



The Effect of Adding Different Levels of Dried Chicken Eggshell Powder on The Egg Productivity Traits of the Lohman Layer Chicken

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Abstract:

This study was conducted at the Department of Animal Production, College of Agriculture, University of Kirkuk, from 7/24/2023 to 10/1/2023, with One hundred 28-weeks-old birds were used, distributed randomly among five treatments, twenty birds for each treatment, and placed in production batteries inside a hall. The birds from each treatment were distributed into five replicates, with four birds per replicate. The five treatments were: T1=100% limestone + 0% eggshell powder, T2= 75% limestone + 25% eggshell powder, T3= 50%limestone + 50% eggshell powder, T4= 25% limestone + 75% eggshell powder, T5= 0% limestone + 100% eggshell powder. The egg shell was boiled, washed, dried in the sun for 3 days, broken and crushed, and mixed with the feed. The study found that adding different levels of eggshell powder significantly affected egg weight, egg number, and egg production (HD). However, it disagreed with previous studies that found adding different recourse and concentration of calcium in layers' diet did not significantly impact HD.

Keywords: Layers, calcium, powder, eggshell.

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Introduction:

For laying hens, calcium is crucial since the egg shell contains 90% mineral matter, of which 98% is calcium carbonate [1]. Eggshell flaws can result in losses ranging from 6 to 8% of the total eggs laid by a hen [2]. [3] calculated that losses resulting from cracked and/or broken eggs range from 6.0 to 12.3% annually in Brazil. The use of calcium from chicken bones to produce eggshells caused a quick loss of 2 grams of calcium from the body, as reported by [4]; hence, a calcium reserve needs to be formed in the bones prior to the production period. Eggshell quality is influenced by calcium supply, particle size, and solubility [5]. The quantities of protein, phosphate, zinc, free fatty acids, and vitamin D all affect how well calcium is absorbed. One of the most crucial factors, according to [6], is calcium solubility because the body needs to dissolve calcium in order for the digestive system to absorb it.

[7] found that there were no appreciable changes in eggshell quality or egg production when oyster shell or highly soluble limestone was substituted for low-soluble limestone, or vice versa. Both in vivo and in vitro research was done on the connection between calcium level, source, particle size, and solubility. According to [8], the gizzard retains more limestone when the feed's calcium content is high or the solubility is reduced. For the development of eggshells, calcium is a crucial ingredient in commercial laying hen feed. The amount of feed calcium appears to effect on the hypothalamus, causing the production of norepinephrine, a neurotransmitter that works in the central nervous system and stimulates feed intake [9]. This indicates that feed calcium can affect feed intake. The eggshell serves as a container for the egg's contents and shields the embryo; hence, it needs to be robust enough to endure the laying, gathering, sorting, and shipping of the eggs until they are received by the intended recipient. Due to consumers' growing concerns about food safety and the possibility of bacterial contamination, eggshell quality is particularly

important from a business standpoint [10]. There are several ways to supply calcium, including oyster shell, eggshell, calcium sulfate, and limestone. Of these, oyster shell and limestone are the most frequently utilized in laying hen diets [10].

Understanding calcium sources that can take the place of calcareous limestone is crucial for preserving or enhancing eggshell quality and performance, as commercial laying hens have high calcium requirements.

Materials and methods:

The experiment was conducted in the fields of the Department of Animal Production, College of Agriculture, University of Kirkuk, for the period from 7/24/2023 to 10/1/2023, with the aim of adding different levels of chicken egg shell powder to diet of Lohman laying hens and its effect on productive performance. One hundred 28-weeks-old birds were used, distributed randomly among five treatments, twenty birds for each treatment, and placed in production batteries inside a hall with dimensions of 5 meters by 15 meters. The birds from each treatment were distributed into five replicates, with four birds per replicate. The five treatments were: T1=100% limestone + 0% eggshell powder, T2= 75% limestone + 25% eggshell powder, T3= 50% limestone + 50% eggshell powder, T4= 25% limestone + 75% eggshell powder, T5= 0% limestone + 100% eggshell powder. The egg shell was boiled for an hour in water, then the eggshell was washed well and cleaned of impurities. Once the washing was completed, the eggshell was dried in the sun for 3 days, stirring constantly. After the end of the drying period, the eggshell was broken and crushed using a grinder, after which it was ready to be mixed with the feed. Five parameters were used for the duration of the experiment, and the components and chemical composition of the materials included in the composition of the diets are shown in Table 1.

