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**SİİRT UNIVERSITY**
**INSTITUTE OF SCIENCE**

# IMPACT OF ENZYMES SUPPLEMENTATION ON PERFORMANCE OF BROILER CHICKENS FED IN DIETS CONTAINING CORN AND WHEAT

**MS THESIS**

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## THESIS ACCEPTANCE AND APPROVAL

This thesis entitled *"Impact of Enzymes Supplementation on Performance of Broiler Chickens Fed in Diets Containing Corn and Wheat"* presented by Hardi Ahmed Karim AL-JAF under supervision of Asst. Prof. Dr. Muhammet Ali KARA and Secondary Supervisor:Asst. Prof. Dr. Saman Abdulmajid RASHID in the Department of agriculture has been accepted as a M.Sc. thesis according to Guidelines of Graduate Higher Education on ..../...../..... With unanimity / majority of votes members of jury.

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I conform to above results.

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**THESIS NOTIFICATION**

I hereby declare that this paper is my unique authorial work, which I have worked out by my own. Every information bases, references and liter-ature used or excerpted through explanation of this work are correctly cited and listed in complete reference to the owing cause.

Hardi Ahmed Karim AL-JAF

Note: In this thesis, the use of original and other source notifications, tables, gures and photographs without reference, it is subject to provision of law No 5846 on Intellectual and Artistic Works.

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## LIST OF ABBREVIATIONS

| Abbreviation | Statement |
|---|---|
| **AME** | **:** Apparent metabolisable energy |
| **BW** | **:** Body weight |
| **FCR** | **:** Feed conversion ratio |
| **FI** | **:** Feed intake |
| **G** | **:** Gram |
| **GLM** | **:** General linear models |
| **Kg** | **:** Kilogram |
| **ME** | **:** Metabolisable energy |
| **MW** | **:** Molecular weight |
| **NSP** | **:** Non-starch polysaccharide |
| **RCD** | **:** Randomized complete design |
| **RSD** | **:** Rate of starch digestion |
| **SE** | **:** Standard Error |
| **TAXI** | **:** Triticum aestivum xylanase inhibitor |
| **TME** | **:** True metabolizable energy |
| **UMN** | **:** University of Minnesota |
| **WG** | **:** Weight gain |
| **XIP** | **:** Xylanase inhibitor protein |

## ABSTRACT

## MS THESIS

## Impact of Enzymes Supplementation on Performance

## of Broiler Chickens Fed in Diets Containing Corn and Wheat

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**In Animal Science**

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This study conducted at the Poultry field of Animal Science Department, Faculty of Agricultural Sciences, University of Sulaimany to investigate the Impact of Enzymes Supplementation on Performance of Broiler Chickens Fed on Diets Containing Corn and Wheat**.**

Bird naturally output enzymes for digesting nutrients. However, bird does not have enzymes to moulder fiber perfectly and that enzymes secretion by salivary glands is very limited, especially to digesting high ratio of starch. So we need to add enzymes (α- Amylase and Xylanase) in the feed to aid digestion. The influence of enzyme supplementation on performance and digestibility in broiler chicks was examined for the diet containing corn and wheat with different levels of enzyme, While the diet containing corn and wheat, And adding enzymes to the diet of broiler chickens resulted Significant ($P \leq 0.05$) increases in live body weight, weight gain, feed conversion and carcass weight, The best results for the traits included in this study were recorded by supplementing diet of broiler chickens with enzymes at the level of 0.04 % (T3, T6, and T9).

The experiment was conducted during the period from March 7th, 2017 to April 17th, 2017 by using 378 Ross 308 broiler chicks, one-day-old. Chicks were allocated to nine treatments of three replicates per group; each group constitutes 14 chicks, 42 chicks pertreatment group.



**Keywords:**Broiler, α-amylase, xylanase, corn, wheat, performance

## 1. INTRODUCTION

Studies indicate that the food of the most people of the world especially, developing countries is suffering from protein deficiency and since protein, especially animal protein, play important role in human nutrition, its quality and quantity must reach to ideal extent Nikougoftar., (2003). Since poultry meat is an important source of high quality protein, minerals and vitamins to balance the human diet, poultry industry continues to play a significant role in the whole world as the major supplier for animal protein.

Enzymes are importance for optimal performance and nutrient digestibility in broiler chickens fed diets containing high levels of grains rich in non-starch polysaccharides (NSP) (Salih et al., 1991; Lazaro et al., 2003a, b). At fifty years ago Utilizing enzymes to bird diet is main advances in nutritional. Addition of enzymes supplementation to diets can help to eliminate the effects of anti-nutritional factors and improve the utilization of dietary energy (Rotter et al., 1990; Cowan et al., 1996; Yu et al., 2007; Zhou et al., 2009). Thus, supplemental enzymes increase digestibility of feed and performance. Supplemental enzymes increase digestibility in broiler chicken caused by action in the crop, pancreas, or small intestine such as Amylase and Xylanase. (Ritz et al., 1995). Plants consist several structures that the poultry cannot digestion, in order to the poultry cannot product the necessary enzyme to digest them. Scientists able help the poultry by selecting these indigestible structure and nutrition an adequate enzyme. These enzymes produce from microorganisms under controlled situation (Wallis., 1996). Corn is the major source of energy in poultry diets on a global scale (Ertl and Dale., 1997; Summers., 2001). And its inclusion rate in commercial diets can be up to 70% (Summers., 2001). Corn used as a main source of energy in bird rations and feed ingredient because of the corn high source of energy that easy to digestion and low soluble non-starch polysaccharides, which are an anti-nutrient factor (Iji et al., 2003). Corn metabolism energy is main caused by the type of corn starch that is classified into three groups: fast digestion of starch, tardily digestion of starch, and resistant digestion of starch (Englyst et al., 1996). Wheat is an essential surrogate for maize in the bird ration however dietary modifications request to be made in order to of its anti-nutritive portion, non-starch polysaccharide (NSP) Wheat consists a relatively high level of non-starch polysaccharide (NSP) as a compound of carbohydrate (Annison., 1990; Ward.,

1995). The majority of the carbohydrate portion is derived in the β-glucan and Arabinoxylan in the grain cell wall (Annison and Choct.,1991; Classen and Bedford et al., 1991). Xylanase is the major non-starch polysaccharide (NSP) of wheat, and rise levels of wheat in poultry diets able raise the viscosity of the digestive system contents, that hinder the absorption of feeds, causing decreased weight gain, feed intake and feed conversion ratio (Annison and Choct).

# 2. LITERATURE REVIEW

## 2.1. Corn and Wheat Quality

### 2.1.1. Corn classification

Corn is one feature as a cereal that comprises of 50% or a greater amount of dent corn as well as flint corn. Furthermore, not over 10% various cereals for when principles are one built up beneath the United States Grain Norms Act (USDA-GIPSA., 1996). Corn is one arranged into five public groups: Dent corn, Flint corn, Popcorn, Flour corn, and Sweet corn. Flint corn usually used for livestock, also consist a hard boring layer totally encompassing external part piece. Flint corn, also called as Indian corn, is using to same purposes as dent corn. A hard layer distinguishes flint corn and there have two colors, white and red. Popcorn is soft starchy center by a very hard exterior layer. When popcorn is warmed the natural moisture inside the kernal turns to steam that builds up enough pressure for the kernal to explode. Flour corn is utilized in baked goods because it is a soft, starch-filled, kernal that is easy to grind, flour corn is primarily white. Sweet corn is common eaten by the human, or it can be canned or frozen for future eaten and to sale in the market, sweet corn is commonly used for feed or flour. Sweet corn is extra sweet because it consists more natural sugars than other types of corn. Corn is essentially a resource of poultry nutrition individually (USDA-NASS., 2007). USDA-GIPSA., (1999). Some factor effect on corn production that is gravely ground-harmed, severely climate harmed, infected, ice harmed, germ-harmed, warm harmed, insect-bored, mold-damaged, sprout-damaged, or generally tangibly harmed.

### 2.1.2. Corn composition

Maximumdentscorniscropped at development which the dampness substance between 22 to 25% and dried. The Nutrient Profile as follows (Table. 2.1).

Naturally named of the maize nucleus is single-seeded organic product (Wolf et al., 1952). Maize grain consists of three segments: germ,endosperm and pericarp.The germ consists of 15% of the maize weight,the endosperm consists of 82 to 80% of the maize weight and thepericarp consists of 3 to 5% of the maize weight (Bonnett., 1954; Schoch Maywald., 1956 and Blessin et al., 1963). The 81 to 85% of portion lipidstorage in the germ for the most part insetting of the triacylglyceride(Earle et al., 1946; Logan et

al., 2001).

Table 2.1. Nutrient profile of corn: (%) (Steven and John., 2005).

| Material | % | Material | % |
|---|---|---|---|
| Dry Matter | 85.0 | Methionine | 0.20 |
| Crude Protein | 8.5 | Methionine + Cystine | 0.31 |
| Metabolizable Energy | | Lysine | 0.20 |
| (kcal/kg) | 3330 | Tryptophan | 0.10 |
| (MJ/kg) | 13.80 | Threonine | 0.41 |
| Calcium | 0.01 | Arginine | 0.39 |
| Av. Phosphorus | 0.13 | | |
| Sodium | 0.05 | Dig Methionine | 0.18 |
| Chloride | 0.05 | Dig Meth + Cys | 0.27 |
| Potassium | 0.38 | Dig Lysine | 0.16 |
| Selenium (ppm) | 0.04 Dig | Dig Tryptophan | 0.07 |
| Fat | 3.8 | Dig Threonine | 0.33 |
| Linoleic acid | 1.9 | Dig Arginine | 0.35 |
| Crude Fiber | 2.5 | | |

Maximum energy in the maize is gotten in the endosperm of the nucleus that has a lot of starch. The starch of the corn is various in structure and size, contingent upon the sort and assortment of grain and the new of the tissue in the creating endosperm (South et al., 1991). There are three types of the starch that are: fast digestion of starch, tardily digestion of starch, and resistant digestion of starch, (Englyst et al., 1996) Three subgroups of safe starch is distinguished: (1) Starch grain is difficult to reach, this type needs the digestion enzymes to help fast breakdown, (2) Local starch grain is difficult to absorption because of their component and structure, and (3) Recessive starch grain is shaped amid handling, for example, high-temperature cooking taken after by capacity at bringing down temperatures over drawn-out stretches ( Eerlingen et al., 1994 and Brown., 1996 and). The starch of maize consists 25 to 30% tardily digestion of starch, and 70 to 75% fast digestion of starch can be broken down in water and warming (Marshall and Whelan., 1974). The proportion of energy to ratio of net energy didrise

for maize when contrasted and other ordinarily utilized diet (69.2, 78.9 and 86.8,) % for barley, wheat and corn individually (Summers., 2001). The nature of maize delivered by rancher's changes enormously in every quality calculate as a result of contrasts soils, atmosphere, insects, disease, hybrids, and administration hones with respect to gathering, drying, putting away, and so forth. The variety of corn supplements in Indiana was accounted for by testing from various regions of the state (Maier., 1995).

