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Effects of Natural Fillers in Wheat on Broiler Growth Performance

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Abstract: A total of 180 day-old straight run arbor acres broiler chicks were fed *ad libitum* on 5 iso nitrogenous (starter, 22-23; finisher, 20-21) and iso energetic (starter, 2900-3000; finisher, 3100-3200) diets containing different levels of filler such as, D_0 (100% filler), D_1 (75% filler), D_2 (50% filler), D_3 (25% filler), D_4 (0% filler) for a period of 42 days. Decreasing fillers from dietary wheat increased crude protein decreased crude fibre and ME content of wheat and diet. Decreasing filler in wheat increased live weight and improved conversion leading to higher profitability. It is concluded that removal of fillers may be beneficial in improving growth performance and profitability of broiler rearing.

Key words: Broiler, wheat, diet, filler and growth

Introduction

Grains used, as energy source constitutes about 50% of the finished poultry diet. Wheat and maize are the main grains available in Bangladesh to include in diet. Wheat is the principal grain to use in poultry diet. The amount is quit insufficient to meet the demand for human only. Therefore, huge amount of wheat and maize is imported each year for human and poultry. A small portion of domestically produced and imported wheat became available for consumption of poultry. The availability and cost of grains appears to be the major constraints towards development of poultry industry. All feed ingredients contain some impurities or fillers. Fillers are defined as some undesirable constituents in poultry feed, such as hulls, husks, sand, dust other seeds, stems, stones, silica and cobs etc. with lower or no nutritive value. Many observations showed that fillers in might influence chemical composition of diet and broiler performance. However, fillers vary among the grains of different locations and types.

Cabel and Waldroup (1990) reported that diet removing 50% of inert filler improved feed efficiency, but reduced body weight in broilers. But, recent studies have confirmed that removal of the hulls improved the nutritive value of lupine (Brenes *et al.*, 1994). It is to be expected that hulls consist primarily (>950g/kg DM) of insoluble, indigestible polysaccharides (Daveby and Aman, 1993) is high in fibre content, which reduces its energy value for poultry (Halnan, 1928). Oats groats obtained by dehulling is comparable to maize or grain sorghum (Scott *et al.*, 1982), but a cost of dehulling is added to formulate diet.

Some automated feed mills have facilities (device) for cleaning fillers, but some do not have this arrangement. Again cleaning incurs some cost, which is eventually added to feed cost and therefore, influence profitability of broiler rearing. So, it becomes imperative to decide whether cleaning out fillers from feed is at all necessary or beneficial to improve performance. Because grains constitute around 50% of diet, most of dietary fillers are likely to be contributed by the grain or grains used. Many investigators abroad tested in most cases the effects of adding artificial fillers in diet. But, the effects of fillers naturally present in diets under Bangladesh condition have never been studied.

With those consideration in view, the current study was aimed at investigating the effect of natural dietary fillers in grain on chemical composition of feed, diet density (volume/unit weight) and growth performance of broilers.

Materials and Methods

Statement of the Experiment: A total of 180 day-old straight run arbor acres broiler chicks were fed on 5 different diets containing 0, 25, 50, 75 and 100% of natural fillers. The effect of natural dietary fillers on chemical composition of feed, diet density and performance of broilers were compared. The research work was conducted at Bangladesh Agricultural University Poultry Farm, Mymensingh, Bangladesh.

Preparation of the Experimental House.

The experimental room of the broiler house was properly washed and cleaned by using tap water. Ceiling, walls and floor were thoroughly cleaned and disinfected by using diluted iosan solution. After drying, the experimental room was divided into fifteen separated pens of equal size by using bamboo materials and wire net. The height of each wire net partition was 90cm.

Experimental diet

Proximate Analysis of feed ingredients: The proximate analysis of wheat with 100, 75, 50, 25 and 0 % of fillers was performed in the Poultry Science Laboratory of the Bangladesh Agricultural University, Mymensingh.

Calculation of metabolizable energy: Metabolizable Energy (ME) of wheat with different dietary levels of fillers

(100, 75, 50, 25 and 0) % was calculated using formula suggested by Wiseman (1987).
True ME (Kcal/kg DM) = 3951 + 54.4 EE - 88. 7 CF - 40.8 Ash.

