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Effect of Synbiotic (Bacflora) on Performance and Dressing Percentage of Broiler Chicken

أثر السنبيوتك (باكفلورا) علي الأداء الانتاجي ونسبة التصافي للدجاج اللاحم

A dissertation submitted for Partial fulfillment requirements for the degree of Master of Science (M.Sc.) in Animal Production in The Tropics

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Dedication

To the soul of my beloved mother

To my father

To my grandfather for great love and care for me

To my brothers and sisters

To every student has the knowledge of carrying the flag as matter to invoke it, and he becomes a scientist

To my friends and colleagues

I dedicate this to every reader who gave precious time and attention for reading this research

Acknowledgement

First, praise is to Allah for giving me strength, health good and success to complete this research.

*Secondly, I extend my thanks and full respect and gratitude to my supervisor **Dr. Abubakr Sayed Ali** for his care, guidance and assistance during the period of study.*

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Abstract

A study was conducted at the college of Animal Production Science and Technology, Sudan University of Science and Technology, Poultry Farm to evaluate the effect of addition synbiotic in broiler diets on performance parameters and dressing percentage. A total of one hundred and twenty (7 days old) unsexed broiler chicks (*Hubbard F15*) of 114g average weight were randomly divided into three groups (40chicks/group). Each group was sub divided into four replicates (10 chicks in each). Experimental diets were formulated twice to meet the nutrient requirements of broiler chicks during the starter and finisher periods. The control diets contained 0% synbiotic and the other diets contained (0.25%, 0.375%) synbiotic. Complete randomized design was used to analyze the obtained data of the study and subjected to one way-ANONA followed by least significant difference (LSD) to test the differences among the groups. The results showed no significant effect of different levels of synbiotic groups on the studied performance parameters with exception of the fourth week of feed conversion ratio, protein efficiency ratio and energy efficiency ratio. Also the results revealed no significant differences on the studied carcass characteristics. The study conclusion was no significant effect of added different levels of synbiotic on the performance and the dressing % of broiler chickens was observed.

المستخلص

أجريت هذه الدراسة في كلية علوم وتكنولوجيا الانتاج الحيواني، جامعة السودان للعلوم والتكنولوجيا في مزرعة الدواجن لتقييم أثر إضافة السنبيوتك إلى علائق الدجاج اللاحم علي الأداء الإنتاجي و بعض خصائص جسد الذبيح. أُستخدم 120 كتكوت (عمر 7 أيام) من سلالة (*Hubbard F15*) ذات متوسط وزن 114جرام ثُم قسمت الطيور عشوائيا إلى ثلاث معاملات (40طائر/معاملة)، كل معاملة قسمت إلى أربعة مكررات (10 طيور/مكررة) وفقاً للتصميم كامل العشوائية. تم تكوين ثلاث علائق لمقابلة الإحتياجات الغذائية للطيورخلال مرحلتي البادئ والناهي. عليقة التحكم تحتوي على 0% سنبيوتك والعلائق الأخرى تحتوي على (0.25%، 0.375%) سنبيوتك . أُستخدم إختبار التباين لاتجاه واحد لتحليل بيانات التجربة وأخضعت لإختبار أقل فرق معنوي لمقارنة الفروقات بين المجموعات. أظهرت النتائج عدم وجود فرق معنوي لإضافة مستويات مختلفة من سنبيوتك علي معايير الأداء الإنتاجي لفراخ اللحم بإستثناء معامل التحويل الغذائي، معدل كفاءة البروتين و معدل كفاءة الطاقة في الاسبوع الرابع. أيضاً أظهرت عدم وجود فروق معنوية ($P<0.05$) لإضافة مستويات مختلفة من سنبيوتك علي نسبة التصافي. خلاصة الدراسة هي عدم وجود فروق معنوية لإضافة مستويات مختلفة من السنبيوتك علي الأداء الإنتاجي و نسبة التصافي للفراخ اللاحم.

Chapter One:

Literature Review

Introduction

Poultry industry plays an important role in alleviating animal protein deficiency in the last two decades throughout the world via increased availably of poultry eggs and meat (Pervez *et al*., 2011). Sudan has a very good potential to be world major player in poultry production exports, a lot of local and international investors are starting new poultry business in Sudan (Writers, 2012).