### 2.1.3. Wheat classification

Wheat takes second place to corn on an overall premise as bolster grain for animals. Be that as it may, wheat grain can rise to corn with in vitality esteem and regularly betters maize concerning protein focus in 1985 in UK wheat represent 95% of the cereal segment of compound nourishes for poultry and 80% for pigs (Williams and Chesson., 1989). Also prepared grain, wheat mind, for instance metabolizable energy (ME) per kilogram of dry matter for ruminant and poultry, separately.

Wheat is regularly utilized as a part of poultry slims down in western Canada and parts of Europe. The husk of wheat disengages from the grain amid sifting (in traditional barley and oats, the husk stays connected), diminishing the grain's fiber content. The energy content of wheat is 94% to 96% that of maize. Wheat is higher in protein and the amino acids lysine and tryptophan than maize. Wheat contains gluten, which is beneficial really taking shape of pellets since it disposes of the requirement for pellet fasteners. Wheat classification is ordered by three orders:

- Wheat assortments can be categorized soft or hard relying upon their gluten content. Hard wheat assortments have a tendency to have high protein content, while soft wheat assortments have high starch content. Durum wheat, utilized regularly for human utilization, is the hardest of the wheat assortments.
- Wheat sorts are likewise delegated red or white contingent upon the grain color.
- The third categorization mirrors the assortment's developing season:

Winter Wheat – planted in the fall, collected in the spring, involves roughly 75% of wheat developed in the U.S. Spring Wheat – planted in the spring, gathered in late summer or early fall.(Mike and Paul., 1997)

Distinctive wheat assortments contain diverse sorts of starches, some of which

are troublesome for stomach digest. These starches move toward becoming food source for bringing down gut microscopic organisms(bacteria) that may shape waxy particles and prompt sticky fecal material. The utilization of supplemental sustains compounds eases this issue in chickens (Mike and Paul., 1997).

### 2.1.4. Wheat composition

Wheatgrain consists of three segments: embryo,endosperm and grain layer.The embryo consists of 2% of the maize weight,the endosperm consists of 85% of the maize weight and the grain layer consists of 13% of the maize weight. The layer of the grain consists a lot of Non-starch polysaccharide, also itconsists oil, protein and (Ravindran and Amerah,. 2009). The endosperm of the grain consists a lot of part of starch that built ligaments with the protein framework. In order to endosperm is very solidity of the critical qualities of that is way decides to utilize of the wheat flour(Turnbull and Rahman,. 2002). Pasha et al. (2010).Solidityis a geneticaly characteristic under chromosome locus controlled (Sourdille et al., 1996; Cornell and Hoveling., 1998; Turnbull and Rahman., 2002) there have a pentosans and dampness nature in wheat grain. Turnbull and Rahman.(2002). Several physical factor influences on the wheat grain for broiler diet that including feed forms and solidity, indicate in some reported there is gotting better broiler performance with solidity wheat.Also some factor influence on the chemical structure of wheat grain that including contingent on zone, developing area, utilization of compost, dampness situation and other agronomic variables(Ravindran and Amerah., 2009; Svihus and Gullord., 2002). The Nutrient Profile of wheat that showed in (Table. 2.2) (Steven and John., 2005)..The apparent metabolisable energy (AME) estimation of the wheat relies on under controlled oil, protein and starch digestion(Carre et al., 2007;Svihus and Gullord., 2002; Wiseman., 2006 and McCraken., and Quintin., 2000). Main source of energy in wheat grain is carbohydrate that is consisting a lot of starch. (Ravindran and Amerah., 2009;Pirgozliev et al., 2003). Also, there are two types of starch in the endosperm of wheat grain that including fast digestion of starch and tardily digestion of starch under controlled structure of starch in the endosperm (Svihus et al., 2005).Then, the ratio of starch in wheat grain influence on broiler performance that is called rate of starch digestion (RSD) (Del Alamo et al., 2008; Ball et al., 2013). Del Alamo et al., (2008) and Ball et al., (2013) Reported about this that is indicating the rate of starch digestion (RSD) effects on feed efficiency and growth of broiler.

Table 2.2. Nutrient profile of wheat: (%)

| Material | % | Material | % |
|---|---|---|---|
| Dry Matter | 87.0 | Methionine | 0.20 |
| Crude Protein | 12 - 15 | Methionine + Cystine | 0.41 |
| Metabolizable Energy | | Lysine | 0.49 |
| (kcal/kg) | 3150 | Tryptophan | 0.21 |
| (MJ/kg) | 13.18 | Threonine | 0.42 |
| Calcium | 0.05 | Arginine | 0.72 |
| Av. Phosphorus | 0.20 | | |
| Sodium | 0.09 | Dig Methionine | 0.16 |
| Chloride | 0.08 | Dig Meth + Cys | 0.33 |
| Potassium | 0.52 | Dig Lysine | 0.40 |
| Selenium (ppm) | 0.50 | Dig Tryptophan | 0.17 |
| Fat | 1.5 | Dig Threonine | 0.32 |
| Linoleic acid | 0.50 | Dig Arginine | 0.56 |
| Crude Fiber | 2.70 | | |

Here have arabinoxylans in wheat grian that contain xylan, cellulose and lignin that is why it need the digestion especially enzymatic digestion for breakdown the outer layer of the wheat grain (Choct., 2006; Choct., 1997; Bedford and Schulze, 1998)Also, there have endo-xylanase inhibitors in the wheat nucleus (Simpson et al., 2003). Morever, there are two sorts of endo-xylanase in wheat nuleus that the ratio of these various in wheat to another wheat under controlled situation of agriculture in area, and that sort is called xylanase inhibitor protein (XIP) and Triticum aestivum xylanase inhibitor (TAXI) (Sørensen et al., 2004; Bedford., 2006; Dornez et al., 2006).

## 2.2. Corn and Wheat in Poultry Diets

Maize is one of the materials is very importance in broiler chicken diet. There are not non-starch polysaccharides in maize grain, however there are anti-nutrient in many cereals (Iji et al., 2003). In order to the maize source of high energy and low protein that is why the maize main source of energy in feedstuff of poultry, that it consists60 to 70% broiler chicken diet. In addition, some factor influence on nutrition

values of maize that including situation of climate and type soil (Leeson et al., 1993). Starch digestion of corn is better compared other cereal grain like wheat that is digestion of starch about 80 to 85% for poultry (Noy and Sklan., 1995; Iji et al., 2003).

Some nutritionists work on genetically of maize to raising nutrition value of maize, increasing digestion and absorption of maizeand increasing of true metabolizable energy (TME) and apparent metabolizable energy (AME) of maize in poultry feedstuff. (Mahagna et al., 1995). Also, in some reported about this topic indicate birds age in tne main factor in raising of nutritional value of maize and indicate finisher period of broiler chicken is better period to gotten best useful in the maize in the poultry feedstuff (Collins et al., 1998; Noy and Sklan., 1995).

Wheat takes second place to corn on an overall premise as bolster grain for animals.In addition, some country like Canada, Australia and New Zealand wheat is major source of energy.Be that as it may, wheat grain can rise to corn with in vitality esteem and regularly betters maize concerning protein(Choct et al., 1999). Wheat grain consists 35% of the protein and 70% to more of the metabolisable energy of broiler chicken. That is why, wheat grain main influence on growth of broiler chicken in the farm (Del Alamo et al., 2008). Physical and chemical properties of wheat different from the maize. While wheat contains non-starch polysaccharide (NSP) more than corn that is influence on growth of broiler chicken in farm. Also, for increasing of digestibility of wheat there are need exogenous enzymes. (Wiseman., 2000; Rose et al., 2001; Péron et al., 2006; Carre et al., 2007).

The absorption of nitrogen in small intestines of broiler chicken about 78% on fourth day to 92% on 21 days. While has been indicated there can this ratio increasing by using of enzymes supplementation in corn and wheat (Persia and Lilburn., 1998). Also, there are other factor that influence of digestibility of cereal especially corn and wheat is grain crushing, that is raising of digestibility of the corn and wheat there can increasing the area of corn and wheat grain that is by utilizing of exogenous enzymes.

### 2.3. Enzymes

Enzymes are non-living substances creating in the sort of protein. Biological catalyst acts on specific substrate and the rapid of chemical reaction. Each enzyme is the

particular substrate to a particular reaction, also there are needs to be the suitable shape for the working on material like xylanase just work on breakdown of xylose. Utilize as feed supplements for destroying large indigestible materials into smaller digestible materials that is the best helping for digestion system because the gut breaking down bigger, insoluble materials into smaller, soluble materials that can be absorbed through the wall of the small intestine.(Acamovic and McCleary., 1996).