Preparation of diet: Total wheat was divided into 5 diets. Firstly, wheat was cleaned out of all fillers by chalon and blow out by fan to make 0% filler in wheat. Then 0%, 25%, 50%, 75%, 100% of fillers were again added to diets D_4, D_3, D_2, D_1 and D_0, respectively. Diet D_4 was prepared removing all fillers (8%) of wheat. In diet D_0, D_1, D_2 and D_3 (100% i.e. containing 8% fillers, 75% i.e. containing 6% fillers, 50% i.e. containing 4% fillers, 25% i.e. containing 2% fillers and 0%) fillers were reinforcing with wheat.
Nutritional requirements of the birds were fulfilled according to breeder's recommendation. The formulated diet was fortified with the proper vitamin and mineral premix (Embavit B) at an inclusion rate of 2.5g per kg.

Management: The following management procedures were followed during the whole experimental period and the uniformity in the management practices was maintained as much as possible.

Housing: A total 180 birds were selected at random from a large population of same hatch. They were randomly distributed in 15 equal size pens, which were previously cleaned and disinfected. The birds were kept separately in each pen under similar management. Chicks were brooded with electric bulb and providing with a temperature of 33^{o}C at first week of age decreasing gradually at the rate of 3-4^{o}C per week for the adjustment to normal temperature of the house. A 100-watt electric bulb was provided up to 6 weeks of age for the convenient of the feeding and drinking.

Floor space: Each pen was 100cm x 90cm and was allotted for 12 birds. Therefore, floor space for each bird was 900cm^2. Necessary care was always taken uniformly for maintaining comfortable condition for the experimental birds.

Feeder and waterer space: Sufficient feeders and waterers were provided to get adequate feeding and watering. In starter and finisher period, feeder space was 5cm per bird and 12cm per bird respectively. Waterer space was 2.5 and 4cm/bird respectively at starter and finisher period.

Litter: Fresh and dried rice husk was used as litter at a depth of about 5cm. After 3rd weeks of age, dropping were cleaned from the surface level of litter and new litter was spread on the old litter.

Feeding and watering: Feed and water were supplied *ad libitum* to the birds throughout the experimental period. Water-soluble vitamin (Introvit 4 + WS) was added to the drinking water at the rate of 1g per 100 liters of water only in the morning. Electropak was dissolved 500g in 1000 liter water for once a day in the morning were added for the balance of electrolyte formulation for restoring ionic balance during periods of stress in hot fluctuating weather.

Lighting: The birds were always exposed to a continuos lighting of 23 hours and 1hr a dark period in each 24 hours of photoperiod. During night, electric bulb was used to provide necessary light.

Medication: For the treatment of Coccidiosis the following medicine was used during 3rd week of age. Coccicure, 100gm powder was added @ 2.5g powder per liter drinking water as per manufacturer's recommendation to prevent coccidiosis.

Recording of temperature and relative humidity: Temperature (^{o}C) of the pen during the experimental period was recorded four a day (at 8am, 2pm and 8pm, 2am). The Relative humidity (%) was also recorded four a day at the same time using a dry and wet bulb hygrometer.

Statistical analysis: All recorded and calculated data were statistically analyzed using analysis of variance technique by a computer using a MSTAT statistical computer package programmed. All growth and profitability parameters were for a Completely Randomized Design (CRD). An analysis of variance (ANOVA) was performed to compare data among dietary treatments. The significant differences were used to isolate by Duncan's New Multiple Range Test.

Results

The results on the performance of broilers fed different levels of fillers in the diets are discussed under the following sub-heading:

Chemical Composition of wheat: Proximate composition of wheat as influenced by dietary fillers is shown in Table 2. Removal of fillers in general increased crude protein and ME, decreased crude fibre, but Dry matter, Ether extract, Nitrogen free extract and Ash contents remained almost unaltered.

Volume of wheat and diet: The volume (cc) per unit weight (g) of wheat and diet obtained are shown in Table 3. Removal of fillers from dietary wheat almost linearly decreased volume per unit weight of wheat and diet as the filler % was reduced from 0 to 100 %.

