

Replacement of maize by different levels of triticale on performances and meat yield characteristics of broiler chickens

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[Received: 02 January 2011, Accepted: 28 March 2011]

ABSTRACT

An experiment was conducted for a period of 5 weeks with 240 day-old Cobb-500 broiler chicks and were allocated into six dietary treatments with isocaloric and isonitrogenous containing 2975 Kcal ME/kg DM & 21.70% CP and 3077 Kcal ME/kg DM & 20.34% CP both starter and finisher ration respectively. There were 40 chicks per treatment, each treatment had 4 replication having 10 chicks in each. The dietary treatments were T₁ (0% triticale + 100% maize), T₂ (20% triticale + 80% maize), T₃ (40% triticale + 60% maize), T₄ (60% triticale + 40% maize), T₅ (80% triticale + 20% maize) and T₆ (100% triticale + 0% maize). The broilers of all treatment groups were supplied feeds and water *ad libitum* throughout the experimental period. There were no significant differences (P>0.05) in feed intake, final body weight, total gain, feed conversion efficiency, survivability% but feed cost per kg live broiler production was differed significantly (P<0.01) among dietary treatments at 35 days of age. Therefore, it is clear that triticale is a good alternative cereal for broiler diet without affecting performance and it may safely replace up to 100% of maize but 40% replacement enhance production performance and edible meat yield of broiler and reducing feed cost (Tk. 2.88/kg) per unit of broiler production.

Keywords: Triticale, maize replacement, production performance, meat yield characteristics

INTRODUCTION

Poultry today has emerged as the fastest growing segment of the agricultural industry. Broiler farming is an important part of commercial poultry enterprise which provides a large part of increasing demand for animal protein, cash income and creates employment opportunities. Due to the available supply of poultry feed and also its high cost, particularly energy and protein sources feed items inhabit for the formulation of least cost ration, which is the most burning issue for the development of this sector at present. Because feed cost alone accounts for 65-75% of the total cost of poultry egg & meat production ^[1]. As a result poultry nutritionists have been working with various types of unconventional feed (shrimp wastes, rumen ingesta, kitchen wastes, banana leaf meal, leucaena leaf meal and tannery wastes etc.) to reduce the poultry ration cost ^[2,3]. Addressing the availability of food grain for poultry as well as human in the country a cereal triticale can be substituted for other cereals in poultry diets. Triticale is the product of a cross between wheat and rye with the intention of producing a grain with the feeding characteristics of wheat and the winter hardiness, drought and disease resistance of rye ^[4] & become an important cereal that may supplant wheat or maize in some area ^[5]. Relatively high protein content makes triticale an attractive cereal for use in poultry diets ^[6,7] Feeding triticale grain had no effects on body weight gain, feed consumption and FCR of broiler chicken even 100% replacement of wheat with triticale ^[8]. In another experiment revealed no differences on body

weight and feed intake of broiler with a wheat-based diet but higher FCR with a diet in which when triticale was substituted for wheat ^[7].

In Bangladesh there is little information about triticale grain its utilization, effects of replacement by other cereal like maize, inclusion level and economic benefits of diets and also makes popularity for abundant use as poultry ration as a cheaper feed in the country. Therefore, a study was conducted to investigate the effect of maize replacement by different level of triticale on the production performance, cost effectiveness and meat yield characteristics of broiler chicken.

MATERIALS AND METHODS

A feeding trial was conducted for a period of 5 weeks with 240 day-old Cobb-500 broiler chicks collected from a local hatchery. The initial live weights of the day old chicks were between 42-50g. The chicks were arranged in a completely randomized design with 6 dietary treatments. There were 40 chicks per treatment, each treatment had 4 replication having 10 chicks in each replicate. The dietary treatments were T₁ (0% triticale + 100% maize), T₂ (20% triticale + 80% maize), T₃ (40% triticale + 60% maize), T₄ (60% triticale + 40% maize), T₅ (80% triticale + 20% maize) and T₆ (100% triticale + 0% maize). Lighting was provided for 24 hours for the first 3 weeks and then from 1800h to 0600h for the rest of the days. One

thermometer and a dry and wet bulb hygrometer were hanged in the experimental room to record temperature and relative humidity. The temperature and humidity percentages were recorded 3 times a day.

