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Comparative Study Evaluating the Productive Performance of three Laying Hen breeds versus Local Iraqi Naked-neck breed under Heat Stress Conditions

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Abstract— objectives: This study was conducted at Agricultural Research Center / Scientific Research Commission, from May 1 to September 20, 2025 to evaluate the productive performance of four chicken strains under heat stress conditions The findings highlight the limited attention given to local chicken breeds in Iraq despite their potential importance. Materials and Methods: The experiment included two commercial egg laying strains (ISA Brown and White Leghorn) and two local strains (Naked Neck and fully feathered local chickens). Birds were allocated into four treatments according to strain, with three replicates per treatment, and reared in floor pens. All birds were fed a standard layer diet and subjected to a 16-hour daily lighting program. Heat stress was imposed for 10 hours daily at 37°C.The evaluated traits included daily feed intake, egg production percentage, cumulative egg number, egg weight, egg mass, and feed conversion ratio (FCR). The results revealed significant differences among treatments. The Naked Neck chickens (T1) exhibited superior performance compared with the other treatments. This strain recorded the highest daily feed intake, egg production percentage, cumulative egg number, egg weight, egg mass, and the best feed conversion efficiency. In contrast, reductions in feed intake observed in the other treatments, particularly the fully feathered local strain (T4), were associated with poorer productive performance. The fully feathered local chickens recorded the lowest values for egg production, egg weight, egg mass, and feed conversion efficiency. The Naked Neck chicken, demonstrated a remarkable capacity to tolerate high ambient temperatures and maintain satisfactory productive performance under heat stress conditions. Conclusion: These results indicate that this local strain represents a valuable genetic resource that could contribute to improving poultry production under hot climate conditions.

Keywords — naked neck chicken, poultry heat stress, egg production, Laying Hen.

INTRODUCTION

The increasing rise in global temperatures is currently a result of global warming; it is expected that this rise in temperatures will continue in the coming years (1), which necessitates that expert in the fields of agriculture and sustainable food development devise strategic plans to confront this serious challenge (2). Since the poultry production sector plays a vital role in providing animal protein, ensuring its sustainability requires strategic planning, one such strategy involves breeding chicken strains with genetic potential to resist heat stress, Among these strains is the Naked Neck chicken, which carries the Na gene, this breed is characterized by the absence of feathers on the neck and the upper chest area, additionally, this gene reduces feather density by about half compared to fully feathered chickens, thereby allowing greater dissipation of body heat (3). This contributes positively to the birds' productive performance in hot climates (4). Romania is considered the original homeland of the Naked Neck chicken, the breed later spread to Germany and was further developed and improved by the United States, it has been officially recognized by the American Poultry Association (APA) since 1965 (5). This breed comes in several colors, including white, black and orange (6). One of the most important characteristics of the Naked Neck chicken is its ability to adapt to hot climates, making it the best choice for poultry farming in such environments, in addition to its heat tolerance, the breed also possesses strong immune traits, disease resistance, and the ability to maintain internal body balance under heat stress conditions (7). many researchers have shown that feed consumption is inversely related to environ mental temperature). High environmental temperatures or cyclic tempera tures have been reported to lower egg production and decrease egg weight and egg shell thickness (8). During the thermoneutral range, laying hens use practical heat loss mechanisms to regulate body temperature when ambient temperatures rise, with little to no effect on egg production (9). Heat stress can have negative impacts such as decreased feed consumption, growth rate, body weight, egg quality, and egg production (10). Despite the presence of the naked neck chicken strain in Iraq, it has not received sufficient research attention aimed at evaluating its ability to tolerate heat stress during the summer season compared with other chicken strains. Therefore, this study seeks to investigate and assess its heat tolerance performance relative to other genotypes.

MATERIALS AND MTHODS

Study location: This study was conducted at the Poultry farm of the Latifiya Research Station, affiliated with the Agricultural Research Center / Scientific Research Authority at the Ministry of Higher Education. The field experiment lasted from 1/5 2025, to 20/9/ 2025, aiming to compare the productive performance of four chicken breeds under heat stress conditions. The temperature was maintained at 37°C for 10 hours daily, from 9:00 AM to 7:00 PM, throughout the experimental period.