Poultry meat is one of the most important sources of animal protein in the world today; therefore, poultry serves as one of the means of satisfying the increased demand for animal protein. Presently, chicken meat is on demand as a cheap source of protein with low cholesterol value; therefore, investment in broiler production is increasing day by day. As 70% of total cost of poultry production is contributed by feed only. Improvement of feed conversion ratio (FCR) will significantly enhance the margin of profit. (Sarangi *et al.,* 2016). Many feed additives are presently used in the poultry industry, such as probiotics, prebiotics, and symbiotics. Probiotics are live organisms which have been studied for their antimicrobial and growth promoter abilities (Hume, 2011).

To reach a profitable balance among the cost of feed, broiler performance and product quality, certain feed additive are available in the market for the use in broiler feed. These additives may be recommended for either their chemotherapeutic and prophylactic effects or for their growth promoting effects (Pervez *et al*., 2011).

The objective of this study is to study the effect of different levels of Bacflora (synbiotic) on the performance and some carcass characteristics of broiler chicks.

Chapter one

Literature review

1.1-Feed additives:

Feed additives are materials that are administered to the animal to enhance the effectiveness of nutrients and exert their effects in the gut or on the gut cells (Donald *et al*., 2011). Some of feed additives are available as antibiotics, enzymes and probiotics, these compounds are added to diets of farm animals, to improve the growth performance, nutritional parameters and carcass traits (Alam *et al*., 2003). Moreover, probiotics, Prebiotics, and synbiotics derived from live organisms and can be used as antimicrobial and growth promoters (Hume, 2011). Feed additives are two main groups. The nutritive feed additives (NFA) and non nutritive feed additives (NNFA). A nutritive feed additive is define as a chemical element or compound that aid in support of life and necessary for cells to live, growth and function properly. These nutrients are essential amino acids (lysine and Methionine), vitamins and minerals. The NFA are added in the feed to compensate the deficient nutrients in the rations, such as a vitamin mix, mineral mix and single or the mixture of amino acids…etc. Non nutritive additives are substances added in amounts of less than 0.05 percent, to maintain health status, uniformity and production intensive systems. These additives have now became vital components of practical diets. NNFA had different forms and types such as pellet binders, flavoring agents, enzymes, antifungals, antibiotics, cocccidiostats, anti-helminthes drugs, antioxidants, hormone and asprin (James and Gillespie, 2003).

1.2- Growth promoters

There are different types of growth promoters including:

1.2.1- Probiotics:

There are many definitions of probiotics most of them define it as common additives including varity of types of non pathogenic bacteria and yeast which contribute to intestinal microbial balance (Parker, 1974 and Islam *et al.*, 2004). The use of probiotics can reduce the incidence of enteric infectious diseases and increase broiler performance (Lee *et al.*, 2010).

Probiotics include bacteria, moulds, and yeast, but most probiotics used as feed supplemented are live bacteria especially lactic acid bacteria are more popular, also yeast particularly *Saccharomyces cerevisiae* (Patterson and Burkholder, 2003; Mountzouris *et al.*, 2007 and Noohi *et al.*, 2014). Microbial probiotics are commonly administered to birds orally either through the feed or drinking water. Use of probiotics through the feed or via drinking water has been found to improve the performance of broilers (Jin *et al.*, 1998 and Ohimain and Ofongo, 2012). Probiotic effects might be attributed to the great efficiency in the utilization of food, resulting in improvement of the growth. It is well established that, probiotics have digestion stimulating properties and anti-microbial function in the gut (Eltrefi *et al.*, 2017).

Many characters of good probiotics include: must be capable of exerting a benfical effect on the host animal, e.g. increase growth or resistance to disease, non pathogenic, non toxic, present as viable cells, preferably in large numbers, capable of surviving and metabolizing in the gut environment by its resistance to low pH, organic acids and bile, stable under storage conditions (Fuller, 1989 ; and Lima *et al.*, 2007).

The normal flora bacteria in the intestinal tract of the chicken play important role in the health of the host animals by improving their intestinal balance and preventing ingested pathogens. Supplementation of probiotics (yeast and bacteria based) in broiler diets provides the most beneficial microflora and removal of pathogenic bacteria by means of competitive exclusion and antagonism. Probiotics are considered a potential substitute for antibiotics (Fuller, 1989; Jin *et al*., 1998 ; Patterson and Burkholder, 2003; Ahmed *et al*., 2006 and Awad *et al*., 2009), nutrient digestibility (Li *et al*., 2008), improving digestion, absorption, performance, balance intestinal micro flora and they have been administered to contract stress due to various factors such transport, overcrowding, vaccination, …etc, moreover, probiotics help in synthesis of vitamins of B-groups, improving immunity stimulation, prevention harmful microorganisms, providing digestive enzymes and increasing of production of volatile fatty acids (Fuller, 1989; Panda *et al*., 2003; Ahmed, 2006; Khan *et al*., 2007; Mountzoures *et al*., 2007; Mountzoures *et al*., 2010; Hume *et al*.,2011; Alloui *et al*.,2012 and Ghfari *et al*., 2017).

