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EFFECT OF CONTINUOUS AND INTERMITTENT HIGH AMBIENT TEMPERATURE ON GROWING MALES OF GIMMIZAH AND GOLDEN-MONTAZAH CHICKEN PERFORMANCE

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ABSTRACT: This study was carried out in the Poultry Experimental Farm of Animal production Department, Faculty of Agriculture, Al-Azhar University, Assiut Branch, Egypt. It amid to study the effect of continuous and intermittent high ambient temperature on growing males of Gimmizah and Golden-Montazah chickens performance from 4 up to 16 weeks of age.

A total of 96 male chicks 4 weeks old, were randomly classified to three equal groups each of them 16 Golden-Montazah and 16 Gimmizah. The chicks in the first group (control) were daily exposed to normal conditions. The chicks in the second and third groups were daily exposed to continuous and intermittent high temperatures (35°C) for 5 hours, respectively. All chicks were housed on a partition of floor pens and reared under normal environmental poultry house and daily exposed to 16 continuous lighting hours. All chicks were fed ad-libitum on a commercial standard starter diet.

The obtained results revealed that the Golden-Montazah was significantly higher body weight (p<0.05) compared to Gimmizah. Whereas, daily weight gain between both strains were not differed. Body weight and body weight gain for chicks exposed to intermittent heat cyclic decreased significantly as compared with control and continuous heat cyclic. Daily feed consumption was significantly (p<0.05) affected by strain, heat cyclic and their interactions, while feed conversion ratio was insignificantly by strain and heat cyclic just during the periods from 4-12 and 12-16 weeks of age. Carcass cutup parts and hematological parameters were not affected by strain, heat cyclic and their interaction. Liver and testes percentages were significantly affected by strain, while heart and thymus were significantly affected by heat cyclic. The total protein, GPT, T3 and T4 concentrations were significantly affected by strain, heat cyclic and their interaction. Phosphorous, T3 and T4 concentrations were significantly increased in Golden-Montazah compared with Gimmizah. Thus, it could be concluded that the Golden-Montazah more tolerant to high temperature compared to Gimmizah under Upper Egypt climatic conditions.

Key words: Local Strains- Heat Stress- Productive Performance- Blood Constituents

البحث جزء من رسالة الماجستير الخاصة بالسيد/محمد حسنى

INTRODUCTION

Chickens are homoeothermic like mammals, this mean that they can maintain their internal body temperature through a slight change regardless of ambient temperature without significant perturbation (St-Pierre et al., 2003). So, birds have a constant body temperature (41.5ºC), which fluctuate to some extent depending on the degree of heat environment (Sottnik, 2002), while the thermoneutral zone for raising birds in the tropical regions ranges between 18-24°C (Furlan and Macari, 2002; and Holik, 2009). In tropical and subtropical areas, chicken production suffers great losses every year due to the adverse effect of heat stress, particularly heat waves exceed 30ºC from sudden, which might occur during summer season (Abdur-Rahman and Abu-Dieyeh, 2007). High ambient temperature is one of the major problems that adversely affect productive performance, carcass characteristic, feed consumption, thermoregulatory responses and other traits (Har et al., 2000; Deeb and Cahaner, 2002; and Abu-Dieyeh, 2006).

Several studies were conducted to study the effect of high temperature on the productive performance. The findings of Lin et al. (2006) found that heat stress take more consideration in poultry production due to the rapid development of poultry industry in hot climate countries as well as to the reduced poultry performance during summer months in temperate countries. Similarly, Ain Baziz et al. (1996) and Geraert et al. (1996) found that the broilers exposed to heat was lower breast yield and higher fat deposition, which are undesirable, considering the economic value of breast meat and that excessive amount of fat in broiler carcasses is not well accepted by customers. El-Sheikh (1997) reported in Fayoumi and Dandarawi chickens that body weight and egg weight at sexual maturity of the group which exposed to 32°C decreased by about 59.3 and 2.7 grams, respectively than those of their control (22°C).

Genotype is another factor that influences chicken performance. In Egypt, local chicken developed stains are varied according to genetical effect as well as the purpose of production. Some of these strains are Golden-Montazah (Dakki- 4 x Rod Island) and Gimmizah strain (Dakki- 4 x Plymouth rock). From the last decades, Kosba and Abd El-Halim (2008) found that the mean body weight of male Gimmizah chicks at 8 weeks of age was 702.1g decreasing remarkably than that 812.6g of male Golden- Montazah chicks. The findings of Youssef et al. (2014) showed that application of acute heat stress at 5 days of age (early heat conditioning) increased growth for Fayoumi and Golden-Montazah, while treated El- Salam with acute heat stress had adverse effect.

There was a little information on the effect of high temperature on Gimmizah and Golden-Montazah strains. Therefore, the present study aimed to determine which one of the two strains (Gimmizah and Golden-Montazah) can tolerant to high ambient temperature through measuring productive performance, carcass characteristics and hematological variables under Assiut conditions.

MATERIALS AND METHODS

This study was carried out at the Experimental Poultry Farm, Animal production Department, Faculty of Agriculture, AL-Azhar University, Assiut Branch, Egypt.

Bird's husbandry and treatments:

A total of 96 male chicks were individually weighted and classified into three experimental groups each of them 16 Golden-Montazah and 16 Gimmizah, with 2 replicates. In the first group, male chicks were raised under normal environmental conditions and considered as the control group. In the second group, chicks were daily exposed to continuous high ambient temperature (35°C) for 5 hours from 11.0

AM to 4.0 PM by using electric heater Chicks in the third group were daily exposed to intermittent high ambient temperature (35°C) for 5 hours from 9.00 to 11.30 AM and 1.30 to 4.00 PM up to 16 weeks of age. All chicks were housed on a partitioned floor pens; each of (100cm L × 125cm W), equipped with feeders. They were reared under normal environmental poultry-house and daily exposed to 16 continuous lighting hours. All chicks in this experiment were fed ad-libitum on a commercial standard starter diet (mash form), which formulated to exceed requirements of grower chicks by the NRC (1994) as presented in Table (1).