Experimental animals: The experiment included 15 hens for each treatment, randomly distributed into three replicates, with five hens per replicate The chickens were thirty weeks old. **Experimental design and management of experimental animals:** The birds were fed ad libitum on a standard diet throughout the rearing period, containing 16% crude protein and 2927 kcal of metabolizable energy per kilogram of feed. Feed and water were provided freely throughout the trial. A lighting program of 16 hours of light and 8 hours of darkness was applied daily.

The experiment was divided into four treatments:

Treatment 1 (T1): Naked neck local chickens.

Treatment 2 (T2): ISA brown chickens.

Treatment 3 (T3): White leghorn chickens.

Treatment 4 (T4): Fully feathered local chickens.

Table A: The diet used in this study

Ingredient	Amount (%)
Yellow corn	55
Soybean meal (44% cp)	25
Limestone (caco3)	9
Dicalcium phosphate	1.5
Vegetable oil	1
Salt (Nacl)	0.3
Vitamin-mineral premix	0.2
DL-methionine	0.05

Crude protein = %17

Metabolizable energy = 2700 Kcal / Kg

Data collection: Eggs were collected manually several times a day, and the following traits were measured:

The following traits were studied:

- Daily feed intake
- Daily egg production percentage
- Cumulative egg number
- Egg weight
- Egg mass
- Feed conversion ratio (F C R)

Eggs production: The eggs were collected daily for each replicate throughout the duration of the experiment to calculate the hen-day egg production percentage. The formula provided by North (11), shown below, was applied.

$$HD = \frac{\text{No. of eggs produced on daily basis}}{\text{No. of hens on each day x No. of days}} \times 100$$

Accumulative eggs number: The cumulative number of eggs during the experimental period was calculated for each week using the following equation:

$$\text{Cumulative egg No.} = \frac{HD}{100} \times \text{No. of days}$$

The weight of Egg: during the experimental period, eggs produced from each replicate were collected daily and weighed by electronic scale and the average mean egg weight (g) was recorded weekly.

Egg mass: Egg mass was calculated by multiplying egg production on replicate by average of egg weight, using the following formula (11).

$$\text{Egg mass (g)} = \frac{HD}{\text{Average egg wight x No. of days}} \times 100$$

Feed intake: feed intake per experimental group was recorded Weekly and compute feed intake per bird per day, using the following equation:

$$\text{Feed consumption} = \frac{\text{Feed intake by a replicate weekly}}{\text{No. of birds in a replicate}} \times \frac{1}{7}$$

Feed conversion (FCR): Feed conversion ratio (FCR) was calculated for per replicate as the ratio of the feed consumed to the egg mass.

$$FCR = \frac{\text{Feed consumed (g)}}{\text{Egg mass (g)}}$$

STATISTICAL ANALYSIS

The data were statistically analyzed using the CRD (Completely Randomized Design) within the SAS statistical program (12), and the differences between treatment means were compared using Duncan's Multiple Range Test (13).

RESULT AND DISCUSSION

Table 1 shows that the trait of average daily feed intake was significantly ($P \leq 0.05$) higher in the Naked Neck chicken strain (T1) compared to the other strains, which did not differ significantly from each other during the study period. The overall mean for treatment T1 showed a significantly superior performance in this trait compared to the other strains, which were statistically similar.

Table 1. effect of chicken strains on feed consumption (g/bird/day) under heat stress conditions. (Mean ± SE)

