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Research Article

EFFECT OF REPLACING MAIZE WITH PEARL MILLET ON THE GROWTH RESPONSE AND CARCASS CHARACTERISTICS IN BROILER CHICKS

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ABSTRACT

Day-old commercial broiler chicks were randomly divided into three treatment groups (T1, T2 and T3) with 3 replicates of 20 chicks each. Ration containing 54% maize was used during starter phase and 60% maize during finisher phase in controls (T1). In rations T2 and T3, 50% and 100% maize was replaced with pearl millet, respectively. Significantly higher ($P<0.05$) body weight gain and feed intake were observed in T2 i.e. in 50% pearl millet based diets. However, there was no significant difference in the feed intake of T2 and T3 treatments. Dry matter retention was significantly higher ($P<0.05$) when pearl millet was incorporated at 50% level. Higher ($P<0.05$) nitrogen retention was observed in pearl millet based diets. Difference in carcass and intestinal morphology characteristics were non-significant among various treatments.

Key words: Pearl millet, broilers, replacement, nutrient metabolizability, intestinal morphology

Pearl millet (*Pennisetum typhoides*) is a cereal grain with good drought tolerance and hardiness and is commonly grown in the semiarid regions of Africa and Asia (Andrews and Kumar, 1992). Its production in India is 9.4 million tonnes whereas maize production is 14 million tonnes (FAO, 2009). Energy in pearl millet is reported to be higher or equal to maize (Adeola and Rogler 1994; Prasad *et al.*, 1997). Studies have been conducted with conflicting results in the past by replacing maize with pearl millet in broiler diets (Rama Rao *et al.*, 2002; Elangovan *et al.*, 2003; Kumaravel *et al.*, 2006). Incorporation of pearl millet can reduce the dependency on maize and also the cost of poultry feeding. Therefore, an experiment was conducted to study the effect of replacing maize with graded levels of pearl millet on growth response and carcass traits in commercial broiler chicks.

MATERIALS AND METHODS

One hundred and eighty, day-old commercial broiler chicks were wing banded on day one and randomly divided into three groups, each with three replicates of 20 birds each. Chicks reared on deep litter were offered feed and water ad lib through out the experiment. Ground maize was provided *ad lib* on day one and then followed by the respective experimental diets. Three diets, each, were formulated for starter (0-4 weeks) and finisher phase (4-6 weeks) separately. Control diet was prepared to meet the requirements as per BIS (1992). Ration containing 54% maize was used as control (T1) during starter phase and 60% maize during finisher phase. In treatments T2 and T3, 50% and 100% maize, respectively was replaced with pearl millet. Ingredients and chemical composition of starter and finisher rations are presented in Table 1.

Feed ingredients were analyzed for proximate principles (AOAC, 2007). Body weight gain and feed intake per replicate at weekly intervals were recorded. The efficiency of feed utilization was calculated as feed intake per unit weight gain. A metabolism trial was conducted to determine the dry matter and nitrogen retention and gross energy metabolizability in each treatment. Four birds per dietary treatment were sacrificed at the end of the experiment to evaluate the carcass yield, intestinal length and weight, thigh and breast muscle composition. For the statistical analysis of data, factorial completely randomized design was used (Snedecor and Cochran, 1994). The animal care and

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Table 1
Ingredients and nutrients composition of starter and finisher rations

Feed ingredients	Starter ration			Finisher ration		
	T1	T2	T3	T1	T2	T3
Maize (%)	54	27	0	60	30	60
Pearl millet (%)	0	27	54	0	30	0
Soybean meal (%)	32	32	32	20	20	20
Fish meal (%)	8	8	8	10	10	10
Rice polish (%)	3.5	3.5	3.5	7.5	7.5	7.5
Mineral mixture (%)	2.5	2.5	2.5	2.5	2.5	2.5
Feed additives* (g/100kg feed)	340	340	340	340	340	340
Feed cost (Rs./100kg)	1484.38	1484.31	1434.29	1403.96	1403.93	1348.25
Nutrients composition						
Metabolizable energy** (Kcal/kg)	2806.39	2684.89	2563.39	2906.27	2771.27	2636.27
Crude protein (%)	23.05	23.57	24.20	20.05	20.68	20.36
Crude fiber (%)	2.88	3.17	3.48	2.74	3.08	3.43
Ether extract (%)	4.35	4.73	4.91	4.91	5.33	5.75
Total ash (%)	9.38	10.45	10.52	9.61	9.88	9.66
Lysine**	1.30	1.36	1.43	1.26	1.33	1.41
Methionine**	0.58	0.59	0.61	0.60	0.62	0.63

