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Effect of Enzyme Supplemented High Fibre Sunflower Meal on Performance of Broilers

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Abstract.- Eight iso-nitrogenous chick rations with different levels of sunflower meal (SFM) supplemented with two commercially available enzymes NIBGE and Grindazym^{TM} were used to test the performance of broiler chicken. Non-significant differences among rations for feed consumption, highly significant difference for weight gain and significant differences for feed conversion ratio were observed. Average feed consumption of birds in finisher phase with different rations containing NIBGE ranged between 1477 and 1500g whereas the same containing GRINDAZYM^{TM} ranged between 1503.75 and 1511.25g. The average weight gain of birds on rations with NIBGE was between 661.25 and 7.22 g whereas it was between 747.50 and 774.00g on rations with GRINDAZYM^{TM}. The feed conversion ratio (FCR) with rations containing NIBGE ranged between 2.02 and 2.28 and 1.95-2.01g with Grindazym. The dressing percentage of experimental birds ranged between 49.64 and 56.55g. The analysis of experimental data on feed consumption, weight gain, FCR and dressing percentage revealed significant difference ($P<0.01$) among rations. The results suggested that enzyme supplementation helped improve digestion of fibre contents of SFM and increased bioavailability of metabolizeable energy from treated SFM. Enzyme supplemented sunflower meal can therefore be used safely in poultry ration formulation without compromising the performance of broiler birds but it can reduce cost of feed production by making use of locally available ingredients.

Key words: Sunflower meal, enzyme supplementation, broiler birds, growth rate, feed efficiency, weight gain.

INTRODUCTION

Poultry production presents an efficient alternative to meet animal protein needs of the nation because of its rapid growth and short gestation. It has played a vital role to meet the gap in animal protein supply at cost effective prices in Pakistan during the last 3 decades. At present, the industry is facing feed crisis because of high cost of production attributed to scarcity of cereal grains. Feeding cost constitutes 77% of the total cost of production in broiler farming (Perry, 1982). Protein and energy are the major nutrients for poultry feed formulation. Animal protein sources are expensive as well as malpractices may make them unhealthy for the growing birds. Vegetable protein sources on the other hand, are not only cost effective but also available in abundance as by products of oil seed industry. High fibre content with non-starch poly-saccharides is however, the major limiting factor in vegetable feeds as they are almost indigestible in chicken. Cellulose and hemi-cellulose are the main structural component of seed cell wall and consist of un-branched polymers of glucose. Xylan is the major component (80%) of hemi-cellulose and is usually associated with cellulose and lignin components of plant cell wall (Irwin *et al*., 1993).

Sunflower (*Heliantus annus*) ranks second to soybean in the world for vegetable oil production. In recent years, there is an increased interest for sunflower cultivation in Pakistan. The government launched a crash program to increase sunflower cultivation during 1997-98 and its production stands at 656,000 tones (Economic Survey of Pakistan, 2006-07) at the present and therefore the sunflower meal (SFM) availability is on the rise as oil industry by product. There is a great potential for SFM to be utilized as an important protein source in poultry feed however, its high fibre content poses practical problems in achieving satisfactory growth in broiler birds. This study was therefore, designed to

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determine the feeding value of sunflower meal in poultry and to explore means to improve its nutritional value through enzyme treatment.

MATERIALS AND METHODS

All feed ingredients and enzymes were procured from local market and National Institute of Biotechnology and Genetic Engineering (NIBGE), respectively.

Birds and housing conditions

The present experiment was conducted at Experimental Station, Department of Animal Nutrition, University of Veterinary and Animal Sciences, Lahore from July to August.

Three hundred and twenty, day old Hubbard broiler chicks of both sexes were weighed, and randomly divided into 32 experimental units of 10 chicks each, each unit lodged in independent pen. The house was properly washed and fumigated before the initiation of experiment. The temperature of the experimental room was maintained at 24°C. Proper ventilation and sanitation were ensured throughout the experimental period.

All the experimental chicks were reared on litter floor for 6 weeks and the chicks were randomly distributed in each pen.

