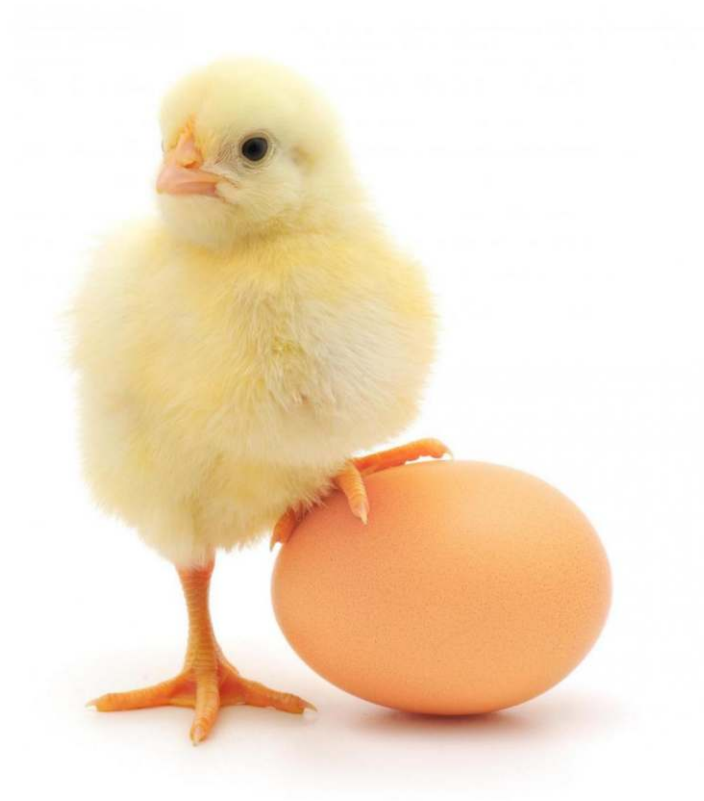
ISSN 1682-8356
ansinet.org/ijps



INTERNATIONAL JOURNAL OF POULTRY SCIENCE

ANSInet
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan
Mob: +92 300 3008585, Fax: +92 41 8815544
E-mail: editorijps@gmail.com

International Journal of Poultry Science 3 (11): 719-723, 2004

Effect of Dietary Concentration Meat and Bone Meal on Broiler Chickens Performance

M. Bozkurt[1], H. Basmacioglu[2] and M. Ergül[2]
[1]Institute of Poultry Research, Aydin,Turkey
[2]Department of Animal Science, Faculty of Agriculture, Agean University, Izmir, Turkey
E-mail: basmacioglu@ziraat.ege.edu.tr

Abstract: The study was conducted to determine the effect meat and bone meal (MBM) supplementation (added at 2.0, 3.5 and 5.0%) to broiler chickens diets on performance from 22 to 42 days of age. Twenty two day-old one thousand and two hundred unsexed broiler chickens (Ross-308) were distributed to four treatment groups. Six pens of 50 broilers (25 male+25 female) were fed each of the dietary treatments containing 0, 2.0, 3.5 and 5.0% meat and bone meal. Supplementation MBM up to 5% to broiler chickens diets did not significantly affect body weight, body weight gain, feed consumption, feed conversion rate, mortality. Body weight gain, feed conversion rate, mortality were 1.282 kg, 1.90, 2.79% for 5% meat and bone meal versus 1.273 kg, 1.83, 1.60% for the control at 22 to 42 days of age, respectively. Also, dietary treatments had no significant (P>0.05) effect on carcass yield when slaughtered at 42 d. The data showed that dietary meat and bone meal up to 5.0% can be used successfully for broiler chickens diets when diets formulated isonitrogenous and isocaloric. In this study, formulation of cost of meat and bone meal included diets at level of 2.0, 3.5 or 5.0% were cheaper 2.19, 3.65 and 4.49% than that of control diet containing no meat and bone meal, respectively.

