J. Bangladesh Agril. Univ. 5(2): 295–301, 2007 ISSN 1810-3030

Effect of triticale based diet on the production performance and carcass characteristics of broiler

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Abstract

A feeding trial was conducted for a period of 5 weeks with 264 day-old Starbro broiler chicks and were allocated into six dietary treatments containing 21.5% CP and 2930 Kcal ME/kg DM. At 5 weeks of age, 2 broilers from each block (8 from each treatment) was randomly selected considering average body weight and slaughtered to analyze the meat yield traits. There were no significant differences ($p>0.05$) in feed and water intake, initial and final weight, total gain and gain/day, feed conversion efficiency and mortality of broilers among the dietary treatments. Liveweight at slaughter and dressing percent did not differ significantly ($p>0.05$) among the dietary treatments but dressing percent ($p<0.05$), head weight ($p<0.05$), blood weight ($p<0.001$), thigh+drumstick meat ($p<0.001$) and back bone +breast bone ($p<0.001$) were higher in triticale based diet. Triticale based diet had no effect on production performances, but it affected on the length of neck ($p<0.001$), thigh ($p<0.05$) and drumstick ($p<0.05$). However, triticale-based diet did not affect ($p>0.05$) the length of shank and wing of broiler among the dietary treatments. There was clear advantage of using triticale over wheat because no significant difference ($p>0.05$) among the dietary treatments were observed.

Keywords: Triticale, Replacement of wheat, Production performance and Carcass characteristics

Introduction

The poultry industry is gradually increasing in Bangladesh where imported costly ingredients like maize, wheat, protein concentrates etc. are used in formulating poultry diet that increased production cost. Feed cost alone contribut about 65% of the total production cost of poultry (Singh, 1990; Banerjee, 1992). Poultry nutritionists are looking for cheaper unconventional energy and protein sources feed items to formulate least cost ration. Various types of unconventional feeds (e.g. shrimp wastes, rumen ingesta, kitchen wastes, banana leaf meals, leucaena leaf meal and tannery wastes etc.) are available in Bangladesh most of which are regarded as wastes and research has been done incorporating it in diets for poultry (Rahman and Reza, 1983; Islam et al., 1994).

Triticale is the product of a cross between wheat and rye introduced recently in Bangladesh. It is very high in yield, drought tolerance and disease resistance become an important cereal that may supplant wheat or maize in some areas (Todorov, 1988).

Whole triticale caused an improvement in feed conversion ratio (FCR) when wheat was the sole cereal used in a diet (Taylor and Jones, 2000). Feeding untreated triticale grain up to 50% instead of corn had no effect on weight gain and feed consumption was not affected up to 100% replacement (Lotfallahian *et* al., 1999). With increasing proportion of dietary triticale reduced feather growth and produced white carcass (Charalambous et al., 1986). Potentiality of using triticale in poultry feeding have been observed in different countries but very little information is available on its utilization as livestock feed in Bangladesh. On the other hand, much debate exists about the magnitude and extent of protein availability and the overall nutritional status triticale. The conflicting results obtained by the various authors above necessitate undertaking further research to examine the effects of wheat replacement by triticale in the diet of poultry. Therefore, a study was conducted to investigate the effect of wheat replacement by triticale on production performance and carcass characteristics of broiler.

Materials and Methods

The study was conducted between July and August, 2003 in order to compare the effect of wheat replacement with that of triticale at various proportions on production performance and carcass characteristics of broiler. A feeding trial was conducted for a period of 5 weeks with 264 day-old Starbro broiler chicks collected from a local hatchery. The initial average live weights of the chicks were between 40 and 43g. The chicks were arranged in a Completely Randomized Design (CRD) and allocated into six dietary treatments. The treatments were designated as T_0, T_1, T_2, T_3, T_4 and T_5. Treatment T_0 contained 50 g. wheat per 100 g. diet and 20, 40, 60, 80 and 100% wheat was replaced by triticale in treatment T_1, T_2, T_3, T_4 and T_5. There were 44 chicks per treatment. Each treatment had 4 blocks where each block had 11 chicks.

