RELATIONSHIP OF LEI0234 MARKER WITH SOME PRODUCTIVE TRAITS OF LOCAL CHICKENS

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ABSTRACT

This study utilized 100 local Iraqi laying hens, aged 67 days, which were individually housed in numbered cages (1 to 100) for the duration of the experiment, conducted from October 26, 2021, to March 5, 2022. The results revealed highly significant differences (P ≤ 0.01) in the number and frequency of the LEI0234 marker among the different alleles, with the A1 allele showing superior performance compared to the other alleles. The A1 allele appeared in various genotypic forms, with a frequency of 27.00%. No significant differences were observed among the alleles in terms of body weight, age at sexual maturity, egg mass, or feed conversion efficiency. However, significant differences (P ≤ 0.05) were recorded during the 84-day period. Egg weight showed significant differences (P ≤ 0.05) during the production periods of 14 and 28 days. However, no significant differences were observed during the subsequent periods of 42, 56, 70, 84, 98, and 100 days. In contrast, feed consumption exhibited significant differences (P ≤ 0.05) during the production periods of 14, 28, 42, 56, 98, and 100 days.

Key words: DNA extraction, age at sexual maturity, egg weight, microsatellite marker, Polymerase chain reaction

علاقة الواسم LEI0234 ببعض الصفات الانتاجية للدجاج المحلي

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المستخلص

أُجريت هذه الدراسة باستخدام 100 دجاجة محلية عراقية بيّاضة بعمر 67 يومًا، حيث تم إيواؤها بشكل فردي في أقفاص مرقمة من (1 إلى 100) طوال مدة التجربة التي امتدت من 26 أكتوبر 2021 إلى 5 مارس 2022. أظهرت النتائج وجود فروق عالية المعنوية (P ≤ 0.01) في عدد وتكرار واسم العلامة الجينية LEI0234 بين الأليلات المختلفة، اذ تفوق الأليل A1 في الأداء مقارنةً بباقي الأليلات. وقد ظهر الأليل A1 بأشكال جينية مختلفة، وبلغ تكراره 27.00%. ولم تُسجّل فروق معنوية بين الأليلات من حيث وزن الجسم أو عمر البلوغ الجنسي أو كتلة البيض أو كفاءة التحويل الغذائي. تم تسجيل فروق معنوية (P ≤ 0.05) خلال فترة الإنتاج الممتدة خلال 84 يومًا. وأظهرت أوزان البيض فروقًا معنوية (P ≤ 0.05) خلال فترتي الإنتاج في اليومين 14 و28، بينما لم تُسجّل فروق معنوية في الفترات اللاحقة (42، 56، 70، 84، 98، و100 يوم). وعلى النقيض من ذلك، أظهر استهلاك العلف فروقًا معنوية (P ≤ 0.05) خلال فترات الإنتاج في الأيام 14، 28، 42، 56، 98، و100.

الكلمات المفتاحية: استخلاص DNA، العمر عند النضج الجنسي، وزن البيضة، واسمات التكرارات الاليلية المترادفة القصيرة، تفاعل الكوثرة المتسلسل.

