J. Agric. & Env. Sci. Alex. Univ., Egypt. Vol. 2 (1) 2003

Response of productive performance, carcass quality and plasma constituents of male Muscovy ducklings to different dietary levels of fish meal

By

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ABSTRACT

An experiment was conducted to study the response of male Muscovy ducklings during 7-84 d of age to different dietary levels of fish meal. Thus, six levels of Herring fish meal were included at 0, 1, 2, 3, 4 and 5% in isocaloric-isonitrogenous diets. Each diet was fed to two replicates, each containing 8 male ducklings. At the end of experiment, three male ducks were randomly chosen from each treatment and slaughtered for evaluation of carcass characteristic, chemical composition and cholesterol content of breast and thigh meat, as well as plasma protein, total lipids and cholesterol.

As small as 1% of fish meal in the diets for male ducks improved growth compared to 0%, also increasing fish meal to 4% improved growth of ducks compared to 1 and 2%. There was a linear increase in feed intake with increasing level of fish meal in the diets for ducks. The best FCR was recorded by birds fed 1% fish meal containing diet, although there was no significant influence of fish meal on FCR for the whole experimental period. On the other side, the best economic efficiency was obtained of group fed all-plant protein diet followed by those fed 1% fish meal.

Increasing fish meal level increased percentage liver and abdominal plus visceral fats. Nonetheless, increasing fish meal level decreased pancreas hypertrophy. Increasing fish meal to 4 or 5% significantly increased percentage protein in breast and thigh

meat compared to those fed 0%. There was a significant increase in cholesterol content of breast and thigh meat accompanied with feeding 4% or more and 3% or more fish meal, respectively. Plasma total protein and total cholesterol were significantly increased with increasing dietary fish meal above 1 and 3% compared to 0%, respectively.

It is concluded that the ideal level of fish meal that improved growth and carcass quality of male Muscovy ducklings is 3%, whilst FCR was not significantly affected, while the best economic efficiency was obtained of ducks fed all-vegetable protein diet.

INTRODUCTION

Recently, the widespread use of computer for feed formulation has resulted in raw material usage being determined largely by the economic assessment. The use of computer by nutritionists for feed formulation using a constraining material has largely governed the success of material inclusion, to ensure that the final formulation is both nutritionally and economically acceptable and will result in optimum animal performance and quality of product.

Before the discovery and ready commercial availability vitamin $B_{12,}$ as well as methionine and lysine, fish meal was an almost universal ingredient in poultry diets. Since 1951, the use of soybean meal has steadily increased and the use of animal protein has decreased. Thereafter, fish meal inclusion has been steady decreased as it has been shown by research that fish meal is not necessary in balanced diets based on soybean meal and synthetic amino acid supplements (Balloun, 1980). Even though, animal nutritionists recognize high quality fish meal as an excellent source of protein, energy, minerals, vitamins and unidentified growth factors.

Richter *et al*. (1991) studied the effect of replacing fish meal and soybean meal by bacterial protein grown in methanol at 7.5 and 15%. They found that feed intake of Muscovy ducks decreased with bacterial protein, and there was a negative relation between the amount of bacterial protein and body weight gain of Muscovy. However, carcass composition of Muscovy ducks was not significantly different among different protein sources. Rowland and

Wang (1993) indicated that fish meal had no effect on growth and FCR of broilers. There was no significant difference between groups in dressing percentage, carcass weight and lean and fat percentage. Soybean meal with synthetic amino acids can replace fish meal as main protein source of diets in table duckling production (Yuan, 1989). Also, El-Deek *et al*. (1997) showed that body weight and FCR of Muscovy ducks showed no differences among different protein sources e. g. fish meal, soybean meal, meat meal and protein concentrate. Kutlu *et al*. (1997) indicated that body weight, feed intake, carcass weight, carcass yield, abdominal fat and percentage of abdominal fat were not significantly affected by replacing fish meal with molasses yeast. However, percentage of abdominal fat tended to increase with the increase in percentage of yeast replacing fish meal. The results demonstrated that fish meal up to 6% in broiler starter and finisher diets can be totally replaced with dried molasses yeast without adverse effect on broiler performance.

In another research, fish meal was used for improving the utilization of rice bran by Martin *et al*. (1998) who showed that fish meal improved growth rate and increased feed intake on the diet without rice bran. Fish meal addition to diets with rice bran improved the apparent digestibility of several indispensable amino acids as well as that of dry matter. The stimulating effect of fish meal on duckling performance was probably caused in part by the improvement in the digestibility of some amino acids.

The sharp increase in feeding costs for poultry in Egypt besides the restriction put on the use of animal protein supplement since the discovery of mad cow disease (BSE), have forced the nutritionists to reinvestigate the necessity of using fish meal as an animal protein supplement. Because of the nature of ducks as a waterfowl bird and especially Muscovy as a modern breed with excellent genetic potential, this experiment was conducted to study the response of fish meal on growth performance and carcass quality of male Muscovy ducks.

MATERIALS AND METHODS

This research was conducted at Poultry Research Center, Faculty of Agriculture, University of Alexandria during the period from September to December 2000.

