Affect of *Moringa oleifera* Leaf Supplementation on Intestine Morphology and Growth Performance in Broiler Chickens

Imad Khan¹, Dr. Hafsa Zaneb¹, Dr. Saima Masood¹, Hafiz Faseeh Ur Rehman¹, Muqader Shah¹, Ghulam Abbas¹, Salahud Din¹, Hafiz Yasir¹, Dr. Muhammad Shahbaz Yousaf² and Kauser Shaheen³

¹Department of Anatomy and Histology, 
²Departments of Physiology, 
³Civil Veterinary Hospital, Dheri Julagram Malakand, KPK, Pakistan.

Correspondence Author: imadkhan107@hotmail.com

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**ABSTRACT**

*Moringa oleifera* is an indigenous plant growing wild in Northern India and Pakistan. It was introduced into South-East Asia and now cultivated throughout the tropics (Hermogenes et al., 2012). Ogbe and John (2011) have mentioned that essential minerals and nutrients in *Moringa oleifera* leaves used as a source of feed supplement to improve growth performance and health status of broilers. The inclusion of protein from leaf source in diet for birds is quick attaining due to its accessibility in abundance and relatively cheap cost leaf meal do not only serve as protein sources but also provide some essential mineral, vitamins, oxycarotenoid that induce yellow coloration of broiler shank, skin and egg yolk (Onu and Aneibo, 2011). Akhouri et al. (2013) supplementation of *Moringa Oleifera* leaf extract in diet of broiler can be usefully used as an effective feed supplement for its supporting results in relation to feed conversion efficiency and body weight gain in the broilers. It is able to use potentially earlier than mass immunization of the broilers for immune-modulators property like levamisole.

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Ganguly (2013) has reported that the products derived from plants increased the height of villi in intestine and reduced the harmful bacteria. The growth performance also enhances due to plant derivatives. Yasar and Forbes (1999) reported their work on wet and dry cereal grains and their effect on gut. It was suggested that the increase in the depth of crypt and height of villi consequently increases the surface area for absorption. Sayrafii et al. (2011) conducted experiment to compare the effects of prebiotic as alternative feed additive to an antibiotic growth promoter (bacitracin methylene disalicylate) on the growth performance and morphometrical parameters of the gastrointestinal tract of chickens. The use of antibiotic and prebiotic in feed improved feed intake of birds as compared to birds with control diet. Inclusion of prebiotic or antibiotic increased the height villus in duodenum and prebiotic increased width villus and depth of crypt of duodenum and ileum compared with other treatments. It is concluded that prebiotics can substitute the use of antibiotic in feed. The reviewed data on supplementation of symbiotic (Biomin® IMBO in diet suggests that it improved growth performance villus height: crypt depth ratio in broiler chicken as compared to control diet (Awad et al., 2008). It is observed that longer villin in the small intestine could increase the food utilization efficiency in early stages of chicken life and result in better performances of broilers. Several studies have shown that glutamine supplementation to the diet could increase length of villin of the gastrointestinal tract. Soltan (2009) has observed that broilers feed diet containing glutamine had significantly longer villin in duodenum and jejunum compared to the control group.

Arshami and Raji (2013) made an experimental design to check the effect of Chicory Root Powder (CRP) as growth promoter supplemented in broilers diet to investigate the growth performance and histomorphometry of jejunum. Result showed that chicory root powder can improve growth performance by enhancing food digestion and absorption through modification of jejunum histomorphometry and number of goblet cells increased in broiler. Mehri et al. (2010) studied the effect of different level of B-mannasease diet in soybean meal on intestinal morphometry. Manganese supplementation increased goblet cell number, height of villus and depth of crypt. So mannose has a positive effect on gut morphology and immune system. Fructooligosaccharide supplementation significantly increased ileal villus height, jejunal and ileal microvillus height and villus height: crypt depth ratio at the jejunum and ileum (Xu et al.2003). Markovicva et al. (2009) conducted study and reported that supplementation with mannan-oligosaccharides (BIO-MOS) and Direct Feed Microbial (DFM) increased villus height and width but decrease in crypt depth in all parts of intestine.

Preic et al. (2010) investigated prebiotics and phyto genetic additive effects on cecal microbial concentrations and gut morphology. The data on gut morphology showed that probiotics had useful effect on jejunum morphology causing a significant (p<0.05) increase in height of villus and surface area of villus compared to other two groups. The phyto genetic additive had no effect on height of villus or surface area of villus, but reduced the villus height: crypt depth ratio which may indicate that the improved production results in the phyto genetic additive group are not directly connected with changes in gut integrity, but due to some other physiological mechanisms.

