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SİİRT UNIVERSITY
INSTITUTE OF SCIENCE

EFFECT OF DIETARY SUPPLEMENTATION WITH DIFFERENT LEVELS OF CREATINE MONOHYDRATE ON PRODUCTIVE AND CARCASS PERFORMANCE OF BROILER CHICKENS

MS THESIS

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September -2017
SİİRT

THESIS ACCEPTANCE AND APPROVAL

This thesis entitled “Effect of Dietary Supplementation with Different Levels of Creatine Monohydrate on Productive and Carcass Performance of Broiler Chickens” presented by Nma Hassan Ahmed AHMED under supervision of Asst. Prof. Dr. Muhammet Ali KARA and Second-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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Nma Hassan Ahmed AHMED

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.

ACKNOWLEDGMENT

I would first like to thank God without whom nothing is possible. I would like to acknowledge and thank the following important people who have supported me, not only during the course of this project but throughout my Master’s degree. I would like to thanks, My Supervisor, Asst. Prof. Dr. Muhammet Ali Kara for his meaningful assistance, tireless guidance, and patience I would also like to thank my II-Supervisor: Asst. Prof. Dr. Saman Abdulmajid Rashid Without access to her hard work this research would not have been possible. Saman’s encouragement and belief in what she does have inspired me.Special thanks to my uncle Mr. Ali Ahmadi who took the responsibility for the total expenses of my studies

I would also like to thank my parents, my brothers for their moral and material assistance. Special mention goes to Jeanne whose literature, advice and encouragement have been priceless.

Finally, I would like to thank all my close friends and family. You have all encouraged and believed in me. You have all helped me to focus on what has been a hugely rewarding and enriching process.

Nma Hassan Ahmed AHMED
SİİRT-2017

LIST OF CONTENTS

LIST OF TABLE

Page

LIST OF FIGURE

Page

LIST OF ABBREVIATIONS

Abbrevıatıons	**Statements**
Cr	**:** Creatine
CHM	**:** Creatine monohydrate
ATP	**:** Adenosine triphosphate
ADP	**:** Adenosine diphosphate
PCr	**:** Phosphocreatine
CrP	**:** Creatine phosphate
BW	**:** Body weight
FI	**:** Feed intake
WG	**:** Weight gain
FCR	**:** Feed conversion ratio
P	: Peroid

ABSTRACT
MS THESIS

Effect Of Dietary Supplementation With Different Levels Of Creatine Monohydrate On Productive And Carcass Performance Of Broiler Chickens

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2017, 34 sayfa

The study was conducted during the period from March 8th, 2017 to April 19th, 2017 at the Poultry Farm of Animal Sciences Department, College of Agricultural Sciences, University of Sulaimani to investigate the effects of dietary supplementation with different levels of Creatine Monohydrate on productive and carcass performance of broiler chickens. By using 300 one-day old of Ross 308 broiler chicks, divided into three periods with 4 treatments for each 3 replicates based on completely randomized design for 42 days. Feed and water were provided as ad libitum.Chicks were divided into four treatments for 3 periods (1-42, 28-42 and 35-42) days, control 30 birds and for each treatment 90 birds; each treatment for one period contained three replicates of 10 birds. Dietary Creatine Monohydrate was added to the diet from the first day to the end of experimental which lasted 42 days at levels of 0% (Control), for each period 0.05%(T1),0.075%(T2) and 0.1%(T3). The body weight had significantly ($P<0.05$) affected by Creatine Monohydrate supplementation at period (1-42), Creatine Monohydrate had a significantly ($P<0.05$) effect on weight gain at period (1-42), it had significantly ($P<0.05$), effect on breast meat yield at period (1-42). However, Creatine monohydrate had no significant effect on feed intake at the period (1-42, 28-42 and 35-42), there was no significant effect on feed conservation ratio, mortality and Thigh meat yield at periods (1-41, 28-42 and 35-42). Creatine monohydrate had no significant effect on (body weight, weight gain, and breast meat yield) at periods (28-42 and 35-42).

Key words: Broiler Chicks, Creatine Monohydrate, Diet, Performance,

1. INTRDUCTION

Creatine, an amalgamated build on amino acids (arginine, glycine, and methionine), produced in the liver, kidneys and pancreas, Newly Creatine (Cr) supplements are extensively disseminated as a performance- increase additive used as athletic assistance to increase high-intensity athletic performance. Scientists have referred to the utilization of creatine as an energy source by skeletal muscles; therefore, Creatine is significantly well-known inside mainstream researchers. Based on such research, creatine monohydrate (CMH) has become one of the better extensively used dietary supplements in the world with an annual evaluated utilization of 2.7 million kilograms. Day by day interest for Cr is met through two procedures, either by ingestion of Creatine taken in through eating regimen or by "de novo biosynthesis" (Balsom et al., 1994; Williams et al., 1999; Wyss and Kaddurah- Daouk, 2000).

Over the most recent 20 years, Cr has turned into an extremely well-known dietary supplement. In the U.S.A. alone, a yearly sale of Cr totaling over $400 million has been announced since the year 2000 (Bird et al., 2003; Maughan et al., 2004) In the process of de novo biosynthesis, Creatine is composed of the body itself. It is composed outside of the muscle itself and then carried to the muscle via the bloodstream. Human studies have demonstrated that Cr supplementations increment slender tissue mass and muscle fiber measure. (Burke et al., 2003). The expanded concentration of intramuscular phosphocreatine attract water into the muscle cell and increase the cell amount (Hultman et al., 1996).

Earlier research has implied that creatine can aid the body expeditiously provide ATP through the creatine-phosphocreatine energy shuttle system, better the muscle aerobic metabolism increase the natural oxidation of mitochondria, keep up the ATP concentration and buffer lactic acid in muscle aggregation (Bessman and Carpenter,1985). This may help clarify the expansion in lean-tissue mass found in Cr studies (Burke et al., 2003). Growth performance of broiler chickens has been incremented especially over the last 30 years chiefly due to improvements of nourishment and controlled environment. Appropriately, it takes just 33 days to capacity completing body weight of around 2 kg (Wilson, 2005). As creatine keeps on being separated in the body's metabolic procedures, many animals such as growing broilers are not capable of production, enough creatine in serious cultivating conditions (Casey et al., 2011).

Creatine keeps up to maintain the energy balance in cells and tissues by tolerating high energy phosphate groups from adenosine triphosphate (ATP) to make phosphocreatine (PCr) and afterward discharging the high-energy phosphate group to form ATP when energy demand is high (Guimarães-Ferreira, et al.,2014). The additive of creatine can save arginine and improvement growth performance of poultry (Baker et al., 2009). Dietary incorporation of CMH (1200 mg/kg) for 14 days before slaughter significantly reduce drip loss, transported 3 h during the summer which keeps up the meat quality by lactate content and glycolytic potential the pectoralis major of broilers (Zhang et al ., 2014). Sadly, this growth rate is joined by increased muscle fat ratios testimony, (Zubair and leeson, 1996). Late discoveries likewise feature the impact of Cr supplementation on the expansion of skeletal muscle and brain total Cr and PCr concentrations, with a much more noteworthy level of increment found in organs with low pattern Cr substance, for example, kidney and liver (Ipsiroglu et al., 2001). These discoveries are important to the poultry industry given that the major breast muscle of broilers and turkeys (Pectoralis major) contain primarily fast-twitch (type IIB) muscle fibers (von Lengerken et al., 2002). Creatine monohydrate (CMH) is one of the primary substance types of creatine, and its loading has been extensively studied due to its hidden ergogenic effect in sports performance (Harris et al., 1992; Vandenberghe et al., 1997).