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INTRODUCTION

Poultry production is one of the most important foundations of the economy in many countries of the world, where it is distinguished by the rapid rate of capital turnover and in meeting the nutritional needs of humans (21) natural additives work positively affecting the growth and improving the performance of poultry by various ways (40). Chicken has already established itself as one of the most efficient protein sources (6). Bodyweight (BW) and egg production (EP) traits are most important economic traits for farmers at rural level and producers at commercial level (2). Local breeds are essential material for developing new varieties with unique characteristics, including disease resistance and tolerance to environmental conditions. Therefore, these local breeds must be preserved, and the presence of commercial breeds has posed a major challenge to the conservation of local breeds (14). Breeding chickens in Iraq began in rural areas, and offered the surplus of these two products for sale in urban markets. The breeding in rural areas was characterized by its low costs and its reliance on local breeds of chickens, which are often of modest production of eggs and meat (5. 12). found that higher heritability estimates and more accurate predictions in livestock growth a crucial selection criterion in chicken breeding. Local chicken is considered one of the genetic diversity manifestations, and its importance lies in preserving local genetic resources (8). This method benefits both local and commercial (24) Crossbreeding has been implemented in local chicken breeds (25). The researcher (11) stated that local chickens can be crossbred with exotic breeds to improve egg production characteristics. The production of dual-purpose chickens is determining how to balance the selection for growth-related and egg-production traits (26, 27). Study conducted by (39) showed that microsatellite play an important role in analyzing the genetic diversity of poultry, as well as studying their origins and the species descended from them. The researcher (18) used microsatellite markers to determine genetic diversity and its association with productive traits of poultry in the Nigerian local chicken. In a study conducted by the researcher (37) using of 20 microsatellite markers to determine of genetic diversity (Effective number of alleles Ne, Shannon index I) and a phylogenetic tree to identify genetic variations among local chicken species in Burkina Faso. Environmental resilience has become an important trait for chicken populations (31) reliance a purebred system has decreased the environmental stress compared to crossbred lines (32). The purpose of contributing to genetic improvement programs for local breeds, molecular genetics techniques (DNA markers) were used to improve the productive performance of genotypes of local chicken breeds (16) dealing with breeds shaped by the genetic drift process (33) the agro-ecological zone is to affect genetic diversity (34), Genetic markers are the most important factors in local programs and genetic improvement of local chickens that increase utilized for both meat and egg production (7) may account for diversity observed is that a small number of may have founded colonies (38) . Recent studies have dealt with a number of candidate genes whose economic importance lies in the phenotypic expression of quantitative traits (egg production and egg quality) (20), as well as the contribution of the receptors of those genes and hormones in regulating the functioning of the reproductive system and egg production and quality. In domestic birds (22). The recent scientific developments in molecular genetics have opened the way for workers to learn about modern, accurate and fast methods in order to improve the performance of animals (15). This technique gives an accurate description of the occurrence of mutations compared to other methods and is used to estimate genetic variation between and within breeds (13). Molecular markers are based on the animal's DNA, providing an objective measure of genetic variation (17). Using molecular biology nowadays is one of the keystones to save time (35, 36). In a study on QTL marker (3) concluded that the presence and absence of QTL regions significantly affect on egg weight and eggshell weight, which is suitable for selection programs to improve the genotype of Iraqi chickens. The aim of genetic diversity studies on indigenous chickens is to examine allelic variability, genetic diversity, genetic relationships and differentiations across different regions using various phenotypic and molecular markers (19). Small allelic tandems have proven effective in studies of genetic diversity and genetic mapping compared to other molecular markers (9). The aim of this study is to know the effect of the genetic marker LEI0234 on some productive traits and to study the genetic diversity in local chickens.

MATERIALS AND METHODS

Experimental birds: This study was conducted on one hundred chickens, 67 days old, at Department of Animal Production / College of Agricultural Engineering Sciences / University of Baghdad, the eggs produced by each chicken were collected, numbered, and weighed individually, and veterinary measures were all carried out in accordance with the program in the location of the breeding of laying chickens and herds of Local Iraqi chickens. This was done in order to record the production of egg per chicken to 100 days (from the age of sexual maturity to the age of 100 Day of production). On the first day at the farm, drinking water supplemented with vitamin C (0.5 g/L) was provided. Throughout the experiment, meals were delivered to the birds, and 100 grams of feed per day was given to Lohman lighting system were used at all the period of breeding.

