Thyroid and Parathyroid Glandular Cell Activities During Growth and Production of Certain Breeds of Chickens .

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Seventy two birds of Dokki-4(D-4)and White Plymouth Rock(W.P.R.) were used for thyroid and parathyroid histological studies at the 7th week of age and at the 90th day of egg production .

Thyroid and parathyroid glandular cell activities, as indicated by cell nuclear index(N.I.) were significantly ($P \leq 0.01$) affected by season of the year during growth and egg production stages.During these two stages,thyroid cell N.I. was highest during winter indicating hyperactivity , and lowest during summer indicating hypofunctioning of the gland .

Parathyroid gland cell activity followed a similar trend as that of the thyroid cell during growth and egg production .

The thyroid and parathyroid cells of D-4 growing chicks and laying hens were significantly ($P \leq 0.01$) more active as compared to that of W.P.R.

Male thyroid cell, during growth was significantly ($P \leq 0.05$) more active in comparison with that of the female . No sex difference was detected in the parathyroid cell N.I. during growth .

Thyroid gland cell of the growing chicks was significantly ($P \leq 0.01$) more active as ocompared to that of laying hens . A similar trend was observed in the parathroid cells .

Thyroid gland activity in the domestic fowl was shown to vary with season of the year,(Stahl and Turner, 1961 ; Fulconer , 1971 and Kicka, 1973); with age, (biellier and Turner, 1955 and Stahl and Turner, 1961) and with breed (Huston et al.,1957; Huston and Carmon; 1962 and Collins and Weinner, 1968) .

Variations in parathyroid functional activities , due to season, age , sex and breed of the domestic fowl are not as clear .

Various techniques were used to detect glandular activities in birds , one of which was the histological appearance of the gland . Evidence on the relationship between glandular cell nucleus size and the state of cellular secretory activity has been presented . Hyperfunctioning of the glandular cell is reflected in increased volume of its nucleus (Bachrach et al., 1961 : Pellegrino et al.,1963; Roels, 1963 and Kotby,1967).

This study was to investigate thyroid and parathyroid glandular cell activities during growth and production in White Plymouth Rock and Dokki-4 chickens under changing climatic conditions .

Material and Methods

Seventy two birds of Dokki-4 (D-4) and white Plymouth Rock (W.P.R.) represented the four seasons of the year were selected at random for thyroid and parathyroid histological studies at the 7th week of age and at the 90th day of egg production . Birds were sacrificed and autopsied . Thyroid and parathyroid glands were dissected , immediately fixed in Bouin fixative , embeded in paraffin wax and sectioned at 4-5 microns. Sections were stained according to a standard hematoxylin and eosin stain procedure (Bancroft and Stevens, 1977). Two slides from each gland per bird were used for histological examination . A total of 2400 thyroid cell nuclei and an equal number of parathyroid cell nuclei were randomly used for cell nuclear index (N.I.) estimation using an occular and a Carl Zeiss research microscope . Cell nuclear index was calculated by multiplying the longest and the shortest diameters of the nucleus .

Statistical analysis were carried out as described by Snedecor (1965) .

Results and Discussion

1. Thyroid and parathyroid glandular cell activities during growth

Differences in thyroid and parathyroid cell N.I. due to season of the year, breed and sex presented in Table(1) and shown in Fig. (1 a and b) .

Season of the year significantly ($P \leq 0.01$) affected thyroid cell N.I. which was highest during winter indicating hyperactivity , and lowest during summer indicating hypofunctioning of the gland . That poultry thyroid gland activity rises in winter and declines in summer have been reported by Falconer (1971) .

Regardless of the season of the year, the thyroid cell of D-4 growing chicks was significantly ($P \leq 0.01$) more active as compared to that of W.P.R. Such breed differences in thyroid activity are known to exist (Huston and Carmon, 1962 and Collins and Weinner, 1968) .

Moreover, male thyroid cell, during growth was significantly ($P \leq 0.05$) more active in comparison with that of the female. Sex differences in chicks thyroid activity in response to heat stress have been reported by Mutaal (1977) .