2. LITERATURES REVIEW

2.1. Protein

Any of a category of nitrogenous organic compounds that have big molecules composed of one or extra-long chains of amino acids and an important part of all living organisms. Afterwards, poultry eats up protein, the digestive step breaks down the protein into amino acids. The amino acids are then absorbed by the blood and carried to cells that change over the individual amino acids into the specific proteins needed by the animal. Proteins utilized as a part of in the structure of body tissues such as muscles, skin, beak, feathers, ligament, and nerves and so high in protein on Egg white. Growth rate and feed efficiency of chicks enhance with the increment in dietary protein, on the body composition and performance of broiler (Jackson et al., 1982).

2.2. Amino acids

Organic mixed are containing amine (-NH2) and (carboxyl COOH) functional groups, alongside chain(R group) specific to each amino acid. The component of an amino acid is hydrogen, nitrogen, carbon, and oxygen. Even though different elements are determined in the side chains of certain amino acids. About 500 amino acids known and can be classified in many ways (Wagner. 1983). Amino acids are commonly isolated into two categories: essential and nonessential. Essential amino acids are those that cannot be made in sufficient amounts to meet the needs of the animal. The nonessential amino acids are those that the carcass can make in adequate quantities as lengthy as a convenient starting material is accessible. They are 22 amino acids commonly found in food and ingredients. Ten amino acids are essential and should be provided in the nutrition. Poultry nutrition typically contains an assortment of feedstuffs because no single ingredient is able to supply all the needed amino acids in the right levels. Compose amino acids are the necessary part of the protein. Ten amino acids are essential to the poultry :(Lysine, Methionine, Arginine, Threonine, Phenylalanine, Valine, Tryptophan, Isoleucine, Histidine, Leucine,).

2.3. Creatine

Monohydrate is one of the most popular nutritional supplements used by competitive athletes and recreational fitness enthusiasts. Creatine, a compound based on amino acids (methionine, glycine and arginine), synthesis in the kidneys, pancreas and liver (Van Pilsum et al., 1972). May participate in this market because it is an essential precursor in the production of muscle energy, additionally favoring muscle growth.The results of many, but not all, studies suggest that physical performance involving short-term high-intensity exercise. Repeated bursts of explosive power can benefit from creatine supplementation. Supplementation by various protocols has been shown to elevate muscle creatine levels. Continuous supplementation with a lower dose is required to maintain these elevated levels. The purpose of this paper is to determine if these elevated levels maintained by consuming meat to obtain the necessary amount of creatine. First, the functions of creatine will be presented, followed by a description of creatine synthesis, then protocols to maximize muscle creatine levels, and finally, a section on the creatine content in food along. Give a summary of the amount of meat required for maintenance of elevated levels then.

2.4. Historical use of creatine

In 1832, the French scientist Chevreul discovered a new ingredient of meat to which he gave the name creatine, according to the source from which it was extracted (kreas: Greek for flesh). The German scientist Justus von Liebig confirmed that creatine is a regular constituent of flesh. Creatine levels in wild animals 10 times higher compared to captive animals suggesting that physical activity might have an influence on the amount of creatine present in flesh. A meat extract (Liebigs fleischextrakt) was the only source for creatine supplementation over the next century.

Anecdotal reports in the early 1990's suggested that creatine supplementation might improve sports performance. British track and field 1992 Olympic champions Linford Christie (100 m dash) and Sally Gunnell (400 m hurdles) reportedly used creatine, as did the Cambridge University rowing team in training for three months before defeating the heavily favored oxford.

Numerous controlled clinical trials followed in the upcoming years proving the benefits of creatine supplementation in different sports. Many celebrated professional athletes and Olympic champions acknowledge creatine use an estimated 80% of the athletes at the 1996 summer Olympics in Atlanta used creatine. Mark Mc gwire, one of major league baseball's greatest sluggers, used creatine during the 1998 season and his legendary race to set the single season home run record, making creatine the most popular sports nutrition in the US. Creatine supplementation has become a common practice among professional, elite, collegiate and amateur athletes to enhance exercise performance. Today, creatine is one of the best-studied supplements in the field of sports nutrition and its proven efficacy as an ergogenic substance was review and accepted by numerous authorities.

2.5. The composition of Creatine

Really is not that complex. It is a nitrogenous organic acid. With the mixture of sarcosine, cyanamide, and water. The acids in which scientists make their creatine. Now there is a lot more expensive creatine, with more amino acids, and chemicals, that will have more effects on the human body. Other chemicals naturally produced are glycine, arginine, and methionine.