Key words: Broiler chicken, meat and bone meal, performance

Introduction

Meat and bone meals (MBM) are important feedstuffs in poultry nutrition, due to their high protein content and competitive cost. This ingredient is also an excellent dietary source for phosphorus and calcium, and the phosphorus in MBM is highly available (Waldroup and Adams, 1994; Sell, 1996; Sell and Jeffrey, 1996; Waldroup, 1999; Dozier, 2000).

The nutritive contents (protein, ash and fat), protein quality and amino acid digestibility of MBM can vary greatly depending on processing systems (extraction by pressure or by organic solvents), processing temperature and duration, raw material source (Johnson and Parsons, 1997; Parsons *et al*., 1997; Wang and Parsons, 1998b; Shirley and Parsons, 2000; Shirley and Parsons, 2001). Also, TMEn of MBM will vary due to nutrient variability, and this ingredient has variable TMEn content ranging from 1770-3200 kcal/kg (Dolz and De Blas, 1992; Chandler, 1994). Parsons *et al*. (1997) determined that ash was a good indicator of MBM protein quality, and ash content was negatively correlated (-0.80, P>0.05) with protein efficiency ratio. The average dry matter, crude protein, crude ash and TMEn content of thirty one MBM samples 95, 50, 29% and 2536 kcal/kg respectively, and varied among samples (Wang and Parsons, 1998a). Dolz and De Blas (1992) determined that MBM averaged (DM basis):6.01% moisture, 4.25 kcal gross energy , 55.5% crude protein(CP), 14.5% ether extract, 29.6% ash, 10% calcium and 4.0% phosphorus. Parsons *et al*. (1997) determined that MBM averaged (DM basis):7.7% moisture, 51.6% CP, 12.3% ether extract, 22.8% ash, 10.0% calcium and 4.0% phosphorus.

In some recent studies, it was observed that MBM supplementation up to 10% in broiler and turkey diets had not negative effect on broiler performance even if included at highest level (Martosiswoyo and Jensen, 1988; Sell, 1996; Lilburn *et al*. 1997; Baker and Firman, 1998). But, the variability in the nutrient profile of MBM can be lead to unwanted variability in poultry performance (Chandler, 1994; Miles and Jacob, 1998). Some researchers determined that low quality MBM supplementation to broiler chicks diets decreased performance of birds (Johnson and Parsons, 1997; Wang and Parsons, 1998a).

The average usage level of animal protein feedstuffs in the U.S. today approaches 3% in broiler diets (Waldroup, 2002). However, MBM is usually incorporated in poultry diets at levels not exceeding 5 to 10% which meet phosphorus requirements. Besides, the increased levels of MBM incorporated in poultry diets might reduce costs portionally as cheaper protein, calcium and phosphorus source than those conventional feedstuffs (Chandler, 1994; Drewyor and Waldroup, 1998; Waldroup, 2002).

In our country, fish meal and MBM are common ingredients as animal by-products in poultry diets. But, fish meal was imported abroad at high amounts, thus it's cost is extremely high. In recent years, there have been attention paid to MBM supplementation in diets by

Table 1: Composition of experimental finisher diets and starter diet before the experiment (%).

