Introduction

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. At present there is an increasing demand for the animal products such as milk, fish, egg and broiler meat. Poultry industry plays major role as an important source of egg and meat, which was good source of animal protein. Successful poultry production in developing countries requires careful attention to environment, management, disease control and nutrition, by maximizing the efficiency of growth performance and meat yield. Antibiotic can be used in animal feed in small amount to improve growth rate and feed efficiency (Luckstadt, 2005).

Due to growing concerns about antibiotics resistance and potential for a ban for antibiotic growth promoters in many countries, there is an increasing interest in finding alternatives to antibiotic in poultry production such as feed additive. Include enzymes, probiotic, pre probiotic, and organic acids (Skinner *et al*1991). The aim of probiotics is to rapidly develop a healthy intestinal microbial balance.

The objective of this research was to study the effect of probiotic on broiler performance, edible part and blood profile.

Chapter one

Literature review

1.1Growth promoters :-

Many growth promoters were available such as antibiotics and probiotic. These compounds were added to diets for farm animals to improve the growth performance, nutritional parameters and carcass traits (Allam *et al*., 2001).

1.1.1 Antimicrobials:

The antimicrobial growth promoters include a variety of chemotherapeutics agent used for improving feed conversion efficiency, body weight gain and overall health.(Modi *et al.,* 2011).The term "antimicrobial growth promoter is used to describe any medicine that destroys or inhibit bacteria and is administered at a low, sub therapeutic dose for the purpose of performance enhancement. The use of antimicrobials for growth promotion has arisen with the intensification of livestock farming. Antimicrobial growth promoters are used to "help the animals to digest their food more efficiently, get maximum benefit from it and allow them to develop into strong and healthy individuals".

Antibiotic growth promoters produce beneficial effects. It increases growth, feed efficiency and improving animal health by acting on gastrointestinal bacteria causing lethal or sub lethal damage to pathogen. ,causing reduction in the production of bacterial toxin .,producing bacterial utilization of essential nutrients .,allowing increased synthesis of vitamins and other growth factors., improving the absorption of nutrients by reducing the thickness of the intestinal wall thickness., reducing intestinal mucosal epithelial cell turnover and reducing intestinal motility (Prescott and Baggot,1993 and Niewold *et al.,* 2007).Indeed evidence exist that

antibiotic resistance genes can be retransmitted from animal to human microbiota (Greko, 2001).The development of resistance to certain antibiotic poses real problem to the public health (Barton 2000.Hofacre et al., 2001).Consequently many additives (probiotics and symbiotics) raise a particular interest as product of substitution to antibiotic in order to improve the production performance and health of animal (Bach 2001and Revington2002). However the use of growth-promoting antibiotics is being placed under more and more Pressure as consumers increasingly fear that their use in feed rations of productive live stocks leads to the formation of resistance against bacteria which are pathogenic to humans (Langhout, 2000).

1.1.2. Probiotics

Probiotics are organisms and substances which help to improve the environment of the intestinal tract. It may be defined as living microorganism which, given to animals, assist in the establishment of an intestinal bacterial population which is beneficial to the animal and antagonistic to harmful microbes (Green and Sainbury, 2001). By producing acids (such as acetic acid and lactic acid) and other compounds which inhibit the growth of “bad” bacteria which produce toxins, lactic acid and other useful bacteria have demonstrated probiotic effects (Honma et al., 1987).Also probiotics can be define as beneficial live microorganisms that can be added to feed or water as single and mixed culture (Todrove *et al*.,2007).

There are many definitions for probiotics i.e.: it is defined probiotics as mono or mixed cultures of “live microorganisms which, when administered in adequate amounts confer a health benefit on the host”.

A number of probiotic are available in commercial forms for use in poultry production such as:

Pronifier :-

Pronifer is a fermentation product and is a bacterial cocktail of specific lactic acid producing bacteria. Pronifer improves health performance, minimize diarrhea and increase growth rate. (EL.Basiony *et al.*,1998*).*

Dry yeast:

Yeast cultures have been used as non-hormonal compound that stimulate meat production (Khalifa *et al.*, 2001). Yeasts are known as rich sources of vitamins, enzyme and other important nutrients and co-factors which make them alterative as digestive enhancer and affect feed utilization and nutrient digestibility (Wohlt *et al.*, 1991. EL-Waziry *et al.*, 2000 and EL-Talty *et al.*, 2001).