### 2.4. Enzymes in poultry diet

The digestion of feeds is not good in the poultry because the feeds contain anti-nutrition factor that resistant digestion of feed is good.There are six anti-nutritional effects on the feed (Huisman and Tolman., 1992). The one factor, there is factor that negative impact on the digestibility of protein like soyabean contains anti-nutrition negative impact on protien digestion. The second factor, there is factor that negative impact on the digestibility of carbohydrates like xylose in cereals that poultry cannot digestion that is why xylanase is necessary for breakdown of xylose in cereal. The third factor, there is factor that negative impact on the digestibility of minerals like phytic acid. The fourth factor, there is factor that negative impact on the digestibility of vitamin that vitamin is very necessary for broiler chicken.The fifth factor, there is factor that impact on poisonous of feed like lectins andThe sixth factor, there are factor that negative impact on immune system like antigen proteins. one of the solution for these problems utilizing heat for removing of the anti-nutrition in the feed specific for soybean meal(Lusas., 2000).

Another solution for decreasing anti-nutritional in the feed utilization of supplemental exogenous enzymes. The importance of the utilization of exogenous enzymes explained as following (Johnoson et al., 1993). 1- Utilization of exogenous enzymes decreases anti-nutritional factor like tannins, saponin and goitrogen. 2- Positive influence on the raising utilization of feed and conversion of feed by the broiler chicken. 3- Exogenous enzymes supplementation to help the normal digestion of feed especially during the stress situation. 4- Positive influence on the reduce toxin gases in the farm of broiler chicken in order to it reduced excreta, watery dropping, and ammonia-like use of phytase. 5- Positive influence on the reduce diarrhea in the poultry (Sun et al., 2005; Francesch et al., 2005 and Inborr and Ogle, 1988).

The fiber contains non-starch polysaccharides (NSP). The bird produced enzymes like Amylase secretion by salivary glands and Lipase The main source in the pancreas. Poultry can produce Amylase but the producing amylase is very limited that not enough for digestion of starch completely in feedstuff of the broiler chicken. In addition, poultry has not cellulase and xylanase enzymes in the stomach as ruminant for digesting fiber because poultry stomach has not microbial digestion. That is the way there need exogenous enzymes for helping digestion completely of the diet of broiler chicken (Steven and John., 2005).

### 2.5. Kind of Enzymesin the Poultry Diet

There are several kinds of exogenous enzymes that act on the ingredient of the feedstuff of the broiler chicken that showed in the (Table. 2.3) (Wallis., 1996). The utilization of exogenous enzymes in feedstuff of the bird is very importance and impact on digestibility of lipid, protein, starch, and fiber in all ingredient that consists feedstuff of the bird especially non-starch polysaccharides in the cereals. Moreover, the addition of exogenous enzymes positive effect on anti-nutrition in the ingredient of the feedstuff of broiler chicken (Wallis., 1996).

Table 2.3. Enzymes used in poultry feeds

| **Enzymes** | **Substrate** |
|---|---|
| *Amylases* | Starch |
| *Lipases* | Lipids |
| *Proteases* | Proteins |
| *Phytases* | Soybean |
| *ß-galactosidases* | Grain legumes Lupins |
| *ß-glucanases* | Barley |
| *Xylanases* | Wheat |

**2.5.1.** Alpha amylase

Amylase is the family of enzymes that enzymes produced by microorganisms such as fungi and bacteria. Also, enzymes utilized in poultry feedstuff and some manufacturing like textiles. The major types of amylase apply on starch (carbohydrate) that including glucoamylase, α-amylase, and β-amylase. The α-amylase produced by *Aspergillus oryzae, Bacillus subtilis*etc that it act on endo-hydrolysis of α-1, 4-

glucosidic linkages.

The molecular weight of α-amylase is about 50 kD. The PH of α-amylase difference under controlled that is things produced, for example, the optimum PH of α-amylase that produced by *Bacillus subtilis* is 5.8-6.0, the optimum PH of α-amylase that produced by *Apspergillus oryzea* is 4.8-5.8 and the optimum PH of α-amylase that produced by *B. licheniformis* is 5.5-7.0. Also the temperature of α-amylase difference under controlled that is things produced for example the optimum temperature of α-amylase that produced by *B. licheniformis* is 90 °C and the optimum temperature of α-amylase that produced by *B. subtilis* is 70 to 72 °C (Dawson and Alllen., 1984).

The utilization of α-amylase in a lot of research indicate positive influence on the growth and feed conversion ratio of broiler chicken, also the cause of raising the apparent metabolisable energy (AME) of the feedstuff of poultry and positive effect on feed digestion in broiler chicken (Gracia et al*.,* 2003; Jin et al.,2000 andSimbaya et al., 1996).

**2.5.2. Xylanase**

*Xylanase*is the family of enzymes that enzymes produced by microorganisms such as fungi and bacteria. Also, enzymes utilized in poultry feedstuff and some manufacturing like pulp paper. The main function of *Xylanase*applies on plant cell wall (fiber). The *Xylanase*produced by *Penicillium canescens, Penicillium fellutanum, Penicillium clerotiorum* and etc, that it acts on endo-hydrolysis of β-1,4glycosidic bonds.

The molecular weight of *Xylanase* is about 30 kD. The PH of *Xylanase*difference under controlled that is things produced, for example, the optimum PH of *Xylanase*that produced by Penicillium canescens is 7.0, the optimum PH of *Xylanase*that produced by Aspergillus niger PPI is 5.0 and the optimum PH of *Xylanase*that produced by Penicillium clerotiorum is 6.5. Also the temperature of *Xylanase*difference under controlled that is things produced for example the optimum temperature of *Xylanase*that produced by Penicillium canescens is 30 °C, the optimum temperature of *Xylanase*that produced by Aspergillus niger PPI is 28 °C and the optimum temperature of *Xylanase*that produced by Neocallimastix sp. strain L2 PPI is 50 °C (Nagar et al., 1983).

The cell wall of the plant contains lignin 20 to 23%, hemicellulose 30 to 35% and cellulose 40 to 45%. There are cellulose and hemicelluloseconsists polysaccharides (Ladisch et al*.,* 1983). The hemicellulosecontainsxylose thatxylose haveglucose linked by β-1,4glycosidic linkage with simple primary and complex compound. (Timell., 1967).

Nutritionist's research about effect enzymes supplementation on hemicellulose, that indicate enzymes can be able to exchange hemicellulose to solublesugars(Suurnakki et al.,1997). There is two major enzymes supplementation in destroyingof the hemicellulose that includingendoxylanases (xylanases) and endomannanases (mannanases) (Franco et al.,2004).

**2.6. Benefits of Enzymes**

The utilization of exogenous enzymes for broiler chicken diet is very importance. In addition, exogenous enzymes are best assistance for helping digestion of ingredient in the feedstuff of broiler chicken. In addition, enhanced body weight, weight gain and feed efficiency, decrease in digesta viscosity, decreased beak impaction and vent plugging, reduced extent of the gastrointestinal tract. Moreover, altered population of microorganisms from gastrointestinal tract, decreased water intake, decreased water content of excreta, decreased ammonia product in the excreta and decreased excreta output that is very importance for broiler chicken farm ( Jansson et al., 1990; Esteve-Garcia et al., 1997;and Campbell et al., 1989).

**2.7. Factors Affecting the Benefits of Enzyme**

Some factors effect on enzymes that adding to broiler chicken diet (Bedford., 1996), involving the sort and ratio of cereal from feedstuff, because some sort of cereal contains the high ratio of anti-nutritive like barley contains more ß-glucan that is very difficult for digestion. Which also, the sort of animal effect on the activity of enzymes while there is poultry best reaction with exogenous enzymes compared with the pig that is the lower response for exogenous enzymes. Moreover, the main factor effect on the benefit and activity of the enzyme is age while there is young bird best reaction with enzymes supplementation compared with old bird that is lower response for enzymes supplementation (Vukic Vranjes and Wenk., 1993; Allen et al., 1995 and Choct et al., 1995).

## 2.8. Effect of Enzymes on Body Weight

The enzymes are to improve the performance of the poultry, the enzymes enhance body weight of broiler chickens, this agrees with the result obtained by Schutte et al., (1995) and Chesson., (2001). However, emphasized that with the application of enzyme on a low energy diet, positive results are achieved, mostly in young broiler chickens, where as in old classification these positive impacts are less expressed. Inversion to this result, Perić et al., (2002) did not register comparable result on the impact of enzymes supplement in mixtures with few levels of energy and protein. Ravindran et al., (2001) reported a significant linear impact on body weight by feeding broilers with the microbial enzyme in broilers diet.

Enzymes are able to restore the nutritional value in the intensity diet, these findings suggesting that raise muscle mass is partially responsible for observe enhance in body weight on utilizing of enzymes preparation by Ghazi et al., (2003). Supplemental enzymes enhance nutrition digestibility and increase a level of body weight in order to it act on digestion of energy and protein in broiler chicken diet. While the result is inconsistent with findings of McCraken and Quintin., (2000) reported that there was no significant effect of enzyme supplemented on the measured apparent metabolisable energy (AME) content of broiler chickens diet.

## 2.9. Effect of Enzymes on Weight Gain

The enzymes are to improve the performance of the broiler chicken; the enzymes increase weight gain of broiler chickens. The results of this experiment are in agreement with the reports of Jiang et al., (2008); Kaczmarek et al., (2014) reported that A significantly improved weight gain, who reported that broilers fed on African yam bean meal based diets with and without enzymes addition weight gain was significantly ($P<0.05$) depressed by enzyme addition, Sekoni et al., (2008), reported that weight gains increased with addition of supplemental enzymes. Ghazi et al., (2003). Supplemental enzymes enhance nutrition digestibility and increase the level of weight gain, in order to the enzymes act on digestion of energy and protein in broiler chicken diet. Also reported that an enzyme supplemented to a diet based on corn improved weight gain from 0.5 to 10.9% over the control, (Cowieson., 2005). While some researcher said The supplemental enzymes were not impacted on nutrition digestibility

and enhanced of weight gain of broiler chickens This result agrees with the result by (Choct and Annison., 1992; Mandal et al., 2003).

