Egypt. J. Anim. Prod. 19, No. 2, pp. 187-203 (1979)

Acclimation of Fayoumi Chickens to Constant and Varying Temperatures

M.M. Shafie, A.M. Borady and N.H. Abdelmutaal
Faculty of Agriculture, Cairo University, Egypt.

A number of 160 males and 200 females one day old Fayoumi chickens from the flock of Poultry Research Unit of the Faculty of Agriculture, Cairo University, were available for the present study

Investigations were conducted in which four independent groups were acclimated from the day of hatch until three months old to: (a) constant hot conditions of 33° air temperature (lst gr.) (b) hot temperature of 33° for 2 months then subjected to heat stress of 42° for one month (2nd gr.), (c) hot conditions for one month then acclimated to warm temperature of 25° for two months (3 rd gr), and (d) hot conditions from one month (4 th gr).

Body temperature, respiration rate and body weight of 1,2 and 3 months old chicks were recorded before and after 24 hr transference to new environment. At the end of acclimation period chicks were slaughtered and thyroid glands were individually collected from 40 chicks (20 males and 20 females) from each of the four groups.

The results revealed that chickens acclimated to warm temperatures 25° hot were less tolerant to increased air temperature than those acclimated to conditions of 33° air temperature.

Acclimation of 2 months old chicks to high environmental temperature of 42° caused increase in their body temperature and respiration rate at the end of acellimation period. Chicks acclimated to warm conditions had lower body temperature and respiration, rate.

The data obtained revealed depression of thyroid activity of chickens of the 2nd and 4 th groups acclimated to high environmental temperature of 42°. More active thyroids were observed in groups acclimated to hot (33°) or to warm (25°)conditions. Body weight of hot acclimated chicks was nearly two thirds of that acclimated to warm temperature.

Acclimation usually occurs naturally when animals or birds are subjected to a complex of extreme environmental factors. Exposure of chickens few hours daily through 2 successive or many days or even weeks to severe hot or cold conditions, is a process usually called " Short-term physiological acclimation". If birds were brooded or reared under continuous extremes of ambient temperature, the process is called "Long-term physiological acclimation")

During the process of acclimation or acclimatization many suystems and organs of the animal modify their activity to function normally under the new environmental conditions.

Physiological status, vitality, viability, production and reproduction are greatly affected in most of temperate poultry breeds, or even birds that live in hot climates, when subjected to severe environmental temperatures (which may naturally occur).

Many investigations were carried out with temperate and tropical breeds of chickens to arrange their physiological make up to withstand expected severe changes in the environmental conditions or to live and produce normally under unfavourable conditions.

Trials were conducted to adapt birds to severe temperature changes by exposing the birds, at different ages, and under different nutritional conditions, to extreme ambient temperatures for different periods few hours to several months. Physiological responses and deviations in the functions of different body systems serve as criteria for heat tolerance while successful performance in the tropics and subtropics denotes economic adaptation of that particular breed in these hot zones.

The majority of available literature on the variation in body temperature and respiration rate during acclimatization or acclimation to heat or cold stress is obtained from experiments carried out on adult chickens.

Acclimation to cold or hot conditions affects body temperature and heat tolerance ability of chickens. Cold acclimated adult birds have much lower body temperature than that of hot acclimated animals. Respiration unlike body temperature was the same in both cold and hot acclimated chicks at the end of the acclimation period (Wilson, 1949).

The reaction of adult chicks to heat stress was found to be different in accordance with the previous time of acclimation to hot ambient temperature (Hutchinson and Sykes, 1953). The type of acclimation to cold or hot conditions affects the response of animals to heat stress (Weiss and Borbely, 1957; Weiss, 1959 and Thornton, 1961 and 1962). The thyroid gland plays a major part in the metabolic complex process in the animal body . Thus it has a predominating role in the regulation of the internal body conditions particularly the body temperature.

The phylogenetic differences in the thyroid structure and activity is in good accordance with the specific functions of the animals within their particular environments (Hoffman and Shaffner, 1950; Garren and Shaffner, 1956; Conner *et al.*, 1958; Henninger *et al.*, 1960; Huston, 1960; Huston *et al.*,1962 and Hendrich and Turner, 1963 and 1967).

The present work was carried out to elucidate variations in body temperature, respiration rate and thyroid activity of the native Egyptian Fayoumi chicks during acclimation to different climatic conditions.

Material and Methods

This work was carried out in the Poultry Research Unit of the Faculty of Agriculture, Cairo University, Egypt.

Experimental animals

The study comprised 360 chicks (160 males and 260 females) of the Fayoumi native Egyptian breed.

Upon hatching chickens were individually weighed, wing - banded and placed in electrically heated brooding pens at 33 $\pm$2 °. The air temperature was controlled by a set of electrical heaters and thermostats in accordance with the particular groups. No attempt was executed to control the humidity within the pens.

Chickens were fed on a ration composed of 22% decorticated cotton seed meal, 15% ground barley, 40% ground maize, 5% wheat bran, 10% rice bran, 5 % blood meal, 1.0 phizer mineral mixture, 1.5 % lime stone and 0.5% sodium chloride.

Food and water were available *ad libitum* for all chicks.

