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The Effect of Food Volume on Feed Consumption Conversion, Digestion Coefficient and Growth Performance of Pekin Ducklings

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This work was conducted to study the effect of food volume on feed consumption, feed conversion, growth performance, digestion coefficient and the economical efficiency of feed utilization of pekin ducklings as grazing and early growing birds.

156 pekin duckling of two weeks old were divided into three groups A, B and C, of equal number, *i. e.* 52 ducklings per each group.

Rations were formulated from the available ingredients prevailing in Egypt. All the experimental rations were nearly isocaloric, (2589-2725 K.Cal. M.E/kg) and isonitrogenous (18,04-18,86% crude protein), but the difference was in volume and density as follows:

Rations	:	A	B	C
Volume cc/g	:	1.53	1.70	1.85
Density g/cc	:	0.65	0.59	0.54

Birds were weighed individually and food consumption was recorded per each group at weekly intervals up to 9 weeks. Digestibiliy trials were conducted at the end of the experimental period for each group.

Results obtained can be summarized as follows:

— Birds fed on larger of rations consumed more food than that fed smaller volume. The increase in food consumption by pekin ducklings which fed on ration B (1.70 cc/g) and C (1. 85 cc/g), represented 15.5% and 25.6% excess relatively to that consumed by ducklings fed on ration (1.53 cc/g).

— Feed conversion of the birds which fed on compact ration were better than that fed on coarser and bulkey rations. Feeding bulky food required consequently more energy and more protein for one gain weight unit while the compact food required less in this respect.

— The birds which fed on ration A gave more gain in weight than that fed on rations B and C.

— Birds fed on larger volume rations produced lower values of digestion coefficient.

— From the economical point of view, one unit gain in weig ht for birds fed on ration A may save 23.8 and 44.1% of the costs of rations B and C, respectively.

Generally speaking, it could be concluded that feeding peking ducklings on compact ration may be, not only more favourable for growth, but also of more economical use than feeding bulky food .

The chemical analysis of poultry feed-stuffs do not give an accurate picture about the biological value of these feeds. Other measurements should be taken into consideration, hence the physical properteis of the feeding ingredients or rations could also be of great value.

In Egypt there are a lot of feed-stuffs which differ greatly in their physical properteis (volume cc/g and density g/cc).

Studying the effect of such physical properteis on some productive traits may be of great benefit in poultry rations.

In this work, the effect of food volume on feed, feed conversion, growth performance of peking ducklings and the digestion coefficient of the experimental rations were studied.

Material and Methods

This work was carried out in the Poultry Farm, Faculty of Agriculture, Zagazig University during 1974. 156 peking ducklings of two weeks old nearly similar in their live weight were used in this study. The birds were divided into three groups, A, B and C of 52 pekin ducklings per each group. All the birds were wingbanded to obtain individual records. The birds were reared and treated under the same managerial and environmental conditions in total confinement house keeping system of floor breeding rooms. Waterers, feeding troughs, electric heaters, deep wheat straw litter and good ventilation were provided.

The experimental rations were formulated from the available ingredients prevailing in Egypt as shown in Table 1.

The volume of experimental rations expressed as cc/g and density as g/cc were estimated from random samples and the average of 5 estimates was recorded. The volume cc/g was measured by lightly pouring 100 of rations into a graduated cylinder.

The rations volume was increased by coarse wheat bran, rice bran and cow manure (air dried).

The chemical analysis of experimental rations for groups followed the ordinary conventional methods of A.O.A.C. 1965 are shown in Table 2.

TABLE 1. The formula of the experimental rations.

Ingredients	Groups		
	A	B	C
	%	%	%
Ground yellow corn	55	55	55
Rice 1bran	18	10	—
Coarse wheat bran	—	5	10
Dec. cotton seed meal	17	17	18
Fish meal	3.5	3.5	3.5
Blood meal	3.5	3.5	3.5
Cow manure (air dried)	—	3	7
Bone meal	2	2	2
Ground limestone	0.5	0.5	0.5
Sodium chloride (Salt)	0.3	0.3	0.3
Mineral mixture*	0.2	0.2	0.2
Total	100	100	100

Feed additives

0.5% yeast (Pfizer)

0.5% vit. A + D- (each g contains 5000 I.U. vit. Assnd 500 I.U. Vit. D)

* Each kg of this mixture (Pfizer) contains : sodium chloride 990.101 g, ferrous sulphate 6.077 g, ferric sulphate 1.980 g, potassium iodide 21.000 mg, copper oxide 199.000 mg, potassium chloride 990.000 mg, manganese sulphate 199.000 mg, zinc oxide 100.000 mg, magnesium sulphate 199.000 mg, sodium borate 21.000 mg and cobalt chloride 63.000 mg.

