INTRODUCTION

Feed considers the highest cost of poultry production, about 95 % of total feed cost is used to meet energy and protein (amino acid) requirements. Improvement of poultry production is an important activity that can be done with enhancing this important issue **(Madiya, 2005).**

Two main nutritional ways may be helpful to decrease N losses in poultry production. The primary is to feed dietary protein (amino acid) as possible to be closing for poultry requirements. The second is that the dietary additives as probiotics, enzymes and organic acid for poultry to enhance N utilization. **(Ayanrinde *et al.*, 2014).**

Reducing the cost of poultry feeding is one of the important goals which is given to precision poultry production and maximize the economic efficiency of poultry farming. Nutrient management is that the highest concern for today’s modern poultry innovativeness, because feed represents, is that the greatest costs associated with poultry production. Whereas formulating a broiler’s diet, the importance is given for using the correct amount of balanced diets from protein and amino acids (AA) because it is one amongst the highest ingredients costs of poultry diets then energy ingredients and protein has the highest effect on growth performance.

During the last decades, researchers have been investigated ways which may reduce the environmental pollution by N and phosphorus that utilized for poultry productions. The accurate is important to calculate the nutritional allowance of birds to be having nutrient needs. The second approach to enhance the utilization of poultry's nutrients has to be investigated. Levels of N, Ca, P, Cu, Mn, and Zn that found in poultry excreta were significant which led to environmental pollution **(Payne, 1998; Paterson, 2002)**. However, the Nitrogen excreted in manure was estimated relative to dietary intake that is 65–70% for poultry or swine **(Han *et al.*, 2001).**

INTRODUCTION

The utilization efficiency of dietary P is considered low (20–27%) while, manure phosphorus content is a significant amount **(Ferket *et al*., 2002).**

Most P excretion is associated with swine and poultry because of the P concentration in the manure. Poultry and swine excrete about 36% of the total P output (**Crenshaw and Johanson 1995).**

Phosphorus is an essential mineral for poultry to attain maximal potential in growth performance. However, endogenous plant phytate binds to minerals, and this has negatively affect processes of digestion and absorption for other nutrients and cause decrease availability of nutrients. Phytase is an exogenous enzyme. It is a feed additive using to release phytate-bound P, so, exogenous phytase adding to diets because it is an effective method to improve P digestibility **(Adeola and Cowieson, 2011)**.

However, the level of nutrients specially Ca and P can be decreased in poultry diets when adding phytase to enhance broiler performance. Total P was reduced in the manure of broilers fed the low phosphorus diets ($P<0.01$) in broilers fed phytase **(Powell *et al.*, 2008).**

The first experiment amid to evaluate the effect of different nutritional levels, with reduction crude protein diets on growth performance, carcass characteristics, some measurements for meat quality, some bone traits, some blood parameters, economic efficiency and nutrient (N) retention and excretion in 42-day-old.

The second experiment amid to evaluate the effect of decreasing the phosphorus level in the broilers diets without or with adding phytase on growth performance, carcass characteristics, some measurements of meat quality, some bone traits, some blood parameters, economic efficiency and nutrient (Ca and P) retention and excretion in 42-day-old.

REVIEW OF LITERATURE

Nutrient management is of major concern for today's modern poultry enterprise because feed represents the greatest single expenditure associated with poultry production. Major emphasis is given to precision feeding to reduce the cost of feeding and maximize the economic efficiency of poultry farming. While formulating a broiler's diet, the importance is given for utilizing the correct amount of balanced dietary protein and amino acids (AA) because it is one of the major cost components of the poultry diets second to energy and have a major effect on growth performance.

Poultry excreta contain significant N, Ca, P, Cu, Mn, and Zn levels, which contribute to environmental pollution, particularly of water sources **(Payne, 1998; 2002).**

2.1.1. Effect of protein levels on growth performance of broilers

2.1.1.1. Effect of protein levels on body weight and body weight gain

Zain Ul Abiden *et al. (*2019) found that CP of broiler diets can be replaced by synthetic amino acids up to 17 in start diet and 15% in finisher diet, without changing on daily weight gain of broilers.

During 1 to 17 days of age **Kriseldi *et al.* (2018)** reported that reducing dietary CP % from 25.8 to 20.9% with maintaining optimal essential amino acids concentrations which had no response on body weight gain of chicks compared with chicks fed the control diet, whereas average daily gain hadn't affected with reducing dietary CP content with adding free amino acids to chicks diets.