Ingredients	Starter diet (0 to 22 d)	Experimental finisher diets (22 to 42 d)			
		Control	2.0% MBM	3.5% MBM	5.0% MBM
Yellow corn	40.57	58.95	60.48	61.63	62.00
Wheat	15.00	-	-	-	-
Soybean meal	35.00	33.08	31.16	29.40	28.25
Meat-bone meal	-	-	2.00	3.50	5.00
Fish meal	2.00	-	-	-	-
Vegetable oil	4.00	4.36	3.74	3.41	0.15
Ground limestone	1.83	1.31	1.05	0.90	0.70
Dicalcium phosphate	0.70	1.40	0.67	0.26	-
Iodized Salt	0.25	0.25	0.25	0.25	0.25
Vitamin Premix[1]	0.25	0.25	0.25	0.25	0.25
Mineral Premix [2]	0.10	0.10	0.10	0.10	0.10
Coccidiostat	0.10	0.10	0.10	0.10	0.10
DL-Methionine	0.10	0.10	0.10	0.10	0.10
Lysine	0.10	0.10	0.10	0.10	0.10
Analyzed composition (%)					
Crude matter	90.23	90.55	90.07	89.63	89.42
Crude protein	22.18	20.12	20.02	19.78	19.93
Crude fat	5.32	7.31	6.96	6.79	6.83
Crude cellulose	2.91	2.17	2.41	2.20	2.08
Crude ash	5.58	4.43	5.13	5.34	5.60
Starch	36.89	36.81	37.06	37.03	37.44
Sugar	4.77	5.03	4.91	5.21	4.79
ME, kcal/kg	3083	3182	3154	3141	3150
Total calcium	1.19	0.88	0.93	0.96	0.93
Total phosphorus	0.66	0.59	0.65	0.64	0.62
Methionine+Cystein *	0.85	0.78	0.78	0.78	0.78
Lysine *	1.33	1.25	1.25	1.25	1.25
Available P*	0.46	0.44	0.45	0.45	0.45

*: Calculated values. 1) Each 2.5 kg of vitamin premix contained: Vit. A, 12 000 000 IU, Vit.; D_3,1 500 000 IU; Vit. E, 30 000 mg ; Vit. K_3 ,5 000 mg , Vit. B_1,3 000 mg ; Vit. B_2, 6 000 mg; Vit. B_6, 5 000 mg ; Vit. B_{12}, 30 mg ; Nicotine amide, 40 000 mg ; Calcium-D-Pant., 10 000 mg ; Folic acid, 750 mg ; D-Biotin, 75 mg ;Choline 375 000 mg. 2) Each 2.5 kg of mineral premix contained: Mn, 80 000 mg ; Fe, 80 000 mg; Zn, 60 000 mg ; Cu, 8 000 mg; I, 500 mg;, Cobalt 200 mg ; Se, 150 mg.

Table 2: Composition of MBM selected (%)

Dry matter	89.91
Crude protein	42.03
Crude fat	11.56
Crude cellulose	2.41
Crude ash	38.23
Calcium	11.58
Phosphorus	5.82
ME, kcal/kg	2450

poultry feed industry. However, there was limitation in it's use in poultry rations, due to variability in protein quality of MBM. MBM supplementation to broiler diets has not approached 5% such as in U.S.

The study was conducted to determine the influence of different dietary concentration (2.0, 3.5 and 5.0%) of MBM containing 42.03% crude protein and 38.23% crude ash on performance of broilers from 22-42 d of age.

Materials and Methods

One thousand two hundred Ross-308 broiler chickens in combines sexes were used in the experiment. Before experiment, the chicks fed a commercial starter diet (22.18% CP and 3083 kcal ME/kg) from day-old to 22 days of age. Four different treatments were formed in the study. First treatment was control with no MBM. The other treatments were 2.0, 3.5 and 5.0% MBM supplementation, respectively. Experimental finisher diets were formulated as isonitrogenous and isocaloric (20% CP and 3150 kcal ME/kg), and to meet the requirements listed by NRC (1994). Experimental diets were given to broiler chickens 22 to 42 days of age. Diets were supplied in mash form. Composition of starter diet used before the experiment and experimental grower diets was given in Table 1. The chemical composition of commercial MBM selected was showed in Table 2.