Table1: The percentage and chemical composition of fed materials fed to experiment birds

Ingredients	control
Wheat	16.30
Yellow corn	47.07
Soybean meal (48%)	20.00
Barley	4.00
Oil	0.60
Limestone	9.00
T. Salt	0.20
Methionine	0.07
Lysine	0.01
Laymix 2.5	2.50
Colin Chloride	0.25
Total	100.00
Energy / protein ratio	167.03
Energy	2753
Protein%	16.08
Lysine%	0.81
Methionine%	0.44
Calcium%	3.76
Phosphors%	0.41

The females weighed each treatment separately at the beginning and end of the experiment, using a sensitive balance (0.01) g. Eggs were weighed twice a week using a sensitive scale with a sensitivity of (0.01) g at a rate of 8 eggs per replicate. The mass of eggs was calculated using the equation below [11]:

Egg mass = egg production percentage x average egg weight x number of days

The weekly production for each replicate was calculated on the basis of HD, as in the equation below [12]:

Egg production (HD%) = (number of eggs produced during a period / length of period in days' x number of birds) x 100.

The weekly feed consumption of the repeats was calculated according to the equation below [13]:
Feed consumed (g) = amount of feed provided at the beginning of week - remaining feed at the end of week

The feed conversion factor for each bird was calculated according to the equation below [14]:
Feed conversion Ratio=amount of feed consumed/mass of eggs produced
The numbers of birds killed for each replicate

were recorded daily and calculated as a percentage as in the equation below [15]:

Mortality rate = (number of birds killed / total number of birds) x 100 SAS version 4.9 and the CRD method were used to analyze the data, and Duncan's multi-range test [16] was employed to determine how much the means of the coefficients for each attribute under study varied from one another

Results and discussion:

The mean and standard error for the egg weight that treated with different levels of eggshell powder for different periods are shown in table 2. The egg weight was differing significantly in most periods ($p < 0.05$). For the first week until the fifth week the treatment three and four were exceed other treatments, and the least of them was second treatment. For the treatment six, the least was the fifth treatment, and the other did not show and differences between them. There were non-significant differences among the treatment in the seventh, and eighth week. The ninth week the treatment three was the least, and there were non-significant differences among the other treatments. The tenth week, treatment three and five was the least and there were non-significant

differences among the other. Our study agreed to [17], which find in his study that adding different level and resource of calcium effected significantly to the egg weight. And also agreed to [18], that find in his study that adding different recourse and levels of eggshell powder, and

oyster shell affected significantly on the egg weight. Moreover, our finding disagreed with [19] that find in his study the egg weight didn't effect significantly by the recourse or the concentration.

Table 2: the mean of egg weight that treated with different levels of eggshell powder for different periods

Periods	T1	T2	T3	T4	T5
	Control	25% Ca	50% Ca	75% Ca	100% Ca
W 1	55.80±2.07 c	55.82±5.71 c	57.93±1.37 a	57.74±2.21 a	56.28±1.30 b
W 2	57.31±1.53 b	55.44±3.13 c	58.70±4.00 a	59.44±1.67 a	56.54±2.60 b
W 3	57.80±1.29 b	55.43±2.46 c	58.59±2.49 a	58.08±2.92 a	58.60±2.67 a
W 4	55.52±1.78 b	49.84±5.07 c	58.59±2.07 a	57.73±1.19 a	54.87±1.88 b
W 5	55.20±1.66 b	55.34±3.85 b	58.29±1.44 a	57.42±1.96 a	55.70±2.98 b
W 6	58.99±6.28 a	60.07±1.11 a	58.93±0.62 a	58.91±4.07 a	55.89±1.95 b
W 7	59.88±1.67 a	60.11±2.90 a	58.69±1.37 a	60.64±2.27 a	57.92±3.05 a
W 8	59.48±1.87 a	59.96±1.51 a	58.08±2.11 a	58.60±4.17 a	59.75±2.51 a
W 9	60.78±1.09 a	59.84±2.48 a	57.27±2.17 b	59.93±3.41 a	60.11±2.19 a
W 10	59.65±2.33 a	59.11±1.93 a	56.98±3.96 b	58.57±3.39 a	57.04±3.83 b

*Different letters within one row indicate the presence of significant differences ($p < 0.05$) between the coefficients.