Procedures

Daily maximum and minimum ambient air temperature, inside the brooding pens, were recorded twice daily at 7 a.m. and 4 p.m., throughout the experiment by a maximum and minimum thermometers.

The body temperatures and respiration rates were taken at various times throughout the test according to the design of each experiment. Rectal temperatures were measured by a clinical thermometer inserted in the cloaca for two minutes. Respiration rate per minute was obtained by visual observation (counting the movement of the abdomen in 30 seconds and then doubled).

At one month of age chickens were weighed and their rectal temperatures and respiration rates were recorded. The chicks were then divided into four groups, 40 and 50 males and females respectively in each group. The first and the second groups were kept in the original pen under the temperature 33° $\pm$ 2°. The third and the fourth groups were transferred into a brooding pen with a lower temperature, 25 $\pm$ 2°. After 24 hr rectal temperatures and respiration rates of the 3rd and 4th groups were recorded.

At two months of age the chicks of each group were individually weighed and their rectal temperatures respiration rates were recorded. The first and third groups remained in their particular pens under 33$\pm$2 ° and 25 $\pm$ 2° respectively. Chickens of the 2nd and the 4 th groups were transferred to a new pen of a high temperature, 42 $\pm$ 2 °. The body temperature and respiration rates of these transferred chicks were recorded after 24 hr of exposure to that high temperature.

At three months of age all chickens of all groups were indiviually weighed and their rectal temperatures and respiration rates were recorded.

At the end of acclimation studies when chicks were at3 months of age, they were slaughtered and thyroid glands were individually collected from 40 chickens - 20 males and 20 females from each of the four groups.

The glands were weighed after 2 weeks of fixation in Bouin's solutions, sectioned at 5 microns at the equatorial plane and stained by haematoxylin and eosin.

Five glands from each sex were microscopically examined in 10 fields, outer and inner follicular diameters were measured from which epithelial cell height was calculated. The number of epithelial cells in each follicle was also counted.

Results

Body temperature and respiration rate reactions to acclimation

1. *Effect of acclimation to constant hot conditions of 33° during the first three months of age (lst group)*

A. *Body temperature :* The body temperature of Fayoumi chicks kept since hatching at 33° (91°F) ambient temperature significantly rose (P 0.01) from 105.2°F at 2 days old ot 1080°F at one month (Table 1 and Fig. 1). Slight, difference between body temperature of males and females was observed at one month of age (Table 1). After two months exposure to constant warm environmental temperature of 33° (91°F), the body temperature of both males and females increased. The increase in body temperature was greater in females than in males+0.9 (P 0.01) and +0.5 (P 0.05) for females and males respectively. After three months the body temperature decreased from 10.8.5° to 108.2°F (P 0.05) and from 108.6° to 108.0°F (P 0.01) in males and females respectively.

B. *Respiration rate :* Under warm environmental conditions of 33° (91°F) the respiration rate of the chickens decreased from 75.6 breath/min at one month to 66.8 at two months of age and from 78.5 to 69.1/breath/min in males and female respectively (P 0.01). With the advancement of age more decrease in respiration rate was observed it became 54.4 and 54.0 breath/min. for males and females respectively (P 0.01) at 3 months of age (Table 2 and Fig. 1).

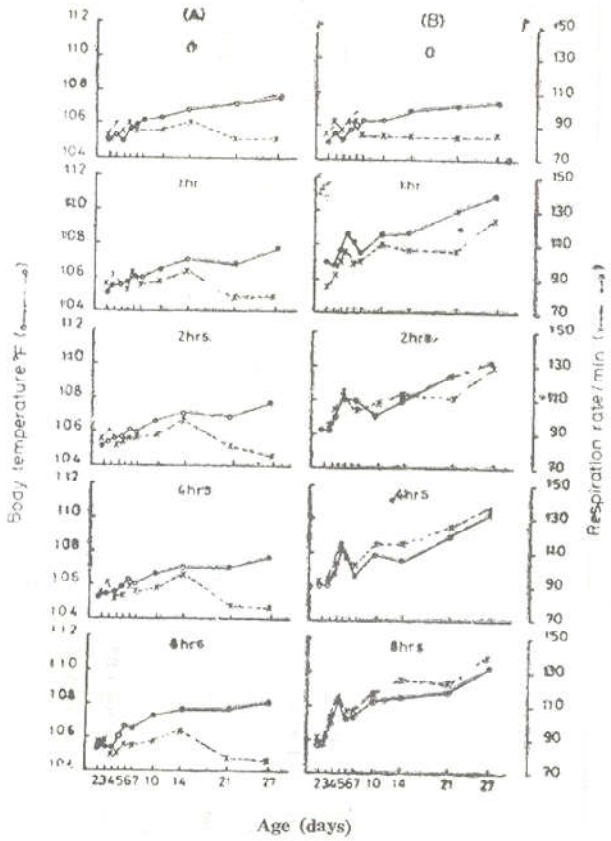

Fig. 1. Body temperature and respiration of Fayoumi chicks during the first 27 days after hatch at successive daily periods.
A—Under normal brooding temperature of 31 ° (88 °F)
B—Under heat stress of 42 ° ambient temperature (108 °F).