Parathyroid gland cell activity of the growing chicks followed a similar trend as that of the thyroid cell . However, there was no sex difference in the parathyroid cell N.I.

As we have been able to review the literature there has been no earlier reports concerning the influence of the season of the year , breed or sex on the activity of the parathyroid gland of the growing chicks .

2. Thyroid and parathyroid glandular cell activities during production

Differences in thyroid and parathyroid cell N.I. due to season of the year and breed are presented in Table (2) and shown in Fig. (1 c and d) .

Thyroid glandular cell activity , as indicated by cell N.I. was significantly ($P \leq 0.01$) affected by season of

the year during egg production . It was highest during winter indicating hyperactivity , and lowest during summer indicating a state of hypofunctioning .

The thyroid cell N.I. of the D-4 layers was significantly ($P \leqslant 0.01$) higher in comparison with that of the W.P.R. layers , suggesting that D-4 thyroids during production were more active than those of the W.P.R. layers .

That thyroid gland activity affects egg production have been reported by Turner et al.(1945).

Parathyroid gland cell activity of the laying hens followed a similar trend as that of thyroid cell. As we have been able to review the literature there has been no earlier results concerning the effect of season of the year or breed on chickens parathyroid activity . Only one early report(1948),by Turner who detected seasonal changes in the size of chickens parathyroids .

Careful examination of Table (1) and (2), however, suggests a higher activity of thyroid cells in growing female chicks as compared to mature layers , although the latter were in a state of active egg production . This is clear as the thyroid cell N.I. was significantly ($P \leqslant 0.01$) higher in the growing chicks as compared to that of the layers , (Table 3) and (Fig. 1 e) .

A similar trend could be observed concerning the parathyroid cell N.I. which was significantly ($P \leqslant 0.10$) higher in the growing female chicks as compared to that in mature layers during active production , (Table 3) and (Fig. 1 f) .

These results may suggest a higher metabolic rate during the growing stage of chicks which requires hyperfunctioning of both the thyroid and parathyroid glands for mascular and skeletal tissues build up, respectively , and probably other tissues .

Although the thyroid activity affects egg production (Berg and Bearse, 1951) and shell thickness (Gabuton and Shaffner, 1954), and although parathyroid functioning affects shell deposition in producing birds even on the expense of bone structure (Bloom et al.,1941), but it appears that active growth

requires hyperthyroid and parathyroid functioning than required for active egg production .

It is concluded that thyroid and parathyroid glands activities are influenced by age, sex , breed , season of the year and also by the physiological state of the bird. The endocrine activities in growing and producing birds as influenced by environment awaits comprehensive investigations , however. Also techniques to prevent the severe environmental deleterious effects on endocrine balance should be studied .

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TABLE 1 . Means ($\bar{X}$) $\pm$ Standard errors (S.E.) of cell nuclear index (N.I) of thyroid and parathyrois glands at the 7th week of age .

Classification	Number	Thyroid N.I.(u^2) $\bar{X} \pm$ S.E.	DT*	Farathyroid $\bar{X} \pm$ S.E.	DT
Overall mean	1600	23.32 $\pm$ 0.11		15.07 $\pm$ 0.12	
Season :					
Autumn	400	26.84 $\pm$ 0.22	a	15.14 $\pm$ 0.25	a
Winter	400	31.33 $\pm$ 0.22	b	17.47 $\pm$ 0.25	b
Spring	400	18.22 $\pm$ 0.22	c	15.06 $\pm$ 0.25	a
Summer	400	16.88 $\pm$ 0.22	d	12.59 $\pm$ 0.25	d
Breed :					
D-4	800	24.39 $\pm$ 0.15	L	15.70 $\pm$ 0.18	L
W.P.R.	800	22.25 $\pm$ 0.15	m	14,43 $\pm$ 0.18	m
Sex :					
Male	800	23.58 $\pm$ 0.15	g	14.93 $\pm$ 0.18	h
Female	800	23.06 $\pm$ 0.15	h	15.20 $\pm$ 0.18	h

* Within each classification , means with different letters differ significantly at $P \leq 0.05$ (Duncan , 1955).