Feeding Trial

Ninety-six one-d old male Muscovy ducklings were purchased from a commercial dealer. They were fed from 1 to 7 d of age a commercial broiler starter diet containing 22% CP, 3000 kcal ME/kg diet, 1% Ca, 0.45% non-phytate phosphorus, 0.90% TSAA and 1.26% lysine. At 7 d of age, ducks were distributed randomly to six dietary treatments. The experimental treatments included six levels of Herring fish meal at 0, 1, 2, 3, 4 and 5% in isocaloric-isonitrogenous diets (Table 1). Each diet was fed to two replicates, each containing 8 ducklings. The experimental period was lasted from 7-84 d of age. Ducklings were kept under similar managerial and hygienic conditions, with a twenty-four hours lighting program. Water and mash form of feed were provided *ad libitum* from automatic drinkers and tube feeders, respectively.

Measurements

Ducklings were individually weighed at 7, 28, 49, 70 and 84 d of age, and at the same ages feed intake was recorded for each replicate and FCR was calculated. The economic efficiency was calculated as the price of body weight gain –total costs of feeding a duckling as relative to the feeding costs. Three ducklings of each treatment were randomly chosen and slaughtered at 84 d of age to evaluate carcass characteristics, abdominal plus viscera fat and body organs, which were expressed as percentage of live body weight of birds. Simultaneously, blood samples were collected from the slaughtered birds of each treatment and plasma was separated by centrifugation at 3000 rpm for 10 minutes and stored at -18^{o}C until analysis. Representative samples of skinless-boneless breast and thigh meat and the experimental diets were chemically analyzed.

Analytical Methods

Proximate chemical composition of meat and diets were determined according to the methods of AOAC (1990). Ether extract was determined according to the method of Garton and Vioque (1961). Fat was extracted of meat from breast and thigh according to the method of Folch *et al*. (1957), as modified by Washburn (1989), and then meat cholesterol was determined as described by Ajuyah *et al*. (1991).

Plasma total protein was determined by Biuret's reaction according of the method of Weichselbaum (1946), using the method of Gormall *et al*. (1949). Plasma total lipid was determined according to the method of Zollner and Kirch (1962). Plasma total cholesterol was determined according to the method of Ratliff and Hall (1973).

Statistical analysis

One-way analysis of variance was carried out according to GLM procedure of SAS® Institute (SAS®, 1985). Duncan's New Multiple Range Test (Duncan, 1955) was used to test mean differences at $P<0.05$. Data were tabulated based on mean values and the pooled SEM which equal to root mean square error (MSE)/$\sqrt{n}$ (number of observations per treatment).

RESULTS

Body weights and weights gains

There were no significant differences in the initial body weight of male Muscovy ducklings (Table 2), indicating complete random distribution of birds at the initiation of the experiment. It was observed that feeding fish meal above 2% significantly ($P<0.05$) increased body weight of 28-d ducklings compared to those fed 0, 1 and 2%. There were insignificant differences between groups fed diets containing less than 3% or more than 2% fish meal, however differences between the former and the latter groups were significant (Table 2).

Including fish meal above 2% significantly increased body weight of 49 d old ducklings compared to the control group, with the largest birds was from group fed 5% (Table 2). There were significant differences among groups fed 0 and 3% as well as among groups fed 3, 4 and 5% fish meal.

It was observed that including fish meal in duckling diets at 1% or above significantly increased body weight of 70-d old ducks

compared to 0% (Table 2). Also, growth of ducks fed 4 and 5% of fish meal was significantly heavier than that of those fed 0, 1, 2 and 3%. Also, there was significant difference between groups fed 0 and 1% as well as 1and 3% fish meal.

Final body weight as well as weight gains for the whole experimental period of ducks were significantly higher for groups fed 4 and 5% fish meal than groups fed 0, 1 and 2%. Group fed 3% fish meal exhibited intermediate body weight and weight gains, which were not significantly different from groups fed 1, 2, 4, 5% fish meal. Obviously, group fed 0% fish meal exhibited the smallest body weight and weight gains compared to those of the other fish meal containing-diets.

Feed intake (kg\bird\period)

During 7-28 d of age, group fed 5% fish meal consumed the greatest amount of feed intake, meanwhile group fed 0% fish meal consumed the smallest amount (Table 2). Differences between these groups were statistically significant as well among them and the other fish meal fed ducklings. Group fed 1% fish meal containing-diet consumed less than those fed other fish meal containing-diets. Also group fed 4% fish meal diet consumed more feed than those of group fed 0, 1 and 2%.

It was shown that increasing fish meal above 1% increased feed intake during 29-49 d of age significantly ($P<0.05$) compared to 0% (Table 2). Also, groups fed 3, 4 and 5% fish meal consumed significantly more feed than that fed 1 and 2%. The same was observed between groups fed 0 and 2%.

Feed intake during 50-70 d of age showed significant ($P<0.05$) linear increase with increasing fish meal from 0 to 2% as well as from 3 to 5%, meanwhile difference between 2 and 3% was insignificant (Table 2).

Feed intake during 71-84 d of age averaged 2.780 kg/bird for group fed 0% fish meal and 2.992 kg/bird for group fed 5% fish meal containing-diet, difference between these groups was significant (Table 2). Also, group fed 4 or 5% fish meal containing-diet consumed more feed than those did on 0, 1, 2 and 3%.

Feed intake during 7-84 d of age was increased linearly with each increase in fish meal, revealing that differences among the all groups were statistically significant (Table 2).

Feed conversion ratio and Economic efficiency

Obviously, including fish meal at any tested level significantly increased FCR compared to the control group during 7-28 d (Table 2). It was shown that, FCR was significantly ($P<0.05$) impaired with increasing fish meal from 1 to 2% and from 3 to 4 or 5%. In contrast, results indicated that groups fed 5% fish meal recorded the best FCR among the experimental groups during 29-49 d of age. Group fed 4% fish meal exhibited better FCR than only that fed on 3%. While, groups fed diets containing 5% fish meal showed better FCR values than those fed other fish meal containing-diets. There were insignificant differences in FCR during 50-70 d of age. However, groups fed fish meal containing-diets exhibited better FCR than that fed the control diet (0% fish meal).