Blood sampling and DNA extraction

Blood samples (3 ml) were collected each bird via brachial vein using EDTA-containing tubes and kept under -20°C. DNA extraction was done by the Geneaid-Kit Company in Taiwan. At some modification on extraction protocol were done by reducing blood volume to 20 µl (26). The genomic DNA Electrophoreses was performed by 1% Agarose gel and 0.2 µl Ethidium bromide, then visualized by UV Light, a digital camera was used to get photo for the gel. The PCR technique condition was carried out estimation of the DNA concentration of the samples of LEI0234 marker:

F: 5'- ATGCATCAGATTGGTATTCAA -3'
R: 5'- CGTGGCTGTGAACAAATATG -3'

Using the diagnostic kit (GoTaq® Green Master Mix) produced by American Promega the PCR condition was: initial at 94°C for 5 min, than 35 cycles of initial denaturation at 94°C for 30s, annealing at 55.3 °C for 30 sec, elongation at 72°C for 30 sec, and final elongation at 72°C for 5 min. Sample migration was carried out.

Statistical analysis

Data were statistically analyzed using statistical analysis system program (30) to study the association of LEI0234 marker in productive traits to compare the significant differences using Duncan test (10) polynomial. The relationships of LEI0234 marker to the studied traits were:

$Yij= \mu+Ai+eij$

Where: Yij: the observations value j of the alleles i

µ: the overall means of the trait

Ai: influence of alleles of LEI0234 marker

Eij: the random error is normally distributed with a mean of zero and a variance of $\sigma^2 e$.The chi- square test was also performed to examine the percentage of allele's distribution for LEI0234 marker in the analyzed sample.

RESULTS AND DISCUSSION

PCR product , as shown in Figure (1), was a successful and essential step. we were referred to them with different letters(A3,B1,B2,B1,A3,D1,B4,D1). This PCR reaction was conducted by knowing the marker allele packages and using a special kit, the samples were migrated using ladder (100-1000) bp.

Number and percentage of genotypes for the LEI 0234 marker allele: Table (1) revealed that there were high significant differences ($P \leq 0.01$) in Distribution on different alleles, also the A1 allele superiority with (27.00%) respectively, that may be due to effect of sample size or environmental conditions.

Effect of LEI0234 marker alleles on feed consumption: The Table (2) that there are significant differences ($P \leq 0.05$) between the alleles of the traits of feed consumption in the (14,28,42,56,98,100)g. The alleles (B1, D2, D2,D2,D2,D2) recorded excelled of (1307.71, 1326.65, 1356.26, 1376. 98, 1991. 91,10122. 48)g respectively. The results of the table indicated that there were no significant differences in productive periods (70,84). The reason may be due to the existence of differences between the alleles in that it has to do with the quality of feed consumption that was chosen on the basis of this characteristic, as there is an overlap between heredity and the environment.

