Effect of Feeding High Glucosinolate Rapeseed Meal to Laying Japanese Quail

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ABSTRACT : The laying performance of Japanese quails fed graded levels of high glucosinolate (92.5 μmole/g) rapeseed meal (RSM) was assessed. One hundred and twenty Japanese quails aged 1 day-old were assigned at random to four dietary treatments consisting of 0, 50, 75 or 100 g/kg RSM in the diet replacing part of the soybean meal and de-oiled rice bran in a standard quail ration. 12 female representative quails from each diet were selected at random and housed in individual cages from 7-20 wk of age. The egg production, feed intake and FCR was comparable among the different dietary groups. The egg quality characteristics, organoleptic evaluation of boiled eggs as well as the haematological (haemoglobin, total erythrocyte count, total leucocyte count) and biochemical (glucose, protein, cholesterol, aspartate amino transferase, alanine amino transferase and alkaline phosphatase) constituents did not differ significantly among the groups. The gross and histopathological studies of vital organs did not reveal any appreciable changes. The feed cost was reduced by the incorporation of RSM in the diet, but only the production cost of quails fed the 75 g/kg RSM was lower in comparison to other groups. In the present study, the laying potential of Japanese quail was well-maintained up to the 100g/kg dietary level of rapeseed meal. *(Asian-Aust. J. Anim. Sci. 2001. Vol 14, No. 9 : 1304-1307)*

Key Words : Quails, Rapeseed Meal, Egg Production, Blood Biochemicals, Histopathology

INTRODUCTION

Rapeseed meal is one of the major oil seeds available in most parts of the world as well as in India. There has been much work on rapeseed meal (RSM) feeding to poultry but very few studies have been conducted in quails. The main reason hindering the use of raw RSM in poultry diets is the level of glucosinolate and sinapine which leads to liver damage as well as tainting of eggs.

There have been several reports of mortality in laying hens fed rapeseed meal due to massive liver haemorrhage (Jackson, 1969; March et al., 1972; Hall, 1974; Marangos et al., 1974; Marangos and Hill 1976; Smith and Campbell, 1976; Campbell, 1979). The fishy, musty, or off-taint has been reported by many workers (Millar et al., 1972; Hobson-Frohock et al., 1973; Griffiths et al., 1979) and the main cause is due to the presence of trimethylamine in the yolk, and mainly brown shelled eggs have been tainted to a major extent. Thus, this study was planned to study the effect of graded levels of RSM on the production performance and egg quality as well as pathological changes, if any, in vital organs of quail.

MATERIALS AND METHODS

One hundred and twenty Japanese quails at hatch were assigned at random to 4 dietary groups which was further replicated to three of 10 chicks each. After 6 wks of age, 12 female representative quails from each group were selected and maintained individually in metal cages (19 cm × 25 cm × 20 cm) fitted with feeder, waterer and dropping tray from 7-20 wks of age. The mean ambient temperature during the period ranged between 8 and 25°C.

Feeds and feeding

Out of the 4 groups, one was fed a soybean rice bran based reference diet (D_1) as control (table 1). The other three groups were offered test diets containing 50 (D_2), 75 (D_3) and 100 g (D_4) of RSM per kg. Daily egg production and net feed intake were recorded. The test materials and the diets were analysed for proximate principle (AOAC, 1990), total glucosinolates (McGhee et al., 1965) and gross energy by ballistic bomb calorimeter.

Egg quality

Ten eggs from each diet were collected on the first two consecutive days of the 11th, 15th and 19th weeks of experimental feeding (i.e. 10×3×4=120) for egg quality measurements. The eggs were examined for shape index (100 times the ratio of width to length of an egg), albumen index (the ratio of average albumen height to the average of the width and length), yolk index (the ratio of yolk height to its average width), internal quality unit (IQU) as per Kondiah et al. (1981), shell weight and shell thickness.

