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Effect of different cereals on the performance of White Pekin ducks during second year of laying under intensive rearing system

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ABSTRACT

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White Pekin ducks (45) in second year of laying (53 weeks) were divided into three groups with three replicates in each group and each replicate had five ducks. Three diets with wheat (W100BR0), wheat plus broken rice (W50BR50) and broken rice (W0BR100) were prepared and offered randomly to the above groups for a period of 20 weeks followed by a metabolism trial of 4-d collection period on six birds from each group. All the diets were iso-nitrogenous and iso-caloric. The dry matter intake was similar among the groups. The metabolisability (%) of DM, OM, CP, EE and CF in group W50BR50 was higher than W0BR100, but both were similar to W100BR0. The nitrogen balance in W50BR50 group was higher than W0BR100 group, but was similar to W100BR0 group. The total feed intake, egg production, DDEP%, FCR (feed consumed in kg per dozen egg production) was similar among the groups. The cost (Rs.) per egg in W0BR100 was lower than W100BR0 and W50BR50. The egg weight, egg shape index, albumen index, yolk index, Haugh unit albumen% and yolk% were similar among the groups. The percentage of shell weights in W0BR100 group was significantly lower than the W100BR0 group; but both the values were similar with W50BR50 group. It can be concluded that White Pekin ducks can be raised on exclusive wheat or broken rice based diets during second year of laying under intensive rearing system; however, mixture of wheat and broken rice in equal ratio increased the metabolisability of the nutrients of the feed.

Keywords: Cereals, Ducks, Egg, Rice, Metabolisability, Nutrient, Wheat, White Pekin

INTRODUCTION

The total egg production in India in 2018-19 was 103.32 billions and has increased by 8.5% over the previous year. The contribution (1.15%) of ducks in the total egg production of the country is next to chicken (Anonymous, 2019). Nowadays, exceptional importance is being provided to duck farming as there are many advantages of duck rearing over chicken such as large sized eggs, early morning egg laying, hardiness to diseases, suitable for integrated farming, survivability in moist land, suitable for backyard farming, easily tamed, long production year, etc. White Pekin ducks can be reared in backyard with supplementation of locally available feed ingredients in rural areas for both egg & meat production (Naik *et al.*, 2020a, b; Naik *et al.*, 2022a, b). Broken rice or rice kani is a predominant locally available feed ingredient in coastal areas of the country. Further, as wheat cost is increasing extremely, duck farmers prefer to use locally available broken rice in place of wheat for feeding their birds. Therefore, a study was conducted to find out the effect of feeding different cereals on the performance of White Pekin ducks during the second year laying under intensive rearing system.

MATERIALS AND METHODS

White Pekin female ducks (45) in second year of laying (53 weeks) were randomly divided into three groups. Each group had three replicates with five ducks in each. Three isonitrogenous and isocaloric experimental diets with wheat ($W_{100}BR_0$), wheat plus broken rice ($W_{50}BR_{50}$), and broken rice (W_0BR_{100}) were prepared (Table 1). Each diet was offered *ad libitum* to one group of birds at random as per the suggested practical nutrient requirement levels for an age group of 20-72 weeks (Singh and Panda, 1996). During the experiment, the ducks were reared on deep litter system following the standard management practices. During the feeding trial, a metabolism trial with 4-d collection period was conducted on six birds from each group (two birds from each replicate) in individual cages. During the trial, a known quantity of feed was offered to each bird daily and the residues left were measured. The faeces voided over 24 h periods were collected quantitatively on each day. On daily basis, aliquots of excreta were made separately after mixing it well for dry matter and nitrogen estimations. For dry matter estimations, the faecal samples were dried in hot air oven at 70^{o}C for 72 h (Sahoo *et al.*, 2014). For faecal nitrogen estimations, samples were preserved in 25% sulphuric acid in duplicate (Pathak and Kamra, 1999). The samples of feeds, residues, and faeces were analyzed for proximate principles following standard procedures (AOAC, 1997). The metabolisability of the nutrients was calculated as the difference between nutrient intake and nutrient voided. The data on feed intake and egg production were recorded daily; while the live