2. *Effect or acclimation to varying hot to high (33-42°) environmental temperatures during the first three months of age (2 nd Group)*

A. Body temperature : As mentioned previously, 2 months of age the second group of chickens brooded at 33° were transferred toa room with air temperature of 42° (108 °F). After 24 hr exposure their body temperature rose from 108.3° to 108.9° and from 108.5 to 109.1°F for males and females respectively (P 0.01) After one month the body temperature of both sexes showed a significant decrease (P 0.05) (Tables 1 and 3 and Fig. 1) but it was still higher than before exposure and than that of the three months old chicks of the first group kept under 33° (91 °F) (P 0.01).

TABLE 1. Effect of acclimation to different ambient temperatures on body temperature (°F) of chicks from hatch up-to three months of age.

Age (months)	One	Two		Three		
Duration of exposure for one month in :	33° 91°F	33° 91°F	25° 77°F	33° 91°F	25° 77°F	42° 108°F
Group	Males					
1st. Group	108.0±0.21	108.5±0.07	—	108.2±0.10	—	—
2nd. "	108.0±0.06	108.3±0.07	—	—	—	108.7±0.11
3rd. "	108.1±0.08	—	108.0±0.08	—	108.1±0.08	—
4th. "	108.1±0.08	—	108.2±0.14	—	—	108.0±0 13
	Females					
1st. Group	107.7±0.08	108.6±0.07	—	108.0±0.09	—	—
2nd. "	107.8±0.07	108.5±0.06	—	—	—	108.9±0.13
3rd. "	107.9±0.08	—	108.3±0.07	—	108.2±0.07	—
4th. "	108.1±0.06	—	108.3±0.08	—	—	109.1±0.11

TABLE 2. Effect of acclimation to different ambient temperature on respiration rate/minute of chicks from hatch up-to three months of age.

Age (months)	One	Two		Three		
Duration of exposure for one month in :	33° 91°F	33° 91°F	25° 77°F	33° 91°F	25° 77°F	42° 108°F
	Males					
1st. Group	75.6±1.44	66.8±1.63	—	54.4±1.64	—	—
2nd. "	78.6±0.89	70.1±1.40	—	—	—	53.9±2.03
3rd. "	81.1±1.80	—	65.9±2.02	—	49.1±1.54	—
4th. "	80.1±1.44	—	68.1±1.47	—	—	54.6±2.20
	Females					
1st. Group	78.5±1.54	69.1±1.59	—	54.0±1.70	—	—
2nd. "	78.0±1.26	71.3±1.30	—	—	—	65.4±3.0
3rd. "	80.1±1.25	—	67.7±1.36	—	50.1±1.21	—
4th. "	81.1±0.98	—	73.5±1.21	—	—	62.4±2.70

TABLE 3. Effect of varying ambient temperature on the body temperature of chicks at different ages, after 24 hr exposure.

Age	One month		Two months			
Group	Before exposure at 33° 91°F	After 24 hr in 25° 77°F	Before exposure (at 33°) 91°F	After 24 hr in 42° 108°F	Before exposure (at 25°) 77°F	After 2 hr. in 42° 108°F
Males						
2 nd.	108.0±0.06	—	108.3±0.07	108.9±0.02	—	—
3 rd.	108.1±0.08	107.6±0.06	—	—	—	—
4 th.	108.1±0.08	107.6±0.07	—	—	108.2±0.14	10.8±0.15
Females						
2 nd.	107.8±0.07	—	108.5±0.06	109.1±0.09	—	—
3 rd.	107.9±0.08	107.6±0.08	—	—	—	—
4 th.	108.1±0.06	107.6±0.06	—	—	108.3±0.08	109.4±0.12

TABLE 4. Effect of varying ambient temperature on the respiration rate min of chicks at different ages, after 24 hr of exposure.

Age	One month		Two months			
Group	Before exposure (at33°) 91°F	After 24 hr in25° 77°F	Before exposure (at33°) 91°F	After 24 hr in 42° 108°F	Before exposure (at 25°) 77°F	After 24 hr in 42° 108°F
Males						
2nd	78.6±0.89	—	70.1±1.40	100.0±5.05	—	—
3rd	81.1±1.80	77.8±1 65	—	—	—	—
4th	80.1±1.44	76.6±1.50	—	—	68.1±1.47	129.7±6.51
Females						
2nd	78 0±1.26	—	71.3±1.30	113.1±4.67	—	—
3rd	80.1±1.25	78.7±1.70	—	—	—	—
4th	81.1±0.98	80.3±1.29	—	—	73.5±1.21	130.1±5.11

B. Respiration rate : After 24 hr under heat stress of 42 ° (108 °F) these 2 month-old chickens acquired an increase in respiration rate from 70.1 breath/min before exposure to 100 and from 71.3 to 113.1 breath/min in males and females respectively (P 0.01) (Table 4).

It is worthy to note that the respiration rate of females increased significantly more than that of males (P 0.05) although there was no significant difference in their initial respiration rate before exposure.