### 2.10. Effect of Enzymes on Feed Intake

The enzymes are the compound that effect broiler performance. Supplemental enzymes enhance nutrition digestibility when using the diet for broiler chicken consist rise cereal and rich level of non-starch polysaccharides also supplemental enzymes increase the level of feed intake in order to it act on digestion of energy and protein in broiler chicken diet. (Salih et al., 1991) Lazaro et al., (2003a, b). The inclusion of two enzymes was expected to improve broiler chick feed intake, and to enhance palatability and availability of nutrients. However, this finding varies with observations of Richter et al., (1995); Angelovicová and Michalik., (1997); Leeson et al., (1996) who all conducted research work on enzymes which were added to diets for starter and finisher broiler chicks is very importance for helping digestion and enhance of feed intak.

While reduced feed intake on addition of enzyme has been reported by Pettersson and Aman., (1989); Kadam et al., (1991) Daveby et al., (1998) and Samarasinghe et al., (2000) They reported about feed intake reduced on enzymes supplementation. Ranade and Rajmane., (1992) who reported about effect supplemental enzymes on performance and feed intake indicate addition enzymes supplementation did not effect on feed intake of broiler chicken. Also, Meng, et al., (2004) observed that broiler chicks fed diets added with amylase, lipase, and protease generally consumed lesser amount of feed compared to that of control diet. However, feed intake of broiler chicken was the independence of various energy levels of the experimental diets and their enzymes additive.

### 2.11. Effect of Enzymes on Feed Conversion Ratio

The enzymes supplementation impact on the broiler performance specifically effects of enzymes on feed conversion ratio. Reports that addition of enzymes to poultry diets has been shown to improve feed conversion ratio, apparent nutrient digestibility and in the non-starch polysaccharides (NSP) of the diet, (Marquardt et al., 1996). Who reported about enzymes supplementation that positive effect on feed efficiency of broiler chicken together with microbial protease, lipase, and amylase fed diets after 40 days of feeding. In addition, enzyme supplement (xylanase) added to diet improved feed

conversion ratio (Pourreza et al., 2007). Reported that an enzyme supplementation added to a diet based on corn improved feed conversion ratio from 0.78 to 10.5% over the control (Cowieson., 2005) exogenous enzyme supplementation improves feed conversion ratio of broiler chicken, also exogenous enzyme supplementation increased feed conversion ratio by mixed their diet with supplemental enzymes (Alam et al., 2003), added exogenous enzyme to the diet significantly enhanced digestibility coefficients for dry matter, crude protein, and energy.Thus the commercial enzymes supplementation mix with diets of broiler chicken indicates the significant effect on feed conversion ratio (Ramesh et al., 2000).

However, some researcher work on enzymes supplementation writing no improvement of broiler performance and no significant effect on feed efficiency Marsman et al., (1997). In addition, enzyme supplementation in the present study did not affect feed conversion ratio of the broiler chicken and was found to be non-significantly affected among the supplemented diets.

**2.12. Effect of Enzymes on Carcasses**

The exogenous enzymes supplementation influence on the carcass weight of the broiler chickens. Dietary enzyme added to diet indicates the significant effect on carcass weight of broiler chicken. This is agreement with the result of Wojcik., (1995); Jamroz et al., (1996) and Pisarski. Reported that an enzyme supplementation added to a diet raised the carcass of broiler chickens. Also, the present study is in agreements with findings of Wang et al., (2005) and Alam et al., (2003). They reported enhance carcass yield by enzymes supplementation in diet attributable to the carcass and also for raised breast meat yield. Thus Leeson et al., (1996) reported significant in the percentage of carcass weight reported that raised concentrations of dietary metabolism energy (ME) will not alter abdominal fat. Hidalgo et al., (2004). In agreement with the present results, Holsheimer and Ruesink., (1993), reported similar carcass yield responses to raising metabolism energy (ME) concentration in the diets of broilers chicken. Moreover, Ritz et al., (1995) and Downs et al., (2006) Supplemental enzymes enhance nutrition digestibility and increase the level of carcass weight, in order to the enzymes supplementation act on digestion of energy and protein in broiler chicken diet. (Caspary., 1992).

While Biswas et al., (1999) who reported about enzymes supplementation on broiler chicken performance that indicates no positive effect on carcass weight. Kocher et al., (2003) in their experiment add 1000 mg multi-enzyme per kg of diet contain corn soy-bean had no significant effect on carcass components. Though, results from some former studies showed that addition of enzyme to diets of broiler chickens was not affected on carcass yields and internal organs (Biswas et al., 1999; Kidd et al., 2001; Café et al., 2002 and Hassan et al., 2011).

## 3. MATERIAL AND METHODS

This study was applied from the Bakrajo bird farm, Animal Science Department, Faculty of Agricultural Science, the University of Sulaimany from the North Iraq during the period from March 7th, 2017 to April 17th, 2017 to study the impact of Xylanase and α-amylase supplementation on performance of broiler chickens fed on diets containing corn and wheat. A total of 378 chick's un-sexed 42-day old broiler chicks (Ross 308), the chicks divided into nine groups, each group divided to three replications containing 14 chicks.

### 3.1. Preparation of the Experimental Field

Broiler chicks were rearingfrom cleanly hallthat before cleaned and disinfected by potassium permanganate and formalin.Then the floor, wall and ceilings thoroughly cleaned by spraying forced water with the help of a hosepipe. After cleaning, feeders, drinkers, buckets, brooder and all other necessary equipment were disinfected by formalin, the feeders and drinkers were dried before use, at a depth of about 5 cm the Sawdust was utilized as litter, the chicks have been randomly distributed into the one floor and chicks were raised on floor cages (120*110*80), showed in (Fıgure 3.1).

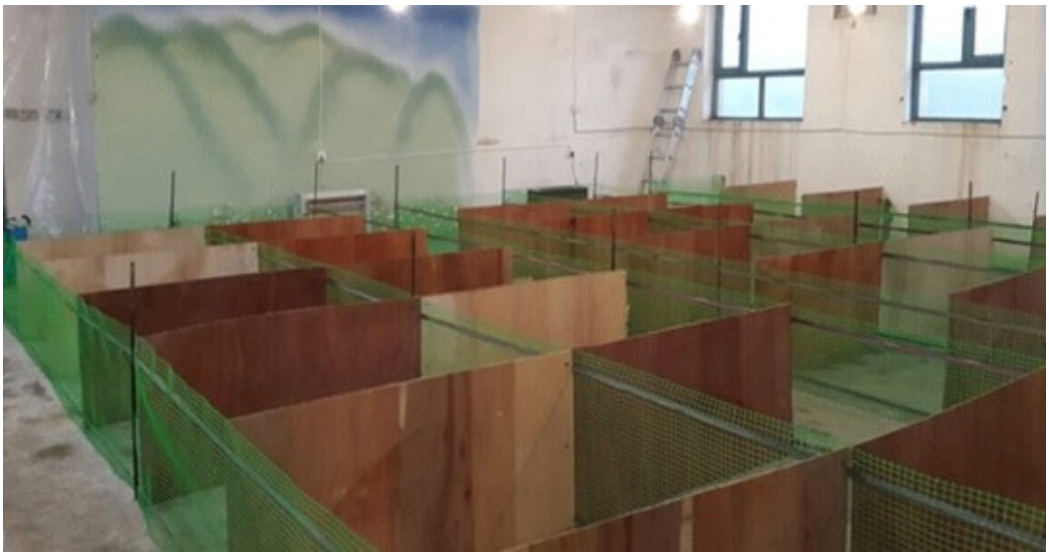


**Figure 3.1. Preparing experiment house for rearing broiler chicken.**

### 3.2. Experimental Protocol and Layout

Experimental protocol a total of 378 chicks un-sexed 42-day old broiler chicks (Ross 308) commercial broiler chickenwere divided into nine groupsand each group consisted threereplications. first treatment of chicks is control group diet consist feed that contained(corn and wheat) without enzymes, the second treatmentof chicks that diet consists feed that contained(corn and wheat) with 200mg/kg α_amylase and 200mg/kg xylanase, the third treatment of chicks that diet consist feed that contained(corn and wheat) with 400mg/kg α_amylase and 400mg/kg xylanase, the treatment group of chicks that diet consist feed that contained(corn) without enzymes, the fifth treatment of chicks that diet consist feed that contained(corn) with 200mg/kg α-amylase, the sixth treatment of chicks that diet consist feed that contained(corn) with 400mg/kg α-amylase, the seventh treatment of chicks that diet consist feed that contained(wheat) without enzymes, the eighth treatmentof chicks that diet consist feed that contained(wheat) with 200mg/kg xylanase and the ninth treatmentof chicks that diet consist feed that contained(wheat) with 400mg/kg xylanase (Table 3.1) and the experiment design showed in (Fıgure 3.2).

