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Genetic and non-genetic factors affecting the body weight of the Kurdish local chicken

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Abstract

The current study was conducted at Kani –Graw private field around Erbil city –for the period from 01/09/2022 to 01/05/2023. The study was carried out to know the impact of changes in live weight of Kurdish local chickens due to sex and generation effects. The number of the Kurdish local chicks was two hundred and fifty chicks and their first generation. The effects cleared that, the live weight range substantially in accordance to the sex and generation of the chicks and their interactions especially at some stage in the period from one to eighteen weeks ($P<0.01$). Also, the live weight in male greater than females and accelerated steadily from zero to eighteen week of age the value the closing weight used to be 1704.06±11.83g and 1380.00±20.50g for males and females parents, respectively and 1649.69±15.64g and 1299.22±10.30g for males and females in 1st generation, respectively.
Heritability estimate (h^2) indicated that, the heritability estimates for live weight trait. Estimates of h^2 two values had been average to excessive the value it ranged from 0.27 to 0.41 for live weight.

Key words: Body weight, local chickens, Sex, Generation, Heritability.
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Introduction

The local chicken is regarded as one of the most vast farm animals and is extraordinary with the aid of its combined genetic make-up [1]. The chickens have been domesticated for a long time, genetic tendency and phenotype help them adapt to their environment. These situations have led to the emergence of bird communities with heritable and comparable morphological characteristics within the same species [2].

The breeds of local chickens are properly genetic sources characterized through their potential to adapt to difficult environmental stipulations and resistance to some ailments [3]. Local Iraqi chicken is one of the breeds categorized for manufacturing of egg [4]. However, its productive overall performance is vulnerable in contrast to the global fashionable breeds [5].

The attribute of live weight is one of the vital monetary characteristics in hen farming

that is managed by means of more than one factor. Understanding the elements affecting increase will furnish a probability to enhance productive and physiological performance of bird. Body weight of chicken can be described as the dimension of the animal and its well-known condition, and the distinction in live weight in the herd can be caused by genetic factor and environmental influences [6].

The development of reproductive efficiency is of great importance in the rooster industry. As the required production time of broiler chickens has been genetically shortened, the impact of egg and chick weight on overall broiler performance gains is increasingly recognized and may also become apparent. is essential in corporate broiler initiatives[7].

[8] counseled that the propose length desired for the chicks to reap two kg live weight is 60.79 day in 1980 at the same time as the equal weight in 2000 took about 40.86 day. The crossbreeding has been used to make bigger the growth rate however; rapid growth has been associated with some reasons consequences, such as a make better in fat deposition [9]; [10].

The day-old weight shows the egg weight as there is an immoderate genetic correlation between the two traits [11]; [12].

Moreover, the chick weight at first day has a massive have an effect on mortality at first day [13] and the average overall performance by way of later tiers of broiler age [14];[15].

There is no contract amongst specific lookup related to the effect of the day old weight on subsequent weight. Some lookup said that the day-old weight have an impact on the average overall performance of broilers [16]; [17] and [18], while distinctive lookup have demonstrated that the versions in day-old weight has a little have an effect on the ordinary overall performance of broilers [19]; [20].

Kurdish local chickens are Iraqi local chickens that vary from other chickens in terms of their feather color, earlobe color, comb shape, eggshell color, and other physical traits. Additionally, there are variations in their quantitative qualities, including body weight, feed intake, egg production, egg size, and weight, among other traits [21].

The aim of current study is to check out the impact of changes in live weight of nearby chickens due to sex and generation effects.

Material and Method

The current study was conducted at Kani – Graw private field around Erbil city –for the period from 01/09/2022 to 01/05/2023.

The study was carried out on raising 250 local chicks which collected at different village around Erbil at the age of one week and continued until the age of eight months. For the period of study a number of samples were collected from both sexes at the age of two, four, six and eight months.