*Feed additives:Spectromix=10g; Spectro BE=20g; Coccidiostat=50g; Choline chloride=50g; Cygro=10g; Lysine=150g; Methionine=50 g.
**Calculated values (Singh and Panda, 1988)

experimental protocol were approved by the Institutional Animal Ethics Committee.

RESULTS AND DISCUSSION

The body weight gain was significantly (P<0.05) lower in control diet as compared to the pearl millet based diets (T2 and T3) during 0-4 and 0-6 weeks period (Table 2). The differences in body weight gain were non-significant (P<0.05) between the treatments T2 and T3, however, the body weight gains were numerically higher in T2 and T3. Kumaravel *et al.* (2006) and Tornekar *et al.* (2009) also reported higher body weight gains in the diets having pearl millet as compared to maize based diets.

Feed intake was significantly higher (P<0.05) in pearl millet based diets (T2 and T3) compared to T1 up to 4th week of age. This might be due to better utilization of smaller particles of feed and less wastage of feed due to ungrinding of pearlmillet grains from the feeders. The feed intake did not differ significantly between 50% and 100% pearl millet based diets. During 4-6 weeks of age, feed intake differed significantly in T2 as compared to T1, whereas it was non-significant between treatments T3 and T1 (Table 2). Tornekar *et al.* (2009) also reported higher feed intake in bajra based diets.

At 4th and 5th week of age, non-significant (P<0.05) difference in FCR was observed among pearl millet based treatments and control. However, at 6th week of age a significant (P<0.05) difference in FCR was observed in T2 and T3 treatments as compared to T1. During 4-6 weeks, significantly (P<0.05) lower FCR was recorded in pearl millet based treatments as compared to control, whereas FCR was non-significantly (P<0.05) different between pearl millet based diets at 50 and 100%. Dry matter retention was higher in diets T2 and T3 as compared to T1. Significant (P<0.05) improvement in percent nitrogen retention was observed in T2 and T3 treatments as compared to T1 (control). Percent gross energy metabolizability was the highest in T1 (67.41%) and the lowest in T3 (67.17%). Slightly lower gross energy metabolizability was observed in pearl millet based diets (T2 and T3) as compared to T1.

The dressed yield, eviscerated yield, drawn yield and giblet yield were non-significant among different treatments and controls (Table 3). There was also non-significant difference in intestinal length, thigh muscle, breast muscle composition, liver, heart, gizzard and intestine weight (% of live weight) among

Table 2
Effect of replacement of maize with pearl millet on growth parameters in commercial broiler chiken

Parameter	Age	Treatments		
		T1	T2	T3
Body weight gain (g/bird)	0-2	237.82±5.60^{a}	268.58±12.46^{b}	264.67±10.12^{b}
	0-3	575.28±11.06^{a}	605.07±9.06^{b}	607.54±8.16^{b}
	0-4	954.90±15.12^{a}	1002.29±20.12^{b}	1014.74±25.42^{b}
	0-5	1448.40±26.10^{a}	1496.16±35.12^{b}	1503.46±41.16^{b}
	0-6	1980.41±0.08^{a}	2072.37±0.06^{b}	2063.13±0.07^{b}
	4-6	1025.51±11.06^{a}	1070.08±12.01^{ab}	1048.39±16.15^{a}
Feed intake (g/bird)	0-2	444.71±4.84^{a}	475.73±7.12^{b}	472.28±9.22^{b}
	0-3	1093.04±11.10^{a}	1123.77±12.14^{b}	1123.73±13.12^{b}
	0-4	1833.02±17.14^{a}	1919.33±20.06^{b}	1947.03±19.04^{b}
	0-5	2846.92±35.66^{a}	2929.26±45.93^{b}	2957.73±60.16^{b}
	0-6	4011.77±121.22^{a}	4120.94±107.61^{b}	4103.24±121.42^{b}
	4-6	2178.75±28.08^{ab}	2201.61±30.03^{b}	2156.21±35.14^{a}
Feed conversion ratio	0-2	1.86±0.04^{b}	1.77±0.08^{a}	1.78±0.19^{a}
	0-3	1.90±0.06^{b}	1.85±0.04^{a}	1.84±0.11^{a}
	0-4	1.92±0.27	1.91±0.14	1.92±0.17
	0-5	1.97±0.05	1.96±0.18	1.97±0.16
	0-6	2.02±0.12	1.98±0.17	1.98±0.22
	4-6	2.12±0.03^{b}	2.05±0.11^{a}	2.05±0.08^{a}

