ANKARA UNIVERSITY FACULTY OF AGRICULTURE DEPARTMENT OF ANIMAL SCIENCE

Change of Thyroxine (T4), Triiodotrionine (T3) and Testosterone Hormones in White Goats

BARITCI, İ.[1], POLAT, H[2]., DELLAL, G.[3]

1.Gaziosmanpaşa University Faculty of Agriculture Department of Animal Science, 2. Aksaray University Faculty of Science and Art Department of Biology, 3. Ankara University Faculty of Agriculture Department of Animal Science

Abstract

In this research, the blood serum samples collected from 14 female (2, 3 and 4 years of age) and 9 male (2 and 4 years of age) White Goats during a 12-month (January through December) period, have been analyzed for thyroid (T3 and T4) and T4 hormones. As result of the analyses, the general averages of T3 and T4 hormones with respect to months were respectively, T3: 106.07±5.28, 109.57±7.24, 105.14±5.96, 100.67±6.19, 99.02±5.66, 97.24±3.60, 90.80±2.88, 87.74±5.38, 103.34±5.76, 110.48±8.48, 125.23±7.24, 114.32±6.56 ng/dl, and T4: 4.54±0.20, 4.63±0.17, 4.44±0.28, 3.90±0.31, 3.46±0.20, 2.96±0.16, 2.64±0.17, 2.45±0.14, 4.75±0.27, 5.56±0.24, 6.45±0.35, 5.18±0.53 µg/dl. Although the differences between the age and sex groups seemed statistically insignificant, the differences with respect to months in the same group were statistically significant (p<0.05). The research has revealed that T3 and T4 hormone levels are affected by high environmental temperature and humidity. According to the temperature-humidity index (SNI) results, the animals experience temperature oppression during August. It has been determined that T3 and T4 hormone levels change with respect to season and different physiological periods (sexual session, pregnancy, post-partum, lactation). The monthly general averages of testosterone hormone in male White Goats during this one year period were respectively 2.11±0.73, 2.22±0.52, 2.44±0.59, 2.10±0.41, 2.35±1.00, 3.42±1.48, 4.77±1.32, 5.61±1.40, 7.91±1.24, 10.84±1.59, 7.82±1.60, and 2.63±0.61 ng/dl. With respect to these values, the difference between the monthly general averages were found to be statistically significant (p<0.05). Although the differences between the age groups seemed to be statistically insignificant, the monthly differences in the same group were determined to be statistically significant (p<0.05). It was determined that testosterone hormone levels change with respect to season and different physiological periods.

I. Introduction

Endocrinal activities have an important part in physiological mechanisms. Hormones are special chemical substances which are secreted to invitro from cells or cell groups and, from here, carried to everywhere in the body via blood and lymph circulation to affect definite tissues and organs. Hormones are effective in sustaining internal balance in accordance with outer conditions, in growth, development, reproduction, and in energy production, usage and storage. Hormones perform important functions both by themselves and together with nervous system (Yılmaz 1999 and Todini 2007). These include thyroid (total T_3, total T_4) and testosterone hormones. This research on White Goats will contribute to researches on animal metabolism (energy, feeding, growth and development) and the relations between meat production, fiber production, and progeny yield properties, especially lactation physiology.

II. Materials and Methods

This research was carried on the White Goat herd bred by Ankara University Faculty of Agriculture Animal Department. A total of 14 female (4 heads of 2-years-of-age, 5 heads of 3-years-of-age, 5 heads of 4-years-of-age) and a total of 9 male (3 heads of 2-years-of-age, 6 heads of 4-years-of-age) goats, and blood serum samples collected from these constitute the material of this research. DSL (USA) brand ELISA (EIA) kits were utilized in the hormone (total T3, total T4, and testosterone) analyses. To determine whether there are any differences between sex, age group and months for the observed values of hormone levels, a variance analysis was adopted with double factors, one of the factors being repeatedly measured. Since there is not sufficient observation for sub-groups, (factorial) variance analysis with the two factors "sex X month and period" and "age group X month and period" was performed. According to the results of the variance analysis, the differences between the age and sex group averages were found to be insignificant in the scope of all properties, whereas only the differences between periods and monthly averages were found to be significant. Duncan multiple comparison test was utilized to determine different month or period averages with respect to the results of the variance analysis. The comparisons were performed with respect to the 5% importance or significance criteria. The variance analyses were performed with the program package SPSS 15, whereas the Duncan multiple comparison tests with MSTAT-C.

