Vit. A/kg :</i>						
Average body weight, g.	52.6	44.8	49.4	697.8	630.0	672.1
$S_{\bar{x}}$	1.7	2.5	1.5	29.0	26.6	21.2
Feed efficiency	—	—	—	—	—	5.73
Mortality %	—	—	—	0.00	8.30	3.23
<i>Gp 3 : 5000 USP units Vit. A/kg :</i>						
Average body weight, g.	52.4	45.9	48.9	623.9	618.4	621.0
$S_{\bar{x}}$	2.4	2.0	1.6	26.8	16.4	15.5
Feed efficiency	—	—	—	—	—	6.06
Mortality %	—	—	—	0.00	0.00	0.00
<i>Gp 4 : 6000 USP units Vit. A/kg :</i>						
Average body weight, g.	49.5	48.8	49.1	768.3	668.0	709.6
$S_{\bar{x}}$	2.4	1.5	1.3	22.1	17.0	16.2
Feed efficiency	—	—	—	—	—	5.43
Mortality %	—	—	—	0.00	5.56	3.33
<i>Gp 5 : Berseem :</i>						
Average body weight, g.	56.7	43.6	47.2	731.4	612.0	646.9
$S_{\bar{x}}$	2.7	1.2	1.6	8.0	18.1	18.4
Feed efficiency	—	—	—	—	—	7.00
Mortality %	—	—	—	0.00	10.53	7.69

Analysis of variance at this age, revealed no significant differences due to treatment indicating that supplementing the ration of female B. W. chicks with 2000 up to 6000 units vitamin 'A/kg'. ration or *ad libitum* feeding of berseem had no significant effect on body growth up to 15 weeks of age. These results agree with those reported by Hill *et al.* (1961) and Kurnick *et al.* (1964). The low average body weight of the female B W chicks fed the berseem as compared to the higher average body weight of the males of the same group suggests possible sex difference in the ability to cleave the carotene molecule by the epithelial lining of the small intestine.

Feed Efficiency :

It is defined as kilograms of feed required to produce 1.0 kilogram of body gain. Feed efficiency was calculated as 5.50, 5.73, 6.06, 5.43 and 7.00 kg. for group 1, 2, 3, 4 and 5 respectively. This reveals that group 4 (6000 USP) was the best in this respect while group 5 which was fed berseem, was the most inferior from the feed efficiency point of view. In the vitamin supplemented groups, excluding group 3, it may be concluded that vitamin 'A' supplementation from 2000 to 6000 USP units/kg. had no prominent effect on feed efficiency. Similar results were arrived at by Thornton and Whittet (1962).

Mortality Rate :

Mortality rate for the different groups was recorded as : 0.00, 3.33, 0.00, 3.33 and 7.69% for groups : 1, 2, 3, 4 and 5 respectively (Table 2). This shows that among the vitamin 'A' supplemented groups, mortality ranged between a narrow range from 0.00 to 3.33%. However, the mortality rate of the berseem fed group was about twice as the maximum mortality rate encountered in the vitamin 'A' supplemented groups.

It is known that berseem supplies the chick with vitamin 'A' in the form of its precursor carotene. Cheng and Deuel (1950) reported that the epithelial lining of the intestinal tract is the site of conversion of carotene to vitamin 'A' in the chick. Erasmus *et al.* (1960), reported that vitamin 'A' is required for the growth and maintenance of this tissue. Therefore, injury of the intestinal wall by any infection such as coccidia may result in impaired conversion of carotene to vitamin 'A'. This may explain the relatively high mortality rate encountered in the berseem fed group. Since mortality was only observed in females which were also inferior in their growth as compared to the males of the same group, it is proposed that females have less ability to convert carotene to vitamin 'A'. Further experiments will be carried out to testify this observation.

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دراسة تأثير استعمال مستويات مختلفة من فيتامين أ على نمو كتاكيت البلدى الأبيض

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الملخص

أجريت هذه الدراسة في محطة التجارب الزراعية بكلية الزراعة - جامعة القاهرة على كتاكيتا بلدى أبيض عمر ثلاث أسابيع واستمرت حتى عمر ١٥ أسبوع ابتداء من عمر يوم حتى عمر ثلاث أسابيع غذيت الكتاكيت على ذرة بيضاء مجروشة لضمان استنفاد فيتامين أ المخزون في الكبد وحتى لا يؤثر ذلك على استجابة الكتاكيت للمعاملات المختلفة .

غذيت الكتاكيت على علائق التجربة ابتداء من عمر ثلاث أسابيع وكانت مستويات الفيتامين المستخدمة كالاتى : مجموعة ١ : ٢٠٠٠ وحدة / كجم ، مجموعة ٢ : ٤٠٠٠ وحدة / كجم ، مجموعة ٣ : ٥٠٠٠ وحدة / كجم ، مجموعة ٤ : ٦٠٠٠ وحدة / كجم . المجموعة الخامسة كانت تعطى العليقة الأساسية بالإضافة الى برسيم أخضر وكانت العلائق تعطى للشبع .

يمكن تلخيص نتائج هذه التجربة كما يلى :

الكتاكيت الذكور المفداه على ٦٠٠٠ وحدة فيتامين أ / كجم عليقة - كان وزنها عند عمر ١٥ أسبوع هو أعلى وزن يليها ذكور الكتاكيت المفداه على البرسيم بينما لوحظ أن احتواء العليقة على ٢٠٠٠ الى ٥٠٠٠ وحدة فيتامين أ / كجم لم يكن له تأثير معنوى على وزن ذكور الكتاكيت عند عمر ١٥ أسبوع .

بالنسبة لاثاث الكتاكيت لم يلاحظ تأثير معنوى نتيجة تغذيتها على مستويات مختلفة من فيتامين أ أو تغذيتها على البرسيم بمعنى أن أوزانها عند عمر ١٥ أسبوع لم تختلف احصائيا وأن كانت اناث الكتاكيت المفداه على البرسيم ضعيفة النمو طوال فترة التجربة .

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بمقارنة نمو اناث وذكور الكتاكيت المفداه على البرسيم يلاحظ اختلاف كبير مما قد يدل على احتمال وجود اختلاف بين الجنسين في القدرة على تحويل الكاروتين الموجود في البرسيم الى فيتامين أ في الخلايا الطلائية المبطنه لجدران الأمعاء الدقيقة ويعزز ذلك حدوث نسبة وفيات عالية نوعا ما في اناث هذه المجموعة . كما لوحظ أن مجموعة البرسيم كان معدل الاستفادة من الفداه بها منخفضة بمقارنتها بالجاميع المفداه على فيتامين أ . وكان احسن معدل استفادة من الفداه في المجموعة المفداه على ٦٠٠٠ وحدة فيتامين أ / كجم .