Live Newcastle Disease Virus (NDV)-vaccine was administered in drinking water at 7, 17, 27, and 32 days of age and after this monthly during the experimental period, while the live Infectious Bursal Disease Virus (IBDV)-vaccine was given in drinking water at 10 and 20 d. of age.

Meteorological observations: The daily internal and external ambient temperatures (˚C) and relative humidity (%) were recorded at 12 AM and 3 PM, respectively. The means of THI (units) were weekly and every 4 weeks calculated according the formula of Marai et al. (2002) as follows: THI=db˚C-[(0.31-0.31RH)(db˚C-14.4)]
where: db˚C= dry bulb temperature in Celsius and RH = RH% / 100.

Studied traits: Birds on a pen basis and feed were weighed at 4, 8, 12 and 16 weeks of age. The incidence of mortality was recorded daily. Body weight gain was calculated during the periods of 4-8, 8-12, 12-16 and 4-16 weeks of age. Feed consumption and feed efficiency were recorded and calculated during the periods of 4-8, 8-12, 12-16 and 4-16 weeks of age. At 18 weeks of age, 36 male chicks (18 Golden-Montazah & 18 Gimmizah) were randomly selected and subjected to carcass and body organ evaluation. The feed was excluded for 6 hours before slaughter to ensure emptying of the digestive tract. The birds were individually weighed, slaughtered by severing the jugular vein and allowed to bleed thoroughly according to the method recommended by Odunsi et al. (1999). Birds were scalded at 85°C in a water bath for about 20 seconds before de-feathering and then the birds were reweighed to calculate feathers weight by difference. The wings were removed by cutting interiorly severing at the humeoscapular joint, the cuts were made through the rib head to the shoulder girdle, the back was removed intact by pulling interiorly. Thighs and drum stick were dissected from each carcass and weighed separately. The measurement of the carcass traits (Carcass weight %, thigh, chest and back, gizzard, heart, liver, spleen, pancreas, bursa, intestine and lung weights) were taken before dissecting out the organs.

Blood samples, 36 samples from Golden-Montazah and Montazah male chicks were taken after slaughtering into heparinized tubes (2ml) at 11 AM from 12 birds per each group at 16 weeks of age. Blood plasma was obtained from the samples by centrifugation for 15 minutes at 4000 rpm and stored at -20°C until analysis. The frozen plasma was allowed to thaw at room temperature prior to analysis. Total protein, albumin, triglyceride, cholesterol and activities of AST, ALT were measured using a biochemical analyzer kits (Technic on RA-XT, New York, USA).

At 16 weeks of age, 36 blood samples were taken to determine number of red blood cell's (RBCs) by using haemocytometer. Total count of white blood cells (WBCs) and their differentiations (Heterophils%, lymphocytes%, monocytes%, eosinophils% and basophils %) was measured according to Wintrobe (1967). The H/L ratio was calculated by dividing the number of heterophils by the number of lymphocytes. Both slides were counted and the means were calculated for each bird (Gross and Siegel, 1983). Triiodothyronine (T3) and thyroxin (T4) hormone concentrations were determined by using commercial kits.

Statistical analysis: Data were subjected to two ways analysis of variance with treatment group effect by using the GLM procedure of SAS [1998] according to the following model: Yijk = μ + Si + HCj + SHCij + eijk Where, Yijk = an observation; μ = general mean; Si = fixed effect of i^{th} strain, i = 1 & 2 (Gimmizah or Golden Montazah); HCj = fixed effect of jth heat cyclic, i = 1, 2 and 3 (control, continuous and intermittent); SHCij = interaction effect of i^{th} strain and j^{th} Heat cyclic and eijk = error of the model, which included all the other effects not specified in the mixed model. Differences among experimental groups were separated by Duncan's multiple range test (Duncan, 1955).

RESULTS AND DISCUSSIONS

Productive performance

Referring to strain effect, date presented in Table (2&3) showed that the means BW of Golden-Montazah chickens increased significantly than that of the Gimmizah at 4, 8, 12 and 16 weeks of age. Also, the mean BWG of Golden-Montazah increase significantly ($p<0.05$), during the period from 4-8 and 8-12 weeks of age, while the increase during 12-16 week was not affected. The increased body weight and gain in Golden-Montazah could be attributed to genetical responses of developed strains. Theses findings agree with those of El-Gendy et al. (2006), who found that breed differences in resistance to high temperature were associated with the breed differences in body weight. Also, these findings showed a significant decrease in feed consumption for Golden-Montazah chicks at 4, 8, 12 and 16 weeks of age, while the feed conversion was not affected. This could be attributed to increased feed utilization and viability of Gimmizah than Golden-Montazah. These results are inagreement with the findings of Youssef et al. (2014), who found that the mean body weight of Golden Montazah at 2 and weeks of age increased significantly than those of Fayoumi and El- Salam strains. Similarly, the findings of El-Soudany (2003) and Hassan et al. (2008), who reported that sex and line showed highly significant differences in live body weight and body weight gain of chickens at different ages.

Regarding heat cyclic effects, these findings showed that the means body weight of chickens exposed to intermittent heat cycling decreased significantly ($p<0.05$) than those of control and continuous heat cycling at 8, and 12 weeks of age, while the body weight at 16 week of continuous and intermittent cycling significantly decrease as compared with control group. The mean of body weight gain of chickens exposed to intermittent heat cycling decreased significantly ($p<0.05$) than those of control and contentious heat cycling during the period from 4-8 and 8-12 weeks of age, while the increase at 12-16 week was not affected.

The decrease in body weight and body weight gain for chickens exposed to high ambient temperature (35ºC) could be attributed the deleterious effect of heat stress, which leads to minimize feed consumption, in addition some changes in body status and consequently due to decrease in body weight. These results are in agreement with those of Abu-Dieyeh (2006) reported that the decrease in weight gain due to heat exposure is more related to the reduction in feed intake than to the direct effect of temperature. Similarly, the findings of Abdur-Rahman and Abu-Dieyeh (2007) showed that the broilers exposed to high temperature at 35ºC, had significantly ($p<0.05$) lowest growth rate and feed consumption as compared with control group.