Group fed diet-containing 0 or 1% fish meal exhibited better FCR than those fed on 2, 3, 4 and 5% levels during 71-84 d of age. Also, 2, or 3% had better FCR than those of 5% fish meal. There were insignificant differences in FCR for the whole experimental period due to feeding different levels of fish meal in male ducklings. However, group fed 1% fish meal exhibited the best FCR among the experimental groups followed in a decreasing order by the control group and 2% fish meal containing –diet, respectively (Table 2).

Economic efficiency as relative to feeding costs was the best of group fed 0% fish meal followed by a decreasing order by that fed 1% fish meal and gradually decreased with increasing fish meal level.

Carcass characteristics and internal organs

Percentage liver showed a significant effect of dietary fish meal level, showing that increasing fish meal in duckling's diets increased relative weight of liver (Table 3). The largest liver weight was recorded by the group fed 5%, while the smallest was from that fed 0% fish meal (Table 3). There were significant ($P<0.05$) differences among groups fed 5% and those fed 0, 1, 2 and 3%, as well as among those fed 4% and 0, 1 and 2% fish meal.

Relative weight of giblets (Liver +gizzard +heart) was significantly affected by dietary fish meal level (Table 3). The largest relative weight of giblets was recorded by group fed 4 or 5%, while the smallest one was obtained from group fed 0% fish meal. Groups fed 4 or

5% showed significant higher percentage of giblets than those fed 0, 1 and 2% fish meal.

There was a significant decrease in pancreas percentage with increasing fish meal level (Table 3). The largest pancreas weight percentage was of group fed diet containing no fish meal supplement. Differences between group fed 0% and those fed 1, 2, 3, 4 and 5% as well as between groups fed 1 or 2% and those fed 4 and 5% or those between 3 and 5% fish meal were significant ($P<0.05$).

Percentage abdominal + viscera fat exhibited a significant impact of dietary fish meal level (Table 3). It was found that percentage abdominal + viscera fat increased with increasing the fish meal level in ducklings' diets, the largest was from group fed 5%, while the smallest was from those fed 0% fish meal. Group fed 5% fish meal containing-diet exhibited higher abdominal + viscera fat than those fed 0, 1, 2, 3 and 4%. Also, groups fed 4% fish meal containing-diet showed higher value than those fed 0 and 1%.

Composition and cholesterol of fresh breast meat and thigh meat

Percentage crude protein of breast meat was significantly affected by using different levels of fish meal in the diet for male Muscovy ducklings (Table 4). Including fish meal in duckling diets at any tested level increased percentage protein of breast meat compared to the control group. Moreover, group fed diet containing 5% had significantly higher percentage protein of breast meat than only those fed 0 or 1% fish meal. Other fish meal fed-groups exhibited intermediate percentage protein, which was not significantly different among those fed 1 or 5% (Table 4). Results showed that including fish meal in male duckling diets above 3% significantly increased cholesterol content of breast meat compared to 0 and 1% (Table 4). Breast meat cholesterol of group fed 2 and 3% fish meal was intermediate among the experimental groups.

Including fish meal in duckling diets at any tested level increased percentage protein of thigh meat compared to the control group (Table 4). Group fed diet containing 5% fish meal had only significant higher percentage protein than only those fed 0, 1 and 2%. Also, group fed 3 or 4% fish meal containing-diet showed higher percentage protein than those fed 0 or 1%. Cholesterol content of thigh meat was significantly affected by feeding fish meal-containing diet. Results showed that including fish meal in male duckling diets at 3% or more increased

cholesterol content of thigh meat significantly compared to 0, 1 and 2%, however the former groups and the later groups showed insignificant differences among them (Table 4).

Plasma constituents

Plasma total protein was significantly increased when fish meal was included in male diets above 1% compared to 0 and 1% (Table 4). Plasma cholesterol was significantly affected by the level of fish meal in the diets for male Muscovy ducklings. Increasing fish meal above 3% significantly increased cholesterol content of plasma compared to groups fed 0, 1, 2 and 3% (Table 4). Nonetheless, there were no significant changes in plasma total cholesterol over the range from 0 to 3% or 4 to 5% fish meal.

DISCUSSION

Results indicate that as early as 28-d of age and thereafter growth of male Muscovy was significantly improved due to dietary inclusion of fish meal, and this was stabilized when 3% fish meal was included in the diets. Weight gains for the whole experimental period was significantly improved by 4.6% when 3% fish meal was fed compared to all vegetable diet. Results also indicated that there was no further significant improvement due to increasing fish meal to 4 or 5% (Table 2).

The present results are similar to the early reporters by Potter and Shelton (1973) and Potter *et al*. (1977) with broilers and Chang and Waibel (1970) and Potter *et al* (1971) with turkeys. They concluded that birds fed diets with fish meal grow faster and utilize the feed more efficiently. On the other hand, studies by Rowland and Wang (1993), Kutlu *et al*. (1997), with broilers, Skrivan *et al*. (1987), Yuan (1989), Richter *et al*. (1991) and El-Deek *et al*. (1997) with ducks, showed no significant enhancing effect on growth of birds due to feeding fish meal containing-diet. The enhancement in growth due to including fish meal in duckling diets could be attributed to:

1. The increase in feed (Table 2) and consequently protein\ amino acids and energy intakes (Mohamed, 2002). Feed intake was reported to be the major effect affecting growth of birds (Noy and Sklan, 1996; Attia *et al*. 1998; Al-Harthi, 2001)
2. The complementary nature between the fish meal as an animal protein supplement and soybean meal as plant protein to supply the

requirements for protein\amino acids of ducks (Woodham and Dean, 1977; Calabotta, 1989 and Opstvedt *et al*., 1991).

