EFFECTS OF ENZYME SUPPLEMENTATION ON DIFFERENT LEVELS OF SUNFLOWER MEAL AND FIBRE ON THE PERFORMANCE OF BROILERS

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Abstract— *An experiment was conducted to evaluate the efficiency of multi enzyme. For this purpose, eight isonitrogenous starter and finisher rations were formulated. Eight isonitrogenous chick rations were prepared using levels of SFM 0, 5, 10 and 15% and 4, 5, 6 and 7 FL respectively without enzyme supplementation designated as A, B, C and D and with NIBGE enzyme (one litre enzyme per hundred kg feed) supplementation designated as E, F, G and H (containing 0, 5, 10 and 15% and SFM and 4, 5, 6 and 7% FL respectively). Three hundred and twenty-day-old broiler chicks were randomly divided into 32 experimental units (replicates) of 10 chicks each. Standard environmental conditions were maintained to rear the birds. There was non-significant difference among rations in respect of feed consumption, highly significant difference in respect of weight gain and significant difference in respect of feed conversion ratio. There was non-significant difference in respect of feed consumption, highly significant difference in respect of weight gain and highly significant difference in respect of FCR among rations and there was highly significant difference in respect of dressing percentage. The results suggest that enzyme had reduced the fibre contents of SFM and had increased the bioavailability of ME from treated SFM. It was reflected in terms of better weight gain, feed intake, feed conversion ratio and dressing percentage.*

Index Terms— *isonitrogenous, multi enzyme, feed conversion, FCR*

1 INTRODUCTION

Sunflower oil meal (SFOM) is a by-product obtained after the extraction of oil from partially decorticated sunflower seed. Being a good source of protein (29.8-45.5%) the sunflower meal can be developed as a good vegetable protein supplement for poultry rations. However, high level of inclusion of sunflower meal in poultry diets posses certain problems due to its high fibre content (14-18%). The testa of sunflower meal is rich in fibre content, which reduces the digestibility of its meal (Smith, 1968). The fibre content of the seed can be reduced partially by removing the testa through the decortication process (McDonald *et al.*, 1977 and Niazi *et al.*, 1991), but in Pakistan, this method is not practiced.

Dietary protein shortage in human nutrition is a major problem in Pakistan. More than 50% of the population is affected by unbalanced protein in the diet (GOP, 1998). Eight million children were malnourished, mainly due to protein shortage in the diet during the year 2000-2001. Poultry is a relatively cheaper source of protein. It converts low grade cereals and industrial by products into high quality protein. Poultry industry in the country has developed to a large extent during the last recent years. Production of poultry meat was 190,000 tons in the year 2000-2001. Per capita availability was 19 kg (GOP, 2001).

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Poultry production is now becoming more expensive and feed is the single cost item, which greatly affects the profit margin. The economic importance becomes apparent when it is realized that 55-75% of the total production cost of poultry is from feed (GOP, 1998). Protein and energy are major costly nutrients in feed, whereas protein requirement of poultry are mainly met from animal and vegetable protein sources. Animal protein sources are subjected to variation as a result of manufacturing conditions and the nature of raw materials from which they are processed.

The term "Non starch polysaccharides" (NSP's) is now frequently used to describe what is past has been referred to as fibre. Among NSP's, cellulose is the main structural component of the cell wall, while the hemicellulose, the second largest component is primarily composed of three main groups of polysaccharides such as xylans, mannans, galactomannans, galactans and arabinogalactans. Xylan is major component (80%) of hemi-cellulose and usually associated with cellulose and lignin components of plant cell wall. The NSP content negatively affects performance of birds (Jaroni *et al.*, 1999). These NSP's are not digested by the bird and interfere with the digestion of other nutrients in feed. Their presence increases gut viscosity, which leads to reduce growth rate, increased feed to gain ratio and sticky droppings in chicks.

The present study was designed to determine the feeding value of sunflower meal for poultry and to find out the means to improve the nutritional value of the meal product by enzyme treatment with the following objectives.

1. Chemical and biological evaluation of enzyme treated sunflower oil meal.
2. Use of sunflower oil meal in different proportions using enzyme supplementation.
3. To determine the performance of broilers using parameters such as weight gain, feed consumption, FCR, dressing percentage, economics and overall growth.

2 MATERIALS AND METHODS

APPLICATION OF ENZYME

The experiment was conducted to study the biological evaluation of the sunflower without or with cellulytic enzymes. The present experiment was conducted at experiment station, department of Animal Nutrition, University of Veterinary and Animal Sciences, Lahore from February to March. Keeping in view, the objectives of study, the effect of different levels of sunflower meal (0, 5, 10 and 15%) without and with supplementation of enzyme (cellulose and xylanase complex) with different levels of fibre (4, 5, 6 and 7%) without and with enzyme supplementation (cellulose and xylanase complex) for broiler chicks. All the ingredients of feed and enzyme were procured from local market and NIBGE respectively.

