Growth performance and carcass characteristics of Japanese quail fed rations with inclusion of different levels of broken rice

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Abstract

Rapid increase in poultry production is boosting the use of corn, since this ingredient is the main cereal grain for livestock feeding. Due to high demand, especially during off-seasons periods, corn price sometimes increases and it is necessary to reduce the dependency on imported corn. Therefore, this study was untertaken to investigate the feeding effects of different levels of broken rice inclusion as replacement for corn in the diet on the growth performance, survivability and carcass characteristics of Japanese quails (3-11 wk of age). A total of 180 unsexed quails (2 wk of age) were randomly divided into 3 experimental diets with 3 replicates of 20 birds each according to a completely randomized design. Experimental diets consisted of 3 levels (10, 20 and 30%) of broken rice for replacing the corn. The weekly body weight (BW), feed consumption and mortality were recorded. At the end of feeding trail, 5 male birds from each replicate were slaughtered. The carcass weight, dressing percentage, and yields of heart, liver, gizzard and feet were taken. Results showed that increasing levels of broken rice in the diets did not affect ($p>0.05$) feed intake, weekly BW, average BW gain and survivability, except for final BW. Birds fed diet containing 20% broken rice showed significantly ($p<0.05$) lower final BW than the brids fed diets containing 10 or 30% broken rice. Regarding to carcass characteristics, increasing levels of broken rice in the diets did not affect ($p>0.05$) dressing percentage or yields of heart, liver and fee, except for gizzard. Birds fed diet containing 30% broken rice showed lower ($p<0.05$) gizzard yield than the birds fed diets containing 10 or 20% broken rice. The results of this study indicated that broken rice can be used in growing quails' diet up to 30% without any adverse effects on their growth performance, survivability and carcass characteristics.

Keywords: Broken rice, carcass traits, corn, growth characteristics, Japanese quail, mortality

Intorduction

Quail production is considered a profitable and an alternative to traditional chicken production due to the quail fast growth, early maturity, low initial investment and rapid economic returns (Silva et al., 2009). Similar to other poultry productions, high feed costs also involve in quail production, which indicates the importance of finding locally available feedstuffs. Corn is the main cereal grain used in poultry ration and this ingredient needs to be imported by the poultry feed millers in Malaysia (Loh, 2004). Corn is also largely used for ruminants as well as other non-ruminants (i.e., pig) feeding. Due to import and high demand, the price of corn fluctuates in the global market.

As such, local smallholder farmers sometimes face increased corn price in the local market, which can negetively affect on their production. Thus, it is required to find any alternative feed resources, which may replace the corn and make available within Malaysia for sustainable livestock production.

Besides whole grain rice, broken rice can be found as agro-industrial by-product during the milling process. This broken rice may be an alternative option to corn, if it is available in large quantities and at a sufficiently low price in the local market. It has been estimated that broken rice forms about 6% of total rice milled. The nutritive value of broken rice is also comparable to corn in terms of energy and protein contents (Daghir, 2008). There are reports on utilisation of broken rice in broiler diets and no detrimental effects had been reported on broiler performance (Cancherini et al., 2008; Ali et al., 2018). In contrast, there are limited reports on the evaluation of broken rice in quail feeding (Sethi et al., 2006; Filgueira et al., 2014). Filgueira et al. (2014) reported that broken rice can be considered a potential replacement of corn in meat-type quail diets.

The present research work was, therefore, designed to evaluate the effects of inclusion of different levels of broken rice as a replacement for corn in quail's diet on their growth performance, survivability and carcass characteristics.