Experimental rations

Eight isonitrogenous broiler starter rations were formulated according to the standards prescribed by NRC (1994) using 0, 5, 10 and 15% sunflower meal with an enzyme (concentrated liquid-NIBGE 1.5 litre/100kg feed) supplementation designated as A, B, C and D with fibre levels 4, 5, 6 and 7%, respectively and with commercial-GRINDAZYM™ 0, 5, 10 and 15% supplementation designated as E, F, G and H with 4, 5, 6 and 7% fibre levels, respectively. These rations were fed to each group up to 2 weeks. Another 8 corresponding broiler finisher rations were with similar specifications for enzyme supplementation. fiber levels and labeling nomenclature. The composition of broiler starter and finisher rations is given in Tables I and II, respectively.

Experimental procedures

The experimental birds were fed *ad libitum* and clean drinking water was made available throughout the experimental period. Each experimental unit was randomly assigned to 8 experimental rations in such a way that there were 3 experimental units on each ration. All the experimental birds were weighed at weekly intervals. Daily feed offered was recorded and the refusal was weighed at the end of each week to work out weekly feed consumption and all the ailments and mortality were also recorded during the trial period. Weight gain, feed consumption and FCR were recorded separately for starter and finisher phases as well as for overall 6 week trial period. At the end of the experiment, three birds from each treatment were picked randomly and slaughtered to work out dressing percentage, liver, gizzard, heart, pancreas and thymus weight. The comparative economics of different experimental rations containing different SFM levels was also calculated to determine the feasibility of enzyme treatment in high fibre (cellulase and xylanase complex) broiler rations.

Data collection and analysis

The data on weight gain, feed intake, feed conversion ratio, dressing percentage, liver, gizzard, heart, pancreas and thymus weights were recorded on weekly basis. Mortality record was maintained for each pen separately. At the end of the trial period the dressing percentage was also determined. The same data were subjected to statistical analysis using completely randomized design with 2x4 factorial arrangement. Duncan multiple range test was applied to compare difference of treatment means (Steel and Torrie, 1981).

RESULTS

Feed consumption

Starter phase (0-4 weeks)

Feed consumption of the birds fed on experimental rations A, B, C and D with NIBGE enzyme (containing 0, 5, 10 and 15% SFM and 4, 5, 6 and 7% FL) was 1627.50, 1636.25, 1626.25 and 1647.50 g while feed consumption of the birds fed on experimental rations E, F, G and H with GRINDAZYM™ was 1635.00, 1638.00, 1617.00 and 1624.50g, respectively (Table III). Maximum (1638.00g) feed was consumed by birds in group F

and minimum (1617.00g) by birds fed on ration G. Data on feed consumption by different groups, when subjected to statistical analysis revealed non-

Table I.- Composition of experimental broiler starter rations.

Ingredients	NIBGE @ 1.5 L/100 kg feed				GRINDAZYM™ @ 0.5 kg/ton			
	A	B	C	D	E	F	G	H
Maize	33.39	29.52	31.00	30.00	33.39	29.52	31.00	30.00
Wheat	16.00	16.00	15.00	05.00	16.00	16.00	15.00	05.00
Rice polish	06.00	08.00	08.00	10.66	06.00	08.00	08.00	10.66
Fish meal	06.00	05.98	04.63	05.00	06.00	05.98	04.63	05.00
Soyabean meal	20.10	18.00	13.00	14.00	20.10	18.00	13.00	14.00
Cotton seed meal	04.36	05.80	05.00	05.58	04.36	05.80	05.00	05.58
Sunflower oil meal	0.00	5	10	15	0.00	5	10	15
Corn gluten 60%	07.00	05.92	06.00	07.00	07.00	05.92	06.00	07.00
Oil	02.95	02.30	02.50	02.00	0.95	02.30	02.50	02.00
Molasses	2	2	2	2	2	2	2	2
Lime stone	0.93	0.97	1.10	1.16	0.93	0.97	1.10	1.16
DCP	0.71	0.62	0.76	0.56	0.71	0.62	0.76	0.56
Premix	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
L-lysine	--	--	0.08	0.10	--	--	0.08	0.10
DL-methionine	0.06	0.07	0.08	0.06	0.06	0.07	0.08	0.06
L-threonine	--	--	--	--	--	--	--	--
Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**
Metabolizable energy (Kcal/kg)	3200	3200	3160	3160	3200	3200	3160	3160
Crude protein	23	23	23	23	23	23	23	23
Crude fibre (%)	4	5	6	7	4	5	6	7
Calcium (%)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Available phosphorus	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
Linoleic acid	3.96	4.60	4.78	5.00	3.96	4.60	4.78	5.00
Methionine	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Lysine	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10

significant variation ($p>0.05$) in feed consumption for various experimental rations. All the averages were recorded on per bird basis.

