EFFECT OF FEEDING COOKED HATCHERY WASTE ON THE PERFORMANCE OF BROILERS

Sohail Hassan Khan and Bashir Mahmood Bhatti
Poultry Research Institute, Punjab, Murree Road, Shamsabad, Rawalpindi-Pakistan

ABSTRACT

Raw hatchery waste was cooked with water at 2:1 ratio for 15 minutes and then oven dried at 65 °C and ground. Hatchery waste meal (HWM) thus prepared contained 32% crude protein, 16% ether extract, 0.9% crude fibre, 40% total ash, 11.1% nitrogen free extract, 20% calcium and 0.6% available phosphorus, with no *E. coli* and Salmonella. In biological evaluation trial, non significant difference was observed among rations in which HWM replaced the fish meal at 0 (A), 25(B), 50 (C) and 75 (D) levels in broiler rations. These rations showed that protein efficiency ratios were 1.68, 1.79, 1.65 and 1.64; apparent protein digestibility 66.17, 69.97, 64.06 and 62.01%; net protein utilization 39.86, 41.58, 38.10 and 36.12% biological value 59.96, 60.25, 59.75 and 58.32% respectively, indicating better balance of amino acid in HWM to be replaced with fish meal. In 6 weeks performance trial, the body weight gains were 1807.69, 1916.39, 1788.39 and 1635.66 gm in A, B, C and D rations, respectively, whereas, FCR values were 2.59, 2.32, 2.43 and 2.63 in the corresponding groups, which shows no significant difference among all rations. The cost per chick to market age was lowest in ration containing high level of HWM (7.5%) and highest in ration containing high level of fish meal (10%) indicating maximum replacement of fish meal by HWM in broiler ration is economical. Similarly, slaughtering data revealed no significant difference among all rations in all parameters. It may be concluded that the HWM can completely replace fish meal in commercial broiler rations.

Key words: Hatchery waste meal, broiler chick, body weight

INTRODUCTION

In Pakistan, increasing cost of poultry feedstuffs and its direct competition with human diets are adversely affecting the growth and development of poultry industry. The situation is particularly alarming in respect to protein sources of animal and vegetable origin and needs immediate remedial measures to explore new protein sources.

Hatchery waste consisting of infertile eggs, dead embryos, shell of hatched eggs and low grade unsalable chicks. It can be converted into cheap and fairly good protein feed stuff for poultry ration. This process helps to minimize the environmental pollution resulting from its disposal under the existing situation (Dhaliwal *et al.*, 1997).

Hatchery by-product meal has a crude protein content of 13.09% (Froning and Bergguist, 1990) which may be increased to 42.26% by excluding shell (Kundu *et al.*, 1986) and it also contains high calcium and fat contents i.e. 23.96 and 42.15%, respectively.

When hatchery waste from 2 to 6% was incorporated in the broiler diet, it replaced the meat scrap, skim milk and soybean cake from the ration (Wisman, 1964; Ilian and Salman, 1986). This study was conducted to examine the feasibility of the hatchery waste as a useful feedstuff to replace fish meal in the commercial broiler rations.

MATERIALS AND METHODS

Raw hatchery waste was collected from hatchery of Breeding and Incubation Section, Poultry Research Institute, Rawalpindi. It was cooked with water at 2:1 ratio for 15 minutes and then oven dried at 65 °C for 24 hr. A representative sample of the cooked hatchery waste meal (HWM) was subjected to proximate analysis, calcium and phosphorus (AOAC, 1990), gross energy (Herris, 1970) and metabolizeable energy (ME) were calculated (NRC, 1994). The samples were also analyzed for identification of pathogens (Collee *et al.*, 1989). All other feed ingredients were also analyzed for proximate analysis (AOAC, 1990).