Table 1 : Feed Ingredients nutrient composition of maize-based diet used in broiler starter (0-3 weeks) ration replacing by different levels of triticale

Feed ingredients	Triticale as % of total maize grain content of the diet					
	T ₁ (0)	T ₁ (20)	T ₁ (40)	T ₁ (60)	T ₁ (80)	T ₁ (100)
Maize	50	40	30	20	10	0
Triticale	0	10	20	30	40	50
Wheat	07	07	07	07	07	07
Rice polish	9.25	10.00	12.00	14.00	16.00	17.50
Soybean meal	22.00	22.00	21.00	20.00	18.50	17.50
*Protein Concentrate	6.50	5.50	4.50	3.50	3.00	2.50
Meat & Bone meal	2.50	2.50	2.50	2.50	2.50	2.50
Soybean oil	1.0	1.0	1.0	1.0	1.0	1.0
DCP	1.0	1.25	1.25	1.25	1.25	1.25
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
Commol Salt	0.3	0.3	0.3	0.3	0.3	0.3
Total	100	100	100	100	100	100

Calculated composition:

Crude protein	21.44	21.56	21.61	21.66	21.79	22.08
ME, Kcal/kg	3016.40	2980.60	2972.50	2964.40	2961.40	2953.95
Crude fiber	4.62	4.58	4.46	4.36	4.31	4.49
Crude fat	5.46	5.19	5.07	4.94	4.86	4.73
Crude ash	5.06	4.94	4.89	4.84	4.86	4.88
Lysine	1.16	1.13	1.15	1.13	1.14	1.15
Methionine	0.45	0.45	0.45	0.44	0.45	0.44
Methionine+Cystine	0.34	0.33	0.33	0.32	0.31	0.31
Tryptophan	0.26	0.26	0.25	0.25	0.25	0.25
Calcium	0.96	1.01	0.96	0.90	0.87	0.85
Available Phosphorus	0.97	0.96	0.95	0.94	0.93	0.92

*Composition: CP 60 % ME 3230 kcal/kg, crude fat 10-12%, crude fiber 4%, ash 21%, moisture 7%, calcium 5.8%, phosphorus 2.4%, arginine 4.05%, isoleucine 1.77%, lysine 3.20%, methionine+cystine 1.96%, phenylalanine+tryptophan, 4.19%, tryptophan 0.49%, histidine 1.20%, leucine 4.26%, methionine 0.91%, phenylalanine 2.35%, threonine 2.21%, valine 2.61%.

One feeder and one round drinker were provided in each pen for 10 birds. All mash dry diets were supplied in different feeders for each replication under each treatment to all birds *ad-libitum*, three times a day throughout the experimental period. Water also provided once daily in the morning. The

birds were vaccinated against Newcastle (1st day and 21st day) and Gumboro disease (7th day and 14th day). Table 2: Feed Ingredients and nutrient composition of maize-based diet used in broiler finisher (3-5 weeks) ration replacing by different levels of triticale

Feed ingredients	Triticale as % of total maize grain content of the diet					
	T ₁ (0)	T ₁ (20)	T ₁ (40)	T ₁ (60)	T ₁ (80)	T ₁ (100)
Maize	50	40	30	20	10	0
Triticale	0	10	20	30	40	50
Wheat	7.0	7.0	7.0	7.0	7.0	7.0
Rice polish	11.00	12.75	14.75	16.75	18.25	19.50
Soybean meal	19.00	18.00	17.00	16.00	15.00	14.25
*Protein Concentrate	6.50	5.50	4.50	3.50	3.00	2.50
Meat & Bone meal	2.50	2.50	2.50	2.50	2.50	2.50
Soybean oil	2.25	2.25	2.25	2.25	2.25	2.25
DCP	1.0	1.25	1.25	1.25	1.25	1.25
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
Commol Salt	0.3	0.3	0.3	0.3	0.3	0.3
Total	100	100	100	100	100	100

Calculated composition:

