

## Enhancing Animal Feed Efficiency Using Organic Acids: Effects on Poultry Production

Yusuf Ishaq<sup>1</sup>, Sibel Canogullari<sup>1</sup>

<sup>1</sup>Department of Animal Production and Technologies, Faculty of Agricultural Science and Technologies, Nigde Omer Halisdemir University, Nigde 51240, Turkey

### Abstract

Organic acids have been the common one used in animal feeds. Organic acids have contained both carboxylic and fatty acids in structure with acidic properties. There are selected organic acids used for feed additives in poultry feeds. The main aim of this review was to examine animal feed efficient using organic acids with focus on poultry production. The study identified the various forms of organic acids, their application in poultry production, beneficial and detrimental effects. The common organic acids used in poultry feeds are fatty acids with short chain structure such as formic acid, acetic acid, propionic acid, and butyric acid, while other acids in carboxyl form like citric acid, lactic acid, malic acid, and fumaric acid are also in use within the poultry sector due to their physical and chemical attributes. The study concluded that although organic acids are significant to poultry birds in terms of nutrient digestion, feed consumption, feed efficiency ratio, immunity, and overall growth and performance, they also have negative effects if not properly used in poultry feed. There is need for animal scientist to recommend specific level of organic acids in poultry feed to achieve the best result in overall growth and development of the poultry birds.

**Keywords:** *Animal, Poultry, Feed, Organic acids, Efficiency*

### Introduction

There have been a vast development over the years in poultry production from backyard practice to technology based commercial industry. Coupled with increase in demand and production of poultry products with corresponding increase in consumer needs in terms of food safety which involved the use of animal protein, genetic modified materials and antimicrobial growth promoters to enhance poultry bird performance (Archana *et al.*, 2016). The marketing and use of antibiotics as growth promoters in animal feed have been banned by the European commission (Luckstadt, 2014). Animal scientist that specialized in feed have developed a means to overcome the limitation of low performance to ban on antibiotics, substance such as prebiotics, herbs, enzymes, and organic acids were deemed alternative solutions in poultry production (Bagal *et al.*, 2016). (Wang *et al.*, 2009) identified the use of organic acids for antimicrobial and feed preservation for commercial feeds for animals. There are various forms of dietary acids for poultry feeds, which can be organic or inorganic acids. Organic acids have been the common one used in animal feeds. Organic acids have contained both carboxylic and fatty acids in structure with acidic properties. There are selected organic acids used for feed additives in poultry feeds. The common organic acids used in poultry feeds are fatty acids with short chain structure such as formic acid, acetic acid, propionic acid, and butyric acid. The other component of organic acids commonly used in poultry are citric acid, lactic acid, malic acid, and fumaric acid due to their physical and chemical attributes applicable to poultry feeds (Kim *et al.*, 2014). (Khan and Iqbal, 2015) reported that organic acids used in the poultry industry are short chain fatty acids, antimicrobial in nature, and have high soluble ability in water. Propionic acid, citric acid, lactic acid, and formic acid are the widely used, because there is the thought that acidifiers are composed of single acid, but when a combined of any of these acids have more microbial effects (Šamudovská *et al.*, 2018).

The combination of organic acids such propionic acid and formic acid in broiler drinking water improves food conversion ratio, nitrogen retention, and body weight gain (Desai *et al.*, 2007). In the same vein, the mixture of formic, citric, propionic, and lactic acids aids body weight and broiler flock uniformity (Eftekhari *et al.*, 2015). According to (Sohail and Javid, 2016) organic acids health improve gut health and effective promoters of growth in poultry production. The need of modern poultry sector are increase in production levels and feed conversion efficiency which can be archived through the use of specific feed additives. Based on this background this study will therefore focus on how poultry feeds are enhanced through the application of organic acids to improve production and overall performance.

### Organic acid effects on Animals

Organic acids serves alternative to antibiotics in animal feed. The European union also have stated that organic acids with the salt content in them are safe and approved for use in animal production as feed additives. They can



exist in either simple monocarboxylic acids such as formic, acetic, propionic and butyric acids or carboxylic acids with hydroxyl group such as lactic, malic, tartaric and citric acids or short chain carboxylic acids containing double bonds like fumaric and sorbic acids (Archana *et al.*, 2016). The organic acids disrupt microbial growth in the feed of animals, and also affects gastrointestinal tract due to microbial balance. The highlighted acids performs microbial activity which results in alteration of the gut micro plant attributes (Chen *et al.*, 2013). (Lückstädt, 2014) reported that propionic and formic acids are the two most effective organic acids used for several years in animal feed additives basically for preservation purpose.

