Indian Journal of Animal Sciences **82** (9): 1062–1066, September 2012

Canola meal as a source of feedstuff in formulated diets for broiler production after incorporation with digestive enzymes

MEHRDAD IRANI[1], NIMA ILIA[2], MEHDI YOUSEFIAN[3], HASAN ABEDI[4] and SHAHABODIN GHARAVEYSI[5]

Qaemshahr Branch, Islamic Azad University, Qaemshahr, Iran

Received: 20 October 2011; Accepted:10 January 2012

ABSTRACT

This study was conducted to evaluate effects of using Canola meal as a substitute to soybean meal in diets for broiler production. Male broiler chicks (720) were allocated to 16 treatments. The factors were canola level (0, 7.5, 15 and 22.5%) with combination of 4 levels of commercial enzyme (0, 90, 180 and 270 mg/kg). On the basis of growth response, food conversion ratio, 22.5% canola meal incorporated in the diet resulted in the best performance of broiler but was not significantly higher than control. Growth and feed utilization efficiencies of chicks fed canola meal containing enzyme of 180 mg/kg were superior to those fed diets containing lower canola and lower enzyme. The feed intake in 22.5% of canola was significantly higher than control, but the weight gain did not show the difference. It means by extra feeding of chicks on canola and using appropriate enzyme the reduction in weight will be compensated, however the growth rate for canola meal was lower at all levels of inclusion in comparison to those for the zero canola meals. The main effect of all enzyme level was not significant on feed intake, body weight gain and feed conversion ratio. There was no significant difference among treatments in dressing percentage, pancreas, abdominal fat, breast, thighs and legs ash percentage. The present results indicated that supplementation of canola diet with commercial enzyme 15 000 improved feed digestion in chicks. It was suggested that the optimum enzyme dose was about 180 mg / kg of feed.

Key word: Broiler, Canola meal, Carcass traits, Enzyme

Soybean meal is considered an essential ingredient in feeds for broiler for its high value protein resources but the cost of soybean meal has increased. Canola meal is a locally available and cheap source of feed ingredients. Conventional canola meal is an important ingredient of concentrate mixture commonly used for livestock feeding in some countries. The use of feed additives probiotic, prebiotic and different enzymes (Yousefian *et al.* 2011) has proven to be effective by improving nutrient utilization leading to improved feed conversion ratio and better growth rate in most cases. The most frequently occurring anti-nutritional substances in the canola is non-starch polysaccharides, the use of commercial enzyme is a potentially important processing method that can be expected to improve the nutritive value and decrease certain anti-nutritional factors, like non-starch polysaccharides. In the present study, canola meal and a commercial enzyme (composition of xylanase and beta-endoglucanase) were used to evaluate the possible utilization of canola meal as a partial substitute of dietary chicken meal protein in diets for the broiler production.

Present address: [1-5] Department of Animal Sciences (yousefianeco@yahoo.com).

MATERIALS AND METHODS

Male chicken (720), day-old and of 60±5 g body weight (BW), were assigned to a 2 factorial design with 4 canola level (0, 7.5, 15 and 22.5% of diet) and 4 levels of enzyme (0, 90, 180 and 270% of standard advised) with 3 replications of 15 chicks in a completely randomized design. Diets consisted of 640 g/kg corn and soybean meal 260 g/kg as the main ingredients, supplemented with mineral and vitamin mix 5.5 g/kg. The canola meal used in experiment had CP 35.6%, fiber 16%, ash 6.6%, Ca 0.9%, P 0.8%, crude fat 2% and moisture 9%. Experimental periods were 42 days with 1 day of adaptation and 1 days of sampling. Chicks were housed in 12 m × 120 m salon with 48 cages (1.7 m×0.85 m) during the experimental period. Chickens were fed daily 23 h (1h as dark time as no feeding time) and freshwater was made available throughout the experimental period. The chicks were weighed at every 2 weeks, the end of each period. At the final stage average of feed intake, average increase weight, fed conversional rate, carcass traits including dressing percentage, pancreas, abdominal fat, breast, thighs and legs ash percentage, were scored. Also the hormonal level of iodine thyronine (T3) and thyroxin (T4) were measured.

All data were pooled together within groups and the

difference was tested by One-way ANOVA. To compare the mean multiple range test of Duncan were used. All statistical analyses were performed with SAS, 9.1 and Excel, 2007 for Windows where significance level was set at 0.05.