Materials and Methods

This study was carried out at Agro Techno Park, Universiti Malaysia Kelantan, Jeli Campus, Kelantan, Malaysia. A total of 180 unsexed Japanese quails (2 wk of age) were randomly divided into 3 dietary treatment groups (60 quails in each group) according to a completely randomized design. Each group of quails was subdivided into 3 replicates (20 quails in each replicate). Birds were housed in group replicate wise in wire cages with concrete floor covered with sawdust litter. Each cage was equipped with feeder and waterer. The experimental diets were formulated according to the nutrient requirments of growing quail as recommended by NRC (1994). Three experimental diets were formulated as isocaloric and isonitrogenous, and consisted of 10% (diet 1), 20% (diet 2) and 30% (diet 3) broken rice (replacing 19.2, 38.5 and 57.7% corn w/w, respectively). The name of the ingredients, their amount in percentage and chemical composition of the 3 formulated rations are shown in Table 1. Birds received experimental feed and water *ad libitum* basis throughout the experimental period (3-11 wk of age). Experimental diets were provided to respective quails twice (morning and afternoon) a day. All birds were raised under the same management and hygenic conditions

Table 1. Ingredients and chemical composition of different formulated diets

Ingredients	Amount (kg) in 100 kg mixed feed		
	Diet 1	Diet 2	Diet 3
Cracked corn	42.0	32.0	22.0
Broken rice	10.0	20.0	30.0
Soybean meal	37.0	37.0	37.0
Fish meal	1.9	1.4	1.0
Tapioka meal	5.0	5.0	5.0
Palm oil	1.0	1.5	1.9
Limestone	2.2	2.2	2.2
Vitamin mineral premix	0.4	0.4	0.4
Salt	0.5	0.5	0.5
Calculated nutrients (dry matter basis)			
Crude protein (%)	22.7	21.7	20.8
Crude fiber (%)	5.3	4.9	4.5
Crude fat (%)	4.7	4.0	3.8
Crude ash (%)	3.3	3.2	3.1
Metabolizable energy (MJ/kg)*	12.1	12.3	12.5

*obtained from secondary data (Yusoff et al. 2005).

All brids were weighed individually at 7-day intervals in order to calculate body weight (BW) gain. At 7th and 8th wk of age, daily feeds offered and daily feed residuals were recorded per replicate for a period of 14 d in order to calculate feed intake (g/bird/d). Mortaity was recorded daily. At the end of 11 wk of age, 5 male quails from each replicate were randomly selected, fasted (6 h before slaughter), weighed and slaughtered. After been plucked and eviscerated, carcass weight (without edible and non-edible by-products) was recorded and dressing percentage was calculated relative to BW. The carcass characteristics studied were edible by-products (heart, liver, gizzard and feet) and dressing percentage (carcass weight/BW) × 100. Birds of all dietary groups started to lay their eggs at 6th wk of age. During the experimental period, birds fed diet 1, diet 2 and diet 3 produced a total of 309, 125 and 463 eggs, respectively.

Feed ingredients were analysed for crude protein, crude fibre, crude fat, moisture and ash following the methods of AOAC (2005). All data were analysed using the General Linear Model of the SPSS (version 22, SPSS Inc., Chigaco, IL, USA). A value of $P < 0.05$ was considered significant. Duncan's Multiple Range Test was used to compare the statistical differences between the treatment means.

Results and Discussion

The initial BW weight, final BW, average BW gain and feed intake are shown in Table 2. The increasing levels of broken rice in the diets did not affect ($p>0.05$) average daily BW gain and feed intake of quails during 3-11 wk of age. However, birds fed diets containing 10 or 30% broken rice showed higher ($p<0.05$) final BW than those fed diet containing 20% broken rice (Table 2). The weekly BW of quails fed different levels of broken rice are shown in Figure 1. No significant ($p>0.05$) difference in weekly BW was observed among the experimental diets during 3-11 wk of age. Our results are in agreement with Swain and Barbuddhe (2008) that broken rice

can replace corn up to 20% in the quail diet withour any adverse effect on their performance. A similar result was observed by Sethi et al. (2006) who suggested that broken rice could replace corn up to 50% in the quail diet without affecting growth performance.