The mean and standard error for the egg number that treated with different levels of eggshell powder for different periods are shown in table 3. The egg weight was differing

significantly in most periods ($p < 0.05$). for the first week until the sixth week the treatment three was exceed compere with the other treatments, and from the seventh week until the tenth week the treatment five was exceed above the other treatments. Our study agreed with each of [18, 20], and disagreed with [21].

Table 3: The mean of egg number that treated with different levels of eggshell powder for different periods

Periods	T1	T2	T3	T4	T5
	Control	25% Ca	50% Ca	75% Ca	100% Ca
W 1	19.60±1.95 d	23.40±0.55 b	26.20±1.48 a	23.40±2.61 b	22.40±2.30 c
W 2	23.40±3.36 b	22.60±3.05 c	26.40±1.67 a	22.20±2.59 c	23.60±2.88 b
W 3	24.40±2.70 b	19.20±2.49 d	25.80±1.92 a	22.80±2.78 c	23.20±3.56 bc
W 4	21.20±3.96 c	18.00±2.92 d	26.00±0.06 a	23.00±2.83 b	23.20±3.35 b
W 5	21.60±3.78 c	11.80±2.28 d	24.20±1.48 a	23.00±2.34 b	24.20±3.03 a
W 6	23.20±4.21 b	18.60±5.86 d	24.60±0.55 a	21.60±1.52 c	23.80±3.70 b
W 7	25.00±2.00 a	21.80±4.81 c	23.80±1.92 b	23.40±3.58 b	25.20±3.12 a
W 8	24.20±1.30 b	23.60±4.04 c	20.00±1.41 d	19.60±0.55 d	25.60±3.78 a
W 9	24.80±2.78 b	23.80±3.27 c	17.20±3.96 d	18.60±2.88 d	25.40±2.88 a
W 10	25.20±2.49 a	24.20±4.09 b	23.00±2.65 c	24.20±2.59 b	25.80±3.84 a

*Different letters within one row indicate the presence of significant differences ($p < 0.05$) between the coefficients.

The mean and standard error for the egg production (H.D.) that treated with different levels of eggshell powder for different periods are shown in table 4. The egg production (HD) was differing significantly in most periods

($p < 0.05$). for the first week until the fourth week the treatment three was exceed above the other treatments, and for the week five until the tenth week the treatment five was exceed above all the other treatments. Our study was disagreed with each of [21] that find adding different recourse and concentration of calcium in layers' diet did not significantly on the HD.

Table 4: the mean of egg production (HD) that treated with different levels of eggshell powder for different periods

Periods	T1	T2	T3	T4	T5
	Control	25% Ca	50% Ca	75% Ca	100% Ca
W 1	70.00±6.96 c	83.57±1.95 b	93.57±5.29 a	83.57±9.31 b	80.71±8.22 b
W 2	83.57±12.01 b	80.71±10.89 b	94.29±5.98 a	79.29±9.24 c	84.29±10.29 b
W 3	87.14±9.65 b	68.57±8.89 c	92.14±6.87 a	86.19±9.62 b	87.38± 9.73 b
W 4	75.71±14.15 c	64.29±10.41 d	92.86±0.01 a	86.67±6.54 b	87.14±5.98 b
W 5	77.14±13.51 c	47.86±13.51 d	86.43±5.30 b	86.67±3.30 b	91.19±7.22 a
W 6	82.86±15.03 b	72.62±14.82 c	87.86±1.96 ab	82.14±11.29 b	89.29±6.68 a
W 7	89.29±7.14 ab	85.95±8.76 b	85.00±6.87 b	87.85±6.96 b	95.00±7.83 a
W 8	86.43±4.66 b	93.57±5.55 a	71.43±5.05 c	74.52±9.05 c	95.95±4.26 a
W 9	93.33±2.74 a	94.76±5.36 a	61.43±14.15 c	74.29±7.74 b	95.71±5.87 a
W 10	95.00±4.07 a	95.95±5.56 a	82.14±9.45 b	96.67±6.03 a	96.67±3.89 a

*Different letters within one row indicate the presence of significant differences ($p < 0.05$) between the coefficients.