III. Analyses and Findings

Since, for animal organisms, thyroid hormones (T3 and T4) constitutes an important part in physiological mechanisms and testosterone hormone is needed for reproduction, this research evaluates the findings related to female White Goats of 2, 3, and 4 years of age and male White Goats of 2 and 4 years of age, for monthly periods during one year. In the research, changes related to temperature, humidity, SNI values, age, sex, season, and different physiological periods (sexual session, pregnancy, post-partum and lactation) have been investigated and the results have been demonstrated in tables and charts.

Findings for T3 and T4 Hormones

General averages of T3 and T4 hormones with respect to months have been determined to be respectively, T3: 106.07±5.28, 109.57±7.24, 105.14±5.96, 100.67±6.19, 99.02±5.66, 97.24±3.60, 90.80±2.88, 87.74±5.38, 103.34±5.76, 110.48±8.48, 125.23±7.24 and 114.32±6.56 ng/dl and T4: 4.54±0.20, 4.63±0.17, 4.44±0.28, 3.90±0.31, 3.46±0.20, 2.96±0.16, 2.64±0.17, 2.45±0.14, 4.75±0.27, 5.56±0.24, 6.45±0.35 and 5.18±0.53 µg/dl.

Table III.I. Descriptive statistics and comparison results belonging to T3 hormone levels in White Goat age groups

Months	Age 2 (n:7)			Age 3 (n:5)			Age 4 (n:11)		
	$\overline{X} \pm S_{\overline{X}}$	Min.	Max.	$\overline{X} \pm S_{\overline{X}}$	Min.	Max.	$\overline{X} \pm S_{\overline{X}}$	Min.	Max.
January	102.94±6.03 **e***	68.90	130.40	107.52±15.26 **c**	86.20	167.10	109.09±10.33 **b**	83.10	169.20
February	117.28±15.44 **c**	67.70	226.80	108.26±9.54 **c**	90.60	142.70	100.74±5.94 **e**	74.70	124.40
March	108.12± 9.59 **d**	74.60	167.10	104.84±18.82 **d**	68.20	176.30	101.60±6.59 **e**	74.60	129.30
April	101.70±8.34 **e**	69.90	158.60	105.54±24.05 **d**	70.80	200.90	96.34±4.81 **f**	78.80	118.40
May	93.85±4.29 **f**	76.10	115.10	104.30±23.20 **d**	67.10	195.10	102.18±7.66 **de**	76.60	141.50
June	90.77±4.49 **g**	71.30	114.20	104.86±9.81 **d**	90.60	142.70	100.58±5.99 **e**	74.70	124.20
July	88.35±4.59 **h**	65.00	114.60	91.50±6.81 **e**	67.40	108.30	93.43±4.72 **g**	73.80	109.70
August	86.22±6.00 **i**	68.60	121.40	88.12±20.56 **f**	54.40	168.70	89.40±7.22 **g**	62.00	132.70
September	102.69±4.23 **e**	85.40	125.80	104.30±23.20 **d**	67.10	195.10	103.54±8.83 **d**	62.40	132.50
October	118.83±15.43 **c**	72.70	201.30	108.66±23.14 **c**	78.40	200.90	101.19±7.11 **e**	81.20	130.70
November	127.99±12.58 **a**	76.40	194.60	126.52±11.01 **a**	102.10	165.90	120.98±13.10 **a**	64.40	182.30
December	121.69±7.79 **b**	84.70	147.20	111.96±23.25 **b**	56.50	191.40	106.59±8.94 **c**	75.50	158.80
General	**105.04±2.80**	**65.00**	**226.80**	**105.53±4.96**	**54.40**	**200.90**	**102.14±2.30**	**62.00**	**182.30**

*** :** The difference between the averages having different small letters in each column, is significant (p<0.05)

Table III.II. Descriptive statistics and comparison results belonging to T3 hormone levels in White Goat sex groups