3.The better digestibility of protein and amino acids of fish meal (Calabotta, 1989; Martin *et al*., 1998)

4.The unidentified growth factors of fish meal such as Vit B_{12}, sulphate and taurine (Maculin, 1965; Ross and Harms, 1970; Hinton and Harms, 1972), Arsenic (Bjornstad *et al*., 1974), selenium (Miller *et al*., 1972; Bjornstad *et al*., 1974; Scott, 1975), thinning gut walls (Harrison and Goates, 1972; Touchburn *et al*., 1974), as well as TSH and thyroid hormones of fish meal (Ingram and Evans, 1980).

It clear that, the overall effect of fish meal on feed utilization was not statistically significant. However, males fed 1% fish meal recorded the best FCR (Table 2). The lack of significance in the overall FCR, although growth was significantly improved could be attributed to the associated increase in feed intake, which may be affected, by feeding behavior of ducks and the impact of fish meal on the palatability of the diet. These results agree with those reported by DeGroot (1973), Avila and Balloun (1974) with broilers and turkeys and Yuan (1989) and El-Deek *et al*. (1997) with ducks. They concluded that feed efficiency of fish meal fed birds did not significantly different from that of soybean control-diet. Moreover, Anderson *et al*. (1968) reported that soybean meal diets balanced in nutrient contents yielded better growth and feed utilization than 5% fish meal containing-diet.

Obviously, including fish meal in the diet for male ducks increased liver and abdominal + viscera fat percentage (Table 3). This may be a reflection of the increase in feed/energy intake accompanied with feeding fish meal to Muscovies, overfeeding could increase lipogenesis and obesity (Attia *et al*., 1995a). However, Yuan (1989), found no significant differences between corn-soybean diet and fish meal diet in dressing percentage, carcass weight and lean and fat percentage. Also, Richter *et al*. (1991), Kutlu *et al*. (1997) and El-Deek *et al*. (1997) reached similar conclusion.

Results indicated that feeding fish meal to Muscovy significantly decreased pancreas hypertrophy compared to soybean meal diet (Table 3). Proteases inhibitors of soybean meal is very well known (Nesheim, 1968; Balloun, 1980) to induce pancreas

enlargement and this depends on the intake of soybean meal (Attia *et al*., 1995b), meanwhile heat treatment during soybean processing destroys this factors (Scott *et al*., 1982). Yet, it seems that processing conditions of the present sample of soybean meal did not completely overcome the anti-proteases of soybean meal. In accordance with the present results, Attia *et al*. (1995b) illustrated that pancreas was enlarged in broilers fed on all-vegetable protein diet compared to animal protein containing-diet. The enlargement in pancreas of soybean meal fed-groups besides the low feed intake could be accused for the poor growth of corn-soybean meal fed-group in the present study.

Protein percentage of breast and thigh meat was significantly increased when fish meal was included in the diets for ducks, as results of the increase in feed/protein intake (Table 2). Similarly, Mohamed (2002) found that increasing protein\amino acids intakes for Muscovy ducks increased moisture, protein and NFE% of meat, while decreased fat content. The increase in protein contents of breast and thigh meat was parallel to the increase in plasma protein ($r=0.59$; $P=0.0002$) and ($r=0.75$; $P=0.0001$), respectively. In the literature, the positive relationship between plasma protein and protein intake as well as tissue protein was reported (El- Nagger *et al*. 1997; Attia *et al*. 2001; Abo El-Maaty, 2002).

The increase in cholesterol content of meat of male ducks parallels the increase in feed and thereby energy/fat intakes of ducks fed on the fish meal containing –diets. Similarly, El- Nagger *et al*. (1997), Attia *et al*. (2001) and Abo El-Maaty (2002) reported a positive relationship between fat and cholesterol content of meat. It is very well known that animal protein supplement had more fat and cholesterol than that of feedstuffs of vegetable origin. Also, El-Deek *et al*. (1997) found that fish meal containing- diet did not result in decreasing plasma and tissue cholesterol compared to soybean control-groups, but did compared to other animal protein sources such as meat meal or meat and bone meal.

Conclusion and application

It is concluded that the ideal level of fish meal that improved growth and carcass quality of male Muscovy ducklings is 3%, whilst

FCR was not significantly affected, and the best economic efficiency was obtained of ducks fed all-vegetable protein diet.