A highly significant decrease occurred in the respiration rate after acclimation for a month under the hot 42° after the initial increase due to the first shock of the exposure to this heat stress in both sexes. The rate decreased from 100 breath/min after the initial 24 hr exposure to 53.9 breath/min in males and from 113 to 65.4 in females (P 0.01). The respiration rate of females was higher than that of males (P 0.05).

It is clear from Table 2 that the respiration rate of the males of this group (2 nd group) after being kept under heat stress (42°) for one month was the same as that of chickens of the first group kept for three months under the warm environment of 33° air temperature. On the other hand, the respiration rate of the females of the second group was significantly higher (P 0.05), (65.4 breath/min) than that of the chickens of the first group (54.0 breath/min).

3. *Effect of acclimation to varying hot to warm environmental temperatures during the first three months of age (3rd group)*

A. Body temperature : After 24 hr of exposure of one month old chickens to 25° (77°F) ambient temperature the body temperature of both sexes decreased by - 0.5° and 0.3°F (P 0.01 and 0.05) for males and females respectively (Table 1). After one month residence in 25° (77°) (at 2 months of age), the body temperature remained almost stable in males, while females showed significant increase from 107.9° to 108.3°F (P 0.01).

No changes were observed after 2 months residence in 25° (77°F), and the average body temperature in this group did not differ much from that of the chickens of the first group kept continuously at 33°.

B. Respiration rate : Although the body temperature of chickens of this group decreased after 24 hr exposure to 25° (77°F) environmental temperature, their respiration rate did not change either in males or females (Table 4). Great decrease in respiration rate was observed after one month, in males it became 65.9 breath/min instead of 77.8 after 24 hr exposure, in females it changed from 78.7 to 67.7 (P 0.01). The respiration at 2 months of age was nearly the same as the chickens of the frst group acclimated continuously to 33° (91°F).

Continuous residence of chicks in 25° (77°F) for two months (up to three months of age further reduction in the respiration rate of males and females was observed (by 16 8 breath/min and 17 6 breath/min) (P 0 01) respectively (Table 2 and Fig 1). Respiration rate of this group of chickens at three months of age was lower by 5 3 and 3 9 breath/min (P 0 05) for males and females respectively than the chickens of the first group kept continuousy under 33° (91°F) for three months.

4.*Effect of heat stress of* 42° (18°F) *on chickens kept for one month at* 25° (77°F) *(4th group)*

A. Body temperature: When chickens brooded for one month under 25° (77°F) were subjected to ambient temperature of 42° (108°F) a highly significant rise (P 0 01) in body temperature was observed after 24 hr exposure, + 1 6° and ± 1 1°F for males and females repectively (Table 3). The response of males was greater than that of females.

After one month residence under this high environmental temperature the body temperature of males decreased by 1 0°F (P 0 01) while the reduction in females body temperature was only 0 3°F (P 0 05) (Tables 1 and 3). The body temperature of males was lower than that of females(108.8°F and 109 1°F for males and females respectively), however this difference was not significant. The body temperature of males and females of this group as higher by +0 6°F and + 1 1°F than the first group brooded for 3 months under 33° (91°F) respectively.

B. Respiration rate: Respiration rate of male and female Fayoumi chickens acclimated to 25° (71°F) for one month became nearly the double after 24 hr exposure to heat stress of 42° (108°F)(Table 4). The increase in respiration rate of male chickens was more than that of females, 61 6 and 56 6 breaths/min respectively.

After one month residence in 42° (108°F) the respiration rate of males decreased to the same value as male chicks of the same age in the first group brooded at 33° for three months. The respiration rate of the stressed females decreased but to a level higher (P 0.01) than that of females of the first group (Table 2 and Fig. 1).

II. Effect of acclimation on body weight

The body weight of chickens brooded from one month of age up to three months of age under ambient temperature of 25° (77°F) was higher (P 0.01) than that of those kept under 33° (91°F) (Table 5 and Fig. 2).

Residence of animals acclimated to warm (33°) or to low (25°) environmental temperature in high ambient temperature of 42° (108°F) the second and fourth groups respectively caused a great retardation in growth and their body weight at 3 months of age was 30 - 37 % lower than that of

animals maintained under warm or cold conditions (Table 5, Fig. 2). The effect of heat stress on body weight was of the same order in both sexes although it seems slightly more marked in males.

At one and two months of age there was no difference between body weight of males and females brooded under 33° (91°F) for 2 months (lst group) or of that subjected to 25° for one month (3rd group). At three months of age the body weight of males of the first and third groups was higher (P 0.01) than that of females.