Proposed mechanisms of pathogen inhibition by the probiotic microorganism include competition for nutrients. Production of antimicrobial conditions and compounds (volatile fatty acids. low ph and bacteriocins). Competition for binding sites on the intestinal epithelium and stimulation of the immune system (Roffe,2000).The inclusion of desirable microorganisms (probiotics) in the diet allows the rapid development of beneficial bacteria in the digestive tract of the host, improving its performance (Edens, 2003). Probiotics reduce production of toxic components by bacteria and a chance in the morphology of the intestinal wall and reduces colonization of pathogens on the intestinal wall, thus preventing damage to the epithelial cells (Langhout, 2000).It was hypothesized that using probiotic in poultry diets would not only enhance the digestive rate, but also increase the nutrient retention and decrease their passage rate as undigested

because of secreting energy nutrients hydrolyzing enzymes from the microbes present in probiotic (Rahman *et al.*, 2009).

Probiotic species belonging to Lactobacillus, Streptococcus, Bacillus, Bifidobacterium, Entrococcus, have beneficial affected on broiler performance (Kalavathy *et al.*,2003,Kabir *et al.*,2004 and Gil De Los Santas *et al.,2005*), modulations of intestinal micro flora and pathogen inhibition and immune modulation (Zulkifli *et al.*, 2000).

1.2. Broilers:-

Broiler meat is one of the sources of bacterial contamination of humans. Concerns about food safety have prompted the poultry industry and governments to introduce control plans to combat bacteria. This has been strengthened by legislation, as is the case in the EU, where targets have been set forcing member states to decrease bacteria prevalence in poultry flocks. Strategies to prevent transmission of bacteria to humans should focus on the whole production chain of broiler meat and on the subsequent storage and handling of meat, thus from farm to fork. In the primary production phase, both hygienic measures and general farm management strategies are important.

1.2.1. Management:-

Many factors influence broiler breeder performance. Reducing the total daily feed allowance may cause a decline in egg production and performance. (Neuman et al.,1998). In addition to these factors, other factors that are less well understood, such as the geographical location of the breeder house and hatchery, especially with respect to the altitude from sea level, and drinking water quality. (Grizzle *et al.*,1997*).*May factors affect chick production rate and, thereafter, the quality of the hatched chicks. In some countries, such as Iran, latitude, altitude, season, day and night temperatures, and many other environmental factors vary greatly. Most of the drinking water on poultry farms is supplied from subterranean sources that are very

hard and briny. To date, the relationship between variable environmental parameters and broiler breeder performance has not been clearly described.

1.2.2. Biosecurity

Biosecurity is defined as a set of practices designed to prevent the entry and spread of infectious diseases into and from, poultry farm. Biosecurity plan must be part of a farm's good management practices. This would include: the provision of high quality feed and water, adequate temperature and ventilation, sufficient floor space, as well as feeder and drinker space for every bird. Maintaining a regular flock record provides essential information and understanding regarding flock health and development status. This information enables one to gauge performance in comparison to previous production cycles or current cycles on other farm sites. It is important to keep records of the source and number of birds being placed on the farm, the daily mortality and culls, the daily feed and water consumption, and any vaccinations, medications or vitamins that are being administered. Over the last few decades the poultry industry – supported by technological advances in genetic selection, feed quality, growing methods, processing and marketing – has outstripped all other agricultural commodities in both, developed and developing countries. This is mainly due to poultry being the most efficient protein-producing (meat and eggs) domestic species with the lowest feed conversion ratio. Any biosecurity plan regardless of farm size or production type should contain these three essential elements of biosecurity, these are: Segregation and traffic control, cleaning and disinfection

Segregation and traffic controls are the strongest and most effective forms of biosecurity able to prevent disease entrance risks. Segregation and traffic control prevents disease agents from entering the farm by keeping potentially infected animals and contaminated objects such as clothing, footwear, vehicles and

equipment away from healthy poultry. This requires the creation of barriers; nothing crosses these barriers unless absolutely necessary. The barriers can be:

Physical: e.g. locks on doors, fences, gates, warning signs and wide distances between farms, screened walls and windows;

Procedural: e.g. controlling who enters the farm, washing hands and feet, changing footwear and outer clothes, usage of footbaths for washing and disinfection of shoes and boots, washing and disinfection of any equipment brought into the farm, vehicles kept off the farm, separation by age group.