Referring to the effect of high ambient temperature (35ºC) on feed consumption and feed conversation of chicks, these results showed a significant decrease in feed consumption for chicks exposed to high temperature at 4, 8, 12 and 16 weeks of age, while the effect on feed conversion was not affected. The decrease in feed consumption for broiler exposed to high ambient temperature could be attributed to a direct effect of temperature, which may be a result both of feed digestibility reduction (Bonnet et al., 1997), in addition to an increase of maintenance energy requirement (Sakomura et al., 1988).

Referring to the effect of interaction (S× HC), it had a significant effect on body weight and body weight gain at deferent weeks of age except during 12-16 weeks of age for body weight gain. The feed consumption and feed conversation of chicks, these data showed a significant decrease in feed consumption for chicks during the period from 4-8, 8-12 and 12-16 weeks of age, while the effect on feed conversion was not affected. These results are inagreement with those of (Rosa et al., 2007), who found a significant interaction ($p<0.05$) was found between pair-feeding scheme and genetic groups for body weight, while they found no significant interaction was observed between pair-feeding scheme and genetic group for feed conversion ratio.

Carcass characteristics: Regarding the effect of strain, date presented in Tables (4&5) showed that the mean final body weight and percentages of livers and testes of Golden Montazah chicks significantly ($p\leq0.01$) affected than that of Gimmizah, while the percentages of feathers, carcass, chest & back, thai, pancreas, heart, lymphoid organs were not affected. The difference in final body weight and percentages of liver and testes could be attributed to strain effects. These results agree with those of Stringhini et al. (2003), who found no difference effects on yield carcass or cuts between breeds.

Regardless the effect of strain and interaction, these findings showed that the means final body weight of chickens exposed to contentious and intermittent heat cyclic (35ºC) decreased significantly ($p<0.05$) than those of control. While, heart percentage in intermittent heat stressed group (35ºC) was increased significantly ($p<0.05$) as compared with those in control and contentious heat cyclic (35ºC) groups. The decrease in body weight could be attributed to the adverse effect of heat stress, which led to decrease in feed intake and changes in physiological status. These results agree with those of Abdur-Rahman and Abu-Dieyeh (2007), who reported that broiler exposure to 25ºC had significantly ($p<0.05$) higher live body weight than those of birds kept under 30 and 35ºC, respectively. Similar results were found by Hacina et al. (1996) found that the body weight of broilers reared at 32ºC was significantly less than at 22ºC by 47 %. In the present study, the percentage of heart was significantly affected by heat stress; however, the higher percentage of liver was obtained in treated groups as compared with control group.

The increase in heart percentage in treated groups could be attributed to increased blood flow for chicks under heat stress as well as an indirect effect of decreased carcass yield in broilers exposed to heat stress. These results agree with those of Değer et al. (2014), who found that the higher percentages of liver and gizzard were obtained in HS group, compared with PC group.

Referring to lymphoid organs, these findings showed that thymus percentage of chicks exposed to high temperature (ºC) significantly decreased than those of chicks in the control group, while the percentages of bursa and spleen were not affected. The decrease in lymphoid organs in chicks kept at high temperature could be attributed to general regression response of chickens to chronic heat stress, which is recognized as an important to tolerant of bird. These findings agree with Bartlett and Smith (2003), who reported that lymphoid organ weights (thymus, bursa, spleen) were significantly reduced by heat stress.

The final body weight, carcass, liver, pancreas, testes and thymus percentages were significantly ($p<0.05$) affected by the interaction between strain × treatment. No significant interaction ($p>0.05$) were detected for feather, Chest & back, Thai, Heart, Bursa, Spleen.

Haematological parameters: Data presented in Table 6 showed that the means of hemoglobin, RBCs, Lymphocytes, Eosinophils, Heterophils, Monocytes and H/L ratio were not influenced by strain, while the effect of Basophils was significantly affected. No significant differences between different groups (C, T1 and T2) or interaction (Strain*Treatment) in the hemoglobin, RBCs, Lymphocytes, Eosinophils, Basophils, Heterophils, Monocytes and H/L ratio.

2- 2- Blood proteins and liver enzymes:

Total protein (g/dl), albumin (g/dl), globulin (g/dl) and liver enzymes were insignificantly affected by strain. These results agree with Hassan et al. (2006), who found no significant differences of serum total protein level in Silver-Montazah, Mandarah and El-Salam hens at 6 and 8 months of age, respectively. Also, Hanan (2006) reported that no significant differences were found in total protein, albumin, globulin and A/G ratio between two groups of layer; the late heat stress group which exposed to 4 hour /day for 5 consecutive days at 38-39ºC at 18 weeks of age or early and late heat stress which exposed to early at 4 weeks of age and late at 18 weeks of age to the same conditions of heat stress.

Refereeing to heat cyclic effect, total protein (g/dl) and GPT enzyme were significantly ($p<0.05$) influenced by heat cyclic than that of the control group. These results agree with Khan et al. (2002), who found that the environmental temperatures have significant ($p<0.01$) effects on the concentration of serum ALT. Similarly, Shu Tang et al. (2013) stated that the concentrations of GPT increased ($p<0.05$) after 3 h of heat stress and reached a maximum after 10 h ($p<0.01$), compared with control, while GOT levels were not statistical significant ($p<0.05$) compared with the control group. In contrast, the findings of Melesse et al. (2011) showed that the GPT activity in heat stressed chickens significantly increased by 29.2% in all genotypes.

Cholesterol (mg/dl), Triglycerides (g/dl), minerals and thyroid hormones:

Regarding the effect of strains, date in Table 8, showed that the mean cholesterol (mg/dl), triglycerides (g/dl) and Ca (mg/dl) were not affected, while the phosphorus (mg/dl), T3 (ng/ml) and T4 (ng/ml) hormone concentrations of Golden Montazah chicks significantly ($p \leq 0.01$) increased than that of Gimmizah. These results in harmony with those of El-Kaiaty and Hassan (2004), who found that Matrouh females were significantly higher in serum cholesterol during the growing stage compared to Fayoumi and Golden-Montazah at 12 weeks of age. On the other hand, El-Slamony (2005) found that Matrouh strain had significantly higher serum cholesterol values than that of Golden-Montazah strain (188.73 vs. 158.24 mg/dl) at 44 weeks of age.