Organoleptic evaluation of eggs

Ten boiled eggs from each dietary group laid on the third and fourth day of the 11th, 15th and 19th weeks of feeding (i.e. 10×3×4=120) were evaluated organoleptically by a panel of 10 semi-trained judges on an eight point hedonic scale in terms of colour, flavour, taste, smell, odour,

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Table 1. Ingredient and nutrient composition of layer diet

Item	Dietary group			
	D_1	D_2	D_3	D_4
Ingredient composition (g/kg)				
Basal mixture[1]	720.0	720.0	720.0	720.0
Soybean meal (SBM)	220.0	177.5	157.5	135.0
Deoiled rice bran (DORB)	60.0	57.5	47.5	45.0
Rape seed meal (RSM)	-	50.0	75.0	100.0
Calculated nutrient composition (g or MJ/kg)				
CP	186.1	185.8	186.1	185.6
ME	11.27	11.20	11.29	11.30
Lys	9.80	9.63	9.53	9.40
Met	3.34	3.45	3.49	3.54
Determined nutrient composition (g/kg)				
CP	186.9	183.2	185.5	182.8
Ca	28.8	29.2	28.3	30.2
P	9.33	9.45	9.25	1.00

[1] Basal mixture consisted of : maize, 51.5; fish meal, 10; dicalcium phosphate, 1.43; ground limestone, 1.0; common salt, 0.3; trace mineral supplement[a], 0.1; vitamin mix.[b], 0.17%

(a) supplied mg/kg diet: Mg, 300; Mn,55; I, 0.4; Fe, 56; Zn, 30; Cu. 4

(b) supplied per kg diet : Vitamin A, 8,250 IU; Vitamin D_3,. 1,200 ICU; Vitamin K, 1 mg; Vitamin E, 40 IU; Vitamin B_1, 2 mg; Vitamin B_2 4 mg; Vitamin B_{12}, 10 mcg; niacin, 60 mg; pantothenic acid, 10 mg; choline, 500 mg

texture, and overall acceptability.

Haematological and biochemical profile

At the end of 20 weeks of experimental feeding, blood collected in heparinized (20 IU/ml) glass vials from 6 quails in each diet were examined for the estimation of haemoglobin (Hb) (Schalm et al., 1975) total erythrocyte (TEC) and total leucocyte counts (TLC) (Natt and Harrick, 1952).

The serums separated from blood drawn into separate vials without any anticogulants were stored at -20°C and were later analysed for protein (Hiller and Van, 1927), cholesterol (Wynbenga and Pillegi, 1970), alanine amino transferase (ALT, EC 2.6.1.2, Reitman and Frankel, 1957), aspartate amino transferase (AST, EC,2.6.1.1, Reitman and Frankel, 1957) and alkaline phosphatase (ALP, EC 3.1.3.1, Kind and King, 1954), but the glucose (Cooper and Mc Daniell, 1970) estimation was carried out immediately.

Gross and histopathological changes

The tissues of the various organs (thyroid, intestine, liver, spleen, heart, kidney and ovaries) collected from sacrificed birds at the end of 20 wk of experimental feeding were examined for gross and histopathological changes to see the effect of feeding RSM.

Cost economics

The cost of each mash was calculated by considering the prevailing market price of each ingredient. The feed cost per kilogram egg mass was derived by dividing the total cost of mash consumed by total mass of eggs produced by each dietary group.

Statistical analysis

The data were analyzed for variance in one way classification for completely randomized design as per Snedecor and Cochran (1967) and the means were tested for significance by Duncan's multiple range test.

RESULTS

RSM contained 395 g CP, 24 g EE, 73 g CF and 75 g total ash per kg DM, and glucosinolates 92.5 µmoles per g. The egg production, feed intake, egg weight and feed / egg of quails in the different dietary groups ($p>0.05$) were almost similar (table 2).

The egg quality characteristics in terms of shape index, shell thickness, shell weight, albumen index, IQU and yolk index ($p>0.05$) at the 11th, 15th and 19th week of feeding were also comparable (table 2).The organoleptic evaluation of meat from different dietary groups did not reveal ($p>0.05$) any untoward flavour and all were equally acceptable (table 2).

The blood haematological (Hb, TEC, TLC), biochemicals (glucose, cholesterol, protein) and enzyme activities (AST, ALT and ALP) also did not vary ($p>0.05$) among the various dietary groups. The gross and histopathological examination of tissues from vital organs (intestine, liver, spleen, kidney, heart and ovaries) did not reveal any pathological changes. The histopathological examination of target tissue, i.e. thyroid of quails fed rapeseed meal, revealed mild hypertrophic changes in the follicles but the effect on production performance was insignificant.

The feed cost was reduced by the incorporation of RSM in the diet but the production cost remained the same except for the quails fed 75 g/kg RSM (table 4).