Periods (weeks)	T1	T2	T3	T4	Level of significance
1	80 ±1.41 a	70 ±1.12 b	69 ±1.36 b	70 ±1.34 b	*
2	81 ±1.23 a	72 ±1.21 b	70 ±1.27 b	69 ±1.25 b	*
3	80.8 ±1.21 a	70.4 ±1.23 b	70.5 ±1.22 b	71 ±1.28 b	*
4	80.5 ±1.09 a	70 ±1.32 b	71 ±1.34 b	70.4 ±1.35 b	*
5	80.7 ±1.24 a	70.3 ±1.43 b	72 ±1.55 b	70.5 ±1.32 b	*
6	80.6 ±1.54 a	72 ±1.32 b	70 ±1.32 b	69.8 ±1.36 b	*
7	80.3 ±1.11 a	70.5 ±1.11 b	69.6 ±1.34 b	71 ±1.15 b	*
8	80.8 ±1.33 a	70.2 ±1.15 b	70.4 ±1.23 b	72 ±1.22 b	*
9	81 ±1.23 a	69.8 1.18 b	71 ±1.32 b	70.6 ±1.36 b	*
10	82 ±1.11 a	71 ±1.24 b	73 ±1.43 b	70.8 ±1.38 b	*
11	80.5 ±1.53 a	70.8 ±1.33 b	70 ±1.44 b	70.2 ±1.45 b	*
12	79.9 ±1.22 a	72 ±1.43 b	71 ±1.12 b	70.8 ±1.22 b	*
13	81 ±1.33 a	73 ±1.12 b	74 ±1.32 b	72 ±1.41 b	*
14	80.4 ±1.45 a	69.9 ±1.54 b	72 ±1.26 b	70.6 ±1.14 b	*
15	81 ±1.41 a	70 ±1.22 b	72 ±1.15 b	71 ±1.31 b	*
16	80 ±1.12 a	71 ±1.34 b	69.8 ±1.13 b	71 ±1.22 b	*
Overall means	80.65 ±1.12 a	70.80 ±1.11 b	70.95 ±1.23 b	70.66 ±1.44 b	*

T1: naked- nick strain, T2: ISA brown strain, T3: white leghorn strain, T4: Local Fully Feathered Strain Means in same rows with the same superscript were not significantly different, with different superscript were significantly different. *($P \leq 0.05$). Periods: each period presented one week.

Table 2 indicates a significant superiority ($P \leq 0.05$) of treatment T1 (Naked Neck chicken) in the percentage of egg production compared to the other treatments throughout the rearing period, except during the first week, where there was no significant difference ($P \leq 0.05$) between T1 and both T2 (ISA brown) and T3 (White leghorn). Both T2 and T3 showed a significant superiority over treatment T4 (Local Fully Feathered strain) during this period. There was no significant difference ($P \leq 0.05$) between treatments T2 and T3 throughout the entire study period, and both achieved a significant superiority compared to treatment T4. The overall average of treatment T1 showed a significant superiority ($P \leq 0.05$) over all treatments, while the overall averages of T2 and T3 did not differ significantly from each other but showed a significant superiority over the overall average of treatment T4 at the ($P \leq 0.05$) level.

Table 2. effect of chicken strains on egg production (%) H.D under heat stress conditions. (Mean ± SE

Periods (weeks)	T1	T2	T3	T4	Level of significance
1	26.72 ±0.02 a	24.58 ±0.05 a	25.10 ±0.11 a	22.29 ±0.02 b	*
2	39.00 ±0.02 a	29.60 ±0.02 b	28.78 ±0.021 b	24.43 ±0.16 c	*
3	44.86 ±0.01 a	37.86 ±0.15 b	37.43 ±0.030 b	32.43 0.057 c	*
4	51.00 ± 0.17 a	44.72 ±0.02 b	41.72 ±0.035 b	37.00 ±0.01 c	*
5	56.15 ±0.02 a	47.58 ±0.01 b	42.73 ±0.025 b	38.20 ±0.16 c	*
6	63.22 ±0.17 a	59.50 ± 0.15 b	58.80 ±0.28 b	54.50 ±0.15 c	*
7	64.43 ±0.01 a	59.20 ±0.05 b	60.39 ±0.029 b	55.00 ±0.57 c	*
8	64.15 ±0.02 a	60.25 ±0.29 b	60.96 ±1.03 b	55.20 ±0.07 c	*
9	68.45 ±0.02 a	63.33 ±0.01 b	62.10 ±0.02 b	54.9 ±0.15 c	*
10	68.40 ±0.03 a	61.50 ±0.02 b	61.29 ±0.095 b	55.61 ±0.18 c	*
11	67.00 ±0.22 a	63.30 ±0.01 b	63.24 ±0.03 b	55.86 ±0.98 c	*
12	65.20 ±0.27 a	61.50 0.02 b	62.10 ±0. 26 b	55.40 ±0.28 c	*
13	58.40 ±0.29 a	53.35 ±0.02 b	52.19 ±1.23 b	48.45 ±0.13 c	*
14	48.55 ±0.01 a	43.44 ±0.01 b	41.90 ±0.29 b	38.34 ±0.15 c	*
15	47.45 ±0.02 a	44.25 ±0.02 b	43.20 ±0.017 b	38.10 ±0.13 c	*
16	45.00 ±0.03 a	40.45 ±0.17 b	41.10 ±0.021 b	34.24 ±0.28 c	*
Overall means	54.87 ±1.1 a	49.65 ±1.80 b	48.93 ±1.8 b	43.74 ±0.76 c	*

T1: naked- nick strain, T2: ISA brown strain, T3: white leghorn strain, T4: local fully feathered strain Means in same rows with the same superscript were not significantly different, with different superscript were significantly different. *($P \leq 0.05$). Periods: each period presented one week.

