Global Veterinaria 12 (5): 622-626, 2014
ISSN 1992-6197
© IDOSI Publications, 2014
DOI: 10.5829/idosi.gv.2014.12.05.83128

Effect of ß-Mannanase on Broilers Performance at Different Dietary Energy Levels

[1]Muhammad Imran, [1]Talat Naseer Pasha,
[1]Saima, [2]Muhammad Akram, [3]Khalid Mehmood and [4]Ahmad Jawad Sabir

[1]Department of Animal Nutrition,
[2]Department Poultry Production,
University of Veterinary and Animal Sciences, Lahore-54000, Pakistan
[3]University College of Veterinary and Animal Sciences, The Islamia University of Bahawalpur-63100, Pakistan
[4]ICE and E, University of Veterinary and Animal Sciences, Lahore-54000, Pakistan

Abstract: A study was conducted to determine the effect of ß-mannanase on broilers performance at different dietary energy levels. The objective of this study was to enhance the availability of energy from soybean meal and guar meal along with getting high profiled protein without affecting the birds performance. The trial was conducted on 450 birds, 5 treatments and 30 replicates. Five types of iso-nitrogenous feeds were prepared i.e. A, B, C, D and E. Diet A was control diet, diet B and D were with 60kcal/kg and 90kcal/kg less energy content as compared to control diet respectively. Diet C and E are with less energy and with the supplementation of ß-mannanase. The duration of trial was 35 days. Statistical analysis of the recorded data showed that supplementation of this enzyme improved ($P<0.05$) body weight gain, gut morphology, feed conversion ratio, immunity of the birds and the relative weight of organs. There was non-significant decrease ($P>0.05$) in feed intake and mortality because this enzyme increased the density of bio-available nutrients in the diet.

Key word: Broiler · Energy · ß-Mannanase · Feeds · Performance

INTRODUCTION

Economy of every country always has one main pillar which runs the economy of that country. Likewise agriculture is the main pillar for the economy of Pakistan. The contribution of livestock sector in the agricultural value added is about 55.4 percent and 11.9 percent to the Pakistan GDP. In recent decades poultry industry showed a remarkable bloom in Pakistan. Poultry Industry contributes about 5.76% in the agricultural growth and about 10.4% in the growth of Livestock sector [1]. In poultry industry, cost of feed is the single largest cost in producing meat and eggs [2], accounting for nearly 60-70% of the total investment.

Efficient conversion of diet nutrients into broiler body part is a complimentary feature of successful poultry production industry. As a result of this fact, both the identification and quantification of factors inhibiting and conversely alleviating nutrient utilization are mandatory. Among these main factors anti-nutritional fibers are the Non Starch Polysaccharides (NSP) or the presence of anti-nutritional factors [3, 4]. β-mannanase (Hemicell) is a fermentation product of *Bacillus subtilis* [5]. This enzyme can be employed to optimize dietary energy, protein and phosphorous in poultry ration. It is a robust ß-mannanase capable of breaking down difficult to digest carbohydrates in typical poultry diets. It can reduce dietary costs by lowering energy levels in feed without sacrificing bird performance.

Keeping in view the importance of β-mannanase the present project was designed to study the effect of ß-mannanase on birds' performance with respect to soybean meal and guar meal and the immune response of birds on the immune organs by the addition of β-mannanase.

MATERIALS AND METHODS

The study was conducted at environmentally controlled shed at Poultry Research and Training Centre,

Corresponding Author: Khalid Mehmood, University College of Veterinary and Animal Sciences,
The Islamia University of Bahawalpur-63100, Pakistan.
Tel: +92 334 7840591.

Department of Poultry Production, UVAS-Ravi Campus, Patoki to evaluate the effect of ß-mannanase on broiler performance. Each pen was one square meter and covered with rice husk. Birds were allowed free access to the feed and fresh water throughout the experiment. Performance parameter such as feed intake: body weight gain (F: G) ratio were measured weekly.

