REPLACEMENT OF SOYBEAN MEAL BY RAPESEED (CANOLA) MEAL IN THE DIETS OF JUVENILE AND ADULT MEAT BREEDER GENOTYPES

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Although there are several reports in the literature on the inclusion of rapeseed meal (RSM) as the primary protein source in diets of leghorns used for the production of table eggs, there are few reports on the use of RSM in meat breeder diets (March et al., 1972, 1975; Hulan and Proudfoot 1980; Hulan and Proudfoot 1981). With but one exception (Proudfoot et al., 1982) there are no reports in the literature dealing specifically with the use of CANOLA meal (CM-produced from Canadian low glucosinolate rapeseed) as a protein source for meat breeder genotypes.

Therefore, it was considered desirable to determine the combined effects of SM and CM as sources of dietary protein during both the juvenile and laying periods on : 1) the general performance of broiler breeders during the laying period; 2) fertility and hatchability of eggs produced, and; 3) performance of progeny.

Experimental

The four female genotypes used in this experiment were obtained as hatching eggs from the primary breeders and hatched at our laboratory. Male lines were provided by the primary breeders. The house where the birds were brooded and reared was windowless and contained 12 compartments, each divided into 4 pens ($13.5 m^2$/pen). The four genotypes were randomly assigned to compartments within each of 3 replicates and the 4 combinations of juvenile and adult diets were randomly assigned to pens within each compartment. Each pen initially housed 55 females and 11 males but through random removal each pen population was reduced to 45 females and 5 males at 154 days of age (154d).

The entire population was maintained on 8 hours of light per 24 hour day cycle from 1 to 132d. From 132 to 448d the photoperiod treatment consisted of 10.5L : 9.5D : 2L : 2D for the remainder of the experiment (Proudfoot et al. 1980). During the first week, light intensity was 20 lux. This was linearly reduced so that at 21d the birds were receiving 1 lux intensity which was continued to 126d. The intensity was then increased linearly so that at 140d the birds were receiving 10 lux intensity which was maintained throughout the adult laying period.

The comparable starter, grower and breeder diets fed are shown in Table 1. CM replaced SM in case of each diet group (starter, grower, breeder) and appropriate adjustments were made in the other ingredients in order to keep the diets making up a group isonitrogenous and isoenergic. Restriction of feed intake commenced at 21d; from

22 to 28d feed was provided on a daily basis. Skip-a-day feeding started at 29d and was continued to 140d and then feeding reverted to a daily schedule throughout the end of the test (448d), Proudfoot et al. (1982).

Table 1. Composition (kg/tonne) of starter, grower and beeder diets

Ingredient	Starters (1-35d)		Growers (36-140d)		Breeders (141-448d)	
	Control	CM	Control	CM	Control	CM
Ground corn	198	198	190	215	185	188
" wheat	280	280	300	300	280	280
" oats	150	150	200	165	200	185
" barley	150	150	200	200	160	160
Canola meal (CM)	-	50	-	50	-	65
Soybean meal (SM)	150	70	55	-	50	-
Fishmeal (63)	30	56	-	15	35	37
Animal fat	2	6	10	10	-	-
Dehy. alfalfa	15	15	15	15	20	20
Ground limestone	7.5	7.5	7.5	7.5	50	45
Dibasic Ca phos.	7.5	7.5	12.5	12.5	10	10
Iodized salt	5.0	5.0	5.0	5.0	5.0	5.0
Vit-min premix	5.0	5.0	5.0	5.0	5.0	5.0
Calculated anal.						
Crude Prot. (%)	18.1	18.0	13.1	13.1	14.5	14.5
ME (MJ/kg)	11.73	11.73	11.94	11.94	11.94	11.94

Between 232 and 238d, 150 hatching eggs were collected from each of the 48 pens, incubated and hatched. Random samples of 25 males and 25 females were selected from each of the 48 pens and grown as broiler chickens to slaughter age (49d) for a progeny test of parental genotypic and dietary effects. The population was fed a crumbled starter diet containing 24 % C.P. and 12.45 MJ/Kg M.E. to 28d, and a pelleted finisher diet containing 16 % C.P. and 13.28 MJ/Kg M.E. from 29 to 49d.

Analyses of variance were based on pen means and computed as a split plot model (Snedecor and Cochran, 1980).

Results and discussion

Since first and second order interactions with genotypes and dietary regimens occurred for but one trait, (egg production), in the interest of brevity the data for the four genotypes tested were pooled and are presented here.