RESULTS AND DISCUSSION

There were no significant differences between canola treatments and control (Table 1), however the difference in chicks weight feed 22.5% and 15% was significant (P<0.05). As per other reports rapeseed meal like canola meal caused a weight loss in broilers and decreased food consumption (Fritz *et al.* 1989, Kralik *et al.* 2003, Roth-Maier 2004), however in the present study no decreases in weight were observed in treatment groups and the result is in agreement with those reported by Fenwich and Curtis (1980) and Chappa *et al.* (1989).

There were not significant differences in dosage of enzyme, but the interaction between canola and enzyme was markedly higher in combination of 180 mg enzyme and canola (Table 2). The feed intake by different groups was not equal and the difference was significant (P<0.05). The highest and significant intake was in group of 22.5% canola, while the lowest was related with control. The lowest feed intake by chicks was in groups that received 90 mg enzymes supplemented with canola feed. Concerning the interaction between enzyme and canola, the minimum feed intake was in group of without canola, while even without using canola, the enzyme was effective (Table 2).

It is expected that by increasing the canola in chicks meal, the feed intake is reduced due to presence of high glucosinolate and fiber in canola (Thomas *et al.* 1983 and Slinger *et al.* 1978).

The growth performance and feed utilization of chicks in terms of FCR and carcass traits are presented in Tables 1, 3. The FCR in treatments, in comparison to the control was significantly different (P<0.0047). In treatment group that received 180 mg/kg enzyme, FCR decreased (Table 1). The analysis of variance did not show significant differences of interaction between canola and enzyme levels (P>0.505), but using 180 mg enzyme markedly reduced FCR (Table 2). The addition of fatty acid lowers the speed of food transition within the digestive system and helps in more efficient absorption and thus improves FCR as indicated in our results. Addition of canola meal in chicken meal did not show any unfavorable effect. This is maybe due to amino acid balances due to addition of Canola meal to diet and the presence of several ingredients, including different protein and fat (Blair *et al.* 1986 and Chappa *et al.* 1989). The taste of feed is very important in poultry meat quality. By replacing soybean meal with canola, it is assumed that the taste of feed changed, which had negative effect on consumption rate of chicks. The increase of canola in meal, increased feed intake significantly (P<0.05). In fact the effect of smell and taste of

Table 1. Effect of the canola and enzyme on average weight, consumption and FCR of chickens

Treatment	Feed (g)	Weight (g)	FCR
Canola 0%	3722±63.4^{c}	1863±323^{ab}	1.99±0.05^{b}
Canola7.5%	3802±53.4^{ab}	1848±108^{ab}	2.06±0.05^{a}
Canola 15%	3795±38.5^{b}	1832±56^{b}	2.07±0.03^{a}
Canola 22.5%	3872±16.2^{a}	1906±103^{a}	2.03±0.03^{ab}
Enzyme 0 mg/kg	3840±80^{a}	1882±39	2.04±0.03
Enzyme 90 mg/kg	3761±48^{b}	1829±91	2.05±0.05
Enzyme 180 mg/kg	3807±46^{ab}	1891±88	2.01±0.07
Enzyme 270 mg/kg	3783±73^{ab}	1847±73	2.05±0.02

Means with the same letter within rows are not significantly different (P > 0.05); * significant at 0.05; ** significant at 0.01; *** significant at 0.001.

Table 2. The interaction effect of canola meal and enzyme on average weight, consumption and FCR of chickens

treatments	Weight (g)	Feed (g)	FCR
0% canola + 0 mg enzyme	1909±86.9^{abc}	3823±46.9^{abcd}	2±0.07^{bc}
0% canola + 90 mg enzyme	1814±27.8^{abc}	3638±47.3^{e}	2±0.02^{bc}
0% canola + 180 mg enzyme	1908±16.3^{abc}	3714±4.7^{de}	1.9±40.0^{c}
0% canola + 270 mg enzyme	1820±75.6^{abc}	3714±32.7^{de}	2.04±0.07^{bc}
7.5% canola + 0 mg enzyme	1819±72^{abc}	3742±75.3^{bcde}	2.06±0.05^{ab}
7.5% canola + 90 mg enzyme	1772±74.8^{c}	3763±85.5^{cde}	2.12±0.05^{a}
7.5% canola + 180 mg enzyme	1940±43.2^{ab}	3920±89.8^{ab}	2.02±0.01^{bc}
7.5% canola + 270 mg enzyme	1861±166.3^{abc}	3786±181.4^{acd}	2.04±0.08^{abc}
15% canola + 0 mg enzyme	1852±90^{abc}	3818±104.3^{abcde}	2.06±0.04^{ab}
15% canola + 90 mg enzyme	1823±12.8^{abc}	3791±39.1^{abcd}	2.08±0.02^{ab}
15% canola + 180 mg enzyme	1855±18.8^{abc}	3825±58.7^{cde}	2.06±0.04^{ab}
15% canola + 270 mg enzyme	1800±8.3bc	3749±23.2^{cde}	2.08±0.01^{ab}
22.5% canola + 0 mg enzyme	1949±71.1^{a}	3770±138.4^{a}	2.04±0.05^{abc}
22.5% canola + 90 mg enzyme	1907±76.8^{abc}	3855±63.4^{abc}	2.02±0.07^{bc}
22.5% canola + 180 mg enzyme	1860±76.2^{abc}	3770±138.4^{abcd}	2.03±0.01^{abc}
22.5% canola + 270 mg enzyme	1908±42.6^{ab}	3883±73.1^{bcd}	2.03±0.02^{abc}