The data in Table 3 indicate a significant superiority ($P \leq 0.05$) of treatment T1 (Naked Neck chicken) in cumulative egg production compared to the other treatments throughout the rearing period, except for the first week, during which there were no significant differences (P ≤ 0.05) between T1 and both T2 (ISA brown strain) and T3 (White leghorn strain). These two strains (T2 and T3) significantly outperformed treatment T4 (Local Fully Feathered strain) during this period. Moreover, treatments T2 and T3 did not show significant differences (P ≤ 0.05) between each other during the entire study period, except in the fourth and fifth weeks, where the ISA brown strain (T2) significantly (P ≤ 0.05) outperformed the White leghorn strain (T3). Both T2 and T3 also showed significant superiority compared to treatment T4 during these weeks. The overall average of treatment T1 showed a significant superiority (P ≤ 0.05) over all other treatments, while the overall averages of treatments T2 and T3 did not differ significantly (P ≤ 0.05) from each other but were significantly superior to the overall average of treatment T4.

Table 3. effect of chicken strains on Cumulative eggs number under heat stress conditions. (Mean ± SE)

Periods (weeks)	T1	T2	T3	T4	Level of significance
1	1.87 ±0.010 a	1.72 ±0.051 a	1.75 ±0.10 a	1.56 ±0.021 b	*
2	2.73 ±0.02 a	2.07 ±0.024 b	2.01 ±0.020 b	1.71 ±0.015 c	*
3	3.14 ±0.01 a	2.65 ±0.13 b	2.62 ±0.031 b	2.27 ± 0.052 c	*
4	3.57 ±0.15 a	3.13 ±0.022 b	2.92 ±0.034 c	2.59 ±0.012 d	*
5	3.93 ±0.02 a	3.33 ±0.01 b	2.99 ±0.022 c	2.67 ±0.06 d	*
6	4.42 ±0.12 a	4.16 ±0.14 b	4.11 ±0.25 b	3.81 ±0.10 c	*
7	4.51 ±0.013 a	4.14 ±0.058 b	4.22 ±0.023 b	3.85 ±0.50 c	*
8	4.49 ±0.022 a	4.21 ±0.28 b	4.26 ±1.06 b	3.86 ±0.078 c	*
9	4.79 ±0.024 a	4.43 ±0.019 b	4.34 ±0.020 b	3.84 ±0.015 c	*
10	4.78 ±0.03 a	4.27 ±0.024 b	4.29 ±0.093 b	3.89 ±0.018 c	*
11	4.69 ±0.20 a	4.43 ±0.01 b	4.42 ±0.032 b	3.91 ±0.098 c	*
12	4.56 ±0.21 a	4.30 ±0.04 b	4.34 ±0. 24 b	3.87 ±0.028 c	*
13	4.08 ±0.22 a	3.73 ±0.020 b	3.65 ±0.26 b	3.39 ±0.14 c	*
14	3.39 ±0.015 a	3.04 ±0.012 b	2.93 ±0.20 b	2.68 ±0.13 c	*
15	3.32 ±0.05 a	3.09 ±0.025 b	3.02 ±0.014 b	2.66 ±0.11 c	*
16	3.15 ±0.06 a	2.83 ±0.16 b	2.87 ±0.025 b	2.39 ± 0.25 c	*
Overall means	3.84 ±0.01 a	3.47 ±0.080 b	3.42 ±0. 09 b	3.06 ±0.76 c	*

T1: naked- nick strain, T2: ISA brown strain, T3: white leghorn strain, T4: local fully feathered strain Means in same rows with the same superscript were not significantly different, with different superscript were significantly different. *(P≤0.05). Periods: each period presented one week.