Probiotic efficacy depends on several factors, such as microbial species composition (e.g., single or multi strain) and viability, application procedure, dosing level, frequency of application, age, type of diet, sanitation and environmental stereos factors (Mountzouris *et al*., 2007).

1.3 -Prebiotics:

Gibson and Roberfroid, (1995) defined Prebiotics as non-digestible feed ingredient substances that act as microbial modulators and it beneficially affect the host by selectively stimulating the growth activity of one or a limited number of bacteria in the colon and thus improve host health. Also, Gibson *et al*., (2004), ISAPP (2008) and Hijova *et al*., (2012) defined them as a selectively fermented ingredient that allows specific changes, both in the composition and/or activity in the gastrointestinal microflora that confers benefits upon host well being and health.

Prebiotics typically refer to oligosaccharides that are not digested by the animal's enzymes, but can be utilized by intestinal microflora, which beneficially affects the host, thus improves gut health." Certain oligosaccharides are considered to be prebiotic compounds because they are not hydrolyzed in the upper gastrointestinal tract and are able to favorably alter the colonic microflora. Also it can be selectively stimulating the replication of selected intestinal bacterial species, which have potential beneficial effects on the host's health. Prebiotics hypothetically act by selectively stimulating the beneficial microbes that are already present in the gut. Prebiotics serve as fuels for the endogenous microflora, thus providing the host with energy, metabolic substrates, and essential micronutrients. (Gibson and Roberfroid, (1995); Collins and Gibson, 1999; Patterson and Burkholder.2003; Zhang *et al.*, 2003; Biggs *et al.*, 2007 and Yang *et al.*,2009).

1.2.3-Synbiotics:

Synbiotic are combination of prebiotics and probiotics, as well as other growth-promoting substance they beneficially affect the host by improving the survival and implantation of live microbial dietary supplements in the gastrointestinal tract (Gibson and Roberfroid, 1995; Collins and Gibson, 1999 and Patterson and Burkholder, 2003).Recent research and development of synbiotic products has been increasingly focused on functional benefits including resistance to gastrointestinal bacterial infection, antibacterial activity, and improved immune status in broiler chicks , alternative to antibiotic growth promoters. Also have a positive effect on gut health, diet digestibility, and life performance of broilers. The combinations of Prebiotics and probiotics (synbiotics) are often more effective when compared with the individual additives (Gibson and Roberfroid, 1995; Patterson and Burkholder, 2003; Awad *et al*., 2008; Awad *et al*., 2009; Ashraf *et al*., 2013).

1.3-Effect of dietary supplementation on broiler performance:

1.3.1-Feed intake:

Supplementation of probiotic or synbiotic in broiler diet improve feed intake (Mokhtari *et al*., 2010; Jang *et al*., 2011; Ghahri *et al*., 2013; Tabidi *et al*.,2013; Mokhtari *et al*., 2015; Nawaz *et al*., 2016 and Eltrefi *et al*., 2017).Addition of probiotic in broiler diets decreased feed intake(Ghfari *et al.*, 2017).The consumption of the prebiotic and/or probiotic and their combination on feed intake had no effect on feed intake (Kim *et al*., 2011; Kamaran *et al*., 2013; Zhang *et al*., 2013; Zhang and Kim, 2014; Torres *et al*., 2015; Sarangi *et al*., 2016 ;Al-sagan and Abudabos, 2017 and Musaad *et al*., 2017).

1.3.2-Body weight and body weight gain:

Dietary supplementation of probiotic and/or prebiotic or their combination significantly increased body weight gain (Capcarova *et al*., 2010; Hijova *et al*., 2012; Nikpiran *et al*., 2013; Hrncar *et al*., 2014; Zhang *et al*., 2014; Murshed and Abudabos, 2015; Sarangi *et al*., 2016 and Musaad *et al*., 2017).The addition of probiotic in broiler diets decreased body weight gain (Ananthanarayanan and Dubhashi, 2017 and Ghfari *et al*., 2017).The probiotic or synbiotic supplemented in broiler diet had no effect on body weight and body weight gain (Lee *et al*., 2010; Amerah *et al*., 2013; Nikpiran *et al*., 2013; Salim *et al*., 2013; Gutierez *et al*., 2016 and Al-sagan and Abudabos, 2017).