Onu and Aniebo (2011) investigated Moringa oleifera leaf meal (MOLM) effects on the growth performance of broilers. Their experiment showed that (MOLM) significantly effects (p<0.05) the average final body weight, average daily gain, average daily feed intake and feed conversion as compared to control diet. Banjo (2012) conducted a study to investigate that addition of feed supplementation as Moringa oleifera leaf meal in the diet broilers. The addition of Moringa oleifera leaf meal in the diet of the broilers significantly (p<0.05) enhanced their weight gain as compared to the control group. The reason for
improved weight gain can be attributed to high protein content of Moringa leaf meal. Nkukwana et al. (2014) observed the effect of Moringa oleifera leaf supplementation on productive performance, intestinal integrity, digestive organ size, digestibility, bone breaking strength and bone ash content, as well as meat yield of broiler chickens throughout the production period. Birds supplemented with Moringa Oleifera leaf have increase body weight than the birds fed the basal diets. Result showed that supplementation of Moringa oleifera leaf have the potential difference on the bird performance without any detrimental effect on nutrient utilization, bird health, meat quality and bone strength, which can concluded that Moringa oleifera leaf enhanced the birds genetic potential for optimal productivity.

Tesfaye et al. (2013) found that there was significantly increase in feed intake, organs weight, weight gain, FCR organs weight, intestine length with supplemented groups as compared to the control group when they used Moringa oleifera leaf meal supplementation in broilers diet. Similarly, Akhouri et al. (2013) found that supplementation of broilers feed with Moringa oleifera leaf extract had significant effect on total body weight gain and feed conversion efficiency in the broiler chicks. Ogbe et al. (2012) conducted an experiment to evaluate the effect of polyherbal aqueous extracts Moringa oleifera supplementation in broilers diet. Result revealed that Moringa oleifera leaf extract as a feed supplementation improves health and growth of chickens.

**Effect of Different Supplementation on Growth Performance**

Ghally and El-Latif (2007) conducted research to investigate the effect of dietary yeast culture Saccharomyces Cerevisiae (SC) supplementation on growth performance, carcass characteristics and economic efficiency of growing Japanese quails. Results showed that birds fed diet contain yeast culture of 1 or 2% showed slightly improvement in bodyweight and feed conversion ratio, while adding yeast as compared with control diet diminished the feed intake. A study was conducted by Yang et al. (2009) to observe the effect of MOS supplementation in broilers at different ages on various parameters of small intestine and growth performance. MOS offered at the rate of 2 gm kg\(^{-1}\) of diet showed improvement in the weight gain when compared to the control group. But MOS showed no encouraging effect on morphology of gut and function was noticed. Al-Manssour et al. (2011) carried out an experiment to evaluate the response of yeast supplement in the broilers diet on growth performance. Feed intake and Weight gain were measured after 3 weeks. The results of this study revealed that supplementation YC when added to the diet enhances performance of growth in broilers. The basic purpose of using dietary prebiotics (Organic acid OA) supplement, mannanoligosaccharide (MOS), β-glucan and xylanase supplementation in poultry production is to enhance body weight gain, dressing percentage, weight of vital organs, muscles and mean lengths of villus in gastrointestinal tract. The additional benefit of Prebiotics in poultry diet is, they can stimulate immune system. The term immunostimulant can be used interchangeably with immunomodulators, adjuvant and biological response modifier. Drugs and nutrients can be Immunostimulators (Ganguly, 2013). Bozkurt et al. (2008) designed a feeding trial to compare the effect of feed supplementations with an antibiotic growth promoter (avilamycin) and two prebiotics; mannan oligosaccharide (MOS) and dextran oligosaccharides (DOS) on growth performance in broilers. Control group were fed basal diet while other group were given basal diet supplemented with antibiotic, basal diet supplemented with mannan oligosaccharides and basal diet supplemented with dextran oligosaccharides. Research showed that body weight gain of birds was significantly higher for both antibiotic growth promoter and prebiotics as compare to birds fed on the basal diet.

**Moringa oleifera Induced Changes in Intestinal Micro-Architecture**

A study was reported by Nkukwana (2012) to check the effect of Moringa oleifera leaf meal supplementation on intestinal morphology. Birds that were supplemented with MOLM have duodenal, jujunal and ileal villi were longest and also the
surface area for absorption was larger in duodenal, jejunum and ileum. Moringa oleifera supplementation in diet or addition in water showed promising biological effect on growth performance and increase the height of villus in different segment small intestine mainly in duodenum of broilers. The plant extract also help in obtaining higher protective antibody against different infections including production and development of more effective cell mediate immune response for protection against various bacterial, viral and other disease. Herbal formulation may be therefore recommended for use as positive immunomodulators in normal and immunocompromized susceptible birds (Ganguly, 2013).