Rearing of chicks takes place on the ground in semi-open halls, divided by iron partitions and wire mesh equipped with vacuum cleaners. Suitable environmental conditions for ventilation, heating, lighting, water and feed are provided. The preventive feeding program used as a guide for as ISA brown layer is also followed. The chicks were raised communally until six day of age (acclimation period).

On the seventh day, local chickens and sex are leg-tied, personally weighted and randomly divided into four groups of chicks.

Each group was randomly assigned to one of sixteen experimental pens, each measuring 1.50 x 2.85 m. Each pen was once equipped with two 175-watt infrared lamps for heating up to 21 days of age, two tube feeders, and two bell drinkers, with the result that each feeder allowed chickens 6.2 cm in length and 4.7 cm in drinking space.

Bird had been vaccinated against infectious bronchitis, Newcastle and Infectious bursal disease.

After the initial weighting, bird are weighed weekly until eighteen weeks of age. Bird were fasted for twelve hours before weighing and fed in each barn and leftovers are recorded before each weighing.

Body weight:

The weight of the birds in (g) was recorded in each period by using digital scale which sensitive to 1 g.

Statistical analysis:

For all analyzes pen ability was used. The statistics have been analyzed through evaluation of variance the use of the GLM system of statistical analyzes of the statistics have been done through the use of the program software SAS 9.2 (SAS institute, 2009) [22]. (Parents and 1st era and two sexes have been tested. Statistical magnitude of variations amongst skill was once decided by way of Duncan Multiple Range Test (DMRT).

Estimating of genetic parameters:

The data set up to mixed model equations to estimate the components of variance according to [23].

The model was in matrix notation: **Y=Xb+Zu+e**

Where:

Y: is the vectors of observations

b and **u**: are the vectors of fixed and random effects , with incidence matrices **X** and **Z**, and **e** is the environmental random effects vector.

$$E\begin{vmatrix} Y \\ a \\ d \\ e \end{vmatrix} = \begin{vmatrix} Xb \\ 0 \\ 0 \\ 0 \end{vmatrix}$$

$$V\begin{vmatrix} Y \\ a \\ d \\ e \end{vmatrix} = \begin{vmatrix} V_{dom} & Z'A_{\sigma^2 a} & Z'D_{\sigma^2 d} & I_{\sigma^2 e} \\ AZ'_{\sigma^2 a} & A_{\sigma^2 a} & 0 & 0 \\ DZ'_{\sigma^2 d} & 0 & D_{\sigma^2 d} & 0 \\ I_{\sigma^2 e} & 0 & 0 & I\sigma^2 e \end{vmatrix}$$

Where: $V_{dom} = z\,(A\,\sigma^2\,a + D\,\sigma^2\,d)\,z' + I\,\sigma^2\,e$,

σ^2 d: is the dominance genetic variance;

A and D: are the additive and dominance animal relationship matrices,

σ^2 e: is the random environmental variance

I: is an identity matrix. Heritability was computed according to [24].

$h^2 = \sigma^2\,A / (\sigma^2\,A + \sigma^2\,e)\,\lambda$

is the ratio $\sigma^2\,e/\sigma^2\,u$

Where:

h^2: is the heritability,

σ^2A: is the additive genetic variance,

σ^2e: is the random environmental variance.

The best linear unbiased prediction solutions for fixed and random effects by solving the usual Mixed Model Equations given by [25] [26].

Estimates of (Co) variance were obtained with REML individual animal model using the DEREML Software [27].

$$\begin{vmatrix} X`X & X`X`Y \\ Z`X & Z`Z+\lambda A^{-1}1 \end{vmatrix} \begin{vmatrix} b\hat{} \\ u\hat{} \end{vmatrix} = \begin{vmatrix} Z \\ Z`Y \end{vmatrix}$$

Results and Discussion

The results observed in Table (1) cleared that, the body weight differ significantly according to the sex and generation and their interactions especially during the period from 1 to 18 weeks ($P<0.01$). This results attributed to the effect of sex and generation affected positively on the on the body weight of chicken.