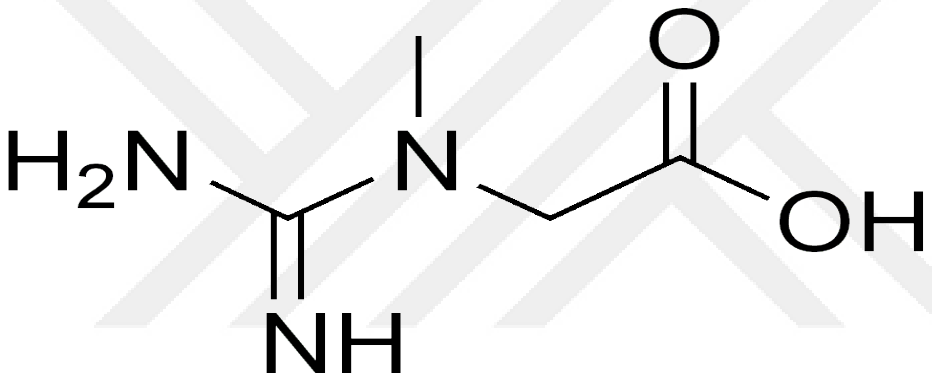

Figure 2.1. Chemical composition of Creatine

2.6. Creatine Biochemistry:

Creatine compose involves the three amino acids methionine, arginine and glycine. The ultimate step in this reaction is a permanent transmethylation (extension of a methyl group) to production the creatine molecule. The enzymes for creatine synthesis are found in the, liver, pancreas and kidney with the major of make occurring in the liver. Synthesized creatine is produced outside the muscle and should be carried by the blood to the inside muscle. Exogenic (dietary) creatine is absorbed straight from the intestinal into the blood and carried to the skeletal muscles. In the creatine Natural plasma concentrations of range from 50 - 100 won. (Demant and Rhodes, 1999). With additive, plasma creatine levels have been shown to increase to above 500 ttmol/L 1 hour after direction (Balsom et al., 1994). Creatine take-up into the muscle happens against a concentration gradient more possible via a Na-dependent creatine carrier. The normal level of whole creatine (free creatine plus creatine phosphate) in skeletal muscle is 125 mmol/kg dry matter (Greenhaff, 1997). The average intracellular concentration seems to be 90- 150 mtnol/lcg (Balsom et al., 1994). Around 95% of the body's whole creatine is found in skeletal muscle. The additional 5% can be found mostly in the brain, testes, and heart. In skeletal muscle, about 40% of the creatine is free creatine through the other 60% is creatine phosphate. Without exogenic creatine, the amount of creatine poverty to creatinine estimated at 1.6% per day (Crim et al., 1976). Therefore, the normal turnover amount of a 70kg person, with a total creatine pond of 120g, is near 2g per day. Creatinine then filtered by the kidneys and expelled in the urine. Creatine lost this method is replaced by together endogenic (liver synthesis) and exogenic sources. Endogenous synthesis is believed to be controlled by exogenous creatine consumption through a response mechanism (Walker et al., 1960).

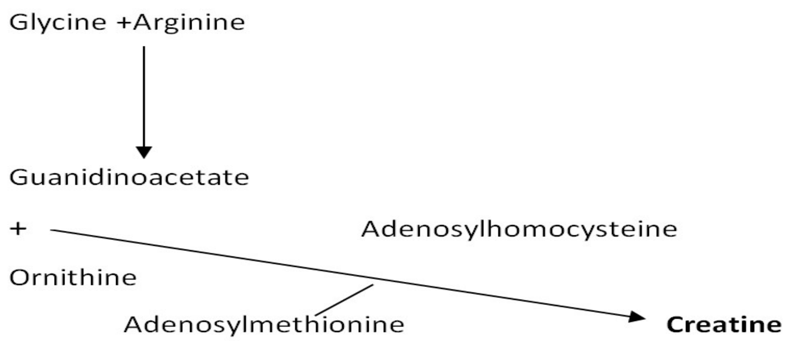

Figure 2.2. Synthesis of creatine

2.7. Phosphocreatine Synthesis

Phosphocreatine (PCr) is shaped when an energy rich phosphate group is removed since ATP and attached to Cre in creatine in a reversible reaction. The phosphorylation cycle of Creatine and Phosphocreatine is very important to energy delivery and for the maintenance of energy in cells (Guimarães-Ferreira, 2014). Creatine kinase facilitates the conversation of energy rich phosphate groups between Creatine and Phosphocreatine, thus using adenosine triphosphate (ATP) and adenosine diphosphate (ADP) as metabolism intermediates (Wyss and Kaddurah-Daouk, 2000; Brosnan et al., 2010; Guimarães-Ferreira, 2014). The “shuttle” theory is the periodic move of ATP and ADP through the procedure of Phosphocreatine (PCr) and creatine (Cre).Start with the formation of ATP in the mitochondria, Creatine slices the phosphate from ATP forming ADP and PCr. Phosphocreatine, due mainly to size and ease of dispersal(Yoshizaki et al., 1990; Minajeva et al., 1996), movement from the mitochondria to the cytoplasm where isomers of Creatine remove the phosphate group from Phosphocreatine (PCr), form Cre, regenerating ATP from ADP. The regenerated ATP is changed back into ADP by an ATPase in muscle, brain, or other tissues, wherever the phosphate group used for metabolic work (e.g., muscle contraction). Creatine diffuses back into the mitochondria to be used again the cycle(Wyss and Kaddurah-Daouk, 2000; Guimarães-Ferreira, 2014).

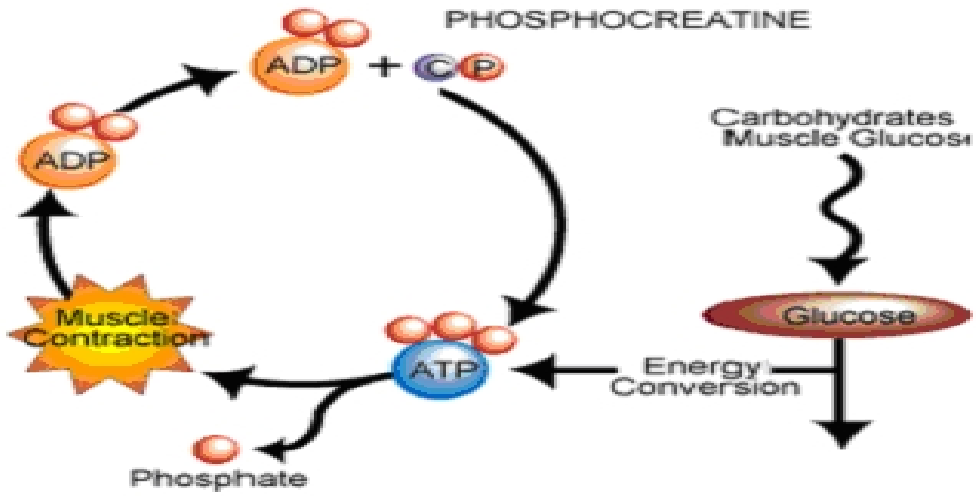

Figure 2.3. Synthesis of Phosphocreatine

2.8. Creatine Supplementation

Creatine supplement can principal to improve performance. More, but not total, studies showed that creatine additive increases the capability to yield higher muscular power output during the small division of exercise. By the highest enhancements in performance seen during repeated high –power output exercise bouts. For a studies effects of creatine supplementation (Graham and Hatton; 1999).

2.9. Creatine function

Creatine phosphate (CrP) is the proposition to have manifold roles in a muscle cell. One is as an impermanent energy buffer. Muscle mitochondria finally supply all the ATP to a skeletal muscle but mitochondria cannot yield a big amount of ATP fast from a resting station. A "reserve" or "buffer of ATP is necessary to deliver energy in transitions from rest to exercise and to provide energy at excessive intensities. This buffer is current in the muscle cell as creatine phosphate (CrP). The availability of creatine phosphate (CrP) normally thought to be any contractions. The results in enhancing in cellular ADP concentration and the growth of tiredness via a reticence of muscle cross -bond formation (Greenhaff et al., 1997). Little period high-intensity exercise, for example, a 100m dash, weight exercise, or a 25m swim, needs an instant source of energy. The energy for these kinds of activities is nearly all supplied by high-energy phosphate (ATP and CrP). Muscle contraction causes the break of ATP to ADP + Pi. ADP can be resynthesized to ATP via phosphate (CrP).