The chicks were housed in an open sided thatched roof covered by polythene sheet. The floor was 0.6 m above the ground level, prepared by slated bamboo. Fences were made from galvanized wire net. The house was cleaned, washed and then disinfected before the start of the experiment. After drying, the experimental shed was divided into blocks of equal sizes according to the design mentioned above. The birds were housed with a stocking density of 0.9 square feet/bird. Rice husk was dried and used as litter, First 15 days, long trough feeders were used and the last 20 days round plastic basins 40 cm in diameter and 10 cm deep were used in every block. Drinkers were 15-cm deep rectangular 30×60 cm pottery basins. Both feeders and drinkers were cleaned daily in the morning. Day-old chicks were brought from local hatcheries and allowed to take glucose water for first three days. Brooding was done by using bulbs to manipulate smallholder farmers practice. The temperature and humidity percentages were recorded 3 times a day i.e. morning, noon and evening in each day. The birds were vaccinated against Newcastle disease and Gumboro disease.

The ingredients used to prepare the diet were purchased from the local feed shop. Diets were prepared in the form of mash and all six dietary treatments were isocaloric and isonitrogenous containing 21.5% CP and 2930 Kcal ME/kg DM. The ingredient used and the nutrient composition of the diets is shown Table 1 and 2.

Feeding trial was performed for a period of 5 weeks. Initial body weight of day old chicks was recorded immediately before the start of the trial and then weekly thereafter. All birds were weighted individually, before morning feeding and offering of water. Diets were supplied in different feeders for each block and also for each treatment and offered *ad libitum* twice a day in the morning and evening. Feed intake including left over was recorded daily and was calculated from the difference between offers and left over. In the same way, water also provided. Feed conversion ratio (FCR) was recorded for the whole period as total feed intake (kg) per kg weight gain. Room temperature of the pen was ranged from 26-34ºC and Humidity ranged from 71-96%. Health status of birds was monitored everyday and mortality of birds was recorded.

At 5 weeks of age, two birds out of 11 per block were slaughtered to analyze the meat yield traits. All birds to be slaughtered were kept off feed overnight but drinking water was provided ad libitum. Birds were slaughtered following 'halal' method (Singh et al., 2003; by severing the jugular vein and allowed to bled completely and then plucked and weighed to determine blood and feather losses (Kotula, 1960; Pandey and Shyamsunder, 1990). Data on pre-slaughter live weight, blood loss weight, eviscerated weight, shank length and weight, neck length and weight, head weight, breast meat weight, drumstick weight and length, thigh bone length and weight, digestive tract weight, wing bone length and weight were recorded. Morphological characteristics such as length of neck, thigh, drumstick and wing were recorded by a measuring scale. All of the weights related to carcass traits were dissected according to Singh et al. (2003) except that birds were not subjected to scalding at 130ºF for 30 seconds.

Table 1. Ingredients and nutrient composition of the diets

Ingredients (kg/100 kg)	Diets					
	T_0	T_1	T_2	T_3	T_4	T_5
Wheat	50	40	30	20	10	0
Maize	5	5	5	5	5	5
Triticale	0	10	20	30	40	50
Rice polish	15	16	16	17	17	17
Soya bean meal	20.25	20	20	20	20	20
DCP	1	1.25	1.25	1.25	1.25	1.25
Protein concentrate†	8	7	7	6	6	6
Lysine	0.1	0.1	0.1	0.1	0.1	0.1
Methionine	0.1	0.1	0.1	0.1	0.1	0.1
Vitamin-mineral premix††	0.25	0.25	0.25	0.25	0.25	0.25
Salt	0.3	0.3	0.3	0.3	0.3	0.3
Total	100	100	100	100	100	100
Chemical composition						
Crude protein	21.3	21.1	21.5	21.4	21.8	22.2
Crude fiber	2.9	3.2	3.5	3.8	4.0	4.3
Ether extract	4.5	5.0	6.2	5.3	5.5	6.1
Crud ash	3.4	3.5	3.5	3.7	3.7	3.7
Amino acid						
Lysine*	1.2	1.1	1.2	1.1	1.1	1.2
Methionine*	0.4	0.4	0.4	0.4	0.4	0.3
Methionine + Cystine*	0.8	0.7	0.7	0.6	0.6	0.6
Tryptophan*	0.0	0.0	0.0	0.0	0.0	0.0
Calcium*	3.3	3.3	3.3	3.3	3.3	3.3
Phosphorus*	1.1	1.1	1.1	1.1	1.0	1.0
Available P*	0.5	0.5	0.5	0.4	0.4	0.4
ME, Kcal/kg*	2920.0	2920.2	2925.7	2931.6	2937.1	2942.6

