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Effect of Dietary Supplementation with Different Levels of Creatine Monohydrate on Productive and Carcass Performance of Broiler chicks

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Abstract

The study was conducted to investigate the effects of dietary supplementation with different levels of Creatine Monohydrate on productive and carcass performance of broiler chickens. Day old 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 was 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 was significantly ($P<0.05$) there was effect to creatine Monohydrate supplementation at period (1-42) on body weight also was effect to creatine Monohydrate supplementation at period (1-42) on weight gain, it was not 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).

Introduction

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 [1]; 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[2]. 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 [4, 5] 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 [6]. The expanded concentration of intramuscular phosphocreatine attract water into

the muscle cell and increase the cell amount [7]. 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 [8].. 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 [9, 10]. 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 [11]. The additive of creatine can save arginine and improvement growth performance of poultry [12]. 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 [13 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 [14, 15]. 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 [16].

Materıals and methods

This study was conducted at the Bakrajo poultry breeding field, Animal Production Department, Faculty of Agricultural Science, University of Sulaimani 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. 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.

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. 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,P2 and P3), the third group of chicks that diet consists feed with 750mg/kg Creatine monohydrate in (P1,P2 and P3, the fourth group of chicks that diet consists feed that contained 1000mg/kg Creatine monohydrate in (P1, P2 and P3).

Feed and water were providing *ad libitum* during the experimental period. The diets were determined according to [18]. The nutrition substances were as follows: Starter feed: (CP= 22.8% and ME = 3,079 kcal/ kg) from (1- 11) day of age; Grower 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 are shown in (Table 1).

The following parameters were recorded throughout the experimental period: Body weight, weight Gain, feed intake, feed conversion ratio and mortality.

At the beginning of the experiment, the broiler chicks were weighed in group and then every 7 days intervals until the termination of the experiment at 42 days of age. 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.

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 ($p< 0.05$) [19].

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

Yij = μ + Ti + Pj + TP ij + eij
Where:
Yij= Observation of the performance traits.
μ = Overall mean.
Ti = Effect of treatments (T1 0%, T2 0.05%, T3 0.075%, T4 0.1%)
Tj = Effect of periods (day 1, 7, 14, 21, 28, 35 and 42 of age).
TDij = Interaction between treatments and periods.
eij= Random error, assumed to be equal to zero and variance is б2e (N~ 0, б2e)

Table 1. 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 seed oil	*3.5*	*3.5*	*3.7*
Limestone	*1*	*1.2*	*1.2*
NaCl	*0.2*	*0.1*	*0.1*
Total	*100*	*100*	*100*
*Calculated composition***			
Crude 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.
** The calculated composition of the diets was determined according to [18].

Results and discussion

The results in a table (2) 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 T3 at the age 42 day old was significant ($p<0.05$).

Table 2. Effect of supplemental Creatine Monohydrate on body weight (gm) of broiler chicken that Diets at different weeks of age.

(T) Creatin	*Periods*		
	1-42	*28-42*	*35-42*
T1(0)mg	*2388.333^{b}*	*2388.333*	*2388.333*
T2(500)mg	*2480.000^{b}*	*2456.667*	*2463.333*
T3(750)mg	*2610.000^{a}*	*2450.000*	*2536.667*
T4(1000)mg	*2400.000^{b}*	*2491.667*	*2433.333*

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

Table 2 showed that treatment T3 was 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 broilers receiving dietary supplemented with Creatine Monohydrate increased final BW [20]. 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 [10], 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 [3]. 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. [21] feeding Creatine monohydrate did not significantly affect the average final body weight. Creatine monohydrate had no significant effect ($p > 0.05$) on total BW [13]**.**

The results in a table (3) 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 T4 at the age 1 to 42 day old was significant ($p<0.05$).

Table 3. Effect of supplemental Creatine monohydrate on feed intake (gm) of broiler chicken that Diets at different weeks of age.