The data in Table 4 shows that treatment T1 (Naked Neck chickens) did not achieve a significant superiority (P ≤ 0.05) in egg weight during the first week of rearing compared to treatments T2 (ISA brown strain) and T3 (White leghorn strain), which were significantly superior to treatment T4 (Local fully-feathered strain) during that week. However, treatment T1 showed a significant superiority (P ≤ 0.05) over the other strains up to the ninth week of the study, after which no significant differences were observed among the strains in this trait. Furthermore, no significant differences (P ≤ 0.05) were found between treatments T2 and T3 throughout the study period. The overall average of treatment T1 showed a significant superiority (P ≤ 0.05) over all other treatments, while the overall averages of treatments T2 and T3 did not differ significantly (P ≤ 0.05) from each other but were significantly superior to the overall average of treatment T4.

Table 4. effect of chicken strains on eggs weight under heat stress conditions. (Mean ± SE)

Periods (weeks)	T1	T2	T3	T4	Level of significance
1	47.3 ±0.010 a	46.8 ±0.051 a	46.6 ±0.10 a	45.7 ±0.021 b	*
2	48 ±0.02 a	46.3 ±0.024 b	45.4 ±0.020 b	44.4 ±0.015 c	*
3	47.5 ±0.01 a	46.04 ±0.13 b	45.2 ±0.031 b	44.2 ± 0.052 c	*
4	46.9 ±0.15 a	45.8 ±0.022 b	44.9 ±0.034 c	43.8 ±0.012 d	*
5	47.1 ±0.02 a	45.7 ±0.01 b	45.0 ±0.022 c	44.1 ±0.06 d	*
6	46.8 ±0.12 a	45.34 ±0.14 b	45.11 ±0.25 b	44.18 ±0.10 c	*
7	47.1 ±0.013 a	46.1 ±0.058 b	45.9 ±0.023 b	44.8 ±0.50 c	*
8	47.5 ±0.022 a	46.6 ±0.28 b	46.3 ±1.06 b	45.2 ±0.078 c	*
9	46.9 ±0.024 a	45.8 ±0.019 b	45.6 ±0.020 b	44.8 ±0.015 c	*
10	47.2 ±0.03 a	46.8 ±0.024 a	46. 9 ±0.093 a	46.89 ±0.018 a	n. s
11	48.1 ±0.20 a	47.9 ±0.01 a	47.8 ±0.032 a	47.8 ±0.098 a	n. s
12	47.8 ±0.21 a	47.6 ±0.04 a	47.9 ±0. 24 a	47.87 ±0.028 a	n. s
13	47.8 ±0.22 a	47.6 ±0.020 a	47.85 ±0.26 a	47.76 ±0.14 a	n. s

14	48.3 ±0.015 a	47.9 ±0.012 a	47.8 ±0.20 a	47.79 ±0.13 a	n. s
15	48.1 ±0.05 a	47.8 ±0.025 a	47.9 ±0.014 a	47.88 ±0.11 a	n. s
16	48.2 ±0.06 a	47.89 ±0.16 a	47.77 ±0.025 a	47.87 ±0.25 a	n. s
Overall means	47.5 ±0.011 a	46.72 ±0.080 b	46.49 ±0.09 b	45.49 ±0.76 c	*

T1: naked- nick strain, T2: ISA brown strain, T3: white leghorn strain, T4: local fully feathered strain Means in same rows with the same superscript were not significantly different, with different superscript were significantly different. *(P≤0.05). Periods: each period presented one week.

The data in Table 5 shows that treatment T1 (Naked Neck chickens) did not achieve a significant superiority (P ≤ 0.05) in egg weight during the first week of rearing compared to treatments T2 (ISA brown) and T3 (White leghorn strain), which were significantly superior to treatment T4 (Local fully-feathered strain) during that week. However, treatment T1 showed a significant superiority (P ≤ 0.05) over the other strains up to the ninth week of the study, after which no significant differences were observed among the strains in this trait. Furthermore, no significant differences (P ≤ 0.05) were found between treatments T2 and T3 throughout the study period. The overall average of treatment T1 showed a significant superiority (P ≤ 0.05) over all other treatments, while the overall averages of treatments T2 and T3 did not differ significantly (P ≤ 0.05) from each other but were significantly superior to the overall average of treatment T4.