Cleaning of housing, vehicles and equipment is the next most effective step. Cleaning removes up to 80% of contaminants. When all dirt is removed, there is little organic material left in which disease agents may be protected and carried. In practice, cleaning means that the surfaces of the walls and equipment must be cleaned to the extent where no dirt, dust or cobwebs are visible to the eye. Proper cleaning requires scrubbing, brushing and high pressure washing with detergent and water. Cleaning should take place prior to farm entry. This is to be monitored by the farm manager who should ensure that the workers' and visitors' hands, feet, clothes and footwear, as well as vehicles, equipment and instruments such as syringes, de-beakers, and egg trays, are clean. Similarly, at the farm one should ensure regular cleaning of workers' hands between chores, their clothes and footwear, of equipment used on the farm such as: drinkers, feed pans and egg trays. Between production cycles, one should ensure cleaning of the poultry house internally and externally and of all pieces of equipment used in the farm.

Disinfection is the least reliable element of biosecurity and depends on many factors, in particularly on the quality of cleaning and water hardness. To achieve effective disinfection the removal of all dirt during the cleaning process is crucial. Only disinfectants approved by national or international regulatory bodies should be used. The preparation of the disinfectant solution should be done according to

manufacturer recommendations, in the correct concentration and the application at the correct volume to ensure effective contact time and to cover the entire surface of the farm to ensure the destruction of any remaining disease agent. It is important to remember that most disinfectants are highly toxic to workers and poultry, therefore the preparation and application must be done in a safe manner taking all the required precautions.

1.3. Effect of probiotic on broiler performance and blood profile:-

1.3.1. Feed intake:-

The receiving of probiotics in broiler diet on feed intake during the experimental period was not significant different between experimental birds and the control group. (Pelicano *et al.*, 2004, Arslan and Saatci, 2004, Hosseini *et al.*, 2013). The supplementation of probiotic in broiler diet significantly improve feed intake. (Roth and Kirchgessner, 1986 and Kalavathy *et al.*,2003).

1.3.2. Body weight gain:-

The use of probiotic in broiler diet on body weight gain showed no significant effect (Mohan *et al.*, 1996, Edens .2003, Arslan. 2004 and Pelicano *et al.*, 2004). Broilers fed probiotic-supplemented diet on body weight gain had significantly improved when compared to the broilers fed the un-supplemented diet. (Chiang and Hsieh. 1995, Yeo and Kim.1997, Fritts ***et al***., 2000 and Hosseini *et al*., 2013).

1.3.3. Feed conversion rate (FCR)

The inclusion of probiotic in broiler diet had no effect on feed conversion (Mohan *et al*., 1996, Fritts *et al.*, 2000 and Pelicano *et al.*, 2004).Feed conversion ratio was significantly improved in chicken which had received probiotic in broiler diet. (Hosseini, 2013).

1.3.4. Protein efficiency rate (PER):-

The supplementation of probiotic in broiler diet had no effect on protein intake, similarly protein efficiency rate was not affected (Ashayerizadeh *et al.,* 2011). On the other hand, during the starter phase, chickens fed probiotic had significantly higher protein efficiency rate than chicken fed control diet. (Safaelkatoull *et al.*, 2012).

1.3.5. Energy efficiency rate (EER):-

The addition of probiotic in broiler diet on energy intake showed an insignificant difference between dietary treatments and control during the experimental period from the starter up to finisher stages, the energy efficiency rate followed the same trend (Ashayerizadeh *et al.,* 2011). The energy efficiency rate in diets with 3% kaolin and zeolite in the grower phase there were no significant differences between dietary treatments and control (Nasr *et al*, 2011).

1.3.6. Carcass characteristics and edible organs:-

The probiotic supplemented in broiler diet on carcass had no effect on final body weight and carcass yield during experimental period. (Arslan.2002, Ghavidel *et al.*, 2011 and Khan *et al*., 2013).

The final body weight was significantly improved by probiotic Moreover, probiotic supplemented birds, in second period (22-42 days) had a greater body weight than control birds (Ghavidel *et al*, 2011).

