IOSR Journal of Agriculture and Veterinary Science (IOSR-JAVS)
e-ISSN: 2319-2380, p-ISSN: 2319-2372. Volume 15, Issue 2 Ser. II (February 2022), PP 01-04
www.iosrjournals.org

Effect diet probiotic supplementation on broiler chickens zootechnical performances

N.E. FEHRI [1,2], S. BEJAOUI [2], M.A. FERCHICHI [2], M. BEN LARBI[3], B. JEMMALI[2]

[1]*University de Jendouba, Tunisie, Kef Higher School of Agriculture,Kef 7119,Tunisia*
[2] *University of Carthage, LR13AGR02, Mateur Higher School of Agriculture, Mateur 7030, Tunisia*
[3] *University of Carthage, UR17AGR04, Mateur Higher School of Agriculture, Mateur 7030, Tunisia*

Abstract:
Improving the quality of products of animal origin is an international priority. The use of antibiotics in chicken feed results in residues in these products. Therefore, it was essential to find potential alternatives to growth-promoting antibiotics in order to ban their use in poultry farming.Functional food additives of biological origin can be alternatives to antibiotics allowing quality improvement. Studies have been conducted to examine how probiotic supplementation affects broiler growth performance and microflora population. Thus they ensured that there is a good balance of the intestinal microbiota and an improvement in digestive health and zootechnical performance. The objective of this work is to focus on the different components that perform probiotics and this by going from their mechanism of action and their effects on the zootechnical parameters and the digestive health of the broiler.

Key Word*: Poultry; Probiotic; Zootechnical parameters; Antibiotic; body weight*

Date of Submission: 13-02-2022 Date of Acceptance: 28-02-2022

I. Introduction

Antibiotics have residual effects on consumers as they lead to the development of antibiotic resistance[1].The development of antibiotic resistance has prompted the exploration of alternatives to improve animal health and performance without endangering the health of consumers[2].

Recent concerns about human resistance to antibiotics as well as increasing consumer demand for healthy foods have led to the prohibition of the use of growth promoting antibiotics in poultry diets[3]. As a result, it has become necessary to develop natural alternatives such as probiotics, prebiotics, enzymes, natural plant extracts, organic acids and essential oils[4].

Among these poultry feed additives, probiotics have attracted considerable attention. In recent years, the use of this additive as a substitute for antibiotics is considered by veterinarians and nutritionists[5]. In broiler chicken nutrition, probiotic species have a beneficial effect on broiler performance[6] and immunomodulation[7]. Numerous studies have been conducted to examine the effects of probiotics on the growth performance of broilers.

II. Probiotics

Probiotics are living microorganisms that can replace antibiotics that promote growth and have a beneficial effect on the host animal by improving its intestinal microbial balance[8]. Although competitive elimination and the creation of a balanced population in the digestive system, they can improve health conditions in poultry[9].

Indeed, probiotics involve several species such as beneficial bacteria, fungi or yeasts. However, the most commonly used probiotics are strains of Bacillus subtilis, Lactobacil-lus, Bifidobacterium, Butyricicoccus, and Streptococ-cus. In addition to their growth promoting activity, these microorganisms are also able to reduce the incidence of many pathogens like Salmonella typhimurium, Staphylococcus aureus, Escherichia coli, Clostridium perfringens, etc [10].

A probiotic used for poultry can be composed of a single strain or a mixture of two or more species[10]. Moreover, there are different forms of probiotics: liquid, powder, gel, paste or granules which are normally available in capsules, tablets, sachets, etc[11].

III. Mode of action of probiotics

The probiotics distributed in animal feed increase the production of organic acids in the digestive tract, which leads to modulation of the microbiota. The increase in the production of organic acids changes the permeability of the intestine and thus increases the absorption of certain nutrients, which in turn improves growth performance. In addition, the multiplication of probiotic bacteria and the increase in the production of organic acids lead to the reduction of certain pathogenic bacteria (e.g. salmonella) [12].

Mechanisms by which probiotics improve food conversion efficiency include alteration of the gut flora, enhancement of the growth of facultative non-pathogenic anaerobic bacteria and gram-positive bacteria forming lactic acid and peroxide hydrogen, suppressing the growth of intestinal pathogens, and improving digestion and nutrient utilization. Therefore, the main results of using probiotics include improved growth and improved feed conversion efficiency[13].

IV. Effect of probiotics on zootechnical parameters

There are a lot of studies concerning the effect of the use of probiotics including Lactobacillus, Bifidobacterium, Bacillus, Strepto-coccus, Pediococcus, Enterococcus and Saccharomyces cerevisiae on the various performance parameters.