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weights were recorded weekly. For external egg quality parameters, weight, length, and width of the egg were recorded weekly and the egg shape index was calculated. For internal egg quality parameters, percent of albumen, yolk, shell, shell thickness; and length, width, and height of albumen and yolk were recorded weekly; and albumen index, yolk index, and Haugh unit were calculated. The external egg quality parameters were determined as per the formula of Shultz (1953); while the internal egg quality parameters were calculated as per the formula of Heiman and Carver (1936), Sharp and Powell (1930), Haugh (1937) and Funk (1948). The experimental design used in this study was completely randomized design (CRD). The data were statistically analyzed (Snedecor and Cochran, 1994) for one-way analysis of variance and the comparisons among means were made by Duncan's multiple range test (Duncan, 1955) with significance level of $P<0.05$.

Table 1: Ingredient composition (%) of experimental feed

Feed ingredient	$W_{100}BR_0$	$W_{50}BR_{50}$	W_0BR_{100}
Wheat	55	27.50	0
Broken rice	00	27.5	55
Soybean meal	09	13	16
Fishmeal	10	10	10
Deoiled rice bran	14	10	07
Oyster shell	10	10	10
Di-calcium phosphate	02	02	02
Trace minerals	0.50	0.50	0.50
DL-methionine	0.20	0.20	0.20
Lysine	0.10	0.10	0.10
Vit. AD_3B_2K	0.025	0.025	0.025
Vit E & Se	0.03	0.03	0.03
Vit B Complex	0.025	0.025	0.025
Toxin binder	0.15	0.15	0.15
Choline chloride	0.15	0.15	0.15

$W_{100}BR_0$:100% Wheat+0% broken rice; $W_{50}BR_{50}$:50% wheat+ 50% broken rice; W_0BR_{100}: 0% Wheat+100% broken rice.

RESULTS AND DISCUSSION

The chemical compositions of the feeds are presented in Table 2. All the diets were iso-nitrogenous (17.97-18.62% CP) and iso-caloric (2614-2661 ME Kcal/ kg). The dry matter intake (171.69-180.09 g/d) was similar among the groups (Table 3). The metabolisability (%) of DM, OM, CP, EE and CF in group $W_{50}BR_{50}$ was higher than W_0BR_{100}, but both were similar to $W_{100}BR_0$. However, similar (72.99-75.38) and higher (76.17-78.87) DM metabolisability (%) than this present study (67.97-73.72) has also been reported in White Pekin ducks by Sahoo *et al*. (2014) fed on maize, broken rice and cassava based diets; and Naik *et al.* (2021) fed on wheat & broken rice based diets. The OM metabolisability observed in this study (69.38-75.06, %) was lower than the findings (77.29-80.78%) of the earlier workers (Sahoo *et al*., 2014; Naik *et al*., 2021) in White Pekin ducks. The metabolisability (%) of CP in this experiment (68.16-75.41) was higher than the findings (67.26-70.73) of the earlier workers (Sahoo *et al*., 2014; Naik *et al.*, 2021) in White Pekin ducks. The metabolisabilities (%) of EE in this study (70.01-79.26) were similar to the findings (76.74-83.78) of the earlier workers (Mohanty *et al*., 2015; Naik *et al*., 2021). However, other workers (Sahoo *et al*., 2014; Joshi *et al*., 2015) observed lower EE metabolisability (50.66-61.18, %) than the present study. The range of the CF metabolisability observed in this experiment (50.90-60.44%) was higher than the findings (41.57-51.23) of the earlier workers (Sahoo *et al*., 2014; Joshi *et al*., 2015) and similar to the findings (59.57-62.05) of Naik *et al.* (2021). The higher nutrients metabolisability in $W_{50}BR_{50}$ group may be attributed to the synergetic effect of mixture of nutrients from two different sources of cereals (wheat and broken rice).