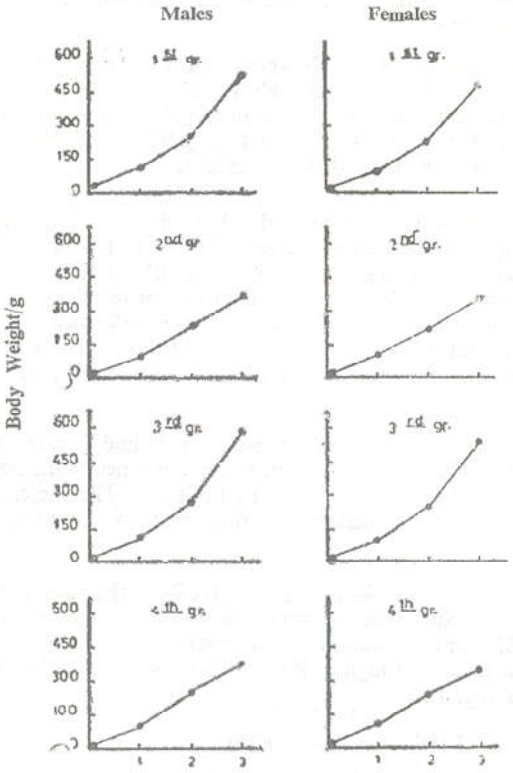

Fig. 2 Effect of acclimation to different ambient temperatures on body weight of Fayoumi chicks during the first three months of age

III. Effect of acclimation on thyroid activity

1. *Thyroid weight :* Residence of Fayoumi chickens in high ambient temperature of 42° (108°F) for one month caused depression in absolute thyroid weight. Smaller thyroids of both sexes were observed either in chickens of the second group brooded at 33° (91°F) for two months and of the 4 th group subjected to 25° (77°F) for one month before their transference to heat stress of 42° (108°F) (Table 6 and Fig. 3). The effect was highly significant (P 0.01).

The large thyroids were found in chickens kept for two months under ambient temperature of 25° (2 nd group) (P 0.05) in comparison to that of the first group (33°) the 2 nd and the 4 groups (42°)

Significant differences (P 0.05 and 0.01) between males and females in absolute and relative thyroid weights were observed in all studied groups except in the 4 th group. Reduction in absolute weight of thyroid glands of the 2nd and the 4 th groups of chickens subjected to heat stress of 42° (108°F) was greater in females than in males (-6.3, 4.9 and 4.2, 1.5 mg for females and males respectively) (Table 6 and Fig. 3).

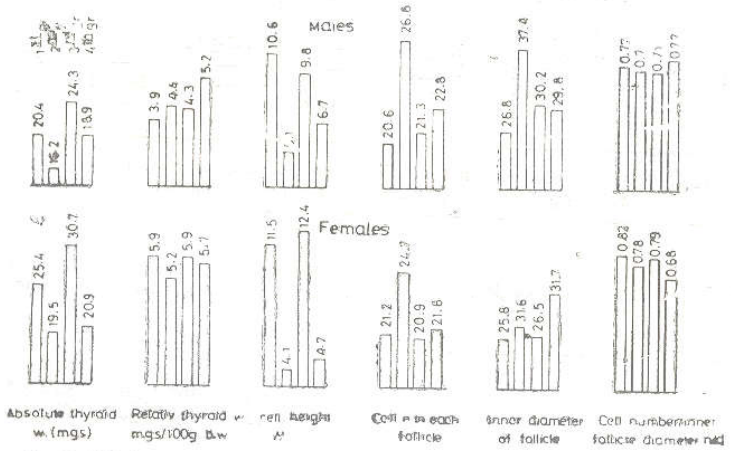

Fig. 3. Effect of acclimation to different ambient temperatures on the weight and the histological structure of the thyroid gland of Fayoumi chicks.

Male and famale chickens of the 2nd and the 4th groups acclimated to high ambient temperatures were characterised by the smallest absolute thyroid weight and the highest body temperature (compared to those of the first and third groups (P 0.01 and 0.05) for the second and the fourth groups respectively.

Heminger *et al.* (1960) reported that body temperature of White Rock Cockerels (108 1°F) brooded from the third day after hatch up to three-five weeks of age under high environmental temperature of 108°F was significantly higher than that of those brooded at 75, 85 and 96°F (106.5 - 106.8°F). High body temperature of heat stressed animals were accompanied by decreased thyroxine secretion rate. Bakke and Lawrence (1956) suggested that increased body temperature affected the response of the thyroid gland to thyrotrophic hormone released from the interior pituitary.

TABLE 5. **Effect of acclimation to different ambient temperature on body weight (g) of chicks from hatch up-to three months of age.**

Age (months)	One	Two		Three		
Duration of exposure for one month in:	33° 91°F	33° 91°F	25° 77°F	33° 91°F	25° 77°F	42° 108°F
	Males					
1st. Group . .	108±1	258 ± 12	—	536±10	—	—
2nd " . .	108±3	235 ± 9	—	—	—	371±3
3rd " . .	109±4	—	276±7	—	598±13	—
4th " . .	102±2	—	244±7	—	—	376±9
	Females					
Ist " . .	98.±2	229±6	—	482±12	—	—
2nd "	102±2	221±5	—	—	—	367±8
3rd " .	107±3	—	251±7	—	549±2	—
4th " . .	105±3	—	234±6	—	—	362±9

TABLE 6. **Effect of acclimation to different ambient temperatures on body weight, thyroid weight body temperatures (°F) and respiration rate/min of chicks.**