Biological evaluation of *HWM*

Biological evaluation was done using broiler chicks to determine its protein quality. In ten days metabolic trial, 0, 25, 50 and 75% of the fish meal component of the commercial broiler ration was replaced with HWM on protein equivalent basis. Four iso-nitrogenous (23% protein) and a nitrogen free ration were formulated with same (3000 Kcal/Kg) energy content. Ration A served as control while rations B, C and D had 25, 50 and 75% of the fish meal replaced with HWM on protein equivalent basis. Ration E without protein, was fed to the birds to determine endogenous nitrogen loss. Twenty five birds, (10-day old broiler chicks) with almost uniform body weight were kept individually in separate cages and were randomly allotted to rations A, B, C, D and E in such a manner that each ration was fed to five birds. Each chick was considered as a replicate. Initial live body weight of experimental birds ranged between 183.4 to 191.9 gms. The birds were fed allotted ration *ad libitum* along with fresh and clean water round the clock. All chicks were vaccinated against New Castle disease by intra-ocular route at the age of 10 days. Droppings of individual birds were collected every 24 hr and weighed. A representative sample was deep frozen for nitrogen analysis at the end of 10 days metabolism trial. Record of weight gain, feed intake and faeces voided was maintained.

At the end, all the chicks were killed in desicator with chloroform. After opening of their abdominal cavities, the carcasses were oven dried at 80 C for 48 hours, weighed and finally ground for nitrogen determination. Chemical analysis was done for feed: gain ratio, apparent protein digestibility (APD), net protein utilization (NPU), biological value (BV) and protein efficiency ratio (PER), using formulae of Pellet and Young (1980).

Performance trial

A six weeks feeding trial was also conducted to determine the optimum level of HWM to replace fish meal in the broiler ration. Four experimental broiler rations (A, B, C and D) were formulated, replacing fish meal with hatchery waste at 0, 25, 50 and 75% levels on isoproteinic basis. The levels of incorporation of hatchery waste in the rations were worked out to be 0, 2.5, 5.0 and 7.5% in place of 10, 7.5, 5.0 and 2.5% fish meal in the rations. The experimental rations were formulated as per NRC (1994) recommendations. A total of 300 day-old Hubbard broiler chicks were randomly divided into 12 experimental units of 25 chicks each. Each of the experimental ration was allotted randomly to three experimental units. The chicks were reared on slatted floor, providing 1 sq. ft. floor space bird and vaccination was performed as per schedule. Mortality was recorded each day and feed adjusted for the dead bird. The data on feed intake and live body weight were maintained and feed conversion ratio was worked out. At the end of experiment, 3 birds from each replicate were selected for slaughtering data. Dressing percentage of birds was calculated as percentage of carcass weight, similarly organs (Liver, Heart, Spleen and Gizzard) weight of birds were calculated in gm per 100 gm dressed carcass weight of birds.

The data thus collected were subjected to statistical analysis using ANOVA technique and the significance of means was compared using Duncan's Multiple Range test (Steel and Torrie, 1982).

RESULTS AND DISCUSSION

Chemical composition of cooked hatchery waste is given in Table 1. The protein of the cooked HWM in this study was 32% which was very close to 35% reported by Verma and Rao (1974). However, the meals

Table 1: Nutrient composition of cooked hatchery waste meal (on DM basis)

Nutrients	HWM(%)
Dry Matter	92.0
Crude Protein	32.0
True Protein	29.3
Ether Extract	16.0
Total Ash	40.0
Crude Fibre	0.9
Nitrogen Free Extract	11.1
Calcium	20.0
Phosphorus (available)	0.6
ME (Kcal/Kg)	2464
E.Coli	Nil
Salmonella	Nil

prepared by Froninng and Bergguist (1990) and Ilian and Salman (1986) contained lower protein contents i.e., 13.09 and 22.8% CP, respectively. Kundu *et al.* (1986), Dhaliwal *et al.* (1998) and Rasool *et al.* (1999) reported high protein contents i.e., 42.26, 44.25, and 54.59% respectively. This is attributable to certain factors that affect the crude protein contents i.e., proportion of eggshells, processing techniques etc.

Crude fat and energy contents in cooked HWM were 16% and 2464 K cal Kg in this study, whereas Ilian and Salman (1986) have reported 14.4% fat and 2706 K cal Kg which supports these results. Total ash contents of HWM were 40% which agree with 35.3% reported by Zohari (1978). High ash contents, 86.8 and 59.43% reported by Tacon (1982) and El-Alaily and Attia (1978) are ascribable to high shell contents in cooked meal. No organisms were observed in cooked HWM, which agrees with the findings of Rasool *et al.* (1999)

Biological evaluation

The metabolism trial (Table 2) shows that the highest average weight gain (312.2 gm) was recorded in chicks fed on ration B (containing 2.5% HWM). The lowest average weight gain (262.6 gm) was recorded in chicks fed ration D (containing 7.5% HWM). Similar pattern was observed in feed: gain ratio. Statistically, there was non-significant difference among all rations in above parameters. These findings are supported by previous studies by Rasool *et al.* (1999). However, Escalona and Pesti (1987) observed that chick growth and feed efficiency were depressed when poultry by product meal was incorporated into diet at the 10% level. In this study, highest level of HWM i.e. 7.5% also caused depressed growth (1635.67 gm) as compared to lower level i.e. 2.5% (1916.39 gm).