(CrP + Arip ll+ 4 - Creatine Masse ----> (Cr + ATP) *

The additional character of CP is as a spatial energy buffer. Creatine and creatine phosphate distributed between the mitochondrial product sites and muscle operation sites, a processing referred to as the "CP shuttle" notion. As a result of their smaller size, creatine and CP diffuse through the muscle cell quicker than bigger ATP and ADP molecules and have possible to "shuttle" high-energy phosphates from their site of making (mitochondria) to their site of use (contractile proteins). When a creatine phosphate molecule is breaking by creatine kinase, providing energy for ATP resynthesize, the resulting free Creatine distributes to the mitochondria! Membrane. At the membrane, the Creatine is rephosphorylated to CP by locally higher ATP concentrations. The resynthesized CP then diffuses back to the contracted proteins where its hidden energy used to produce ATP from ADP. The third rolling of creatine phosphate is, for example, a proton buffer. At the start of the maximum physical action, blood lactate accretion begins to happen. Lactate addition results in enhance in le (protons), which reductions muscle pH and in turn, results in a reduced muscle performance. Fr is moreover incremented by ATP breaker (see reaction *). Creatine acts to buffer pH by used H+when the creatine kinase reaction favoritisms ATP resynthesize. By stopping H+build up, creatine assistances continue usual pH in the muscle cell. A finishing role of creatine phosphate (CP) is to adjust glycolysis. A key enzyme in glycolysis, phosphofructokinase (PFK), is at smallest partially inhibition by creatine phosphate (CP). During intense physical activity, as CP decreases, PFK becomes less inhibition and the level of glycolysis increment to resynthesize most ATP for the constricting muscle. Creatine, so, has potential as an ergogenic if supplementation can improve one or some of its functions in the muscle cell.

2.10. Creatine Levels in Muscle

Hultman et al., (1996) informed that two different dosing procedures resulted in the same enhance in all creatine in muscle. A dose of 20 g per day for six days or 3 g per day for 28 days resulted in a 20% increment in all muscle creatine. They moreover reported that increase levels of creatine should be maintained with an additive of only 2 g per day. In the absence of this supplementation, creatine levels in the muscle slowly decline to baseline levels. At 30 days after the finale of additive, muscle concentrations were no dissimilar from prior to creatine ingestion. (Hultman et al. 1996) concluded that there are two similarly effecting means of reaching increase muscle creatine, one procedure that will raise levels in 1 week and one that will raise levels of the course of 28 days. Therefore, it seems that an effective method to get immediate and continued performance benefits from creatine ingestion may be to use a loading dose of (0.3 g/kg body mass per day) for a period of 5 - 6 days, following by upkeep dose of (0.03 g/kg body mass per day) later the load part (Hultman et al., 1996).

Another study viewing at long-term creatine use reported significant increment, above placebo, in maxim strength and fat five mass after additive for four days at 20 g per day followed by a lesser dose of 5 g per day though on a ten weeks strength exercise program. It was additionally watched that suspending creatine admission returned muscle phosphocreatine to pre-supplementation levels inside four weeks (Vandenberghe et al., 1997).

There does seem to be a physiological maximum for all creatine concentration that takes been appraised at 150 - 160 mmol/kg, which is unlikely to exceed irrespective of further enhance in creatine feasting (Balsom et al., 1994, Greenhaff et al., 1997). In addition, around 20- 30% of individuals who undergo creatine-loading protocols are "nonresponders", these individuals show little/no increment in muscle all creatine later a period of additive (Greenhaff et al., 1997). More likely, individuals who start out with high levels of muscle total creatine will respond less than individuals who have normally low levels of muscle creatine. Whichever from genetics or the nutrition (i.e. vegetarians). Once taken with a big amount of carbohydrate (around 370 g per day), when loading, muscle creatine levels were raised in all subjects close to the upper limited of 160 mmol per kg dm (Greenhaff et al., 1997).

2.11. Creatine Supplementation in Livestock Nutrition

The additive of creatine prospective as a way to increase meat quality was highlighted in a review by (James et al. 2002). When creating additive has little result on improving body size and weight, indication exists that supplementing creatine has a useful effect on post-more biochemical processes (Stahl et al.,2001; Berg and Allee, 2001; Berg et al., 2003; Stahl et al., 2007). Swine fed diets additive for 5 days with creatine showed meat with larger water holding capacity comparison to controls (Berg et al., 2003). Further indication exists to corroborate data found inhuman studies representative that creatine effects differ between individuals who are responders and non-responders.

In swine, a genetic compassion connected to type is responsible for the different creatine additive effects in responders and non-responders (Young et al., 2007). A comparison of meat quality between (Duroc and Landrace)types show that Durocs are most likely to respond to creating additive resulting in higher post-mortem pH values and higher water.

Holding capacity (Young et al., 2005). In an additional study, ham from creatine additive Duroc swine had a higher creatine phosphate(CrP) concentration in the muscle ante-mortem leading to a relaxed pH decline post-mortem and a lower L*value comparison to the creatine supplemented Landrace swine (Lindahl et al.,2006).Alternatively, studies exists that creatine additive has no effect on meat quality and in some cases may result in reduced quality (Nissen and Young, 2006; Stahl et al., 2007) creatine supplementation that reduced quality of muscle attributes is a result of exceeding a maximal number of period five days (Stahl et al., 2001).

3. MATERIALS AND METHODS

This study was conducted at the Bakrajo poultry breeding field, Animal Production Department, Faculty of Agricultural Science, the University of Sulaimani from the North Iraq during the period from March 7th, 2017 to April 17th, 2017 to study the Effect of Supplemental Creatine monohydrate on productive and carcass Performance of Broiler Chicks Fed on Diets. A total of 300 chick's un-sexed one-day-old broiler chicks (Ross 308) were divided into three periods (P1=1-42, P2=28-42 and P3=35-42) day. In addition, the chicks were divided into four treatment, each treatment was replicated to three replications and each replicates containing 10 chicks.

3.1. Preparation of the experimental on field

Broiler chicks were housed in clean well – ventilate floor previously disinfected by potassium permanganate and formalin, Then the floor, wall and ceilings were thoroughly cleaned by spraying forced water with the help of a hosepipe. After cleaning, feeders, waterers, buckets, brooder and all other necessary equipment were Disinfected by formalin, the feeders and waterers were dried before use, at a depth of about 5 cm fresh and dry rice husk was used as litter, the chicks have been randomly distributed into the one floor and chicks were raised on floor cages (120*110*80).

3.2. Experimental protocol and layout

Experimental protocol a total of 300 un-sexed chicks with divided into three periods(P1, P2, and P3) day. Also, the chicks were divided into four subgroups t. First group of chicks is normal group as control that diet consist feed without Creatine monohydrate(0) in (P1) , the second group of chicks that diet consists feed with 500mg/kg Creatine monohydrate in (P1) ,also consists feed with 500mg/kg Creatine monohydrate in (P2) and consists feed with 500mg/kg Creatine monohydrate in (P3) , the third group of chicks that diet consist feed with 750mg/kg Creatine monohydrate in (P1) ,also the consists feed with 750mg/kg Creatine monohydrate in (P2) and the diet consist feed that with 750mg/kg Creatine monohydrate in (P3), the fourth group of chicks that diet consists feed that contained 1000mg/kg Creatine monohydrate in (P1), also the consists feed with 1000mg/kg Creatine monohydrate in (P2) and the diet consist feed that with 1000mg/kg Creatine monohydrate in (P3) (table 1).