Table 2: Chemical composition (on % DM basis) of feeds

Parameters	$W_{100}BR_0$	$W_{50}BR_{50}$	W_0BR_{100}
Dry Matter	98.37	98.90	98.47
Organic Matter	88.09	87.04	86.34
Crude Protein	18.62	18.31	17.97
Ether Extract	2.68	2.76	2.27
Crude Fibre	6.18	5.93	6.11
Nitrogen Free Extract	72.52	73.00	73.65
Calculated values			
Energy (ME, Kcal/kg)	2614	2620	2661
Lysine %	1.07	1.14	1.19
Methionine %	0.56	0.58	060
Calcium %	4.93	4.91	4.89
Available P%	1.15	1.12	1.11

$W_{100}BR_0$:100% Wheat+0% broken rice; $W_{50}BR_{50}$:50% wheat+ 50% broken rice; W_0BR_{100}: 0% Wheat+100% broken rice

The nitrogen intake (g/d) in $W_{100}BR_0$ group (5.58) and $W_{50}BR_{50}$ group (5.46) was similar and higher ($P<0.05$) than W_0BR_{100} group (5.17); but, the nitrogen outgo (g/d) in $W_{50}BR_{50}$ group (1.33) was lower than W_0BR_{100} group (1.64) and both were similar to $W_{100}BR_0$ group (1.53). The nitrogen balance in $W_{50}BR_{50}$ group (4.12) was higher than W_0BR_{100} group (3.53), but was similar to $W_{100}BR_0$ group (4.06). However, when the nitrogen balance was expressed as percentage of nitrogen intake, it was higher ($P<0.05$) in $W_{50}BR_{50}$ group (75.41) than W_0BR_{100} group (68.16), but both were similar to $W_{100}BR_0$ group (72.65). Similar nitrogen balance (3.76-3.90, g/d) and nitrogen balance as percentage of nitrogen intake (67.40-70.09) have also been reported by Naik *et al.* (2021) in White Pekin ducks.

The total feed intake (23.87-25.03, kg) and egg production (5.78-5.83, dozen) was similar among the groups (Table 3). There was no significant difference in the percentage of duck day egg production (DDEP) among $W_{100}BR_0$ group (49.86%), $W_{50}BR_{50}$ group (50.00%) and W_0BR_{100} group (49.57%). The feed conversion ratio (feed consumed in kg per dozen egg production) was similar among the groups and ranged from 4.13 to 4.32. The cost (Rs.) per Kg feed in $W_{100}BR_0$, $W_{50}BR_{50}$ and W_0BR_{100} was 32.50, 31.95, and 31.56, respectively. The cost (Rs.) per egg in $W_{100}BR_0$, $W_{50}BR_{50}$, W_0BR_{100} was 11.71, 11.24 and 10.86, respectively.

Table 3: Effect of feeding different cereals on metabolisability of various nutrients and nitrogen balances

Parameters	$W_{100}BR_0$	$W_{50}BR_{50}$	W_0BR_{100}	SEM
DM Intake (g/d)	180.09	177.07	171.69	1.76
Metabolisability (%) of Nutrients				
Dry matter*	71.34^{ab}	73.72^{b}	67.97^{a}	1.10
Organic matter*	73.71^{ab}	75.06^{b}	69.38^{a}	1.07
Crude protein*	72.65^{ab}	75.41^{b}	68.16^{a}	1.09
Ether extract*	75.79^{ab}	79.26^{b}	70.01^{a}	1.52
Crude fibre*	54.84^{ab}	60.44^{b}	50.90^{a}	1.81
Nitrogen Balances				
N intake (g/d)*	5.58^{b}	5.46^{b}	5.17^{a}	0.06
N out go (g/d)*	1.53^{ab}	1.33^{a}	1.64^{b}	0.05
N Balance (g/d)*	4.06^{b}	4.12^{b}	3.53^{a}	0.10
N balance as % of N intake*	72.65^{ab}	75.41^{b}	68.16^{a}	1.09
Feed conversion ratio (FCR)				
Total feed intake (kg)	25.03	24.61	23.87	0.26
Total egg production (dozen)	5.82	5.83	5.78	0.09
DDEP%	49.86	50.00	49.57	0.78
Feed conversion ratio	4.32	4.22	4.13	0.08
Economics				
Cost of feed (Rs./kg)	32.50	31.95	31.56	0.14
Cost (Rs.)/ egg	11.71	11.24	10.86	0.23

*Means bearing different superscripts in a row differ significantly ($P<0.05$).