TABLE 2 . Means ($\bar{X}$) $\pm$ standard errors (S.E.) of cell nuclear index (N.I.) of thyroid and parathyroid glands at 90th day of production .

Classification	Number	N.I. (u^2) Thyroid $\bar{X} \pm$ S.E.	DT*	Parathyroid $\bar{X} \pm$ S.E.	DT
Overall mean	800	20.85 $\pm$ 0.16		14.68 $\pm$ 0.15	
Season :					
Spring	200	17.38 $\pm$ 0.32	a	11.11 $\pm$ 0.30	a
Summer	200	15.15 $\pm$ 0.32	b	10.40 $\pm$ 0.30	a
Autumn	200	23.77 $\pm$ 0.32	c	16.75 $\pm$ 0.30	b
Winter	200	27.08 $\pm$ 0.32	d	20.46 $\pm$ 0.30	c
Breed :					
D-4	400	21.87 $\pm$ 0.22	L	15.32 $\pm$ 0.21	L
W.P.R.	400	19.82 $\pm$ 0.22	m	14.04 $\pm$ 0.21	m

* Within each classification , means with different letters differ significantly at $P \leqslant 0.05$, (Duncan , 1955) .

TABLE 3. Means ($\bar{X}$) $\pm$ standard errors (S.E.) of N.I. of female thyroid and parathyroid cells during growth and production .

Physiological state	Number	N.I. (u^2) Thyroid $\bar{X} \pm$ S.E.	t**	Parathyroid $\bar{X} \pm$ S.E.	t*
Growth	800	23.06 $\pm$ 0.18	a	15.20 $\pm$ 0.20	a
Production	800	20.85 $\pm$ 0.18	b	14.68 $\pm$ 0.20	b

** Means with different letters in this column differ significantly at $P \leqslant 0.01$, (t test) .

* Means with different letters in this column differ significantly at $P \leqslant 0.10$, (t test) .