Figure 3.1. Training area of chicks into the replicates

Table 3.1. The type of feed and level of (Creatine Monohydrate) offered for each treatment at forty-two days periods of experiment.

Treatment	Days		
	period (1-42)	**period (28-42)**	**period (35-42)**
T1	Creatine(0)	Creatine(0)	Ccreatine(0)
T2	Creatine(500mg/kg)	Creatine(500mg/kg)	Creatine(500mg/kg)
T3	Creatine(750mg/kg)	Creatine(750mg/kg)	Creatine(750mg/kg)
T4	Creatine(1000mg/kg)	Creatine(1000mg/kg)	Creatine(1000mg/kg)

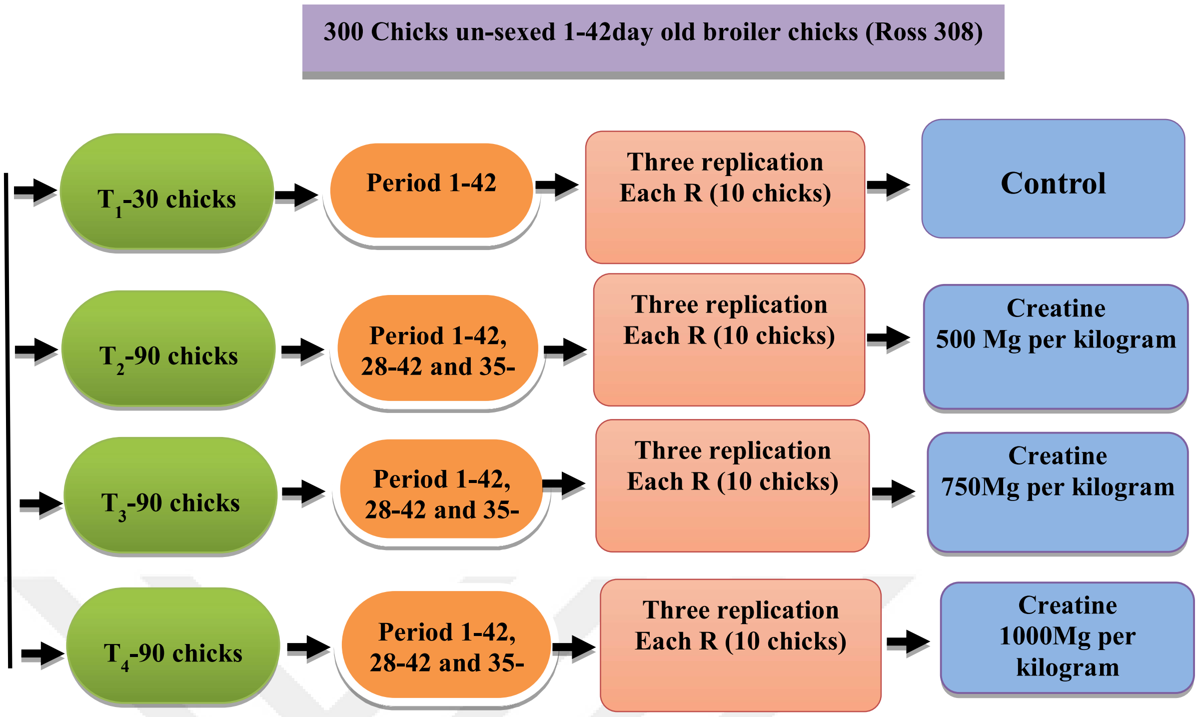

Figure 3.2. Experimental Design

3.3. Diets of experimental birds

Feed and water were providing ad libitum during the experimental period. The diets were determined according to NRC (1994). The nutrition substances were as follows: Starter feed: (CP= 22.8% and ME = 3,079 kcal/ kg) from (1- 11) day of age; Growth feed: (CP = 21.0% and ME = 3,139Kcal/ kg) from (11-28) day of age; Finisher feed: (CP =19.1% and ME = 3,212 kcal/ kg) from (29-49) day.

Ingredients composition of Commercial feed were Soybean meal, wheat, corn, sunflower seed Oil, limestone, vitamins, minerals, salt (NaCl), calcium phosphate (Table 2).

Table 3.2. Ingredient composition of the diet(%)

Ingredients %	Periods		
	Starter	Grower	Finisher
Corn	32	32	35
Soya bean meal	34	28	22.5
Protein conc.*	5	5	5
Wheat	24.3	30.2	32.5
Sunflower oil	3.5	3.5	3.7
Limestone**	1	1.2	1.2
Salt	0.2	0.1	0.1
Total	100	100	100
	Calculated composition***		
Protein	22.8	21	19.1
ME Kcal / Kg	3079	3139	3212
Calcium	0.76	0.82	0.81
Fiber	3.7	3.5	3.3
Lys.	1.34	1.19	1.04
Me.	0.89	0.83	0.77
Fat	5.6	5.6	6.0

* Protein concentrate used in the diets was produced in Holland (WAFI) which contains: 40 % crude protein,2100 Kcal ME / Kg,5%crude fat, 2% crude fiber, 6.5% calcium, 2.50% phosphorus, %3.85 lysine, 3.70 % methionine, and 4% cysteine.
** Limestone:
*** The calculated composition of the diets was determined according to NRC (1994).

3.4. Feeding and drinking

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

Figure 3.3. Feeder and drinker for the starter period.

3.5. Litter management

The Tree crumbling were used as litter material at a depth of 5cm. For first 7 days, there were Fiber over the litter.

Figure 3.4. Litter for broiler chicken

3.6. Health Care:

The birds were raised throughout the experiment period with the health precaution program, and they were being taken care of as follows:

1- Providing Vitamin C (1 g /liter of water) when the broilers have been brought to the field for twelve hours to reduce the stress of transportation from the hatchery to the field.

2- Providing Vitamin E (1 g /liter of water) and vitamin B complex (2 g /liter of water) while the birds showed vitamin deficiency.

3.6.1. 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):

Table 3.3. Vaccination schedule

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

3.7. Data collection and record keeping

The following parameters were recorded throughout the experimental period.

3.8. Studied Characteristics

3.8.1. Body weight

At the beginning of the experiment, the broiler chicks were weighed group wise and then every 7 days intervals until the termination of the experiment at 35 days of age. The weight was taken in the evening (about 5 pm). The average live weight was recorded on weekly basis and at the end of the experiment. The live weight gains of the broilers chicks on different dietary treatments were calculated.

Body Weight = weight of the birds (g) / number of birds

3.8.2. Weight Gain

The average daily body weight gain was calculated by subtracting the average initial live weight of a certain period (which was usually weekly) from the average final live weight of the same period for each chick.

3.8.3. Feed intake

The amount of feed consumed by the experimental birds of different treatment groups was 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.

Feed Intake Weekly = (The feed intake g/week)/ (number of birds)

3.8.4. Feed conversion ratio

Feed Conversion Ratio is the amount of feed intake estimated to unit weight for each weight gain estimated in the same unit and calculated by the following formula (Al – Zubaidi, 1986).