Ospina-Rojas *et al.* (2014), **Belloir *et al.* (2017)** and **Shaoa *et al.* (2017)** reported that decreasing dietary CP levels from 19% to 15% had no significant effect on body weight and daily weight gain when adding limiting synthetic amino acids. In addition to**, Aletor *et al.* (2000)** demonstrated that decreasing CP diets from 225 to 153g/ kg had no significant effect on chicks' body weight gain**.** Moreover, the protein was an important factor revealed feasibility of protein reduction with limiting supplementation of amino acids, whilst, protein reduction (1.5%) significantly reduced the body weight gain during pre-starter and on a cumulative basis (**Kumar *et al.*, 2016)**. Furthermore, broilers fed diets containing less than 18.12% protein reduce body weight gain by 4.6% during the grower period and by 5.6% during overall period **(Rezaei *et al.*, 2004).**

The live body weight at 21 days in the experiment for different dietary treatments; T1 (17), T2 (19), and T3 (21) were 422.33g, 419.67g, and 416.67g respectively with no significant difference. During the period from 28 and 35 days, the birds that received T2 and T3 were significantly heavier than birds fed T1. But the period up to 42 days of age, broiler weights of T2 were significantly higher ($P<0.01$) than T1 and T3. That's mean the medium level of protein (19%) is good enough to maximize body weight. And through the whole experimental period, the heavier weight was for broilers fed T2 (19% protein) (**Roy *et al.* (2010);** with an excess amount of EAA while**,** reducing dietary CP below a minimum level (which was 19% in this experiment), with maintaining essential amino acids (EAA) levels, retarded growth performance **(Namroud *et al*., 2008).** Additionally, during pre-starter and starter phase, body weight gain significantly increased with birds fed low levels of CP (21 and 19%) as compared to the diets with high levels of CP (23 and 21%) moreover, feed consumption was lower in birds fed high levels of CP in addition**,** lowers dietary CP concentrations may increase the protein availability, which reflected on supporting the growth of broilers fed CP with low levels in diet broilers that mean in increasing efficiency of feeding low protein diets **(Srilatha *et al.* 2016).** Also, feeding bird's low-CP diets improve the performance of birds in hot climates **(Thim *et al*., 1997)**

Also**,** inclusion excess to a low-CP diet resulted in more reduction in body weight **(Namroud *et al*., 2008).** Furthermore, **Houshmand *et al*. (2012)** found that chicks fed the recommended levels of protein resulted in higher body weight gain and therefore heavier final BW, compared with those fed the low-protein diets. These results suggested that the **NRC (1994)** recommended levels of birds' protein diets are necessary for optimal performance, even in tropical conditions**.** Additionally**,** the reduction in CP content with decreasing essential amino acids, even a reduction in nonessential amino acids, can be causing a reduction of weight gain and conversion efficiency of the diet. **(Bregendahl *et al*., 2002; Dozier *et al*., 2008).** Also, During 8 to 21 days in male chickens, **Hernandez *et al.* (2012)** observed that there was a negative effect on weight gain of male chickens when reducing the protein content of the broiler's diets. Whereas, reducing 3% CP from the broilers diets resulted in lower growth, but there were no differences between the medium treatment and the control. While reducing the protein content of female diets by 3% did not affect weight gain during the total period.

Xue *et al.* (2016) reported that post-hatching from 14 to 21 days, Low CP diets depressed the final BW and BW gain in broilers comparing with the high CP diets (P<0.05).

On the other hand, broilers performance at market age showed that weight gain was not significantly affected by CP regimens **(Oyedeji *et al.*, 2005).** Sequentially**,** Chicks fed the three low-CP diets had no differences (P>0.05) in growth rate. However, chicks fed any of the three low-CP diets detected less weight gain than chicks fed the control diet as found by **Bregendahl *et al.*, (2002)**.

The levels of dietary CP had no significantly effect on daily weight gain, body weight and mortality **(Shao *et al.* 2017)** and **Laudadio *et al.* (2012)** found that average daily weight did not change with the reduction of dietary CP**.**

When low-protein diets are fed no effect was observed on performance **(Widyaratne and Drew 2011).** Besides**, Berres *et al.* (2010)** who conducted different trials with broilers fed low-CP diets that had generally poor performance comparing with broilers receiving adequate amino acids.