All rations were nearly equal in the estimated crude protein, metabolizable energy, ether extract and energy protein ratio, but these rations were siffered in their volume cc/g and density g/cc as shown in Table 2.

The birds were weighed, individually, at weekly intervals up to 9 weeks by mettlar balance to the nearest g/at 8 a.m., absolute and relative gain weight were also calculated according to Brody, (1949):

$$\text{Relative growth rate} = \frac{W_2 - W_1}{1/2(W_1 + W_2)} \times 100$$

The food intake was recorded from the difference between the offered and rest food after 24hr to the nearst g. Food conversion was calculated for each experimental group as number of kg ration required to one kg growth.

TABLE 2. Chemical and physical analysis of the experimental rations.

	Rations		
	A	B	C
Moisture %	6.54	7.22	6.91
C.P. %	18.68	18.39	18.04
E.E. %	7.79	7.44	8.52
C.F. %	5.79	6.63	6.98
Ash %	6.74	6.71	6.76
N.F.E. %	54.47	53.61	52.81
T.D.N. %	74.57	71.77	75.96
M.E. Kcal/kg*	2680	2589	2725
C/P ratio	143.1	141.1	151.1
Volume CC/g	1.53	1.70	1.85
Density g/cc	0.65	0.59	0.54

* Estimated according to the equation of Kabota and Morimate (1965).

The economical efficiency of the rations volume was expressed as the price of food in L.E. required to produce 1000 g growth.

T.D.N. was calculated in the usual manner, and metabolizable energy were thereafter, calculated according to Kabota and Morimoto(1965); M.E./k. Cal./100 g = (3.23xT.D.N.) 27.1. Energy/protein ratio was also calculated according to Combs equation, (1962):

$$C/P = \frac{\text{K.Cal·M.E./kg food}}{\text{\% crude protein}}$$

At the end of the experiment period, digestibility trials were conducted to compare the digestion coefficient of the different rations in each group. Two males of each group were housed individually in metabolic cages. The preliminary period continued for 5 days to adjust consumption to minimize residual food. The collection period was extended to 5 days to able collect dung material suitable for chemical analysis. Jakebsen *et al.*, procedure (1960) using trichloro-acetic acid was adopted for estimating the faecal nitrogen in the dung.The urinary organic matter(O.M) was calaulated after Galal A.G.H. 1968 as follows: O.M. in urinary = Urinary N x 2.62. The percentage of urinary O.M. in the dung was added to the sum of its other components to

calculate the fraction of non-free extract by differences. The dry matter consumed dung excreted and their percentage analysis were used to calculate the digestion coefficient of different nutrients..

Results and Discussion

1—*Effect of food volume on feed consumption and conversion*

The average values of feed consumption per bird for different ages of peking ducklings durings the experimental period from 2 to 9 weeks old are shown in Table 3.

TABLE 3. **Average and relative values of feed consumpion per bird for different ages of peking ducklings during the experimental periods.**

Group	A		B		C	
Age in weeks	F.C./g	Relative	F.C./g	Relative	F.C./g	Relative
2—4	996.1	100.0	1106.0	111.0	1162.0	116.7
4—6	1389.5	100.0	1626.1	117.0	1753.5	126.2
6—9	2906.4	100.0	3381.0	116.3	3732.4	128.4
2—9	5292.0	100.0	6113.1	115.5	6647.9	125.6

F.C. × feed consumed

It is evident that birds in groups B and C which were fed rations of larger volume, consumed more feed than that of group A which were fed smaller volume ration. The increase in feed consumption of groups B and C, represented 15.5 and 25.6% more, relatively, to group A. Generally speaking we can say that the increase in food volume caused a considerable increase in food consumption.