1.3.3-Feed conversion ratio:

Broiler diets containing probiotic and/or prebiotic or their combination improved significantly feed conversion ratio (Corduck *et al*., 2008; Shabani *et al*., 2012; Amerah *et al*., 2013; Nikpiran *et al*., 2013; Murshed and Abudabos, 2015; Ashayerizadeh *et al*., 2016; Pourakari *et al*., 2016 and Shankar *et al*., 2017).Feed conversion ratio was significantly lower in chicks which had received probiotic or synbiotic supplementation diets (Alloui *et al*., 2012; Abudabos *et al.*, 2013; Tabidi *et al*., 2013; Ananthanarayanan and Dubhashi, 2017 and Ghfari *et al*., 2017). The consumption of the probiotic in broiler diet on feed conversion ratio was not significantly different (Biernasiak and Slizewskak, 2009; Kim *et al*., 2011; Salim *et al*., 2013 ; Weis and Harncar, 2013 ; Zhang and Kim, 2014; Gutierez *et al*., 2016 and Alsagan and Abudabos, 2017).

1.3.4-Production efficiency factor:

The supplementation of probiotic or synbiotic in broiler diets increased production efficiency factor (Awad *et al*., 2008; Awad *et al*., 2009; Khan *et al*., 2013 and Saiyed *et al*., 2015).The probiotic supplemented in broiler diet had no significant effect on production efficiency factor (Biernasiak and Slizewska, 2009).

1.3.5-Protein efficiency ratio:

Addition of probiotic or synbiotic in broiler diets increased protein efficiency ratio significantly during the experimental period (Arslan and Saati, 2004 and Ashayerizadeh *et al*., 2011).Low-protein diets with constant metabolisable energy : crude protein ratio decreased protein efficiency ratio. Whenever dietary protein decreased during grower, finisher, and overall experimental period’s protein efficiency ratio was decreased (Kamaran *et al*., 2008). Inclusion of different levels of lysine in broiler diets did not affect protein efficiency ratio (Nasr *et al*., 2011).

1.3.6-Energy efficiency ratio:

The addition of the synbiotic in broiler diet was significantly improved energy efficiency ratio (Ashayerizadeh *et al*., 2011).Low-protein diets with constant ME:CP ratio decreased energy efficiency ratio. When dietary protein and energy were decreased during grower, finisher, and overall experimental periods. The energy efficiency ratio was decreased (Kamaran *et al*., 2008).The increment of probiotic in broiler diets had no significant effect on energy efficiency ratio (Ashayerizadeh *et al*., 2011) Also, broiler diets content of different levels of lysine did not affect on energy efficiency ratio (Nasr *et al*., 2011).

1.3.7**-Carcass yield:**

Broilers fed probiotic or synbiotic-supplemented diet their showed significant improvement in carcass yield compared to the broilers fed the un-supplemented diet. (Ghahri *et al*., 2013; Saiyed *et al*., 2015; Pourakari *et al*., 2016; Eltrefi *et al.*, 2017; Ghfari *et al*., 2017 and Musaad *et al*., 2017).The increment of probiotic on broiler diets decreased carcass yield (Eo *et al*., 2017).The inclusion of probiotic and/or prebiotic or their combination in broiler diet had no effect on carcass yield (Arslan and Saatci,2004; Corduck *et al.,* 2008; Abudabos *et al.,* 2013; Khan *et al*., 2013; Sayied *et al*., 2015; Gutierez *et al*., 2016 and Alsagan and Abudabos *et al.*, 2017).

1.4-Enviromental factors affect broilers performance:

They are several factors that can influence broilers performance including:

1.4.1-Heatstress:

Heat stress is one of the most important environmental problem challenging poultry production worldwide, heat stress negatively affects the welfare and productively of broilers and also laying hens (Lara and Rostagno, 2013). When the air temperature rose to 33 C°, average daily feed intake, daily gain, carcass weight and feed conversion ratio decreased (Ghazalah *et al*., 2008 and Gu *et al*., 2008). On the other hand, feed intake, weight gain, water intake, feed conversion ratio and dressing percent were significantly high in heat free group compared to heat stress group, reared during the summer, when the ambient temperature ranged between (35°- 38C°). Heat stress has deleterious effect over the performance of broiler (Hubbard) chicken. (Jahejo *et al*.,2016). Also May *et al*., (2000) found that both feed and water consumption were depressed during the peak of the daily cyclic temperature.