Regardless the effect of strain, the phosphorus and T4 (ng/ml) concentration were significantly affected in heated groups than in control, while cholesterol (mg/dl), triglycerides (g/dl), Ca (mg/dl) and T3 (ng/ml) were not affected. The decreased T4 in intermittent heat cyclic group may be due to thyroid hormones were involved in the thermoregulatory process (Decuypere and Kiihn, 1988) and these results agree with Garriga et al. (2006), who reported that heat stress significantly reduced T3 and T4 by (52 and 37%, respectively). The thyroid hormone concentrations can be used as an indicator of the physiological adaptation, especially in the birds (Sohail et al., 2010). Significant effect for the interactions was achieved on the cholesterol, phosphorus, T3 and T4 concentrations (Table 8).

CONCLUSION

From this study could be concluded as follow:

I- Golden-Montazah chickens can be select for better productive performance especially under high ambient temperature compared with Gimmizah.

II- Exposure male chicks to high temperature led to adversely affect live weight and feed consumption.

III- Productive performance, testes, bursa and thymus in male chicks which exposed to constant and intermittent cyclic heat (35°C) are more affected compared to control.

Tableb (1): Ingredients and chemical composition of starter and grower rations

Ingredients and Composition	Starter 4-10 week	Grower 10-16 week
Yellow corn	66.85	69.35
Soy bean meal (44% CP)	26	17.25
Wheat Bran	-	8
Lime stone	1	2.5
Salt	0.35	0.35
Concentrate	4	-
Di calcium phosphate	1.5	2.25
Premix[1]	0.3	0.3
Total	100	100
Chemical composition		
CP %	19.4	15
ME/kcal/kg	2931	2811
Calcium %	1.1	1.6
Total Phosphorus %	0.47	0.48
C F %	3.4	3.7
E E %	3	3
Lysine	1	0.72
Methionine	0.36	0.26

Calculated according to NRC (1994).

[1]Each 3 Kg of vitamin minerals Premix contents: Vit. A 1200000 I.U; Vit. E 700 mg; Vit. Bl 500 mg ; Vit. B 2 200 mg; Vit. B6 600 mg, Vit. B12 20 mg; Choline 1000 mg; Vit. D3 3000 I.U; Vit. K3 500 mg; Nicotinic Acid 40 mg; Pantothenic acid 670 mg; Methionine 3000 mg; Nicene 3000 mg; Folic acid 1.5 mg; Biotin 75 mg; Mn Sul 3000 mg; Irion Sul 10000 mg; Co Sul 300 mg; Se 0.108 mg; Zn Sul 1800 mg; Cu Sul 3000 mg; I 0.5 mg.

Table (2): Exterior and interior temperature (T), relative humidity (RH) and temperature humidity index (THI) allover experimental period

Period	Exterior			Interior			THI Ext-In (units)
	AT (°C)	RH (%)	THI (units)	AT (°C)	RH (%)	THI (units)	
26Feb-25Mar	28.8±1.0^{c}	45.0±0.3^{a}	26.5±0.9^{c}	24.2±0.9^{b}	62.5±0.8^{a}	23.1±0.8^{b}	3.3±0.2^{b}
26Mar-22Apr	34.1±1.0^{b}	57.1±0.5^{a}	31.5±0.9^{b}	28.5±0.9^{b}	63. 9±1.3^{a}	26.9±0.8^{b}	4.6±0.5^{a}
23Apr19May	37.0±1.7^{a}	52.8±2.2^{a}	33.7±1.4^{ab}	31.1±1.2^{ab}	62.7±1.2^{a}	29.2±1.0^{ab}	4.6±0.5^{a}
20May-16Jan	38.8±0.4^{a}	54.1±1.5^{a}	35.3±0.3^{a}	34.0±0.4^{a}	59.7±2.8^{b}	31.5±0.2^{a}	3.8±0.1^{ab}
Probability	***	NS	**	***	*	**	*

AT= Ambient temperature (°C), RH= Relative humidity (%) and THI= Temperature humidity index (units)

Table (3): Effect of strain and heat cyclic on body weight and body weight gain of male chickens