Finisher phase (5-6 weeks)

The feed consumption per bird on rations A, B, C and D (containing 0, 5, 10 and 15% SFM and 4, 5, 6, 7% FL, respectively) with NIBGE enzyme was recorded to be 1477.50, 1502.00, 1503.75 and 1500.00g, whereas the corresponding values on rations E, F, G and H with GRINDAZYM™ (containing 0, 5, 10 and 15% SFM and 4, 5, 6 and 7% FL, respectively) were 1503.75, 1506.25, 1503.75 and 1511.25g, respectively (Table IV). Maximum feed was consumed (1511.25g) at 15% SFM and 7% FL level in H ration, while minimum feed consumed was 1477.50g at 0% SMF and 7% FL with enzyme. Data analysis on feed consumption by different groups revealed non-significant ($p>0.05$) differences among various experimental rations.

Overall feed consumption (0-6 weeks)

Overall feed consumption by birds fed on experimental rations A, B, C and D with NIBGE enzyme containing 0, 5, 10 and 15% SFM and 4, 5, 6 and 7% F was 3105.00, 3138.75, 3130.00 and 3147.50g, respectively. Maximum feed (3147.50g) was consumed by the chicks fed on ration D and minimum feed (3105.00g) was consumed by the birds fed on ration A. Feed consumption of birds fed experimental rations E, F, G and H with GRINDAZYM™ (containing 0, 5, 10 and 15% SFM and 4, 5, 6 and 7% FL, respectively) was

3138.75, 3144.25, 3120.75 and 3135.75g, respectively (Table V). The analysis of data indicated non-significant ($p>0.05$) variation for feed consumption among various experimental rations.

Table II.- Composition of experimental broiler finisher rations.

Ingredients	NIBGE @ 1.5 L/100 kg feed				GRINDAZYM ™ @ 0.5 kg/ton			
	A	**B**	**C**	**D**	**E**	**F**	**G**	**H**
Maize	46.33	41.10	37.00	38.86	46.33	41.10	37.00	38.86
Wheat	10	10	10	10	10	10	10	10
Rice polish	7	10.21	10	10	7	10.21	10	10
Fish meal	5	4.78	4.18	4.75	5	4.78	4.18	4.75
Soyabean meal	12.96	10	13.89	8	12.96	10	13.89	8
Cotton seed meal	6.00	6.00	6.00	--	6.00	6.00	6.00	--
Sunflower oil meal	0	5	10	15	0	5	10	15
Corn gluten 60%	6.00	6.00	1.72	6.55	6.00	6.00	1.72	5.55
Oil	2.28	2.44	2.50	2.00	2.28	2.44	2.50	2.00
Molasses	2	2	2	2	2	2	2	2
Lime stone	1.02	1.06	1.10	1.00	1.02	1.06	1.10	1.00
DCP	0.94	0.89	0.89	0.43	0.94	0.89	0.89	0.41
Premix	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
L-lysine	--	--	--	--	--	--	--	--
DL-methionine	--	--	--	--	--	--	--	--
L-threonine	--	--	--	--	--	--	--	--
Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**
Metabolizable energy (Kcal/kg)	3170	3170	3170	3170	3170	3170	3170	3170
Crude protein	20	20	20	20	20	20	20	20
Crude fibre (%)	4	5	6	6.97	4	5	6	6.97
Calcium	1	1	1	0.90	1	1	1	0.90
Available phosphorus	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
Linoleic acid	3.39	3.99	5	5.2	3.39	3.99	5	5.2
Methionine	0.39	0.38	0.35	0.40	0.39	0.38	0.35	0.40
Lysine	0.92	0.88	0.94	0.85	0.92	0.88	0.94	0.85

Table III.- Effect of enzyme supplementation and type of feed on broiler performance (0-4 weeks).