Table 3: The effects of MBM supplementation to broiler diets at different levels on various live performance and carcass yield

Parameter	Control	2.0% MBM	3.5% MBM	5.0% MBM	SEM	P pdiff[1]
22 d BW,kg	0.559	0.561	0.556	0.557	1.93	0.883
32 d BW	1.210	1.224	1.229	1.215	11.02	0.580
42 d BW	1.832	1.816	1.824	1.839	15.80	0.769
22 to 32 BWG, kg	0.651	0.663	0.673	0.658	13.10	0.674
32 to 42 BWG	0.622	0.592	0.595	0.624	22.84	0.666
22 to 42 BWG	1.273	1.254	1.268	1.282	19.52	0.808
22 to 32 FC, kg	1.205	1.340	1.234	1.253	30.65	0.625
32 to 42 FC	1.153	1.127	1.119	1.186	23.77	0.144
22 to 42 FC	2.341	2.366	2.352	2.438	43.13	0.249
22 to 32 FCR, feed:gain (kg:kg)	1.85	1.87	1.83	1.90	0.05	0.574
32 to 42 FCR	1.85	1.90	1.87	1.90	0.04	0.841
22 to 42 FCR	1.83	1.88	1.85	1.90	0.03	0.436
22 to 42 Mortality, %	1.60	2.39	2.79	2.79	0.78	0.678
Carcass yield, %	73.73	73.93	73.95	74.50	0.42	0.609

[1]:Probability of difference among treatments means.

Broiler chickens were assigned randomly to the total four treatment groups (per treatment/6 pens). Fifty broilers (25 male+25 female) were housed on litter-floor. The stocking density in each pen was 0.10 m^2 of floor space per bird. Feed and water were available on an ad libitum basis. The experiment lasted for 3 weeks. Broilers were weighed individually at the 22, 32 and 42 d of age. For each pen, feed consumption (FC) was measured on a weekly basis. Feed was weighed back on the same day that body weights (BW) were determined, so that feed conversion rate (FCR) could be calculated. The weights of dead birds were included in weight gains when feed to gain ratios were calculated. Mortality (MT) was monitored throughout in the study. In the end of experiment (42 d of age), four birds (2 female + 2 male) for per pen (24 birds/treatment), approximate to the median BW of that treatment, were selected for slaughter, and thus total nighty six birds were slaughtered. Carcasses were eviscerated and weighed. Carcass yield (CY) was calculated as carcass weight to body weight ratios. The standard techniques for the Proximate analysis were used to determine the nutrient concentrations in the diets (Naumann and Bassler, 1993). The experimental diets were analyzed also for starch, sugar, total calcium and phosphorus, according to VDLUFA method (Naumann and Bassler, 1993). Metabolizable energy content of the diets was calculated based on their chemical composition (Anonymous, 1991). All data were analyzed using single degree comparisons of each of the various test diets to the negative control group using General Linear Models procedure of SAS (SAS Institute, 1989). Statements of statistical significance are based upon a probability of $P<0.05$ unless stated otherwise.

Results and Discussion

The effects of supplementation MBM up to 5% to broiler diets on various live performance and carcass yield are shown in Table 3. All criteria determined in this study were not significantly influenced by the treatments ($P>0.05$).

No significant effect of MBM supplementation up to 5% to diets was determined on all parameters. While 5% MBM supplementation increased BW and BWG of broilers, it unimproved FCR at 42 d, 32 to 42 and 22 to 42 d of age. CY at 3.5 and 5.0% MBM supplementation to diets were higher than those of 2.0% MBM, and treatments containing MBM gave a better CY than that of control group containing no MBM as numerically.

The data obtained from experiment agree with same results (Johri *et al.* 1980; Martotiswoyo and Jensen, 1988; Drewyor and Waldroup, 1998; Weatherford and Cherry, 1999;) showing that substantional concentrations of MBM reaching to the level of 10% can be used successfully in diets of broiler chickens. Similarly, Lilburn *et al.* (1997) and Barker and Firman (1998) reported that diets containing 3.64 and 11.0% MBM respectively supported satisfactory BWG and FCR of growing turkeys.