Birds:
Three hundred and twenty day old Hubbard broiler chicks of mix sexes were purchased from a commercial local hatchery. All the experimental birds were initially weighed. The chicks were randomly divided into 32 experimental units of 10 chicks each. Each experimental unit of 10 chicks served as one replicate.

Housing:
The experimental room comprised of 32 pens and each pen housed 10 chicks. This broiler house was properly washed and disinfected by fumigation before the initiation of the experiment. All the experimental chicks were reared on floor throughout the experimental period of 6 weeks. The placement of each chick in the pen was also made at random. The temperature of the experimental room was maintained at 33±2°C during the first week of trial and then reduced by 3°C each week till it reached 24°C which was maintained for the rest of the period. Proper managemental practices like ventilation, sanitation, etc. practiced throughout the experimental period.

Experimental Rations:
Eight isonitrogenous broiler starter rations were formulated according to the standards prescribed by NR (1994) using levels of sunflower meal viz; 0, 5, 10 and 15% without enzyme supplementation designated as A, B, C and D with fibre levels 4, 5, 6 and 7% respectively and with NIBGE enzyme (one litre enzyme unconcentrated per hundred kg feed) supplementation designated as E, F, G and H with fibre levels 4, 5, 6 and 7% respectively. These rations were fed to each group upto four weeks. Using the same principle, eight corresponding broiler finisher rations were formulated in such a way that rations containing aforementioned levels of sunflower meal (0, 5, 10 and 15%) without an enzyme supplementation designated as A, B, C and D with fibre levels 4, 5, 6 and 7% respectively and with NIBGE enzyme (one litre enzyme unconcentrated per

hundred kg feed) supplementation designated as E, F, G and H with fibre levels 4, 5, 6 and 7% respectively.

Composition of broiler starter rations with respective nutrient composition are shown in Table-1. On the other hand, composition of broiler finisher rations with respective nutrient profile are shown in Table-2. Chicks were fed ad libitum. Availability of fresh and clean drinking water was assured 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 the start of the trial and at weekly intervals, thereafter. All the groups were fed the allotted rations ad libitum. Daily feed offered was recorded and the refused feed was weighed at the end of each week to note weekly feed consumption. Any untoward ailment and mortality was also noted during trial. Weight gain feed consumption was recorded separately for starter and finisher phase then total feed intake and gain was recorded for 6 weeks trial. Feed conversion ratio was also calculated for starter and finisher phase.

STATISTICAL METHOD

The data obtained regarding weight gain, feed intake, feed conversion ratio and dressing percentage, liver, gizzard, heart, pancreas and thymus weight were subjected to statistical analysis using completely randomized design with 2x4 factorial arrangement where there were two treatments i.e. without or with enzyme. Duncans's multiple range tests were applied to compare the significance of mean differences (Steel and Torrie, 1981).

PARAMETERS OF STUDY

Data was collected and analyzed to determine following parameters.

1. Feed intake
2. Weight gain
3. Feed conversion ratio
4. Dressing percentage

TABLE-1

INGREDIENT AND NUTRIENT COMPOSITION OF EXPERIMENTAL BROILER STARTER RATIONS

Ingredients	Without Enzyme				With NIBGE Enzyme Added @ 1L/100 kg feed			
	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
Di-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

Price of enzyme (Rs.10/100 kg) included.

TABLE-2

INGREDIENT AND NUTRIENT COMPOSITION OF EXPERIMENTAL BROILER FINISHER RATIONS

Ingredients	Without Enzyme				With NIBGE Enzyme Added @ 1L/100 kg feed			
	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	--	--	--	--	--	--	--	--
Di-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

Price of enzyme (Rs.10/100 kg) included.

3 RESULTS AND DISCUSSION

BIOLOGICAL EVALUATION OF TREATED SUNFLOWER OIL MEAL

FEED CONSUMPTION – 0-6 WEEKS

Feed consumption of birds fed experimental rations A, B, C and D without enzyme containing 0, 5, 10 and 15% SFM and 4, 5, 6 and 7% F) was 3506.75, 3511.25, 3515.00 and 3505.00 gm respectively and feed consumption of birds fed experimental rations E, F, G and H with NIBGE enzyme (containing 0, 5, 10 and 15% SFM and 4, 5, 6 and 7% FL) was 3501.25, 3498.75, 3508.75 and 3514.75gm respectively as shown in Table-3. Apparently the maximum feed (3515.00gm) was consumed by the chicks fed on ration C and minimum feed (3498.75 gm) was consumed by the birds fed on ration G as shown in Table-3. Data when subjected to statistical analysis showed that there was non-significant difference among various experimental rations.