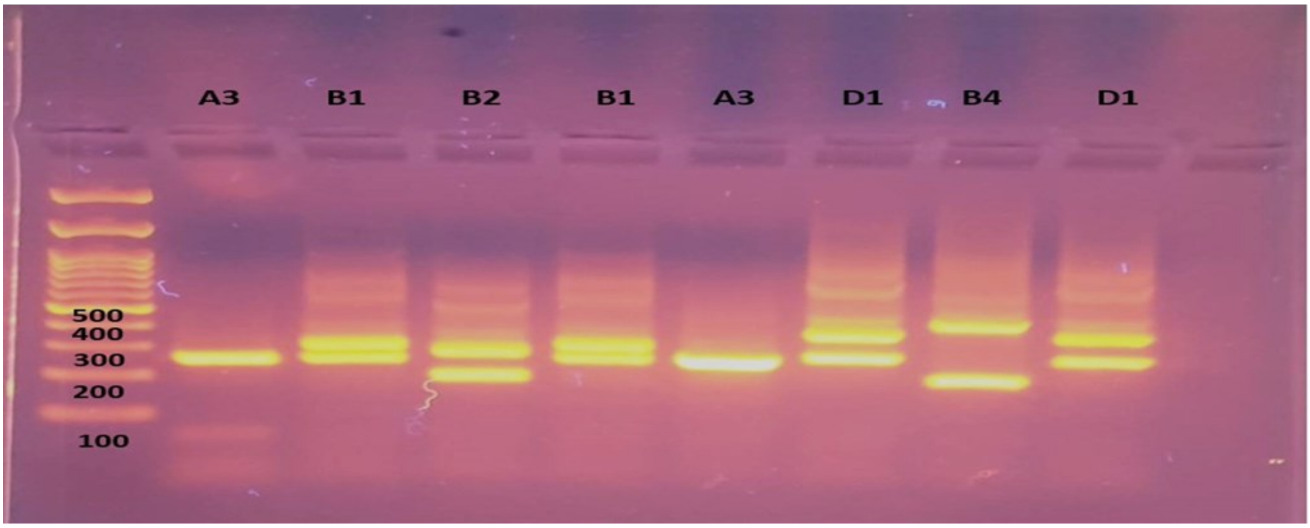

Figure 1. LEI0234 marker Electrophoresis of PCR-Product from the blood of laying hens with 5 volt /cm2 for half an hour with a concentration of 1.5% agarose

Table 1. Number and percentage of genotypes for the LEI 0234 marker alleles

percentage (%)	numbers	(Polymorphism)
27.00	27	A1
5.00	5	A2
7.00	7	A3
13.00	13	A4
8.00	8	B1
23.00	23	B2
9.00	9	B3
3.00	3	B3
1.00	1	C2
2.00	2	D1
2.00	2	D2
100%	100	Average
12.307 ; P≤0.01.	---	chi-square value

Table 2. Effect of LEI02434 marker alleles on feed consumption in local chickens across different production periods (Mean ± SE).

Feed consumption(g) days	Alleles										Significance level
	A1	A2	A3	A4	B1	B2	B3	B4	D1	D2	
14	1093.06±38.35ab	1229.53±73.20a	1141.23±83.05ab	1178.82±59.95ab	1307.71±69.36a	1156.99±41.82ab	1209.39±64.93ab	1041.97±142.69ab	930.38±15.64b	1295.01±2.00 a	P≤0.05
28	1120.35±36.86ab	1275.96±61.75a	1167.21±77.93ab	1206.57±56.84ab	1304.28±59.11a	1185.73±39.39ab	1225.54±61.16ab	1087.15±140.81ab	993.52±37.71b	1326.65±9.83a	P≤0.05
42	1145.72±35.38ab	1310.64±53.17ab	1189.30±73.31Ab	1234.25±52.75ab	1321.80±55.72a	1210.93±37.03ab	1241.42±57.62ab	1121.96±139.45ab	1051.67±64.33b	1356.26±4.96a	P≤0.05
56	1182.52±32.97Ab	1336.82±43.66ab	1201.88±65.92Ab	1262.82±48.02ab	1332.11±54.25ab	1240.72±32.98ab	1259.07±54.41ab	1154.57±133.56ab	1108.43±58.87b	1376.98±4.32a	P≤0.05
70	1228.62±29.85	1361.08±28.39	1249.15±56.20	1291.62±42.39	1339.39±51.89	1247.68±29.11	1286.36±49.87	1193.63±134.67	1385.69±1.52	1385.69±1.52	N.S
84	1264.77±27.05	1382.01±11.54	1282.20±48.91	1316.92±36.04	1347.59±47.48	1308.00±25.13	1309.54±44.98	1224.92±136.86	1276.78±65.29	1390.00±0.99	N.S
98	1744.15±47.52ab	1926.68±73.86ab	1809.54±99.70ab	1846.56±72.97ab	1983.85±89.19a	1821.30±50.17ab	1869.14±82.33ab	1662.89±196.22Ab	1599.98±44.93b	1991.91±2.10a	P≤0.05
100	8779.20±242.03ab	9822.71±345.47ab	9040.51±489.29Ab	9337.56±363.38ab	9936.73±419.31ab	9198.36±250.31ab	9400.46±408.55ab	8487.10±995.99Ab	8157.00±348.44b	10122.48±17.52a	P≤0.05

N.S: Non-significant

Effect of different alleles of LEI0234 marker on feed conversion efficiency

Table (3) results indicated that there were no significant differences between the different alleles in feed conversion efficiency in different production periods. The researcher (4) stated that genetic diversity was high among 8 Chinese breeds using short allelic repeat markers, indicating the presence of an influence of breed and environment within a single species.