Treatment	Sex	Body weight	Thyroid Weight (g)		Body temperature °F	Respiration rate
			Absolute (mg)	Relative mg/100g body weight		
1st Group	M	531±19	20.4±0 1	3.9±0.2	108.1±0.1	54±2.3
	F	471±16	25.8±1.1	5.9±0.3	108.2±0.1	55±2.6
2nd Group	M	380±15	16.2±0.8	4.4±0.3	108.9±0.2	55±3.8
	F	376±12	19.5±0.8	5.2±0.2	109.0±0.2	66±6.0
3rd Group	M	565±28	24.3±1.8	4.3±0.3	108.1±0.1	51±2·2
	F	523±21	30.7±2.0	5.9±0.3	108.1±0.1	58±3.7
4th Group	M	367±12	18.9±0.8	5.2±0.2	108.6±0.2	54±3.2
	F	372±11	20.9±0.9	5.7±0.3	109.0±0.2	60±4.9

M = males F = fe = males

2. *Histological structure of the thyroid*

Thyroid tissue of the first and third groups of chickens brooded under continuous warm temperature of 33°(91°F) (first group) or under 25°(3 rd group) from one month after hatch up to 3 months,was more compact than that of the heat stressed groups, (2nd and 4th groups), Plates 1-8). Most of the follicles of the non-stressed animals were irregulary shaped with small lumen with granular vaculated colloid. Epithelial cells were cuboidal and their

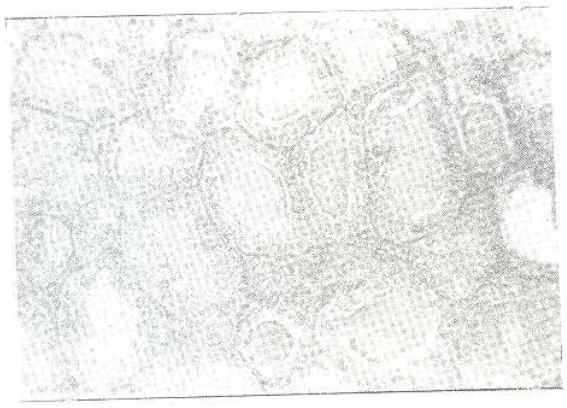

Plate 1-Males

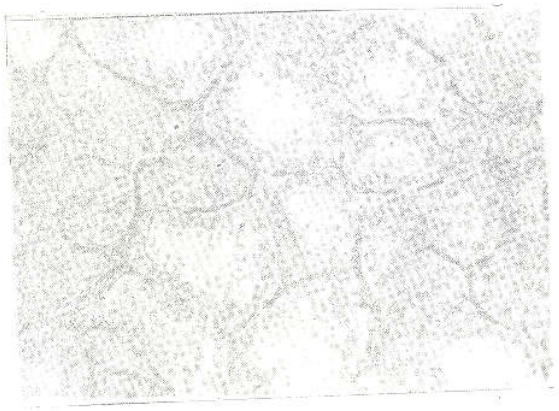

Plate 2-Females

Histological structure of the thyroid gland of 3 months old, Fayoumi chickens brooded under continuous hot conditions 33° for the first three monthes of age (first + group) (× 960)

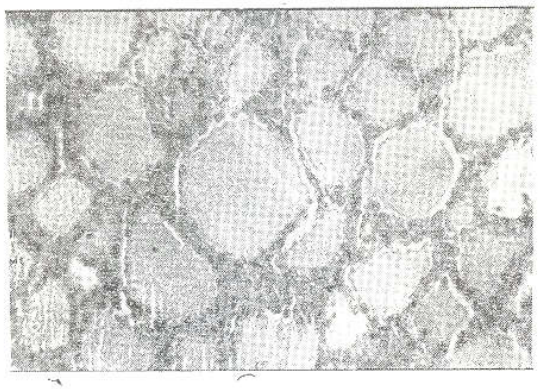

Plate 3-Males

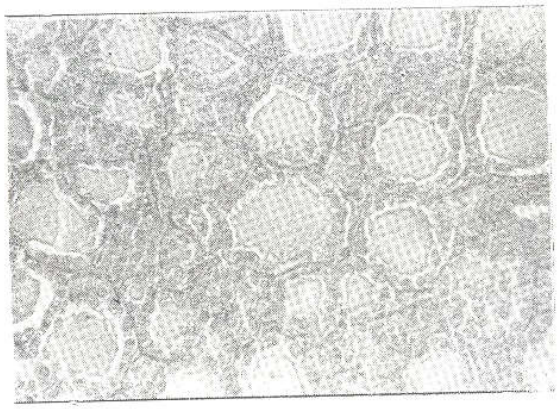

Plate 4-Females

Histological structure of the thyroid gland of 3 months Fayoumi chickens subjected to heat stress of 42° for one month after their residence in 33° for 2 months (2 nd group) (× 960)