Crude protein	20.11	20.13	20.18	20.23	20.52	20.89
ME, Kcal/kg	3103.17	3089.32	3081.22	3073.12	3065.67	3056.0
Crude fiber	3.44	3.61	3.80	3.98	4.16	4.35
Crude fat	6.86	6.70	6.58	6.45	6.32	6.15
Crude ash	4.99	4.92	4.83	4.82	4.83	4.84
Lysine	1.12	1.10	1.07	1.05	1.03	1.03
Methionine	0.44	0.43	0.44	0.42	0.42	0.42
Methionine+Cystine	0.32	0.31	0.30	0.29	0.29	0.29
Tryptophan	0.23	0.23	0.23	0.22	0.22	0.22
Calcium	1.00	0.98	0.95	0.89	0.86	0.83
Available Phosphorus	0.97	0.95	0.94	0.92	0.90	0.89

*Composition: CP 60%, ME 3230 kcal/kg, crude fat 10-12%, crude fiber 4%, ash 21%, moisture 7%, calcium 5.8%, phosphorus 2.4%, arginine 4.05%, isoleucine 1.77%, lysine 3.20%, methionine+cystine 1.96%, phenylalanine+tryptophan, 4.19%, tryptophan 0.49%, histidine 1.20%, leucine 4.26%, methionine 0.91%, phenylalanine 2.35%, threonine 2.21%, valine 2.61%.

Feeding trial was performed for a period of 35 days. Feed conversion ratio for a particular period was calculated dividing the total feed consumed by the cumulative body weight attained at that period. Management like litter, feeding system and temperature were similar for all treatments. At the end of 5 weeks, 2 broiler from each replication i.e, 8 birds from each treatment was randomly selected considering around same body weight and slaughtered to analyze the morphological and edible meat yield characteristics. Birds were slaughtered following halal method [9] by serving the jugular vein and allowed to bleed completely.

For morphological characteristics such as length of neck, thigh, drumstick and wing were recorded by a measuring scale.

Collected and Calculated data were analyzed for analysis of variance using MSTAT-C Computer package program in according to the principles of Completely Randomized Design (CRD). Least Significance Difference (LSD) was done to compare variations between treatments where adjudged by Duncan's New Multiple Range Test.

RESULTS AND DISCUSSION

Weight gain:

The results on live weight of broilers fed different levels of triticale based diets are shown in Table-3. The live weight did not differ significantly ($P < 0.01$). However, the highest live weight and weight gain of broilers were found when 40% maize was replaced with triticale (T4). The present findings of live weight of broilers are agreed with the investigation of other scientists [8, 13]. Whole triticale in the pelleted food produced identical body weight responses to when ground triticale was incorporated in the food [14]. However, broiler feeding untreated triticale grain up to 50% instead of corn had no effect on weight gain [15]. However, diet containing upto 30% triticale obtained higher weight gain but differences were similar [17]. Triticale could substitute maize up to the level of 50% did not affect weight gain in the diets of growing chicks [18]. When 60% wheat was replaced with triticale grain in cobb-500 broiler ration at 35 days of age lead significantly higher ($P < 0.01$) final weight gain [19]. Higher weight gain observed in broilers fed maize-triticale diets than fed a diet with triticale as the only cereal grain [20].

The higher concentration of triticale or different levels of triticale replaced with maize or wheat-based diet or other cereal sources in broiler ration decreased body weight as reported by other scientists which are agreed the present study.

Feed conversion ratio:

Feed conversion ratio of broilers received different level of triticale in maize-based dietary treatments was not significantly different at 35 days that is similar with another studies used a corn-soy basal diet with different inclusion of triticale were given to male Ross broiler chicks and found no significant differences in FCR at 42 days [16, 28,21]. It was reported that significantly no differences of FCR on meat type chickens at 28 days given maize and soybean meal based diet replacing maize with 35, 69.55 or 100% by triticale grain [25].

Feed consumption:

Feed consumption of broilers among different levels of triticale-based dietary groups were not statistically ($P < 0.01$) different at 35 days that is agreed with another research [7, 8]. It was also reported that broiler feeding untreated triticale grain up to 100% replacement with corn had no effect on feed consumption [15]. In another experiment found no significant difference in feed consumption when corn was replaced with different levels of triticale grain for Ross broiler diet at 42 days [16]. It was concluded from an experiment that feed intake was not significantly different among the groups when diet included triticale 30%, maize 20% and wheat 15% in the diet of Lohmann broilers [26].