Table 3. Effect of LEI02434 marker alleles on feed conversion efficiency across different production periods (Mean ± SE).

Feed conversion efficiency (g)	Alleles										Significance level
	A1	A2	A3	A4	B1	B2	B3	B4	D1	D2	
14	3.20±019	3.93±0.70	3.72±0.89	3.96±0.71	3.09±0.21	3.45±0.24	2.90±0.27	2.48±0.84	2.07±0.16	2.77±0.34	N.S
28	2.72±0.19	3.54±0.71±	2.91±0.35	5.43±2.20	3.04±0.24	2.80±0.23	3.12±0.29	3.10±0.73	2.15±0.10	3.11±0.75	N.S
42	2.76±0.16	3.82±1.33	2.86±0.44	3.28±0.39	3.33±0.36	2.87±0.20	2.57±0.19	2.75±0.80	2.36±0.07	2.93±0.02	N.S
56	2.61±0.18	3.77±1.21	2.44±0.19	3.96±0.94	2.97±0.24	2.56±0.12	2.61±2.27	2.59±0.68	2.24±0.01	2.81±0.15	N.S
70	3.00±0.23	3.72±0.76	2.69±0.11	3.18±0.26	3.12±0.16	2.74±0.11	2.18±0.22	2.75±0.47	2.46±0.20	3.26±0.34	N.S
84	2.88±0.17	3.65±0.49	2.50±0.17	3.28±0.23	3.45±0.26	2.87±0.14	3.02±0.31	2.60±0.55	3.17±0.06	3.45±0.71	N.S
98	3.30±0.17	4.53±1.03	3.78±0.23	4.28±0.46	4.74±0.91	3.62±0.22	3.57±0.27	3.49±0.78	3.07±0.39	4.80±1.84	N.S
100	2.92±0.13	3.85±0.82	2.99±0.31	3.91±0.48	3.39±0.26	2.99±0.13	2.94±0.22	2.82±0.68	2.50±0.07	3.31±0.55	N.S

N.S: Non-significant

Effect of LEI0234 marker alleles on weight and age at sexual maturity: Table (4) results indicated that there were no significant differences between the different alleles for each of the traits of age and weight at sexual maturity. (23) Mentioned that the marker MCW0330 has a significant effect on the characteristic of age at sexual maturity. While the researcher (28) founded no significant differences in age at first egg (AFE) for MCW0014 marker in Rhode Island Red chickens.

Table 4. Effect of LEI0234 marker alleles on age and weight at sexual maturity of local chickens (Mean ± SE).

Productive traits	Alleles									significance level
	A1	A2	A3	A4	B1	B2	B3	B4	D1	D2	
Age at sexual maturity (days)	154.59±22.90	160.20±8.12	159.42±6.80	157.84±5.09	172.12±5.49	165.82±4.36	162.00±9.08	164.33±11.66	154.50±10.50	174.00±1.00	N.S
Weight at sexual maturity (kg)	1361.5635.97	1465.80±116.63	1235.7±73.26	1310.00±42.58	1506.75±118.17	1358.70±47.16	1420.89±77.13	1330.67±98.19	1331.00±9.00	1397.00±103.00	N.S

N.S: Non-significant

Table 5. Effect for LEI0234 marker alleles on the number of eggs across different productive periods (Mean ± SE).