$W_{100}BR_0$:100% Wheat+0% broken rice; $W_{50}BR_{50}$:50% wheat+ 50% broken rice; W_0BR_{100}: 0% Wheat+100% broken rice

The egg weight (74.59-75.88, g) was similar among the groups (Table 4). Earlier workers (Rath *et al.*, 2016; Kavitha *et al.*, 2017; Naik *et al.*, 2020a) have reported lower egg weight (59.03-73.33) in White Pekin ducks. However, similar egg weights (72.79-74.79g) in White Pekin ducks were reported by Swain *et al.* (2018). In general, egg weight in ducks is heavier than the chickens; and further, egg weight in White Pekin is higher than the other breeds of ducks which might be due to their heavier body weight. The egg shape index (68.90-69.47) was similar among the groups, which were very close to the findings (68.97-73.44) of other workers (Naik *et al.*, 2020a; Swain *et al.*, 2018). However, higher egg shape index values (74.36-77.63) have also been reported by the earlier workers (Rath *et al.*, 2016; Kavitha *et al.*, 2017) in White Pekin ducks.

There was no difference ($P>0.05$) in albumen index (0.12-0.13) and yolk index (0.42-0.43) among the groups; and the values corroborate well with those of the earlier workers in White Pekin ducks (Rath *et al*., 2016; Kavitha *et al*., 2017; Swain *et al.*, 2018; Naik *et al.,* 2020a). The Haugh unit (85.92-87.93) was similar among the groups, but were lower than the findings of other workers (Swain *et al.*, 2018; Naik *et al.*, 2020a). The egg contents *viz.* percentage of albumen (53.72-55.40) and yolk (33.35-33.79) were similar among the groups, which corroborated well with the findings (50.32-55.10 and 33.52-36.87%) of the earlier workers (Rath *et al.*, 2016; Swain *et al*., 2018; Naik *et al*., 2020a). The percentage of shell weights in W_0BR_{100} group (11.25) was significantly lower than the $W_{100}BR_0$ group (12.66); but both the values were similar to $W_{50}BR_{50}$ group (11.93). These values were lower than the findings of other workers (Swain *et al*., 2018; Naik *et al.,* 2020a), but higher than the observations (9.07-9.10%) of Rath *et al*. (2016).

Table 4: Effect of feeding broken rice replacing wheat on egg production and egg quality

Parameters	$W_{100}BR_0$	$W_{50}BR_{50}$	W_0BR_{100}	SEM
External egg quality				
Egg weight (g)	75.67	75.88	74.59	0.40
Egg shape index	69.47	68.90	69.44	0.26
Internal egg quality				
Albumen index	0.13^{ab}	0.13^{b}	0.12^{a}	0.002
Yolk index	0.43	0.43	0.42	0.003
Haugh Unit	87.42	87.93	85.92	0.42
% Albumen weight	53.72^{a}	54.92^{ab}	55.40^{b}	0.30
% Yolk weight	33.61	33.79	33.35	0.17
% Shell weight	12.66^{b}	11.93^{ab}	11.25^{a}	0.21

*Means bearing different superscripts in a row differ significantly ($P<0.05$). $W_{100}BR_0$:100% Wheat+0% broken rice; $W_{50}BR_{50}$:50% wheat+ 50% broken rice; W_0BR_{100}: 0% Wheat+100% broken rice.

CONCLUSIONS

It can be concluded that white Pekin ducks can be raised on exclusive wheat or broken rice based diets during second year of laying under intensive rearing system; however, mixture of wheat and broken rice in equal ratio increased the metabolisability of the nutrients of the feed.

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