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Performance of White Pekin Ducks Fed Wheat or Broken Rice based Diets during Mid Phase of Laying under Intensive Rearing System

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ABSTRACT

Background: White Pekin ducks can be reared under intensive rearing system for meat and egg production. Depending upon the availability, duck farmers use different types of cereals for feeding their ducks. Therefore, a study was conducted to find out the performance of White Pekin ducks during mid phase of layingfed on wheat and/or broken rice based diets under intensive rearing system.

Methods: White Pekin laying ducks (45; 41 weeks old) were divided into three groups. Three types of diets without (BR-0) and with broken rice (BR), replacing 50 (BR-50) and 100 (BR-100) per cent of wheat were prepared and offered randomly to the above three groups till the ducks attained 52 weeks of age under standard feeding and management practices.

Result: The total egg production (dozen) and duck day egg production (DDEP) % were higher in BR-50 group (4.51 and 64.44) than the BR-100 group (3.85 and 55.00); however, both were similar to BR-0 group (4.09 and 58.49). The total feed intake (12.55-13.80, kg) and feed conversion ratio (feed consumed in kg per dozen eggs produced) (2.93-3.31) were similar among the groups. The cost (Rs.) per egg was lower in BR-50 group (7.79) than the BR-0 group (8.32) and BR-100 group (8.71). The egg weight in BR-50 group (76.61 g) was higher than the BR-0 group (75.42 g); however, both were similar with BR-100 group (76.19 g). There was no significant difference in the egg shape index (68.22-69.69), albumen index (0.13-0.14) and yolk index (0.42-0.44) among the groups. The However, the Haugh unit in BR-100 groups (87.32) was lower than BR-0 group (89.90); but both were similar with BR-50 group (89.56). There were no significant differences in the percentage of albumen (55.09-55.71), yolk (31.75-32.38) and shell (12.45-12.63) among the groups. Similarly, the shell thickness with membrane (0.50-0.52, mm) and without membrane (0.43-0.44, mm) were also similar among the groups. It can be concluded that White Pekin ducks can be raised on wheat and/or broken rice-based diets during mid phase of laying under intensive rearing system; however, mixture of wheat and broken rice in equal ratio increased the performance and was economical.

Key words: Intensive rearing, Mid laying phase, Pekin ducks, Rice or wheat based diets.

INTRODUCTION

The major chunk (98.86%) of the total egg production of India (103.32 billion) is by chickens and only 1.15% is contributed by ducks. The meat production from chicken is 4.06 million tonnes, contributing about 50% of the total meat production of the country (8.11 Million tonnes) (Anonymous, 2019). The requirement for egg and poultry meat in India is 180 and 10.8 kg per person per annum, respectively; however, the per capita availability of egg and poultry meat is only 86 and 2.2 kg (Anonymous, 2021a, 2021b). Therefore, to be self-sufficient and sustain nutritional security, other alternate species, particularly ducks should be explored for egg and meat production. The total population of ducks in India is 33.511 Million, which is only 3.93% of the total poultry population of the country. However, the percentage of increase in duck population than the previous census is more (+42.4) than the chickens (+16.6). Due to unavailability of water bodies, now days, many farmers keep ducks under intensive rearing system. White Pekin ducks can be reared under intensive rearing system with good quality feeds for meat and egg production (Mishra *et al.,* 2021). Depending upon the availability and cost, duck farmers use different types of cereals time to time for feeding their ducks. Cereals like wheat and broken rice are important ingredients for the duck feeds. Therefore, a study was conducted to find out the performance of White Pekin ducks during mid phase of laying when fed wheat and/or broken rice-based diets under intensive rearing system.

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MATERIALS AND METHODS

The experiment was conducted at ICAR-Directorate of Poultry Research Regional Station, Bhubaneswar, Odisha,

India, during 2019-2020. White Pekin female ducks (45) in mid phase of laying (41 weeks) were divided into three groups. Each group had three replicates and each replicate had five ducks. Three experimental diets without (BR-0) and with BR, replacing 50 (BR-50) and 100 (BR-100), percent wheat were prepared (Table 1). The diets were offered randomly to the above groups, as per the suggested practical levels of nutrient requirements for a period of 12 weeks till they attained 52 weeks of age (Singh and Panda, 1996). During the experiment, the ducks were on deep litter system and the respective diets were fed *ad lib* following standard management practices. The data on feed intake and egg production were recorded daily; while the live 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, per cent 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 data were statistically analyzed for the test of significance (Snedecor and Cochran, 1994).

