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Effect of graded replacement of maize by paddy on carcass quality traits of broilers

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Abstract
This experiment was planned to evaluate the effect of graded replacement of maize by paddy on the carcass quality traits of broilers. In this experiment 108 day old chicks were randomly distributed into 06 dietary treatments where treatment one (T_1) acted as control. The control diet contained 2800Kcal ME/kg and 22% CP and remaining 05 treatments, T2, T3, T4, T5 and T6 were formulated using 20, 40, 60, 80 and 100% paddy, respectively, replacing maize in the diet. Use of graded levels of paddy replacing maize produced significant effect on carcass traits of broilers. Maximum and significantly ($p<0.05$) higher dressed weight (%) was observed in groups contained 40, 60 and 80% paddy instead of maize. While, maximum eviscerated and drawn weight (%) was observed in the groups with 40 and 60% paddy replacing maize. No specific trend was recorded in organs weights of broilers. Most of the processing losses (Blood, head, shank & wing tips as well as total losses) were minimum in broilers assigned control diet.

Keywords: paddy, maize, broiler, graded, carcass traits

1. Introduction
The urgency of the world food problem has presented a challenge to nutritionist to investigate the possibilities of utilizing other potential energy sources because, the major portion of the maize crop is diverted for other purposes such as bio fuel, brewery and starch industries and human consumption. One of the cheap energy sources available for replacing maize in poultry ration is paddy.

Paddy which is available in rural areas at bulk in economical rates where can be alternate to maize. Because it is available with the farmers and they have not to purchase from the market which adds to the price of commodity. Further, if they will purchase rice bran/ rice polish, they will get it at higher price from market. Still more, rice polish purchased from the market is mostly adulterated as a result it contains less amount of fat and high amount of fibre. Hence, use of paddy can be an economical alternate to maize (Sheikh, 2009) [10].

Paddy seed (*Oryza sativa*) contains a rough, hard and woody outer covering (husk) which make, paddy as such inedible. During milling process several by-products viz. rice hulls, rice bran, rice polish and broken rice are available. These ingredients are used as energy source other than maize in poultry ration. Rice kani and rice bran has lower nutritive value than maize. Rice polish has better nutritive value, especially energy than rice bran. Paddy on an average contains 7-8% crude protein, 12-14% crude fibre, 2-3% ether extract, 74-75% NFE, 36-38% available carbohydrates and is a good source of energy (Sikka, 1990) [11]. The steeply increasing price of maize, and its less production and availability to livestock feed has created increased interest in alternate feedstuffs for broiler feeding.

In our effort at revealing the potentials of paddy which could replace popular energy source like maize in broiler ration, we report in this work utilization of paddy by replacing maize at particular levels in broiler rations with respect to carcass quality traits of broilers.

2. Materials and methods
2.1 Location and Place of work: The experiment was conducted in the Department of Animal Nutrition, College of Veterinary Science & Animal Husbandry, NDVSU, Jabalpur (M.P.).

2.2 Experiment: The experiment was planned to evaluate the response of broiler chickens to use of paddy instead of maize at graded level with reference to carcass quality traits. Experiment was conducted for a period of five weeks.

2.3 Housing: The experimental chicks were reared in the battery brooder house. Randomly distributed chicks were placed in separate tiers of the battery brooders in order to provide equal floor space for each replicate. Separate feeder, waterer and faecal tray, were used in this experiment. The battery brooders were kept side by side in clean well ventilated room. Provision was also made for the supply of light.

2.4 Experimental Diet: Diets were formulated as per ICAR (1998) [7] feeding standards. Control diet (T_1) was containing 2800 Kcal ME/kg and 22% CP for 5 weeks (Table-01). Rest of the diets were formulated using whole paddy instead of maize @ 20%, 40%, 60%, 80% and 100% by weight (Table - 02). Mineral mixture was added @ 3% of the diet.

Table 1: Composition of broiler control diet.