Table 2. Growth performance of Japanese quails fed diets containing different levels of broken rice

Parameters	Levels of broken rice			P value
	Diet 1 (10%)	Diet 2 (20%)	Diet 3 (30%)	
Initial BW (g)	93.3 ± 5.9	85.5 ± 6.9	89.1 ± 6.6	0.402
Final BW(g)	258.7[a] ± 2.6	247.9[b] ± 2.8	262.1[a] ± 2.2	0.001
Average weight gain (g/day)	3.0 ± 0.1	2.9 ± 0.1	3.1 ± 0.1	0.197
Feed intake ((g/brid/day)[#]	28.9 ± 2.9	28.6 ± 3.8	35.1 ± 3.9	0.076

[#] for 7-8th weeks of age

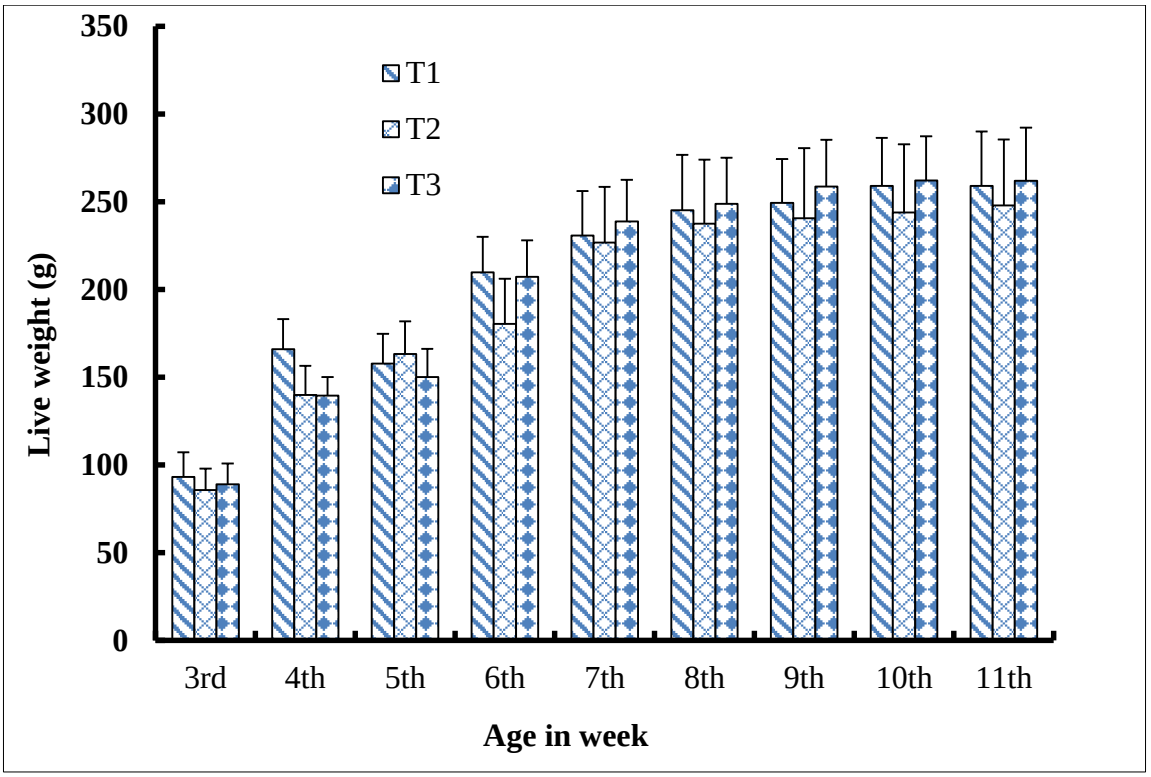

Figure 1. Weekly average body weight (mean ± standard deviation) of quails fed diets containing different levels of broken rice.

During the experimental period (3-11 wk of age), the survivability of quails were 86.7, 95.0 and 93.3% for diets containing 10%, 20% and 30% broken rice, respectively. There was no significant ($p>0.05$) difference on survivability among three experimental diets (Table 3). In this study, cumulative mortality rates (between 3-11 wk of age) for the diet 1, diet 2 and diet 3 were 13.3, 5.0 and 6.7%, respectively. These results are fairly higher

than 1.49% as reported by Dauda et al. (2014) for 4-5 wk of age, and also higher than 2.20% reported by Roshdy et al. (2010). In general, mortality rate tended to decrease with increasing age as also reported by Seker et al. (2009).