Means with the same letter within rows are not significantly different (P > 0.05); *significant at 0.05; **significant at 0.01; ***significant at 0.001.

Table 3. Effect of the canola and enzyme on average level on traits

Treatment	Carcass	Liver (%)	Pancreas (%)	Abdominal fat (%)	Legs (%)	Breast (%)	Ash (%)
Canola 0%	76.3±0.9	1.34±0.13	0.11±0.03^{b}	1.84±0.08	23.1±0.4	13.1±1	1.45±0.06
Canola7.5%	75.6±1	1.32±0.16	0.12±0.01^{ab}	1.53±0.13	22.8±0.6	12.9±0.9	1.44±0.05
Canola 15%	75.4±0.3	1.39±0.13	0.14±0.02^{a}	1.39±0.02	23.6±0.1	13.3±1	1.42±0.04
Canola 22.5%	74.9±0.9	1.38±0.06	0.12±0.01^{ab}	1.55±0.13	22.9±0.4	13.0±0.6	1.41±0.08
Enzyme 0 mg/kg	75.5±0.6	1.36±1.2	0.13±0.02^{ab}	1.53±0.19	22.9±0.7	13.3±0.4	1.37±0.05
Enzyme 90 mg/kg	75.7±1	1.37±1.5	0.1±0.01^{b}	1.45±0.14	22.8±0.1	13.3±0.1	1.52±0.12
Enzyme 180 mg/kg	75.5±2	1.31±1.4	0.14±0.01^{a}	1.53±0.15	23.2±0.2	13.2±0.1	1.40±0.07
Enzyme 270 mg/kg	75.3±0.8	1.39±1.3	0.13±0.02^{ab}	1.44±0.19	23.4±0.5	13.6±0.2	1.43±0.04

Means with the same letter within rows are not significantly different (P > 0.05); * significant at 0.05; ** significant at 0.01; *** significant at 0.001.

Table 4. The interaction effect of canola meal and enzyme on traits of chicken

Treatment	Carcass (%)	Liver (%)	Pancreas (%)	Abdominal fat (%)	Legs (%)	Breast (%)	Ash (%)
0% canola + 0 mg enzyme	76.3	1.22^{b}	0.10	1.28	23.3^{ab}	12.8	1.36
0% canola + 90 mg enzyme	76.2	1.41^{ab}	0.12	1.37	22.7^{b}	12.3	1.36
0% canola + 180 mg enzyme	77.6	1.18^{b}	0.12	1.45	22.4^{b}	13.5	1.48
0% canola + 270 mg enzyme	75.3	1.45^{ab}	0.17	1.28	22.9^{ab}	14.7	1.45
7.5% canola + 0 mg enzyme	75	1.49^{ab}	0.12	1.68	23.6^{ab}	12.7	1.46
7.5% canola + 90 mg enzyme	76.9	1.53^{ab}	0.11	1.38	22.5^{b}	13.9	1.54
7.5% canola + 180 mg enzyme	76.1	1.20^{b}	0.12	1.57	22.8^{ab}	11.9	1.40
7.5% canola + 270 mg enzyme	74.4	1.28^{ab}	0.13	1.63	23.7^{ab}	12.2	1.46
15% canola + 0 mg enzyme	75.6	1.42^{ab}	0.15	1.69	23.8^{ab}	13.5	1.43
15% canola + 90 mg enzyme	75.5	1.25^{ab}	0.10	1.63	24.7^{a}	11.9	1.50
15% canola + 180 mg enzyme	75	1.57a	0.13	1.66	22.4^{b}	14.2	1.53
15% canola + 270 mg enzyme	75.6	1.47^{ab}	0.12	1.65	23.3^{ab}	13.7	1.44
22.5% canola + 0 mg enzyme	75.1	1.34^{ab}	0.13	1.59	22.2^{b}	13.5	1.48
22.5% canola + 90 mg enzyme	74.2	1.36^{ab}	0.11	1.33	23.2^{ab}	12.2	1.27
22.5% canola + 180 mg enzyme	74.2	1.32^{ab}	0.13	1.31	22.8^{ab}	13.1	1.37
22.5% canola + 270 mg enzyme	76.2	1.21^{b}	0.12	1.34	22.6^{b}	12.5	1.38