Table 1. Composition and calculated analyses of the experimental diets fed during 7-84 d of age

Ingredients, %	**Dietary level of Herring fish meal, %**					
	0.0	**1.0**	**2.0**	**3.0**	**4.0**	**5.0**
Yellow corn	59.0	59.0	59.0	59.0	59.0	59.0
Soybean meal	35.0	33.5	32.0	30.0	29.0	27.5
Fish meal (72% CP),	0.0	1.0	2.0	3.0	4.0	5.0
Commercial oils	1.5	1.5	1.5	1.5	1.5	1.5
Limestone	1.0	1.0	1.0	1.0	1.0	1.0
Bone meal	2.00	2.00	2.00	2.00	2.00	2.00
Vit+Min- Mix.[1]	0.35	0.35	0.35	0.35	0.35	0.35
NaCl	0.30	0.30	0.30	0.30	0.30	0.30
Dl-methionine	0.10	0.09	0.07	0.06	0.05	0.05
L-lysine[2]	0.037	0.021	0.010	0.010	0.0	0.0
Antibiotic	0.001	0.001	0.001	0.001	0.001	0.001
Sand	0.712	1.238	1.769	2.779	2.799	3.299
Total	100.0	100.0	100.0	100.0	100.0	100.0
Calculated values:						
CP, %	20.88	20.92	20.97	21.01	21.06	21.10
ME kcal/kg,	2906	2905	2904	2901	2900	2899
Calcium, %	1.01	1.03	1.04	1.06	1.07	1.08
Av. P, %	0.43	0.46	0.46	0.47	0.48	0.49
Methionine, %	0.42	0.42	0.42	0.42	0.42	0.42
TSAA, %	0.76	0.76	0.76	0.76	0.76	0.76
Lysine, %	1.13	1.13	1.13	1.13	1.15	1.17
Crude fibre, %	3.75	3.65	3.55	3.42	3.36	3.25
Crude fat,%	2.52	2.61	2.70	2.78	2.87	2.96
Price/ton LE	763.4	776.2	787.4	793.3	809.4	820.5

[1] Vitamins and minerals mixture provide per kilogram of diet: vitamin A (as all-trans-retinyl acetate),; 12000 IU; vitamin E (all rac-a-tocopheryl acetate),; 10 IU; k_3 3mg; Vit.D_3, 2200 ICU; riboflavin, 10 mg; Ca pantothenate,10 mg; niacin, 20 mg; choline chloride, 500 mg; vitamin B_{12}, 10mg; vitamin B_6, 1.5 mg; thiamine (as thiamine mononitrate),; 2.2 mg; folic acid, 1 mg; D-biotin, 50mg. Trace mineral (milligrams per kilogram of diet), : Mn, 55; Zn, 50; Fe, 30;Cu, 10; Se, .1 and Ethoxyquin 3mg.

[2] Equivalent value to L-lysine as Lysine–HCl, the adjustment was done by changing sand contents.

Table 2. Impact of different dietary levels of fish meal on growth performance of male Muscovy ducklings during 7-84 d of age

Parameters	Dietary level of Herring fish meal , %						SEM	P Value
	0.0	1.0	2.0	3.0	4.0	5.0		
Body weight and body weight gain, g								
7 d- old body weight, g	163.1	163.1	162.8	163.2	164.6	163.6	1.46	0.84
28 d-old body weight, g	1122.5^{b}	1123.1^{b}	1126.3^{b}	1156.9^{a}	1155.9^{a}	1165.6^{a}	14.6	0.005
49 d-old body weight, g	2423.9^{d}	2446.9^{cd}	2457.2^{cd}	2498.8^{c}	2572.5^{b}	2636.3^{a}	26.5	0.0001
70 d-old body weight, g	3414.4^{d}	3499.4^{c}	3538.8^{bc}	3586.3^{b}	3669.7^{a}	3719.1^{a}	39.5	0.0001
84 d-old body weight, g	3927.5^{c}	4025.3^{b}	4051.6^{b}	4102.5^{ab}	4173.1^{a}	4212.8^{a}	31.4	0.0001
Body weight gains, g	3764.4^{c}	3862.2^{b}	3888.8^{b}	3939.3^{ab}	4008.5^{a}	4049.2^{a}	29.9	0.0001
Feed intake/bird/period, kg								
Feed intake during 7-28 d-of age, kg	1.760^{e}	1.808^{d}	1.900^{c}	1.952^{bc}	2.024^{b}	2.072^{a}	0.014	0.0001
Feed intake during 29-49 d of age, kg	3.252^{c}	3.300^{bc}	3.324^{b}	3.384^{a}	3.422^{a}	3.450^{a}	0.092	0.0001
Feed intake during 50-70 d of age, kg	4.332^{e}	4.404^{d}	4.424^{c}	4.488^{c}	4.512^{b}	4.556^{a}	0.037	0.0001
Feed intake during 71-84 d of age, kg	2.780^{c}	2.848^{b}	2.892^{b}	2.920^{b}	2.976^{a}	2.992^{a}	0.035	0.001
Feed intake during 7-84 d of age, kg	12.124^{f}	12.360^{e}	12.540^{d}	12.744^{c}	12.934^{b}	13.070^{a}	0.05	0.0001
Feed conversion ratio (FCR) kg/kg								
FCR during 7-28 d-of age, kg\kg	1.834^{d}	1.884^{c}	1.972^{b}	1.964^{b}	2.042^{a}	2.068^{a}	0.035	0.001
FCR during 29-49 d of age, kg\kg	2.498^{ab}	2.493^{ab}	2.498^{ab}	2.521^{a}	2.416^{b}	2.346^{c}	0.043	0.006
FCR during 50-70 d of age, kg \kg	4.374	4.184	4.090	4.127	4.112	4.209	0.106	0.21
FCR during 71-84 d of age, kg \kg	5.418^{c}	5.419^{c}	5.640^{b}	5.657^{b}	5.912^{ab}	6.060^{a}	0.21	0.008
FCR during 7-84 d of age, kg \kg	3.221	3.200	3.225	3.235	3.227	3.228	0.016	0.38
Economic Efficiency, %	184.9	181.9	175.8	172.7	168.0	164.4	------	-------