Table 3.1. The type of feeds and level of enzymes offered for each treatment at 42 days' periods of experiment.

| Treatments | Experimental period | | |
|---|---|---|---|
| | Days (1-42) | | |
| | Feed contained | α-amylase (mg per kg) | Xylanase (mg per kg) |
| T1 (control) | Corn+Wheat | 0 | 0 |
| T2 | Corn+Wheat | 200 | 200 |
| T3 | Corn+Wheat | 400 | 400 |
| T4 (control) | Corn | 0 | 0 |
| T5 | Corn | 200 | - |
| T6 | Corn | 400 | - |
| T7 (control) | Wheat | 0 | 0 |
| T8 | Wheat | - | 200 |
| T9 | Wheat | - | 400 |

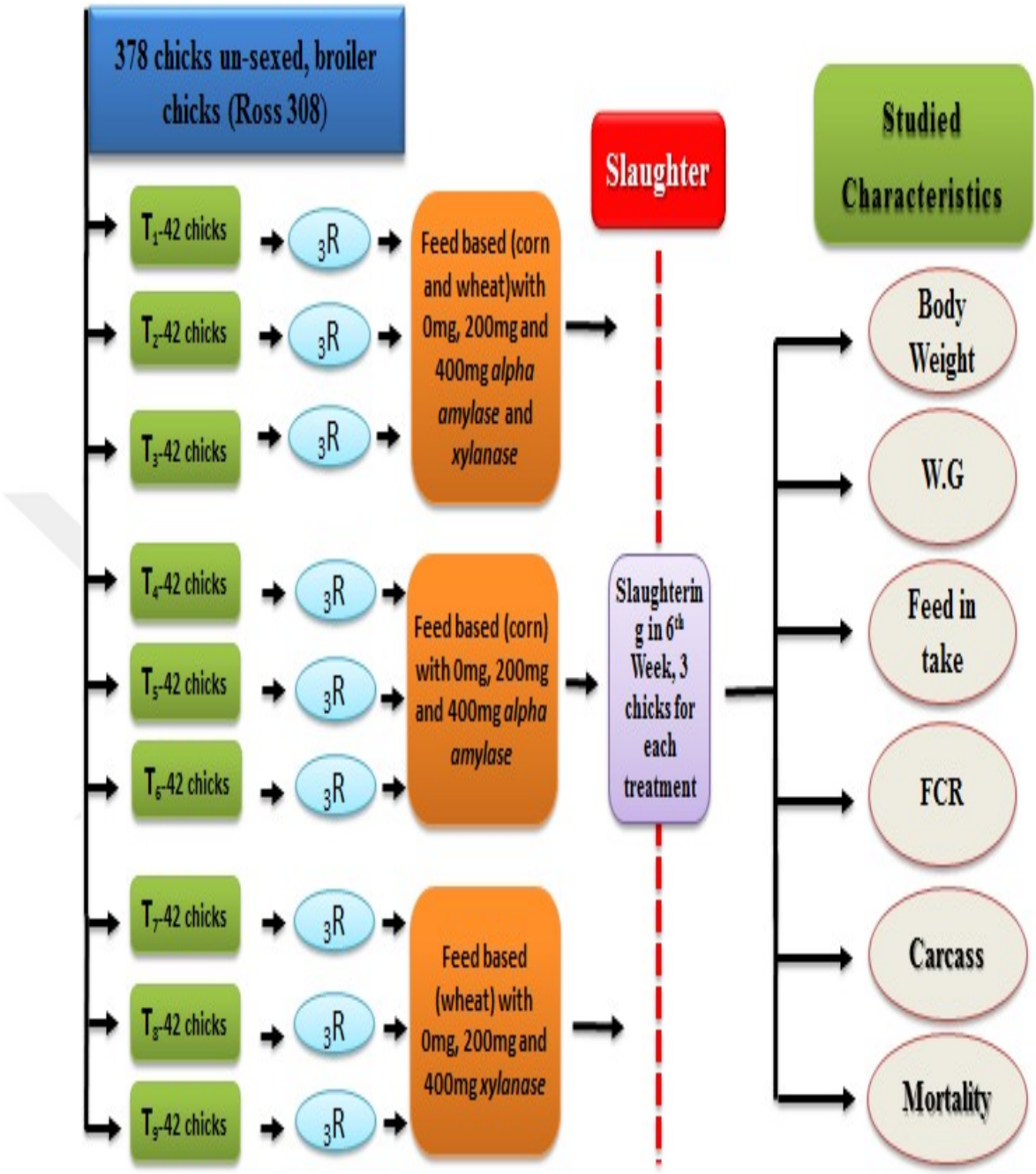



Figure 3.2. Experimental design.

### 3.3. Diets of experimental birds

All diets were fed in mash form and formulated on a corn with wheat, corn and wheat meal basis Experimental by. Different raw materials for feeding were purchase from local market, Diets for different treatment groups were formulate as per following composition (Table 3.2).

Table 3.2. Ingredient composition of the diet.%

| Ingredients | Diet | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | T1, T2 and T3 | | | T4, T5 and T6 | | | T7, T8 and T9 | | |
| | Starter (0-10) | Grower (11-23) | Finisher (24-42) | Starter (0-10) | Grower (11-23) | Finisher (24-42) | Starter (0-10) | Grower (11-23) | Finisher (24-42) |
| Protein | 8 | 5 | 5 | 8 | 5 | 5 | 8 | 5 | 5 |
| Soy | 28 | 28 | 26 | 30 | 30 | 25 | 26.25 | 26.25 | 21 |
| Wheat | 27.5 | 29.5 | 29.5 | - | - | - | 58 | 61.5 | 65 |
| Wheat bran | 5 | 4.5 | 5.5 | 7 | 6 | 8 | 5 | 4 | 5 |
| Fat | 2.5 | 3 | 4 | 2.5 | 3 | 4 | 2.5 | 3 | 4 |
| Corn | 28 | 30 | 30 | 52.5 | 56 | 58 | - | - | - |
| Total | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| Chemical compositions | | | | | | | | | |
| Crude protein | 23 | 22 | 21 | 23 | 22 | 20 | 23 | 22 | 20 |
| Metabolizable energy | 3000 | 3100 | 3150 | 3000 | 3100 | 3150 | 3000 | 3100 | 3150 |
| Calcium | 0.35 | 0.35 | 0.35 | 0.35 | 0.35 | 0.35 | 0.35 | 0.35 | 0.35 |
| Lysine | 1.18 | 1.18 | 1.18 | 1.18 | 1.18 | 1.18 | 1.18 | 1.18 | 1.18 |
| Methionine | 0.58 | 0.58 | 0.58 | 0.58 | 0.58 | 0.58 | 0.58 | 0.58 | 0.58 |

*Protein concentration utilize in the diets was produced from Holland country by named (WAFI) that consists: (2100) Kcal ME / Kg, (40)% crude protein, (5)% crude fat, (6.5)% calcium, (4)% cysteine, (3.85)% lysine, (3.70)% methionine, (2.50)%phosphorus and (2)% crude fiber.
** The calculated composition of the diets was determined according to NRC., (1994).

### 3.4. Using Enzymes in Diet

The enzymes utilized in the broiler diet. How to used enzymes in diet and the detailed of mixed enzymes with another ingredient that is at first all enzymes mixed or dissolved into the oil of the diet after shacked for few minute next enzymes and the oil mixed with soyabean meal after shack mixed with other ingredient showed in (Fıgure 3.3).Thus, these enzymes utilized to the experiment are active by the factory.

Figure 3.3. Mixed of ingredient diets.

### 3.5. Feeding and Drinking

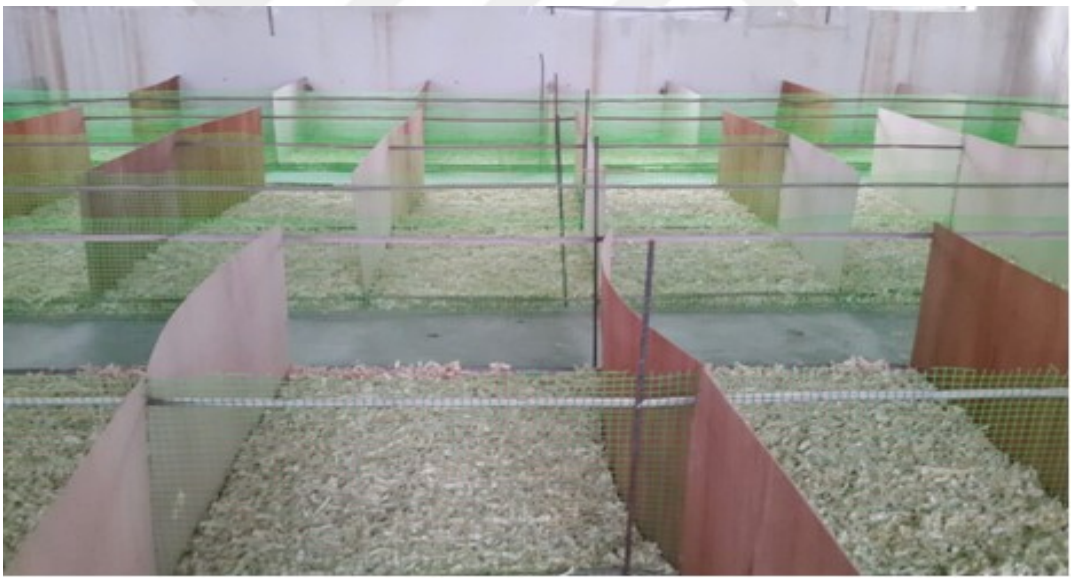
For the first 7 days, the feed was supplied three timesthen from 8 to 23 days twice dailyand finally (morning and evening) for the remaining periods. For the first week, feeds given on tray showed in (Fıgure 3.4), and then from other weeks round tube feeders used for supplying feed showed in (picture.5). Fresh and clean drinking water was also supplied ad-libitum showed in (Fıgure 3.5), basis twice daily (morning and afternoon). One feeder and one drinker allotted for the birds of each cage.

Figure 3.4. Feeder and drinker for the starter period.

Figure 3.5. Feeder and drinker for the grower and finisher period.

### 3.6. Litter Management

The Sawdust as litterutilized. Litter at a deepness of (5) cm showed in (Fıgure 3.6). For first (7)days there was fiber over the litter showed in (Fıgure 3.7), to prevent the chick eating sawdust and increase chick's activity.



Picture 3.6. Litter for broiler chicken.