Broiler weight gain was linearly affected by the level of dietary crude protein, reducing from 1542 g at 220 g/kg to 1455g at 184 g/kg of CP, which meant, weight gain reduced with about 5.6% (87 g). Results illustrated that decreasing CP level had low effect on weight gain unless; when the reduction of CP was less than 210 g/kg weight gain reduced more. **(Oliveira *et al.* 2013).** Also**,** during the finisher phase (25- 42 d age),the level of CP in the broilers diets can be lowered up to 10 % (18.89 vs17 %) without any bad effect on broiler's growth performance **(Abbasi *et al.* 2014).**

2.1.1.2. Effect of protein levels on feed consumption

Srilatha *et al.* (2016) reported that during the pre-starter and starter phase, higher feed consumption was observed with chicks fed diets with lower CP levels compared to those fed high-CP diets. The depression in feed intake with increases in crude protein diets may be due to the deficient of CP effect/amino acids over of chicks' dietary requirement. Also, broilers received a low-CP diet with supplemented EAA led to more reduction in feed intake while**,** reducing dietary CP below a minimum level (19%), retarded feed intake as reported by **Namroud *et al.* (2008) and Darsi *et al.* (2012).** Furthermore, **Roy *et al.* (2010)** illustrated that feed consumption reduced during different stages of growth period with higher level of protein diets despite, the difference was non-significant ($p>0.05$). Moreover, reducing CP diets, feed intake was linearly increased during grower, finisher, and overall periods. **(Kamran *et al.*, 2008)**

The levels of dietary CP had no significant effect on daily feed intake and mortality rate **(Shaoa *et al.* 2017).** In addition, **Liu *et al.* (2017)** found that, when the CP level decreased from 22.5% to 20.5%, there were no effects on feed consumption at 1 to 21 d of age. Feed intake wasn't changed by dietary protein levels as reported by **Laudadio *et al.* (2012).**

During different stages of growth as the whole experimental period, feed consumption of birds with a higher level of protein reduced but the difference was non-significant ($p>0.05$) (**Roy *et al.*, 2010).**

Broiler's performance at market age showed that feed intake and water intake were not significantly affected by CP strategies ($p>0.05$) **(Oyedeji *et al.*, 2005).**

Chicks fed the three low-CP diets had no differences ($P > 0.05$) in feed consumption, or feed utilization. However, chicks fed any of the three low-CP diets detected less utilized the feed less efficiently than chicks fed the control diet **(Bregendahl, *et al.* 2002)**.

At 14 to 21 days, Low CP diets depressed the feed intake in broilers comparing with the high CP diets ($P<0.05$). However, in the low CP diets, the feed intake enhanced linearly with an increasing level of C.P ($P<0.05$)**(Xue *et al.* 2016).**

Despite reducing protein diets, the birds can meet the requirement of first three limiting amino acids may be by making minor adaptation in feed intake however, this adjustment was not adequate to increase the subsequent limiting amino acids intake as valine, isoleucine, and tryptophan (**Kumar *et al.* 2016).**

2.1.1.3. Effect of protein levels on feed conversion ratio

The growth parameters of boilers in control diet which received 20.0% CP resulted in the best feed conversion ratio in addition to, can decreasing by3 percentage of CP diets without any adverse effects on the growth performance **(Olawumi,*et al.* 2017)**.

So, using 16% and 15% CP diets resulted in significant higher in the FCR comparing with the other diets as noticed by **Belloir *et al.* (2017)**. However, **Srilatha *et al.* (2016)** found that during the pre-starter and starter phase, better feed conversion ratio significantly increased with birds fed low levels of CP (21 and 19%) as compared to the diets with high levels of CP (23 and 21%).There was significant deterioration for FCR when decreasing protein level by 0.75% (**Kumar *et al.* 2016).**

At 14 to 21 days, Low CP diets depressed the final gain: feed ratio in broilers comparing with the high CP diets ratio ($P<0.05$). However, in the low CP diets, the final gain: feed enhanced linearly with an increasing level of P ($P<0.05$) **(Xue *et al.* 2016).**

Body weight gain improved when broilers fed diets with high protein percentage (23, 21 and 20%) during the production life but best feed conversion ratio was noticed in broilers fed on low CP diets (20, 21 and 20%, in pre-starter, starter and finisher period; respectively **(Corzo *et al.* (2010)**.