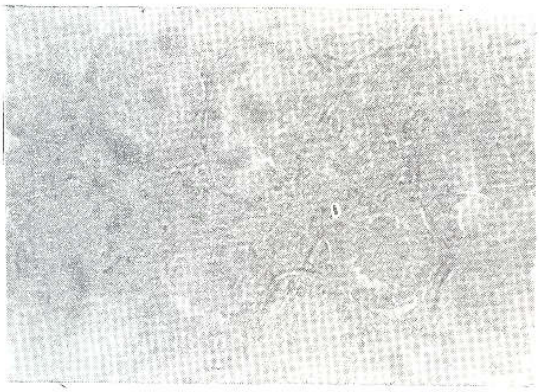

Plate 5 Males

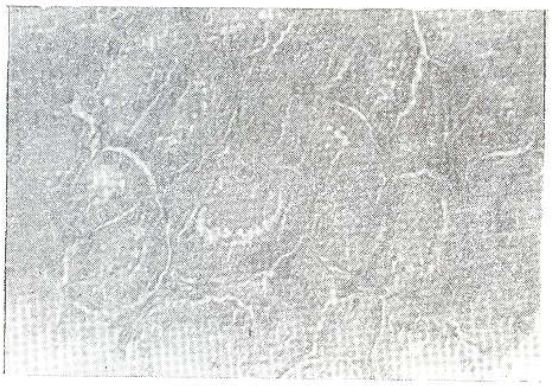

Plate 6 Females

Histological structure of the thyroid gland of 3 months Fayoumi chickens subjected to moderate cold temperature of 25° for two months of age after their residence in hot conditions of 33° for one month (× 960)

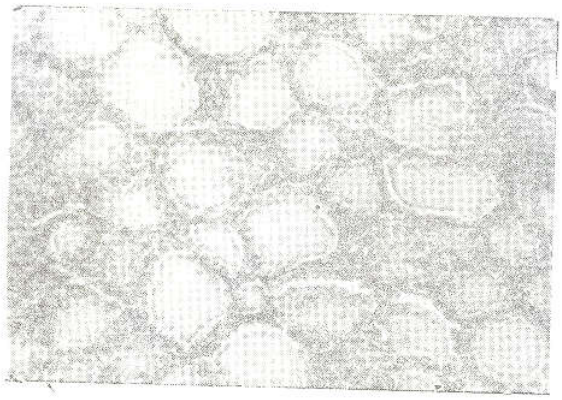

Plate 7 Males

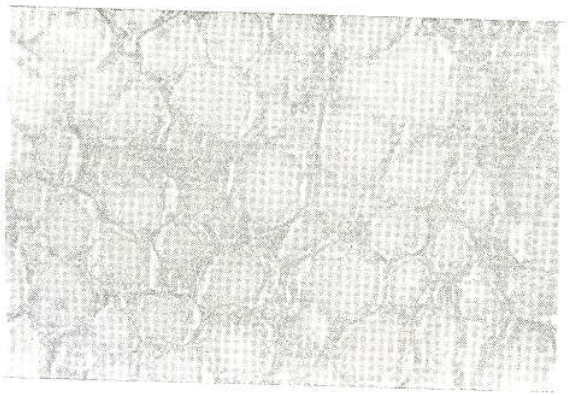

Plate 8 Females

Histological structure of the thyreid gland of 3 months Fayoumi chickens subjected to heat stress of 42° for one month after their residence in moderate-cold conditions of 25° for one month (4th group) (×960).

height was nearly two folds of that of heat stressed group (P 0.01) (Table7). The inner follicular diameter in the 2nd and 4th groups affected by heat stress of 42°, were much larger than that of the first and third groups (P 0.05-0.01) (Table 7, Fig. 3 and plates 1-8).

The decrease in thyroid weight and the mentioned changes in their secretory tissue in heat stressed animals indicate decreased thyroid activity.

Differences in histological structure of the thyroid glands of females and males in all groups studied were observed (Table 7, Fig.3 and Plates 1-8). As judged by follicular cell height the response of female's thyroid glands was greater than that of males. The cell height of follicular cells of female's thyroid thissue of the first and third groups was larger than that of males of the same groups (P 0.05 and 0.01). The contrary was found in the heat stressed groups (2nd and 4th groups) (P 0.05 and 0.01) (Table 7, Fig. 3 and Plates 3, 4, and 7,8).

TABLE 7 Effect of acclimation to different ambient temperatures on the histological structure of the thyroid gland of chicks.

Treatment	Sex	Cell height (μ) (mean± S.E.)	Gell number in each follicle mean± S.E.)	Inner diameter of follicale (μ mean± S.E)	Gell number/ inner follicular diameter n/d
1st Group	M	10.6±0.3	20.6±0.6	26.8±1.2	0.77
	F	11.5±0.3	21.2±0.6	25.8±1.2	0.82
2nd Group	M	5.1±0.3	26.8±0.8	37.4±1.1	0.72
	F	4.1±0.3	24.7±1.0	31.6±1.2	0.78
3rd	M	9.8±0.4	21.3±0.8	30.2±1.3	0.71
Group	F	12.4±0.6	20.9±0.7	26.5±1.6	0.79
4th Group	M	6.7±0.3	22.8±0.8	29.8±1.2	0.77
	F	4.7±0.4	21.6±0.7	31.7±1.1	0.68

M = males F = females

Discussion

It is clear from this study that the preceeding brooding temperatures greatly affect the response of the chicken to heat stress. The rise in body temperature and respiration rate in the 2 months old chickens kept under warm conditions goup 2 was about one and half times less than in those brooded at moderate cold temperatures. This is in accordance with the work of Ahmed *et al.*, (1967) and of Harrison and Bieller (1969) who found similar results.