RESULTS AND DISCUSSION

The chemical compositions of the feeds are presented in Table 2. The total egg production (dozen) and duck day egg production (DDEP) % in BR-50 group were higher (P<0.05) than the BR-100 group; however, both were similar to BR-0 group (Table 3). The total feed intake was similar among the groups. The feed conversion ratio (feed consumed in kg per dozen egg production) was also similar among the groups. The feed cost per egg in BR-50 was lower than BR-0 and BR-0 groups. The higher nutrients metabolisability in BR-50 group might have the reason for the better performance of the ducks of the BR-50 group (Naik *et al*., 2021a).

The egg weight in BR-50 group was higher than the BR-0 group; however, both were similar with BR-100 group (Table 4). The egg weight observed in this study was higher than the observations (59.03-74.79 g) of the earlier workers (Rath *et al*., 2016; Kavitha *et al*., 2017; Swain *et al.,* 2018 and Naik *et al.,* 2020a) in White Pekin ducks. However, higher and lower egg weights in White Pekin ducks have also been reported than the present study. 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 was similar among the groups, which were very close to the findings of other workers (Naik *et al*., 2020a; Swain *et al*., 2018). However, higher egg shape index values 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 and yolk index among the groups and the values corroborate well with those of the earlier workers in Whit Pekin ducks (Rath *et al*., 2016; Kavitha *et al*., 2017; Swain *et al*., 2018; Naik *et al.,* 2020a). The Haugh unit in BR-100 group was lower than BR-0 group; however, both were similar to BR-50 group). The Haugh unit observed in this experiment was lower (P<0.05) than the findings of other workers (Swain *et al*., 2018; Naik *et al*., 2020a). The egg contents *viz*. percentage of albumen and yolk were similar among the groups, which corroborated well with the findings of the earlier workers (Rath *et al*., 2016; Swain *et al*., 2018; Naik *et al*., 2020a). The percentage of shell weights was similar among the groups, which was lower than the findings of other workers (Swain *et al*., 2018; Naik *et al.,* 2020a), but higher than the observations of Rath *et al*. (2016). The shell thickness (mm) with membrane was higher (P>0.05) in BR-100 group than BR-0 group; however, both were similar to BR-50 group. Similar, lower and higher egg shell thickness have also been recorded in White Pekin ducks (Palanivel and Harikrishnan, 2011; Rath *et al*., 2016; Kavitha *et al*., 2017; Swain *et al*., 2018; Naik *et al.,* 2020a). The shell thickness without

Table 1: Ingredient composition (%) of feeds.

Feed ingredient	Feed[1]		
	BR-0	BR-50	BR-100
Wheat (kg)	55	27.5	0
Broken rice (kg)	0	27.5	55
Soybean meal (kg)	9	13	16
Fishmeal (kg)	10	10	10
DORB (kg)	14	10	7
Oyster shell (kg)	10	10	10
DCP (kg)	2	2	2
Trace minerals (g)[2]	300	300	300
DL-methionine (g)	200	200	200
Lysine (g)	100	100	100
Vit. AD_3B_2K (g)[3]	25	25	25
Vit E and Se (g)[4]	30	30	30
Vit B Complex (g)[5]	25	25	25
Toxin binder (g)	150	150	150
Choline chloride (g)	150	150	150

[1]BR-0: Diet without broken rice; BR-50: Diet with broken rice replacing 50% wheat; BR-100: Diet with broken rice replacing 100% wheat.
[2]Compositions per 100 g: Manganese-11 g; Zinc-10 g; Copper -2 g; Ferrous-11 g; Organic Selenium-0.15 g; Iodine-0.25 g; Organic Cobalt-0.125 g; Organic Chromium-40 mg.
[3]Compositions per gram: Vit. A-100000 IU; Vit.B_2- 50 g; Vit. D_3-20000 IU; Vit.K-20 mg; Antioxidants- 200 ppm.
[4]Compositions per 100 g: Vit. E-10 g; Selenium-100 ppm; Biotin-150 mcg.
[5]Compositions per 10 g: Vit. B_1-50 mg; Vit.B_6-80 mg; Vit.B_{12}-500 mcg; Nicotinamide-600 mg; Calcium D Pantothenate-450 mg; Vit.E-450 mg; Folic acid-40 mg.