Strain / Heat cyclic / Age		Body weight (g)				Body weight gain (g)		
		4th week	**8th Week**	**12th week**	**16th week**	**4-8 Weeks**	**8-12 weeks**	**12-16 weeks**
Effect of strain (S)								
Golden-Montazah		355.6^{a}±9.4	798.5^{a}±34.4	1198.3^{a}±42.1	1406.3^{a}±46.9	15.8^{a}±1.1	12. 1^{a}±0.8	6.1^{a}±1.1
Gimmizah		278.4^{b}±5.6	683.4 ^{b}±13.4	1035.6^{b}±20.2	1225.0^{b}±26.1	16. 0^{a}±0.4	12.6^{a}±0.3	6.8^{a}±0.5
Effect of heat cyclic (HC)								
Control (C)		317.3^{a}±10.2	776.4^{a}±24.9	1157.7^{a}±36.6	1371.6^{a}±47.4	16.4^{a}±0.6	13.6^{a}±0.6	7. 6^{a}±0.7
Constant (T1)		324.5^{a}±14.6	776.7^{a}±33.3	1165.8^{a}±48.1	1339.8^{a}±54.6	16.1^{a}±0.7	13.9^{a}±0.7	6.7^{a}±0.1
Intermittent(T2)		309.2^{a}±9.7	668.4^{b}±37.4	1013.8^{b}±35.4	1204.1^{b}±31.6	12.8^{b}±1.3	10.7^{b}±0.8	4.8^{a}±1.3
Effect of interaction (S*HC)								
Golden-Montazah	C	351.9^{ab}±13.3	856.3^{ab}±41.3	1269.7^{b}±50.2	1504.4^{a}±58.3	18.0^{a}±1.2	14.8^{a}±0.9	8.3^{a}±1.4
	T1	375.9^{a}±13.3	893.2^{a}±44.1	1311.4^{a}±53.7	1458.1^{ab}±64.7	18.2^{a}±1.3	14.9^{a}±0.9	6.0^{ab}±1.5
	T2	339.1^{b}±13.3	657.8^{c}±41.3	1003.6^{c}±53.7	1219.6^{b}±67.3	11.4^{c}±1.2	9.0^{c}±0.9	3.3^{b}±1.5
Gimmizah	C	282.8^{c}±13.3	696.6^{bc}±41.3	1045.6^{bc}±50.2	1238.8^{b}±58.3	14.9^{b}±1.2	12.5^{bc}±0.9	6.9^{ab}±1.4
	T1	273.^{d}±13.3	674.7^{c}±41.3	1038.4^{bc}±50.2	1243.8^{b}±58.3	14.4^{bc}±1.3	13.0^{b}±0.9	7.3^{a}±1.4
	T2	279.4^{cd}±13.3	679.1^{c}±41.3	1022.8^{c}±50.2	1192.5^{c}±58.3	14.3^{bc}±1.2	12.3^{bc}±0.9	6.1^{ab}±1.4
Probability								
Strain (S)		***	**	***	**	NS	NS	NS
Heat cyclic (HC)		NS	*	*	*	*	**	NS
Interaction(S*HC)		**	***	***	**	***	***	*

Means with different superscripts (a, b, c) in the same column for every factor are significantly different ($p<0.05$).
*$p\leq0.05$; **$p\leq0.01$; ***$p\leq0.001$; NS, not significant.

Table(4): Effect of strain and heat cyclic on feed consumption (g) and feed conversion ratio of male chickens

Strain / Heat cyclic / Age		Feed consumption (g) 4-8 weeks	Feed consumption (g) 8-12 weeks	Feed consumption (g) 12-16 Weeks	Feed conversion ratio (g) 4-8 weeks	Feed conversion ratio (g) 8-12 weeks	Feed conversion ratio (g) 12-16 weeks
Effect of strain (S)							
Golden-Montazah		$46.2^{a}\pm0.5$	$62.9^{a}\pm0.9$	$79.5^{a}\pm0.7$	$2.6^{a}\pm0.2$	$3.8^{a}\pm1.2$	$8.4^{a}\pm3.2$
Gimmizah		$39.0^{b}\pm0.4$	$57.3^{b}\pm0.7$	$67.0^{b}\pm0.5$	$2.9^{a}\pm0.1$	$5.2^{a}\pm0.2$	$12.5^{a}\pm1.5$
Effect of heat cyclic (HC)							
Control (C)		$45.7^{a}\pm0.5$	$66.1^{a}\pm0.6$	$75.9^{a}\pm0.5$	$2.9^{a}\pm0.1$	$5.3^{a}\pm0.2$	$9.8^{a}\pm2.6$
Constant (T1)		$36.6^{c}\pm0.5$	$50.5^{c}\pm0.5$	$66.6^{c}\pm0.8$	$2.5^{b}\pm0.1$	$4.1^{a}\pm0.2$	$11.7^{a}\pm2.1$
Intermittent(T2)		$41.9^{b}\pm0.6$	$59.5^{b}\pm0.5$	$70.9^{b}\pm1.3$	$2.8^{ab}\pm0.2$	$4.6^{a}\pm1.3$	$11.7^{a}\pm2.8$
Effect of interaction (S*HC)							
Golden-Montazah	C	$48.9^{a}\pm0.3$	$69.8^{a}\pm0.6$	$81.2^{a}\pm0.5$	$2.7^{ab}\pm0.2$	$4.9^{a}\pm1.2$	$7.6^{a}\pm3.9$
	T1	$40.9^{ab}\pm0.4$	$54.9^{bc}\pm0.7$	$73.4^{b}\pm0.7$	$2.4^{c}\pm0.3$	$4.0^{a}\pm1.5$	$12.7^{a}\pm4.2$
	T2	$47.1^{a}\pm0.3$	$61.1^{b}\pm0.6$	$82.2^{a}\pm0.6$	$2.6^{b}\pm0.2$	$2.4^{b}\pm1.3$	$5.8^{a}\pm4.4$
Gimmizah	C	$43.6^{ab}\pm0.3$	$63.7^{b}\pm0.5$	$72.3^{b}\pm0.4$	$3.1^{a}\pm0.2$	$5.6^{a}\pm1.0$	$11.3^{a}\pm3.2$
	T1	$34.5^{c}\pm0.3$	$48.2^{c}\pm0.5$	$63.4^{c}\pm0.5$	$2.5^{b}\pm0.2$	$4.1^{a}\pm1.0$	$11.3^{a}\pm3.3$
	T2	$38.5^{b}\pm0.3$	$59.0^{bc}\pm0.5$	$65.0^{c}\pm0.4$	$2.9^{a}\pm0.2$	$5.8^{a}\pm1.0$	$14.8^{a}\pm3.2$
Probability							
Strain (S)		***	***	***	NS	NS	NS
Heat cyclic (HC)		***	***	***	*	NS	NS
Interaction(S*HC)		***	***	***	*	*	NS

Means with different superscripts (a, b, c) in the same column for every factor are significantly different ($p<0.05$).

*$p\leq0.05$; ***$p\leq0.001$; NS, not significant.