(T) Creatin	*Periods*		
	1-42	*28-42*	*35-42*
T1(0)mg	*4233.333*	*4233.333*	*4233.333ab*
T2(500)mg	*4310.000*	*4246.667*	*4243.333ab*
T3(750)mg	*4332.667*	*4294.792*	*4201.250b*
T4(1000)mg	*4296.667*	*4353.125*	*4360.833a*

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 was significantly ($p<0.05$) high affect feed intake [28]. 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 [20]; [22] found that creatine supplementation did not affect feed intake. Creatine supplementation not significant ($p>0.05$) on feed intake from hatch until slaughter [23].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 [13].

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. The value of weight gain (WG) in T3 at the age 1 to 42 day old was significant ($p<0.05$).

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 [20].Broilers performed by [22] showed the creatine supplementation improved weight gain in broilers.

Table 4. Effect of supplemental Creatine monohydrate on weight gain (gm) of broiler chicks at different weeks of age.

(T) Creatin	Periods		
	1-42	28-42	35-42
T1(0)mg	2340.667 b	2340.667	2340.667
T2(500)mg	2432.333b	2413.333	2416.667
T3(750)mg	2563.000a	2405.333	2490.000
T4(1000)mg	2355.333b	2446.000	2387.667

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

In this study at T2 and T4 had no significant (p>0.05) difference in weight gain (WG) compared their control (T1) at period 1-42day, [21]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 effect on weight gain from 1-d-old until slaughter [23].

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 conversion ratio (FCR) in all treatments at the age 1 to 42 day old were significant (p<0.05).

Table 5. Effect of supplemental Creatine monohydrate on feed conversion ratio (gm) of broiler chicken that Diets at different weeks of age.

(T) Creatin	Periods		
	1-42	28-42	35-42
T1(0)mg	1.809ab	1.809	1.809
T2(500)mg	1.772ab	1.760	1.75
T3(750)mg	1.69b	1.790	1.691
T4(1000)mg	1.825a	1.781	1.827

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 [20], reported Creatine monohydrate wassignificant improvement in FCR. [10, 24] 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) [13]**.** 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 [25]; the experiments results shown There was no influence (p>0.05) on feed conversion ratio at 42 days by [26]. CHM had no affect feed conversion ratio (FCR) [21].

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.

Table 6. Effect of supplemental Creatine monohydrate on mortality percentage of broiler chicken at different weeks of age.

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

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 was no significant difference in mortality compared their control (T1).at periods 1-42, 28-42 and 35-42.

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 Breast meat yield in all treatments at the age 1 to 42 day old were significant (P<0.05).

Table 7. Effect of supplemental Creatine monohydrate on Breast meat yield of broiler chicken that Diets.at different weeks of age.

(T) Creatin	Periods		
	1-42	28-42	35-42
T1(0)mg	501.667^{b}	501.667	501.667
T2(500)mg	600.000^{a}	550.000	543.333
T3(750)mg	616.667^{a}	570.000	576.667
T4(1000)mg	555.000^{ab}	541.667	505.000

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 [20], Earlier studies showed that CMH supplementation in breast muscle water-holding capacity (WHC) of broilers [23, 27].
In the same experiment at T4 was 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).

The results in a table (8) show the effect of supplemental Creatine monohydrate on performance and nutrient

(T) Creatin	Periods		
	1-42	28-42	35-42
T1(0)mg	572.500ab	572.500	572.500
T2(500)mg	586.667ab	555.000	548.333
T3(750)mg	550.000b	551.667	581.667
T4(1000)mg	636.667a	536.667	536.667

digestibility of broiler chicks fed on diets during 1 day to 42 days. The value of Thigh meat yield in T4 at the age 1 to 42 day old was significant (P<0.05).

There was a significant difference (P<0.05) to T4 compared T3 in period 1-42 day 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 experiments effect 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 [13].

Effect of periods, supplemental Creatine monohydrate and interaction on all characterizes 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.

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.

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 was 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).

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