Table 1: Analysis of variance for study the sex and generation effects and their interaction on the body weight development of Kurdish local chicks

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	One day	331.690[a]	3	110.563	8.623	0.000
	2weeks	12597.422[b]	3	4199.141	61.619	0.000
	4weeks	109493.422[c]	3	36497.807	91.899	0.000
	6weeks	322098.315[d]	3	107366.105	12.643	0.000
	8weeks	91757.258[e]	3	30585.753	22.587	0.000
	10weeks	1115295.313[f]	3	371765.104	94.181	0.000
	12weeks	1413149.172[g]	3	471049.724	209.180	0.000
	14weeks	1560533.105[h]	3	520177.702	321.864	0.000
	16WEEKS	1765929.687[i]	3	588643.229	255.457	0.000
	18WEEKS	1895827.637[j]	3	631942.546	173.368	0.000
Local Chickens	One day	120.313	1	120.313	9.383	0.003
	2weeks	405.016	1	405.016	5.943	0.018
	4weeks	4176.391	1	4176.391	10.516	0.002
	6weeks	11522.681	1	11522.681	1.357	0.249
	8weeks	31329.000	1	31329.000	23.136	0.000
	10weeks	64389.063	1	64389.063	16.312	0.000
	12weeks	189551.391	1	189551.391	84.174	0.000
	14weeks	122718.848	1	122718.848	75.933	0.000
	16WEEKS	89251.563	1	89251.563	38.733	0.000
	18WEEKS	73068.848	1	73068.848	20.046	0.000
Sex	One day	184.790	1	184.790	14.412	0.000
	2weeks	12182.641	1	12182.641	178.770	0.000
	4weeks	105057.016	1	105057.016	264.527	0.000
	6weeks	288402.563	1	288402.563	33.960	0.000
	8weeks	60178.223	1	60178.223	44.440	0.000
	10weeks	1040400.000	1	1040400.000	263.570	0.000
	12weeks	1219092.016	1	1219092.016	541.364	0.000
	14weeks	1434754.785	1	1434754.785	887.767	0.000
	16WEEKS	1673789.063	1	1673789.063	726.386	0.000
	18WEEKS	1819969.629	1	1819969.629	499.292	0.000
Local Chickens * sex	One day	26.587	1	26.587	2.074	0.155
	2weeks	9.766	1	9.766	.143	0.706
	4weeks	260.016	1	260.016	.655	0.422
	6weeks	22173.071	1	22173.071	2.611	0.111
	8weeks	250.035	1	250.035	.185	0.669
	10weeks	10506.250	1	10506.250	2.662	0.108
	12weeks	4505.766	1	4505.766	2.001	0.162
	14weeks	3059.473	1	3059.473	1.893	0.174
	16WEEKS	2889.063	1	2889.063	1.254	0.267
	18WEEKS	2789.160	1	2789.160	.765	0.385
Error	One day	769.324	60	12.822		
	2weeks	4088.813	60	68.147		
	4weeks	23829.063	60	397.151		
	6weeks	509544.434	60	8492.407		
	8weeks	81247.992	60	1354.133		
	10weeks	236840.625	60	3947.344		
	12weeks	135113.438	60	2251.891		
	14weeks	96968.359	60	1616.139		
	16WEEKS	138256.250	60	2304.271		
	18WEEKS	218705.859	60	3645.098		

Sex and generation effects on body weight development at different periods:

Sex and generation results on live weight improvement at unique periods: Our effects determined in Table (2) cleared that, the live weight vary drastically amongst male and females amongst first generations (P<0.01). The outcomes cleared that, the live weight in male greater than females and improved gradually from one day to eighteen week the value the last weight was once 1704.06±11.83g and 1380.00±20.50g for male and females parents, respectively and 1649.69±15.64g and 1299.22±10.30g for males and females in first generation, respectively.

These results are consistent with results of [28] the vicinity they proven that live weights at zero, four, eight and twenty weeks of age have been drastically extremely good (P<0.01) between the two generations that prolonged via the artificial selection. Also, there had been fairly exquisite variants between traces in live weight from zero to twenty weeks of age (P<0.01) and the chosen line had increased live weight than the manipulate line over generations.