Means with the same letter within rows are not significantly different (P > 0.05); * significant at 0.05; ** significant at 0.01; *** significant at 0.001. Cano, canola; Enzy, enzyme.

feed is lower in poultry comparing to other domestic animal, besides the bird does not chew the food, therefore the food remains in mouth for a shorter period of time (Bell 1982).

The performance of dressing percentage and other carcass traits of canola and enzyme effect are presented in Table 3 and their interaction in Table 4. The effect of different level of canola and enzyme on dressing percentage showed, no significant differences within treatment groups and control (P>0.05), however the highest dressing percentage was in the group fed with no canola supplement. The value of legs and breast to dressing percentage was not significantly different in both cases in treatment and control groups. However the best result was obtained in a dosage of 15% canola meal.

The canola and enzymes did not increase liver weight significantly (P>0.157). By using 22.5% of canola and with increasing enzyme in chick meal, the liver weight decreased. On pancreas the effect of different level of canola and enzymes was significant (P<0.05). No significant interaction between different level of canola and enzyme were obtained (P>0.05). The abdominal fat % in different treatments did not differ significantly between treatments and control group as well (P>0.25). The lowest rate of fat content was belonging to a treatment with no canola and no enzymes in chicks meal. The ash content (Table 3) was same in treatment groups but was markedly different in control with no canola increment.

Increasing the canola in diet gradually decreased T4 level, and between 0 and 22.5% the difference was significant (P<0.05). In T3 no fluctuation (Table 5) and marked difference was observed. The presence of glucosinolate in poultry meal affects thyroid activity and reduces the thyroid hormones circulation and the fraction of T3 to T4 in blood

Table 5. The comparison mean of T1 and T4 at the end of culture period

Treatment	T3	T4
0% canola + 180 mg enzyme	3.66[a]	2.19
7.5% canola + 180 mg enzyme	2.97[ab]	2.30
15% canola + 180 mg enzyme	3.50[ab]	2.46
22.5% canola + 180 mg enzyme	2.68[b]	1.21
sem	0.25	0.42

Means with the same letter within rows are not significantly different (P > 0.05); * significant at 0.05; ** significant at 0.01;*** significant at 0.001.

of animal (Lo and hill 1971). It is well known that T3 plays a far greater role in bio-oxidation processes in cells than does T4 (Bobek *et al.* 1976), therefore the rate of these two hormone is also very important. Klandorf *et al.* (1981) confirmed that T3 is, in chickens, a metabolically more active substance than T4, therefore every change in thyroid activity results in metabolism of animal. Bilczikian *et al.* (1980) observed in turkey that at hypothyroidism condition the body temperature decreases. This may have occurred in the present study by using of canola meal, but it may have been compensated by the presence of fatty acid in meal.

Analysis of variance of feed conversion ratio (FCR) in different rearing periods revealed that the effect of treatment on FCR during whole rearing period was significant (P<0.05). The best FCR was observed on no canola meal diet and within treatment groups having the lowest i.e., 22.5% that did not significantly differ from the other treatment groups (P>0.05). These results are in agreement with others. The higher dosage of canola showed lower FCR in treatment group. It seems that amount of enzyme and feed composition has more effect in balance of meal and FCR as well. The presence of commercial enzyme reduced the food consumption or on other hand, increased the energy requirement for metabolism of feed in the diet so the energy may be regarded as limiting factor in feed intake. Rotkiewicz *et al.* (1993) reported increase in liver of broiler fed 6% canola meal. Also Griffiths *et al.* (1980) reported that 10% canola meal to broiler feed increased liver weight while in the present study due to low glucosinolate in canola meal, there was no significant difference in mean weight of liver of different treatments. The tannin binds with protein preventing the enzyme activity. Any disturbance in the activity of enzyme causes dramatically changes in the activity of pancreas and its size. Due to presence of tannin in canola meal the differences in treatment was significant. Analysis of variance of traits in broilers internal organs weight, abdominal fat, during the whole period showed that treatment with 15% canola had the highest abdominal fat while the lowest fat content was related to control group with no canola meal in meal. Canola meal have relatively high amount of phytic acid and sulphur. In the present study no significant differences were observed between different treatments and control as well. The experiment illustrated that FCR of different canola treatment and the use of enzyme has no significant difference with each other, therefore it is suggested that using 22.5% canola could be used in diet, which is more economical.