Table 3: Production performances of broiler chicken fed on maize-based diet replacing by different levels of triticale

Variables	Triticale as % of total maize grain content of the diet						LSD (SD) and level of significance
	T1(0)	T2(20)	T3(40)	T4(60)	T5(80)	T6(100)	
Initial body weight (g/bird)	45.36±2.04	45.40±2.68	45.49±1.41	45.51±2.64	45.41±2.39	45.42±2.00	1.118NS
Final body weight (g/bird)	1472.96±7.42	1483.88±1.95	1498.54±1.25	1478.21±2.64	1470.78±1.498	1466.42±2.2281	8.595NS
Body weight gain (g/bird)	1427.35±5.86	1441.54±1.515	1453.05±1.17	1432.69±2.616	1425.37±1.734	1421.00±23.85	8.996NS
Feed consumption (g/bird)	2614.25±1.517	2611.69±1.048	2606.94±1.223	2610.19±7.20	2619.25±9.42	2626.06±8.06	5.381NS
FCR (g feed/g gain)	1.83±0.01	1.81±0.02	1.79±0.01	1.82±0.03	1.83±0.03	1.85±0.04	0.015NS
Survivability %	97.50±0.82	97.50±0.82	97.50±0.82	95.00±0.82	97.50±0.82	95.00±0.82	4.876NS
Feed cost (Tk./kg broiler) in 2007-2008	40.99±0.41	39.60±0.41	38.11±0.81	37.22±0.82	36.89±1.22	36.24±0.41	4.428**

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Survivability:

The survivability percent of Cobb-500 broilers received different level of triticale in maize-based diet did not differ significantly at 35 days. The highest survivability of birds were recorded on dietary group T1, T2, T3 & T5 whereas lowest on group T4 & T6 respectively. The lower survivability of birds might be happened due to heat stress during experimental period. The present observation of survivability about triticale feeding in broiler diets is consistent with the previous findings as reported in various studies [29, 17, 16]. Moreover, many researcher reported that there were no differences on survivability about triticale feeding even diets consists of 100% triticale in the broiler or layer ration [1, 8, 19].

Feed cost:

Feed cost per unit of broiler production in terms of profitability was highest due to reduced feed cost (2.88 Tk./kg) per unit of production when broilers fed a diet in which 40% maize was replaced with triticale grain (T3). The present study of reducing feed cost per unit of broiler production is supported with the previous findings of other researcher [17,19,31]. They also noted that cost reduction from using triticale ranged from 1.3 to 2.3% for broiler rations

and from 1.87 to 3.54% for layer rations when triticale was priced equal to corn.

The Morphological characteristics:

The morphological characteristics (Table-4) were almost similar in all the treatments and the differences were non-significant. It reveals that triticale-based diets have no negative effect on body characteristics of broiler. The present finding of this study is agreed with another investigation that showed no differences of body characteristics of Cobb-500 broilers fed different levels of triticale in wheat-based diet at 35 days [19]. However, the length of wing and shank were not affected among dietary treatments [3, 8] which are agreed in the present study.

Table 4: Effect of feeding different levels of triticale on the body characteristics of broiler chicken in maize-based diets.

Variables (cm)	Treatment groups						SED(LSD) & level of significance
	T ₁	T ₂	T ₃	T ₄	T ₅	T ₆	
Neck	11.08±0.16	11.11±0.26	11.06±0.24	10.73±0.17	10.90±0.23	10.93±0.29	(0.114)NS
Thigh	5.46±0.22	5.52±0.11	5.45±0.14	5.44±0.18	5.39±0.16	5.49±0.12	(0.080)NS
Drumstick	9.53±0.17	9.56±0.15	9.65±0.10	9.49±0.14	9.44±0.14	9.56±0.21	(0.077)NS
Wing	17.88±0.11	17.92±0.16	17.94±0.13	17.77±0.13	17.80±0.10	17.99±0.11	(0.063)NS
Shank	5.48±0.13	5.36±0.05	5.39±0.11	5.28±0.10	5.31±0.11	5.35±0.09	(0.05)NS

The figure in a row having similar alphabet do not differ significantly but dissimilar alphabet differ significantly; SED- Standard error difference; LSD- Least significant difference; NS = Not significant

On the other hand, it was observed statistically different in the length of neck (P<0.001), thigh (P<0.05) and drumstick (P<0.05) among triticale-based diets when replacing different levels of triticale in wheat-based diets on carcass characteristics of Starbro broiler at 35 days of age [8] whereas, the length of thigh and drumstick were affected on different dietary treatments while observation of carcass characteristics of cockrels due to strains and age [32] were disagreed with the present study.