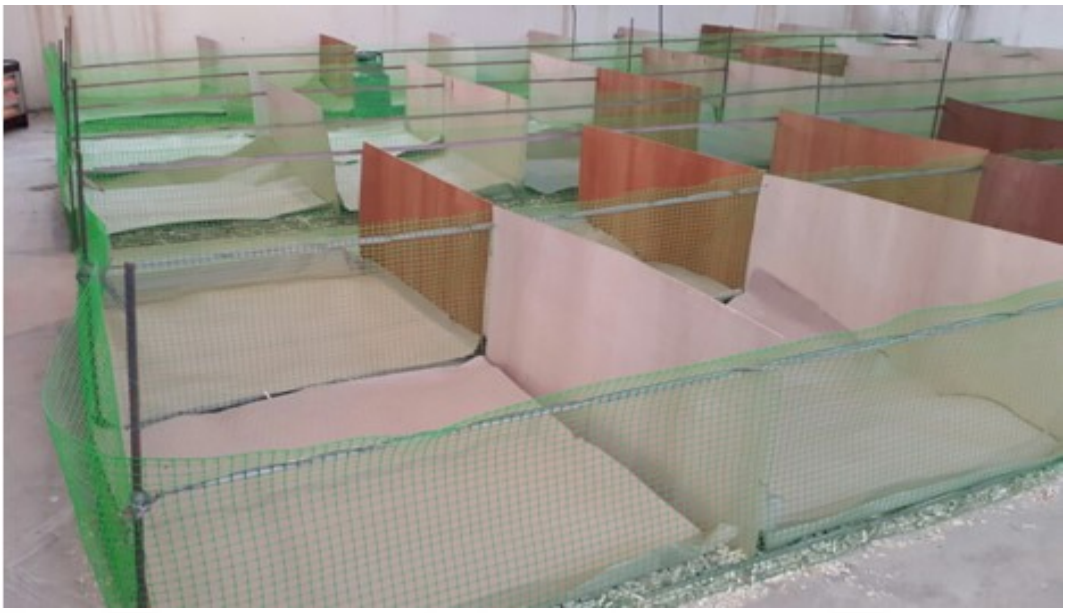


Figure 3.7. Fiber over the litter.

### 3.7. Multivitamin Supplementation

The first day given sugar mix with water by 5 kg per 100-liter water, from the 7 day to 14 days the chicks were have problem the leg to solution that problem given the vitamin B complex and vitamin E for one week by 1cc per 1liter water then the finally 24 to 42 given the vitamin AD3E by 1cc per one-liter water.

### 3.8. Vaccination

For the prevention of common diseases birds were vaccinated on the scheduled date of vaccines. Vaccines were used as per manufacturers' instructions and the schedule is shown in (Table 3.3).

Table 3.3. Vaccination schedule

| Age | Name of vaccine | Method of vaccination |
|---|---|---|
| 7th Day | (Newcastle disease) | water |
| 14th Day | 228E* (Gumboro) | water |
| 25th Day | (Newcastle disease) | water |
| 30st Day | (Newcastle disease) | water |

### 3.9. Studied Characteristics

Characters studied in this experiment were as showed (Figure 3.2).

#### 3.9.1. Live body weight

All chicks of each replicate were weighed individually each week of the experiment (week 1 to week 6) utilizing Starter scale (Sensitivity 5 kg.) for starter period and utilizing normal scale (Sensitivity 50 kg.) for the grower and finisher periods.The weight was taken at the evening (about 5 pm).

#### 3.9.2. Weight gain

The weight gain was takein the two periods of body weight at weekly by calculated between two periods of the body weight.

Weekly weight gain =P2 – P1

P2= live body weight in period second.

P1= live body weight in period one.

Final Weight gain = P6 – P1

P6= live body weight in period sixth.

P1= live body weight in period one.

#### 3.9.3. Feed intake

The amount of feed consumed by the experimental birds of different treatment groups were calculated for every week by deducting the weight of rest of the feed in the bucket from the weight of the total feed supplied in that week (Al – Zubaidi., 1986; Al-Zubaidi., 1986).

.

$$\text{Feed intake} = \frac{\text{The amount of feed was consumed by the birds - feed residual}}{\text{Number of alive birds at the end of the week}}$$

#### 2.9.4. Feed conversion ratio

The Feed conversion ratio was take in the two data (feed intake and weight gain) at weekly wascalculate as following:

$$\text{Feed conversion ratio (FCR)} = \frac{\text{Feed intake during a week (gm)}}{\text{Weight gain during a week (gm)}}$$

### 3.9.5. Mortality percentage

Mortality was recorded for each replicate if occurred according to the date of happening, and mortality percentage was calculated by the following equation (Naji and Hanna., 1999) :

$$\text{Mortality percentage} = \frac{\text{Number of mortal birds}}{\text{Number of birds for each replicate}} \times 100$$

### 3.9.6. Carcass traits

At the final of the experiment, (1/14)broiler chickenin each replicationwas randomly chosen for slaughter and evaluation carcass traits. Before slaughter, the birds were starving for 12 hours, then weighed, slaughtered and allowed to bleed freely for about 5 minutes. After that proportional weight of carcass.

### 3.10. Statistical Analysis

Utilizing XLSTATprogram, (version 7.5, 2004). For analyzed all data.

The following model was use: $Yij = \mu + Ti + Pj + TPij + eij$

Where:

Yij= Observation of the performance traits

μ = The overall means of traits.

Ti = Effect of treatments (T1 0%, T2 0.02%, T3 0.04%, T4 0%, T5 0.02%, T6.04%, T7 0%, T8 0.02% and T9 0.04%)(

pj= Effect of periods (day 1, 7, 14, 21, 28, 35 and 42 of age).

TPij = Interaction between treatments and periods.

eij= Random error, assumed to be equal to zero and variance is $\sigma^2 e$ (N~ 0, $\sigma^2 e$)

The significant differences between means of traits included in this study byutilizing Duncan's multiple comparison test under the likelihood ($p < 0.05$) (Duncan, 1955).

## 4. RESULTS AND DISCUSSION

### 4.1. Effect of Enzymes on Body Weight, Weight Gain, Feed Intake and Feed Conversion Ratio From 1-42 Day-Old

The results in (Table 4.1) showing the impact of enzymes supplementation on performance of broiler chickens fed on a diet containing corn and wheat. during 1 day to 42 days. The values of body weight, weight gain, feed intake and feed conversion ratio during of the experiments have raised ($p<0.05$) due to the raising of enzymes supplementation. In addition, the effect of enzymes on body weight was significant ($p<0.05$) higher body weight at T2, T3, T5, T6, T8, and T9 compared with their controls T1, T4 and T7, respectively. Schutte et al., (1995) and Chesson (2001) were also found significant ($p<0.05$) effect of enzymes on body weight compared with control. Moreover, the effect of enzymes on weight gain was significant ($p<0.05$) higher weight gain at T2, T3, T5, T6, T8 and T9 compared with their controls T1, T4, and T7, respectively. Jiang et al., (2008); Sekoni et al., (2008) and Kaczmarek et al., (2014) reported that enzymes significantly ($p\leq0.05$) effected on weight gain compared with control. Also, the effect of enzymes on feed intake was significant ($p<0.05$) lower feed intake at T2, T3, T5, T6, T8 and T9 compared with their controls T1, T4 and T7, respectively. The results are in agreement with findings of Ranade and Rajmane., (1992) who reported about effect supplemental enzymes on performance and feed intake indicate addition enzymes supplementation did not effect on feed intake of broiler chicken. Decreased feed intake on the addition of enzyme has been reported by Samarasinghe et al., (2000); Richter et al., (1995) and Kadam et al., (1991). They reported about feed intake reduced with enzymes supplementation. Then, the effect of enzymes on feed conversion ratio was significant ($p<0.05$) higher feed conversion ratio at T2, T3, T5, T6, T8 and T9 compared with their controls T1, T4 and T7, respectively. While, T3, T6, and T9 were significant ($p<0.05$) higher feed conversion ratio compared with T2, T5, and T8, respectively. In order to, the diet of T3, T6 and T9 contain the high ratio of enzymes that (400)mg/kg compared T2, T5 and T8 their diet contain the low ratio of enzymes that (200)mg/kg. This agrees with the result obtained by Marquardt et al., (1996); Espino et al., (2000); Alam et al., (2003); Cowieson., (2005); Ramesh et al., (2006) and Pourreza et al., (2007). Who reported about the enzymes supplementation mixed with diets of broiler chicken indicates the significant effect on feed conversion ratio.

Table 4.1. Effect of supplemental enzymes on body weight, weight gain, feed intake and feed conversion ratio (g) of broiler chicken from 1-42 day-old (Mean ± SE)

| | Body weight | Weight gain | Feed intake | Feed conversion ratio |
|---|---|---|---|---|
| **T1(control)** | 2293.33±41.12e | 2251.36±13.62fg | 3908.33±46.12b | 1.73±0.01b |
| **T2** | 2390.00±44.23bc | 2348.13±15.43cd | 3781.00±16.25d | 1.61±0.02d |
| **T3** | 2453.33±55.66a | 2411.00±31.63ab | 3700.33±14.67ef | 1.53±0.02ef |
| **T4(control)** | 2330.00d±75.05de | 2286.03±5.97ef | 3864.33±15.72bc | 1.69±0.01bc |
| **T5** | 2418.33±41.66ab | 2375.70±15.71bc | 3744.33±48.67de | 1.57±0.02de |
| **T6** | 2471.66a±80.13a | 2430.43±15.20a | 3669.33±11.05f | 1.51±0.02f |
| **T7(control)** | 2240.00±38.22f | 2199.56±17.75g | 4002.66±17.14a | 1.820±0.03a |
| **T8** | 2343.33±40.99cde | 2303.10±8.24def | 3835.33±35.57c | 1.665±0.02c |
| **T9** | 2360.00cd±55.19cd | 2318.43±20.58de | 3751.33±7.53de | 1.61±0.02d |

*a,b,c Means followed by different letters are statistically different ($p<0.05$).
**T1=(control) wıthout enzymes + T2 and T3 their diet consist corn and wheat wıth enzymes, T4(control) wıthout enzymes + T5 and T6 their diet consist corn wıth enzymes, also T7(control) wıthout enzymes + T8 and T9 their diet consist wheat wıth enzymes.