REFFRENCES

Bobek S, Jastrzebski M and Pietras M. 1976. Age-related changes in oxygen consumption and plasma thyroid hormone concentration in the young chicken. *General Comparative Endocrinology* **31**: 169–74.

Bell J M. 1982. From rapeseed to canola: A brief history of research for superior meal and edible oil. *Poultry Science* **61**: 613–22.

Bilczikian J P, Loeb J N and Gammon O F. 1980. Induction of sustained hyperthyroidism and hypothyroidism in the turkey. Physiological and biochemical observations. *Poultry Sci*ence **59**: 628.

Blair R, Bell J M and Clandinin D R. 1986. The chemical composition and nutritional value for chickens of meal from recent cultivars of canola. *Canadian Journal of Animal Science* **66**: 821–25.

Chappa V, Stranznick A H and Pastuszewska B. 1989. Effect of Czeck of polish 00–rapeseed meal on performance of broiler chickens. *Zivocisna Vyroba* **34**: 1037–46.

Fenwich G R and Curtis F R. 1980. Rapeseed meal in reaction for laying chicks. A review of the effect on egg quality. *Journal of Science Food and Agriculture* **31(6)**: 515–25.

Fritz Z, Schleicher A, Jaresz A and Jamproz D. 1989. Mixtures supplemented with new variety rapeseed meal, floromycine or tyrosine in broiler chicken feeding. *Zootechnica* **31**: 69–77.

Katok S H, Amanlo E and Kamyab E A. 1382. The effect of different level of canola meal and Ca supplement in chicken production. *Chakava* **12(2).** [In Percian].

Klandorf H, Sharp P J and Newcomer W S**.** 1981. The influence of feeding patterns on daily variation in the concentrations of plasma thyroid hormones in the hen. *IRC Medical Sci*ence **9**: 82.

Kralik Z, Skartic Z, Kusec G and Kadlec J. 2003. The influence of rapeseed oil on the quality of chicken carcasses. *Journal of Animal Science* **81(1)**: 77–84.

Lo M and Hill D C. 1971. Evaluation of protein concentrates prepared from rape seed meal. *Science Food and Agriculture* **22**: 128–30.

Rotkiewicz T, Koziowski M, Fanuga A, Wisniewska Sledz M, Ikuiski D, Kozlowska H, Rotiewicz D and Kozlowski K. 1993. Pathomorphologocal examination of thyroid glands and livers of broilerchickens fed with diets with maximum content of extracted rapeseed oil meal of the polish Jan ta, caltivar and Canadian canola. *Act Academian Agriculture ac Technicae Olstenensis. Vetermana*, **21(2)**: 19– 22.

Roth-Maier D. 2004. Investigations on feeding full-fat canola seed and canola meal in broilers. *Poultry Science* **83(3)**: 295–300.

SAS Institute. 2004. SAS/STAT user's guide. Release 9.1. SAS Institute, Inc., Cary, NC

Slinger S J, Leeson S, Summers J D and Sadique M. 1978. Influence of steam pelleting on the feeding value of tower and candle rapeseed. *Journal of American Oil and Chemical Society* **54**: 94–99.

Thomas V M, Katz R J, Auld D A, Peterse C F, Sauter E A and

Steel E E. 1983. Nutritional value of expeller extracted rapeseed and safflower oil seed meal for poultry. *Poultry Science* **62(9)**: 882–86.

Yousefian M and Shirzad E. 2011. The review of the effect of growth hormone on immune system, metabolism and osmoregulation of fish. *Australian Journal of Basic and Applied Sciences* **5(5)**: 467–75.

Yousefian M, Nikkhoo M, Safari R and Nikkhoo M. 2010. Evaluation of Aqualase as probiotic on wild carp (*Cyprinius carpio*) grow immunity characteristics and resistance to streptococcosis. *Research Journal of Fisheries and Hydrobiology* **5(2)**: 173–78.