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

3.8.5. Mortality

The chicks were observed daily and any bird that died was recorded.
Calculated weekly by the following formula (Naji and Hanna., 1999).

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

3.9. Statistical Analysis

General Linear Model (GLM) within the statistical program XLSTAT (version-7.5) will be used to analyze the two factors namely the treatments and periods affecting productive traits within the Factorial Complete Randomized Design (CRD).

The significant differences between means of traits included in this study were determined using Duncan's multiple range test under the probability ($p< 0.05$) (Duncan, 1955).

The total variance was partitioned into main effects and their interaction according to the following model:

$$Y_{ij} = \mu + T_i + P_j + TP_{ij} + e_{ij}$$

Where:

Y_{ij}= Observation of the performance traits.

μ = Overall mean.

T_i = Effect of treatments (T1 0%, T2 0.05%, T3 0.075%, T4 0.1%)

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

TD_{ij} = Interaction between treatments and periods.

e_{ij}= Random error, assumed to be equal to zero and variance is б2e (N~ 0, б2e)

(Duncan,. 1955).

4. RESULTS AND DISCUSSION

4.1. Production traits

4.1.1. Effect of Creatine monohydrate on body weight

The results in a table (4) show the effect of supplemental Creatine monohydrate on performance and nutrient digestibility of broiler chicks fed on diets, during 1 day to 42 days for three periods. The value of body weight in all treatments at the age 42 day old were significant ($p<0.05$).

Table 4.1. Effect of supplemental Creatine Monohydrate on body weight (gm) of broiler chicken that Diets at different weeks of age (Mean ± SE).

(T) Creatin	Peroids		
	1-42	28-42	35-42
T1(0)mg	2388.333^{b}± 31.798b	2388.333 ± 31.798	2388.333 ± 31.798
T2(500)mg	2480.000^{b}± 12.583b	2456.667 ± 23.333	2463.333 ± 68.394
T3(750)mg	2610.000^{a}± 43.589a	2450.000 ± 104.083	2536.667 ± 68.394
T4(1000)mg	2400.000^{b}± 25.166b	2491.667 ± 54.645	2433.333 ± 44.096

a,b: Values within columns followed by different letters differ significantly ($p<0.05$).

T1= (control) diet without Creatine monohydrate, T2= consists feed with 500mg/kg Creatine monohydrate in three period 0-42 day, 28-42 and 35-42. T3= consists feed with 750mg/kg Creatine monohydrate in three period 0-42 day, 28-42 and 35-42. T4= consists feed with 500mg/kg Creatine monohydrate in three period 0-42 day, 28-42 and 35-42.

Table 1 showed that treatment T3 had a significantly ($p<0.05$) on body weight at period 1-42 day of experiments which explain the effect of dietary Creatine monohydrate supplementation on body weight (BW) comparison with T1=control and T2 and T4 for the same period, while there was no significant effect on body weight at period 28-42 and 35-42.

The broiler receiving dietary supplemented with Creatine Monohydrate increased final BW (Doaa et al., 2015). Creatine supplementation has been shown to build add up to body weight and move liquid into the intracellular space, thereby significantly elevating total body and intracellular fluid, creatine supplementation has been advertised to escalation body weight (Casey and Greenhaff., 2000), that is main cause to observing significant at T3 because feeding for more time at 1-42 age of poultry. Creatine monohydrate is an amino acid cognate that has become a trendy sports additive used to increment muscle performance (Wyss and kaddurah-daouk, 2000). When T2 and T4 had no significant (p>0.05) difference in body weight compared their control (T1) at period 1-42, 28-42 and 35-42 day of experiments. (Abdullahi et al., 2012) feeding Creatine monohydrate did not significantly affect the average final body weight. Creatine monohydrate had no significant effect (p > 0.05) on total BW (Zhang *et al*., 2014)**.**

4.1.2. Effect of Creatine monohydrate on feed intake in different period and different ration

The results in a table (5) show the effect of supplemental Creatine monohydrate on performance and nutrient digestibility of broiler chicks fed on diets during 1 day to 42 days. The value of feed intake (FI) in all treatments at the age 1 to 42 day old were significant (p<0.05).

Table 4.2. Effect of supplemental Creatine monohydrate on feed intake (gm) of broiler chicken that Diets at different weeks of age (Mean ± SE).

(T) Creatin	peroids		
	1-42	28-42	35-42
T1(0)mg	4233.333 ± 35.277	4233.333 ± 35.277	4233.333± 35.277ab
T2(500)mg	4310.000 ± 66.583	4246.667 ± 75.351	4243.333± 27.975ab
T3(750)mg	4332.667 ± 67.234	4294.792 ± 67.440	4201.250± 47.549b
T4(1000)mg	4296.667 ± 23.333	4353.125 ± 20.732	4360.833± 43.798a

a,b: Values within columns followed by different letters differ significantly (P<0.05).

Effect of treatments on feed intake at T3 compared T4 was significant (p<0.05) at period 35-42 day, but no significant compared T1=control and T2 at period 35-42 day of experiments, Creatine monohydrate supplementation had significantly (p<0.05) high affect feed intake (Faraj et al., 2014).

In the same experiment at T2, T3 and T4 had no significant (p>0.05) difference in feed intake (F.I) compared their control (T1) at period 35-42. Also at period 1-42 day of experiments effect of dietary creatine monohydrate supplementation at treatment T2, T3 and T4 had no significant difference in feed intake (FI) compared T1=control, moreover at period 28-42 day of experiments at T2,T3 and T4 had no significant (P>0.05) difference in feed intake (FI) compared their (T1) (control), Reduced feed intake on addition of Creatine monohydrate by Doaa et al. (2015); Halleet al.,(2006) found that creatine supplementation did not affect feed intake. Creatine supplementation not significant ($p>0.05$) on feed intake from hatch until slaughter (Nissen and Young. 2016).The growth performance of broiler chickens fed with CMH from 28 to 42 days of age was Dietary supplementation with different CMH levels had no significant Effect on feed intake (Zhang et al., 2014).

4.1.3. Effect of Creatine monohydrate on weight gain in different period and different ration

The results in a table (6) show the effect of supplemental creatine monohydrate on performance and nutrient digestibility of broiler chicks fed on diets during 1 day to 42 days. The value of weight gain (WG) in all treatments at the age 1 to 42 day old were significant ($p<0.05$).

Table 4.3. Effect of supplemental Creatine monohydrate on weight gain (gm) of broiler chicken that Diets.at different weeks of age (Mean ± SE).

(T) Creatin	Peroids		
	1-42	28-42	35-42
T1(0)mg	2340.667 ±30.845b	2340.667 ±30.845	2340.667 ±30.845
T2(500)mg	2432.333±13.980b	2413.333 ±23.954	2416.667 ±68.216
T3(750)mg	2563.000± 44.163a	2405.333 ±104.167	2490.000 ±69.060
T4(1000)mg	2355.333 ± 24.969b	2446.000 ±55.510	2387.667 ±44.348

a,b: Values within columns followed by different letters differ significantly ($P<0.05$).