There were significantly differences between the sexes at live weight from four to twenty weeks of age (P<0.01) with live weight of male from four to twenty weeks of age being higher than those female in the two effects across generation.

There have been quite big versions (P<0.01) between generations, traces and sex in shank dimension and keel measurement at all whilst in the current study. Some huge relations found between the predominant consequences wondering about the special studied aspects which suggest that the influence has now not because of the foremost effects, alternatively it can additionally express distinctive factors than the most essential effects. Also, there have been non-significant interactions between the fundamental penalties that suggest the versions between the characteristics studies had been due to the important effects.

This cease end result in harmony with [29] and [30], on the other hand it used to be insignificant at twelve and sixteen weeks of age because of some environmental factors. On the other hand [31] indicated that the chicks belong to the first and second generations have significantly (P<0.01) higher body weight at sex maturity than those of parents.

Regardless of sex, the generation that knows how to interact x-line [28] used to be located instead significant (P<0.01) at zero, eight, twelve, sixteen and twenty weeks of age, the location it viewed that the chosen line had the ideal weight over generation and in the equal time the manipulate line in the 2nd generation had the same weight of the chosen line in the 1st generation at zero weeks of age, at the same time as at eight, twelve, sixteen and twenty weeks of age it observed that over generations the chosen line had the best weight, then again in the 1st generation the control line had the best weight than in the 2nd one, then again at four weeks of age, it used to be non-significant (Table 2).

The interaction between generation and sex used to be significant (P<0.01) wondering about live weight at zero and four weeks of age. It viewed that the live weight of males used to be higher than female over generations, on the other hand at zero weeks of age female had the equal weight over generations, at the same time as at four weeks of age female in the 2nd generation used to be as soon as higher than that at first generation, on the other hand at eight, twelve, sixteen and twenty weeks of age it used to be non-significant.

Males have an additional ability to gain weight in domestic chickens due to the effect of the gene on the sex chromosomes or because of the effect of the sex hormones on the survival of the bird at live weight. Also, [32] [33], showed that the adult males extensively excelled in females' increase features at one of a kind ages.

The sex is also considered the motives for the variant in the productive overall performance of chickens [34], Males are usually outperformed females of Ross traces at six and nine weeks discovered by [35]. The superiority of adult males as compared female due to their ability to dominate through feeding and hormonal that lead to faster muscle deposition in adult males involving FSH and LH hormones.

Table 2: Parents and generation effects on body weight (g) in Kurdish local chicken at different periods

Parameters	Local Chickens	Sex	N	Mean Std. Error
One day	Parents	Male	16	43.19±0.59A
		Female	16	38.50±0.85A
	First generation	Male	16	39.16±1.07A
		Female	16	37.05±0.99A
2weeks	Parents	Male	16	111.81±2.02A
		Female	16	83.44±1.95C
	First generation	Male	16	106.00±2.14B
		Female	16	79.19±2.15C
4weeks	Parents	Male	16	289.88±2.94A
		Female	16	204.81±5.2C
	First generation	Male	16	269.69±4.48B
		Female	16	192.69±6.6D
6weeks	Parents	Male	16	576.56±9.01A
		Female	16	479.53±6.92B
	First generation	Male	16	586.95±43.5A
		Female	16	415.47±10.08C
8weeks	Parents	Male	16	745.08±11.42A
		Female	16	679.80±6.41C
	First generation	Male	16	696.88±9.72B
		Female	16	639.50±8.51D
10weeks	Parents	Male	16	1115.00±13.72A
		Female	16	834.38±10.28C
	First generation	Male	16	1025.94±20.22B
		Female	16	796.56±16.85D
12weeks	Parents	Male	16	1318.75±12.23A
		Female	16	1025.94±10.5C
	First generation	Male	16	1193.13±11.86B
		Female	16	933.88±12.75D
14weeks	Parents	Male	16	1465.16±10.65A
		Female	16	1151.88±11.39C
	First generation	Male	16	1363.75±9.59B
		Female	16	1078.13±8.3D
16weeks	Parents	Male	16	1580.31±11.51A
		Female	16	1270.31±8.64C
	First generation	Male	16	1519.06±14.69B
		Female	16	1182.19±12.37D
18weeks	Parents	Male	16	1704.06±11.83A
		Female	16	1380.00±20.5C
	First generation	Male	16	1649.69±15.64B
		Female	16	1299.22±10.3D