Body weight: The results on body weight of broilers fed

Table 1: Nutrient requirement for broilers

Ingredients (kg)	Broiler starter (0-21d of age)	Broiler Finisher (22d-42d of age)
Wheat	50	52
Rice polish	17	17
Soybean meal	21	19.5
Protein concentrate (Jasoprot)	8	7.5
Bone and meat meal	4	4
Common salt	0.5	0.50
Vitamin and mineral premix (Embavit B 250g/100kg ratio)	0.25	0.25
Calculated Composition		
Metabolizable Energy (kcal/kg)	3000	32000
Crude Protein (%)	22-23	20-21
Methionine (%)	-	-
Meth. + Cyst. (%)	0.47	0.44
Lysine (%)	1.20	1.01
Ca (%)	0.90	0.85
Av. P (%)	0.45	0.45

Table 2: Proximate composition of wheat as influenced by dietary fillers

Component	Dietary levels of fillers (%) 100 (D_0)	75 (D_1)	50 (D_2)	25 (D_3)	0 (D_4)
Dry matter (%)	80.00	80.00	80.00	80.00	80.00
Organic matter (%)	20.00	20.00	20.00	20.00	20.00
Crude protein (%)	12.83	13.09	13.03	13.17	13.70
Crude fibre (%)	6.00	6.00	5.20	5.16	5.16
Ether extract (%)	2.60	2.60	2.60	2.60	2.60
Ash (%)	3.33	3.00	3.00	3.33	3.33
Nitrogen free extract (%)	55.24	54.61	55.90	56.74	55.21
ME (Kcal/kg)	3434.37	3437.84	3508.80	3498.88	3498.88

*ME was estimate by using the formula proposed by Wiseman (1987).

Table 3: The volume (cc)/unit weights (g) of wheat and diet as influenced by dietary fillers

Item	Dietary levels of fillers (%) 100 (D_0)	75 (D_1)	50 (D_2)	25 (D_3)	0 (D_4)
Volume/g of wheat	1.60	1.45	1.53	1.47	1.47
Volume/g of diet	1.61	1.56	1.56	1.55	1.53

five different diets at varies stages are shown in Table 4. Removal of fillers is improved the final live weight. But this happened only when 75% or more filler (100%) was removed from dietary wheat. Body weight at 42 days of age was highest in diet D_4 (0 % filler in wheat) followed by D_2, D_0, D_1 and D_3.

Feed consumption: Feed consumption was not significantly (P>0.05) affected by the removal of fillers from dietary wheat at any level at all ages. Up to 35 days of age, feed intake on 3 different levels except D_1 and D_4 diet was almost similar. Removal of filler from wheat tended decline feed consumption almost at all ages.

Feed conversion: Removal of filler from dietary wheat could not significantly (P>0.05) influence feed conversion (Table 4), except at 14 days of age where removal of filler at 50 % level improved feed conversion (FC), but other levels decreased FC. However, FC at 42 days of age appeared highest on D_4, followed by D_1, D_2, D_0 and D_3.

Survivability: The data on survivability percent are presented in Table 5. There was no difference in survivability, which could attribute to removal of fillers from dietary wheat. However, survivability was nil on 0 and 75 per cent filler in dietary wheat.

Profitability for removal of filler from dietary wheat: Profitability of broilers (Tk./kg broiler) in general increased as the fillers from dietary wheat, except on D_2 and D_3 where mortality was higher, but not attributable to diet indicating beneficial effect of filler removal on profitability.

Discussion

Chemical composition of wheat: It is evident from data in Table 2 that possibly the fillers removal had lower crude protein and ME and higher crude fiber than wheat which might have altered the composition of wheat and diet formulated removing fillers. Supported by previous workers (Lessire *et al.*, 1987; Classen *et al.,* 1985; Igbasan and Guenter, 1996). They reported that dehulling increased protein and decreased fibre content of diet.

Volume of wheat and diet: The data in Table 3 signify that the volume per unit weight of wheat and diet were increased for the increased inclusion of filler. Fillers are usually husky materials with higher volume/unit weight. It was assumed that increasing level of fillers with relatively higher volume/unit weight might have increased the volume of wheat and diet. Such filler related increased volume is supported by Islam (1994). He observed that volume of diet was increased almost linearly for the increased inclusion of rice polish (a husky material) in diet.

Growth performance: Improved growth performance of broilers in term of live weight, feed conversion (Table 4) recorded in this study may be related to increased nutrient availability to the broilers on diet with decreasing filler level. Perhaps removal of fillers increased nutrient concentration especially, crude protein and ME both in wheat and diet. Therefore, on similar feed intake birds on decreasing level of fillers ate more nutrients and less crude fiber with consequent improvement in growth performance. Improved growth performance for the removal of fillers from the diet noted is in agreement with the findings of (Campbell *et al.*, 1985; Brenes *et al.*, 1993; Endey *et al.*, 1977). They reported that removal of hulls from the barley increased live weight and feed conversion.