Treatment	Feed consumption bird	Weight gain bird	FCR bird
0% SFM, 4% fibre N-Enzyme	1627.50±17.017	$770.50±6.850^{B}$	$2.12±0.029^{C}$
5% SFM, 5% fibre N-Enzyme	1636.25±5.543	$793.00±3.629^{A}$	$2.06±0.008^{C}$
10% SFM, 6% fibre N-Enzyme	1626.25±9.437	$685±6.45^{D}$	$2.37±0.02^{A}$
15% SFM, 7% fibre N-Enzyme	1647.50±12.500	$735±6.45^{C}$	$2.24±0.02^{B}$
0% SFM, 4% fibre GRINDAZYM™	1635.00±7.906	$766.50±9.987^{B}$	$2.13±0.037^{C}$
5% SFM, 5% fibre GRINDAZYM™	1638.00±8.236	$786.25±5.543^{AB}$	$2.09±0.22^{C}$
10% SFM, 6% fibre GRINDAZYM™	1617.00±42.777	$782.50±7.773^{AB}$	$2.07±0.072^{C}$
15% SFM, 7% fibre GRINDAZYM™	1624.50±10.540	$792.50±6.614^{A}$	$2.05±0.24^{C}$

FCR, feed conversion ratio; N, NIBGE; SFM, Sunflower meal.

Weight gain

Starter phase (0-4 weeks)

The average weight gain per bird of chicks fed on starter rations, A, B, C and D with NIBGE enzyme (containing 0, 5, 10 and 15% SFM and 4, 5, 6 and 7% FL, respectively) was 770.50, 793.00, 685.00 and 735.00g, respectively. The highest weight with NIBGE enzyme (793.00g) was observed in chicks fed on ration B (5% SFM and fibre level 5%), while the lowest weight gain

(685.00 g) was on ration C (10% SFM and fibre level 6%) as shown in Table III.

The average weight gain of chicks fed on starter rations E, F, G and H with GRINDAZYM™ (containing 0, 5, 10 and 15% SFM and 4, 5, 6 and 7% FL) was 766.50, 786.25, 782.50 and 792.50g, respectively. The highest weight gain (792.50g) was observed in chicks fed on ration H (15% SFM and fibre level 7%), while the lowest weight gain (766.50g) was on ration E (0% SMF and fibre level 4%). The present results indicated that rations containing 15% SFM and fibre level 7% had more weight gain except in the case of those with enzyme rations (Table III). The statistical analysis of data revealed that there was highly significant ($p<0.01$) difference between with and without enzyme treated rations for weight gain in birds.

Table IV.- Effect of enzyme supplementation and type of feed on broiler performance (5-6 weeks).

Treatment	Feed consumption bird	Weight gain bird	FCR bird
0% SFM, 4% fibre N-Enzyme	1477.50±25.941	$722.00±12.702^{B}$	$2.05±0.065^{B}$
5% SFM, 5% fibre N-Enzyme	1502.50±4.767	$743.50±4.444^{AB}$	$2.02±0.015^{B}$
10% SFM, 6% fibre N-Enzyme	1503.75±2.394	$661.25±19.41^{C}$	$2.28±0.07^{A}$
15% SFM, 7% fibre N-Enzyme	1500.00±0.000	$685.00±6.45^{C}$	$2.19±0.02^{A}$
0% SFM, 4% fibre GRINDAZYM™	1503.75±2.394	$758.00±7.842^{A}$	$1.99±0.022^{B}$
5% SFM, 5% fibre GRINDAZYM™	1506.25±2.394	$755.50±6.062^{A}$	$2.00±0.020^{B}$
10% SFM, 6% fibre GRINDAZYM™	1503.75±7.465	$747.50±9.242^{AB}$	$2.01±0.025^{B}$
15% SFM, 7% fibre GRINDAZYM™	1511.25±6.575	$774.00±10.025^{A}$	$1.95±0.026^{B}$

FCR, feed conversion ratio; N, NIBGE; SFM, Sunflower meal.

Table V.- Effect of enzyme supplementation and type of feed on broiler performance (0-6 weeks).