These results were in agreement with those obtained by Gleaves *et al.*, (1963, and 1968), Gleaves and Satyavan (1971) and Daader (1972).

However, there was an assumption that the rapid passage of large volume food could not enable the digestive tract to get use of the protein or energy needs of the birds. The digestion of the small particles of larger surface may be more easier than that of larger size and smaller surface. So, more food should be taken by the bird because of the faster rate of the passage of big volume and the incomplete digestion of its larger particles in order to meet its needs.

2—Effect of feed volume on feed conversion

Results concerning feed conversion of different groups of peking ducklings during the experimental period are shown in Table 4.

TABLE 4. **Feed conversion of different groups of pekin ducklings during the experimental period.**

Group	A	B	C
Age in weeks			
2 — 4	2.061	2.601	2.778
4 — 6	3.586	5.365	4.581
6 — 9	4.098	4.410	6.003
2 — 9	3.349	4.089	4.674

The noticeable trend from these results is the superiority of group A (which fed compact ration) than the other two groups (which fed bulky rations), in feed conversion throughout the whole period of the study.

Furthermore, the feed conversion by group B which fed relatively more compact ration, was better than that of group C which fed coarser and more bulky ration.

It is noteworthy that the feed conversion was indirectly affected by both gain and growth rate. It could be concluded that feeding bulky food required consequently more energy and more protein for one gain weight unit, while the compact food required less in this respect. The findings obtained in this study were in agreement with those expected by Heuser and Roblee (1962) and Daader (1972).

3—Effect of food volume on growth performance

Results of live gain weight of different groups at different ages of peking ducklings are shown in Table 5.

TABLE 5. **Live gain weight of different groups at different age of peking ducklings.**

Groups age in weeks	A Male g	Female	B Male g	Female	C Male g	Female g
2 — 4	492.1	474.5	410.9	439.5	405.6	430.9
4 — 6	405.4	369.6	300.5	305.8	407.7	356.7
6 — 9	751.3	667.1	816.6	716.7	640.9	602.6
2 — 9	1648.8	1511.2	1528.0	1462.0	1454.2	1390.2

From the previous table it may be reasonable that the compact ration A more suitable to give better gain than either ration B or ration C (bulky rations).

Furthermore, it was noticed that group A gave a higher gain in both males and females than that of groups B and C.

The analysis of variance for live gain weight data throughout the experimental period of weekly intervals between groups and sex showed significant difference between groups at all ages of the study (P 0.05) except at 8 weeks of ages, Sex difference was not significant up to 6 weeks of ages, but was significant afterwards (P 0.05).

Effect of food volume on economical efficiency of food

Price/ ton/L.E., feed efficient (kg ration/1000 kg growth) and economical efficiency (1000 kg growth/L.E.) of peking ducklings are shown in Table 6.

TABLE 6. Pria / ton / L.E.; feed efficiency (kg ration / 1000 kg growth) and economical efficiency (1000 kg growth / L.E.) of peking ducklings.

Item	Groups		
	A	B	C
Price / ton L.E.	43.4	44.0	44.8
Feed efficiency (kg ration / 1000 kg growth)	3349	4089	4674
Costs of 1000 ,kg growth/ L.E.	145.3	179.9	209.4
Relative costs	100.0	123.8	144.1
Relative economical efficiency %	100.0	76.2	55.9

The values of relative economical efficiency may clarify more accurately the great margine in costs of unit gain of group A which may save 23.8 and 44.1% of the costs required to this unit gain of birds from rations B and C, respectively.

From the previous results; it could be concluded that feeding peking ducklings on compact ration may be, not only more favourable for bird growth but also more economical than feeding bulky food.

Effect of food volume on the digestion coefficient.

The digestion coefficient (percent) of organic matter, crude protein, ether extract, crude fibre and N-free extract of peking duckling males at 9 weeks old are shown in Table 7.

TABLE 7. **Digestion coefficients of rations fed by peking ducklings at 9 weeks of ages.**

Rations	A %	B %	C %
Organic matter . . .	78.18	75.80	79.39
Crude protein	81.11	76.32	76.55
Ether extract	72.44	68.91	68.27
Crude fibre	16.56	13.33	19.68
N-free extract	84.02	84.52	90.28

It is noticed that the digestion coefficient of crude protein of the compact ration A was higher than the other two bulky rations B and C.