$^{a-f}$Means within the same row with no common superscripts differ significantly

P< 0.05

Table 3. Impact of different dietary levels of fish meal on carcass characteristics and internal organs of 84-d old male Muscovy ducklings

Parameters	Dietary level of Herring fish meal, %						SEM	P Value
	0.0	1.0	2.0	3.0	4.0	5.0		
Dressing, %	71.2	70.4	72.1	72.3	73.2	72.4	0.68	0.21
Liver weight, %	1.83^{d}	1.91^{cd}	1.95^{cd}	2.09^{bc}	2.25^{ab}	2.43^{a}	0.07	0.004
Gizzard weight, %	2.12	2.30	2.28	2.43	2.54	2.34	0.11	0.28
Heart weight, %	0.612	0.603	0.571	0.683	0.651	0.605	0.06	0.81
Giblets, %	4.56^{c}	4.80^{bc}	4.80^{bc}	5.21^{ab}	5.44^{a}	5.38^{a}	0.15	0.03
Spleen weight, %	0.082	0.081	0.075	0.073	0.067	0.066	0.006	0.38
Pancreas weight, %	0.233^{a}	0.179^{b}	0.179^{b}	0.164^{bc}	0.135^{cd}	0.127^{d}	0.009	0.001
Abdominal+viscera fat, %	2.36^{d}	2.64^{cd}	2.78^{bc}	2.93^{bc}	3.06^{b}	3.40^{a}	0.092	0.002

$^{a-d}$Means within the same row with no common superscripts differ significantly P< 0.05

Table 4. Impact of different dietary levels of fish meal on chemical composition and total cholesterol of fresh breast and thigh meat as well as plasma constituents of 84-d old male Muscovy ducklings

Parameters	Dietary level of Herring fish meal , %						SEM	P Value
	0.0	1.0	2.0	3.0	4.0	5.0		
Chemical composition and cholesterol content of breast meat								
Moisture , %	71.2	70.4	72.1	72.3	73.2	72.4	0.78	0.21
Crude protein, %	19.07^{c}	19.83^{b}	20.40^{ab}	20.57^{ab}	20.57^{ab}	20.80^{a}	0.23	0.001
Ether extract, %	7.27	7.13	6.47	6.83	6.80	6.93	0.34	0.62
Cholesterol, mg/ g	107.0^{b}	106.8^{b}	110.1^{ab}	111.7^{ab}	116.9^{a}	116.8^{a}	2.47	0.06
Chemical composition and cholesterol content of thigh meat								
Moisture, %	74.2	72.4	73.1	73.3	72.2	73.6	0.58	0.27
Crude protein, %	19.50^{d}	20.40^{c}	20.63^{bc}	21.07^{ab}	21.23^{ab}	21.43^{a}	0.20	0.0002
Ether extract, %	7.60	7.57	7.73	7.63	7.73	7.90	0.14	0.58
Cholesterol, mg/ g	101.5^{b}	106.3^{b}	111.3^{b}	122.6^{a}	123.1^{a}	125.8^{a}	3.66	0.002
Plasma constituents of 70 d old females								
Total protein, g/100 ml	3.33^{b}	3.43^{b}	3.60^{a}	3.57^{a}	3.60^{a}	3.60^{a}	0.04	0.002
Total lipids, mg/100ml	536.0	534.7	532.4	536.0	537.9	544.4	3.17	0.22
Total cholesterol, mg/100ml	135.0^{b}	155.6^{b}	145.6^{b}	160.9^{b}	204.7^{a}	209.6^{a}	8.06	0.001

$^{a-d}$Means within the same row with no common superscripts differ significantly P< 0.05.

REFERNCES

Abo El-Maaty, Hayam, M. A. (2002). Nutritional studies on different dietary protein levels and sources on local chickens diets. M. Sc. Thesis Fac. of Agriculture Mansoura Uni.

Ajuyah, A.O., K. H. Lee, R. T. Hordin and J. S. Sim (1991). Influence of dietary full-fat seeds on total lipid, cholesterol and fatty acid composition of broiler meats. Can. J. Anim. Sci. 71:1011-1019.

Al-Harthi, M. A. (2001). Relieving the adverse effects of heat stress on broilers performance by dietary sodium chloride. Egypt. Poult. Sci.21:1139-1152.

Anderson. J.O., K. Wisutharom and R.E. Warnick (1968). Relation between the available essential amino acid patterns in four fish meals and their values in certain broiler rations. Poult. Sci. 47:1787-1796.

Association of Official Analytical Chemists (AOAC) (1990). Methods of Analysis. 15th Ed., Arlington, USA.

Attia, Y. A., S. A. Abd El-Rahman and E. M. A.Qota (2001). Effects of microbial phytase without or with cell-wall splitting enzymes on the performance of broilers fed marginal levels of dietary protein and metaboilzable energy. Egypt. Poult. Sci.21:(II)521-547.

Attia, Y. A., W. H Burkeand K. A. Yamani and L. S. Jensen, (1995a). Energy allotments and reproductive of broiler breeders. 2-Females. Poult. Sci.74:261-270.

Attia, Y. A., Mona Osman, El-Samra Abou-Egla and A. A. El- Deek (1995b). Response of growth, feed conversion and carcass characteristics of broiler chicks to feed restriction methods, time and diet quality. Mansouria J. Agric. Res, 1995, No. 7:3261-3282.