Ingredients	Control diet (T_1)
Maize	59.50%
Soybean meal (SBM)	37.00%
Mineral mixture (MM)	03.00%
Methionine	00.50%
Vitamin (B complex)	+
Total	100.00%

Table 2: Dietary treatments

S. No.	Treatment groups	Treatment given
1.	T1 (control)	Formulated as per ICAR (1998) specifications (Table-01)
2.	T2	Control diet (T_1) + 20% paddy instead of maize.
3.	T3	Control diet (T_1) + 40% paddy instead of maize.
4.	T4	Control diet (T_1) + 60% paddy instead of maize.
5.	T5	Control diet (T_1) + 80% paddy instead of maize.
6.	T6	Control diet (T_1) + 100% paddy instead of maize.

2.5 Experimental birds: Duly vaccinated against Marek's disease broiler chicks were purchased from the reputed hatchery. Out of which, 108 chicks were selected for experiment. During the experiment, all the chicks were vaccinated against Ranikhet disease (F1 strain), IBD and Ranikhet disease (Lasota strain).

2.6 Experimental designs: The design of experiment was completely randomized design. All the day old broiler chicks were individually weighed at the start of the experiment and 108 birds of identical weight were selected. The chicks were randomly assigned to various groups so that weight of the chicks in any two groups did not differ significantly ($p<0.05$). Overall, there were six treatments. Each treatment consisted of three replicates of six chicks in each replicate.

2.7 Feeding and watering- The feed was offered ad-libitum in feeders. All mash system of feeding was practiced during the experiment. Fresh and clean drinking water was made available to birds all the time. Thus, in the entire study uniform condition of housing, brooding, feeding and watering was maintained for all the groups of the experiment.

2.8 Measurement and observations- The following observations were recorded for the evaluation of carcass traits of broilers during the experimental period –

To study the carcass traits, two representative broilers from each replicate were slaughtered at the termination of experiment. Broilers were kept off feed for 12 hours before slaughter. During this period they were provided clean and fresh drinking water ad libitum.

Before slaughter, each broiler was weighed. By giving severe cut to the jugular vein, it was killed and allowed to bleed completely. For the complete bleeding, birds were hanged in inverted position on the iron rails. After complete bleeding, weight was recorded. The weight was again recorded after manual de-feathering using hot water (50-55ºC). Head, shank and wing tips were removed by giving cuts at atlanto-occipital, hock and knee joints, respectively and their weights were recorded. The dressed weights were recorded as follows:

Dressed weight = Live weight – Weight loss as blood, feathers, head, shank and wing tips.

After recording the dressed weight, a horizontal cut was applied posterior to keel bone. Breast was pushed forward to expose the viscera, which was then pulled out. Weight of the carcass was again recorded. Visceral organs like liver, heart, gizzard, spleen and pancreas were separated. The contents of gizzard were removed and epithelial linings were detached. Individual weights of the organs were taken. The eviscerated and drawn weights were calculated as below:

Eviscerated weight = Dressed weight – Weight of viscera

Drawn weight = Eviscerated weight + Weight of giblet (Liver, heart, gizzard)

Various processing losses such as blood, head, feather, shank and wing tips were also recorded.

2.9 Statistical analysis: Data obtained during the experiment were analyzed statistically using the methods described by Snedecor & Cochran (1980) [12]. Differences among the treatments were tested for significance by Duncan's New Multiple Range Test (1955) [3].

3. Results and discussion

3.1 Carcass yield (% live weight) of broilers

Effect of varying levels of paddy on the percent carcass yield of broilers is presented in Table 03. Dressed weight was significantly ($p<0.05$) higher in broilers assigned T_4 diet and it was significantly lower in groups allotted T_2 diet. Broilers assigned T_3, T_4 and T_5 diet had statistically similar dressed weight. The eviscerated weight was maximum in T_4 and T_3 groups, followed by T_5 and T_1 groups. It was minimum in those assigned T_2 diet. The percent drawn weight was maximum in broilers assigned T_3 diet and was significantly lower in those assigned T_2 diet.