1.4.2-Housing system:

Open-sided house, under the hot humid tropical environment depressed growth, feed intake and feed conversion ratio of broiler chickens. Birds in closed housing were more fearful than these of open house and this could be attributed to lack of environmental stimulation in the former (Al-Agil *et al*., 2009). Housing broiler chickens in free-range housing system caused decrease in body weight gain and feed efficiency during the conventional growth, longer growth period is necessary for the fasting growing broilers strains in free-range conditions (Sekeroglu *et al*., 2009).

1.4.3-Air velocity:

Broilers exposed to the high air velocity consumed less water and more feed, gained more weight, and had an improved feed conversion ratio. The high air velocity had little effect on daily patterns of feed and water consumption (May *et al*., 2000).

1.4.4-Extra vitamins:

The addition of vitamin C did not raise growth rate in broilers during the hot-dry season, however when the breast meat yield was improved (Aboja *et al*., 2011). Supplementation ascorbic acid in broiler diets increased body weight gain. At a relatively high dosage above 400ppm, lowered the abdominal fat deposition and improved the color of chickens' meat (Oqunwole *et al*., 2013).

Chapter Two:

Materials and Method

Chapter two

Materials and Methods

2.1-Experimental site and duration:

The study was carried out in the Poultry Farm, Sudan University of Science and Technology, College of Animal Production Science and Technology, during 31th March to 13th May 2017. Minimum and maximum temperatures were 25.3°C to 45.6°C respectively.

2.2-Experimental house:

The experiment was conducted in an open sided building; the long axis of the building extended from east to west facing the wind direction for efficient ventilation. The house was with concrete floor and constructed of brick wall (50 cm base height), the rest of the wall toward the roof was made of wire net in the open sides. The roof was made of ridged iron sheets supported with iron posts. The house was divided into twelve wire pens the dimensions of each pen was ($1\times1m^2$) The house were dry cleaned washed and disinfected before arrival of birds, every pen was equipped with cleaned, washed and disinfected round feeder and a round drinker. Wood shaving was used for litter.

2.3-Experimental birds:

A total of 120 unsexed one day old commercial broiler chicks (Hubbard F15) were used in this experiment. The chicks were purchased from Arab Poultry Breeders Company (Ommat). They received 2 ml of AD3E multivitamins in drinking water for the first seven days. After the incubation period the chicks were divided into three groups (40 chicks per group). Each group was replicated four times (10 birds per replicate). Birds were offered feed and water *ad libitum* throughout the experimental period.

2.4-Prevention and Vaccination:

The birds were given 1ml/L of AD3EC vitamins at high temperature time during the study period, also they have received 0.2g/L of Doxycycline for respiratory symptoms during the third week. Furthermore birds were vaccinated against Newcastle disease (ND), Infectious bronchitis (IB) on arrival by spraying; also Infectious bursal disease (IBD) on the 12^{th} day and was repeated on the 19^{th} day by eye-drop. On the 21^{th} day old ND vaccine was administrated by eye-drop. Also, 1ml/L of AD3E Vitamins were added after each vaccination for two to three consecutive days.

2.5-Experimental diets:

The commercial synbiotic manufacture compound (*Bacflora*) was provided from commercial company, It is a kind of commercial probiotics, containing *Bacillus Licheniforms* and *Bacillus subtilis, Enterococcus faecium, Lactobacillus acidophilus*, raw protein (from *saccharomyces cerevisiae* extract), Calcium and Magnesium. The birds were incubated for the first week and fed on (*Na Po)* Pre-starter (Table 1). Two broiler starter and finisher basal diets were formulated. Diet (A) is a basal diet without synbiotic (0.0%) served as control group. The other two diets (B), (C) in which the basal diets supplemented with either (0.25% or 0.375%) synbiotic respectively. All experimental diets were formulated to meet the nutrients requirements for broiler as prescribed by (NRC, 1994). The composition and calculated analysis of the experimental diets are shown on table (2), the calculations according to ingredients chemical composition complied by (Sulieman and Afaf, 1999). The experimental diets were fed for six weeks duration.

