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Research Article

EFFECT OF REPLACING MAIZE WITH PEARL MILLET ON THE PERFORMANCE AND NUTRIENTS UTILIZATION IN BROILER CHICKS

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ABSTRACT

The study was conducted to examine the effect of replacing maize with pearl millet on performance and utilization of nutrients in broiler chicks. Two hundred and eighty, day-old broiler chicks were randomly divided in seven treatments (T1-T7) with two replicates in each. Maize based starter (0-4 weeks) and finisher (0-4 weeks) rations were formulated as control. Other rations were: T2 (33.3% maize replaced with ground pearl millet), T3 (66.6% maize replaced with ground pearl millet), T4 (100% maize replaced with ground pearl millet),T5 (33.3% maize replaced with unground pearl millet), T6 (66.6% maize replaced with unground pearl millet) and T7 (100% maize replaced with unground pearl millet). Body weight gain at 42 days was significantly (P<0.05) lower in T7 (1629.76 g) and T4 (1691.05 g) treatments, respectively as compared to control (T1;1827.59 g). Similarly, significantly (P<0.05) lower feed intake was observed in T7 (3575 g) and T4 (3630.50 g) treatments as compared to control (3850 g). The feed conversion ratio was significantly (P<0.05) poor in T4 and T7 treatments irrespective of the physical form of pearl millet as compared to T1. Dry matter metabolizability (%) decreased significantly (P<0.05) in T7 (61.92) as compared to T1 (64.35). Gross energy metabolizability (%) decreased (P<0.05) in T7 (67.28) as compared to T1 (68.93). Percent calcium and phosphorus retention in different dietary treatments was not affected by the replacement of maize with different levels of pearl millet irrespective of grain form.

Key words: Pearl millet, performance, gross energy metabolizability, broiler chicks

There is a huge gap between demand and availability of poultry feed (Anon, 2009). Efforts have been made in the past to utilize cereals such as sorghum, finger millet and pearl millet as a source of energy in poultry rations to replace maize. Pearl millet provides food, feed, stover (dry straw) and fuel to millions of poor farmers and their livestock (Khairwal *et al.*, 2009). It grossly resembles maize in proximate composition except for slight variation in protein, linoleic acid and minerals (NRC, 1994). Compared to maize on dry matter basis, pearl millet has higher protein, fat and better essential amino acids balance because of large embryo size and low yields (Khatri, 2009). Feeding trials have shown that pearl millet can replace maize as an energy source without altering performance and nutrients utilization (Kumaravel *et al.*, 2006). Hence, the present study was undertaken to observe the effect of replacing maize with pearl millet on the performance and utilization of nutrients in broiler chicks.

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MATERIALS AND METHODS

An experiment was conducted on 280, day-old broiler chicks for a period of six weeks. The birds were randomly divided in seven groups having two replicates and 20 birds in each. The diets were formulated for starter (0-4 weeks) and finisher phase (4-6 weeks) separately. Maize based control diet (Table 1) was formulated as per BIS (1992). In diets T2, T3 and T4; maize was replaced with 33.3%, 66.6% and 100% ground pearl millet and in diets T5, T6 and T7; maize was replaced with 33.3%, 66.6% and 100% unground pearl millet, respectively (Table 1). Grinding of pearl millet was done through a 2 mm sieve size. The birds were weighed individually at biweekly intervals and the body weight gain was calculated. The biweekly record of feed offered and residual amount was maintained to calculate intake per bird. Feed conversion ratio (FCR) was calculated as the ratio of total feed consumed (g) to total body weight gain (g). A metabolic trial was conducted during 6th week of

Table 1

Ingredients and chemical composition of starter (0-4 wks) and finisher (5-6 wks) diets fed to commercial broiler chicks

Feed ingredients	Starter diet							Finisher diet						
	T1	T2	T3	T4	T5	T6	T7	T1	T2	T3	T4	T5	T6	T7
Maize (kg)	52	34.66	17.34	-	34.66	17.34	-	59	39.34	19.66	--	39.34	19.66	--
Ground pearl millet (kg)	-	17.34	34.66	52	-	-	-	--	19.66	39.34	59	--	--	--
Whole pearl millet (kg)	-	-	-	-	17.34	34.66	52	--	--	--	--	19.66	39.34	59
Soybean meal (kg)	32	32	32	32	32	32	32	21	21	21	21	21	21	21
Fish meal (kg)	9	9	9	9	9	9	9	10	10	10	10	10	10	10
Rice polish (kg)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5
Mineral mixture*	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Total (kg)	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Feed additives** (g/100kg feed)	350	350	350	350	350	350	350	350	350	350	350	350	350	350
Feed cost (Rs./100kg)	1876.98	1829.62	1782.33	1734.38	1828.42	1779.93	1731.38	1753.68	1699.83	1645.92	1594.48	1698.63	1643.52	1591.48
Chemical Composition(DM basis)														
ME*** (Kcal/kg)	2800.36	2720.84	2632.35	2561.76	2720.84	2632.35	2561.76	2900.88	2810.64	2720.31	2630.07	2810.64	2720.31	2630.07
Crude protein (%)	23.02	23.33	23.64	23.96	23.33	23.64	23.96	20.01	20.32	20.66	21.02	20.32	20.66	21.02
Crude fiber (%)	2.81	2.99	3.18	3.36	2.99	3.18	3.36	2.91	3.13	3.33	3.54	3.13	3.33	3.54
Ether extract (%)	4.33	4.46	4.59	4.74	4.46	4.59	4.74	4.69	4.85	5.01	5.16	4.64	4.58	4.52
Total ash (%)	6.86	6.90	6.95	7.01	6.90	6.95	7.01	6.99	7.04	7.10	7.16	7.04	7.10	7.16
Calcium (%)	-	-	-	-	-	-	-	1.69	1.75	1.78	1.80	1.75	1.78	1.80
Phosphorus (%)	-	-	-	-	-	-	-	0.81	0.84	0.85	0.87	0.84	0.85	0.87
Lysine*** (%)	1.21	1.25	1.29	1.34	1.25	1.29	1.34	1.02	1.06	1.12	1.16	1.06	1.12	1.16
Methionine***(%)	.44	.45	.46	.47	.45	.46	.47	.40	.41	.42	.43	.41	.42	.43