### ***Poultry production and organic acid***

The use of organic had been observed to serve as protection to young chicks through feed conversion efficiency, nutrient use improvement, and competitive exclusion (Thirumeigmanam *et al.*, 2006). Weight gain and increase feed consumption were discovered with the addition of citric acids to broiler feed (Abdel-Fattah *et al.*, 2008). Fumaric, citric, lactic acids coupled with their salts in form organic acids have improved performance of poultry birds in terms of health status. (Adil *et al.*, 2010) reported the use of organic acids and salt components as safe measures to replace antibiotics, due to their safe nature and ability to serve as better feed additives in poultry and other animal diet.

### ***Objectives***

The main aim of this review was to examine the enhancement of animal feed efficiency using organic acids with focus on poultry Production. The purpose of this review is to;

- a. synthesis existing literatures: The goal of this review is to provide a thorough research into the use of animal feeds, organic acids, and effects on poultry production.
- b. Composing relevant data from reliable sources and evaluating reputable articles are part of planned results synthesis.

### ***Materials and Methods***

The reputable research platform Research Gate is used in this review. An analysis of the research gate database was done. The target data based focused on organic acids, utilization in poultry production, effects of organic acids on poultry, and other vital information on the subject. Valuable information were obtained from academic papers using the above keywords. The articles were then reviewed in specific forms which includes reports, conference proceedings, and journal articles. The only topics covered in the study were research papers organic acids, application of organic acids on poultry, feed efficiency on the use of organic farming in poultry production. Furthermore, the study employed several methodologies to identify relevant findings.

### ***Findings and Discussion***

#### ***Organic acid application in poultry production***

The application of organic acids have been discussed in several research findings, (Mansoub *et al.*, 2011) observed the application of organic acids to improve chicks at tender age, and improve overall health performance at this early stage. (Lückstädt and Mellor, 2011) reported the application of organic acids to improve poultry nutrient utilization and feed conversion ratio. Organic acid as feed supplements had significant growth on weight gain and live weight as well (Aksu *et al.*, 2007). Higher live weight and day to day gain was observed due to addition of organic acids in animal feed (Al-Kassi and Mohssen, 2009). According to (Kaya and Tuncer, 2009) reported that no significant difference was observed in broilers weight gain due application of organic acid as supplement in their feed ration. Increase in body weight was discovered with the addition of organic acids in broiler feed (Adil *et al.*, 2010). Propionic acid addition in diet inclusion of broiler lead to improved overall performance with no side effects (Asma and Nagra, 2010). The inclusion of citric acid at specific percentage in broiler chicks had weekly growth while higher percentage had negative impact (Nourmohammadi *et al.*, 2010). Poultry birds consumes feed supplemented with organic acids in form of fumaric, lactic, and butyric had significant impact on body weight gain (Adil *et al.*, 2011). The combination of probiotics, organic acids, and oligosaccharides improve body weight of poultry birds (Armut and Filazi, 2012). Supplementation of citric acid in low nutrient diet enhance weight gain and immunity state (Das *et al.*, 2012).

#### ***Feed Efficiency using organic acids in poultry production***

The feed efficiency using organic acids in poultry production had a lot of benefits which are in form of feed additives. The supplementation of organic acid with yeast component aids feed conversion efficiency and intake (Nicoletti *et al.*, 2010). (Saddeiy, 2013) observed difference in feed conversion ratio and feed consumption when the inclusion of different levels of organic acids as feed supplements. Feed intake and conversion ratio is increased with supplementation with organic acids in certain required proportion (Sarzamin *et al.*, 2013). Poultry intestinal microbes have been stabilized in the past using feed additives, which often leads to thinning of the gut region





resulting in increased nutrient assimilation. The antibiotics have long been supplemented in poultry feed to stabilize microbial flora, thereby leading to prevention of intestinal infection and overall performance (Khan *et al.*, 2016). Another approach to achieve more returns in terms of lower feed conversion is increase in nutrient digestion. Organic acids are often used as acidifiers in poultry feeds due to their nutrient digestion and other attractive attributes (Haq *et al.*, 2017). The also improve carcass quality of broiler chicks, nutrient utilization, feed conversion efficiency, and overall growth and performance. According to the findings of (Archana *et al.*, 2016) observed that increase in weight gain, feed consumption, and efficiency when organic acid is added to broiler feed rations. Mortality reduction effects and increase growth enhancement was observed due to certain required proportion of organic acid in broiler chickens with no effects on carcass output (Brzoska *et al.*, 2013). The findings of (Fascina *et al.*, 2012) revealed that mixture of broiler feeds with organic acids resulted in better carcass quality and improved overall performance. The use of acidifiers such as tartaric, citric, lactic, and formic and malic acids addition to broiler feeds at certain proportion increase body weight gain.