Table 5. effect of chicken strains on eggs mass under heat stress conditions. (Mean ± SE)

Periods (weeks)	**T1**	**T2**	**T3**	**T4**	**Level of significance**
1	88.40 ±0.020 a	80.52 ±0.056 b	81.87 ±0.11 b	71.30 ±0.02 c	*
2	131.04 ±0.020 a	95.93 ±0.021 b	91.46 ±0.021 b	75.92 ±0.16 c	*
3	149.15 ±0.010 a	121.37 ±0.15 b	118.4 ±0.030 b	100.33 ±0.057 c	*
4	167.43 ±0.17 a	143.37 ±0.023 b	131.3 ±0.035 c	113.44 ±0.01 d	*
5	185.12 ±0.021 a	152.1 ±0.010 b	134.6 ±0.025 c	117.92 ±0.16 d	*
6	207.10 ±0.17 a	194.92 ±0.15 b	185.67 ±0.28 b	168.54 ±0.15 c	*
7	212.42 ±0.016 a	191.3 ±0.056 b	192.03 ±0.029 b	172.48 ±0.57 c	*
8	214.49 ±0.02 a	196.53 ±0.29 b	197.57 ±1.03 b	174.65 ±0.07 c	*
9	224.72 ±0.02 a	203.03 ±0.01 b	198.2 ±0.02 b	172.16 ±0.15 c	*
10	225.99 ±0.036 a	201.47 ±0.025 b	201.25 ±0.09 b	182.5 ±0.18 c	*
11	225.58 ±0.22 a	213.92 ±0.010 b	212.04 ±0.035 b	186.9 ±0.98 c	*
12	218.15 ±0.27 a	204.9 ±0.028 b	208.22 ±0. 26 b	185.63 ±0.28 c	*
13	195.40 ±0.29 a	177.76 ±0.023 b	174.6 ±1.23 b	161.97 ±0.13 c	*
14	164.14 ±0.01 a	145.6 ±0.013 b	140.2 ±0.29 b	128.2 ±0.15 c	*
15	159.8 ±0.02 a	148.1 ±0.029 b	144.9 ±0.01 b	127.66 ±0.13 c	*
16	151.83 ±0.03 a	135.60 ±0.17 b	137.4 ±0.02 b	114.7 ±0.28 c	*
Overall means	182.56 ±1.1 a	162.90 ±1.80 b	159.95 ±1.8 b	140.90 ±0.76 c	*

T1: naked- nick strain, T2: ISA brown strain, T3: white leghorn strain, T4: local fully feathered strain Means in same rows with the same superscript were not significantly different, with different superscript were significantly different. *(P≤0.05). Periods: each period presented one week.

The results of the statistical analysis for the feed conversion ratio trait, as shown clearly in Table 6, indicate a significant superiority (P ≤ 0.05) in favor of treatments T1, T2, and T3 compared to treatment T4 throughout the study period. However, no significant differences were observed among treatments T1, T2, and T3 during the study period. As for the overall averages, the same table shows that there were no significant differences among the overall averages of treatments T1, T2, and T3, while all three treatments showed a significant superiority over the overall average of treatment T4.

Table 6. effect of chicken strains on feed conversion ratio under heat stress conditions (FCR). (Mean ± SE)

Periods (weeks)	**T1**	**T2**	**T3**	**T4**	**Level of significance**
1	6.34 ±1.41 b	6.08 ±1.12 b	5.9 ±0.11 b	6.8 ±0.020 a	*
2	4.33 ±1.23 c	5.25 ±1.21 b	5.38 ±0.021 b	6.36 ±0.16 a	*
3	3.79 ±1.21 b	4.03 ±1.23 b	5.06 ±0.030 b	4.95 ±0.057 a	*
4	3.36 ±0.17 c	3.43 ±0.023 c	3.79 ±0.035 b	4.34 ±0.011 a	*
5	3.05 ±0.021 c	3.23 ±0.010 c	3.74 ±0.025 b	4.18 ±0.16 a	*
6	2.72 ±0.17 b	2.58 ±0.15 b	2.65 ±0.28 b	2.90 ±0.15 a	*
7	2.63 ±0.016 b	2.58 ±0.056 b	2.53 ±0.029 b	2.88 ±0.57 a	*
8	2.63 ±0.027 b	2.56 ±0.29 b	2.44 ±1.03 b	2.84 ±0.075 a	*
9	2.52 ±0.027 b	2.40 ±0.018 b	2.50 ±0.028 b	2.87 ±0.15 a	*
10	2.54 ±0.036 b	2.46 ±0.025 b	2.55 ±0.09 b	2.72 ±0.18 a	*
11	2.58 ±0.22 b	2.31 ±0.010 b	2.5 ±0.035 b	2.62 ±0.98 c a	*
12	2.56 ±0.27 b	2.45 ±0.028 b	2.39 ±0. 26 b	2.67 ±0.28 a	*
13	2.90 ±0.29 b	2.87 ±0.023 b	2.97 ±1.23 b	3.61 ±0.13 a	*
14	3.43 ±0.016	3.36 ±0.013	3.7 ±0.29	3.85 ±0.15	*