Table 1. Pre-starter chemical composition

Item	%
Crude protein	23
Crude fat	6.5
Crude ash	3
Crude fiber	0.5
Lysine	1.4
Methionine + Cystine	0.99
Calcium	1
Available phosphorous	0.62
Metabolizable energy (kcal/kg)	3.100

NaPo Pre Starter Feed, Champrix Company, (Netherlands)

Table 2. Composition and calculated chemical analysis of the basal (control) starter and finisher diets

Ingredient %	Starter	Finisher
Sorghum	65	72
Groundnut cake	27.3	19
Concentrate	5*	5**
Vegetable oil	1.6	3.2
Di-calcium phosphate	1	0.6
Antimycotoxin	0.1	0.2
Total	100	100
Chemical Analysis:		
ME (kcal/kg)	3191.82	3315.19
Crude protein	22.25	19.56
Methionine	0.47	0.44
Lysine	1.10	1.00
Calcium	1.01	0.81
Available phosphorus	0.60	0.58
Crude fiber	4.42	3.78

*Concentrate (WAFI) composition: Crude protein 35%, Crude fat 2.7%, Crude fiber 4.8%, Calcium 5%, Available phosphorus 12%, Lysine 3.71%, Methionine 3% and (ME) Metabolisable energy 1897.77 kcal/kg

**Concentrate (WAFI) composition: Crude protein 35%, Crude fat 2.8%, Crude fiber 4.6%, Calcium 6.65%, Available phosphorus 2.5%, Lysine 10%, Methionine 3% and (ME) Metabolisable energy 1904.45 kcal/kg

2.6-Broiler performance parameters:

2.6.1-Feed intake (FI):

Feed intake is the amount of feed consumed every day, and remained feed per replicates recorded by using electronic sensitive balance every day as g/bird/day.

2.6.2-Body weight (BWT) and body weight gain (BWG):

Body weight was recorded on weekly basis then weight gain was calculated by subtraction of weight in birds at the beginning of the week from that at end of the same week.

2.6.3-Feed conversion ratio (FCR):

Feed conversion ratio was calculated by dividing the amount of feed intake on weight gain.

2.7-Mortality:

Mortality was recorded for each replicate and mortality percent was calculated.

2.8-Carcass yield:

At the end of the experiment eight birds (2birds/treatment) were randomly selected from the experimental birds, individually weighed, slaughtered then carcass weight was recorded and dressing percentage was calculated as the following:

$$\text{Dressing }\% = 100 \times \frac{\text{carcass weight}}{\text{live body weight}}$$

2.9-Determination of feed efficiency parameters:

2.9.1-Production efficiency factor (PEF):

PEF was determined according to (Awad *et al*., 2008).

$$= \frac{(\text{Bird final weight/kg} \times \text{livability \%})}{(\text{age per days} \times \text{FCR} \times 100)}$$

2.9.2-Protein efficiency ratio (PER):

PER was determined according to (Ashayerizadeh *et al*., 2011).

$$= \frac{\text{weight gain}}{\text{protein intake}}$$

2.9.3-Energy efficiency ratio (EER):

EER was determined according to (Ashayerizadeh *et al*., 2011).

$$= \frac{(\text{weight gain} \times 100)}{\text{energy intake}}$$

2.10- Statistical analysis:

Complete randomized design was used to analyze the obtained data from this study and subjected to analysis of variance (ANOVA) using Statistical Packages of Social Science (SPSS) (Version 16) software program. The significant differences among means were determined by least significant differences (LSD) test at 0.05 significant levels.

Chapter Three:

Results and discussion

Chapter three

Results and Discussion

3.1-The effect of added levels of synbiotic on feed intake:

The effect of feeding graded levels of synbiotic in broiler diet on feed intake (table 3) revealed that there were no significant differences between the three experimental diet groups. This could be due to the high ambient temperature (45.6°C) during the experiment period. Results agreed with those reported by Murshed and Abudabos, (2015); Sarangi *et al*., (2016) and Al-sagan and Abudabos, (2017) but disagreed with Mokhtari *et al*., (2010); Ghahri *et al*., (2013) and Mokhtari *et al*., (2015). Results in line with those of Taklimi *et al*., (2012) who reported reducing probiotic level affected feed intake at finishing stage, the results of the overall feed intake were insignificant among the experimental groups.

Table 3.The effect of Synbiotic on broilers feed intake (g/bird/day)

	Synbiotic Inclusion (%)			Significance
Week No.	0	0.25	0.375	
week 1	28.61±6.19	25.69±3.18	26.73±4.40	NS
week 2	50.84±4.25	49.05±4.72	52.02±7.47	NS
week 3	68.91±5.67	72.05±3.88	76.18±8.61	NS
week 4	78.30±9.71	89.59±7.50	90.09±12.66	NS
week 5	99.50±14.23	110.96±8.42	113.09±9.81	NS
Overall	2283.05±20.80	2431.38±25.56	2506.77±42.25	NS

N= 40 birds/treatment.
NS =No significant difference.