†Composition: CP 60%, ME 3230 kcal/kg, moisture 7%, crude fat 10-12%, crude fiber 4%, ash 21%, calcium 4.75-5.8%, phosphorus 2.4%, arginine 4.1%, isoleucine 1.8%, lysine 3.2%, methionine/cystine 2.0%, phenylalanine/tyrosine 4.2%, tryptophan 0.5%, histidine 1.2%, leucine 4.3%, methionine 0.9%, phenylalanine, 2.4%, threonine 2.2%, valine 2.6%.
‡Composition: calcium 21%, phosphorus 18%, fluorine 1800mg, arsenic 30mg, lead 30mg.
*Calculated values

Table 2. Chemical composition of major ingredients used in the ration (g/100g DM)

Name of ingredients	Dry matter	Crude protein	Crude fiber	Crude ash	Ether extract
Triticale	87.7	17.3	3.7	02.7	00.8
Wheat	90.4	17.1	1.7	03.7	01.6
Maize	88.0	14.3	4.6	02.4	04.3
Soybean meal	89.7	53.0	7.8	09.4	01.2
Rice polish	90.8	21.3	8.0	10.4	22.9
Protein concentrate	95.5	60.5	1.3	20.5	10.6

Samples of feed ingredients and diets were analyzed for crude protein (CP), crude fiber (CF), ether extract (EE) and ash following AOAC (1990). Amino acids of triticale were determined by HPLC. Dry matter (DM) was determined by oven drying the fresh material at 100ºC for 48h.

Data were analyzed using the procedure of SPSS 10 for WIndows (1998). Means compared for significant differences using Duncans Multiple Range Test (Duncan, 1955).

Results and Discussion

All diets were almost iso-caloric (ME, 2920-2942 kcal/kg DM) and iso-nitrogenous (CP, 21.1-22.2%). The CF, EE and ash content of the diet ranged from 2.9-4.3%, 4.5-6.1% and 1.1-1.2% respectively, which was within the range of requirement (Sing, 1990). Calculated lysine and methionine content of the T_0 diet 1.2% and 0.4 respectively as compared to the triticale based diet that ranged from 1.1-1.2% and 0.3-0.4% respectively. This lysine in the diets was within the range recommended by Ishibashi *et* al. (2001; 1.0-1.1%) and Ueno (1998; 0.9-1.1%). Calculated Ca content of all kinds of diet was 3.3%, which is much higher as recommended by Sing, (1990). The phosphrus content of the diets were ranged from 1.0-1.1% which is similar to the range used by Sing *et* al. (2003). The nutrient concentration of the major feed ingredients is given in Table 2. The triticale contained relatively higher CP and CF than wheat. On the other hand, wheat contained little more Crude ash and ether extract than triticale. The CP content of triticale used in this study (15.9%) was within the range (15.8-19.2 %) as reported by Flores *et.* al. (1994).

The data on feed intake, water intake, initial body weight, final body weight, total gain, gain per day, FCR and mortality of broilers fed on different triticale based diets are presented in Table 3. None of these characteristics differed irrespective of treatments. Pelleted diets, incorporating 20% whole or ground triticale, wheat or barley in the pellets, with or without the use of appropriate exogenous enzymes were fed to broiler chickens and the productive performances and physiological responses were recorded. At 42 days, the incorporation of whole cereals in the pelleted feed produced similar bodyweight responses to the use of ground cereals. Whole triticale caused an improvement in conversion efficiency FCR when wheat was the sole cereal used in a diet (Taylor and Jones, 2000). Feeding untreated triticale grain up to 50% instead of corn had no effect on weight gain and feed consumption was not affected up to 100% replacement reported by (Lotfallahian *et* al., 1999). Moreover, feed conversion of broilers in all diets was relatively better in the present study than those reported by Bai (2000), but was similar to the data of Ishibasi *et* al. (2001) who reported that the body weight gain/feed (g/g) was 0.5 (i.e. FCR = 1.9). However, Charalambous *et* al., (1986) reported that complete replacement of wheat with triticale decreased performance that is disagreed with the present findings.