The supplementation of probiotic in broiler diet on edible organs were not significantly different between the treatment group and control (Arab *et al.*,2014, Ghavidel *et al.,* 2011 and Khan *et al*., 2013). The addition of probiotic in broiler diet had beneficial effect on liver, gizzard and heart (Djouvinov *et al*., 2005**).**

1.3.7. Blood profile:-

The consumption of the probiotic in broiler diet on blood hematological values were not significantly different during experimental period. (Arab *et al.,* 2014 and

Khan *et al.*, 2013).However, the levels of RBCs, Hb, PCV, MCV and MCH were significantly different in the group received the probiotics (Arab *et al.*,2014).

Chapter Two

Materials and method

2.1- Experimental site and duration:

This study was conducted at Sudan University of Science and Technology, College of Animal Production Science and Technology – Khartoum north –East of the Nile–kuku. It was carried out during the period between 3 November to 8 December 2015, in which the ambient temperature was ranged between (20 - 37.8˚C).

2.2- Experimental house:

The experiment was conducted in an open sided deep litter house constructed from iron sheets roofing, wire netting sides and concrete floor. The long axis of the house was extended east – west facing the wind direction for efficient ventilation. The house was partitioned into twelve experimental units (1X1 m^2) (replicates) of equal area with enough working space allowance. The experimental house was dry cleaned, burned and washed by water and soap using high pressure pump. Ground cracks locked by cement and the northern and southern sides of the house were covered by nylon sheets. The house was disinfected with Cypermethrin 10% (3 ml/L) and Virocid 0.5% (1:200L). The house was left closed until the arrival of the chicks. Fresh wood shaving as litter was spread in the pens at a depth of 5cm before the arrival of the chicks. Each replicate was provided with one feeder and one drinker. Both feeder and drinker washed well by water and soap and disinfected by Phonic.

2.3- Experimental birds and management:

A total of one hundred and twenty day old unsexed broiler chicks (Ross) were used in the experiment .The chicks were purchased from Enema Company for Poultry Production. The chicks were incubated for a week and fed on chick care pre starter (broiler 249) (table, 1).After the incubation period the chicks were weighted and randomly allocated into four treatment groups (30 chick/treatment group) of approximately same weight (150 g/bird) each group was sub-divided in to three replicates ten chicks each.

2.4-Prevention and vaccination:

During incubation period the chicks were given antibiotic (Coli dad– Colistin [as sulphate]1g/4L) and (Tilmovet – Tilmicosin [phosphate] 30ml/100L) in water for 5 days also given multi vitamins (1ml/L) in water for 7 days.

One day old chicks were vaccinated against infectious bronchitis and Newcastle disease (IB -ND). On the 8^{th} day each chick was revaccinated against Newcastle disease (ND) by injection. On day 11 each chick was also revaccinated against Newcastle and infectious bursa disease (ND - IBD) by eye- drop and repeated on 17 day. A multi vitamin was added in the drinking water before and after vaccination. The feed was provided ad-libitum.

2.5-Experimental diets:

Four experimental diets were formulated from local ingredients to fulfill the requirements recommended by (Ross breeder, 308) for both starter (table, 2) and finisher (table 5) rations. The four rations contain Probiotic (poultry star) at 0, 0.025. 0.05 and 0.1 %. The ingredients were purchased from local market too, the ingredients chemical composition were compiled by (Sulieman and Afaf, 1999).

Table (1): Pre starter (chick care 249) composition:

Item	%
Crude protein	22.50
Crude fat	5.30
Moisture	9 – 12
Crude ash	3 – 12
Crude fiber	2.4
Lysine	1.35
Methionine+ Cystine	1
Calcium	0.44
Digestible phosphorous	0.17
Metabolizable energy	3030 kcal/kg

Ingredients:Cereals, Vegetable protein, Salmon oil, Vitamins and minerals, Coccidiostat, Enzymes, Amino acids, Mould inhibiter, β – Glucans, 25 -DH-Hydroxycholecalciferol

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Table (2): Ingredient composition of the experimental starter diets (%)

Ingredient	0.0	0.025	0.05	0.1
Sorghum	53.55	53.55	53.55	53.55
Groundnut cake	29.50	29.50	29.50	29.50
Wheat bran	8.70	8.70	8.70	8.70
Concentrate*	5.00	5.00	5.00	5.00
Polyfat	1.50	1.50	1.50	1.50
Methionine	0.10	0.10	0.10	0.10
Lysine	0.30	0.30	0.30	0.30
Antitoxin	0.10	0.10	0.10	0.10
Anticoccidia	0.05	0.05	0.05	0.05
Lime stone	1.00	1.00	1.00	1.00
Salt	0.20	0.20	0.20	0.20
Poultary star	0.00	0.025	0.05	0.1
Total	100.00	100.025	100.05	100.1

* Concentrate (Millerson) composition: Crude protein 35%, Crude fat 2.5%, Crude fiber 3%, Calcium 8.5%, Available phosphorous 5%, Lysine 11%, Methionine 4.5% and Metabolizable energy 2000 kcal/kg.