Probiotic supplementation has an effect on the body weight (BW) of broilers after 28 or 39 days. Feed-to-gain ratios were decreased by 0.194 or 0.166 units for birds treated with probiotics on days 28 and 39, respectively compared to the control. However, the body weight and feed efficiency of birds in probiotic treatments were similar[14].

As well as supplementation with a mixture of Bacillus licheniformis and Bacillus subtilis spores at 0.05% and at a rate of 2.3×108 CFU/g for each strain, significantly improves the feed conversion rate compared to the group control[15].

In addition, the administration of Bacillus coagulans in the diet significantly optimizes the daily and total weight gain as well as the feed conversion rate compared to the non-supplemented group[16]. In addition, weight gain and feed conversion ratio at D42 were improved ($p<0.001$) in birds infected with C. perfringens and supplemented with Bacillus subtilis DSM 32315 at 106 CFU/g feed. Compared to challenge control birds[17].

Indeed, dietary supplementation with B. subtilis at 105 CFU/kg of feed generated a 4.4% increase in weight compared to the group where enramycin is administered as APC[18].

In addition, the administration of a DFM (Direct feed-microbial) based on Bacillus amyloloquefacien at a rate of 20 g/kg of feed for 35 days significantly improves production indicators in broiler chickens[19].

However, the use of Butyricicoccus pullicaecorum in food supplementation in broiler chickens did not have any significant effect on the weight of females while decreasing that of males ($P<0.05$). On the other hand, in females the FCR was significantly lower during the growth phase (1.295 ±0.002 vs 1.384 ±0.008) and finishing (1.516 ±0.001 vs 1.635 ±0.017) compared to the control group[20].

V. Effects on the sectory immune system

The presence of probiotic microorganisms would promote the production of antibodies, especially secretory IgA in the intestinal lumen. Directly in contact with the antigen present in the digestive contents, IgA is important in the digestive tract; they are part, as with the respiratory and genital systems, of the body's first defenses against infection. IgA can inhibit the adhesion of pathogenic bacteria to the surface of mucous membranes [21].

5.1. Immune response

The geometric mean of birds fed diets containing probiotics was higher on each sampling day than the control. Dietary supplementation with probiotics resulted in an increase in antibody titre against Newcastle disease (ND) compared to that of the control. The mean lymphoid organ weight / weight ratio of control birds was significantly lower than that of birds treated with probiotics[14].

Probiotic supplementation dramatically increased resistance to disease and improved body weight. Newcastle disease (NDV) vaccine titer levels were higher in all treated groups than in controls. An increase in immune titre due to an increase in the level of probiotics in the diet could be attributed to an increase in the availability of serum immunoglobulins. Probiotics may modulate the systemic antibody response to antigens in chickens[22].

The birds fed L. acidophilus and B. bifidum had significantly more serum antibodies against sheep red blood cells (SRBCs) than those in non-fed controls[23].The dynamics of probiotics on the immune response of broilers and reported significantly higher antibody production ($P <0.01$) in experimental birds compared to controls[24].

The probiotic diet improved certain cell-mediated immune responses in broilers by modulating the activity of macrophages. It can be assumed that some of these effects are mediated by cytokines secreted by immune cells stimulated by probiotics. The increase in the relative bursa weight in broilers receiving probiotics can be attributed to the increased number of immune cells[25].

Likewise, the increase in thymus weight may be due to the effect of probiotic bacteria on the functional activities of immune system responses, which resulted in an increase in the number of lymphocytes in primary lymphoid organs. The increase in relative spleen weight at 39 days was in agreement with the results [26]. Who found that feeding broilers probiotics caused an increase in the relative weight of the spleen in the treatment group[26].

VI. The effect on the characteristics of the gastrointestinal organs

It is well known that gut health is a key point for animal performance due to its critical importance on nutrient digestion, absorption and metabolism, incidence of enteric disease and immune responses[27].

In a recent study[28] found that supplementation with Lactobacillus bacteria increased the height and absorptive capacity of intestinal villi in broilers, which resulted in an increase in the final weight of birds

The absolute and relative weight of spleen and thymus tended to be greater ($P < 0.1$) for the probiotic-supplemented group. The relative liver weight was greater ($P < 0.05$) for probiotic-fed birds.

In addition, the small intestine weights were higher for birds fed probiotics than controls. In addition, dietary treatments influenced the histomorphological measurements of the small intestinal villi. Addition of probiotics increased ($P <0.05$) the height of the villi: crypt depth ratio and height of the villi in the duodenum and ileum. The depth of the duodenal crypt remained unchanged ($P> 0.05$). However, the depth of the crypt was reduced by dietary supplements compared to the control.