membrane were similar (P>0.05) among the groups, which were very close to the findings (0.43-0.48 mm) of the earlier workers (Swain *et al*., 2018; Naik *et al.,* 2020a). The similar shell thickness without membrane was not affected by substitution of wheat with BR, even though wheat contains higher Ca than BR; as the contribution of the cereals to total Ca supply was very low (Singh and Panda, 1996). Thus, the reduction in absolute Ca supply due to substitution of wheat was rather meagre to cause any adverse impact on shell formation. The CP content of wheat was higher than the BR and the comparative amino acid profile of the two cereals revealed that wheat contained higher amount of lysine than BR (Singh and Panda, 1996; Panda, 2013). In spite of these, no adverse impact on egg quality parameters was observed, when wheat was replaced completely with BR. It could be explained on the basis that the absolute contribution of cereal grains to the CP, lysine and methionine supply is rather low. Moreover, the rations were balanced to be iso-nitrogenous by adjusting the amount of soybean meal in the ration. Earlier, it was reported that the complete replacement of wheat by broken rice in the diets of white Pekin ducks during second year of egg production had no affect on the egg quality (Naik *et al*., 2020a), blood biochemical parameters (Naik *et al*., 2020b) and various nutrients metabolisability (Naik *et al*., 2021b).

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

Parameters	Feed[1]		
	BR-0	BR-50	BR-100
Nutrient content (% DM)			
Crude protein	18.70	18.31	18.62
Ether extract	1.56	1.61	1.54
Crude fibre	6.87	6.13	6.26
Nitrogen free extract	61.07	62.29	61.73
Total ash	11.80	11.66	11.85
Calculated nutrient supply			
Energy (mE, kcal/kg)	2614	2620	2661
Lysine (%)	1.07	1.14	1.19
Methionine (%)	0.56	0.58	0.60
Ca (%)	4.93	4.91	4.89
Available P (%)	1.15	1.12	1.11

[1]BR-0: Diets without broken rice; BR-50: Diets with broken rice replacing 50% wheat; BR-100: Diets with broken rice replacing 100% wheat.

Table 3: Effect of feeding broken rice replacing wheat on egg production, feed conversion and economics in Pekin ducks.

Parameters	Groups[1]			SEM
	BR-0	BR-50	BR-100	
Total egg production (dozen/bird)*	4.09±0.10^{ab}	4.51±0.28^{b}	3.85±0.08^{a}	0.13
Duck day egg production (DDEP)%*	58.49±1.43^{ab}	64.44±4.02^{b}	55.00±1.07^{a}	1.87
Total feed intake (kg/bird)	12.55±0.32	13.8±0.18	12.74±0.32	0.16
Feed conversion ratio	3.07±0.14	2.93±0.21	3.31±0.13	0.10
Cost of feed (Rs./kg)	32.50±0.00	31.95±0.00	31.56±0.00	0.14
Feed cost (Rs.)/ egg	8.32±0.39	7.79±0.56	8.71±0.35	0.26

[1]BR-0: Group fed diet without broken rice; BR-50: Group fed diet with broken rice replacing 50% wheat; BR-100: Group fed diets with broken rice replacing 100% wheat.

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

Table 4: Effect of feeding broken rice replacing wheat on egg quality in Pekin ducks.

Parameters	Groups[1]			SEM
	BR-0	BR-50	BR-100	
External egg quality				
Egg weight (g)*	75.42±0.45^{a}	76.71±0.46^{b}	76.19±0.23^{ab}	0.25
Egg shape index	69.69±1.13	68.57±0.54	68.22±0.58	0.46
Internal egg quality				
Albumen index	0.14±0.003	0.13±0.003	0.13±0.005	0.002
Yolk index	0.43±0.005	0.42±0.009	0.44±0.006	0.004
Haugh unit*	89.90±0.85^{b}	89.56±0.60^{ab}	87.32±0.92^{a}	0.52
% Albumen	55.44±0.15	56.16±0.50	55.72±0.42	0.22
% Yolk	32.61±0.16	32.16±0.17	32.57±0.37	0.15
% Shell	11.96±0.12	11.68±0.55	11.71±0.16	0.19
Shell thickness without membrane (mm)	0.45±0.01	0.42±0.003	0.42±0.003	0.006

[1]BR-0: Group fed diet without broken rice; BR-50: Group fed diet with broken rice replacing 50% wheat; BR-100: Group fed diets with broken rice replacing 100% wheat.

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

CONCLUSION

It can be concluded that White Pekin ducks during mid phase of laying can be raised on what and/or broken rice based diets under intensive rearing system; however, mixture of wheat and broken rice in equal ratio increased the performance and was economical.

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Conflict of interest

All authors declared that there is no conflict of interest.

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