Effects of dietary treaments on morphological characteristics of broiler are presented in Table 4. Although triticale based diet had no effect on production performances, it affected on the length of neck ($p<0.001$), thigh ($p<0.05$) and drumstick ($p<0.05$). Similar results were obtained in the case of later two by Islam *et* al. (2004) in another feeding trial of broiler in the same year. However, triticale-based diet did not affect the length of shank and wing of broiler among the dietary treatments. This result agreed with the finding of Islam *et* al. (2004) who conducted an experiment with broiler.

Table 3. Performance of broiler fed on different diets

Parameters	Level of triticale and wheat (kg/100kg) in the diet						F value and significance
	T_0	T_1	T_2	T_3	T_4	T_5	
Initial weight (g)	41.1	41.8	41.3	41.5	41.4	41.3	0.40, NS
Final weight (kg)	1.5	1.5	1.5	1.5	1.5	1.5	0.07, NS
Total gain (kg)	1.4	1.4	1.4	1.4	1.4	1.4	0.07, NS
Gain (g/b/d)	41.0	40.5	40.9	41.2	40.7	41.1	0.07, NS
Feed intake (kg)	2.7	2.7	2.7	2.6	2.7	2.7	0.30, NS
Water intake (kg)	5.9	5.9	6.2	6.2	6.4	6.3	0.80, NS
Feed conversion rate (kg feed/kg gain)	1.9	1.9	1.9	1.8	1.9	1.9	2.49, NS
Mortality (%)	0.0	0.3	1.3	0.3	1.0	0.8	0.07, NS

NS = non-significant (p>0.05)

Table 4. Morphological characteristics of broiler fed on different diets

Parameters (cm)	Level of triticale and wheat (kg/100kg) in the diet						SE	F value and significance
	T_0	T_1	T_2	T_3	T_4	T_5		
Neck	12.1^c	10.5^{ab}	11.2^b	10.1^a	11.0^b	10.0^a	0.18	9.23,(P<0.001)
Thigh	6.3^a	6.4^a	6.2^a	6.2^a	6.4^a	7.2^b	0.11	3.16,(P<0.05)
Drumstick	9.3^{ab}	9.9^{bc}	9.8^{abc}	9.9^{bc}	9.1^a	10.2^c	0.12	3.41, (P<0.05)
Shank	6.5	6.6	6.4	6.9	6.9	6.6	0.16	0.83, NS
Wing	18.4	17.8	18.4	18.6	18.8	18.9	0.13	1.65, NS

abc, with different letters in the same row differ (P<0.05 to 0.001); NS = non-significant (p>0.05).

Carcass characteristics of broiler fed on different triticale based diets are presented in Table 5. Live weight at slaughter, weight of feather, neck, heart, liver, spleen, breast meat, shank, wing meat, gizzard, skin, abdominal fat, digestive tract, lung and backbone +breastbone did not differ (p>0.05) among the dietary treatments. These results are similar to results obtained by Islam *et* al. (2004) in case following parameters; such as weight of feather, neck, liver, spleen, shank, wing meat, gizzard, skin, abdominal fat and lung. The highest dressing percent (p<0.05) in T_1, T_2 and T_3 (82.1%) and lowest (78.9%) in T_0 i.e. wheat based diet were observed. Highest blood weight (p<0.001) was obtained in T_0 (5.1%) the lowest in T_5 (2.7%). Highest head weight (p<0.05) was observed in the T_1 and T_3 (3.0%) and the lowest in T_0 (2.4%). Thigh + drumstick meat was obtained highest (p<0.001) in T_4 (20.8%) and the lowest value obtained in the case of T_0 (19.4%) and T_1 (19.4%). Significantly highest (p<0.001) backbone + breastbone were obtained in T_1 (14.9%), T_3 (14.5%) and T_5 (14.2%) followed by T_2 (12.6%) the medium value obtained in T_0 (12.3%) and the lowest value were T_4 (11.6%). The abdominal fat content of broilers in the present study (1.0-1.6% of body weight) was nearer to that reported by Ishibashi *et* al. (2001; 1.8% of body weight).