**Immunomodulators Effect of Growth Promoters**

Janardhana *et al.* (2009) used prebiotics fructo-oligosaccharide (FOS) and mannan-oligosaccharide (MOS) in feed and investigated their effects on the phenotypic and functional capability of immune cells in Cecal Tonsil (CT), which is a major Gut Associated Lymphoid Tissue (GALT). At the end of their comparison of the experimental groups with controls revealed that the inclusion of prebiotics to diet appreciably reduced the proportion of B cells and in mitogen responsiveness of lymphocytes in CT. Furthermore, the use of FOS significantly improved the IgM and IgG antibody titers in plasma. These findings emphasize the need for the investigating the gut immune functions following treatment with novel feed additives. The knowledge obtained from such analyses will be quite helpful in understanding the mechanisms involved in the immune capability of the birds, which is an important consideration during selecting and optimizing new feed additives as an alternative of antibiotics for poultry. Bauer *et al.* (2006) reported that mucosal immune system is the first component of defensive system and dietary modulation of defense system of host seems to be an effective strategy for improving the health of host. Awad *et al.* (2009) found that there was significantly increase in the absolute and relative weights of thymus, small intestine, liver and spleen in supplemented groups as compare to the control group when they used symbiotic supplementation in broilers. According to the Ahmadi (2011) any level of yeast Saccharomyces cervisiae (SC) supplementation increase the weight of bursa of Fabricus, spleen and thymus as compared to the control groups in broilers.simularly, Hosseini (2011) found that supplementation of broilers feed with yeast SC had significant effect on immune organs (spleen, gall bladder and bursa of Fabricus) and visceral organs (proventiculus, small intestine, cecum and lungs). Li *et al.* (2009) conducted an experiment for Studying the effect of Astragalus Polysaccharides (APS) and probiotics (Lactobacillus and Bacillus cereus) on intestinal immune status and microbiota in birds. The results revealed that probiotics combined with APS in feed showed synergistic effects on immunity and intestinal microbiota. These results open new horizon for the exploration of new prebiotics.

**Antimicrobial Activity of Moringa oleifera**

Study was designed by Rahman *et al.* (2009) to investigate antifungal and antibacterial activity of Moringa oleifera fruits methanol extract. Moringa oleifera fruits methanolic extract showed a broad-spectrum antifungal activity and antibacterial activity. The highest zone of inhibition was found at the concentration of 200 µg disc⁻¹ for Pseudomonas aeruginosa (22 mm) and Colletotrichum spp. (14 mm). Methanol extract possessed moderate antibacterial activity against bacterial strains- Staphylococcus aureus, Vibrio cholera, Salmonellatyphi, Shigelladyenteria, Bacillus subtilis, Pseudomonasaeruginosa, Klebsiellaspecies, Bacillus cereus and Proteus species and antifungal activity against pathogenic fungi Alternaria spp, Colletotrichum spp. Curvularia spp. and Fusarium spp. Pal *et al.* (1995) conducted experiment to study the antimicrobial action of the Moringa oleifera leaves ethanolic extract. Results of antimicrobial screening of the leaf extract of M.oleifera were measured in terms of zone of inhibition. It is revealed that the ethanolic extract shows antimicrobial properties against gram positives, gram negative and acid-fast bacteria. The effect of this extract was found to decrease in
the following order against different test organisms E. coli, B. subtilis, M. phlei, B. cereus, S. lutea and S. aureus. The antimicrobial activity shown by the extract might be due to some antimicrobial substances present in M. oleifera. Vieira et al. (2010) studied antimicrobial activity of ethanolic and aqueous extracts of seeds of Moringa oleifera and in the concentration of 1:5 and 1:10 in volumes 50, 100, 150 and 200 µL and their activity was examined against Vibrio cholerae, Staphylococcus aureus, Escherichia coli (isolated from the organism and the aquatic environment) and Salmonella enteritidis. Aqueous and ethanolic extracts of Moringa showed antibacterial activity against V. cholerae, S. aureus and E. coli isolated from the white leg shrimp, Litopenaeus vannamei. Ethanolic extract of Moringa oleifera also showed antimicrobial activity against E. coli isolated from tilapia fish, Oreochromis niloticus. Devendra et al. (2011) investigate the antimicrobial activity of leaf extract of Moringa oleifera. Chloroform extract of plant leaves shows antibiotic property against wide range of pathogens like Escherichia coli (ZOI=08.8±1.0 mm), Streptococcus pyogenes (ZOI=7.0±0.5 mm), Pseudomonas aeruginosa (ZOI=9.5±0.5 mm), Staphylococcus aureus (ZOI=6.2±0.7 mm), Candida albicans (ZOI=6.2±0.5 mm), Aspergillus niger (ZOI=7.3±0.5 mm) along with positive controls. So this plant extracts having good healing properties without side effects when compared with synthetic antibiotics.

REFERENCES