Effect of treatments T3 was significant ($p<0.05$) higher body weight gain compared to T1=control, T2, and T4 at period 1-42 day of experiments. Creatine monohydrate affects body weight gain (BWG) at the end as shown as by Doaa et al., (2015).Broilers performed by Halle et al., (2006) showed the creatine supplementation improved weight gain in broilers.

In this study at T2 and T3 had no significant ($p>0.05$) difference in weight gain (WG) compared their control (T1) at period 1-42day , Abdullahi et al., (2012) feeding CHM did not significantly affect the final weight gain, also at period 28-42 day of experiments effect on dietary Creatine monohydrate supplementation at treatment T2, T3 and T4 had no significant ($p>0.05$) difference weight gain (WG) compared

T1=control, moreover at period 35-42 day of experiments at T2,T3 and T4 had no significant ($p>0.05$) difference in weight gain (WG) compared their T1(control). Creatine monohydrate did not significantly affect on weight gain from 1-d-old until slaughter (Nissen and Young. 2016).Dietary supplementation with different CMH levels had no significant effect on average daily gain Zhang et al. (2014).

4.1.4. Effect of Creatine monohydrate on Feed conversion ratio (FCR)

The results in a table (7) show the effect of supplemental Creatine monohydrate on performance and nutrient digestibility of broiler chicks fed on diets during 1 day to 42 days. The value of feed conversion ratio (FCR) in all treatments at the age 1 to 42 day old were significant ($p<0.05$).

Table 4.4. Effect of supplemental Creatine monohydrate on feed conversion ratio (gm) of broiler chicken that Diets at different weeks of age (Mean ± SE).

(T) Creatin	Peroids		
	1-42	28-42	35-42
T1(0)mg	1.809±0.025ab	1.809 ±0.025	1.809 ±0.025
T2(500)mg	1.772±0.037ab	1.760 ±0.040	1.75 ±0.044
T3(750)mg	1.692±0.054b	1.790 ±0.050	1.691 ±0.068
T4(1000)mg	1.825±0.016a	1.781 ±0.032	1.827 ±0.020

a,b: Values within columns followed by different letters differ significantly ($P<0.05$).

Effect of treatments on feed conversion ratio at T3 compared T4 was significant ($p<0.05$) at period 1-42day but no significant ($p>0.05$) compared T1 (control) and T2 at period 1-42day of experiments. Creatine monohydrate had significant ($p>0.05$)showed better values of FCR Doaa*et al.,(* 2015); reported Creatine monohydrate had significant improvement in FCR. (Casey and Greenhaff, 2000; Mihic *et al*., 2000) showed Creatine the significant improvement in feed efficiency.

In this study at T2, T3 and T4 had no significant ($p>0.05$) difference in feed conversion ratio (FCR) compared their control (T1) at period 28-42,The growth performance of broiler chickens fed with CMH from 28 to 42 days of age was present had no significant effect on average comparison with the control group ($p>0.05$) Zhang *et al*., (2014)**.** Also at period 35-42 day of experiments effect of dietary Creatine monohydrate supplementation at treatment T2, T3 and T4 had no significant ($p>0.05$)

difference in feed conversion ratio (FCR) compared T1=control, did not significantly affect the feed efficiency of broilers by Stahl et al., (2003); the experiments results shown There was no influence (p>0.05) on feed conversion ratio at 42 days by Carvalho*et al.,(* 2013). CHM had no affect feed conversion ratio (FCR) Abdullahi *et al*., (2012).

4.1.5 Effect of Creatine monohydrate on mortality

The results in a table (8) show the effect of supplemental Creatine monohydrate on performance and nutrient digestibility of broiler chicks fed on diets during 1 day to 42 days. The value of mortality in all treatments at the age 1 to 42 day old were significant (P<0.05).

Table 4.5. Effect of supplemental Creatine monohydrate on mortality of broiler chicken that Diets.at different weeks of age (Mean ± SE).

(T) Creatin	Peroids		
	1-42	28-42	35-42
T1(0)mg	16.667 ±3.333	16.667 ±3.333	16.667 ±3.333
T2(500)mg	13.333 ±3.333	16.667 ±3.333	20.000 ±0.000
T3(750)mg	13.333 ±3.333	13.333 ±3.333	20.000 ±0.000
T4(1000)mg	13.333 ±3.333	10.000 ±0.000	13.333 ±3.333

a,b: Values within columns followed by different letters differ significantly (P<0.05).

Creatine monohydrate had no Effect on mortality at T2, T3 and T4 had no significant difference in mortality compared their control (T1).at periods 1-42, 28-42 and 35-42.

4.2. Carcass Traits

4.2.1. Effect of Creatine monohydrate on Breast meat yield

The results in a table (9) show the effect of supplemental Creatine monohydrate on performance and nutrient digestibility of broiler chicks fed on diets during 1 day to 42 days. The value of Breast meat yield in all treatments at the age 1 to 42 day old were significant (P<0.05).

Table 4.6. Effect of supplemental Creatine monohydrate on Breast meat yield of broiler chicken that Diets.at different weeks of age (Mean ± SE).

(T) Creatin	Peroids		
	1-42	28-42	35-42
T1(0)mg	**5**01.667^{b}± 23.378b	501.667 ±23.378	501.667 ±23.378
T2(500)mg	600.000^{a}±5.774a	550.000 ±28.868	543.333 ±48.419
T3(750)mg	616.667^{a}±3.333a	570.000 ±34.641	576.667 ±1.667
T4(1000)mg	555.000^{ab}±49.244ab	541.667 ±22.048	505.000 ±15.000

a,b: Values within columns followed by different letters differ significantly (P<0.05)

Effect of treatments on Breast meat yield at T2 and T3 compared T1 (control) was significant (P<0.05) at period 1-42day, but T4 no significant (P>0.05) compared T1 (control). Supplementation of CMH resulted in a significant (*P* <0.05) higher percentage of breast meat Doaa*et al., (*2015), Earlier studies showed that CMH supplementation in breast muscle water-holding capacity (WHC) of broilers (Young et al., 2007; Nissen and Young, 2006).

In the same experiment at T4 had no significant (P>0.05) difference in Breast meat yield compared their control (T1),(T2 and T3) at period 1-42, Also at period 28-42 day of experiments effect on dietary Creatine monohydrate supplementation at treatment T2, T3 and T4 had no significant (P>0.05) difference Breast meat yield compared T1=control, moreover at period 35-42 day of experiments at T2, T3 and T4 had no significant (P>0.05) difference in Breast meat yield compared their T1 (control). In the present study, a 3-h transport had no effect on dressing percentage, breast muscle yield Zhang*et al*., (2014).

4.2.2 Effect of Creatine monohydrate on Thigh meat yield

The results in a table (10) show the effect of supplemental Creatine monohydrate on performance and nutrient digestibility of broiler chicks fed on diets during 1 day to 42 days. The value of Thigh meat yield in all treatments at the age 1 to 42 day old were significant (P<0.05).