In conclusion, the probiotic showed greater efficacy as growth promoters for broilers. In addition, the dietary supplements resulted in an increase in the height of the villi and the depth of the crypt of the intestinal mucosa of broilers. Increased villi height and villus height crypt depth ratios were associated with improved growth performance for and probiotic. This indicates that the probiotic can be used as a growth stimulator in broiler diets and may improve gut health. This product show promising effects as alternatives to antibiotics Pressures to eliminate the use of growth promoting antibiotics increases[29].

VII. Conclusion

Growth promoting antibiotics used in animal feed have contributed to the development and economics of poultry farms by improving health status, growth rate and feed efficiency. This use and its possible consequences should not mask the risks of antibiotic resistance and poisoning in humans resulting from the random prescription of antibiotics. As a result of this development and to the extent that antibiotics act on the level of the intestinal microflora,"probiotics" have appeared, which are strains of living microorganisms which, administered continuously in the food, are supposed to reproduce the favorable effects antibiotics. It is clear from experiments that the administration of probiotics in the feed had beneficial effects on the performance of broilers. Overall, the beneficial effects of probiotic treatments on broiler performance parameters are consistent with a number of other research studies using probiotics in broiler chickens.

References

[1]. Shazali N, Foo HL, Loh TC, Choe DW, Rahim RA. Prévalence de la résistance aux antibiotiques dans les bactéries lactiques isolées des fèces de poulet de chair en Malaisie. Gut Pathog.2014;(6): 1 - 7.
[2]. Seo JK, Kim SW, Kim MH, Upadhaya SD, Kam DK , Ha JK. Microbiens à alimentation directe pour ruminants. Asie-Australasie J Anim Sci.2010; 23:57 - 51
[3]. Castanon J. Historique de l'utilisation d'antibiotiques comme promoteurs de croissance dans les aliments pour volailles européens. Volaille Sci. 2007; 86: 2466 – 2471.
[4]. Dorman HJ et Deans SG. Agents antimicrobiens d'origine végétale : activité antibactérienne des huiles végétales volatiles. Tourillon de microbiologie appliquée, 2000; 88 : 308–316.
[5]. Gao, J, Zhang, HJ , Yu, SH , Wu, SG , Yoon, J et Quigley, YP. Effets de la culture de levure dans l'alimentation des poulets de chair sur les performances et les fonctions immunomodulatrices. Poultry Science, 2008; 87:1377 - 1384.
[6]. Gil de los Santos, JR, Storch, OB et Gil-Turnes, C. Bacillus cereus var. toyoii et Saccharomyces boulardii ont augmenté l'efficacité alimentaire des poulets de chair infectés par Salmonella enteritidis . British Poultry Science,2005 ; 46: 494 - 497.
[7]. Koenen, ME, Kramer, J, VanDerHulst, R , Heres, L , Jeurissen, SHM et Boersma, WJA. Immunomodulation par les lactobacilles probiotiques chez les poulets pondeurs et de type viande. British Poultry Science, 2005; 45: 355 - 366.
[8]. Khan R, Naz S. Les applications des probiotiques dans la production avicole. World Poultry Sci J.2013; 69: 621 – 632.
[9]. Majidi-Mosleh A, Sadeghi A , Mousavi S , Chamani M , Zarei A. L'expression du gène iléal MUC2 et la population microbienne, mais pas les performances de croissance et la réponse immunitaire, sont influencées par l'injection in ovo de probiotiques chez les poulets de chair. Br Poultry Sci. 2017 ; 58: 40 - 45.
[10]. Alagawany M., Abd El-Hack M. E, Farag M. R., Sachan S., Karthik K. and Dhama K. The use of probiotics as eco- friendly alternatives for antibiotics in poultry nutrition. Springer-Verlag GmbH Germany, part of Springer Nature. 2018.
[11]. Iannitti T. and Palmieri B.. Therapeutical use of probiotic formulations in clinical practice. Clin. Nutr.,2010 (29):701–725.