Table (3) Calculated analysis of the starter diets

Item	Ross308 nutrition specification 2014*	Experimental diets			
		0.00%	0.025%	0.05%	0.1%
ME (kcal/kg)	3000	3016.18	3016.18	3016.18	3016.18
Crude	23	23.15	23.15	23.15	23.15
Methionine	0.56	0.58	0.58	0.58	0.58
Lysine	1.44	1.43	1.43	1.43	1.43
Calcium	0.96	1.00	1.00	1.00	1.00
Available Phosphorus	0.48	0.64	0.64	0.64	0.64
Crude fiber	-	5.47	5.47	5.47	5.47
Ash	-	4.35	4.35	4.35	4.35

*www.aviagen.com

Table (4): Determined analysis of the starter diets (%)

Item	Experimental diets			
	0.0	0.025	0.05	0.1
Moisture	6.86	6.86	6.86	6.86
Crude protein	23.17	23.17	23.17	23.17
Crude fiber	5.80	5.80	5.80	5.80
Ash	6.97	6.97	6.97	6.97

Table (5): Ingredient composition of the experimental finisher diets (%)

Ingredient	0.00	0.025	0.05	0.1
Sorghum	66.30	66.30	66.30	66.30
Groundnut cake	21.00	21.00	21.00	21.00
Wheat bran	4.00	4.00	4.00	4.00
Concentrate*	5.00	5.00	5.00	5.00
Polyfat	2.50	2.50	2.50	2.50
Methionine	0.05	0.05	0.05	0.05
Lysine	0.20	0.20	0.20	0.20
Antitoxin	0.10	0.10	0.10	0.10
Anticoccidia	0.05	0.05	0.05	0.05
Lime stone	0.60	0.60	0.60	0.60
Salt	0.20	0.20	0.20	0.20
Poultry star	0.00%	0.025%	0.05%	0.1%
Total	100.00	100.025	100.05	100.1

* Concentrate (Millerson) composition: Crude protein 35%, Crude fat 2.5%, Crude fiber 3%, Calcium 8.5%, Available phosphorous 5%, Lysine 11%, Methionine 4.5% and Metabolizable energy 2000 kcal/kg.

Table (6): Calculated analysis of the finisher diets

Item	Ross308 nutrition specification 2014*	Experimental diets			
		0.000%	0.025%	0.05%	0.1%
ME (kcal/kg)	3200	3200.21	3200.21	3200.21	3200.21
Crude protein	20	20.35	20.35	20.35	20.35
Methionine	0.48	0.50	0.50	0.50	0.50
Lysine	1.19	1.22	1.22	1.22	1.22
Calcium	0.81	0.82	0.82	0.82	0.82
Available phosphorous	0.41	0.60	0.60	0.60	0.60
Crude fiber	-	4.35	4.35	4.35	4.35
Ash	-	3.59	3.59	3.59	3.59

*www.aviagen.com

Table (7): Determined analysis of finisher diets (%)

Item	Experimental diets			
	0.000	0.025	0.05	0.1
Moisture	6.75	6.75	6.75	6.75
Crud protein	20.41	20.41	20.41	20.41
Crud fiber	4.60	4.60	4.60	4.60
Ash	5.30	5.30	5.30	5.30

2.6- Broiler performance:

2.6.1-Feed intake (FI):

Feed intake for the birds of each replicate was calculated daily from the data of feed given by subtracting the amount of feed remained from the amount of feed given.

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

Body weight for the birds of each replicate was recorded daily. Weight gain was calculated daily by subtracting the body weight of day before from present body weight.

2.6.3-Feed conversion ratio (FCR):

Feed conversion ratio (FCR) was calculated by dividing the amount of feed consumed by body weight gain (g feed/g gain).