### 3.2. Effect of Enzymes on Mortality

The results in (Table 4.2) showing the impact of enzymes supplementation on performance of broiler chickens fed on a diet containing corn and wheat during 1 day to 42 days. The value of mortality in all treatments at the age 1 to 42-days old were no significant. In additional there are no significant difference in mortality between all treatments. This agrees with the result obtained by Makkawi., (2009); Bin Baraik., (2010) and Mariam et al., (2013) reported that enzymes did not effect on mortality rate.

Table 4.2. Effect of supplemental enzymes on mortality of broiler chicken.
(Mean ± SE)

| Treatments | Mortality |
|---|---|
| T1(control) | 7.14±0.00 |
| T2 | 11.90±2.38 |
| T3 | 11.90±2.38 |
| T4(control) | 11.90±8.58 |
| T5 | 7.14±4.12 |
| T6 | 19.04±4.76 |
| T7(control) | 16.66±2.38 |
| T8 | 9.52±2.38 |
| T9 | 19.04±2.38 |

*a,b Means followed by different letters are statistically different ($p<0.05$).
**T1=(control) wıthout enzymes + T2 and T3 their diet consist corn and wheat wıth enzymes, T4(control) wıthout enzymes + T5 and T6 their diet consist corn wıth enzymes, also T7(control) wıthout enzymes + T8 and T9 their diet consist wheat wıth enzymes.

### 4.3. Effect of enzymes on carcass

The results in (Table 4.3) showing the impact of enzymes supplementation on performance of broiler chickens fed on a diets containing corn and wheat during 1 day to 42 days. The value of carcass in all treatments at the age 1 to 42-days old were significant ($p<0.05$).

Table 4.3. Effect of supplemental enzymes on carcass (g) of broiler chicken.
(Mean ± SE)

| Treatments | carcass |
|---|---|
| T1(control) | 1830±10.00def |
| T2 | 1925±27.538ab |
| T3 | 1965±22.913a |
| T4(control) | 1865±7.638cd |
| T5 | 1893±29.059bc |
| T6 | 1950±17.321ab |
| T7(control) | 1786±8.819f |
| T8 | 1805±16.073ef |
| T9 | 1846±14.530cde |

*a,b Means followed by different letters are statistically different ($p<0.05$).
**T1=(control) wıthout enzymes + T2 and T3 their diet consist corn and wheat wıth enzymes, T4(control) wıthout enzymes + T5 and T6 their diet consist corn wıth enzymes, also T7(control) wıthout enzymes + T8 and T9 their diet consist wheat wıth enzymes.
***carcass weight consist breast, yield, wing, bone, neck and liver.

Effect of treatments on the carcass at T2 and T3 were significant ($p<0.05$) higher carcass compare with T1 (control). Moreover, T6 was significant ($p<0.05$) higher carcass compare to T4 (control). Also, T9 was significant ($p<0.05$) higher carcass compare to T7 (control). This result agrees with the result obtained by Alam et al., (2003); Pisarski and Wojcik., (1995); Wang et al., (2005) and Jamroz et al., (1996). They reported increased carcass yield by addition of enzymes in diet and Leeson et al., (1996) reported about enzymes supplementation that significant effect ($p<0.05$) on carcass weight of broiler chicken. In addition, the cause of significant ($P\leq0.05$) T2, T3, T6 and T9, including their diet mix with enzymes compared with their controls that their diet did not mix with enzymes. Which also, the chemical composition of diet effect on the activity of enzymes because the enzymes are the best reaction with diet has high the energy value .

While T5 had no significant difference in carcass compared her control (T4). Also, T8 had no significant difference in carcass compared her control (T7). Biswas et al., (1999); Kidd et al., (2001); Hassan et al., (2011) and Café et al. (2002) reported had no significant effect on the carcass.

### 4.4. Effect of enzymes on body weight

Effect of the supplemental enzymes on body weight compared control increased ($p<0.05$) during the experiment due to the raised level of enzymes supplementation and the increase of periods age (Table 4.4). Body weight was enhancing with increased enzymes supplementation. Moreover, the effect of treatments was significant ($p<0.05$) at P4, P5, and P6. At P4 significant ($p<0.05$) higher body weight was obtained by birds in T3, T6 and T9 compared with their controls T1, T4, and T7, respectively. Also, at P5 significant ($p<0.05$) higher body weight was obtained by birds in T3, T5, T6, and T9 compared with their controls T1, T4, and T7, respectively. Next, at P6 significant ($p<0.05$) higher body weight was obtained by birds in T2, T3, T5, T6, T8, and T9 compared with their controls T1, T4, and T7, respectively. This result agrees with the result obtained by Schutte et al., (1995) and Chesson (2001) were also found the significant effect of enzymes on body weight compared with control. The cause of significant ($p<0.05$) T3, T6 and T9 at P4, also T3, T5, T6 and T9 at P5, then T2, T3, T5, T6, T8 and T9 at P6 including their diet mix with enzymes compared with their controls that their diet did not mix with enzymes. Which also, the chemical composition of diet

effect on the activity of enzymes because the enzymes are the best reaction with diet has high the energy value. In addition, there were no significant differences between treatments at other periods. While some researcher like McCraken and Quintin., (2000) reported that enzymes supplementary to diets did not impact on body weight of broilers chicken.

Table 4.4. Effect of supplemental enzymes on body weight (g) of broiler chicken that diets containing corn + wheat, corn and wheat. (Mean ± SE)

| | Periods (days) | | | | | | |
|---|---|---|---|---|---|---|---|
| Treatments | First day | P1 (2-7) | P2 (8-14) | P3 (15-21) | P4 (22-28) | P5 (29-35) | P6 (36-42) |
| T1 (control) | 41.96±0.95 | 101.66±1.99 | 200.00±5.66 | 400.00±12.45 | 805.00±14.74c | 1613.33±30.50cd | 2293.33±41.12d |
| T2 | 41.86±1.03 | 105.00±1.03 | 194.33±7.40 | 400.00±14.28 | 824.33±32.32bc | 1616.66±51.17bcd | 2390.00±44.23b |
| T3 | 42.33 ±0.86 | 101.66±2.27 | 196.66±5.44 | 403.33±7.13 | 856.66±17.25ab | 1688.33±90.89ab | 2453.33±55.66a |
| T4 (control) | 43.96±1.55 | 103.66±3.44 | 198.33±8.55 | 394.33±14.23 | 810.00±31.04c | 1616.66±39.37cd | 2330.00±75.05c |
| T5 | 42.63±1.00 | 104.33±3.18 | 204.33±3.09 | 403.33±5.64 | 826.66±1.25 bc | 1660.00±23.41bc | 2418.33±41.66b |
| T6 | 41.23±3.45 | 96.00±1.33 | 201.00±4.66 | 408.33±11.33 | 878.33±22.66a | 1693.33±40.16a | 2471.66±80.13a |
| T7 (control) | 40.4±2.33 | 97.33±2.44 | 195.00±5.47 | 389.333±5.33 | 803.33±17.44c | 1581.66±40.12d | 2240.00±38.22e |
| T8 | 40.23±4.22 | 92.66±4.11 | 193.66±6.33 | 391.00±2.76 | 830.00±33.14 bc | 1623.33±30.17abcd | 2343.33±40.99c |
| T9 | 41.567±1.33 | 99.33±1.95 | 200.00±3.44 | 395.33±6.33 | 846.66±19.33abc | 1640.00±40.25abcd | 2360.00±55.19c |

* a,b,c Means followed by different letters are statistically different ($p<0.05$).

**T1=(control) wıthout enzymes + T2 and T3 their diet consist corn and wheat wıth enzymes, T4(control) wıthout enzymes + T5 and T6 their diet consist corn wıth enzymes, also T7(control) wıthout enzymes + T8 and T9 their diet consist wheat wıth enzymes.

### 4.5. Effect of Enzymes on Weight Gain

Enzymes supplementation also increased ($p<0.05$) weight gain during most periods of the experiment in the enzymes supplemented groups comparison with the control groups. Influence of the treatments and periods on weight gain were shown in (Table 4.5). The weight gain enhanced with increase enzymes supplementation and the increase of periods age. In addition, the effect of treatments was significant ($p<0.05$) at P4 and P6. Also, at P4 significant ($p<0.05$) higher weight gain was obtained by birds in T3 and T6 compared with their controls T1 and T4, respectively. Then, at P6 significant ($p<0.05$) higher weight gain was obtained by birds in T2, T3, T5, T6, T8 and T9 compared with their controls T1, T4, and T7 respectively. This result agrees with the result obtained by Jiang et al., (2008); Sekoni et al., (2008) and Kaczmarek et al., (2014) reported that enzymes significantly improved weight gain compared with control. The cause of significant ($p<0.05$) T3 and T6 at P4 and T2, T3, T5, T6, T8 and T9 at P6 including their diet mix with enzymes supplementation compared with their controls T1, T4, and T7 that their diet did not mix with any enzymes. Which also, the chemical composition of diet effect on the activity of enzymes because the enzymes are the best reaction with diet has high the energy value. While, other treatments were not any differences between treatments and periods. In order to, the age of bird in other periods is low that is why the enzymes cannot action is very good. Choct and Annison., (1992) and Mandal et al., (2003), reported no significant effect in weight gain.