#### ***Beneficial effects of organic acids in poultry production***

There are several advantages of using organic acids in poultry production. The lowering of PH in the intestinal tract of animals especially poultry birds is one benefits of organic acids because it favours microbial activity and eradicate pathogen microbes. Organic acids are deepen in poultry feed and drinking water to enhance better growth, digestion of nutrient, and immunity levels (Haq *et al.*, 2017). Organic acids aside the maintaining of PH level also correct and improve the actions of proteolytic enzymes during overall protein digestion in the stomach and enhance consumption of feed (Archana, 2016). Authors like (Armut and Filazi, 2012) and (Gonzales *et al.*, 2013) reported in their findings the positive effects of organic acids which can be used in place of antibiotics suitable as feed additives for poultry birds. Due to the safe use of organic acids and their salt component as feed additives in animal production by the European Union (EU), the inclusion of dietary organic acids in broiler feed resulted in villus height (Cengiz *et al.*, 2012). (Haque *et al.*, 2010) in their findings discovered that inclusion of citric acid in animal feed improves lymphocytes density in the lymphoid organs, thus implies non-specific immunity. Poultry birds with greater density lymphocytes have stronger immune status to fight immunogens in their system (Khan *et al.*, 2008). The dietary supplementation of organic acid like phenylacetic acid increase the lymphocyte percentage in a short duration for layers birds (Wang *et al.*, 2009), while (Houshmand *et al.*, 2012) reported usage of organic acids as supplement increase antibodies action against Newcastle disease in broiler birds. (Achana *et al.*, 2016) also discovered in their study that organic acids reduce production of poisonous materials by bacteria, alteration of the structure of the intestinal wall, and reduction pathogen colonization, therefore improving growth performance, prevention of epithelial cells, and enhance broiler chick carcass quality.

#### ***Detrimental effects of organic acids in poultry production***

The organic acid also have negative effects on the poultry feed when included not just to mention the positives alone. Organic acids penetrates the cell wall of microorganism in the intestinal tract causes normal cell functioning and can cause death of these microbes which are important in the stomach of poultry bird. According to (Mani-Lopez *et al.*, 2012) the process of bactericidal mechanism are explained in several forms. The organic acids moves along the bacterial walls and then translates into a conjugated based form with a reduction in cell PH. The reduction then leads to stressful environment which leads to cellular dysfunction and reduction multiplication nature. The consumption of broiler chickens on organic acids reduce harmful bacterial such as coliforms and Clostridia but have contained higher bacterial which are beneficial in form of ileum and lactobacilli compared to the organic acids with antibiotic growth promoters which are harmful (Khan, 2016). (Kil *et al.*, 2011) reported in their findings that observed that organic acid may also prevent bacterial transfer from the feed or the environment due to their PH lowering attributes in the gastrointestinal tract of animals such as poultry birds. Organic acids also serve as feed preservatives (Ewing, 2009). (Adil *et al.*, 2011) in their study discovered reduction in feed intake among broiler when feed with organic acids supplements, but improvement in feed conversion ratio. The inclusion of citric acids in boiler feed within certain concentration leads to reduced feed intake (Kopecky *et al.*, 2012). (Jian-Hui, 2013) also reported that application of acidifier in poultry feed with a number of days resulted in feed intake and feed conversion ratio respectively. (Haq *et al.*, 2017) observed that multiplication of pathogenic microbes in the gastrointestinal damages the villus and make the intestinal walls thick due to cell proliferation which makes the penetration of nutrients difficult resulting is reduced growth performance. This multiplication is caused due to inclusion of excess organic acids in the feed of poultry feed.

#### **Conclusion**

The study concluded that although organic acids are significant to poultry birds in terms of nutrient digestion, feed consumption, feed efficiency ratio, immunity, and overall growth and performance, they also have negative effects if not properly used in poultry feed. There is need for animal scientist to recommend specific level of organic acids in poultry feed to achieve the best result in overall growth and development of the poultry birds.



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