Table(5): Effect of strain and heat cyclic on cutup parts of male chickens

Strain / Heat cyclic ↓		Final BW (g)	Feather (%)	Carcass (%)	Chest + back (%)	Thai + Drumstick (%)
Effect of strain (S)						
Golden-Montazah		1674.72^{a} ±74.7	6.24^{a} ±0.3	50.47^{a} ±0.8	45.72^{a} ±0.5	29.62^{a} ±0.4
Gimmizah		1515.00^{b} ±35.8	6.75^{a} ±0.3	52.01^{a} ±0.7	46.15^{a} ±0.4	30.17^{a} ±0.5
Effect of heat cyclic (HC)						
Control (C)		1707.92^{a}±75.7	6.47^{a}±0.4	50.34^{a}±0.5	45.90^{a}±0.4	30.44^{a}±0.5
Constant (T1)		1605.42^{ab}±67.6	6.81^{a}±0.4	50.35^{a}±1.1	45.66^{a}±0.4	29.45^{a}±0.4
Intermittent (T2)		1471.25^{b}±84.8	6.22^{a}± 0.4	53.03^{a}±1.0	46.25^{a}±0.8	29.79^{a}±0.7
Effect of interaction (S*HC)						
Golden-Montazah	C	1847.50^{a}±96.4	6.41^{a}±0.6	51.41^{ab}±1.2	46.31^{a}±0.8	30.04^{a}±0.8
	T1	1687.50^{b}±96.4	6.25^{a}±0.6	49.07^{b}±1.2	45.29^{a}±0.8	29.39^{a}±0.8
	T2	1489.16^{c}±96.4	6.07^{a}±0.6	50.94^{ab}±1.2	45.56^{a}±0.8	29.44^{a}±0.8
Gimmizah	C	1568.33^{bc}±96.4	6.53^{a}±0.6	49.27^{ab}±1.2	45.50^{a}±0.8	30.84^{a}±0.8
	T1	1523.33^{bc}±96.4	7.36^{a}±0.6	51.64^{ab}±1.2	46.02^{a}±0.8	29.52^{a}±0.8
	T2	1453.33^{c}±96.4	6.37^{a}±0.6	55.14^{a}±1.2	46.95^{a}±0.8	30.15^{a}±0.8
Probability						
Strain (S)		*	NS	NS	NS	NS
Heat cyclic (HC)		*	NS	NS	NS	NS
Interaction(S*HC)		*	NS	**	NS	NS

Means with different superscripts (a, b, c) in the same column for every factor are significantly different (p<0.05). *P<0.05, **P<0.01, NS: No significance.

Table (6): Effect of strain and heat cyclic on the internal and lymphoid organs of male chickens

Strain Heat cyclic ↓		Internal organs				Lymphoid organs		
		Liver (%)	**Pancreas (%)**	**Heart (%)**	**Testes (%)**	**Bursa (%)**	**Thymus (%)**	**Spleen (%)**
Effect of strain (S)								
Golden-Montazah		2.57^{a} 0.1	0.25^{a}±0.02	0.56 ^{a} 0.04	0.29 ^{b} ±0.1	0.23^{a} ±0.03	0.6^{a} ±0.1	0.27^{a} ±0.03
Gimmizah		2.04^{b} 0.1	0.22^{a} 0.01	0.58^{a} 0.03	1.09^{a} ±0.2	0.26^{a} ±0.04	0.7^{a} ±0.1	0.24^{a} ±0.01
Effect of heat cyclic (HC)								
Control (C)		2.19^{a} ±0.1	0.22 ^{a} ±0.01	0.52^{b} ±0.02	0.88^{a}±0.2	0.30^{a}±0.05	1.13^{a}±0.1	0.24^{a}±0.02
Constant (T1)		2.43^{a} ±0.1	0.26 ^{a} ±0.02	0.52^{b} ±0.03	0.57^{a}±0.1	0.20^{a}±0.03	0.40^{b}±0.1	0.26^{a}±0.04
Intermittent(T2)		2.30^{a} ±0.2	0.22^{a} ±0.01	0.66^{a} ±0.06	0.62^{a}±0.2	0.23^{a}±0.04	0.47^{b}±0.1	0.28^{a}±0.02
Effect of interaction (S*HC)								
Golden-Montazah	C	2.39^{ab}±0.2	0.22^{b}±0.02	0.50^{a}±0.1	0.52^{b}±0.3	0.32^{a}±0.07	1.1^{a}±0.1	0.25^{a}±0.04
	T1	2.63^{a}±0.2	0.30^{a}±0.02	0.49^{a}±0.1	0.19^{b}±0.3	0.18^{a}±0.07	0.3^{c}±0.1	0.26^{a}±0.04
	T2	2.70^{a}±0.2	0.22^{b}±0.02	0.69^{a}±0.1	0.19^{b}±0.3	0.21^{a}±0.07	0.5^{b}±0.1	0.31^{a}±0.04
	C	1.99^{b}±0.2	0.21^{b}±0.02	0.54^{a}±0.1	1.26^{a}±0.3	0.28^{a}±0.07	1.2^{a}±0.1	0.23 ^{a}±0.04
Gimmizah	T1	2.25^{ab}±0.2	0.22^{b}±0.02	0.56^{a}±0.1	0.95^{a}±0.3	0.24^{a}±0.07	0.5^{b}±0.1	0.25^{a}±0.04
	T2	1.91^{b}±0.2	0.22^{b}±0.02	0.63^{a}±0.1	1.06^{a}±0.3	0.26^{a}±0.07	0.5^{b}±0.1	0.26^{a}±0.04
Probability								
Strain (S)		**	NS	NS	**	NS	NS	NS
Heat cyclic (HC)		NS	NS	*	NS	NS	***	NS
Interaction(S*HC)		*	*	NS	*	NS	***	NS

Means with different superscripts (a, b, c) in the same column for every factor are significantly different ($p < 0.05$). *P<0.05, **P<0.01, ***p≤0.001; NS: No significance.