Attia, Y. A, M. E.Nawar, Mona Osman and Salwa B. Abd El -Hady (1998). Optimum levels of metabolizable energy and crude protein in the rations for Avian-34 broiler chicks. PP. 223-241. in : Proc. 10 th Conf. of The Egyptian Society of Animal Production, Assiut University, Egypt.

Avila, E. G. and S. L. Balloun (1974). Effects of Anchovy fish meal in broiler diets. Poult. Sci. 53:1372-1379.

Balloun, S.L. (1980). Soybean Meal in Poultry Nutrition, 1st edn . American soybean Association, P.O. Box 27300, St. Louis, Mo 63141, USA.

Bjornstad, J., J. Opstvedt and G. Lunde (1974). Unidentified growth factors in fish meal. Experiments with organic Arsenic compounds in broiler diets. Br. J. of Nurt. 15:481-487.

Calabotta, D. F. (1989). Nutrient bio availability of fish meal and factors affecting its use in Poultry. Zootecnica International, 1989:48-50.

Chang, C. H. and P. E. Waibel (1970). Efficiency of Zinc Bacitracin and source of unidentified growth factors with corn-soybean meal type diet for turkey poults. Poult. Sci. 49:733-743.

De Groote, G. (1973). Research on complete fish meal replacment by soy cake in variable energetic content rations for broilers. Revue de l' Agriculture 4:1-8.

Duncan, D. B. (1955). Multiple range and multiple F tests. Biometrics, 11:1-42.

El-Deek, A. A., Mona Barakat, Y. A. Attia and A.S. El-Sebeay (1997). Effect of feeding Muscovy ducklings different protein sources: Performance omega-3 fatty acid contents and acceptability of their tissues. Journal of the American oils chemists' society (JAOCS),Vol 74: 999-1009.

El-Nagger, N. M., A. Z. Mehrez, F.A.M.Aggoor, Y. A. Attia and E. M. Qota (1997). Effect of different dietary protein and energy levels during roaster period 2- Carcass composition, yield, physical characteristics of meat and serum constituents. Egyptian Poult. Sci. 17 (I): 107-132.

Folch, J., M. Lees and G. H. S. Stanley (1957). A simple method for the isolation and purification of total lipids from animal tissues. J. Biol. Chem. 226:497-509.

Garton, L. and R. Vioque (1961). Glycerid hydrolysis and glycerol fermentation by sheep rumen content. J. Microbial 25:215-225.

Gormall, A. C., C. J. Badawill and A. D. David (1949). J. Biol. Chem. 177:751.

Harrison, G.F. and M.E. Coates (1972). Inter-relationship between the growth promoting effect of fish solubles and the gut flora of the chick. Br. J. of Nutr. 28:213-221.

Hinton, C.F. and R.H. Harms (1972). Evidence for sulphate as an unidentified growth factor in fish solubles. Poult. Sci. 51:701-703.

Ingram, D. L. and S. E. Evans (1980). Dependence of thyroxine utilization rate on dietary composition. Br. J. Nutr. 43:525-531.

Kutlu, H.R., M. Gorgulu, L. Baykai, I. Unsal, U. Serbester and N. Özcan (1997). Effect of replacing fish meal with dried molasses yeast (*Saccharomyces cerevisiae*) in the diet on performance of broiler chicks. Br. Poult. Sci. 38:30-31 (S).

Maculin, L. J. (1965). Studies on the growth response in the chicken from the addition of sulphate to a low-sulphur diet. Poult. Sci. 34:1209.

Martin, E.A., J. V. Nolan, Z. Nitsan and D. J. Farrell (1998). Strategies to improve the nutritive value of rice bran in poultry diets IV. Effects of addition of fish meal and a microbial phytase to duckling diets on bird performance and amino acid digestibility. Br. Poult. Sci., 39:612-621.

Miller, D.and J.H. Soares, P.E. Bauersfield and S.L. Cuppet (1972). Comparative selenium retention by chicks fed sodium selenite, selenomethionine, fish meal and fish solubles. Poult. Sci. 51:1669.

Mohamed, A. F. A. (2002). Effect of dietary protein levels on productive and reproductive performance of Muscovy ducks. Ph.D. thesis, Faculty of Agriculture, Al-Azhar Uni.

Nesheim, M.C. (1968). Evaluation of plant proteins, pp 26-33 in Proceeding 1968 Georgia Nutrition Conference for Feed Manufacturers, USA.

Noy , Y. and D. Sklan (1996). Uptake capacity in vitro for glucose and methionine on subsequent early performance of broiler chicks and turkey poults. Poult. Sci. 72:1861-1866.

Opstvedt, J., E.E. Miller and I.H. Pike (1991). Complementary effects of fish meal with soybean meal replacers in broiler diets. Technical Bulletin-International Association of Fish Meal

Manufacturers No 26: Hoval House, Mutton Lane, Potters Bar, Hans, UK.

Potter, L.M. and J. R. Shelton (1973). Evaluation of crab meal as a dietary ingredient for young turkeys. Br. Poult. Sci. 14:257-261.

Potter, L.M., J. R. Shelton and E. E. Pierson (1977). The unidentified growth factor in Menhaden fish meal. Poult. Sci. 56:1749.

Potter, L.M., J. R. Shelton and M. Kelly (1971). Effects of Zinc Bacitracin, dried bakery product and different fish meals in diets of young turkeys. Poult. Sci. 50:1109-1115.

Ratliff, C. R. and F. Hall (1973). Laboratory Manual of Clinical Biochemistry, Scott and White Memorial Hospital Publication Office, Temple, TX, USA.