3.2-The effect of added levels of synbiotic on broilers weight gain:

The mean values of body weight gain of birds fed on different graded levels of synbiotic tabulated in table (4) revealed no significant differences (P<0.05) among the experimental diet groups. These results were similar to those of Lee *et al*., (2010); Mokhtari *et al*., (2010); Amerah *et al*., (2013); Ghahri *et al*., (2013) Nikpiran *et al*., (2013); Salim *et al*., (2013); Mokhtari *et al*., (2015); Gutierez *et al*., (2016) and Al-sagan and Abudabos,(2017).And disagreed with (Capcarova *et al*., 2010; Hijova *et al*., 2012; Nikpiran *et al*., 2013; Hrncar *et al*., 2014; Zhang *et al*., 2014; Murshed and Abudabos, 2015; Sarangi *et al*., 2016 and Musaad *et al*., 2017).

Table 4.The effect of synbiotic on broilers body weight gain (g/bird/day):

	Synbiotic inclusion (%)			Significance
Week No.	0	0.25	0.375	
week 1	26.64±8.34	21.41 ±6.53	28.91±10.19	NS
week 2	38.35 ±7.47	35.41±3.91	35.91±7.38	NS
week 3	43.89±4.75	45.41±5.55	46.77±6.44	NS
week 4	50.85±8.04	49.57±5.79	47.79±7.59	NS
week 5	46.59±18.19	48.98±21.08	38.70±20.38	NS
Over all	1364.30±154.80	1341.20±234.57	1299.80±285.96	NS

N=40birds/treatment

NS= No significant difference

3.3-The effect of added levels of synbiotic on broilers feed conversion ratio:

From table (5) with exception of the 4th week he different levels of synbiotic showed no significant differences (P>0.05) in feed conversion ratio during the studied period. Control group recorded the lowest value (P>0.05) in FCR. This could be attributed to some respiratory symptoms and heat stress (high temperature, 45.6°C) which might have affected the feed Intake. This result agrees with those recorded by (Sarangi et al., (2016) and Al-sagan and Abudabos, (2017), but (Mokhtari *et al*., (2010); Mokhtari *et al*., (2015) and Murshed and Abudabos, (2015) findings disagreed with this results. This might be due to the different in: added level of symbiotic, management conditions particularly housing system.

Table(5):The effect of synbiotic on feed conversion ratio (gfeed/ g gain)

	Synbiotic inclusion (%)			Significance
Week No.	0	0.25	0.375	
week 1	1.14±0.34	1.25±0.24	0.98±0.20	NS
week 2	1.35 ±0.16	1.39±0.12	1.46±0.11	NS
week 3	1.58±0.17	1.60±0.14	1.63±0.05	NS
week 4	1.56±0.22[a]	1.81±0.07[b]	1.89±0.06[b]	*
week 5	2.70±1.98	2.87±1.92	3.70±2.18	NS
Mean	1.63±0.21	1.78±0.22	1.90±0.23	NS

N=40

NS=No significant differences, *= significant difference at (P<0.05).

[a,b] means in the same row with different subscript letter are significantly different at (P<0.05).

3.4-The effect of added levels of synbiotic on production efficiency factor:

Table (6) shows the effect of different levels of synbiotic on the production efficiency factor. It was found that there were no significant differences (P>0.05) in production efficiency factor between the experimental groups. These findings were agreed with those of Biernasiak and Slizewska, (2009) and disagreed with Awad *et al*., (2008); Awad *et al*., (2009) and Sayied *et al*., (2015). This ought to be due to different inclusion rate of symbiotic/or it contents and the difference in management systems (housing type).

Table(6):The effect of synbiotic added levels on overall production efficiency factor:

	Synbiotic inclusion (%)			Significance
PEF	0	0.25	0.375	
PEF	0.020±0.003	0.019±0.004	00.020±0.005	NS

N=40 birds/treatment
NS=No significance differences

3. 5-The effect of added levels of synbiotic on protein efficiency ratio:

The effect of feeding different levels of synbiotic on protein efficiency ratio (Table 7) showed no significant differences (P>0.05) between experimental groups except in the 4th week where control group differed significantly (P<0.05) from the other groups recording the highest value in PER. High temperature (45.6° C) was recorded in the 4th week and appearance of some respiratory symptoms could have affected the feed intake and general condition of the experiment. Although the results of protein efficiency ratio were insignificant difference among all groups. The week four showed that the control group had the highest value followed by 0.25% hence it have to followed the prescribed level by the manufactured company. Furthermore it was similar to those results reported by kamaran *et al.*, (2008). The results of this study disagreed with those reported by Ashayerizadeh *et al.*, (2011) who explained that the addition of synbiotic improved protein efficiency ratio. Also, the results did not agree with those reported by Arslan and Saatci, (2004) who explained that probiotic fed birds complete their growth at the end of the fifth week though the study found good results in the 4th week.