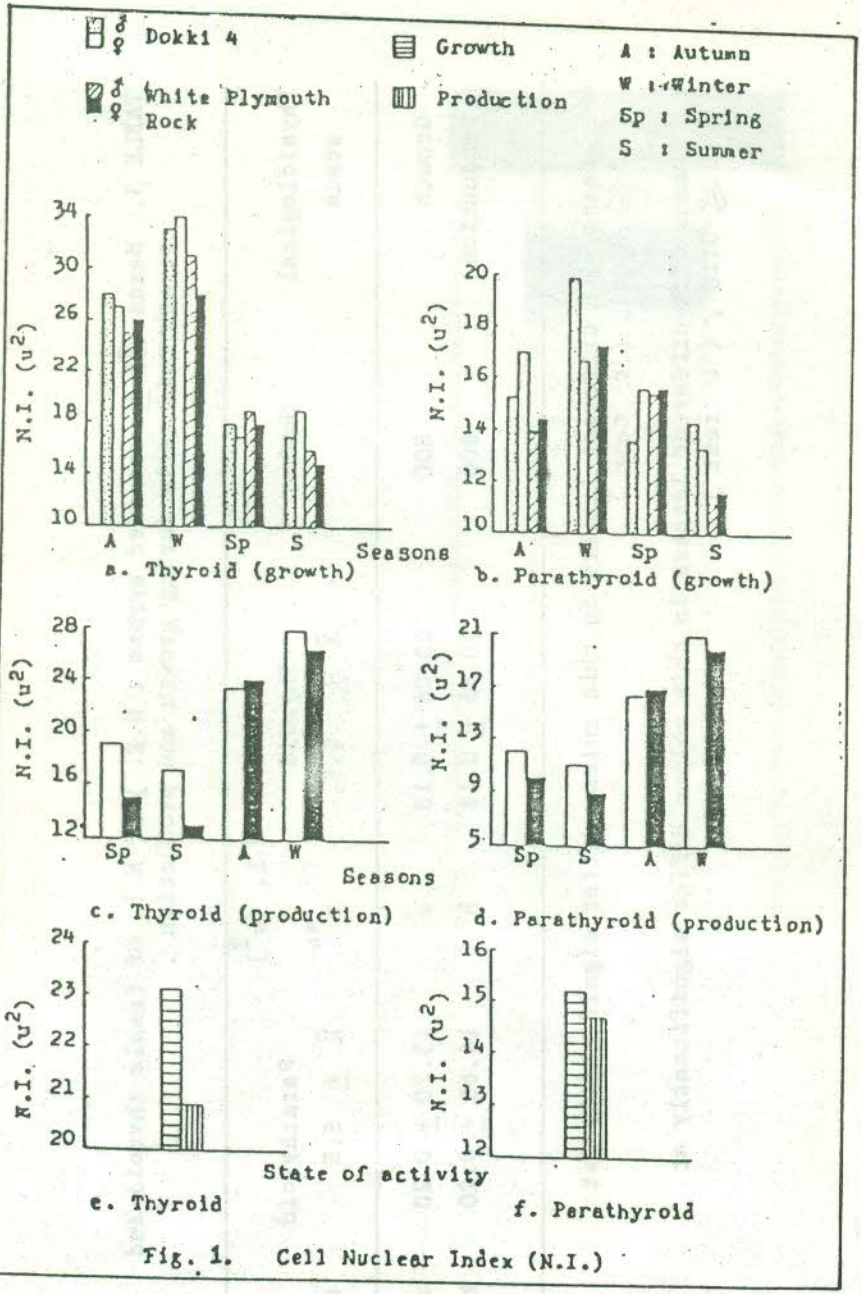

Fig. 1. Cell Nuclear Index (N.I.)

النشاط الغددى لخلية الغدة الدرقية وجارة الدرقية خلال النمو والانتاج فى بعض أنواع خاصة من الدجاج .

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أستخدم فى هذه الدراسة ٧٢ طائر من نوعى الدجاج دقى ٤ والبليموث الابيض وذلك بغرض الدراسة الهستولوجية للغدة الدرقية وجارة الدرقية فى الاسبوع السابع من العمر وعند اليوم التسعون من أنتاج البيض .

النشاط الغددى لخلية الغدة الدرقية وجارة الدرقية - كما أستدل عليه بواسطة مقياس دليل نواة الخلية - تأثر تأثيراً معنويا (أحتمال أقل من ٠١ر٠) - بفصل السنه وذلك خلال مرحلتى النمو وأنتاج البيض ، ففى خلال هاتين المرحلتين كان أعلى دليل لنواة الخلية فى الغدة الدرقية أثناء فصل الشتاء مبينا ذيادة نشاطها فى حين أقل دليل لها فى فصل الصيف مبينا نقص نشاط هذة الغدة .

ولقد حذا نشاط خلية الغدة جارة الدرقية أتجاه مماثل لنشاط خلية الغدة الدرقية خلال مرحلتى النمو وأنتاج البيض ، كذلك فقد لوحظ أن خلايا الغدة الدرقية وجارة الدرقية فى الكتاكيت النامية والدجاجات البياضة كانت معنويا (أحتمال أقل من ٠١ر٠) أكثر نشاطا فى النوع الدقى ٤ بالمقارنة بالنوع البليموث الابيض ، وفى خلال مرحلة النمو كانت خلية الغدة الدرقية فى الذكور أكثر نشاطا من مثيلتها فى الاناث وكان الفرق بينهما معنويا (أحتمال أقل من ٠٥ر٠) ، وعلى أى حال فلم يوجد مثل هذا الفرق المعنوى فى دليل نواة خلية الغدة جارة الدرقية بين الجنسين خلال مرحلة النمو .

كما لوحظ أن خلية الغدة الدرقية فى كتاكيت النامية كانت معنويا (أحتمال أقل من ٠١ر٠) أكثر نشاطا بالمقارنة بنشاطها فى الدجاجات البياضة ، كذلك فقد لوحظ نفس هذا الاتجاة المعنوى (أحتمال أقل من ١ر٠) فى خلية الغدة جارة الدرقية .