While **Shao *et al.* (2017)** reported that the levels of dietary CP had no significant effect on feed conversion ratio and mortality**.** Furthermore, throughout the trial, there were no differences in feed conversion ratio among treatments **(Laudadio *et al.* 2012).**

2.1.2. Effect of protein levels on carcass characteristics of broilers

Roy *et al.* (2010) reported that dietary treatments hadn't differed significantly (p>0.05) among groups for dressing percentage, giblet weight in male, female and mixed sex. Also, the abdominal fat of male and mixed sex was almost similar in all dietary treatments and the difference was non-significant (p>0.05).In beside, **Houshmand *et al.* (2012)** illustrated that spleen weight and the bursa weight: Body weight ratio wasn't significantly affected by dietary protein level. However, a bird fed the recommended level of protein was higher in absolute weights of the bursa and spleen compared with those fed diets with low-protein. The differences were linearly related to differences in BW.

Breast and leg yields were not influenced (P>0.10) by levels of dietary CP. No change was observed in body composition from dietary CP concentration. **(Oliveira *et al.*, 2013)**

The protein factor significantly decreased the carcass yields, breast, and thigh when reducing 1.5% protein diet compared to the recommended protein group. (**Kumar *et al.*, 2016)**

In the pre-starter, starter, and finisher phases, the carcass characteristics were not affected by the change of level CP diets, that the lower levels of CP (21, 19 and 16.5% CP, respectively) and amino acids used at various phases are adequate for optimum ready to cook and breast yields**.** However**,** fat deposition in abdominal area significantly increased in chicken fed low level CP diet either all through 1 to 42 d of age or the lower levels of CP during starter and finisher phases compared to those fed higher levels of CP during all three phases. Increased fat deposition could be due to wider C/P ratio in low protein diets compared to the high CP diets **(Srilatha *et al.* 2016).**

Belloir *et al.* (2017) found that dietary CP didn't effect on the breast meat yield. While, percentage of abdominal fat was enhanced as a result of decreasing of CP content in the diet with greatest values for diets 16% and 15% CP. Thus, the dressing percentage, breast muscle percentage, eviscerated yield, thigh muscle percentage and abdominal fat percentage was not affected by levels of the dietary CP as reported by **Shaoa *et al.* (2017).**

2.1.3. Effect of protein levels on blood component of broilers

Shao, *et al.* (2017) noticed that reducing the plasma albumin and then enhancing quadratic response to depressing of dietary CP levels (p¼.042), whereas no significance was found for other parameters of serum biochemical.

At the pre-starter and finisher phases, the total protein levels in the blood plasma of chicks raised linearly with improving diets protein content**.** However, reducing level blood plasma albumin by decreasing the level of protein in the diet. **(Hernandez *et al.* 2012).** Moreover**,** the decrease in the total protein levels and albumin in blood plasma could be related to a deficit content of amino acids ingested by animals **(Corzo *et al.* 2009).**

The content of uric acid in the plasma was affected by the change of protein level in the pre-starter phase diets. Thus, the blood uric acid had higher linearly with an increasing level of protein content in the diet **(Corzo *et al.* 2009).** Blood plasma uric acid was affected by CP level consumed. The increasing of plasma uric acid value was showed by diets with high-CP as illustrated by **Namroud *et al.* (2008) and Darsi *et al.* (2012).**

Hernandez *et al.* (2012) found that broilers obtained the highest levels of protein resulted in lower levels of glucose in blood plasma (P< 0.05) might be due to increasing starch consumption when the protein level of feed reduced that because diet soybean meal was replaced by cereals. Male chicks had higher glucose levels than females in the grower and finisher phases (P< 0.05). Also, **Corzo *et al.* (2009)** reported that glucose levels were affected by the type of diet in the finishing stage. Thus, broiler's diets with the highest levels of protein resulted in lower blood plasma glucose levels this may be due to the raised intake of starch when decreasing the protein level of feed. Moreover**,** broilers fed levels of protein with the recommended requirements had low blood cholesterol than those others fed low-protein diets.

2.1.4. Effect of protein levels on nitrogen retention and excretion of broilers

Lin *et al.* (2017) reported that nitrogen excretion may be accurately decreased by feed animals according to their protein/amino acid requirements. In practice, dietary crude protein (CP) levels are always higher than those animals received their requirement. So, based on the ideal protein concept, it is possible to low levels of CP in animal diets and received requirements of the amino acid by supplementation with synthetic amino acids. Adding synthetic amino acids to diets with low-CP resulted in reducing N excretion in poultry without any bad effects on the growth performance of animals. However, **Carter and Kim (2013)** explained that excretion excess N by poultry arises that mainly from dietary amino acids and may affect on volatilization of ammonia which increased from animal production systems subsequent air quality can affect**.** Also, **Nahm (2007)** confirmed that losses of nitrogen are mainly due to catabolism of amino acid and metabolism of muscle which resulted in protein turnover.