Table 5. Carcass characteristics of broiler using different diets

Parameters (% Of live weight or as stated)	Level of triticale and wheat (kg/100kg) in the diet						SE	F value and significance
	T_0	T_1	T_2	T_3	T_4	T_5		
Live weight (g)	1583.5	1520.9	1558.5	1559.6	1528.0	1538.0	11.07	0.69, NS
Blood weight	5.1^{b}	3.5^{a}	2.9^{a}	3.4^{a}	3.1^{a}	2.7^{a}	0.19	9.04, (P<0.001)
Feather weight	5.1	5.0	5.2	4.7	5.5	5.5	0.10	2.24, NS
Dressing perceent	78.9^{a}	82.0^{b}	82.1^{b}	82.1^{b}	81.2^{ab}	81.5^{b}	0.33	3.96, (P<0.05)
Head weight	2.4^{a}	3.0^{b}	2.7^{ab}	3.0^{b}	2.8^{ab}	2.6^{ab}	0.11	3.47, (P<0.05)
Neck weight	2.9	3.4	2.6	3.9	3.1	2.8	0.11	4.85, NS
Heart weight	0.6	0.6	0.5	0.6	0.5	0.5	0.03	0.66, NS
Liver weight	2.6	2.4	2.2	2.3	2.3	2.3	0.09	0.40, NS
Spleen weight	0.1	8.2E-02	0.2	9.6E-02	8.2E-02	9.0E-02	0.03	0.93, NS
Breast meat weight	17.4	16.7	18.8	15.8	18.5	17.2	0.36	2.16, NS
Thigh+drumstick	19.4^{a}	19.4^{a}	20.6^{c}	20.3^{bc}	20.8^{c}	19.9^{ab}	0.15	6.30, (P<0.001)
Shank weight	4.2	4.2	4.2	4.6	4.2	4.2	0.05	1.98, NS
Wing meat weight	6.8	6.7	6.7	6.4	6.7	6.5	0.10	0.10, NS
Gizzard weight	2.3	2.7	2.5	2.8	2.5	3.1	0.09	1.84, NS
Skin weight	6.7	7.5	7.1	7.2	6.9	7.2	0.11	1.24, NS
Abdominal fat weight	1.3	1.5	1.3	1.2	1.0	1.6	0.07	1.78, NS
Digestive tract weight	11.0	9.5	9.9	9.9	10.2	10.3	0.20	1.08, NS
Lung weight	0.6	0.6	0.5	0.5	0.5	0.5	1.699E-02	1.52, NS
Back+ breast bone weight	12.3^{ab}	14.9^{c}	12.6^{b}	14.5^{c}	11.6^{a}	14.2^{c}	0.27	30.61, (P<0.001)

abc, with different letters in the same row differ (P<0.05 to 0.001); NS = non-significant (p>0.05).

Conclusion

As the basis of present findings, it was concluded that there was no apparent risk of using triticale based diet at any proportion in the poultry diet to over that of wheat based ones on the productive performance. Moreover, finally it was decided that it is impossible to conclude from only one trial about the nutritional impact of triticale based diet for broiler. Moreover, several batches of feeding trials on inclusion of different levels (0 to 100%) of triticale in the broiler diet are necessary to know which level of triticale needed to be included in the diet.

Acknowledgement

The authors gratefully acknowledge the Director General, Bangladesh Livestock Research Institute (BLRI) and Project Director, Poultry Management Technique Improvement Project, BLRI for funding to carry out this research work.

References

AOAC. 1990. *Official Methods of Analysis*, Association of Official Analytical Chemists, 15th Ed. vol. 2, Washington DC.

Banerjee, G. C. 1992. In: *Poultry.* 3rd Ed. Oxford and IBH publishing Co. Pvt. Ltd. New Delhi, Bombay, Calcutta.