[12]. Vondruskova, H., Slamova, R., Trckova, M., Zraly, Z. et I. Pavlik. Alternatives to antibiotic growth promoters in prevention of diarrhoea in weaned piglets: a review. Veterinari Medicina, 2010; 55 (5): 199-224.
[13]. Yeo, J et Kim, K.. Effet des régimes alimentaires contenant un antibiotique, un probiotique ou un extrait de yucca sur la croissance et l'activité de l'uréase intestinale chez les poussins de chair. Poultry Science, 1997 ; 76: 381 - 385 .
[14]. Khan SH, Yousaf B , Mian AA , Rehman A , Farooq MS . Évaluer l'effet de l'administration de différents probiotiques dans un supplément d'eau potable sur les performances des poulets de chair, la biochimie sanguine et la réponse immunitaire. J Appl Anim Res.2011; 39: 418 - 428.
[15]. Midilli M., AlpM., KocabachN., MuglahO., TuranN., YilmazH. and AkirS. C. Effects of dietary probiotic and prebiotic supplementation on growth performance and serum IgG concentration of broilers. S. A. J. An. Sci. 2008; 38:21–27.
[16]. Kral, M., AngelovicovaM. and MrazovaL. Application of probiotics in poultry production. Sci. Papers Anim. Scien. and biotech.,2012 ; 45:55–57.
[17]. Bortoluzzi C., Vieira B. S., de Paula Dorigam J. C., Menconi A., Sokale A., Doranalli K. and Applegate T. J. Bacillus subtilis DSM 32315 Supplementation attenuates the effects of Clostridium perfringens challenge on the growth performance and intestinal microbiota of broiler chickens. Microorganisms, 2019; 7:1-14.
[18]. Mehdi Y., Létourneau-Montminy M. P., Gaucher M. L., Chorfi Y., Gayatri S., Rouissi T., Brar S. K., Côté C., Ramirez A. A. and Godbout S. Use of antibiotics in broiler production: Global impacts and alternatives. Animal Nutrition, 2018 ; 4:170-178.
[19]. Ahmed S. T., Islam M. M., Mun H. S., Sim H. J., Kim Y. J. and Yang C. J. Effects of Bacillus amyloliquefaciens as a probiotic strain on growth performance, cecal microflora, and fecal noxious gas emissions of broiler chickens. Poult. Sci., 2014; 93:1963–1971.
[20]. Eeckhaut V., Wang J., Van Parys A., Haesebrouck F., Joossens M., Falony G., Raes J., Ducatelle R. and Van Immerseel F. The probiotic Butyricicoccus pullicaecorum reduces feed conversion and protects from potentially harmful intestinal microorganisms and necrotic enteritis in broilers. Front. Microbiol. 2016; 7:1-9.
[21]. Erika Isolauri, Yelda Sütas, Pasi Kankaanpää, Heikki Arvilommi, and Seppo Salminen. Probiotics: effects on immunity. 2001;73: 444–50
[22]. Huang, Z , Subbiah, E , Yunus, AS et Samal, SK. Un virus de la maladie de Newcastle (NDV) recombinant exprimant la protéine VP2 du virus de la bursite infectieuse (IBDV) protège contre le NDV et l'IBDV. Journal of Virology, 2004 ; 78: 10054.
[23]. Haghighi, HR, Gong, J , Gyles, CL , Hayes, MA , Zhou, H , Sanei, B , Chambers, JR et Sharif, S. Les probiotiques stimulent la production d'anticorps naturels chez les poulets. Immunologie clinique et vaccinale, 2006. 1: 975 - 980
[24]. Kabir, SML, Rahman, MM, Rahman, MB, Rahman, MM and Ahmed, SU. The dynamics of probiotics on growth performance and immune response in broilers. International Journal of Poultry Science,2004 ; 3: 361–364.
[25]. Cheng, Y, Lee, D, Wen, C et Weng, C. Effets de la supplémentation en [bêta] -glucane sur la prolifération des lymphocytes, la chimiotaxie des macrophages et les réponses immunitaires spécifiques chez les poulets de chair. Asian-Australasain Journal of Animal Sciences, 2004; 17: 1145 - 1149.
[26]. Willis, W, Isikhuemhen, OS et Ibrahim, SA. Évaluation des performances des poulets de chair ayant reçu un extrait de champignon seul ou en combinaison avec des probiotiques. Poultry Science, 2007; 86: 856 - 860.
[27]. Hozan Jalil Hamasalim. Synbiotic as Feed Additives Relating to Animal Health and Performance. 2016; 6, 288-302.
[28]. Shah M, Zaneb H, Masood S, Khan RU, Ashraf S, Sikandar A, Rehman HFU, Rehman HU. Effect of dietary supplementation of zinc and multi-microbe probiotic on growth traits and alteration of intestinal architecture in broiler. Probiotics Antimicrob Proteins. 2019 ; 11:931–937.
[29]. Awad et al W. A. Awad, . Ghareeb,S. Abdel-Raheem, and J. Böhm. Effects of dietary inclusion of probiotic and synbiotic on growth performance, organ weights, and intestinal histomorphology of broiler chickens. 2009.

N.E. FEHRI, I, et. al. "Effect diet probiotic supplementation on broiler chickens zootechnical performances." *IOSR Journal of Agriculture and Veterinary Science (IOSR-JAVS)*, 15(02), 2022, pp. 01-04.