2.7- Sampling:

At day 35 six birds from each treatment (two birds from each replicate) were taken after weighted and slaughtered (weight of the sample equal the average of group weight).

2.8- Blood analysis:

After slaughtering blood samples were taken and complete hemogram was done using Sysmex kx-21N, SR:b 7637-Jaban (appendix 2)

2.9-Carcass characteristics:

Hot carcass weight, weight of the edible organs and dressing percentage were determined.

2.10- Determination of feed efficiency parameters:

2.10.1-Protein efficiency ratio (PER):

PER was determined according to (Kamran *et al*., 2008) method.

2.10.2-Energy efficiency ratio (EER):

EER was determined according to (Kamran *et al*., 2008) method.

2.11-Statistical analysis:

Complete randomized design (CRD) was used in the current study. The obtained data was analyzed using ANOVA. The statistical package for social science (SPSS) software program (version 22) was used in data analysis.

Chapter Three

Results and discussion

3.1. Effect of added levels of probiotic on broiler feed intake:-

The feed intake of the birds fed on feed supplemented with probiotic (Poultry star) (0, 0.025, 0.05 and 0.1) was shown in table (8).The effect of supplementation of graded levels of probiotic in broiler diet on feed intake showed insignificant difference between the birds fed probiotic and the control group. This result agreed with that reported by (Roth and Kirchgressner, 1986, Pelicano *et al*., 2004, Arslan, 2004 and Hosseini *et al*., 2013) who reported that there was no significant difference in feed intake between the groups receiving probiotics and the control group. The results of the current study disagreed with that reported by Ashayerizadeh *et al*. (2011). The probiotic supplemented broiler diet had no significant effect on feed intake; this may be due to the need of a lag phase before the probiotic illicit its effect (Mohan *et al*., 1996).

Table (8): The effect of probiotic on feed intake (g/bird)

Probiotic %	week2	week3	week4	week5	starter	finisher	Overall
0.00	301.14±11.5	430.18±17.5	810.93±41.2	1140.00±18.2	694.34±82.0	1951.00±55.8	2641.00±107.3
0.025	286.66±19.8	419.89±19.5	783.90±17.3	1084.00±51.8	706.34±38.2	1868.00±69.1	2575.00±102.0
0.05	278.05±6.0	449.79±7.7	818.41±34.5	1151.00±89.4	727.84±8.3	1970.00±123.0	2697.00±116.0
0.10	285.29±10.8	449.63±16.1	796.93±7.1	1183.00±48.6	734.93±24.8	1979.00±47.8	2714.00±59.3
significance	NS	NS	NS	NS	NS	NS	NS

3.2. Effect of added levels of probiotic on broiler weight gain:-

Table (9) showed the effect of supplementation of a graded levels of probiotic in broiler diets on weight gain during the experimental period (2^{nd}, 3^{rd}, $4^{th}$and 5^{th} week). The result of added graded levels of probiotic in broiler diet on weight gain revealed that there was no significant difference between experimental bird fed probiotic and control group. This result agreed with that reported by Mohan *et al*.,(1996) , Eden. (2003), Arslan. (2003) and Pelicano *et al*., 2004). However other researchers disagreed with this result (Chiang and Hsieh.1995,Yeo and Kim 1997 and Hosseini.2013). They reported that broilers fed probiotic-supplemented diet had better weight gain when compared to the broilers fed the un-supplemented diet. The probiotic supplemented broiler diet had no significant effect on weight gain, this may be due to the fact that under good hygienic conditions probiotic supplementation may not be necessary for improving performance. (Arslan.2004).

3.3. Effect of added levels of probiotic on broiler feed conversion rate:-

The effect of added graded levels of probiotic in broiler diet on feed conversion rate during the experimental period (2^{nd}, 3^{rd},4^{th} and 5^{th}week) (table 10).The results of probiotic supplementation in broiler diet on feed conversion rate had no significant difference between the birds fed probiotic and control group. These results agree with Mohan*et al*.,(1996),Fritts *et al*., (2000), Pelicano*et al*., 2004), and Ghavidel *et al*., (2011). However other researchers reported that the supplementation of probiotic in broiler diet resulted in a significant difference (Yeo and Kim. 1997, andHosseini2013).Evidence alreadyexists that under good hygienic conditions probiotics haveno effect on the feed conversion rate of broilers (Arslan.2004).