Months	Female (n:14)			Male (n:9)			General (n:23)		
	$\overline{X} \pm S_{\overline{X}}$	Min.	Max.	$\overline{X} \pm S_{\overline{X}}$	Min.	Max.	$\overline{X} \pm S_{\overline{X}}$	Min.	Max.
January	106.05±5.91 **e***	85.50	167.10	106.11±10.35 **d**	68.90	169.20	106.07±5.28	68.90	169.20
February	109.41±4.90 **d**	88.70	145.90	109.80±17.53 **c**	67.70	226.80	109.57±7.24	67.70	226.80
March	104.94±7.67 **ef**	68.20	176.30	105.46±10.05 **d**	74.60	167.10	105.14±5.96	68.20	176.30
April	102.98±9.62 **g**	69.90	200.90	97.08±5.74 **f**	78.80	135.50	100.67±6.19	69.90	200.90
May	101.41± 8.81 **h**	67.10	195.10	95.29±5.10 **g**	76.10	122.50	99.02±5.66	67.10	195.10
June	98.99±4.32 **i**	74.70	142.70	94.52±6.49 **g**	71.30	124.20	97.24±3.60	71.30	142.70
July	91.49± 3.43 **j**	67.40	109.70	89.72±5.31 **h**	65.00	114.60	90.80±2.88	65.00	114.60
August	87.99±8.44 **k**	54.40	168.70	87.36±4.84 **i**	70.10	119.50	87.74±5.38	54.40	168.70
September	104.71±8.42 **f**	67.10	195.10	101.20±7.24 **e**	62.40	132.00	103.34±5.76	62.40	195.10
October	110.97±9.90 **c**	78.40	200.90	109.72±16.04 **c**	72.70	201.30	110.48±8.48	72.70	201.30
November	126.40±6.04 **a**	97.50	165.90	123.41±16.59 **a**	64.40	194.60	125.23±7.24	64.40	194.60
December	114.43±9.19 **b**	56.50	191.40	114.16±9.44 **b**	75.50	146.30	114.32±6.56	56.50	191.40
General	**104.98±2.23**	**54.40**	**200.90**	**102.82±3.05**	**62.40**	**226.80**	**104.14±1.81**	**54.40**	**226.80**

*** :** The difference between the averages having different small letters in each column, is significant (p<0.05)

Table III.III. Descriptive statistics and comparison results belonging to T4 hormone levels in White Goat age groups

Months	Age 2 (n:7)			Age 3 (n:5)			Age 4 (n:11)		
	$\overline{X} \pm S_{\overline{X}}$	Min.	Max.	$\overline{X} \pm S_{\overline{X}}$	Min.	Max.	$\overline{X} \pm S_{\overline{X}}$	Min.	Max.
January	4.14±0.23 **cdef***	3.26	5.37	4.43±0.09 **bcd**	4.17	4.61	5.10±0.45 **b**	3.93	7.24
February	4.50±0.19 **bcde**	3.27	5.32	4.56±0.34 **bc**	3.77	5.63	4.83±0.40 **bc**	3.33	7.00
March	5.04±0.52 **abc**	3.33	8.78	4.28±0.18 **bcd**	3.78	4.71	3.79±0.37 **cd**	2.19	5.08
April	3.32±0.35 **efg**	2.05	5.27	3.82±0.23 **cde**	2.99	4.37	4.69±0.71 **bc**	2.88	9.13
May	3.51±0.29 **defg**	2.37	4.74	3.29±0.26 **def**	2.57	4.20	3.51±0.43 **d**	2.11	6.24
June	3.16±0.28 **fg**	1.80	4.99	2.88±0.31 **ef**	1.95	3.89	2.81±0.23 **d**	1.86	3.61
July	2.48±0.18 **g**	1.86	3.45	2.52±0.23 **f**	1.77	3.08	2.92±0.42 **d**	1.96	5.50
August	2.36±0.12 **g**	1.92	3.11	2.28±0.15 **f**	1.93	2.80	2.69±0.38 **d**	1.67	4.66
September	4.58±0.38 **bc**	3.33	6.52	4.61±0.63 **bc**	2.39	5.86	5.07±0.50 **b**	3.95	8.14
October	5.85±0.45 **a**	4.12	8.19	5.42±0.31 **ab**	4.60	6.48	5.28±0.38 **b**	3.43	6.44
November	6.14±0.53 **a**	3.95	9.08	6.34±0.80 **a**	4.43	8.29	6.89±0.61 **a**	4.74	10.20
December	5.54±1.12 **ab**	2.26	13.99	5.19±0.90 **ab**	3.18	7.66	4.74±0.43 **bc**	2.68	6.33
General	**4.22±0.17**	**1.80**	**13.99**	**4.14±0.19**	**1.77**	**8.29**	**4.36±0.17**	**1.67**	**10.20**

*** :** The difference between the averages having different small letters in each column, is significant (p<0.05)

Although the differences between the age and sex groups seemed to be statistically insignificant, the monthly differences within the same group were statistically significant (p<0.05). The research revealed that T3 and T4 hormone levels were affected by high environmental temperature and humidity. According to the temperature-humidity index (SNI) results, the animals experienced temperature oppression during August. It was determined that T3 and T4 hormone levels change with respect to season and different physiological periods (sexual session, pregnancy, post-partum, lactation).