Replacing SM with CM in juvenile diets (fed from 0-154d) or in adult diets (fed from 155-448d) had no significant effect on mortality (Table 2). A comparison of the combined effects revealed that, but with one exception, (mortality amongst males fed CM during the juvenile period but switched to a SM adult diet), there was no overall effect from feeding SM or CM to males or females during either the juvenile or adult periods.

Table 2. The effect of CM supplemented juvenile and adult diets on performance of meat breeders

Treatment	Mort. (154-448d) M	F	Mean Liv.Wt (g) M	F	H.H. Egg Prod. to 448d	H.H. Egg Prod. 47+to 448d	Broiler chicks to 448d	Feed/ doz. eggs to 448d
	— % —		— 448d —					
Juvenile :								
SM	10.0	5.7	4627	3353	147	140	115	3.74
CM	4.2	6.1	4648	3330	146	139	117	3.74
SE (24)	2.6	1.3	55	15	1.6	1.6	1.7	.05
Signif.	NS	NS	NS	NS	NS	NS	NS	NS
Adult :								
SM	8.1	5.4	4638	3360	147	140	118	3.72
CM	5.6	6.5	4638	3322	146	138	115	3.76
SE (24)	2.6	1.3	55	15	1.6	1.6	1.7	.05
Signif.	NS	NS	NS	NS	NS	NS	NS	NS
Combined :								
SM-SM	2.4	6.3	4624	3356	146	139	115	3.77
SM-CM	4.7	7.1	4602	3340	148	141	115	3.71
CM-SM	16.9	4.5	4652	3365	149	141	120	3.68
CM-CM	6.5	6.0	4673	3304	144	136	115	3.81
SE (12)	3.6	1.8	78	21	2.2	2.2	2.4	.07
Signif.	*	NS	NS	NS	NS	NS	NS	NS

Replacing SM with CM in diets fed during the juvenile and/or adult periods had no significant effect on mean live weight, hen housed egg production, hen housed production of eggs weighing 47g or more, broiler chicks produced or feed consumed per dozen eggs (Table 2). Neither were there any significant effects demonstrated for these traits by switching the birds from, for example, a SM juvenile diet to a CM adult diet or from a CM juvenile diet to a SM adult diet or from feeding CM throughout compared to when SM alone was fed.

Replacing SM with CM in the diets fed during the juvenile period had no significant effect on the number of days the birds took to reach sexual maturity - age at 50 % production (Table 3). However, birds fed the adult diets in which SM was replaced by CM took significantly fewer days (2) to reach sexual maturity compared to that of birds fed the adult diet in which the primary protein source was SM. Feeding CM diets during the juvenile or adult periods or throughout (CM-CM) or switching from a SM juvenile to a CM adult diet or from a CM juvenile to a SM adult diet had no significant effect on this trait compared to when SM alone was fed.

Replacing SM with CM in the diets, fed during the juvenile or adult period or both switching from one protein source (SM or CM) to the other from the juvenile to the adult period had no significant effect on fertility of eggs compared to when SM alone was fed.

Table 3. The effect of CM supplemented juvenile and adult diets on performance of meat breeders

Treatment	Age at 50% Prod. (days)	Fert. (%) 392d	Hatch. (%) 392d	Egg Weight (g) 224d	Egg Weight (g) 448d	Specific gravity ($x10^{-4}+1.0$) 224d	Specific gravity ($x10^{-4}+1.0$) 434d
Juvenile :							
SM	183	91.4	78.4	57.7	70.1	861	787
CM	183	93.7	82.3	57.1	70.0	859	790
SE (24)	0.50	1.12	0.81	.15	.26	3	3
Signif.	NS	NS	*	**	NS	NS	NS
Adult :							
SM	184	92.8	81.0	57.5	70.3	865	792
CM	182	92.3	79.8	57.3	69.8	855	786
SE (24)	0.15	1.12	0.81	.15	.26	3	3
Signif.	*	NS	NS	NS	NS	*	NS
Combined :							
SM-SM	184	91.5	78.8	67.9	70.6	866	789
SM-CM	182	91.2	78.1	57.5	69.7	856	786
CM-SM	184	94.0	83.1	57.0	70.1	864	794
CM-CM	182	93.3	81.5	57.1	70.0	855	786
SE (12)	0.70	1.58	1.15	.21	.37	4	5
Signif.	NS	NS	NS	NS	NS	NS	NS

Table 4. The effects of CM supplemented juvenile and adult diets on performance of progeny - (0-49 days).