Table (9): The effect of probiotic on weight gain (g/bird)

Probiotic %	week2	week3	week4	week5	Starter	finisher	overall
0.0	194.54±6.1[a]	262.8±12.5	490.31±27.0	578.37± 18.6	446.02±22.9	1069.00±36.8	1515.00±44.6
0.025	193.59±0.1[ab]	247.5±7.1	437.98±27.3	519.94±31.7	428.20±21.1	957.93±55.5	1386.00±76.4
0.05	178.54±7.6[b]	270.3±22.4	466.56±22.0	546.97±49.7	448.90±22.5	1014.00±70.8	1.462.00±90.0
0.1	182.21±6.9[b]	257.8±31.8	455.97±38.1	551.44±12.6	452.86±41.4	1007.00±46.0	1460.00±63.7
significance	*	NS	NS	NS	NS	NS	NS

Different superscript letters within same column means significant difference at P<0.05,
*= significant at P<0.05, NS= Not significant

Table (10): The effect of probiotic on feed conversion ratio

Probiotic %	week2	week3	week4	week5	starter	finisher
0.0	1.54±.0	1.63± 0.1	1.65±0.1	1.97±0.0	1.55±0.1	1.82±0.1
0.025	1.50±.0	1.69±0.0	1.79±0.0	2.08±0.0	1.64±0.0	1.95±0.0
0.05	1.56±.0	1.67±0.1	1.75±0.0	2.10±0.1	1.62±0.0	1.94±0.1
0.1	1.56±.0	1.76±0.2	1.75±0.1	2.14±0.0	1.63±0.1	1.98±0.0
Significance	NS	NS	NS	NS	NS	NS

NS= Not significant

Table (11)Effect of added levels of probiotic on broiler protein efficiency rate

Probiotic %	week2	week3	week4	week5	starter	Finisher
0.0	2.80±0.0	2.65±0.1	3.03±0.2	2.53±0.0	88.61±148.4	2.74±0.1
0.025	2.88±0.1	2.56±0.1	2.79±0.1	2.39±0.0	2.63±0.0	2.56±0.0
0.05	2.79±0.1	2.61±0.1	2.85±0.1	2.37±0.1	2.68±0.2	2.57±0.1
0.1	2.77±0.0	2.49±0.3	2.85±0.2	2.33±0.0	2.68±0.2	2.54±0.1
Significance	NS	NS	NS	NS	NS	NS

NS= Not significant

Table (12) Effect of added levels of probiotic on broiler energy efficiency rate

Probiotic %	week2	week3	week4	week5	starter	Finisher
0.0	5.14±0.0	4.87±0.3	4.52±0.4	3.78±0.1	5.18±0.3	4.09±0.2
0.025	5.28±0.1	4.7 0±0.2	4.17±0.1	3.58±0.1	4.79±0.0	3.82±0.0
0.05	5.12±0.3	4.78±0.3	4.26±0.2	3.54±0.1	4.91±0.2	3.84±0.2
0.1	5.08±0.1	4.57±0.5	4.27±0.3	3.48±0.1	4.91±0.5	3.80±0.1
Significance	NS	NS	NS	NS	NS	NS

NS= Not significant

3.4. Effect of feeding probiotic on broiler protein and energy efficiency rate:-

The supplemented graded levels of probiotic in broiler diet on protein and energy efficiency rate at experimental period (2^{nd}, 3^{rd}, 4^{th} and 5^{th} week)were not significant (table 11and 12).The result agreed with Ashayerizadeh *et al*.,(2011),Gunal *et al*.(2006), Zhang *et al*. (2005) and Willis *et al*. (2007). Other researcher obtain that the supplementation of probiotic in broiler diet on protein and energy efficiency rate was significant. This might be due to that, protein and energy intake showed no significant difference so the protein efficiency rate and energy efficiency rate followed the same trend. (Ashayerizadeh *et al.,* 2011).

3.5. Effect of feeding probiotic on carcass characteristics and edible organs:-

The table (13 and 14) showed the supplementation of different levels of probiotic in broiler diet on carcass weight, dressing percentage, and edible part during the experimental period (2^{nd}, 3^{rd}, 4^{th} and 5^{th} week).There was no significant difference in the carcass weight, dressing percentage, heart weight, liver weight and gizzard weight, of the broiler diet containing probiotic than the control group. The result agreed with Sarangi *et al*.,(2016),Sahin *et al.*,Chumpawadee *et al.(2008).* The present findings were not in agreement with (Abdel- Raheem and Abd-Allah, (2011).