Table 4.7. Effect of supplemental Creatine monohydrate on Thigh meat yield of broiler chicken that Diets.at different weeks of age (Mean ± SE).

(T) Creatin	Proids		
	1-42	28-42	35-42
T1(0)mg	572.500±16.415ab	572.500 ± 16.415	572.500 ±16.415
T2(500)mg	586.667±6.667ab	555.000 ± 5.774	548.333 ±13.017
T3(750)mg	550.000±28.868b	551.667 ± 24.552	581.667 ± 18.333
T4(1000)mg	636.667±10.138a	536.667 ± 8.819	536.667 ± 8.819

a,b: Values within columns followed by different letters differ significantly (P<0.05)

Effect of Thigh meat yield treatments on at T3 compared T4 was significant (P<0.05) at period 1-42day but no significant (P>0.05) compared T1 (control) and T2 at period 1-42day of experiments.

In this study at T2, T3 and T4 had no significant (P>0.05) difference in Thigh meat yield compared their control (T1) at period 28-42,Also at period 35-42 day of experimentseffect of dietary Creatine monohydrate supplementation at treatment T2, T3 and T4 had no significant (P>0.05) difference in Thigh meat yield compared T1(control). a 3-h transport had no effect on dressing percentage, thigh muscle yield Zhang *et al*. (2014).

4.3. Effect of periods, supplemental Creatine monohydrate and interaction on all characterises of broiler chickens

There was a significant difference between creatin levels in terms of Breast meat variant (p <0.01). (0 mg / kg to 500 mg / kg), (0 mg / kg to 750 mg / kg) and (0 mg / kg to 1000 mg / kg) according to multiple comparison results. the highest weight gain is seen at levels of 500 mg / kg to 750 mg / kg (Table 11).

When the application time and creatine interaction were examined, there was a significant difference between the creatin levels only when the application time (1-42) was observed. When multiple comparisons were examined, 1000 mg / kg creatine level was found to be different from other levels. That is, 0 to 500 mg / kg, 500 to 750 mg / kg and 0 to 750 were not significantly different. The maximum weight gain is achieved with 1000 mg / kg creatin.

Significant differences were found between the application times for the Thigh meat variant (p <0.05). The time interval (1-42) was different from other times according to the results of the Duncan multiple comparison tests to determine the source of the difference. In this time interval, thigh meat values are higher.

Significant differences were found between creatine levels in terms of weight gain (p <0.05). (0 to 750 mg / kg) and (750 to 1000 mg / kg). In general, as a number of creatin increases, the values of weight gain increase.

Table 4.8. Effect of periods, supplemental Creatine monohydrate and interaction on body weight, weight gain feed intake, feed conversion ratio (gm), mortality, breast meat and thigh meat of broiler chickens (Mean ± SE)

Muameleler							
Uygulama Zamanı	Body Weight	Weight Gain	Fed Intake	FCR	Mortality	Breast Meat	Thigh meat
1-42	2469,583±25,572	2422,833±25,625	4293,167±24,516	1,775±0,020	14,167±1,443	568,333±13,845	582,500±8,018a
28-42	2446,667±25,572	2401,333±25,625	4281,979±24,516	1,785±0,020	14,167±1,443	540,833±13,845	550,000±8,018b
35-42	2455,417±25,572	2408,750±25,625	4259,688±24,516	1,771±0,020	17,500±1,443	531,667±13,845	555,833±8,018b
Creatin, mg/kg							
0	2388,333±29,528b	2340,667±29,589b	4293,167±24,516	1,809±0,023a	16,667±1,667	501,667±15,987C	556,667±9,259
500	2466,667±29,528ab	2420,778±29,589ab	4281,979±24,516	1,764±0,023ab	16,667±1,667	564,444±15,987AB	563,333±9,259
750	2532,222±29,528a	2486,111±29,589a	4259,688±24,516	1,724±0,023b	15,556±1,667	587,778±15,987A	561,111±9,259
1000	2441,667±29,528b	2396,333±29,589b	4293,167±24,516	1,811±0,023a	12,222±1,667	533,889±15,987BC	570,000±9,259
Creatin*Uyg.Zam. int.							
1-42-0	2388,333±51,144	2340,667±51,250	4233,333±49,032	1,809±0,039	16,667±2,887	501,667±27,690	556,667±16,037bc
1-42-500	2480,000±51,144	2432,333±51,250	4310,000±49,032	1,772±0,039	13,333±2,887	600,000±27,690	586,667±16,037b
1-42-750	2610,000±51,144	2563,000±51,250	4332,667±49,032	1,692±0,039	13,333±2,887	616,667±27,690	550,000±16,037bc
1-42-1000	2400,000±51,144	2355,333±51,250	4296,667±49,032	1,825±0,039	13,333±2,887	555,000±27,690	636,667±16,037a
28-42-0	2388,333±51,144	2340,667±51,250	4233,333±49,032	1,809±0,039	16,667±2,887	501,667±27,690	556,667±16,037bc
28-42-500	2456,667±51,144	2413,333±51,250	4246,667±49,032	1,760±0,039	16,667±2,887	550,000±27,690	555,000±16,037bc
28-42-750	2450,000±51,144	2405,333±51,250	4294,792±49,032	1,790±0,039	13,333±2,887	570,000±27,690	551,667±16,037bc
28-42-1000	2491,667±51,144	2446,000±51,250	4353,125±49,032	1,781±0,039	10,000±2,887	541,667±27,690	536,667±16,037c
35-42-0	2388,333±51,144	2340,667±51,250	4233,333±49,032	1,809±0,039	16,667±2,887	501,667±27,690	556,667±16,037bc
35-42-500	2463,333±51,144	2416,667±51,250	4243,333±49,032	1,758±0,039	20,000±2,887	543,333±27,690	548,333±16,037bc
35-42-750	2536,667±51,144	2490,000±51,250	4201,250±49,032	1,691±0,039	20,000±2,887	576,667±27,690	581,667±16,037bc
35-42-1000	2433,333±51,144	2387,667±51,250	4360,833±49,032	1,827±0,039	13,333±2,887	505,000±27,690	536,667±16,037c

a,b: The differences between the averages indicated by different letters in the same column are significant $P<0.05$

5. CONCLUSION AND RECOMMENDATIONS

5.1. Conclusıon

The results of the present study showed that dietary supplementation with different levels of Creatine monohydrate had a significant effect on body weight at the 1-42 period, there was a significant effect on weight gain at the 1-42 period, Creatine monohydrate had a significant effect on Breast meat yield at (1-42) period of the experiment. Using 0.75% Creatine monohydrate group at the period (1-42) seemed to have a beneficial effect on most of the performance traits (live body weight, weight gains and breast meat yield).

5.2. Recommendatıons

For the better production performance, we recommend the use of 0.75% (T3) Creatine monohydrate wait until 7 weeks of age to obtain the better production in broiler chicken.

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WORK EXPERIENCE

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AREA OF SPECIALIZATION

FOREIGN LANGUAGES

Kurdı – Arabı – Englısh – Persıan

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