Treatment	% Mortality M	% Mortality F	Mean liv.wt. M	Mean liv.wt. F	Feed conv.	Grade A Carc. M	Grade A Carc. F	Monetary Returns ¢
Juvenile :								
SM	5.4	1.2	2631	2177	2.02	66	60	49
CM	4.6	1.0	2622	2192	2.03	70	65	50
SE (24)	1.50	1.09	14.7	14.9	.009	1.3	1.8	1.5
Signif.	NS	NS	NS	NS	NS	NS	NS	NS
Adult :								
SM	6.1	0.7	2625	2177	2.02	66	60	50
CM	4.0	1.6	2627	2192	2.03	70	64	49
SE (24)	1.50	1.09	14.7	14.9	.009	1.3	1.8	1.5
Signif.	NS	NS	NS	NS	NS	NS	NS	NS
Combined :								
SM-SM	5.2	1.5	2632	2174	2.01	61	59	51
SM-CM	5.6	1.0	2629	2179	2.04	72	61	48
CM-SM	7.1	0.2	2618	2181	2.03	70	62	49
CM-CM	2.6	2.5	2625	2204	2.03	69	67	51
SE (12)	2.12	1.54	20.8	21.1	.012	1.5	2.4	2.2
Signif.	NS	*	NS	NS	NS	*	NS	NS

Replacing SM with CM in the juvenile diets resulted in significantly higher hatchability compared to when the SM diet was fed. However, replacing SM with CM in the diets fed during the adult period, switching from one protein source to the other from the juvenile to the adult period, or feeding CM throughout had no significant effect on hatchability (Table 3).

Replacing SM with CM in the diet fed during the juvenile period resulted in significantly lower egg weights. This effect on egg weight when CM was fed may have been the result of enhanced sexual maturity of birds fed this meal as already discussed. Such an effect could be an advantage when dealing with a strain of birds which has the propensity to lay unusually large and oversize egg. The effect of juvenile diet on egg weight had disappeared however at 448d. Replacing SM with CM in the adult diets, switching from one protein source to the other from the juvenile to the adult periods, or feeding CM throughout had no significant effect on egg weight compared to when SM alone was fed. Furthermore, there were no significant effects from replacing SM with CM in juvenile or adult diets, from feeding CM throughout or from switching (juvenile to adult period) from SM to CM or from CM to SM, or from feeding CM throughout on specific gravity of eggs compared to when SM alone was fed (Table 3).

Good performance was observed for the progeny of adults fed the four dietary treatments (Table 4). Replacing SM with CM in the juvenile or adult diets, switching from one source of dietary protein to the other (SM-CM; CM-SM) or feeding CM throughout had no significant effect on mortality, live body weights or mean monetary return (returns per bird housed over the cost of feed and chicks based on local producer prices) of the progeny compared to when SM alone was fed. Overall, mortality was about three percent and 49d live weights exceeded 2600 and 2150 grams for males and females respectively, with 2.02 KG of feed being required to produce one Kg of live bird weight. Interestingly, percentage Grade A carcasses (Canadian Grade Standard) was significantly higher for birds fed CM during the juvenile period, the adult period or throughout (see combined effect, Table 4) compared to when SM was fed throughout (SM-SM). Such an effect was not observed for females. It should be noted that the percentage of Grade A carcasses (both sexes) tend to be underestimated since 80-90 percent of the down grades were graded utility because of damage to the carcass caused by the extra handling required with experimental population.

In the data presented there were, as indicated earlier, first and second order interactions with genotypes and dietary regimens for egg production only. The first order interaction was between juvenile and adult dietary treatments which provided evidence that the mixed regimens SM-CM and CM-SM stimulated egg production up to 448d compared with feeding either CM or SM throughout both the juvenile and adult periods. This interaction is contrary to that reported by March et al. (1972) who concluded that egg production stocks fed meal produced from the older varieties of rapeseed (not canola) performed best when preconditioned with the meal in the grower diets. A second order interaction involving genotypes x juvenile x adult diets also occurred for egg production to 448d. An examination of the data revealed that two of the four genotypes laid more eggs when fed either of the combined regimens (SM-CM or CM-SM), compared to a single source of protein (SM-SM or CM-CM), while egg production for the other two genotypes was similar across all regimens.

It is concluded that CM can partially replace SM in starter diets and can completely replace SM in grower and breeder diets of broiler breeder genotypes without adversely affecting optimum performance of the breeders per se or the performance of their progeny.

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References

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