The present study showed that survivability was not affected by removal of dietary level of fillers from wheat, Maclean *et al.* (1994) reported that dietary naked oat did not affect mortality of the roasters.

Increased profit (Tk/broiler) and (Tk/kg live broiler) on

Table 4: Performance of broilers on different dietary levels of fillers at different ages

Parameter	Age in days	Dietary levels of fillers (%) 100 (D_0)	75 (D_1)	50 (D_2)	25 (D_3)	0 (D_4)	SED, LSD value and level of significance
Body weight	Day old	61.11	62.64	63.19	63.19	62.50	(1.319)^{NS}
(g/broiler)	7	104.16	120.83	118.06	115.28	113.89	(7.604)^{NS}
	14	262.88^{ab}	256.94^{b}	288.89^{a}	247.11^{b}	255.11^{b}	26.04**
	21	427.67	444.44	472.22	427.78	433.34	33.00*
	28	570.00^{b}	583.33^{b}	597.22^{b}	581.56^{b}	630.55^{a}	31.75*
	35	893.33^{c}	946.67^{b}	1023.33^{a}	973.33^{b}	980.00^{ab}	48.18**
	42	1124.07^{a}	1111.11^{a}	1116.67^{a}	1076.94^{a}	1166.67^{a}	0.002**
Feed consumption	7	236.40	214.16	208.16	211.40	225.26	27.499)^{NS}
(g/broiler)	14	555.80	553.03	554.40	537.70	555.80	(10.324)^{NS}
	21	1145.34	1111.67	1075.54	1066.11	1111.67	(28.462)^{NS}
	28	1706.16	1623.04	1644.79	1548.33	1622.75	(110.337)^{NS}
	35	2300.43	2162.22	2297.63	2287.58	2163.36	(108.480)^{NS}
	42	2346.00	2248.20	2427.10	2378.60	2278.90	(103.996)^{NS}
Feed conversion ratio	7	5.63	3.73	3.90	4.27	4.46	(0.780)^{NS}
	14	2.76^{a}	2.84^{a}	2.45^{b}	2.92^{a}	2.88^{a}	0.306**
	21	3.28	2.87	2.63	2.93	2.94	(0.400)^{NS}
	28	3.35	3.12	3.08	3.00	2.90	(0.311)^{NS}
	35	2.78	2.44	2.40	2.53	2.37	(0.225)^{NS}
	42	2.21	2.11	2.19	2.35	2.06	(0.103)^{NS}

* = P<0.05, ** = P<0.01, NS = Non significant. Figures in the same superscript with similar alphabet do not differ significantly. Mortality was adjusted in all calculation.

Table 5: Survivability per cent of the broiler at different dietary levels of fillers

Age in day	Dietary levels of fillers 100 (D_0)	75 (D_1)	50 (D_2)	25 (D_3)	0 (D_4)	Level of significance
7	100.00	100.00	100.00	100.00	100.00	(2.581)^{NS}
14	100.00	100.00	100.00	100.00	100.00	(2.581)^{NS}
21	100.00	100.00	100.00	100.00	100.00	(2.581)^{NS}
28	94.44	100.00	94.44	94.44	100.00	(5.270)^{NS}
35	94.44	100.00	94.44	94.44	100.00	(5.271)^{NS}
42	94.44	100.00	94.44	94.44	100.00	(5.271)^{NS}

NS = Non significant

Table 6: Cost$^{\$}$ of production and profit of broilers on different dietary level of fillers^{+}

Parameter	Dietary levels of fillers (%) 100 (D_0)	75 (D_1)	50 (D_2)	25(D_3)	0 (D_4)	SED, LSD value and level of significance
Live weight (g/broiler)	1124.07^{a}	1127.78^{a}	1170.00^{a}	1075.60^{a}	1166.67^{a}	0.002**
Chick cost (Tk/broiler)	18.00	18.00	18.00	18.00	18.00	-
Feed cost (Tk/kg)	13.75	13.79	13.83	13.88	13.92	NS
Feed cost (Tk/broiler)	32.25	31.00^{+}	35.56	33.01	31.74	(1.543)^{NS}
Feed cost (Tk/live broiler)	28.76	27.61	28.65	31.05	28.77	(1.434)^{NS}
*Other cost (Tk/kg live broiler)	8.37	8.05	7.99	8.49	7.77	NS
Market price (Tk/kg live broiler)	68.00	68.00	68.00	68.00	68.00	-
Profit (Tk/broiler)	13.85	18.66	15.26	10.03	20.56	(2.172)^{NS}
Profit (Tk/kg live broiler)	5.70	9.97	3.70	4.89	9.23	(3.307)^{NS}