number of eggs (days)	Alleles										significance level
	A1	A2	A3	A4	B1	B2	B3	B4	D1	D2	
14	8.48±0.43	8.20±1.06	9.57±1.10	8.46±0.70	9.50±0.26	8.43±0.47	10.33±0.50	10.00±1.52	10.50±1.50	10.50±0.5	N.S
28	9.59±0.45	9.60±1.40	10.14±0.73	8.91±0.70	9.37±0.65	10.130.44	9.33±0.62	8.66±0.88	10.50±0.50	9.50±1.5	N.S
42	4.48±0.46	9.80±1.77	10.00±0.75	9.00±0.57	9.00±0.68	9.69±0.39	10.66±0.47	9.00±1.00	10.00±1.00	10.00±0.00	N.S
56	9.88±0.38	9.00±1.51	10.85±0.55	8.84±0.87	9.62±0.32	10.34±0.34	10.66±0.52	9.33±1.45	10.50±0.50	9.50±0.50	N.S
70	9.70±0.43	8.60±1.20	10.00±0.43	9.15±0.51	9.75±0.49	10.17±0.33	10.11±0.56	9.66±0.88	10.50±1.50	8.50±0.50	N.S
84	9.96±0.35ab	8.80±1.28ab	11.28±0.42a	9.23±0.48ab	8.75±0.55ab	9.69±0.33ab	9.88±0.61ab	10.33±1.20ab	9.50±0.50ab	8.50±1.50b	P≤0.05
98	11.62±0.36	11.00±1.64	11.28±0.42	10.53±0.73	10.50±1.00	11.43±0.43	11.88±0.42	10.66±0.88	11.00±1.00	10.00±3.00	N.S
100	68.74±2.17	65.00±8.87	73.14±3.12	63.75±3.23	66.50±2.87	69.91±1.81	72.88±2.53	67.66±7.33	72.50±3.50	66.50±6.50	N.S

N.S: Non-significant

Effect of LEI0234 marker alleles on the number of eggs for different productive periods: Results in Table (5) indicated that there were no significant differences in the number of eggs (14, 28, 42, 56, 70, 98,100), respectively. The results also showed that there were significant differences ($P \leq 0.05$) in the sixth productive period (84), as the (A3) allele was superior (11.28) The researcher (6) mentioned the effect of some alleles MCW0041, ADL0210 and MCW0110 on the trait of egg production

Effect of LEI0234 marker alleles on egg weight for different productive periods

The results in Table (6) indicated that there were significant differences ($P \leq 0.05$) in the productive period (14) for the traits of egg weight, as the allele (B4) was superior (47.18±3.04). The results also showed that there were no significant differences in the productive period (28, 42, 56, 70, 84, 98, 100) respectively. In contrast, the researcher (29) founded a correlation of AA genotype at ADL0023 MS loci with body weight at 20 weeks and AA genotype at ADL0273 with body weight at 20 and egg weight at 28 weeks, they demonstrated as promising markers for genetic improvement of layer traits in poultry and may be used in future breeding programs. This is due to following a good nutritional program and using balanced feed that contains all the nutritional elements, in addition to having a good management system.

Table 6. Effect of LEI0234 marker alleles on egg weight across different productive periods (Mean SE).

egg weight(g) (days)	Alleles										significance level
	A1	A2	A3	A4	B1	B2	B3	B4	D1	D2	
14	43.13 ±0.18 ab	41.90 ±0.62 ab	37.95 ±1.44 b	41.85 ±1.23 ab	45.15 ±1.53 a	43.03 ±0.81 ab	41.93± 1.77 ab	47.18 ±3.04 a	43.52 ±3.45 ab	44.93± 3.44 a	$P \leq 0.05$
28	46.24 ±0.82	42.85 ±1.56	41.82 ±2.64	45.37 ±1.15	47.16 ±0.99	45.00 ±0.75	43.93± 1.51	42.34 ±0.19	43.92 ±1.69	46.97±4.44	N.S
42	46.82 ±0.58	46.78 ±1.48	44.60 ±2.32	45.75 ±1.07	46.72 ±1.19	46.27 ±0.87	46.22± 1.21	49.29 ±3.54	44.55 ±0.29	46.23±0.48	N.S
56	49.07 ±0.86	50.39 ±1.55	46.52 ±2.28	47.10 ±1.11	47.75 ±1.55	48.39 ±1.01	47.23± 1.63	51.84 ±0.23	46.93 ±0.48	51.67±0.06	N.S
70	46.19 ±1.02	48.22 ±1.21	47.12 ±2.98	46.84 ±0.95	44.68 ±1.78	47.39 ±1.37	46.84± 1.80	45.94 ±1.95	46.87 ±0.44	50.29±2.39	N.S
84	46.89 ±1.15	47.09 ±2.52	46.27 ±1.64	45.78 ±1.44	46.00 ±1.57	48.87 ±1.16	46.50± 1.39	47.67 ±0.10	42.37 ±0.94	49.09±1.51	N.S
98	46.67 ±0.65	44.97 ±1.52	42.88 ±1.87	44.63 ±1.04	45.32 ±1.13	46.18 ±0.83	45.16± 1.31	46.55 ±2.38	47.91 ±3.12	47.24±4.42	N.S
100	46.43 ±0.53	46.03 ±1.25	43.88 ±2.04	45.33 ±0.90	46.11 ±0.64	46.45 ±0.70	45.40± 1.29	47.26 ±1.01	45.15 ±1.01	48.06±2.39	N.S