WEIGHT GAIN - 0-6 WEEKS

During the overall rearing period 0-6 weeks), average weight gain of broiler chicks fed on rations A, B, C and D without enzymes containing 0, 5, 10 and 15% SFM and 4, 5, 6 and 7% FL) was 1744.63, 1781.50, 1562.50 and 1582.50, respectively as shown in Table-3. The highest weight gain (1744.63gm) was observed with chicks fed on ration A, while the lowest gain (1562.50gm) was on ration C. While in case of rations with NIBGE enzymes (containing 0, 5, 10 and 15% SFM and 4, 5, 6 and 7% FL) A, B, C and D weight gain was 1802.50, 1815.00, 1845.00 and 1919.00 gm respectively as shown in Table-3. The highest weight gain 1919.00gm was observed with chicks fed on ration H (15% SFM and 7% FL) while the lowest gain (1802.50gm) was on ration E (0% SFM and 4% FL) as shown in Table-3. The data when subjected to statistical analysis revealed that there was highly significant difference between two enzymes and among different experimental rations.

FEED CONVERSION RATIO (FCR) – 0-6 WEEKS

Average feed conversion ratio (FCR) from 0-6 weeks of chicks age fed on rations A, B, C and D (containing 0, 5, 10 and 15% SFM and 4, 5, 6 and 7% FL) has been shown in Table-3. FCR was 2.01, 1.97, 2.25 and 2.13 in rations A, B, C and D (containing 0, 5, 10 and 15% SFM and fibre level 4, 5, 6 and 7% respectively) as shown in Table-3. Chicks fed on rations with NIBGE enzyme E, F, G and H (containing 0, 5, 10 and 15% SFM and fibre level 4, 5, 6 and 7% respectively) was 1.94, 1.93, 1.91 and 1.83 respectively. The poorest FCR was on ration 1.94 and the best FCR was of ration 1.83 as shown in Table-3. When data was subjected to statistical analysis revealed highly significant differences between without and with enzymes and among rations.

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 without enzyme (containing 0, 5, 10, 15% SFM and 4, 5, 6 and 7% FL) was 60.87, 61.67, 56.44 and 56.98 respectively, while in case of NIBGE enzyme treated rations E, F, G and H (containing 0, 5, 10 and 15% and 4, 5, 6 and 7% FL) was 62.11, 62.35, 62.96 and 64.35 respectively. Statistical analysis of the data however, revealed that there was highly significant difference between without and with enzymes and among rations.

TABLE NO.3

EFFECT OF ENZYME SUPPLEMENTATION AND FEED TYPES ON THE BROILER PERFORMANCE (0-6 WEEKS)

Treatment	Feed Consumption	Weight Gain	FCR
0% SFM 4% Fibre Without Enzyme	3506.75±3.555	1744.63±8.782^{D}	2.01±0.001^{C}
5% SFM 5% Fibre Without Enzyme	3511.25±2.577	1871.50±5.317^{CD}	1.97±0.006^{CD}
10% SFM 6% Fibre Without Enzyme	3515.00±3.680	1562±7.806^{E}	2.25±0.013^{A}
15% SFM 7% Fibre Without Enzyme	3505.00±1.443	1582.50±7.806^{E}	2.13±0.036^{B}
0% SFM 4% Fibre N-Enzyme	3501.25±2.135	1802.50±2.394^{BC}	1.94±0.003^{CD}
5% SFM 5% Fibre N-Enzyme	3498.75±3.733	1815.00±10.104^{BC}	1.93±0.012^{CD}
10% SFM 6% Fibre N-Enzyme	3508.75±3.287	1845.00±3.680^{B}	1.91±0.005^{DE}
15% SFM 7% Fibre N-Enzyme	3514.75±3.981	1919.00±9.009^{A}	1.83±.0.010^{E}

SFM = Sunflower Meal, FCR = Feed Conversion Ratio N = NIBGE

4 DISCUSSION

The objective of this experiment was test the hypothesis whether enzyme supplementation on different levels of sunflower meal with different levels of fibre have influence on performance of broiler chickens. For this purpose, eight rations i.e. four without enzyme and four with different levels of enzymes were fed to broiler chickens. In this experiment, enzyme had reduced the fibre contents of SFM and had increased the 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 effect the weight gain and feeding efficiency of the birds. These results are in line with the findings of who reported that higher levels of sunflower meal adversely effected the weight gain and feed conversion efficiency of birds despite of consuming more feed. Similar results have been reported by (Walderoup *et al*., 1970) and Malik *et al*., 1971). They observed poor feed efficiency due to higher levels of SFM in broiler rations. Ad-

dition of enzymes at higher levels of fiber i.e. 10% and above significantly improved the overall performance of the birds.

Earlier other workers have reported that addition of SFM can be carried out up to 30% without significantly effecting the performance of birds (Sing and Prasad, 1979; Iqbal, 1985; Ibrahim and El-Zubair, 1991). The possible difference may be due to the quality of the sunflower meal processing of the diet or type or variety of the birds used (Campbell *et al*., 1989; Rose and Berdford, 1995; MaCraken and MacGee, 1993).

5 CONCLUSION

Results from this experiment suggest that enzyme supplementation may be an important in feed in broiler chickens. Broiler chickens grew faster and more efficiently on a diet containing fibre degrading enzymes than on a diet without enzymes. Further research in this area is needed to confirm our findings and to elucidate the mechanisms which are responsible for the better performance of broiler chickens on diet with enzymes.

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