The mean and standard error for the egg mass that treated with different levels of eggshell powder for different periods are shown in table 5. The egg mass was differing significantly in most periods ($p < 0.05$). for the first week until the sixth week the treatment three was exceed

above the other treatments, for the seventh week until the ninth week the treatment five was exceed above all the other treatments, and the tenth week the treatment one was the highest among the other treatments. Our study agreed with both [18, 21], that recorded in their studies the egg mass differ significantly by using eggshell powder in different concentrations.

Table 5: The mean of egg mass that treated with different levels of eggshell powder for different periods

Periods	T1	T2	T3	T4	T5
	Control	25% Ca	50% Ca	75% Ca	100% Ca
W 1	273.30±27.96 c	326.79±36.95 ab	379.81±30.03 a	337.49±37.43 ab	318.03±34.25 b
W 2	335.95±53.98 ab	314.00±50.79 b	388.13±43.09 a	330.31±43.60 ab	334.67±52.85 ab
W 3	353.00±43.71 ab	266.30±37.19 c	378.22±36.64 a	33.015±33.38 b	339.64±52.41 ab
W 4	295.35±62.01 c	222.59±29.70 c	380.86±13.43 a	331.75±39.71 ab	318.87±52.67 b
W 5	299.10±57.72 bc	163.38±34.25 c	352.52±20.90 a	330.06±34.83 ab	337.40±49.69 ab
W 6	344.68±87.57 ab	279.36±88.23 c	362.45±10.76 a	319.00±40.80 b	332.65±64.90 ab
W 7	374.65±37.01 a	328.81±79.59 b	349.09±28.13 ab	354.36±53.51 a	365.41±54.19 a
W 8	359.98±24.60 b	354.05±63.03 b	290.56±25.71 c	287.39±24.76 c	382.88±62.63 a
W 9	376.70±41.20 ab	356.31±52.88 ab	246.36±58.38 c	278.39±36.95 bc	381.25±40.97 a
W 10	374.87±28.53 a	359.11±71.26 ab	329.73±58.94 b	353.99±40.34 ab	357.16±52.26 ab

*Different letters within one row indicate the presence of significant differences ($p < 0.05$) between the coefficients.

The mean and standard error for the feed intake that treated with different levels of eggshell powder for different periods are shown

in table 6. The feed intake was differing significantly in most periods ($p < 0.05$). For the first week the treatment three was the highest feed intake compare with the other treatments. For the second week to the tenth week, the treatment five was the highest among the other

treatments. Our study was agreed with [21] that find using different recourse of calcium and concentration. Moreover, [18] find the feed intake in his study significantly differ when he uses different concentration of eggshell powder.

Table 6: for the feed intake that treated with different levels of eggshell powder for different periods are shown

Periods	T1 Control	T2 25% Ca	T3 50% Ca	T4 75% Ca	T5 100% Ca
W 1	629.95±8.47 ab	603.30±8.47 b	688.45±8.47 a	620.75±8.47 ab	652.15±8.47 ab
W 2	680.75±8.47 b	682.00±8.47 ab	683.25±8.47 ab	684.50±8.47 a	685.75±8.47 a
W 3	687.00±8.47 b	688.25±8.47 ab	689.50±8.47 ab	690.75±8.47 a	692.00±8.47 a
W 4	693.25±8.47 b	694.50±8.47 ab	695.75±8.47 ab	697.00±8.47 a	698.25±8.47 a
W 5	699.50±8.47 b	700.75±8.47 ab	702.00±8.47 ab	703.25±8.47 a	704.50±8.47 a
W 6	705.75±8.47 b	707.00±8.47 ab	708.25±8.47 ab	709.50±8.47 a	710.75±8.47 a
W 7	712.00±8.47 b	713.25±8.47 ab	714.50±8.47 ab	715.75±8.47 a	717.00±8.47 a
W 8	718.25±8.47 b	719.50±8.47 ab	720.75±8.47 ab	722.00±8.47 a	723.25±8.47 a
W 9	724.50±8.47 b	725.75±8.47 ab	727.00±8.47 ab	728.25±8.47 a	729.50±8.47 a
W 10	730.75±8.47 b	732.00±8.47 ab	733.25±8.47 ab	734.50±8.47 a	735.75±8.47 a

*Different letters within one row indicate the presence of significant differences ($p < 0.05$) between the coefficients.