N.S: Non-significant

Effect of LEI0234 marker alleles on egg mass for different productive periods

Table (7) results indicated no significant differences between the different alleles of the trait of egg mass by experimental birds at different production periods. The researcher (1) stated that there were significant effects ($P \leq 0.05$) in the egg mass trait at the periods (14, 42, 84, and 100) days for the LEI0258 marker in local chickens. This may be due to the complementary effects of these alleles for each marker, as the quantitative trait is affected by a large number of genes, and therefore their impact is greater than their individual effect.

Table 7. Effect of different alleles for marker LEI0234 on egg mass across different productive periods (Mean ± SE).== N.S: Non-significant

egg mass (g) (days)	Alleles										significance level
	A1	A2	A3	A4	B1	B2	B3	B4	D1	D2	

14	368.92±22.40	343.80±45.94	362.26±43.09	353.41±30.12	429.30±20.15	361.11±20.75	434.10±28.14	472.52±79.32	451.80±29.03	473.51±58.66	N.S
28	445.04±23.89	412.33±66.06	420.54±36.65	403.06±29.61	443.02±33.24	455.09±20.86	407.79±26.33	366.88±37.22	462.06±39.76	452.90±112.66	N.S
42	444.59±23.25	455.43±84.82	444.35±36.04	411.76±26.18	419.45±33.85	446.00±18.88	490.75±18.13	447.15±70.46	445.21±41.65	462.35±4.85	N.S
56	488.06±23.00	449.34±75.10	501.61±26.52	413.47±39.94	461.46±26.46	499.50±18.14	505.00±31.38	484.53±77.60	493.03±28.58	490.88±25.22	N.S
70	445.84±21.07	411.58±56.92	467.37±24.66	429.88±27.14	434.82±25.42	480.96±20.34	471.52±27.66	441.56±29.56	491.47±65.68	428.70±45.50	N.S
84	468.64±21.68	409.13±58.34	521.33±23.47	419.11±20.79	402.09±27.87	474.55±20.06	462.07±35.98	492.47±57.50	402.06±12.23	419.53±86.51	N.S
98	544.05±19.56	494.16±78.55	485.37±31.47	467.98±31.24	472.98±43.70	529.31±22.67	537.77±27.48	496.67±47.97	530.20±82.25	485.76±186.00	N.S
100	3197.53±113.54	2979.68±413.63	3204.12±186.87	2895.02±141.02	3068.82±146.22	3241.86±90.01	3308.19±140.45	3203.35±375.19	3277.32±231.41	3211.84±471.79	N.S

Effect of different alleles of LEI0234 marker on the qualitative traits of different productive periods