Table (7): Effect strain and heat cyclic on hematological parameters of male chickens

Strain / Heat cyclic ↓		Hb (g/dl)	RBCs ×10^{6}	WBCs differentia					
				Lymphocyte	Eosinophil	Basophil	Heterophil	Monocyte	H/L
Effect of strain (S)									
Golden-Montazah		11.4^{a} ±0.4	2.9^{a} ±0.1	69.2^{a} ±0.9	3.9^{a}±0.5	0.44^{a} ±0.20	24.4^{a} ±0.7	1.9^{a} ±0.4	0.36^{a} ±0.01
Gimmizah		12.5^{a} ±0.5	3.1^{a} ±0.2	71.4^{a} ±1.1	3.1^{a}±0.4	0.20^{b} ±0.24	24.1^{a} ±1.0	1.2^{a} ±0.3	0.34^{a} ±0.02
Effect of heat cyclic (HC)									
Control (C)		12.7^{a} ±0.5	3.0^{a} ±0.20	70.5^{a} ±1.18	3.7^{a}±0.4	0.33^{a} ±0.22	23.3^{a} ±1.1	1.7^{a}±0.2	0.33^{a}±0.02
Constant (T1)		11.4^{a} ±0.7	2.9^{a} ±0.13	70.0^{a} ±1.49	3.7^{a}±0.8	0.33^{a} ±0.22	24.3^{a} ±1.2	1.7^{a}±0.6	0.35^{a}±0.02
Intermittent (T2)		11.7^{a} ±0.3	3.2^{a} ±0.16	70.1^{a} ±0.82	3.1^{a}±0.3	0.33^{a} ±0.22	25.1^{a} ±0.9	1.3^{a}±0.4	0.36^{a}±0.02
Effect of interaction (S*HC)									
Golden-Montazah	C	11.5^{a}±0.7	2.9^{a}±0.2	70.3^{a}±1.5	3.7^{a}±0.8	0.67^{a}±0.30	23.3^{a}±1.5	1.7^{a}±0.58	0.33^{a}±0.03
	T1	10.6^{a}±0.7	2.7^{a}±0.2	66.7^{a}±1.5	5.0^{a}±0.8	0	25.7^{a}±1.5	2.7^{a}±0.58	0.39^{a}±0.03
	T2	12.0^{a}±0.7	3.2^{a}±0.2	70.7^{a}±1.5	3.0^{a}±0.8	0.67^{a}±0.30	24.3^{a}±1.5	1.3^{a}±0.58	0.34^{a}±0.03
Gimmizah	C	13.8^{a}±0.7	3.1^{a}±0.2	70.7^{a}±1.5	3.7^{a}±0.8	0	23.3^{a}±1.5	1.7^{a}±0.58	0.34^{a}±0.03
	T1	12.2^{a}±0.7	3.0^{a}±0.2	73.3^{a}±1.5	2.3^{a}±0.8	0.67^{a}±0.30	23.0^{a}±1.5	0.7^{a}±0.58	0.32^{a}±0.03
	T2	11.5^{a}±0.7	3.1^{a}±0.2	69.5^{a}±1.5	3.2^{a}±0.8	0	25.8^{a}±1.5	1.3^{a}±0.58	0.37^{a}±0.03
Probability									
Strain (S)		NS	NS	NS	NS	*	NS	NS	NS
Heat cyclic (HC)		NS	NS	NS	NS	NS	NS	NS	NS
Interaction(S*HC)		NS	NS	NS	NS	NS	NS	NS	NS

Means with different superscripts (a, b, c) in the same column for every factor are significantly different (p<0.05). *P<0.05, NS: No significance.

Table (8): Effect of strain and heat cyclic on blood constituents of male chickens

Strain / Heat cyclic ↓		Total protein (g/dl)	Albumin (g/dl)	Globulin (g/dl)	Liver enzymes	
					GOT	GPT
Effect of strain (S)						
Golden-Montazah		5.7^{a}±0.1	2.3^{a}±0.1	3.4^{a}±0.2	41.1^{a}±1.2	57.6^{a}±1.4
Gimmizah		5.7^{a}±0.1	2.5^{a}±0.1	3.2^{a}±0.2	38.6^{a}±1.1	60.8^{a}±2.5
Effect of heat cyclic (HC)						
Control (C)		5.7^{a}±0.04	2.6^{a}±0.2	3.1^{a}±0.2	40.8^{a}±1.4	64.3^{a}±3.4
Constant (T1)		5.8^{a}±0.1	2.7^{a}±0.2	3.1^{a}±0.2	39.1^{a}±1.2	56.3^{b}±1.4
Intermittent (T2)		5.5^{b}±0.1	2.4^{a}±0.2	3.1^{a}±0.2	39.6^{a}±1.6	57.0^{b}±1.2
Effect of interaction (S*HC)						
Golden-Montazah	C	5.7^{a}±0.1	2.6^{a}±0.2	3.1^{a}±0.3	44.0^{a}±2.0	61.2^{a}±3.3
	T1	5.7^{a}±0.1	3.0^{a}±0.2	2.6^{a}±0.3	39.5^{a}±2.0	53.8^{b}±3.3
	T2	5.5^{b}±0.1	2.2^{a}±0.2	3.4^{a}±0.3	39.7^{a}±2.0	57.8^{b}±3.3
Gimmizah	C	5.8^{a}±0.1	2.5^{a}±0.2	3.3^{a}±0.3	37.7^{a}±2.0	67.5^{a}±3.3
	T1	5.8^{a}±0.1	2.4^{a}±0.2	3.4^{a}±0.3	38.7^{a}±2.0	58.7^{a}±3.3
	T2	5.4^{b}±0.1	2.7^{a}±0.2	2.7^{a}±0.3	39.5^{a}±2.0	56.2^{b}±3.3
Probability						
Strain (S)		NS	NS	NS	NS	NS
Heat cyclic (HC)		**	NS	NS	NS	*
Interaction(S*HC)		*	NS	NS	NS	*

Means with different superscripts (a, b, c) in the same column for every factor are significantly different ($p<0.05$).*$p\leq0.05$; **$p\leq0.01$; NS, not significant.