Supplementation of MBM to broiler diets at three different levels (2.0, 3.5 and 5.0%) had not detrimental effect on MT of birds in the experiment. The result is agreement with earlier observations (Sell, 1996; Baker and Firman, 1998; Drewyor and Waldroup, 1998). Also, MBM supplementation had no negative effect on CY of broilers and this finding is mainly the result of Martosiswoyo and Jensen (1988) who reported that inclusion of MBM up to level 10% had not increased abdominal fat weight of broilers. It is noticeably that the crude protein level of MBM used in this trial was lower, and crude ash was higher than those MBM samples in experiments mentioned above all. In spite of this, no reverse effects of MBM supplementation up to 5% obtained on criteria determined in the study. In our previous study

(Basmacioglu *et al.*, 2003), we used MBM which had lower crude protein (29.02%) and higher crude ash (45.07%) than that used this trial. We concluded that MBM supplementation up to 5% to diet had negative effect on FCR, and attributed the impaired FCR to lower protein quality and nutrient digestibility of MBM as far contained high ash. It was demonstrated in some reports also (Johnson and Parsons, 1997; Wang and Parsons, 1998a) that low quality MBM supplementation to broiler chick diets had detrimental effects on bird performance. Miles and Jacob (1998) emphasized that only one sample of MBM and performance results obtained with other samples may not be the same due to the variability nutritive value of this feedstuffs. The variability in the nutrient profile of MBM can be lead to unwanted variability in poultry performance. Due to nutrient variability, further studies should be conducted with different samples of MBM, which have different nutrient content (protein, ash and fat). In addition, MBM diets should be formulated on a digestible amino acid and an available phosphorus basis. Some researchers determined that formulating for digestible amino acid improved daily gain and feed conversion rate for MBM (Esteve Gorcia *et al.*, 1993; Wang and Parsons, 1998a). The results of the current study have considerable economic implications. As the concentrations of dietary MBM increased, the need for three ingredients that are usually relatively costly, dicalcium phosphate, soybean meal and supplementation fat decreased. In our country, fish meal and soybean meal are imported foreign countries at high amounts, and these feedstuffs increase cost of mixed feed. In this study, formulation of cost of MBM included diets at level of 2.0, 3.5 and 5.0% were cheaper 2.19, 3.65 and 4.49% than that of control diet containing no MBM, respectively.

In conclusion, the study showed that up to 5.0% dietary MBM (containing 42.03% crude protein and 38.23% crude ash) can be used successfully for finished broiler diets. Further studies are suggested to determine if the higher MBM levels than 5% employed in the present study may interfere with the response of broilers performance, and further studies should be conducted with different MBM samples in term of nutrient variability. In addition, amino acid digestibility and available phosphorus should be paid attention in diets with MBM.

References

Anonymous, 1991. Animal feeds-metabolizable energy method (Chemical Method). T.S.E. Ts 9610/December, 1-3, Ankara.

Baker, K. and J. Firman, 1998. Digestible formulation of male turkey diets when utilizing high levels of ruminant byproduct meal. Poult. Sci., 77 (Suppl.1): 9 (Abstr.).

Basmacioglu, H., M. Bozkurt and M. Ergül, 2003. Etlik Piliç Karma Yemlerine Farkli Düzeylerde Ilave Edilen Düsük Ham Protein ve Yüksek Ham Kül Içerikli Et-Kemik Ununun Performans Üzerine Etkisi. Ege Üniv. Ziraat Fak. Derg., 40: 111-118.

Chandler, N.J., 1994. A re-evaluation of protein meals from the rendering industry. 2. International Feed Congress and Exhibition. April 6-8, Kuþadasi-Turkey.

Dolz, S. and C. De Blas, 1992. Metabolizable Energy of Meat and Bone Meal from Spanish Rendering Plants as Influenced by Level of Substitution and Method of Determination. Poult. Sci., 71: 316-322.