Experimental Plan: A total of 450 day old straight-run broiler chicks of Hubbard strain were distributed in 30 experimental units, each having 15 birds. Five different types of broiler diets were formulated, out of which one was normal diet with 2980 Kcal/kg energy (Control) and the others were with lesser energy diets but with enzyme supplementation, each having negative control. Room temperature was maintained at 32°C during the first week and gradually decreased to 24°C by the end of the third week. 24 h of lighting was provided throughout the trial. Feed and water were offered ad libitum at all times during the whole trial. The experimental birds were fed *ad-libitum* balanced ration prepared according to prescribed standards [6].

Experimental Diets: During the trial five iso-nitrogenous experimental diets (A, B, C, D and E) were formulated. All diets were formulated according to guidelines of National Research Council (NRC) [6]. Diet A was serving as control diet (It having 21% protein and 2980 kcal/kg). Diet B was formulated 2920 Kcal/Kg and 21% protein. Diet C was formulated with the same profile as that of 'diet B' with the addition of experimental enzyme β-mannanase. Diet D was formulated with 2890 Kcal/Kg and 21% protein. Diet E was Formulated with the same profile as that of 'diet D' with the addition of experimental enzyme β-manganese.

Data Collection: Proper management practices were followed with *ad -lib* feed and water during 35 days the experimental period of birds were fed on commercial broiler feed (Control) and treatments local feed mill for the whole research project. All birds were offered experimental diets in their respective cages replicates. At the end of 35th day, two birds from each replicate were slaughtered and slaughtering data [body weight gain, gut morphology (villus of the duodenum), feed conversion ratio, immunity of the birds and the relative weight of organs, feed intake and mortality] were collected for analysis.

Parameters Studied: This study was conducted to observe the effect of ß-mannanase on feed quality, growth performance of the birds, immunity of the birds, gut histology and Feed Conversion Ratio in broiler chicken, when birds were fed with different energy levels with the addition of enzyme. The samples were collected at the time of slaughtering and were preserved for further processing.

Gut Histology: Histological examinations were carried out according to the method of Paul *et al.* [7]. Slides were observed under 4 X of microscope (Olympus DP20) attached with camera and operated by software. Scale was calibrated using Neubauer hemocytometer. Observing 1 chamber of Neubauer hemocytometer under 4 X gave a magnification factor of 400, i.e., measured size of villi was divided by 400 to get actual size of villus. The heights of intestinal villus were expressed as micrometers (μm).

Villus height (μm) = (Measured size of Villi/400) x1000

Statistical Analysis: The data thus collected was analyzed using ANOVA in Completely Randomized Design (CRD) [8] with help of a computer based statistical package (SPSS).

RESULTS AND DISCUSSION

The average body weights of commercial broiler chicken at different ages with their standard deviations are shown in Table 1. The results of the present study are in complete agreement with other studies [9-13] reported that the growth rate was improved when it was supplemented with β-Mannanase. The improvement in live weight gain of broilers was observed with addition of β-Mannanase [14].

The average feed consumption based on gram/bird at different ages with their standard deviations is shown in table 2. The results showed that minimum feed consumption was exhibited by group C. The decrease in feed intake might be attributed to the improvement of nutrients absorption by the release of binded nutrients by dissolving in the cell wall matrix, the decrease of digesta viscosity and the increase of villus height. These results are supported by Mehri *et al.* [15] who reported that supplementation of β-mannanase at the rate of 900 g/ton significantly reduced feed intake without affecting the performance of birds.

The average feed conversion ratio (FCR) of different experimental groups at different ages with their standard deviation is shown in table 3. The results showed that minimum feed conversion ratio was exhibited by group C.

