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The Effects of Varying Fishmeal Inclusion Levels (%) on Performance of Broiler Chicks

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Abstract: Fishmeal is very important protein source in poultry nutrition, mainly due to the high quality of the protein it supplies. This study was carried out to investigate the effects of formulating isonitrogenous and isoenergetic diets varying in fishmeal levels (0, 2.5 and 5% during the starter and 0, 1.25 and 2.5% during the grower period) on performance. A total of 264 Hubbard straight-run broiler chicks were allocated to each of these three dietary treatments which were replicated four times (22 chicks per pen) in a completely randomized design. Chick body weights, daily gain, feed intake and feed conversion ratio were determined at 10, 20, 32 and 42 days of ages. The results showed that the body weight at 32 and 42d, daily gain during 0-42d and feed intake during 11-20d, 21-32d and 0-42d significantly increased with fishmeal inclusion. In conclusion the results of this experiment indicated that the beneficial effects of fishmeal on broiler performance becomes most evident at higher use levels and during the latter growth periods, mainly via stimulation of feed intake.

Key words: Fishmeal, broiler, body weight, feed intake

Introduction

Broiler production in developing countries generally, and in Iran particularly has always been dependent on imported sources of protein such as fishmeal, soybean meal and animal protein concentrates (Shariatmadari, 2000). Among the animal protein sources, fishmeal is particularly suited to meet the demands of the contemporary food chain. Fishmeal is a brown powder which normally contains a high level of protein and appreciable quantities of fat and minerals. Within the EU about 50% of fishmeal is used in aquaculture, 20% in poultry, 20 % in pigs and 10% in other markets; mainly pet food (Anonymous, 2002). The reason for its widespread use, especially in young animals, mainly stems from its high nutrient density and excellent digestibility (Fickler, 2002). The protein in fishmeal has a high biological value in diets for animals. It is rich in the essential amino acids, particularly lysine and the sulfur amino acids. The presence of fishmeal in a complete diet will supplement any deficiencies of the amino acids in vegetable protein, such as soybean meal (Barlow and Windsor, 1984; Miles and Jacob, 1997). Fishmeal is also fed to farm animals not only to improve productivity, but also to protect health and welfare and reduce dependence on antibiotics and other drugs (Pike, 1999; Anonymous, 2002).

In most developing countries, fishmeal is the most important conventional animal protein source for poultry, and its supply is mainly dependent on external supply. As a result, the cost of fishmeal is very high and its inclusion level in the diet results in less profitable poultry production. Moreover, due to the use of different varieties, parts of fish and processing technologies inclusively means that there can be significant variation in the quality of different lots of fishmeal (Pike, 1999; Fickler, 2002; Dale *et al.,* 2004). As a result of the fact that feed costs alone currently account for over 65-70% of poultry production in third world countries, there has been recent interest in determining the feeding value of different locally available alternative feeding resources. For instance, alternative protein sources such as leaf protein concentrate, groundnut meal, maggot meal, sun-dried shrimp waste meal, silk worm pupa meal, meat and bone meal, fullfat soybean meal have been used either to replace fishmeal wholly or partly in broiler diets with remarkable success especially in relation to some growth indices (Okan, 1985; Olomu and Offiong, 1985; Swick and Srinongkote, 1996; Agbede and Aletor, 2003; Awoniyi *et al.,* 2003; Khatun *et al.*, 2003; Oduguwa *et al.,* 2004).

The potentials of fishmeal as a valuable protein source in broiler feeding is not in doubt (N.R.C, 1994; Leeson and Summers, 1997). However, the extent of its usefulness and levels of utilization by monogastric animals such as the broiler chick needs to be re-established as much of the original work is dated and does not relate to modern breeds. Therefore, the objectives of the present experiment was to investigate the influence of inclusion of different fishmeal levels on performance of broiler chicks.

Materials and Methods

The present study was an intervention study carried out at the Animal Science Department of Kurdistan University, Kurdistan, Iran. Two hundred and sixty four day-old, mixed-sex, Hubbard broiler chicks, were

Table 1: Composition (%) and calculated analysis of basal diets

	Starter (0-20d)			Grower (21-42d)		
Fishmeal Level (%)	0	2.5	5	0	1.25	2.5
Ingredients						
Corn grain	55.3	57.80	60.50	60.60	61.90	63.2
SBM (44 % Cp)	38.9	34.90	30.90	34.20	32.20	30.2
Fishmeal (63 % Cp)	0.00	2.50	5.00	0.00	1.25	2.50
Corn oil	1.95	1.27	0.57	1.30	0.94	0.59
$CaCo_3$	1.19	1.13	1.08	1.06	1.04	1.00
D.C.P[1]	1.61	1.33	1.05	1.65	1.52	1.38
Common Salt	0.32	0.30	0.26	0.32	0.30	0.28
Mineral premix[2]	0.25	0.25	0.25	0.25	0.25	0.25
Vitamin Premix[3]	0.25	0.25	0.25	0.25	0.25	0.25
DL. Methionine	0.19	0.17	0.14	0.20	0.19	0.18
L-Lysine –HCL	0.08	0.05	0.03	0.21	0.19	0.18
Calculated dietary nutrient content						
ME(Kcal\kg)	2900	2900	2900	2920	2920	2920
CP (%)	22	22	22	20.5	20.5	20.5
Ca (%)	0.95	0.95	0.95	0.9	0.9	0.9
A.P (%)	0.45	0.45	0.45	0.45	0.45	0.45
Met (%)	0.53	0.53	0.53	0.52	0.52	0.52
Met+Cys. (%)	0.88	0.88	0.87	0.85	0.85	0.85
Lys (%)	1.25	1.25	1.25	1.23	1.23	1.23
Na (%)	0.14	0.15	0.15	0.14	0.14	0.14