Richter, G., H. Richter and H. Bentz (1991). Studies of the suitability of methanol grown bacterial mass for fattening turkeys and cairina. Archiv. of Anim. Nutrition 41:195-202.

Ross, E. and R. H. Harms (1970). The response of chicks to sodium sulphate supplementation of a corn-soya diet. Poult. Sci. 49:1605-1610.

Rowland, R. and W. Q. Wang (1993). Meat and bone replaces high-cost fish meal. Oils and Fats International Vol. 9 No.(4): 2-3.

SAS Institute (1985). SAS® User's Guide: Statistics. Version 5 Edn., SAS Institute Inc., Cary, NC, USA.

Scott, M. L. (1975). Proceeding of the Feed Manufacturers, Nottingham, England.

Scott, M. L., M. C. Nesheim and R. J. Young (1982). PP. 63 in Nutrition of the Chicken, 3 rd edn. M.L. Scott& Associates, Ithaca, N.Y., USA.

Skrivan, M., E. Tumova, R. Konrad and K. Mandak (1987). Fattening outcome of Muscovey ducklings in relation to sex. Zivocisna Vyroba 46:131-139.

Touchburn, S. P., R. D. M. Silva and E.C. Naber (1974). Further evidence for an unidentified nutrient in fish solubles which improves hatchability and progeny growth of turkeys and Japanese quail. Poult. Sci.53:1745-1758.

Washbrun, K. W. (1989). A modification of the Folch method of lipid extraction for Poultry. Poult. Sci. 68:1425-1427.

Weichselbaum, T. E. (1946). Method for determination of total protein in serum blood. Amer. J. Clin. Path., 16: 40.

Woodham, A.A. and P. S. Dean (1977). Nutritive value of mixed proteins. 1. In cereal-based diets for poultry. Br. J. Nutr. 39:289-308.

Yuan, G. D. (1989). Performance of table ducklings fed with diets of plant-protein alone. Chinese J. of Animal Sci. 25:3-5.

Zollner, N. and K. Kirch (1962). A colorimeteric method to determined total lipid. Z. Ges. Exp. Med. 135:545.

الملخص العربي

الأداء الإنتاجي و جودة اللحم و بعض مكونات بلازما الدم لذكور البط المسكوفي المغذي علي علائق تحتوي علي مستويات مختلفة من مسحوق السمك

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أستهدفت هذه الدراسة تحديد المستوي المناسب من مسحوق ا لسمك في علائق ذكور البط المسكوفي، و لهذا قسم 96 طائر من ذكور البط مسكوفي عمر أسبوع الي 6 معاملات تجريبية ، و غذيت علي العلائق التجريبيةِ المتساوية في البروتين و الطاقة التي تحتوي علي 0، 1، 2، 3، 4، و 5% من مسحوق السمك هيرنج في الفترة من 7- 84 يوم من العمر، و في نهاية الفترة التجريبية ذبحت 3 طيور/ المعاملة لتقدير مواصفات الذبيحة و التحليل الكيماوي للحوم الصدور و الافخاذ من حيث الرطوبة ، و البروتين، الدهن، و الكلوليستيرول، و قدر أيضا محتوي بلازما الدم من البروتين و الدهن و الكلوليستيرول. و تتلخص أهم النتائج المستخلصة في الآتي:-

1 - أدي استخدام 3% من مسحوق السمك في العلف إلى تحسن معنوي في معدلات النمو للذكور بالمقارنة بمجموعة الكنترول و لم تفرق معنويا عن تلك التي غذيت عن 4 أو 5%.
2 - أدت تغذية ذكور البط المسكوفي علي علائق تحتوي علي مسحوق السمك إلى زيادة خطية في معدل الاستهلاك الغذائي.
3 - لم يؤدي استخدام مسحوق السمك إلى تحسن معنوي في معدل التحويل الغذائي للذكور و ذلك بسبب الزيادة في معدلات الاستهلاك الغذائي المصاحبة لاستخدام مسحوق السمك في العلائق و مع ذلك سجلت العليقه التي احتوت علي 1% مسحوق سمك أفضل كفاءة غذائية.
4 - سجلت العليقة النباتية الخالية من مسحوق السمك اعلي كفاءة اقتصادية منسوبة إلى تكلفة التغذية و ذلك بالمقارنة بالعلائق التي تحتوي علي نسب مختلفة من مسحوق السمك.
5 - زادت نسبة الكبد و الحلويات و دهن التجويف البطني و الحشوي معنويا مع زيادة نسبة مسحوق السمك في العلائق، و لكن استخدام مسحوق السمك أدى إلى تقليل التضخم في البنكرياس المشاهد في الذكور مع التغذية علي كسب فول الصويا كمصدر بروتيني وحيد.
6 - زادت نسبة البروتين في لحوم صدور و أفخاذ الذكور مع زيادة مستوي مسحوق السمك في العلف، و حدث ذلك أيضا في نسبة الكوليستيرول في لحوم الصدور و الأفخاذ.
7 - زادت محتوي بلازما الهم من البروتين و الكلوليستيرول مع زيادة مسحوق السمك في العلف.

من هذه النتائج يمكن استخلاص آن ذكور البط المسكوفي يمكن تغذيته علي علائق تحتوي علي 3% مسحوق سمك هيرنج لتحسين معدلات النمو و جودة الذبيحة، ومع ذلك سجلت العليقة النباتية الخالية من مسحوق السمك افضل كفاءة اقتصادية.

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