Table 3: Effect of graded levels of paddy replacing maize on carcass yield (% live weight) of broilers

Treatments	Dressed weight (%)	Eviscerated weight (%)	Drawn weight (%)
T_1	78.37^{b}±0.58	73.46^{c}±0.43	78.24^{b}±0.37
T_2	77.47^{b}±0.51	70.55^{e}±0.29	76.51^{d}±0.48
T_3	80.30^{a}±0.32	75.58^{a}±0.28	79.92^{a}±0.11
T_4	80.41^{a}±0.41	75.93^{a}±0.56	79.73^{a}±0.19
T_5	79.69^{a}±1.03	74.76^{b}±0.49	78.64^{b}±0.15
T_6	78.63^{b}±0.48	71.73^{d}±0.22	77.54^{c}±0.18
CD	1.51	1.01	0.71

Means bearing different superscript differ significantly ($p<0.05$)

Effect of varying levels of paddy indicated that use of 20% and 100% paddy instead of maize did not influence the dressed weight (Table 03) but incorporation of 40%, 60% and 80% paddy increased it significantly ($p<0.05$). Filgueira *et al.* (2014) [4] and Cancherini *et al.* (2008) [2] found no significant effects of dietary broken rice inclusion on broiler carcass yield. While, the eviscerated as well as drawn weights reduced with diet having 20% incorporation of paddy instead of maize but further inclusion of 40% and 60% paddy increased those weights significantly ($p<0.05$). Complete replacement of maize with paddy reduced the eviscerated and drawn weights significantly ($p<0.05$). Rama Rao *et al*. (2003) [9] reported that replacement of maize with pearl millet at different levels did not influence the carcass traits. Berwal *et al*. (2008) [1] observed that crude fibre level did not affect dressed, eviscerated, giblet and drawn yield.

3.2 Organs weight of broilers

Effect of varying levels of paddy instead of maize on the organs weight of broilers is furnished in Table 04. Maximum and significantly ($p<0.05$) higher weight of heart was recorded in broilers assigned T_2 diet. However, it was statistically similar ($p>0.05$) with those assigned T_3 diet. Significantly ($p<0.05$) lower weight of heart was noted in broilers assigned T_1 diet. The weight of gizzard, liver and giblet was maximum and significantly ($p<0.05$) higher in broilers assigned T_6 diet. The weights of spleen and pancreas were significantly higher in broilers allotted T_2 diet. Minimum and significantly ($p<0.05$) lower weights of heart, liver and giblet were observed in groups assigned T_1 diet. While, gizzard and spleen with T_3 diet and pancreas with T_5 diet were recorded.

Table 4: Effect of graded levels of paddy replacing maize on organ weight (% live weight) of broilers

Treatments	Heart	Gizzard	Liver	Spleen	Pancreas	Giblet
T_1	0.36^{d}±0.00	1.83^{d}±0.01	2.03^{f}±0.01	0.15^{a}±0.01	0.23^{b}±0.01	4.22^{e}±0.01
T_2	0.56^{a}±0.00	2.07^{b}±0.01	2.37^{c}±0.00	0.16^{a}±0.01	0.29^{a}±0.01	5.00^{b}±0.00
T_3	0.56^{a}±0.01	1.81^{d}±0.01	2.19^{e}±0.01	0.11^{b}±0.00	0.23^{b}±0.01	4.56^{d}±0.01
T_4	0.52^{b}±0.01	1.82^{d}±0.01	2.44^{b}±0.02	0.16^{a}±0.01	0.21^{b}±0.01	4.78^{c}±0.02
T_5	0.48^{c}±0.01	1.99^{c}±0.02	2.28^{d}±0.01	0.12^{b}±0.00	0.12^{b}±0.01	4.75^{c}±0.01
T_6	0.53^{b}±0.00	2.41^{a}±0.02	2.54^{a}±0.01	0.16^{a}±0.01	0.28^{a}±0.01	5.48^{a}±0.01
CD	0.01	0.04	0.02	0.02	0.02	0.03

Means bearing different superscript differ significantly ($p<0.05$)

Use of varying levels of paddy instead of maize (Table 04) revealed that with control diet only spleen weight was significantly higher. While, heart, spleen and pancreas weights were significantly ($p<0.05$) higher with T_2 diet. Weight of gizzard, liver, spleen, pancreas and giblet were maximum with diet containing 100% paddy instead of maize. Nanto *et al*. (2012) [8] reported reduced gizzard weight as the substitution of corn by broken rice and de-hulled paddy rice.