Table (8) showed that there are significant differences ($P \leq 0.05$) for the characteristic of shell weight. As the (D2) allele recorded a superiority of (7.34) g over the different alleles. The results also indicated that there were significant differences ($P \leq 0.05$) for the characteristic of shell thickness, as the (B1) allele recorded a superiority of (0.39) mm over the different alleles. The results also showed that there were significant differences ($P \leq 0.05$) for the characteristic of yolk weight between the alleles. The (D2) allele outperformed (17.55) g over the rest of the different alleles. The results also showed that there were significant differences ($P \leq 0.05$) for the characteristic of yolk height between the alleles, as the (B4) allele outperformed (19.31) mm over the rest of the different alleles. The results also showed that there were significant differences ($P \leq 0.05$) for the characteristic of yolk diameter, as the (D2) allele recorded a superiority of (39.84) mm. The results also indicated that there were significant differences ($P \leq 0.05$) for the albumin weight, as the (D2) allele recorded an excelled of (29.18) g on the different alleles. The results also showed that there were significant differences ($P \leq 0.05$) for the traits of albumin diameter, where the (A2) allele recorded a excelled of (79.72) mm over the different. The results also indicated that there were no significant differences for the traits of albumin height (mm) and Haugh unit (HU).

Table 8. Effect for LEI 0243 marker alleles on the qualitative traits of eggs across different production periods of local chickens (Mean ± SE)

studied traits	Alleles										significance level
	A1	A2	A3	A4	B1	B2	B3	B4	D1	D2	
Shell weight (g)	7.00±0.08ab	7.06±0.10ab	6.39±0.18c	6.95±0.11abc	7.11±0.18a	7.01±0.08ab	6.88±0.12abc	6.89±0.19abc	6.45±0.19bc	7.34±0.38a	P≤0.05
Shell thickness mm)(	0.37±0.00ab	0.38±0.00a	0.35±0.00bc	0.38±0.00ab	0.39±0.00a	0.38±0.00a	0.38±0.00ab	0.38±0.00ab	0.35±0.00c	0.38±0.02a	P≤0.05
Yolk weight (g)	16.25±0.18abc	17.46±0.28a	15.01±0.37c	16.28±0.21abc	16.33±0.35abc	16.01±0.17bc	15.96±0.36bc	17.04±0.52ab	15.37±0.50c	17.55±0.58a	P≤0.05
Yolk height (mm)	18.37±0.14abc	19.27±0.23a	17.66±0.24c	18.82±0.19ab	18.97±0.20ab	18.49±0.12abc	18.12±0.23bc	19.31±0.28a	18.28±0.56bc	19.03±0.38ab	P≤0.05
Yolk diameter (mm)	38.69±0.20ab	39.57±0.44ab	38.12±0.38b	38.98±0.27ab	39.02±0.33ab	38.96±0.19ab	38.70±0.33ab	39.43±0.33ab	38.88±0.23ab	39.84±0.31a	P≤0.05
Albumen weight g)(	26.88±0.33ab	28.23±0.47a	23.76±0.72c	26.99±0.46ab	28.76±0.86a	27.14±0.46ab	25.37±0.64bc	28.25±0.94a	24.14±0.35c	29.18±0.68a	P≤0.05
Albumin diameter (mm)	75.37±0.57abc	79.72±1.45a	71.01±1.55c	74.84±1.03abc	77..49±1.15ab	74.07±0.67a	73.68±1.37bc	77.87±2.09ab	77.63±0.94ab	78.08±3.09ab	P≤0.05
Albumin height (mm)	6.75±0.10	6.75±0.20	6.45±0.16	7.09±0.23	6.92±0.24	6.75±0.10	6.47±0.12	6.71±0.36	6.72±0.49	6.34±0.22	N.S
Haugh unit (HU)	83.26±0.98	83.33±1.83	80.59±1.45	86.39±2.08	84.84±2.16	83.33±0.90	80.81±1.11	82.92±3.30	82.99±4.45	79.60±2.01	N.S

N.S: Non-significant.

CONFLICT OF INTEREST

The authors declare that they have no conflicts of interest.

DECLARATION OF FUND

The authors declare that they have not received a fund.

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