[1]Contain 250 g/kg Ca and 180 g/kg P.

[2]Supplied per Kg: Vit. A, 7200 mg; Vit. D_3, 1600mg; Vit. E, 14400mg; Menadion, 800 mg; Thiamine, 720 mg; Riboflavin, 2640 mg; Niacin, 12000 mg; Pyridoxin, 1200 mg; Vit B_{12}, 6 mg; D-Pantothenic acid ,4000 mg; Folic acid, 400 mg; Biotin ,40 mg; Choline chloride, 100000mg; Antioxidant, 40000 mg.

[3]Supplied per Kg: Manganese, 40000 mg; Zinc ,33880 mg; Iron, 20000 mg; Copper, 4000 mg; Iodine, 400 mg; Choline chloride, 100000 mg.

randomly allocated to three dietary treatments, each replicated four times (22 chicks per pen) in a completely randomized design .The chicks were housed in floor pens (1.2 ×1.5 cm) containing wood shavings throughout the experiment. Light was provided continuously for the first day posthatching, after which a 23L: 1D lighting schedule was maintained for the duration of the experiment. Temperature was maintained between 32°C and 34°C at the beginning of the rearing period and were gradually decreased every 2 to 3 d by 1°C to 22°C at the end of rearing period. Chicks were provided free access to feed and water during the experimental period. Care and management of the chicks were in accordance with commercial guidelines.

Dietary treatments: The corn-soybean meal-based starter (0-20d) and grower (21-42d) diets were formulated to meet or exceeded the requirements (N.R.C, 1994) for all nutrients (Table 1). Experimental diets were formulated to contain different Anchovy fishmeal levels (0, 2.5 and 5 % during starter period and 0, 1.25 and 2.5% during grower period).

Measurements: The experiment was conducted for 42 days. Birds were weighed as a group on arrival. At 10, 20, 32 and 42 days of age, all birds were weighed by pen. Feed intake per pen was recorded at the same points in time and feed conversion ratio (FCR) calculated for these periods. Mortality was recorded daily and feed consumption data were corrected for body weight of mortality. Average body weight, daily gain, and FCR were determined for each period and for the overall experiment.

Statistical Analysis: Data were analyzed according to General linear model (GLM) procedure of SAS (SAS institute, 1991) as a CRD experiment. Significant differences among treatments were determined at $P<0.05$ by Duncan's new multiple range tests.

Results and Discussion

During the experimental period mortality was within acceptable levels (less than 2 %) and was not related to dietary treatments. The influences of different fishmeal levels on broiler performance were summarized in Table 2.

During the starter period (0-20d), average broiler body weight, daily gain, and feed conversion ratio were not significantly influenced by 2.5 or 5% fishmeal inclusion to the diets ($P>0.05$). However, broiler average daily feed intake was increasingly ($P<0.05$) improved by increasing fishmeal level inclusion to the diets during last part of the starter period (11-20d).

Through the grower period, the average body weight (32 and 42d) and daily feed intake (21-32d) were

Table 2: The effect of different fishmeal level (%) on performance in broiler chicks

		Fishmeal Level			P-Value
		1	2	3	
Body weight(gr.)					
	10d	210.6±8.6	220.6±14.9	214.0±15.2	0.57
	20d	564.0±50.8	591.7±14.9	608.3±11.5	0.19
	32d	1353.6^{b}±42.8	1474.4^{a}±73.8	1517.2^{a}±87.3	0.02
	42d	2019.8^{b}±171.5	2155.8^{ab}±47.4	2207.1^{a}±25.0	0.08
Daily gain(gr.)					
	0-10d	18.8±0.9	19.9±1.6	19.2±1.7	0.57
	11-20d	35.3±5.0	37.1±2.1	39.4±2.0	0.27
	21-32d	60.8±5.0	67.9±5.6	69.9±6.5	0.11
	33-42d	74.0±14.4	75.7±5.5	76.7±12.4	0.95
	0-42d	47.8^{b}±4.1	51.0^{ab}±1.1	52.3^{a}±0.6	0.07
Feed intake(gr.d-1)					
	0-10d	25.7±1.9	26.0±1.8	26.9±1.1	0.58
	11-20d	67.4^{b}±5.7	75.1^{ab}±3.5	77.6^{a}±5.3	0.04
	21-32d	125.5^{b}±2.3	130.0^{ab}±5.4	134.1^{a}±3.7	0.04
	33-42d	171.6±21.0	189.0±11.0	192.8±10.3	0.16
	0-42d	101.6^{b}±6.8	109.7^{ab}±4.8	112.5^{a}±3.1	0.04
FCR(gr.gr-1)					
	0-10d	1.37±0.1	1.31±0.1	1.42±0.2	0.57
	11-20d	1.95±0.4	2.03±0.2	1.97±0.1	0.91
	21-32d	2.08±0.2	2.08±0.2	1.94±0.2	0.48
	33-42d	2.35±0.2	2.51±0.3	2.57±0.5	0.66
	0-42d	2.26±0.1	2.28±0.1	2.30±0.1	0.87