Treatment	Feed consumption bird	Weight gain bird	FCR bird
0% SFM, 4% fibre N-Enzyme	3105.00±37.081	$1492.50±16.998^{B}$	$2.08±0.039^{C}$
5% SFM, 5% fibre N-Enzyme	3138.75±10.078	$1536.50±7.751^{AB}$	$2.05±0.010^{C}$
10% SFM 6% fibre N-Enzyme	3130.00±10.801	$1346.25±25.77^{D}$	$2.33±0.04^{A}$
15% SFM, 7% fibre N-Enzyme	3147.50±12.500	$1420±12.25^{C}$	$2.22±0.02^{B}$
0% SFM, 4% fibre GRINDAZYM™ Enzyme	3138.75±8.750	$1524.50±10.989^{AB}$	$2.06±0.017^{C}$
5% SFM, 5% fibre GRINDAZYM™ Enzyme	3144.25±9.543	$1541.75±10.547^{A}$	$2.04±0.018^{C}$
10% SFM, 6% fibre GRINDAZYM™ Enzyme	3120.75±49.360	$1530.00±13.229^{AB}$	$2.04±0.40^{C}$
15% SFM, 7% fibre GRINDAZYM™	3135.75±16.948	$1566.50±16.256^{A}$	$2.01±0.025^{C}$

FCR, feed conversion ratio; N, NIBGE; SFM, Sunflower meal.

Finishing phase (5-6 weeks)

During finisher phase, average weight gain per bird of broiler chicks fed on rations A, B, C and D with NIBGE enzyme (containing 0, 5, 10 and 15% SFM and 4, 5, 6 and 7% FL, respectively) was 722.00, 743.50, 661.25 and 685.00g, respectively. The highest weight gain (743.50g) was obtained in chicks fed on group B (5% SFM and fibre level 5% FL), while average weight gain of broiler chicks fed on rations E, F, G and H with GRINDAZYM™ (containing 0,5,10 and 15% SFM and 4, 5, 6 and 7% FL, respectively) was 758.00, 755.50, 747.50 and 774.00g, respectively (Table IV). Statistical analysis of weight gain data revealed highly significant variation between with and without enzymes and experimental rations.

Overall weight gain (0-6 weeks)

During the overall rearing period 0-6 weeks), average weight gain per bird of broiler chicks fed on rations A, B, C and D with NIBGE enzymes (containing 0, 5, 10 and 15% SFM and 4, 5, 6 and 7% FL, respectively) was 1492.50, 1536.50, 1346.25 and 1420.00g, respectively as shown in Table V. The highest weight gain (1536.50g) was observed with chicks fed on ration B, while the

lowest gain (1346.25g) was on ration C. While in case of rations with GRINDAZYM™ (containing 0, 5, 10 and 15% SFM and 4, 5, 6 and 7% FL, respectively) E, F, G and H weight gain was 1524.50, 1541.75, 1530.00 and 1566.50g respectively. The highest weight gain 1566.50g was observed with chicks fed on ration H, while the lowest gain (1530.00g) was on ration G (Table V). Statistical analysis revealed a highly significant variation ($p<0.01$) among all experimental rations.

Feed conversion ratio (FCR)

Starter phase (0-4 weeks)

Average FCR of chicks reared on starter rations A, B, C and D (containing 0, 5, 10 and 15% SFM and 4, 5, 6 and 7% fibre respectively) was 2.12, 2.06, 2.37 and 2.24 per bird, respectively. The birds fed on rations E, F, G and H (containing 0, 5, 10 and 15% SFM and 4, 5, 6 and 7 fibre level respectively) yield 2.13, 2.09, 2.07 and 2.05 FCR, respectively (Table III). Statistical analysis revealed highly significant difference between experimental rations with and without enzyme.

Finisher phase (5-6 weeks)

During finisher phase, FCR per bird fed on rations A, B, C and D with NIBGE enzyme (containing 0, 5, 10 and 15% SFM and fibre level 4, 5, 6 and 7%) was 2.05, 2.02, 2.28 and 2.19, while chicks fed on rations E, F, G and H (containing 0, 5, 10 and 15% SFM and fibre level 4, 5, 6 and 7%) was 1.99, 2.00, 2.01 and 1.95, respectively (Table IV). Statistical analysis revealed that there was highly significant ($p<0.01$) difference among all experimental rations.

Overall FCR (0-6 weeks)

FCR per bird from 0-6 weeks of chicks age fed on rations A, B, C and D has been shown in Table V. FCR was 2.08, 2.04, 2.33 and 2.22 in rations A, B, C and D (containing 0, 5, 10 and 15% SFM and fibre level 4, 5, 6 and 7%, respectively). Chicks fed on rations E, F, G and H (containing 0, 5, 10 and 15% SFM and fibre level 4, 5, 6 and 7%, respectively) was 2.06, 2.04, 2.04 and 2.01, respectively. The poorest FCR was on ration C and the best FCR was of ration H (Table V). Statistical analysis revealed highly significant differences between experimental rations without and with enzymes.