During the process of acclimation to heat stress many systems modify their function to be adapted to these severe conditions. A decline in both body temperature and respiration rate of chickens was observed after their residence in high air temperature for one month, however, the body temperature and respiration rate of these hot acclimated chickens were still higher than that of chickens kept at 33 ° or 25 °. This reduction seems to be brought about by a depression in the function of the thyroid gland.

It is also obvious from the present study that thyroid activity of hot acclimated chickens was depressed as evidenced by decreased thyroid weight, small height of epithelial cells and large inner diameter of follicles, filled with colloidal substances. Similar results were obtained by Clark and Das (1974). Inhibitory effect of heat stress on thyroid activity is brought mostly by the decreased response of the thyroid gland to the effect of thyroid stimulating hormone resulting from the increased body temperature of the heat stressed birds (Heninger *et al.*, 1960; Bakke and Laurence, 1956).

Further studies on the effect of different brooding temperatures during the first 3-4 months of age on growth rate, feed efficiency, productivity and resistance to heat stress after maturation are needed.

References

Ahmed, M.M., Moreng, R.E. and Muller, H.D. (1967) Breed responses in body temperature to elevated environmental temperature and ascrobic acid. *Poultry Sci.*, **46**, 6.

Bakke, J.L. and Lawrence, N. (1956) The effect of thyroid stimulating hormone upon the iodide collecting mechanism of thyroid to tissue slices. *Endocrinology*, **58**, 531.

Clark, C.E. and Das, G.P. (1974) Effect of high environmenta ltemperature on internal organs of chickens. *Poultry Sci* **53**, 859.

Conner, M.H., Menge, H. and Cta, H. (1958) Effect of high temperatures on New Hampshire chicks especially bred for thyroid size. *Poultry Sci.*, **37**, 1195.

Garren, H.W. and Shaffner, C.S. (1956) How the period of exposure to different stress stimuli affects the endocrine and lymphatic gland weights of young chickens. *Poultry Sci.* **35**, 266.

Harrison, P.C. and Biellier, H.V. (1969) Physiological response of domestic fowl to abrupt changes of air temperature. *Poultry Sci.* **46**, 3.

Hendrich, C.E. and Turner, C.W. (1953) Time relations in the alteration of thyroid gland func tion in fowls. *Poultry Sci.* **42**, 1190.

Hendrich, C.E. and Turner, C.W. (1967) A comparison of the effects of environmental temperature changes and 4, 4° cold on the biological halflife ($t_{1/2}$) thyrodine j_{131} in fowls. *Poultry Sci.* **46**, 3.

Heninger, R.W., New Comer, W.S. and Thayer, R.H. (1960) The effect of elevated ambient temperatures on the thyroxine secretion rate of chickens. *poulty* Sci. **39**, 1332.

Hoffmann, E. and Shaffner, C.S. (1950) Thyroid weight and function as influenced by environmental temperature. *Poultry Sci.* **29**, 365.

Huston, T.M. (1960) The effects of high environmental temperatures upon blood constituents and thyroid activity of domestic fowl. *Poultry Sci.* **39**, 1260.

Huston, T.M., Edwards, H.M. Jr and Williams, J.J. (1962)The effects of high environmental temperature on thyroid secretion rate of domestic fowl. *Poultry Sci.* **41,** 640.

Hutchinson, J.C.D. (1954) Heat regulation in birds. In " *progress in the Physiology of Farm Animals*" (J. Hammond, ed.), Vol 1, pp. 299 - 362. Butterworths, London.

Hutchinson, J.C.S. and Sykes, A.H. (1953) Physiological acclimatization of fowls to a hot humid environment. Pt. 1 Management of the fowls and standard tests of heat tolerance. Pt. IV Rectal temperature. Pt III evaporative loss. Pt. IV Heart rate. J. *Agric. Sci.* 43, 294.

Thornton, P.A. (1961) Environmental temperature influences on the body temperature of the chicken. *Poultry. Sci.* 40, 1464.

Thornton, P.A. (1962) The effect of environmental temperature on body temperature and oxygen uptake by the chicken *Poultry, Sci.* 41, 1053.

Weiss, H.S. (1959) The interrelationship of reproductive state and seasonal acclimatization on the hens resistance to lethal high temperature. *Poultry Sci.* 38, 430.

Weiss, H.S., and Borbely, E. (1957) Seasonal changes in the resistance of the hen to thermal stress. *Poultry Sci.* 36, 1383.

Wilson, W.O. (1949) Response of pullets Vs hens when subjected to high environmental temperatures. *Poultry Sci.* 28, 785.

تأقلم الدجاج الفيومى لدرجات الحرارة الثابتة والمتغيرة

محمد الشافعى ، عبد الرحمن البردى ونبيهه عبد المتعال
كلية الزراعة ، جامعة القاهرة

أظهرت النتائج أن الدجاج المتأقلم لدرجات الحراره الدافئة أقل تحملا لدرجات الحرارة الجوية العالية . بينما عندما تأقلمت الطيور على درجة حرارة مرتفعة زادت درجة حرارة جسمها ومعـدل تنفسها • وانخفض معـدل افراز هرمون الثروكسيد فى الدجاج المتأقلم على درجات حرارة مرتفعة •