Means bearing different superscripts in a row differ significantly (P<0.05). T1=Maize based diet; T2=50% maize replaced with pearl millet; T3=100% maize replaced with pearl millet

Table 3

Effect of dietary treatments on digestibility of nutrients, carcass characteristics and economics of feeding

Parameter	Treatments		
	T1	T2	T3
Dry matter retention (%)	69.24±1.56[a]	72.68±2.18[ab]	73.70±0.34[b]
Nitrogen retention (%)	59.22±0.48[a]	61.32±0.61[ab]	61.46±0.18[b]
Gross energy metabolizability (%)	67.41±0.06[a]	67.10±0.40[a]	67.17±0.45[a]
Dressed yield (% live wt.)	70.82±0.78[a]	71.44±0.44[a]	70.52±0.48[a]
Eviscerated yield (% live wt.)	60.04±0.28[a]	60.25±0.22[a]	58.94±0.29[a]
Drawn yield (% live wt.)	66.04±0.14[a]	66.62±0.14[a]	65.04±0.06[a]
Giblet yield (% live wt.)	5.80±0.06[a]	6.15±0.04[a]	5.74±0.16[a]
Heart (% live wt.)	0.64±0.01[a]	0.62±0.01[a]	0.66±0.05[a]
Liver (% live wt.)	2.84±0.05[a]	2.72±0.02[a]	2.70±0.06[a]
Gizzard (% live wt.)	2.24±0.06[a]	2.54±0.08[a]	2.48±0.02[a]
Intestinal Weight (% live wt.)	3.64±0.02[a]	3.92±0.05[a]	5.30±1.43[a]
Intestinal length (cm/100g live wt.)	8.50±0.81[a]	9.04±0.26[a]	9.40±0.19[a]
Thigh muscles			
Moisture%	71.22±0.08	70.85±0.14	70.02±0.10
Crude Protein%	19.03±0.06	19.43±0.22	19.42±0.08
Fat%	7.03±0.16	7.22±0.11	7.17±0.24
Breast muscles			
Moisture%	70.62±0.08	72.42±0.20	72.38±0.06
Crude Protein%	19.20±0.23	20.15±0.14	19.90±0.16
Fat%	6.58±0.24	6.82±0.10	6.68±0.15
Economics (Rs)			
Total production cost*	75.82	76.40	75.63
Gross return**	99.02	103.61	103.15
Profit	23.20	27.21	27.52
Relative profit or loss/bird***	-	4.01	4.32

Means bearing different superscripts in a row differ significantly (P<0.05). T1=Maize based diet; T2=50% maize replaced with pearl millet; T3=100% maize replaced with pearl millet; *Production cost includes chick cost and total feed cost; **Bird sold @ Rs.50/kg live weight; ***Profit or loss in comparison to maize based diet

various treatments (Table 3). The relative profit (Rs) as compared to control (T1) were higher in treatments T3 (4.32) and T2 (4.01) at 100 and 50% replacement level of maize with pearl millet. Higher relative profits in pearl millet based diets were due to its' lower market price, higher body weight gains and less cost of grinding. Rama Rao *et al.* (2002) and Elangovan *et al.* (2003) also reported that feed cost per unit gain was less in pearl millet based diets as compared to maize-soybean based diet.

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