*Mineral mixture had moisture max. 3%, calcium min. 32%, Phosphorus min. 6%, manganese min., 0.27%, iodine min. 0.01%, zinc min. 0.26%, Fluorine max. 0.03%, copper min. 0.001% and iron min. 0.001%; **Feed additives included vitamin mixture-10g (Each g contained vitamin A-82, 500 IU, vitamin D_3-12,000 IU, vitamin- B_2-50mg and vitamin K-10mg.) , vitamin & EAA mixture- 20g (Each g contained vitamin B_1-80mg, vitamin B_6-16 mg, Niacin-120mg vitamin B_{12}-80 mg, calcium pantothenate-80mg,vitamin E-160mg, L-LysineHCl-l0mg, DL-Methionine- l0mg and calcium-260mg.), coccidiostat-50g, choline chloride-50g, lysine-50g, methionine-150g; ***Calculated values

growth period to study the balance of dry matter, nitrogen, calcium, phosphorus and energy metabolizability. Nitrogen corrected metabolizable energy (MEn) was worked out by using the equation given by Hill and Anderson (1958). Four birds from each treatment were randomly selected and transferred to metabolic cages and fed individually. A preliminary period of three days was provided for adaptation of the birds to the new system of housing and management, followed by a collection period of three days. The data was statistically analyzed using completely randomized design as described by Snedecor and Cochran (1994). Analysis of variance was used to study the differences among treatment means and compared by using Duncans Multiple Range Test as modified by Kramer (1956). The animal care and experimental protocol were approved by the Institutional Animal Ethics Committee.

RESULTS AND DISCUSSION

The data pertaining to average body weight gain of chicks, feed intake and FCR in different dietary treatments during various growth periods are presented in Table 2. Perusal of data indicated that at 6th week of age, the body weight gain was significantly (P<0.05) lower in the T7 (1629.76 g) and T4 (1691.05 g) groups as compared to the control group (1827.59 g) which may be due to reduced feed intake due to replacement of maize with pearl millet at 100% level. Significantly (P<0.05) lower feed intake was observed in the T4 and T7 groups as compared to the control group. Non-significant difference in feed intake was observed in pearl millet based diets irrespective of the physical form upto 66.6% replacement level as compared to the control. These results are in conformity with Jha (2005) and Gupta and Kishore (2006). Korane *et al*. (1996) and Reddy *et al*. (2008) recommended 50% replacement of maize with pearl millet and sorghum, respectively.

The FCR was non-significantly different in pearl millet based diets as such and ground upto 66.6% replacement level as compared to the control. At six weeks of age, higher FCR was observed in T7 and T4 as compared to T1 (Table 2). The FCR was significantly (P<0.05) higher in 100% pearl millet based diets as such and ground as compared to T1. High FCR was probably due to somewhat lower growth rate in these groups. The results of our study are in conformity with those of Mandal *et al.* (2004). Contrary to our findings, Jha and Kumar (2008) reported no effect on FCR by complete replacement of maize with pearl millet.

Dry matter metabolizability decreased significantly (P<0.05) in T7 as compared to T1 and other treatments (Table 3). However, there was no difference among T2, T3, T4, T5 and T6 treatments. Further it was found that there was no effect of physical form of pearl millet upto 66.6% replacement. Similarly, nitrogen retention also decreased significantly (P<0.05) in T7 as compared to T1 treatment. There was no difference in nitrogen retention among pearl millet based treatments upto 66.6% with or without grinding. It was clear from the data that to utilize 100% pearl millet based diets, grinding may be required. The gross