Table 3. Mean survivability (%) of Japanese quails fed diets conaining different levels of broken rice at different weeks of age

Age (weeks)	Levels of broken rice			P value
	Diet 1 (10%)	Diet 1 (20%)	Diet 1 (30%)	
3rd	100.0 ± 0.0	100.0 ± 0.0	100.0 ± 0.0	1.000
4th	100.0 ± 0.0	100.0 ± 0.0	95.0 ± 0.0	1.000
5th	95.0 ± 5.0	100.0 ± 0.0	95.0 ± 0.0	0.125
6th	93.3 ± 5.8	98.3 ± 2.9	95.0 ± 0.0	0.317
7th	91.7 ± 7.6	98.3 ± 2.9	93.3 ± 2.9	0.308
8th	88.3 ±10.4	98.3 ± 2.9	93.3 ± 2.9	0.244
9th	86.7 ± 12.6	96.7 ± 5.8	93.3 ± 2.9	0.373
10th	86.7 ± 12.6	95.0 ± 8.7	93.3 ± 2.9	0.523
11th	86.7 ± 12.6	95.0 ± 8.7	93.3 ± 2.9	0.523

SD, standard deviation.

Table 4. Mean carcass characteristics of Japanese quails fed diets containing different levels of broken rice

Parameters	Levels of broken rice			P value
	Diet 1 (10%)	Diet 1 (20%)	Diet 1 (30%)	
Liveweight (g)	269.0 ± 21.7	269.3 ± 33.7	262.1 ± 27.4	0.744
Carcass weight (g)	155.3 ± 17.7	157.9 ± 24.0	144.1 ± 14.4	0.137
Carcass dressing (%)	57.3 ± 4.8	59.3 ± 9.2	55.2 ± 4.8	0.265
Liver (% of BW*)	2.8 ± 1.1	2.9 ± 0.9	2.6 ± 0.7	0.690
Heart (% of BW)	1.1 ± 0.2	1.1 ± 0.2	1.0 ± 0.2	0.466
Gizzard (% of BW)	2.5^{a} ± 1.0	2.5^{a} ± 0.9	1.9^{b} ± 0.5	0.034
Feet (% of BW)	1.9 ± 0.2	2.0 ± 0.5	1.9 ± 0.4	0.544

*BW, body weight

The carcass characteristics of the birds in all 3 diet groups showed that the replacement of corn by broken rice in the diets did not affect dressing percentage and yields of heart, liver and feet (except for gizzard) (Table 3). The results of carcass characteristics in this study are consistent with Filgueira et al. (2014) that there was no effect of corn replacement by broken rice at levels of 0, 20, 40, 60, 80 and 100% in the diet on the quail's carcass weight or yields of heart and liver. In another study, Ashour et al. (2015; 2016) also did not observe any significant effects of dietary broken rice inclusion on quail's carcass weight or yields of heart and liver at 5 wk of age. An effect on gizzard yield in this study was observed, which is in agreement with the findings of Brum Júnior et al. (2007) and Nanto et al. (2012) that gizzard weight was reduced as the replacement of corn by broken rice and dehulled paddy rice increased. Gizzard yield might be reduced with increasing levels of broken rice which contained higher starch and lower non-starch polysaccharide (Choct, 2002). This change in the gut eco-system may be associated with

low fibre ingredients, i.e., broken rice as reported by Dibner et al. (1996). Therefore, reduction in crude fibre content in broken rice at different inclusion levels in the present study were sufficient to decrease gizzard weight.

Pereira et al. (2016) suggested that corn can be replaced by broken rice (up to 100%) in laying quails' diets without detrimental effect in productive performance, but it may affect yolk color. Higher body weight gain of birds is usually related to increased feed intake, which can reflect on dietary nutrient ingestion and abosrption. Consequently, carcass characteristics in the current study may not be affected by increasing dietary levels of broken rice due to lack of insignificant differences in feed intake and daily body weight gain.

Conclusion

There were no significant differences in average weight gain, feed intake, survivability and carcass characteristics among three expeirmental dietary groups (except for final body weight and gizzard yield). Based on the present findings, broken rice could be used up to 30% in quail's diet without detrimental effects on their growth performance, survivability and carcass characteristics.

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