Dressing percentage

Dressing percentage was calculated as carcass weight excluding skin and including internal organs *viz.* heart, liver, gizzard and kidneys of the birds. The average dressing percentage of dressed weight per bird on rations A, B, C and D with NIBGE enzyme (containing 0, 5, 10, 15% SFM and 4, 5, 6 and 7% FL) were 54.45, 55.74, 49.63 and 52.21 respectively, while in case of GRINDAZYM™ treated rations E, F, G and H was 55.39, 55.88, 55.55 and 56.55, respectively. Statistical analysis of the data however, revealed that there was highly significant ($p<0.01$) difference between experimental rations with and without enzymes.

DISCUSSION

The main aim of this experiment was to test whether enzyme (NIBGE or Commercial-GRINDAZYM™) supplementation on different levels of sunflower meal with different levels of fibre influences the performance of broiler chicks. In this experiment, both enzymes reduced fibre contents of SFM and increased bioavailability of ME from treated SFM. It was reflected in terms of better weight gain, feed intake, feed conversion ratio and dressing percentage.

The results revealed that inclusion of sunflower meal at 0% to 10% did not significantly effect the growth in chicks. However, inclusions of 15% and 20% did have a notable effect on weight gain and feed efficiency of the birds. Similar results have been reported by Waldroup *et al.* (1970) and Malik *et al.* (1971). These findings are also supported by Mandal *et al.* (2006) who concluded that the inclusion of rape seed meal and or sunflower meal decreased performance of broiler in terms of poor growth rate and feed efficiency.

Addition of enzymes at higher levels of fiber *i.e.* 10% and above significantly improved the overall performance of the birds. The results of the present study agree with the findings of Swain *et al.* (1996) reporting an improvement of performance in high-CF sunflower cake with multi-enzyme addition. Kocher *et al.* (2000) reported an

improvement in the nutrient digestibility due to enzyme addition at high inclusion of SFM. Cowan *et al.* (1999) also reported an improvement in performance due to pectinase addition in SFM-based diets in female broilers.

The addition of enzymes at 0% and 5% SFM however, did not improve the performance of birds. At 0% SFM addition of enzymes negatively affected the weight gain and feed efficiency of birds. Addition of enzymes at 0% SFM level led to poor weight gain and lesser feed intake of birds. More feed was consumed by birds fed on higher SFM. These findings supported the Results of (Musharaf, 1991). However, Mushtaq *et al.* (2006) found different results contrary to this study and concluded that enzyme supplementation during 2 week post hatching had no remarkable effect when used in SFM-based diets. Attia *et al.* (2003) showed no effect of commercial enzyme preparation Optizyme (Optivite, Retford, Nottinghamshire, UK) in dehulled SFM and reported no effect of SFM at 5, 10, or 15% on mortality.

Earlier other workers have reported that the addition of SFM can be carried out up to 30% without significantly affecting the performance of birds (Sing and Prasad, 1979; Iqbal, 1985; Ibrahim and El-Zubair, 1991; Kocher *et al*., 2000; Rajesh *et al*., 2006). The possible difference may be due to the quality of the sunflower meal processing or variety of the birds used (Campbell *et al.*, 1989).

For feed efficiency the birds fed on 5% SFM meal without enzyme addition were most efficient. Whereas in case of treated feed birds fed on 15% SFM replacement level seem to have best feed efficiency. Higher levels of SFM produced higher levels of fiber up to 7% in feed which resulted in deterioration of feed efficiency. Although birds fed on higher fibre consumed larger amount of feed but their efficiency was poor. This may be due to the increased rate of digesta flow due to presence of high fiber contents in their rations. Thus addition of enzymes at higher level did improve over all performance of the birds by improving the digestibility of high fiber diet (Bedford, 1995; Kocher *et al.*, 2000; Rajesh *et al*., 2006), but the addition of enzymes at 0% SFM adversely effected the gain in weight of birds due to poor feed intake at addition of enzymes at low levels of fiber.

CONCLUSIONS

The results of the present experiment effectively suggest that enzyme supplementation is important in broiler chicks. Broiler chicks grew faster and more efficiently on a diet containing fibre degrading enzymes than on a diet without enzymes.

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