Meat yield characteristics:

The highest dressing yield percent was obtained by the birds of dietary group in which 40% maize was replaced with triticale grain. It indicates that dressing weight percent increased with the increasing level of triticale up to 40% and 100% alone in the diet. The breast meat yield was significantly (P<0.01) increased with higher level of triticale but had no effect up to 40% replacement of triticale in maize based diet of Cobb-500 broiler at 35 days. The causes of increasing dressed weight might be due to the fact that triticale had a positive effect on Cobb-500 broiler with increasing the thigh, drumstick and breast meat because correlation between live weight and dressing weight (r=0.76), thigh (r=0.71), drumstick (r=0.74) and breast meat (r=0.61) all were positive. It is also evident that sole triticale-based

diet obtained better dressing yield percent than sole wheat based diet.

Similarly report showed that there were no effects on carcass weight, uniformity of carcass (measured as CV %) & percentage of grade-A carcass fed triticale or wheat-based diet at 42 days [7]. On the other hand, dressing yield percent of Starbro broiler chickens were significantly (P<0.05) differences among different level of triticale in wheat-based diets at 35 days [8] and also different of dressed weight% of cockrels among various diets due to strains and age [32] which are not supported in the present finding.

Table 5: Effect of feeding different level of triticale on the edible meat yield characteristics of broiler chicken in maize-based diets

Variables%	Treatment						SED(LSD) & level of significance
	T ₁	T ₂	T ₃	T ₄	T ₅	T ₆	
Dressing yield	70.06±1.79	70.63±2.01	71.36±1.10	69.57±1.74	69.29±1.35	70.28±1.23	0.786NS
Thigh	11.54±0.17	11.61±0.18	11.75±0.37	11.46±0.29	11.39±0.20	11.60±0.19	0.122NS
Drumstick	8.55±0.16	8.74±0.21	8.77±0.27	8.57±0.20	8.50±0.12	8.66±0.34	0.114NS
Breast meat	18.67±0.26	18.98±0.28	19.03±0.25	18.44±0.44	18.46±0.35	18.84±0.19	0.226 **
Wing	7.57±0.31	7.56±0.18	7.68±0.30	7.35±0.11	7.32±0.15	7.61±0.19	0.109NS
Shank	4.64±0.19	4.74±0.25	4.50±0.10	4.62±0.11	4.60±0.24	4.70±0.19	0.094NS
Liver	2.37±0.11	2.41±0.12	2.35±0.11	2.39±0.17	2.38±0.09	2.40±0.10	0.059NS
Gizzard	2.42±0.12	2.45±0.18	2.57±0.14	2.54±0.24	2.63±0.34	2.71±0.26	0.112NS
Heart	0.50±0.03	0.53±0.03	0.49±0.03	0.52±0.03	0.52±0.03	0.50±0.02	0.015NS
Abdominal fat	1.22±0.18	1.18±0.20	1.11±0.11	1.00±0.10	1.06±0.12	0.97±0.09	0.070NS

The figure in a row having similar alphabet do not differ significantly but dissimilar alphabet differ significantly (as per DMRT); SED- Standard error difference; LSD- Least significant difference; ** = Significant at 1% level of probability (P<0.01); NS = Not significant

However, some study revealed significantly (P<0.05) lower weight of back half, front half, drum & thigh fed triticale diet when substituted for wheat-based diet [7] which are not supported in the present findings.

CONCLUSION

Considering the above facts and findings, it may be concluded that triticale based diet at any proportion in broiler ration had no adverse effect on production performance. Growth performance and meat yield of broilers were better with 40% replacement of maize with triticale in the diet. It is also more profitable due to a reduction of feed cost. So, triticale can easily be used as the replacement of maize in broiler diet on scarcity of maize or its price is higher.

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