Dozier, W.A., 2000. Economically and ecologically sound poultry nutrition: How to manage dietary phosphorous in environmentally sensitive areas. Feed Management, 51: 27-29.

Drewyor, M.E. and P.W. Waldroup, 1998. Utilization of high levels of meat and bone meal in broiler diets. Poult. Sci., 77 (Suppl. 1): 30 (Abstr.).

Esteve-Garcia, E., E. Caparo and E.J. Brufau, 1993. Formulation with total versus digestible amino acids. IX th European Symposium on Poultry Nutrition. WPSA JELENIA-Gora, Poland.

Johnson, M.L. and C.M. Parsons, 1997. Effects of raw material source, ash content, and assay length on protein efficiency ratio and net protein ratio values for animal protein meals. Poult. Sci., 76: 1722-1727.

Johri, T.S., P. Vohra, F.H. Kratzer and L. Earl, 1980. The evaluation of nutritional value of meat and bone meals as influenced by cereal grains or corn starch.Poult. Sci., 59: 1832-1838.

Lilburn, M.S., G.W. Barbour, R. Nemasetoni, C. Coy, M. Werling, and A.G. Yersin, 1997. Protein quality and calcium availability from extruded and autoclaved turkey hatchery residue. Poult. Sci., 76: 841-848.

Miles, R.D. and J.P. Jacob, 1998. Using Meat and Bone Meal in Poultry Diets. Institute of Food and Agricultural Sciences, University of Florida. Published August 1998, http://hammock.ifas.ufl.edu.

Martosiswoyo, A.W. and L.S. Jensen, 1988. Effect of formulating diets using differing meat and bone meal energy data on broiler performance and abdominal fat content. Poult. Sci., 67 :294-299.

National Research Council, 1994. Nutrient Requirements of Poultry. 9th rev. ed. National Academy Press, Washington, DC.

Naumann, C. and R. Bassler, 1993. Die chemiche untersuchung von Futtermitteln. Methodenbuch, Band 3. Erg., VDLUFA-Verlag, Darmstadt.

Parsons, C.M., F. Castanon and Y. Han, 1997. Protein and amino acid quality of meat and bone meal. Poult. Sci., 76: 361-368.

SAS User's Guide, 1989. Statistics: SAS Inst., Cary, NC.

Sell, J.L., 1996. Influence of dietary concentration and source of meat and bone meal on performance of turkeys. Poult. Sci., 75: 1076-1079.

Sell, J.L. and M.J., Jeffrey, 1996.Availability for poults of phosphorus from meat and bone meals of different particle sizes. Poult. Sci., 75: 232-239.

Shirley, R.B. and C.M. Parsons, 2000. Effect of pressure processing on amino acid digestibility of meat and bone meal for poultry. Poult. Sci., 79: 1175-1781.

Shirley, R.B. and C.M., Parsons, 2001. Effect of ash content on protein quality of meat and bone meal. Poult. Sci., 80: 626-632.

Waldroup, P.W. and M.H. Adams, 1994. Evaluation of the phosphorus provided by animal proteins in the diet of broiler chickens. J. Appl. Poult. Res., 3: 209-216.

Waldroup, P.W., 1999. Nutritional approaches to reducing phosphorus excretion by poultry. Poult. Sci., 78: 683-691.

Waldroup, P., 2002. The future of poultry nutrition. Poultry International, June 2002, 41: 12-19.

Wang, X., C.M. and Parsons, 1998a. Dietary formulation with meat and bone meal on a total versus a digestible or bioavailable amino acids basis. Poult. Sci., 77: 1010-1015.

Wang, X. and C.M. Parsons, 1998b. Effect of raw material source, processing system, and processing temperatures on amino acid digestibility of meat and bone meals. Poult. Sci., 77: 834-841.

Weatherford, P.W. and T.E. Cherry, 1999. Comparison of five animal proteins in commercial broiler diets. Poult. Sci., 78 (Suppl. 1): 105 (Abstr.).