Corzo *et al.* (2009) fount that decreasing CP in starter and finisher phases in the broiler diets enhanced N percentage retained.

Increasing the number of feeding phases in poultry seems beneficial. In the finisher broilers, increasing growth performance was observed by depressing dietary lysine, amino acid with sulfur, and threonine contents underfeeding program. In the finisher broilers, the excretion of nitrogen was decreased **(Pope *et al.* 2004).**

Reducing the nitrogen loss to the environment can result from decreasing the excreta nitrogen **(Sterling *et al*., 2005; Kamran *et al*., 2010).** Besides**,** the reduction of dietary CP content resulted in a decrease in N excretion. However, there weren't any differences for N retention and excretion records as a percent of N intake among treatments. Also, litter moisture and N contents were decreased with low CP diets; however ash content remained without change **(kamran *et al.* (2010).**

Namroud *et al.* (2008) reported that the reduction of CP diets resulted in a significant decrease in the nitrogen excretion, but it was developed by adding a mixture of amino acids (essential or nonessential) at each level of CP. Furthermore, the reduction of CP diets decreasing the uric acid excretion. Moreover, nitrogen excretion was increased by adding an excess amount of EAA with broiler fed 17% CP diet but did not change the rate of uric acid excretion.

The percentage of N retained increased in the chickens by decreasing the protein level in the diet during the starter and finisher phases ($P < 0.001$). **(Hernandez *et al.* 2012)**

Formulation type did not affect nitrogen excretion, while, a reduction 1.5% protein of the dietary protein level significantly minimized nitrogen excretion compared to the normal protein diet. (**Kumar *et al.* 2016)**

Nitrogen content in manure was decreased with decreasing dietary CP levels. **(Shaoa *et al.* 2017)**

Olawumi *et al.* (2017) indicated that the low protein diets, there were relatively low nitrogen retention (NR) and apparent nitrogen digestibility (AND) for birds even with essential EAA supplementation.

As a study by **Belloir *et al.* *(*2017)** who found that when dietary CP content was decreased, the efficiency of retention for nitrogen enhanced from +3.2% to +3.6%/CP percentage point**.** also, decreasing CP content by less than 2 percentage units of broiler diets or by 13% units in nitrogen intake led to more than an 18% of litter N content was depressed **(Ferguson *et al.*, 1998).**

2.2.1. Effect of calcium, phosphorus, and phytase on growth performance of broilers

2.2.1.1 Effect of calcium, phosphorus, and phytase on body weight and body weight gain of broilers

Gautier *et al.* (2018) Found that broilers body weight gain was enhanced by the addition of phytase enzyme regardless of the mineral matrix, however, enhanced the ratio of Ca: P from 2.00:1 to 2.65:1 via depression of mineral concentrations in diets caused an overall decrease in body weight gain (BWG) and with the supplementation of phytase, the reduction was minimum level.

Kahindi *et al.* (2017) studied broilers fed phosphorus by levels zero, 50% and 100% from the requirement in its diets, the results indicated that reducing the content of available P had negatively affected that resulted in depression in the growth of the broiler chickens. Furthermore**,** they showed that there was a reduction ($P<0.05$) in average daily gain (ADG) with reducing dietary phosphorus by 50% in bird's diets**.** Moreover**,** giving broilers sufficient amounts of dietary phosphorus to meet its requirements had higher average daily gain (ADG) than those fed diets with50% of requirements**.**

Results of studies by **Ravindran *et al.* (1995); Woyengo** and **Nyachoti (2013)** reported that the majority of plant phosphorus (P) as based feedstuffs is bound as phytate that is very poorly digested by non-ruminant animals **(NRA).**

A high Ca content depresses phytate hydrolysis and P availability to the bird due to chelate formation leading to lowered feed consumption. **(Selle *et al*., 2009; Wilkinson *et al*., 2014)**

Phytase modestly increased body weight gain ($p = 0.08$) and feed intake ($p = 0.04$) and there was a trend for an interaction between barley and phytase for gain ($p = 0.07$) and intake ($p = 0.03$). **(Thacker *et al.* 2009)**

Phosphorus supplementation from mono-dicalcium phosphate increased ($P < 0.05$) BW gain, and increased ($P < 0.05$) livability, regardless of the level of phytate in the diet, which resulted in a significant P source × phytate interaction. **(Santos *et al.* 2014)**