The digestible protein (g/100 cc) of the experimental rations extracted from Tables (1 and 7) was 9.90, 8.26 and 7.46 for rations A, B and C, respectively.

Rations in Table 1 were isoprotenic and the energy to protein ratio was in agreement with those recommended by Combs (1962), but the digestion coeffecient varied.

From the previous results it may be concluded that the food volume may affect the digestion of protein (g/100 cc) and energy (k. cal.M.E. / 100 cc of food) and consequently may affect the enegy/protein ratio from these two points of view.

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تأثير حجم الغذاء على معدل استهلاك الغذاء والتحول الغذائى ومعاملات الهضم ومظهر النمو لكتاكيت البط البكينى

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أجرى هذا البحث لدراسة تأثير حجم الغذاء على مظهر النمو ومعدل استهلاك الغذاء ومعدل التحويل الغذائى والكفاءة الاقتصادية للاستفادة من الغذاء لكتاكيت البط البكينى كطيور عشبية .

وقد استخدم فى هذه الدراسة ١٥٦ كتكوت بط بكينى فى عمر أسبوعين قسمت عشوائيا الى ٣ مجاميع أ ، ب ، ج بكل منها ٥٢ كتكوتا .

وقد غذيت طيور التجربة على علائق مكونة من خامات العلف السائدة فى مصر . وقد روعى فى تكوينها أن تكون متساوية تقريبا فى كل من الطاقة

الفسيولوجية (٢٥٨٩ ـ ٢٧٢٥) سعر كبيرا مجهود فسيولوجي نافع لكل كيلو جرام عليقة والبروتين الخام (١٨٫٠٤ ـ ١٨٫٨٦٪) . مع اختلاف هذه العلائق فى الحجم والكثافة كالآتى :

العليقـــة	أ	ب	حـ
الحجم سم٣ / جم	١٫٥٣	١٫٧٠	١٫٨٥
الكثافة جم / سم٣	٠٫٦٥	٠٫٥٩	٠٫٥٤

وقد روعى عند أخذ نتائج التجارب أن توزن طيور كل مجموعة فرديا . كما تم تسجيل مقدار الغذاء المستهلك وحساب الكفاءة الغذائية أسبوعيا حتى عمر ٩ أسابيع .

ـ لوحظ أن الطيور التى غذيت على علائق ذات حجم كبير استهلكت كمية من الغذاء أكبر من تلك التى غذيت على العليقة ذات الحجم الصغير . وكان استهلاك العليقة بواسطة الكتاكيت التى تتغذى على العليقة (ب) (١٫٧٠ سم٣\جم) والعليقة جـ (١٫٨٥ سم٣/جم) .

ـ كان معدل التحول الغذائى للطيور التى غذيت على عليقة مندمجة أقل من تلك التى غذيت على العليقة ذات الحجم الكبير . كما لوحظ أن الطيور التى غذيت على عليقة ذات حجم كبير ، تحتاج الى طاقة وبروتين لكل وحدة وزنية أكثر من تلك التى غذيت على عليقة مندمجة .

ـ الطيور التى غذيت على العليقة (١) أعطت زيادة فى الوزن أكثر من تلك التى غذيت على العلائق ب ، جـ .

ـ وقد أثر حجم العليقة على معدلات حجم العلائق بواسطة الطيور . فقد أعطيت الطيور التى نفذت على علائق ذو حجم أقل معدلات هضمية للعليقة .

ـ ومن الناحية الاقتصادية كانت الكتاكيت التى تتغذى على العليقة أ تخفض بتكاليف الزيادة فى الوزن بمقدار وحدة وزنية واحدة بنسبة ٢٣٫٨ ، ١٫٤٤٪ عن تلك التى تتغذى على العلائق ب ، جـ على التوالى .

وبصفة عامة يمكن القول أن تغذية البط البكينى على غذاء أقل حجما وأعلى كثافة لا يكون له تأثير على الطائر فقط ولكن يكون له أيضا أهمية اقتصادية فى استعماله عن الغذاء ذو الحجم الكبير والأقل كثافة .