Table 1: Average body weight (gm) at different ages of broiler in experimental groups

	Weeks					
Treatment	W0	W1	W2	W3	W4	W5
A	40.61±1.82	153.84^{c}±8.54	420.39±52.77	834.07^{b}±53.29	1304.55^{c}±68.94	1881.16^{bc}±264.91
B	40.87±1.54	149.43^{b}±9.97	409.94±41.27	821.01^{ab}±50.61	1258.34^{b}±86.01	1830.49^{b}±239.69
C	40.74±1.13	156.81^{a}±6.04	419.6±45.91	834.47^{b}±43.29	1339.78^{d}±23.32	1904.04^{c}±100.18
D	41.01±1.39	144.13^{a}±10.6	407.20±32.43	816.13^{a}±60.85	1195.13^{a}±87.94	1693.2^{a}±139.32
E	40.88±1.70	153.09^{c}±7.18	419.42±42.33	830.26^{ab}±56.55	1304.67^{c}±62.89	1870.45^{b}±122.67

(P□0.05) showed significant differences

Table 2: Effect of Mannanase inclusion on broiler feed intake

	Weeks					
Treatments	W0	W1	W2	W3	W4	W5
A	149.83^{a}±9.77	342.83^{a}±15.1	617.17^{a}±4.53	867.5^{a}±22.73	1126.5^{b}±52.77	149.83^{a}±9.8
B	156.33^{a}±2.16	343^{a}±8.17	633.17^{b}±4.21	934.5^{c}±13.01	1159^{bc}±18.68	156.33^{a}±2.2
C	151.33^{a}±6.62	328.66^{a}±10.2	617.17^{a}±9.20	875.33^{a}±7.76	1046.17^{a}±17.8	151.33^{a}±6.62
D	161.33^{b}±2.66	363.83^{b}±11.6	649^{c}±17.92	902.33^{b}±5.31	1237.17^{d}±19.3	161.33^{b}±2.6
E	150.5^{a}±6.92	332.67^{a}±10.4	629.67^{ab}±14.9	873.17^{a}±13.10	1197.17^{c}±41.3	150.5^{a}±6.92

(P>0.05) showed non-significant differences

Table 3: Effect of Mannanase inclusion on feed conversion ratio (FCR) of birds taken at the end of every week

	Weeks					
Treatments	W0	W1	W2	W3	W4	W5
A	1.33^{a}±0.11	1.26±0.09	1.52±0.10	1.84^{a}±0.08	1.9688^{a}±0.21	1.33^{a}±0.11
B	1.39^{ab}±0.11	1.3±0.14	1.54±0.13	2.1^{b}±0.19	2.07^{a}±0.35	1.39^{ab}±0.11
C	1.31^{a}±0.09	1.24±0.04	1.49±0.06	1.69^{a}±0.11	1.84^{a}±0.12	1.31^{a}±0.09
D	1.49^{b}±0.17	1.31±0.13	1.56±0.15	2.41^{c}±0.34	2.44^{b}±0.22	1.49^{b}±0.17
E	1.34^{a}±0.07	1.26±0.08	1.53±0.07	1.85^{a}±0.141	2.03^{a}±0.25	1.34^{a}±0.07

(P>0.05) showed non-significant differences

Table 4: Effect of Mannanase inclusion on leukocyte cells and heterophil: lymphocyte ratio

	Leukocyte Count				
Treatments	Heterophil (%)	Heterophil (%)	Heterophil (%)	Heterophil (%)	Heterophil (%)
A	28.33±4.71	62.5^{b}±5.61	5.17^{ab}±1.16	2.5^{ab}±0.54	0.46^{ab}±0.07
B	31.67±4.58	59.17^{b}±3.76	4.17^{ab}±1.47	2^{ab}±1.26	0.5375^{bc}±0.08
C	28±3.46	69.17^{c}±3.97	6^{b}±1.67	3.17^{b}±1.16	0.41^{a}±0.05
D	27±3.74	47.17^{a}±4.91	4^{a}±1.78	1.67^{a}±0.81	0.58^{c}±0.07
E	31±4.56	63.33^{b}±3.88	4.67^{ab}±1.21	2.17^{ab}±0.75	0.49^{abc}±0.09

(P>0.05) showed non-significant differences

This minimum value means the best performance of the bird in converting feed into body parts of the bird. The better FCR is due to the reason of better body weight gain by the addition of enzyme [11, 16]. The same results were seen in turkeys because the gut histology and morphology of turkeys and chick are same [14].