Table(9): Effect of strain and heat cyclic on blood constituents of male chickens

Strain / Heat cyclic ↓		Cholesterol (mg/dl)	Triglycerides (g/dl)	Ca (mg/dl)	P (mg/dl)	T3 (ng/ml)	T4 (ng/ml)
Effect of strain (S)							
Golden-Montazah		162.1^{a}±8.00	272.8^{a}±17.9	10.7^{a}±0.7	5.1^{a}±0.3	5.7^{a}±0.4	3.3^{a}±0.4
Gimmizah		170.1^{a}±15.7	275.8^{a} ±16.1	11.8^{a}±0.6	4.2^{b}±0.3	4.2^{b}±0.3	2.5^{b}±0.1
Effect of heat cyclic (HC)							
Control (C)		155.3^{a}±11.8	265.6^{a}±24.7	12.2^{a}±0.9	5.3^{a}±0.5	4.6^{a}±0.7	2.8^{ab}±0.4
Constant (T1)		187.8^{a}±20.3	290.1^{a}±20.2	10.3^{a}±0.9	3.9^{b}±0.2	5.5^{a}±0.3	3.7^{a}±0.4
Intermittent (T2)		155.2^{a}±10.4	267.2^{a}±17.0	11.2^{a}±0.6	4.8^{ab}±0.3	4.7^{a}±0.2	2.3^{b}±0.3
Effect of interaction (S*HC)							
Golden-Montazah	C	182.0^{ab}±18.6	236.0^{a}±29.1	11.1^{a}±1.1	6.0^{a}±0.5	6.5^{a}±0.5	3.2^{b}±0.5
	T1	151.1^{b}±18.6	319.0^{a}±29.1	10.2^{a}±1.1	4.4^{b}±0.5	5.8^{a}±0.5	4.4^{a}±0.5
	T2	153.3^{b}±18.6	263.4^{a}±29.1	10.7^{a}±1.1	5.0^{ab}±0.5	4.7^{b}±0.5	2.4^{c}±0.5
Gimmizah	C	128.7^{bc}±18.6	295.1^{a}±29.1	13.3^{a}±1.1	4.7^{b}±0.5	2.8^{c}±0.5	2.4^{c}±0.5
	T1	224.5^{a}±18.6	261.2^{a}±29.1	10.3^{a}±1.1	3.5^{c}±0.5	5.3^{ab}±0.5	2.9^{bc}±0.5
	T2	157.0^{b}±18.6	271.0^{a}±29.1	11.7^{a}±1.1	4.6^{b}±0.5	4.7^{b}±0.5	2.3^{c}±0.5
Probability							
Strain (S)		NS	NS	NS	*	**	*
Heat cyclic (HC)		NS	NS	NS	*	NS	*
Interaction(S*HC)		*	NS	NS	*	***	**

Means with different superscripts (a, b, c) in the same column for every factor are significantly different ($p<0.05$). *$p\leq0.05$; **$p\leq0.01$; ***$p\leq0.001$; NS, not significant.

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الملخص العربى

تأثير الحرارة المرتفعة المستمرة والمتقطعة علي اداء ذكور دجاج الجميزة والمنتزه الذهبي النامية

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أجريت هذه الدراسة بمزرعة الدواجن التجريبية بقسم الإنتاج الحيوانى والدواجن بكلية الزراعة جامعة الأزهر فرع أسيوط بمصر.

هدفت الدراسة إلى تقييم تأثير التعرض لدرجتى الحرارة المستمرة والمتقطعة على ذكور دجاج الجميزة والمنتزه الذهبي النامية خلال الفترة من ٤ إلى ١٦ اسبوع من العمر. اشتملت التجربة علي ٩٦ من ذكور الدجاج عند عمر ٤ اسابيع، والتى قسمت بالتساوى إلى أربع مجموعات متساوية بكل منها ١٦ منتزه ذهبي و ١٦ جميزه. ربيت كتاكيت المجموعة الأولى تحت الظروف الطبيعية واعتبرت مجموعة الكنترول. تعرضت كتاكيت المجموعة الثانية يومياً إلى ٣٥ درجة مئوية بصورة مستمرة لخمس ساعات متواصلة، بينما تعرضت مثيلاتها بالمجموعة الثالثة إلى ٣٥ درجة مئوية لخمس ساعات ولكن بصورة متقطعة. تم اسكان جميع الطيور فى عشش خشبية وربيت تحت الظروف الطبيعية السائدة وعرضت يومياً إلى ١٦ ساعة اضاءة مستمرة. تم تغذية الكتاكيت حتى الشبع على عليقة البادئ والنامي وتزويد جميع الطيور بالماء حتى الشبع.

اوضحت النتائج وجود زيادة فى وزن الجسم بصورة معنوية (عند مستوى ٠،٠٥) لدجاج المنتزه الذهبي مقارنة بالجميزه، بينما لم توجد فروق معنوية بين السلالتين فى معدل الزيادة الوزنية. انخفض وزن الجسم ومعدل الزيادة الوزنية معنويا فى الكتاكيت المعرضة لدرجة الحرارة المتقطعة مقارنة بمثيلاتها بمجموعة الكنترول ومجموعة الحرارة المستمرة.

تأثر معنوياً معدل استهلاك الغذاء للديوك بنوع السلالة وتغير درجة الحرارة والتداخل بينهما، بينما معدل التحويل الغذائي لم يتأثر بنوع السلالة ودرجة الحرارة خلال الفترة من ٤-١٢، ١٢-١٦ اسبوع من العمر. لم يوجد فروق معنوية بمقاييس الذبيحة والمقاييس الهيماتولوجية بين السلالتين والمجموعات المختلفة للحرارة والتداخل بينهما. تأثرت نسبتى الكبد والخصية معنويا بنوع السلالة، بينما تأثرت نسبتى الكبد والغدة الثيموسية معنويا بدرجة الحرارة. تأثرت معنويا نسبة البروتين الكلى وانزيم الكبد وهرمونات الغدة الدرقية بنوع السلالة ودرجة الحرارة والتداخل فيما بينهما. ازدادت معنويا قيم الفوسفور وهرمونات الغدة الدرقية فى المنتزه الذهبي مقارنة بالجميزه.

لذلك، يمكن ان نخلص إلى أن دجاج المنتزه الذهبي أكثر تحملاً لدرجات الحرارة المرتفعة مقارنة بالجميزة تحت الظروف المناخية السائدة فى صعيد مصر.