Charalambous, K., A. Koumas and S. Economides. 1986. The effect of triticale grain on the performance of chicks from birth to nine weeks of age. *Technical Bulletin*, Agricultural Research Institute, Cyprus. 79, 7pp; 17 ref.

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

Flores, M. P., J. I. R. Castanon and J. M. Mcnab. 1994. Effect of tannins on starch digestibility and TMEn of triticale and semipurified from triticale and field beans. *British Poultry Science.* 35: 281-286.

Ishibashi, T., K. Koide and C. Yonemochi. 2001. Possibility and limitation in amino acid nutrition in poultry. In: New Challenges for Animal Science in a New Century (Ed. E. Sato and J. K. Ha). *Asian-Aust. J. Anim. Sci.* 14 (Special Issue):164-175.

Islam, M. A., M. D. Hossain, S. M. Bulbul and M. A. R. Howlider. 1994. Unconventional feeds for broilers. *Indian Vet. J.* 71: 775-780.

Islam, M. R., M. P. Mostari, S. Faruque and Q. M. E. Huque 2004. Effect of strains and age at slaughter on the performance and carcass characteristics of cockerels and estimation of carcass characteristics of cockerel from physical characteristics. A Report, Bangladesh Livestock Research Institute, Savar, Dhaka, Bangladesh.

Islam, M. R., W. Pervin and D. C. Paul. 2002. Effect of levels of cassava leaf and root meal on intake, digestibility and performances of broiler. A Report, Bangladesh Livestock Research Institute, Savar, Dhaka, Bangladesh.

Koide, K., E. Watanabe, M. Toyomizu and T. Ishibashi. 1993. Effects of dietary protein sources on performance and plasma amino acid concentration in broilers. *Jpn. Poult. Sci.* 29:368-377.

Kotula, A. W., J. E. Thomson and J. A. Kinner. 1960. Weight increase during chilling of broilers as influenced by methods of opening the abdominal cavity during evisceration. *Poult. Sci.* 39: 26-27.

Lotfallahian, H., M. Shivazazd and A, Nik-Khah. 1999. Replacement of corn by triticale in broiler diets. *Iranian Journal of Agricultural Sciences.* 30: 2, 309-318; 12 ref.

Pandey, N. K. and G. Shyamsunder. 1990. Carcass characteristics, meat yield and physicochemical properties of meat from white leghorn cockerels. *Indian J. Poult. Sci.* 25(4):249-252.

Rahman, M. A. and A. Reza. 1983. Study on the effect of unconventional sources of protein and energy for poultry. M.Sc. Thesis. Dept. of Anim. Nutr., Bangladesh Agricultural University, Mymensingh, Bangladesh.

Singh, P. K., V. K. Khatta, R. S. Thakur, S. Dey and M. L. Sangwan. 2003. Effects of phytase supplementation on the performance of broiler chickens fed maize and wheat based diets with different levels of non-phytate phosphorus. *Asian-Aust. J. Anim. Sci.* 16(1):1642-1649.

Sing, R. A. 1990. In: *Poultry Production.* 3rd Ed. Kalyani Publishers, New Delhi, India. SPSS. 1998. SPSS Base 10.00 Application Guide, SPSS Inc., USA.

Taylor, R. D. and G. P. D. Jones, 2000. Production and physiological responses of broilers to the inclusion of whole grain into pelleted diets. Twenty-fourth Annual Scientific Meeting, Freemantle, Australia, 3-6 December, 2000. *Proceedings-of-the-Nutrition-Society-of- Australia.* 2000, 24: 82-85, 12 ref.

Taylor, R. D. and G. P. D. Jones, 2001. The incorporation of whole grain into pelleted broiler chicken diets: production and physiological responses. *British- Poultry-Science.* 4. 477-483; 30 ref.

Todorov, N. A. 1988. Cereals, pulses and oilseeds; in: De Boer, F. & Bickel., H. (Eds) Livestock Feed Resources and Feed Evaluation in Europe, pp. 47-95 (Amsterdam, Elsevier).

Ueno, K. 1998. Research of arginine and lysine requirements of broilers. PhD dissertation, Niigata University. Pp. 1-171.