In comparison to control, weight of giblet was significantly ($p<0.05$) higher with paddy diets. Gonzalez-Alvarado *et al*. (2007) [6] reported that the relative weight of the gizzard and total tract apparent retention of nutrients were more pronounced in rice diets than for corn diets. Gen (2007) [5] also observed no significant negative effect on organ development in broiler chicken when maize was completely replaced by paddy grain.

3.3 Processing losses of broilers

Effect of varying levels of paddy on the processing losses of broilers is given in Table 05. Treatment means of the processing losses indicated that blood, feather, shank and wing tips losses were maximum and significantly ($p<0.05$) higher in broilers assigned T_5, T_3 and T_6 diets, respectively. While, loss due to head as well as total loss was maximum and significantly ($p<0.05$) higher in broilers allotted T_2 diet. Most of the losses (Blood, head, shank & wing tips as well as total losses) were minimum in broilers assigned T_1 diet. While, feather loss was minimum in those allotted T_6 diet. Increase in the level of paddy in the diet produced inconsistent effect on the blood loss. While, feather losses mostly reduced due to use of paddy instead of maize in the diet. Other organs usually showed inconsistent effect of varying levels of paddy on their weights. Total loss was not much variable among different treatments. It ranged from 19.06% to 21.72%. Maximum loss was recorded with T_2 diet while it was minimum with T_1 diet.

Table 5: Effect of graded levels of paddy replacing maize on processing losses (% live weight) of broilers

Treatments	Blood	Feather	Head	Shank & wing tips	Total
T_1	$4.90^{c}\pm0.02$	$5.99^{a}\pm0.02$	$2.73^{e}\pm0.01$	$5.44^{f}\pm0.02$	$19.06^{e}\pm0.03$
T_2	$6.03^{a}\pm0.02$	$5.63^{c}\pm0.02$	$3.72^{a}\pm0.02$	$6.34^{b}\pm0.01$	$21.72^{a}\pm0.03$
T_3	$5.64^{b}\pm0.02$	$5.03^{a}\pm0.01$	$2.94^{c}\pm0.01$	$6.13^{c}\pm0.01$	$20.74^{b}\pm0.03$
T_4	$4.92^{c}\pm0.02$	$5.71^{b}\pm0.01$	$2.81^{d}\pm0.01$	$6.02^{d}\pm0.01$	$19.46^{d}\pm0.02$
T_5	$6.03^{a}\pm0.01$	$5.42^{d}\pm0.02$	$2.83^{d}\pm0.01$	$5.97^{e}\pm0.01$	$20.25^{c}\pm0.02$
T_6	$5.90^{a}\pm0.01$	$5.40^{d}\pm0.01$	$3.01^{b}\pm0.01$	$6.50^{a}\pm0.02$	$20.81^{b}\pm0.02$
CD	0.04	0.04	0.03	0.03	0.07

Means bearing different superscript differ significantly ($p<0.05$)

Effect of varying levels of paddy on the processing losses (Table 05) revealed that in comparison to control diet use of varying levels of paddy reduced the feather losses but increased the head, shank and wing tip losses. While, there were increasing and decreasing trend in blood loss. Gradual increase in the level of paddy did not show any specific trend on the processing losses. However, no work has been reported in this context.

4 Conclusion

Based on the present findings, paddy can be considered a potential substitute of maize in broiler diets. Use of graded levels of paddy replacing maize produced significant effect on carcass traits. Maximum and significantly ($p<0.05$) higher dressed weight (%) was observed in groups contained 40, 60 and 100% paddy instead of maize. While, maximum eviscerated and drawn weight (%) was observed in the groups with 40 and 60% paddy replacing maize. No specific trend was recorded in organs weights of broilers. Most of the processing losses (Blood, head, shank & wing tips as well as total losses) were minimum in broilers assigned control diet.

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