Table 2

Effect of feeding pearl millet on growth response of commercial broiler chicks

Treat-ments	Period (weeks)					
	Body weight gain (g/bird)		Feed intake (g/bird)		Feed conversion ratio	
	0-4	0-6	0-4	0-6	0-4	0-6
T1	932.4^{a}+27.62	1827.6^{a}+10.79	1790.0^{a}+50.0	3850.0^{a}+100.0	1.91^{c}+0.01	2.10^{bcd}+0.02
T2	936.1^{a}+28.65	1833.9^{a}+14.02	1785.0^{a}+10.0	3815.0^{a}+15.0	1.89^{c}+0.01	2.08^{cd}+0.01
T3	935.9^{a}+1.10	1831.0^{a}+5.21	1762.5^{a}+40.5	3772.5^{a}+20.5	1.88^{c}+0.01	2.06^{d}+0.07
T4	842.8^{b}+3.06	1691.1^{b}+8.51	1692.5^{b}+15.5	3630.5^{b}+20.5	2.00^{b}+0.03	2.14^{abc}+0.04
T5	931.9^{a}+14.63	1824.1^{a}+56.02	1772.0^{a}+20.0	3830.0^{a}+60.0	1.90^{c}+0.04	2.09^{bcd}+0.02
T6	926.9^{a}+38.64	1823.5^{a}+4.81	1757.1^{a}+50.5	3790.5^{a}+40.5	1.89^{c}+0.01	2.07^{d}+0.04
T7	831.5^{b}+4.87	1629.8^{b}+11.36	1685.0^{b}+10.0	3575.0^{b}+25.0	2.07^{a}+0.02	2.18^{a}+0.01

Means bearing different superscripts in a column differ significantly (P< 0.05), T1= Mazed based control diet; T2=33.3% maize replaced with ground pearl millet; T3=66.6% maize replaced with ground pearl millet; T4=100% maize replaced with ground pearl millet; T5=33.3% maize replaced with unground pearl millet; T6=66.6% maize replaced with unground pearl millet; T7=100% maize replaced with unground pearl millet.

Table 3

Effect of feeding pearl millet on the nutrient utilization and metabolizability in broiler chicks

Treat-ments	Dry matter metaboli-zability	Nitrogen retention	Calcium retention	Phosphorus retention	Gross energy of feed (Kcal/kg)	Gross energy of excreta (Kcal/kg)	MEn (Kcal/kg)	Gross energy metaboli-zability (%)
T1	$64.35^{a}\pm3.05$	$62.11^{a}\pm1.01$	45.52 ± 1.50	56.05 ± 1.45	4215	$3113^{abcd}\pm0.79$	$2905^{ab}\pm5.10$	$68.93^{a}\pm2.02$
T2	$66.16^{a}\pm2.40$	$62.70^{a}\pm3.60$	46.50 ± 0.70	57.95 ± 1.25	4105	$3112^{abcd}\pm0.90$	$2899^{ab}\pm11.90$	$70.62^{a}\pm3.02$
T3	$64.09^{a}\pm3.25$	$62.57^{a}\pm2.25$	46.15 ± 2.35	58.45 ± 1.15	4101	$3088^{bcd}\pm0.50$	$2830^{d}\pm5.35$	$69.00^{a}\pm1.05$
T4	$64.55^{a}\pm2.20$	$60.84^{ab}\pm3.03$	45.05 ± 2.45	57.05 ± 2.25	4189	$3109^{abcd}\pm0.50$	$2922^{a}\pm10.50$	$69.76^{a}\pm2.05$
T5	$63.62^{a}\pm3.10$	$62.62^{a}\pm1.05$	44.90 ± 1.60	57.65 ± 2.45	4118	$3053^{d}\pm0.15$	$2877^{c}\pm13.60$	$69.26^{a}\pm3.01$
T6	$63.71^{a}\pm1.02$	$62.63^{a}\pm2.02$	45.70 ± 2.20	58.25 ± 1.35	4099	$3113^{abcd}\pm0.45$	$2790^{c}\pm10.80$	$68.95^{a}\pm2.04$
T7	$61.92^{b}\pm2.25$	$59.13^{b}\pm3.10$	44.85 ± 1.05	55.40 ± 0.10	4025	$3091^{bcd}\pm1.99$	$2784^{c}\pm6.03$	$67.28^{b}\pm2.73$

Means bearing different superscripts in a column differ significantly ($P< 0.05$); MEn = Nitrogen corrected metabolizable energy; T1= Maize based control diet; T2=33.3% maize replaced with ground pearl millet; T3=66.6% maize replaced with ground pearl millet; T4=100% maize replaced with ground pearl millet; T5=33.3% maize replaced with unground pearl millet; T6=66.6% maize replaced with unground pearl millet; T7=100% maize replaced with unground pearl millet.

energy (GE) metabolizability was the highest in T2 group (70.62%) and the lowest in T7 group (67.28%). GE metabolizability decreased ($P<0.05$) in T7 (67.28) treatment as compared to T1. The lower GE metabolizability in T7 was might be due to the presence of anti- metabolites in pearl millet (Sodipo and Arinze, 1985). Similar findings were also reported by Raju *et al*. (2003). Percent calcium and phosphorus retention in different dietary treatments was not affected due to replacement of maize with pearl millet. These findings are in agreement with those of Rama Rao *et al*. (2004) and Mandal *et al*. (2004). Thus it can be concluded that maize may be replaced upto 66.6% with ground or unground pearl millet without affecting the performance in commercial broiler chicks.

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