The mean and standard error for the FCR that treated with different levels of eggshell powder for different periods are shown in table 7. The FCR was differing significantly in most periods ($p < 0.05$). In the first week to the sixth week, the

FCR was the lowest in the treatment three, which was the best treatment for this trait. And for the seventh week was control the lowest, and from the eighth to the tenth the treatment five was the lowest among the other treatments. [21] record same finding when he used eggshell meal for chicken diet. But our result did not agree with the study of [18, 20, 21].

Table 7: the FCR that treated with different levels of eggshell powder for different periods

Periods	T1 Control	T2 25% Ca	T3 50% Ca	T4 75% Ca	T5 100% Ca
W 1	2.32±0.18 b	1.86±0.18 ab	1.82±0.18 a	1.86±0.18 ab	2.07±0.18 ab
W 2	2.07±0.18 b	2.22±0.18 b	1.78±0.18 a	2.10±0.18 b	2.09±0.18 b
W 3	1.97±0.18 ab	2.63±0.18 b	1.84±0.18 a	2.11±0.18 ab	2.08±0.18 ab
W 4	2.45±0.18 b	3.17±0.18 c	1.83±0.18 a	2.13±0.18 b	2.24±0.18 b
W 5	2.44±0.18 b	4.44±0.18 c	2.00±0.18 a	2.15±0.18 ab	2.13±0.18 ab
W 6	2.17±0.18 ab	2.77±0.18 b	1.96±0.18 a	2.25±0.18 ab	2.19±0.18 ab
W 7	1.91±0.18 a	2.28±0.18 b	2.06±0.18 ab	2.06±0.18 ab	2.00±0.18 ab
W 8	2.00±0.18 a	2.09±0.18 b	2.49±0.18 c	2.53±0.18 c	1.93±0.18 a
W 9	1.94±0.18 a	2.08±0.18 ab	3.11±0.18 c	2.66±0.18 b	1.93±0.18 a
W 10	1.96±0.18 a	2.11±0.18 ab	2.29±0.18 ab	2.10±0.18 b	2.05±0.18 a

*Different letters within one row indicate the presence of significant differences ($p < 0.05$) between the coefficients

Conclusion

The study conducted that Adding 50% of egg shell powder to the ration of brown-laying Lohman chickens led to an improvement in the egg production characteristics represented by egg weight, feed consumption, feed conversion factor, and egg production on an HD.

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تأثير إضافة مستويات مختلفة من مسحوق قشر بيض الدجاج المجفف في الصفات الانتاجية لبيض دجاج اللوهمان البياض

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• تاريخ استلام البحث 2024/3/4 وتاريخ قبوله 2024/4/8.

الخلاصة

أجريت هذه الدراسة في قسم الإنتاج الحيواني - كلية الزراعة - جامعة كركوك للفترة من 2023/7/24 ولغاية 2023/10/1، واستخدم فيها مائة طائر بعمر 28 اسبوع، وزعت عشوائياً على خمس معاملات، عشرون طيراً لكل معاملة، ووضعت في أقفاص انتاجية. تم توزيع الطيور من كل معاملة على خمس مكررات بواقع أربعة طيور في كل مكرر. وكانت المعاملات الخمس هي: المعاملة الاولى = 100% حجر الكلس + 0% مسحوق قشرة البيض، المعاملة الثانية = 75% حجر الكلس + 25% مسحوق قشرة البيض، المعاملة الثالثة = 50% حجر الكلس + 50% مسحوق قشرة البيض، المعاملة الرابعة = 25% حجر الكلس + 75% مسحوق قشرة البيض، المعاملة الخامسة = 0% حجر الكلس + 100% مسحوق قشرة البيض. تم غلي قشرة البيضة، وغسلها، وتجفيفها في الشمس لمدة 3 أيام، وتكسيورها وسحقها، وخلطها مع العلف. وجدت الدراسة أن إضافة مستويات مختلفة من مسحوق قشر البيض أثر بشكل كبير على وزن البيض وعدد البيض وإنتاج البيض ومع ذلك، فقد اختلف مع الدراسات السابقة التي وجدت أن إضافة مصادر مختلفة وتركيزات مختلفة من الكالسيوم في علائق الدجاج البياض لم يؤثر بشكل كبير على إنتاج البيض.

الكلمات المفتاحية: الدجاج البياض، الكالسيوم، مسحوق، قشر البيض.