Table(7):The effect of added levels synbiotic on broilers protein efficiency ratio:

	Synbiotic inclusion (%)			Significance
Week No.	0	0.25	0.375	
week 1	1.05±0.32	0.92±0.18	1.18±0.24	NS
week 2	0.48 ±0.06	0.46±0.04	0.44±0.03	NS
week 3	0.49±0.06	0.48±0.04	0.47±0.01	NS
week 4	0.50±0.07[a]	0.42±0.02[b]	0.40±0.01[b]	*
week 5	0.37±0.16	0.33±0.13	0.26±0.13	NS
Starter	1.53±0.32	1.38±0.15	1.61±0.27	NS
Finisher	1.35±0.18	1.23±0.14	1.12±0.12	NS

N=40 birds /treatment.

*= significant difference at (P<0.05).

NS= no significant differences.

[a,b] means in the same row with different subscript letter are significantly different at (P<0.05).

3. 6-The effect of added levels of synbiotic on energy efficiency ratio:

Table (8) shows the effect of feeding different levels of synbiotic in broiler diet on energy efficiency ratio. There were no significant differences (P>0.05) in the EER (excluding the 4th week) between the control group and other groups. These results are disagreed with those of Kamaran *et al*., 2008) and Ashayerizadeh *et al*., (2011). Generally, the same reasons that influenced the feed intake connected with protein and energy intake could affect the FCR, PER, PEF and EER. These findings were in line with those of Ashayerizadeh *et al*., (2011) who explained that inclusion rate of probiotic/or it contents (bacteria or yeast) might affect the efficiency of probiotic.

Table (8):The effect of added levels synbiotic on broilers energy efficiency ratio:

Week No.	Synbiotic inclusion (%) 0	0.25	0.375	Significance
week 1	7.66±2.35	6.67±1.32	8.56±1.75	NS
week 2	3.48 ±0.46	3.35±0.28	3.18±0.24	NS
week 3	2.84±0.33	2.80±0.24	2.73±0.07	NS
week 4	2.90±0.39[a]	2.46±0.09[b]	2.35±0.07[b]	*
week 5	2.16±0.95	1.94±0.78	1.50±0.74	NS
Starter	11.14±2.33	10.02±1.12	11.74±1.94	NS
Finisher	7.90±1.07	7.20±0.81	6.58±0.72	NS

N=40 birds/ treatment.
*=Significant at p<0.05.
NS=No significant differences.
a.b means in the same row with different subscript letter are significantly different.

3.7-The effect of added levels synbiotic on dressing %:

The effect of different levels of synbiotic on some dressing % is presented in table (9). It was shows no significant differences in the dressing percentage, which might be attributed to the management conditions and differences in probiotic types and the rate of inclusion. This results agreed with those reported by Sayied *et al*., (2015) ; Sarangi *et al*., (2016) ; Alsagan and Abudabos, (2017) and Eo *et al*., (2017) and disagreed with that studies reported by Awad *et al*., (2008) ; Mokhtari *et al*., (2010) ; Ghahri *et al*., (2013) ; Mokhtari *et al*., (2015) and Saiyed *et al*., (2015). This ought to be attributed to differences in synbiotic types. Although, there were no significant differences between the experimental groups but the carcass weight was the highest by the 0.375% group followed by 0.250% group, while the control group records the lowest slaughter weight. Also, group 0.375% showed the highest carcass weight, where the control group appeared with the lowest value.

Table(9):The effect of added levels synbiotic on dressing percentage of broiler chicken:

	Synbiotic inclusion (%)			Sig.
Week No.	0	0.25	0.375	
Live weight (g)	1640.60±133.16	1665.00±210.23	1865.00±171.86	NS
Carcass weight (g)	1162.50 ±82.84	1176.20±164.22	1343.80±138.00	NS
Dressing (%)	70.91±1.13	70.56±1.42	72.00±0.88	NS

N=8 birds / treatment
NS=No significance differences

Chapter Four:

Conclusion and Recommendations

Chapter four

Conclusion and recommendations

The study concludes that:

- Added Synbiotic in broiler diets had no significant effect on the performance and dressing percentage of broiler chicks.
- Synbiotic higher than 0.375 % might improve the broiler performance.

The study recommends that:

- Further studies are recommended to study the effect of synbiotic on broilers performance under different Sudan conditions.
- Synbiotic need to study at different levels.

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