Table 4.5. Effect of supplemental enzymes on weight gain (g) of broiler chicken that diets containing corn + wheat, corn and wheat. (Mean ± SE)

| | Periods (days) | | | | | |
|---|---|---|---|---|---|---|
| Treatments | P1 (7) | P2 (14) | P3 (21) | P4 (28) | P5 (35) | P6 (42) |
| T1 (control) | 59.70±0.93 | 98.33±4.66 | 200.00±11.55 | 405.00±15.74c | 808.33±40.50abc | 680.00±51.12b |
| T2 | 63.13±2.03 | 89.333±6.40 | 205.66±10.28 | 424.33±20.32bc | 792.33±45.17abcd | 773.33±64.23a |
| T3 | 59.33±0.57 | 95.00±3.44 | 206.66±5.13 | 453.33±14.25ab | 831.66±61.89a | 765.000±35.66a |
| T4 (control) | 59.70±1.44 | 94.66±6.55 | 196.00±11.23 | 415.66±22.04bc | 806.66±50.37abc | 713.33±65.05ab |
| T5 | 61.70±2.18 | 100.00±7.09 | 199.00±7.64 | 423.33±19.25bc | 833.33±34.41a | 758.33±51.66a |
| T6 | 54.76±0.33 | 105.00±3.66 | 207.33±9.33 | 470.00±18.66a | 815.00±40.33ab | 778.33±70.13a |
| T7 (control) | 56.90±1.44 | 97.667±7.47 | 194.33±8.33 | 414.00±21.34bc | 778.33±60.12bcd | 658.33±48.22b |
| T8 | 52.43±2.11 | 101.00±5.33 | 197.33±12.76 | 439.00±30.17abc | 793.33±50.17abcd | 720.00±35.99ab |
| T9 | 57.76±3.34 | 100.66±5.44 | 195.33±13.33 | 451.33±21.44abc | 793.33±48.25abcd | 720.00±45.33ab |

* a,b,c Means followed by different letters are statistically different($p<0.05$).
**T1=(control) wıthout enzymes + T2 and T3 their diet consist corn and wheat wıth enzymes, T4(control) wıthout enzymes + T5 and T6 their diet consist corn wıth enzymes, also T7(control) wıthout enzymes + T8 and T9 their diet consist wheat wıth enzymes.

### 4.6. Effect of enzymes on feed intake

The effect of supplemental enzymes on feed intake and Influence of the treatments and periods on feed intake was significant ($p<0.05$) as shown in (Table 4.6). The feed intake decreased with increase enzymes supplementation. In addition, Effect of treatments on feed intake at P4, P5, and P6 was significant ($p<0.05$). At P4 significant ($p<0.05$) lower feed intake was obtained by birds in T8 and T9 compared with their controls T7. Then, at P5 significant ($p<0.05$) lower feed intake was obtained by birds in T2, T3, T5, T6, T8, and T9 compared with their controls T1, T4, and T7, respectively. Also, at P6 significant ($p<0.05$) lower feed intake was obtained by birds in T2, T3, T5, T6, T8, and T9 compared with their controls T1, T4, and T7, respectively. While, Decreased feed intake on the addition of enzyme has been reported by (Samarasinghe et al., 2000; Richter et al., 1995; Ranade and Rajmane., 1992). Next, this result agrees with the result obtained by Kadam et al., (1991); Pettersson and Aman., (1989). They reported about feed intake reduced with enzymes supplementation. Moreover, The results are agreement with findings of Ranade and Rajmane., (1992) who reported about effect supplemental enzymes on performance and feed intake indicate addition enzymes supplementation did not effect on feed intake of broiler chicken. The cause of significant ($p<0.05$) lower feed intake T8 and T9 at P4 and T2, T3, T5, T6, T8 and T9 at, P5 and P6 including their diet mix with enzymes supplementation compared with their controlsT1, T4, and T7 that their diet did not mix with any enzymes. Which also, the chemical composition of diet effect on the activity of enzymes because the enzymes are the best reaction with diet has high the energy value. While, other treatments were not any differences between treatments and periods. In order to, the age of bird in other periods is low that is why the enzymes cannot action is very good.

Table 4.6 Effect of supplemental enzymes on feed intake (g) of broiler chicken that diets containing corn + wheat, corn and wheat. (Mean ± SE)

| | Periods (days) | | | | | |
|---|---|---|---|---|---|---|
| Treatments | P1 (7) | P2 (14) | P3 (21) | P4 (28) | P5 (35) | P6 (42) |
| T1 (control) | 95.00±1.17 | 175.00±4.66 | 278.33±11.45 | 651.66±12.74abc | 1335.00±31.50b | 1373.33±46.12ab |
| T2 | 93.33±1.55 | 168.33±5.40 | 272.66±15.28 | 641.66±8.32bc | 1286.667±41.17cd | 1318.33±54.23de |
| T3 | 96.66±1.27 | 171.66±3.95 | 273.66±8.13 | 635.00±13.25c | 1233.33±61.89e | 1290.00±39.66fg |
| T4 (control) | 93.33±3.44 | 171.66±7.11 | 281.000±10.25 | 658.33±22.04ab | 1296.66±71.37c | 1363.33±65.34b |
| T5 | 93.33±2.18 | 170.00±4.20 | 276.00±6.56 | 641.66±11.25bc | 1250.00±41.41de | 1313.33±48.67def |
| T6 | 93.33±1.93 | 171.66±5.33 | 271.00±11.44 | 633.33±12.66c | 1220.00±53.16e | 1280.00±60.13g |
| T7 (control) | 97.66±2.44 | 180.00±5.16 | 283.33±10.45 | 668.33±15.44a | 1376.66±38.12a | 1396.66±78.22a |
| T8 | 101.66±2.11 | 174.33±3.45 | 277.66±7.76 | 638.33±18.14bc | 1286.66±61.17cd | 1356.66±60.99bc |
| T9 | 96.66±2.45 | 169.33±4.44 | 274.33±6.77 | 634.33±21.33c | 1246.66±50.25e | 1330.00±75.22d |

* a,b,c Means followed by different letters are statistically different ($p<0.05$).

**T1=(control) wıthout enzymes + T2 and T3 their diet consist corn and wheat wıth enzymes, T4(control) wıthout enzymes + T5 and T6 their diet consist corn wıth enzymes, also T7(control) wıthout enzymes + T8 and T9 their diet consist wheat wıth enzymes.

### 4.7. Effect of Enzymes on Feed Conversion Ratio

Data of the feed conversion ratio is noticed in (Table 4.7). Effect of interaction between treatments and periods on the feed conversion ratio during the final period of experiments have raised ($p<0.05$) due to the raised level of enzymes supplementation and raise of periods age. In addition, the effect of treatments was significant ($p<0.05$) at P6. Also, at P6 significant ($p<0.05$) higher feed conversion ratio was obtained by birds in T2, T3, T6, T8, and T9 compared with their controls T1, T4, and T7, respectively. This result agrees with the result obtained by Marquardt et al., (1996); Espino et al., (2000); Alam et al., (2003); Cowieson., (2005); Ramesh et al., (2006) and Pourreza et al., (2007). Who reported about the enzymes supplementation mixed with diets of broiler chicken indicates the significant effect on feed conversion ratio. The cause of significant ($p<0.05$) T2, T3, T6, T8 and T9 at P6 including their diet mix with enzymes supplementation compared with their controls T1, T4, and T7 that their diet did not mix with any enzymes. Which also, the chemical composition of diet effect on the activity of enzymes because the enzymes are the best reaction with diet has high the energy value. When, other treatments were not any differences between treatments and periods. In order to, the enzymes cannot actives are very good because the age of bird in other periods is low. In addition, some reported about this like Marsman et al., (1997). There were no significant differences in feed conversion between birds.

Table 4.7. Effect of supplemental enzymes on feed conversion ratio (g) of broiler chicken that diets containing corn + wheat, corn and wheat. (Mean ± SE)

| | Periods (days) | | | | | |
|---|---|---|---|---|---|---|
| Treatments | P1 (7) | P2 (14) | P3 (21) | P4 (28) | P5 (35) | P6 (42) |
| T1 (control) | 1.59±0.07 | 1.78±0.06 | 1.39±0.03 | 1.61±0.9 | 1.65±0.14 | 2.02±0.08 ab |
| T2 | 1.47±0.03 | 1.90±0.10 | 1.32±0.12 | 1.51±0.17 | 1.62±0.18 | 1.71±0.21 bc |
| T3 | 1.65±0.07 | 1.85±0.08 | 1.32±0.05 | 1.41±0.10 | 1.48±0.15 | 1.69±0.17 bc |
| T4 (control) | 1.58±0.04 | 1.81±0.9 | 1.43±0.06 | 1.584±0.9 | 1.60±0.12 | 1.91±0.07 abc |
| T5 | 1.51±0.02 | 1.70±0.11 | 1.39±0.12 | 1.52±0.16 | 1.50±0.19 | 1.73±0.13bc |
| T6 | 1.70±0.05 | 1.64±0.13 | 1.31±0.10 | 1.35±0.15 | 1.49±0.17 | 1.64±0.20 c |
| T7 (control) | 1.72±0.04 | 1.84±0.05 | 1.45±0.06 | 1.61±0.11 | 1.76±0.16 | 2.13±0.15 a |
| T8 | 1.93±0.06 | 1.72±0.07 | 1.41±0.05 | 1.45±0.10 | 1.62±0.13 | 1.88±0.14 bcd |
| T9 | 1.67±0.03 | 1.68±0.9 | 1.40±0.07 | 1.40±0.09 | 1.57±0.15 | 1.84±0.18 bcd |

* a,b,c Means followed by different letters are statistically different ($p<0.05$).
**T1=(control) wıthout enzymes + T2 and T3 their diet consist corn and wheat wıth enzymes, T4(control) wıthout enzymes + T5 and T6 their diet consist corn wıth enzymes, also T7(control) wıthout enzymes + T8 and T9 their diet consist wheat wıth enzymes.

# 5. CONCLUSION AND RECOMMENDATION

## 5.1. Conclusion

Supplemental enzymes with different levels of enzymes resulted in significant improvements regarding the productive performance of broiler as indicated by improvements in live body weight, weight gain, feed conversion ratio, carcass weight and reduce feed intake. Also, The best results for the characteristics included in this study were achieved by adding enzymes to the broiler diet at finisher period(P4, P5 and P6) with the level of 400mg/kg (T3, T6 and T9) and we suggest add enzymes to the broiler diet to improve the digestion of nutrients.

## 5.2. Recommendation

From this study, we are Recommend using enzymes supplementation add in finisher period with high ratio of enzymes especially 400mg per kilogram for getting best production and performance in broiler chicken.

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## OTHER FEATURES YOU WANT TO SPECIFY

## PUBLICATIONS