2.2.1.2. Effect of calcium, phosphorus, and phytase on feed consumption of broilers

Feed consumption of chicken fed deficient of phosphorus diets with adding phytase enzyme at different levels was almost equal to those fed control diet. Supplementation of phytase enzyme enhanced ($P<0.05$) broilers feed intake that fed a deficient of phosphorus diets. Furthermore, the results illustrated that adding phytase with level 1000 PU/kg and higher released phytate P that was maximized the utilization of phosphorus for growth in the same manner as would phosphorus supplied by dicalcium phosphate **(Abo Omar and Sabha 2009).** In addition to**,** the ration containing phytase did not effect on ($p > 0.05$) N intake, but it was better than the control diet whereas it decreased ($p < 0.05$) N excretion by 9.1% and enhanced N retention (g/bird and %) by 6.0% and 5.7%, respectively (**Graña *et al.* 2013)**. While, **Li *et al.* (2016)** found that feed intake was not influenced by diet components at 9 days of bird age, but was lowest in broilers fed that diet with 0.2% NPP level at 19 d of age ($P<0.05$).

Results of **Rousseau *et al.* (2016)** indicated that the reduction from 0.45 to 0.30% in NPP levels for broilers fed the highest level of Ca that led to reducing litter DM (−18 points, Ca× NPP, $P<0.001$). Increasing of litter Ca was observed for birds that fed diets with 1.0% Ca comparing with birds that fed 0.6% Ca diets, especially with the lowest level of NPP (+11 and +8.1 mg/g for diets with 0.30% and 0.45% NPP, respectively; Ca× NPP, $P<0.001$). In addition to, manure P for broilers fed the diet with 0.3% NPP was lower than that broilers fed diet with the 0.45% NPP, especially at the lowest level of Ca (−3 and −1 mg/g, for diets with 0.60% and 1.0% NPP, respectively; Ca× NPP, $P<0.001$). Birds fed P diets with sufficient amounts of P requirements average daily feed intake (ADFI) was higher ($P<0.001$) than those fed diets with P reduced by 50%. **(Kahindi *et al.* 2017)**

2.2.1.3 Effect of calcium, phosphorus, and phytase on a feed conversion ratio of broilers

Lin *et al.* (2017) illustrated that broilers feed: gain ratio in the 0.18% dietary NPP group was higher ($P<0.01$) than those broilers in other groups**.** In addition to, **(Pieniazek *et al.* 2017)** during day 7 and day 14, supplementing the diet with phytase at different levels reduced ($P<0.05$) feed conversion ratio during day 7 compared with positive control diets; however, the inclusion of phytase with level 2,000 U/kg (*P*<0.05) reduced feed conversion ratio throughout the trial. Moreover, decreasing available phosphorus to 0.23%in the negative control reduced feed conversion comparing with the other groups through the experiment. Similarly, the reduction in available phosphorus from 0.45% to 0.35% depressed (*P*<0.05) feed conversion through starter period at d 14 and d 21.Cumulatively through d 14 and d 21, the adding phytase with 250 and 500 U/kg levels enhanced (*P* <0.05) feed conversion comparing with control andPC1 diet; addition of phytase at 2,000 U/kg improved (*P* <0.05) feed conversion comparing with the PC1 and PC2 diet. **(Pieniazek *et al.*, 2017)**

Birds fed P diets with sufficient amounts of P requirements and those fed diets with P reduced by 50%. The feed conversion ratio was not affected by diet (P>0.10). **(Kahindi *et al.*, 2017)**

However, **Rousseau *et al.* (2016)** found that feed conversion ratio (FCR) was almost higher for birds fed diets containing the highest level of Ca and the lowest NPP concentration (*P*<0.05). Also, At 35 d, chickens had equivalent tibia ash weights except for birds that had low body weight which fed the diet with 1.0% Ca percentage and 0.30% NPP percentage (H1; −9.0%; Ca× NPP, *P*<0.01).

Phytase supplementation with different levels enhanced (P<0.05) feed conversion ratio for birds at marketing weight comparing with low Phosphorus diets **(Abo Omar and Sabha 2009)**

Furthermore**, Pieniazek *et al.* (2017)** found that supplementation of phytase at 2,000 U/kg improved (*P*<0.05) feed conversion ratio in both grower and finisher phase compared to the control diet. After of the trial on day 42, the reduction of dietary available phosphorus reduced (*P* <0.05) cumulative feed conversion ratio; the inclusion of phytase at both inclusion levels enhanced (*P* <0.05) feed conversion ratio compared with control diet; however the inclusion of phytase at 2,000 U/kg increased(*P* <0.05) FC to levels that were comparable to the PC diet.