Table 2: Mean weight gain, feed consumption, feed efficiency, protein efficiency ratio, apparent protein digestibility, net protein utilization and biological values for standard and test diets during metabolic trial

Parameters	Rations A	B	C	D
Weight gain (gm/chick)	271 20	312 20	271 0	262 60
Feed consumed (gm/chick)	704 0	763 60	696 00	705 20
Feed efficiency (feed/gain)	2 61	2 45	2 65	2 64
PER (gain/protein)	1 68	1 79	1 65	1 64
APD (%)	66 17	69 97	64 06	62 01
NPU (%)	39 86	41 58	38 10	36 12
BV(%)	59 96	60 25	59 75	58 32

Note: Rations A, B, C and D contained 0, 25, 50 and 75% hatchery waste meal ration, respectively. Means show non-significant differences

Similar trend was observed in other parameters of metabolic trial (Table 2). Protein efficiency ratio (PER) was 1.68, 1.79, 1.65 and 1.64, apparent protein digestibility (APD) was 66.17, 69.97, 64.06 and 62.01%, net protein utilization (NPU) was 39.86, 41.58, 38.10 and 36.12% and biological value (BV) was 59.96, 60.25, 59.75 and 58.32% in rations A, B, C and D, respectively. There was non significant difference among all rations in all parameters.

Overall results of the biological evaluation trial indicated that unknown growth factors (Wisman, 1964) might also be higher in HWM than fish meal. The presence of lower fibre alongwith better quality of HWM adequately replaced fish meal. Mortality was not observed during metabolic trial.

Performance trial

Weekly body weight gain in various treatment groups during six week trial were almost similar in all groups (Table 3). These findings are similar to the results earlier reported by Dhaliwal *et al.* (1998).

Mean body weight gain, feed intake per bird and feed conversion ratio during six weeks performance trial are given in Table 4. The body weight gains (1807.69, 1916.39, 1788.39 and 1635.66 gm in A, B, C and D rations, respectively) and FCR were non significantly different among all rations. It shows that the cooked HWM may replace the fish meal from the commercial broiler ration. According to Kundu *et al.* (1986), Ilian and Salman (1986) and Handa *et al.* (1996), hatchery meal can completely replace fish meal from the broiler ration by incorporating it at 2.5, 5.0 and 6.0% respectively.

Table 3: Weekly body weight (gm) in commercial broilers fed standard and test diets

	Rations A	B	C	D
1st	124.33	126.73	122 5	121.59
2nd	346.00	375.00	348.36	305.33
3rd	773.66	796.73	754.00	696.82
4th	1013.84	1032.80	1001.70	879.30
5th	1358.88	1384.61	1330.00	1206.00
6th	1807.69	1916.39	1788.39	1635.66

Note: Means show non-significant differences

The cost of rations per Kg (Table 4) were Rs.9.51, 9.31, 8.85 and 8.49 for A, B, C and D rations, respectively The total expenses per chick to market age were lowest for ration 'D' (Rs.69.0) and highest in ration A (Rs. 77.97), indicating 75 replacement of fish meal by cooked HWM in the diet of broiler is economical. Similar results reported by Handa *et al.* (1996) and Dhaliwal *et al.* (1998) showed that the cost of producing one Kg live weight gain was lowest at maximum level of 6 and 10.33% of HWM, respectively. There were no significant differences among rations on all parameters of slaughtering data. Similar results were reported by Handa *et al.* (1996) and Dhaliwal *et al.* (1998).

The results indicated that for optimizing the profits from feeding of cooked HWM, it may be used to replace fish meal in the rations of commercial broiler chicks.

ACKNOWLEDGEMENT

The authors are grateful to Mr. Muhammad Aslam, Chief Executive, Islamabad Poultry Breeding Company, Rawalpindi for providing broiler chicks for performance trials. Thanks are also due to Mr. Abdul Rehman, Senior Research Officer (Nutrition) of this Institute for his cooperation.