a-b: Mean values within a row and under each main effects with no common superscripts differ significantly (P<0.05).
1: 1, 2, 3: 0.0, 2.5 and 5.0% in starter, and 0.0, 1.25 and 2.25% in grower periods, respectively.

significantly affected by fishmeal level (P<0.05). Chicks fed with diets containing 1.25 or 2.5 % fishmeal had higher body weight and average feed intake compared with chicks fed diets without of fishmeal. The chick's daily gain and feed conversion ratio were not significantly affected by fishmeal inclusion level during this period of growth. Over the whole experimental period (0-42d), the average chicks daily gain and feed intake were significantly (P<0.05) improved by fishmeal supplementation to the diets. Since the majority of the benefit in gain was driven by increased intake, feed conversion ratio was not significantly influenced by dietary fishmeal (P>0.05).

Results of the present experiment showed that the beneficial effects of fishmeal on broiler performance becomes most evident at higher level and during the mid point of the growth period, with the greatest benefit manifesting between 21-32d of age on gain, mainly via stimulation of feed intake. Benefits of fishmeal inclusion on intake and gain were less evident during 11-20d of age or 33-42d of age. One of the major challenges in modern poultry nutrition is to achieve greater efficiencies in the conversion of basic raw materials and by-products in to high value products of animal origin for human nutrition. When modern animal nutrition is considered it is clear that animal production is not only a consumer of cereals, but also of many low grade basic raw material in to high value products eminently suited for human. Historically fishmeal was a byproduct of fish oil production and a way of utilizing surpluses and small fish that could not be sold for human consumption. As the value of fishmeal came to be recognized, fishing industries were developed with fishmeal production as their primary purpose (Pike, 1999). Fishmeal is a natural, balanced feed ingredient that is high in protein, energy, minerals (calcium and phosphorus) a natural source of vitamins (including choline, biotine and vitamin B12, A and E) and the micronutrients selenium and iodine. Fishmeal also has become a standard ingredient in pig and poultry rations to make up for deficiencies of essential amino acids(N.R.C, 1994; Pike, 1999). Several research workers have come to the conclusion that some feedstuffs such as fishmeal contain an unidentified growth factor. This factor improves the palatability of these feedstuffs which, when fed to broilers, results in an improvement in growth (Barlow and Windsor, 1984; El Boushy and van der Poel, 1994).

Although the feeding value of fishmeal is unquestionable, its use in animal feed can not be without limitations because of their unfavorable effects (fishy taints) on meat, fats and eggs (Leeson and Summers, 1997; Pike, 1999; Kolacz *et al.,* 2003). Another factor that requires attention when the level of fishmeal is high in the ration is its gizzerosine contents, originally found in overheated fishmeal. This compound has been shown to induce gastric acid secretion in young chicks, in a mode of action similar to histamine, but with higher potency and a longer lasting action, resulting in poor performance and gizzard erosion. With inadequately heat-treated fishmeal there is also the potential problem of excessive thiaminase activity

(N.R.C, 1994; Rosselot *et al.,* 1996; Köse *et al.,* 2003; Macan *et al.,* 2005). Availability and price of fishmeal, in relation to other animal protein sources, or even in relation to protein of plant origin, might be the overruling factor in decisions to include fishmeal in broiler diets. These problems together with risk factor associated with diseases from animal protein sources, have resulted in nutritionists studying alternative sources for inclusion in to the diets of poultry (Okan, 1985; Olomu and Offiong, 1985; Swick and Srinongkote, 1996; Agbede and Aletor, 2003; Awoniyi *et al.,* 2003; Khatun *et al.,* 2003; Oduguwa *et al.,* 2004). These byproducts, though only available in small quantities, have served to bridge the gap in supply of animal protein sources as well as to lower feed costs. In conclusion, the results of this experiment showed that the body weight at 32 and 42 d, daily gain during 0-42d, feed intake during 11-20d, 21-32d and 0-42d had significantly increased with fishmeal inclusion to the diets. The beneficial effects of fishmeal on broiler performance become most evident at higher inclusion level and during the mid points of the growth period, mainly via stimulation of feed intake rather than improvement in feed conversion ratio of diets.

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