- For each week: Means within the same column of different litters are significantly different at (P<0.01)

Estimates of direct additive genetic σ^2, error variance eσ^2, phenotypic variance pσ^2 and heritability h^2 of live Body weight at eighteen weeks of age in Kurdish local chicken.

Heritability estimate (h^2) Table 3 presents heritability estimates for live weight trait. Estimates of h two values had been reasonable to excessive the value it ranged from 0.27 to 0.41 for live weight. The excessive h^2 a

estimates features ensuing from the excessive relative significance of additive genetic that are steady with this study. [36] [37] pronounced that, the excessive heritability indicated that, to enhance these traits, character determination greater environment closely than that of family or intra-family selection. Thus, the current estimates of (h^2) are steady with these of the researchers below the identical conditions. This should be attributed to the outcomes of non-genetic factors, which are the foremost supply of variant for all studied litter features however had been no longer considered.

Table 3: Estimates of direct additive genetic variance a$\sigma^{2,}$ error variance eσ^2, phenotypic variance pσ2 and heritability 2 a h of live body weight at different age in Kurdish local chicken.

Body weight	Direct additive genetic variance σ^2a	Error variance σ^2e	Phenotypic variance σ^2p	Heritability h^2
One day	0.84	2.66	3.50	0.24
2-weeks	0.83	1.94	2.77	0.30
4-weeks	0.80	1.49	2.29	0.35
8-weeks	0.80	1.15	1.95	0.41
10-weeks	0.79	1.47	2.26	0.35
12-weeks	0.78	1.82	2.60	0.30
14-weeks	0.76	1.91	2.67	0.29
16-weeks	0.75	2.03	2.78	0.27
18-weeks	0.74	1.91	2.65	0.28

Conclusion:

This study concluded that, sex and generation and their interaction are the main factors affecting the body weight of Kurdish local chickens through its effect on body, the heritability of the traits is high so improvement of this trait can be done through individual selection than the family or inter-family selection.

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العوامل الوراثية و الغير الوراثية التي تؤثر على اوزان الجسم الحي في الدجاج المحلي الكردي

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الملخص

أجريت هذه الدراسة لمعرفة تأثير التغيرات في الوزن الحي للدجاج المحلي الكردي نتيجة تأثير الجنس والجيل، بلغ عدد الدجاج الكردي المحلي 250 دجاجة مع الجيل الاباء و الابناء. أوضحت نتائج التجربة بان الوزن الحي له تأثير معنوي ($P<0.01$) حيث يتراوح بشكل كبير وفقًا للجنس والجيل لافراخ الاباء وابناء خلال الفترة من 1 إلى 18 أسبوعًا .أيضا، الوزن الحي للذكور أكبر من الإناث يتفوق خلال الفترة من 0 يوم إلى 18 أسبوعًا من العمر ، كانت القيمة المستخدمة في الوزن النهائي 1704.06 ± 11.83غم و 1380.00 ± 20.50 غم للذكور والإناث للجيل الاباء على التوالي و 1649.69 ± 15.64غم و 1299.22 ± 10.30غم للذكور والإناث في الجيل الأول على التوالي.

أشارت النتائج بان مكافي الوراثي (h^2) لصفة وزن الجسم الحي تراوحت من 0.27 إلى 0.41 حيث كانت القيم متوسطة

الكلمات المفتاحية: وزن الجسم الحي، الدجاج المحلي، الجنس، الجيل، المكافي الوراثي