Table 4: Economics of standard and test diets fed to broilers

Parameters	Rations			
	A	B	C	D
Weight gain (gm/chick)	1807.69	1916.39	1788.39	1635.67
Feed consumption (gm/chick)	4675.23a	4399.17b	4341.22b	4308.99b
FCR (feed/gain)	2.59	2.32	2.43	2.63
Mortality (%)	---	4.0	2.6	4.0
Cost of day old chicks (Rs./chick)	14.00	14.00	14.00	14.00
Cost of ration per Kg. (Rs./chick)	9.51	9.31	8.85	8.49
Cost of feed consumed (Rs./chick)	44.46	41.00	38.42	36.58
Others (Vaccine + Elect. Etc.) (Rs./chick)	10.00	10.00	10.00	10.00
Total Expenses (Rs./chick)	77.97	74.31	71.27	69.00

Note: Different superscripts on mean values in a row represent significant ($P<0.01$) difference.

REFERENCES

AOAC. 1990. Official Methods of Analysis. (14th Ed.) Association of the Official Analytical Chemists. Arlington. Virginia. USA.

Collec. J.G.. J.P.. Duguid. A.G. Fraser and B.P. Marmion. 1989. Mackie & McCartney Practical Medical Mirobiology (13 Ed.). Vol. 2. Churchill Livingstone. London. pp: 290.

Dhaliwal. A.P.S.. B.K. Shingari and K.L. Sapra. 1997. Chemical composition of hatchery waste Pak. Vet. J.. 17(4): 168-169.

Daliwal. A.P.S.. B.K. Shingari and K.L. Sapra. 1998. Feeding value of extruded hatchery waste mixture in poultry-performance of commercial broilers. Pak. Vet. J.. 18(3): 116-119.

El-Alaily. H.A. and M. Attia. 1978. Biological evaluation of hatchery by product as a protein supplement for growing chicks. Archiv-fur-Geflugekunde. 42(4): 133-135.

Escalona-P. R.R. and G.M. Pesti. 1987. Nutritive value of poultry by-product meal. Poultry Sci.. 66 (6): 1067-1070.

Froning. G.W. and D. Bergguist. 1990. Utilization of inedible egg shells and technical egg white using Extrusion Technology. Poultry Sci.. 69: 2051-2053.

Handa. M.C.. K.L. Sapra and b.K. Shingari. 1996. Effect of feeding extruded hatchery waste on the performance of Soviet Chinchilla rabbits. World Rabbit Sci.. 4(2): 89-92.

Herris. L.E.. 1970. Nutrition Research Techniques for Domestic and Wild Animals. Vol. 1. Utah State University. Logaus. USA.

Ilian. M.A. and A.J. Salman. 1986. Feeding processed hatchery wastes to poultry. Agric. Wastes. 15: 179-186.

Kundu. S.. S. Biswas and T.K. Ghosh. 1986. Feeding value of hatchery by-product meal in broiler ration. Indian J. Poultry Sci.. 21(4): 347-350.

NRC. 1994. Nutrient Requirements of Poultry. (9th Ed.) National Academy Press. Washington. D.C. USA.

Pellet. L.P. and V.R. Young. 1980. Nutritional evaluation of protein foods. The United National University 15-1 Shibuys Z-Chome. Shibuya-Ku. Tokyo. Japan.

Rasool. S.. M. Rehan. A.Haq and M.Z. Alam. 1999. Preparation and nutritional evaluation of hatchery waste meal for broilers. Asian-Aus. J. Anim. Sci.. 12(4): 554-557.

Steel. R.G.D. and J.H. Torrie. 1982. Principles and Procedures of Statistics. A Biometrical Approach. New York. USA.

Tacon. A.G.J.. 1982. Utilization of chick hatchery waste: the nutritional characteristics of day-old chicks and egg shells. Agricultural Wastes 4(5): 335-343.

Verma. A.K. and P.V. Rao. 1974. Hatchery by-product meal. a source of protein. Indian poultry Gaz.. 59(4): 138-1399.

Wisman. E.L.. 1964. Processed hatchery by product as an ingredient in poultry rations. Poultry Sci.. 43: 871-875.

Zohari. M.A.. 1978. By products from hatcheries in feeds for laying hends. 3rd World Congress on Animal Feeding. Vol. 8. Madrid. Spain.