** = P<0.01, NS = Non significant. Figures in the same superscript with similar alphabet do not differ significantly. *Other cost included vaccines, medicine, disinfectant, labors, transport, litter, electricity and water cost. $ All costs were adjusted for mortality

increasing dietary levels of fillers dietary wheat from as a function increased live weight and improved feed conversion obtained is well understood. Moreover, removal of filler is considered as an important ramification in the economics of storage and transport, where volume is an important criterion (Anderson *et al.*, 1960; Classen *et al.*, 1985; Campbell *et al.*, 1985).

In conclusion, we have shown that the removal of fillers from dietary wheat is expected to increase crude protein and ME and decrease crude fiber content of the diet. The growth performance of broilers on diet should be improved on diet with wheat removing fillers for

increased weight gain and feed conversion. There may be increased dressed yield as a function of increased live weight gain on diets with wheat from which fillers are removed. Profitability of broilers is expected to be higher for the removal of dietary wheat. It was recommended to remove fillers from dietary grains to maximize growth, meat yield and profitability of broiler rearing.

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References

Anderson, J.O., N.K. Wagstaff and O.C. Dobson, 1960. Value of barley and hulless barley in rations for laying hens. Poult. Sci., 30: 1230.

Brenes, A., B.A. Rotter, R.R. Marquardt and W. Guenter, 1993. The nutritional value of raw, autoclaved and dehulled peas in chicken diets as affected by enzyme supplementation. Can. J. Anim. Sci., 73: 605-614.

Brenes, A, B.A. Rotter, R.R. Marquardt and W. Guenter, 1994. Effects of enzyme addition, autoclaving treatment and dehulling on the nutritive value of lupine seeds (*Lupinus albus*). Br. J. Nutr., 54: 741-751.

Cabel, M.C. and P.W. Waldroup, 1990. Effect of different nutrient restriction programs early in life on broiler performance and abdominal fat content. Poult. Sci., 69: 652-660.

Campbell, G.L., B.G. Rossnagel and R. Bhatty, 1985. Evaluation of hulless barley genotypes varying in extract viscosity in broiler chick diets. Poult. Sci., 19: 228.

Classen, H.L., G.L. Campbell, B.G. Rossnagel, R.S. Bhatty and R.D. Reichert, 1985. Studies on the use of hullless barley in chick diets: Deleterious effects and methods of alleviation, Can. J. Anim. Sci., 65: 725-733.

Daveby, Y.D. and P. Aman, 1993. Chemical composition of certain dehulled legume seeds and their hulls with special reference to carbohydrates. Swedish J. Agric. Res., 23: 133-139.

Endey, M.J., G.L. Campbell, H.L. Classen and R.D. Reichert, 1977. Enzyme supplementation of diets containing hulless oats, hulless barley or rye for broiler chicks. Department of Animal and Poultry Science, University of Saskatchewan, Saskatoon, Sask, S7NO OWO.

Halnan, E.T., 1928. Digestibility Trails with Poultry. V. The digestibility and feeding value of bulrush millet (Pennisetum typhoideum). J. Agric. Sci., 18: 639-641.

Igbasan, F.A. and W. Guenter, 1996. The enhancement of the nutritive value of peas for broiler chickens; An evaluation of micronization and dehulling process. Poult. Sci., 75: 1243-1252.

Islam, M.N., 1994. Parboiled rice polish as a dietary substitute of wheat on growth performance and meat yield of broilers. Ph.D. Thesis, Department of Poultry Science, Faculty of Animal Husbandry, Bangladesh Agricultural University, Mymensingh.

Lessire, M., J.J. Baudet and M. Larbier, 1987. Nutritional value of high or low glucosinolate rape seed meals, produced from whole or dehulled seeds. 7th European Poultry Conference. Paris, pp: 254-257.

Maclean, J., A.B. Webster, D.M. Anderson and R.M.G. Hamilton, 1994. Naked oats as a feedstuff for male roaster chickens. Poult. Sci., 57: 1170-1171.

Scott, M.L., M.C. Nesheim and R.J. Young, 1982. Nutrition of the chicken, pp: 484-487.

Wiseman, J., 1987. Feeding of non ruminant livestock, Butterworths, London, pp: 10. (Translated Version).