Values of leukocyte differential count have been shown in the table 4. The results showed that the lymphocyte count in treatment group C is the maximum and the ratio of heterophil and lymphocyte (H: L) is the minimum. Statistically both the values are having significant ($p<0.05$) difference from the remaining group

values. These values are related to immunity of the birds. These values showed that the treatment group C has the maximum level of immunity in the birds. The immunity level of birds was maximum by giving β-mannanase [15, 17, 18]. Zangeneh *et al.* [19] reported that dietary supplementation by mannanase-based enzyme significantly improved the Ab response to NDV.

Mortality among different experimental groups was also recorded. The results showed that the performance of the diet containing enzyme was the best according to birds' mortality rate during the whole trial period of 35 days. Statistically the treatment group E is significantly ($P<0.05$) different from all other treatment groups. The second better group according to mortality was group C. The reason behind this is that the immunity of the birds of that treatment group was the maximum as compared to other treatment groups. Similar findings were reported by Jackson *et al.* [11].

Maximum value of dressing percentage was noted in birds fed on diet C. The lowest dressing percentage was found in birds fed on the diet having no enzyme. The data of dressing percentage when subjected to analysis of variance showed non-significant ($P>0.05$) differences with group A and E. This result is in complete agreement with Oviedo-Rondon *et al.* and Mishra *et al.* [20, 21]. Due to the high immunity level of group C there is 2nd most minimum mortality of the birds in present trial.

The villus height for duodenum was maximum in the treatment group C as shown in Fig. 1 and it is significant from the other treatment groups. This is the indication of maximum nutrients absorption at duodenum level because it increases the surface area of the absorption. Villus thickness is minimum in group A followed by group C. More the less value of thickness of villi more will be the absorption. These results are supported by Mehri *et al.* [15] reported that supplementation of β-mannanase at 900 g/ton increased villus height and decrease in epithelial thickness in different sections of small intestine. Same trend was noted in turkey with the addition of same enzyme in the feed by Jankowski *et al.* [22]. Maximum villus height value is shown by group C followed by group A, B, E and D respectively. All the values are non-significant ($P>0.05$). This result shows that the enzyme beta-mannanase have ignorable effects on villus height at the level of jejunum. Minimum villus thickness value shown by group C followed by group E, B, A and D respectively with ascending order.

ACKNOWLEDGMENTS

This research work was conducted at Department Poultry Production, University of Veterinary and Animal Sciences Lahore, so author is very thankful to the Chairman for providing all the facilities.

REFERENCES

1. Anonymous, 2012-13. Economic Survey of Pakistan. Ministry of Finance, Govt. of Pakistan.
2. Behnke, K.C., 1996. Feed manufacturing technology: Current issues and challenges. Animal Feed Science and Technology, 62: 49-57.
3. Annison, G. and M. Choct, 1991. Antinutritional activities of cereal nonstarch polysaccharides in broiler diets and strategies minimizing their effects. World's Poultry Science Journal, 47: 232-241.
4. Bedford, M.R. and H.L. Classen, 1993. An *in vitro* assay for prediction of broiler intestinal viscosity and growth when fed rye-based diets in the presence of exogenous enzymes. Poultry Science, 72: 137-143.
5. Mendoza, N.S., M. Arai, K. Sugimoto, M. Ueda, T. Kawaguchi and L.M. Joson, 1995. Cloning and sequencing of beta-mannanase gene from Bacillus subtilis NM-39. Biochimica et Biophysica Acta, 1243(3): 552-554.
6. NRC (National Research Council), 2001. Nutrient requirements of poultry, 9th Rev. Ed. National Academy Press, Washington DC.
7. Paul, A.I., A.S. Ali and R.T. David, 2001. Intestinal structure and function of broiler chickens on Diets supplemented with a mannan oligosaccharide. Journal of the Science of Food and Agriculture, 81: 1186-1192.
8. Steel, R.G.D., J.H. Torrie and M. Dicky, 1997. Principles and Procedures of Statistics: A Biometrial Approach, 3rd Ed. Mc. Graw Hill Book Co. Inc., New York, USA., pp: 481.
9. Jackson, M.E., D.M. Anderdon, H.Y. Hsiao, G.F. Mathis and D.W. Fodge, 2003. Beneficial effect of beta-mannanase feed enzyme on performance of chicks challenged with *Eimeria* sp. and *Clostridium perfringens*. Avian Disease, 47(3): 759-63.
10. Daskiran, M., R.G. Teeter, D. Fodge and H.Y. Hsiao, 2004. An evaluation of endo-beta-D Manannase effects on the broiler performance and energy use in diets varying in beta-mannan content. Poultry Science, 83(4): 662-668.