3.6.**Effect of added levels of probiotic on blood profile:-**

The supplementation of different levels of probiotic in broiler diet on blood profile was presented in table (15 and 16). There was no significant difference between the experimental and control birds, this result agreed with Arab *et al.*(2014) and Khan *et al.*(2013) and disagreed with that reported by (Strompfová*et al.*,2006)and Arslan and Saatci.(2003) who explain that probiotic fed birds completed their growth at the end of the fifth week.

Table (13) Effect of added levels of probiotic on broiler carcass weight and dressing percentage

Probiotic %	Life weight (g/bird)	Weight after slaughter (g/bird)	Dressing %
0.00	1400.00±70.5	920.00±60.1	65.68±1.5
0.025	1367.50±75.9	925.00±67.8	67.60±1.9
0.05	1441.67±84.0	963.33±61.5	66.80±1.0
0.1	1455.00±130.9	975.00±89.2	67.01±1.4
Significance	NS	NS	NS

NS= Not significant

Table (14) Effect of added levels of probiotic on broiler edible part (liver, heart, and gizzard)

Probiotic %	Liver weight/ib	Gizzard weight /ib	Heart weight /ib
0.00	0.06±0.0	0.08±0.0	0.01±0.0
0.025	0.06±0.0	0.07±0.0	0.01±0.0
0.05	0.07±0.0	0.07±0.0	0.01±0.0
0.1	0.06±0.0	0.08±0.0	0.01±0.0
Significance	NS	NS	NS

NS= Not significant

Table (15) effect of added levels of probiotic on blood profile (1)

Probiotic%	WBCs (10^3/ml)	RBCs (10^6/ml)	HGB (g/dl)	HCT (%)	MCV (FL)	MCH(PS)	MCHC(g/dl)	PLT (10^3/ml)
0.00	231.42±11.7	2.32±0.1	9.77±0.8	31.30±2.4	133.83±2.5	42.45±1.4	32.10±0.7	43.98±16.8[a]
0.025	238.25±13.2	2.37±0.1	9.70±0.3	31.33±1.8	132.06±3.3	41.60±1.1	31.73±0.7	27.31±8.1[b]
0.05	238.96±14.6	2.55±0.2	10.19±0.9	33.98±3.6	133.03±4.3	41.78±2.7	31.38±1.0	29.67±9.4[b]
0.1	236.22±7.7	2.41±0.2	9.33±1.2	32.58±2.5	135.33±3.9	43.15±1.9	36.45±11.3	26.81±9.4[b]
Significance	NS	NS	NS	NS	NS	NS	NS	*

Different superscript letters within same column means significant difference at P<0.05,
*= significant at P<0.05, NS= Not significant

Table (16) effect of added levels of probiotic on blood profile (2)

Probiotic%	LYM (%)	MXD (%)	NEUT (%)	LYM-A(*10^3/ml)	MXD-A(*10^3/ml)	NEUT-A(*10^3/ml)	RDWSD (fl)	RDWCV
0.00	83.75±3.9	8.8±2.5	7.4±2.0	192.25±7.6	20.90±6.5	17.01±5.0	41.38±3.6[a]	14.80±1.8
0.025	82.72±6.2	8.2±2.7	8.6±4.0	196.67±12.8	20.07±7.0	20.88±10.9	36.87±2.8[b]	13.81±1.5
0.05	82.41±4.4	7.8±3.0	9.7±3.1	196.70±11.5	18.78±7.0	23.48±8.6	37.43±2.0[b]	13.93±1.3
0.1	83.96±6.5	8.4±3.4	7.2±2.3	184.99±32.4	23.93±11.4	14.11±7.9	36.88±4.2[b]	19.48±14.2
Significance	NS	NS	NS	NS	NS	NS	*	NS

Different superscript letters within same column means significant difference at P<0.05,
*= significant at P<0.05, NS= Not significant

Conclusion and recommendations

Conclusion:

The addition of probiotic in broiler's diets in good hygienic conditions may be of no great benefit in improving broiler performance.

Recommendations:

Further research on the effect of probiotic on the immune response and the digestive tract flora may explain the mode of action of the probiotics.

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