	b	b	b	a	
15	3.54 ±0.02 b	3.30 ±0.029 b	3.50 ±0.017 b	3.89 ±0.13 a	*
16	3.7 ±0.03 b	3.66 ±0.17 b	3.60 ±0.021 b	4.33 ±0.28 a	*
Overall means	3.28 ±1.1 b	3.30 ±1.80 b	3.35 ±1.8 b	3.86 ±0.76 a	*

T1: naked- nick strain, T2: ISA brown strain, T3: white leghorn strain, T4: local fully feathered strain Means in same rows with the same superscript were not significantly different, with different superscript were significantly different. *(P≤0.05). Periods: each period presented one week.

The results of the present study revealed a statistically significant superiority of treatment T1 (Naked-neck chickens) over the other treatments, this superiority can be attributed to the ability of this genotype to tolerate high ambient temperatures as a result of its enhanced heat dissipation capacity due to the reduced feather density, particularly in the neck region, as reported by (14). This morphological characteristic contributed to maintaining a relative balance between water intake and feed consumption under heat stress conditions which is consistent with the findings of Kim et al (15). In contrast, the fully feathered chickens represented by treatments T2, T3 and T4 exhibited a continuous increase in water intake at the expense of feed consumption, this response may be attributed to their limited ability to dissipate excess body heat due to the dense feather coverage over the entire body as observed by (7). The reduction in feed intake negatively affected the remaining productive traits which agrees with the results reported by (16). Treatment T1 achieved the highest egg production percentage outperforming the two commercial strains (T2 and T3). Whereas, the fully feathered local strain (T4) recorded the lowest egg production percentage. A similar trend was observed for cumulative egg number with treatment T1 recording the highest values among all treatments. Regarding egg weight treatment T1 also achieved the highest mean egg weight, surpassing all other treatments. Conversely, treatment T4 recorded the lowest egg weight, egg mass and the poorest feed conversion efficiency. The inferior productive performance of treatment T4 may be attributed to the fact that, although this strain exhibits relative tolerance to high temperatures due to its adaptation to local environmental conditions it has not been subjected to systematic genetic improvement programs aimed at enhancing egg production and other productive traits, as indicated by (17). Consequently, its production efficiency was lower than that of the two commercial strains (T2 and T3). Furthermore, treatment T1 achieved the best feed conversion efficiency compared with all other treatments, reflecting its superior ability to utilize feed efficiently under heat stress conditions. The overall means of the studied traits followed the same pattern with treatment T1 recording the highest values, whereas treatment T4 recorded the lowest values. This result is consistent with the findings reported by (18).

CONCLUSION

The naked neck chicken strain is characterized by reduced feather coverage, which allows a greater proportion of dietary protein to be directed toward egg production, thereby improving feed conversion efficiency. Under high ambient temperatures, fully feathered chickens typically reduce feed intake and exhibit slower production, whereas naked neck chickens maintain feed consumption and productive performance. This enhanced heat tolerance is attributed to the presence of the naked neck gene (Na), which reduces feather mass to approximately 40–50% of that of fully feathered chickens and increases the size of the neck, comb, and wattles, thereby enhancing heat dissipation and improving thermoregulation. These characteristics make naked neck chickens the preferred choice for poultry production in hot climatic regions. that local naked-necked chickens are able to live and produce in the Iraqi climate, which is known for its high temperatures

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