11. Jackson, M.E., K. Geronian, A. Knox, J. McNab and E. McCartney, 2004. A dose response study with the feed enzyme beta-mannanase in broilers provided with corn soybean meal based diets in the absence of antibiotic growth promoters. Poultry Science, 83: 1992-1996.
12. Lee, J.T., S. Connor-Appleton, C.A. Bailey and A.L. Cartwright, 2005. Effects of guar meal by-product with and without β-Mannanase (Hemicell) on broiler performance. Poultry Science, 84(8): 1261-1267.
13. Zangiabadi, H. and M. Torki, 2010. The effect of a β-mannanase-based enzyme on growth and humoral immune response of broiler chickens fed diets containing grade levels of whole dates. Tropical Animal Health and Production, 42: 1209-1217.
14. Odetallah, P.R. Ferket, J.L. Grimes and J.L. McNaughton, 2002. Effect of mannan endo-1, 4 beta-mannosidase on the growth performance of turkeys fed diets containing 44% and 48% crude protein soybean meal. Poultry Science, 81(9): 1322-1331.
15. Mehri, M., M. Adibmoradi, A. Samie and M. Shivazad, 2010. Effects of Beta-Mannanase on broiler performance, gut morphology and immune system. African Journl of Biotechnology, 37(9): 6221-6228.
16. Torki, M. and V. Chegeni, 2007. Evaluation of dietary replacement of soybean meal by canola meal supplemented by β–mannanase (Hemicell) on performance of broiler chicks. In the proceeding of 6th European Symposium on Poultry Nutrition Strasbourg, France, pp: 637-640.
17. Zoul, X.T., X.J. Qiao and Z.R. Xu, 2006. Effect of β-Mannanase (Hemicell) on growth performance and immunity of broilers. Poultry Science, 85(12): 2176-2179.
18. Shahbazi, H.R., 2012. Dietary inclusion of guar meal supplemented by B-Mannanase evaluation egg quality characteristics and blood parameters of laying hens. Global Veterinaria, 9(1): 67-72.
19. Zangeneh, S. and M. Torki, 2011. Effects of B-mannanase supplementing of olive pulp-included diet on performance of laying hens, egg quality characteristics, humoral and cellular immune response and blood parameters. Global Veterinaria 7(4): 391-398.
20. Oviedo-Rondon, E.O., C.A. Fritts and P.W. Waldroup, 2002. Comparison of bio-mos mannan oligosaccha-ride and antibiotic feeding programs in broiler diets con-taining copper sulfate. In the proceeding from concurrent meetings of the Southern Poultry Science Society (23rd Annual Meeting), The Southern Conference on Avian Diseases (43rd annual meeting), pp: S184.
21. Mishra, A., S.K. Sarkar, S. Ray and S. Haldar, 2013. Effects of partial replacement of soybean meal with roasted guar korma and supplementation of mannanase on performance and carcass traits of commercial broiler chickens. Veterinary World, 6(9): 693-697.
22. Jankowski, J., A. Lecewicz, I. Chwastowska-Siwiecka, J. Juskiewicz and Z. Zdunczyk, 2011. Performance, slaughter value and meat quality of turkeys fed diets with different content of sunflower meal. Archiv fur Geflügelkunde, 75(2): S104-112.