DISCUSSION

Laying performance of quails in terms of egg production, feed intake and feed: egg, as has been observed in various earlier studies (Chand et al., 1980; Sadagopan et al., 1981; Cilly et al., 1977; Grandhi et al., 1977, Campbell, 1979), was found to be not affected by the inclusion of RSM up to 100 g/kg in diet. The reason being the nutrients in RSM were as available as those in SBM and the amino

Table 2. Laying performance and egg quality of quails

Item	Dietary Group				
	D_1	D_2	D_3	D_4	SEM
Production performance(7-20 wk)					
Hen day production (%)	88.9	86.7	87.1	87.6	1.14
Feed intake(g/bird/d)	27.0	26.1	26.4	27.4	0.87
Egg wt (g)	11.6	11.5	11.5	11.3	0.30
Feed /egg (g/g)	2.62	2.71	2.62	2.82	0.06
Live wt change (g/b)	26.2	22.0	21.6	21.0	3.26
Egg quality traits					
Shape index	77.9	77.6	77.8	76.8	0.98
Shell thickness (mm)	0.193	0.195	0.192	0.197	0.015
Shell weight (%)	10.5	10.7	10.3	10.4	0.37
Albumen index	0.129	0.127	0.123	0.135	0.007
Internal quality unit	62.3	63.6	62.9	63.4	1.79
Yolk index	0.478	0.472	0.447	0.482	0.014
Organoleptic evaluation					
Colour	6.98	6.78	6.86	6.89	0.33
Flavour	6.99	6.77	6.90	6.90	0.28
Taste	6.85	6.96	6.75	6.83	0.31
Smell	6.68	6.86	6.55	6.77	0.43
Texture	6.92	6.98	6.87	6.85	0.38
Overall acceptability	7.01	7.05	6.88	7.01	0.29

Table 3. Haematological and biochemical profile of quails

Item	Dietary Group				
	D_1	D_2	D_3	D_4	SEM
Hb (g/dL)	11.2	10.2	11.2	10.5	1.08
TEC ($x10^6/mm^3$)	3.58	3.68	3.72	3.42	0.54
TLC ($x10^3/mm^3$)	22.1	22.8	23.1	22.4	1.71
Glucose (mg/dL)	242	235	222	255	13.28
Protein (g/dL)	3.78	3.89	3.65	3.95	0.19
Cholesterol(mg/dL)	268	255	241	265	13.35
ALT (U/L)[1]	18.6	19.2	17.5	18.3	0.79
AST (U/L)[1]	85.3	83.3	83.4	87.3	4.45
ALP (U/L)[2]	39.5	42.2	40.1	49.5	3.95

[1] μ mol pyruvate produced/L/min.

[2] μ mol phosphate produced/L/min.

Table 4. Feed cost for egg production during laying phase

Item	Dietary group			
	D_1	D_2	D_3	D_4
Feed cost/kg (Rs)	6.19	5.98	5.87	5.75
Feed cost/kg egg mass(Rs)	16.22	16.20	15.38	16.21

1 US dollor=42 Indian Rupees (Rs), 1 UK pound=70 Indian Rupees (Rs).

acid, especially lysine and methionine, levels were also in the required range.

The egg size was not influenced as in the study of Campbell (1979), while in the studies of Summers et al. (1971), Kubota et al. (1972), March et al. (1972) and Grandhi et al. (1977), a lower egg size was observed. In general, egg production and egg size are dependent upon the feed intake as well as the amino acid make up. Thomas et al. (1978) noticed a decrease in production and in Haugh Unit of eggs laid by birds fed 100 or 150 g/kg high glucosinolate RSM. But, in general, RSM feeding has little effect on egg quality indices as has been observed in the present study. The tainting of eggs as has been observed in brown eggers (Miller et al., 1972; Hobson-Frohock et al., 1975; Marangos and Hill, 1976; Blair et al., 1976) was not noticed in the present as judged by the sensory evaluation panel. This may be due to a lower level of RSM inclusion in diet, or species variation.

The haematological and biochemical profile of quails in the different dietary groups did not differ much, suggesting that the high glucosinolate RSM was well tolerated at lower inclusion levels. Massive haemorrhages in the liver (Jackson, 1969; March et al., 1972; Hall, 1974; Marangos et al., 1974; Marangos and Hill, 1976; Smith and Campbell, 1976; Campbell, 1979) with mortality has been reported by various workers, but in the present study due to the lower levels of RSM, no gross and histopathological changes in the vital organs were observed. The mild hypertrophic changes of thyroid of quails fed RSM did not alter the production performance.

The cost of RSM diets was about 5% lower than the control soybean diet, but the cost of egg production was almost similar. RSM could be incorporated in diets whenever the cost of soybean meal is very high.

In the present study, it could be concluded that the

laying potential of Japanese quail was well-maintained up to 100 g/kg dietary level of rapeseed meal.

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