Table III.IV. Descriptive statistics and comparison results belonging to T4 hormone levels in White Goat sex groups

Months	Female (n:14)			Male (n:9)			General (n:23)		
	$\overline{X} \pm S_{\overline{X}}$	Min.	Max.	$\overline{X} \pm S_{\overline{X}}$	Min.	Max.	$\overline{X} \pm S_{\overline{X}}$	Min.	Max.
January	4.46±0.10 **cd***	3.93	5.20	4.66±0.50 **cd**	3.26	7.24	4.54±0.20	3.26	7.24
February	4.56±0.14 **cd**	3.77	5.63	4.73±0.39 **bcd**	3.27	7.00	4.63±0.17	3.27	7.00
March	4.33±0.12 **cd**	3.67	5.08	4.60±0.71 **cd**	2.19	8.78	4.44±0.28	2.19	8.78
April	3.85±0.14 **de**	2.88	4.73	3.98±0.79 **de**	2.05	9.13	3.90±0.31	2.05	9.13
May	3.31±0.15 **ef**	2.57	4.37	3.69±0.45 **ef**	2.11	6.24	3.46±0.20	2.11	6.24
June	2.86±0.17 **fg**	1.80	3.89	3.15±0.31 **fg**	1.90	4.99	2.96±0.16	1.80	4.99
July	2.51±0.15 **fg**	1.77	3.45	2.85±0.38 **g**	1.87	5.50	2.64±0.17	1.77	5.50
August	2.34±0.12 **g**	1.79	3.27	2.62±0.32 **g**	1.67	4.66	2.45±0.14	1.67	4.66
September	4.73±0.29 **c**	2.39	5.96	4.79±0.54 **bcd**	3.33	8.14	4.75±0.27	2.39	8.14
October	5.55±0.23 **b**	4.17	6.86	5.57±0.53 **b**	3.43	8.19	5.56±0.24	3.43	8.19
November	6.44±0.41 **a**	4.43	9.08	6.45±0.66 **a**	3.95	10.20	6.45±0.35	3.95	10.20
December	5.16±0.35 **bc**	3.18	7.66	5.22±1.30 **bc**	2.26	13.99	5.18±0.53	2.26	13.99
General	**4.18±0.11**	**1.77**	**9.08**	**4.36±0.20**	**1.67**	**13.99**	**4.25±0.10**	**1.67**	**13.99**

*** :** The difference between the averages having different small letters in each column, is significant (p<0.05)

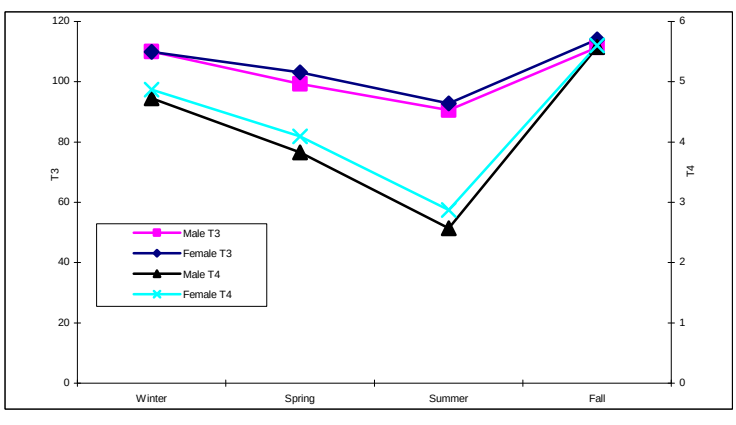

Figure III.I. Seasonal variation of T3 (ng/dl) and T4 (µg/dl) hormones with respect to sex groups

Findings for Testosterone Hormone

The yearly variation of monthly general averages of testosterone hormone levels in male White Goats is as follows: 2.11±0.73, 2.22±0.52, 2.44±0.59, 2.10±0.41, 2.35±1.00, 3.42±1.48, 4.77±1.32, 5.61±1.40, 7.91±1.24, 10.84±1.59, 7.82±1.60, and 2.63±0.61 ng/dl respectively. In the scope of these values, the difference between the monthly general averages was found to be statistically significant (p<0.05). Although the differences between the age groups seemed to be statistically insignificant, the monthly differences in the same group were determined to be statistically significant (p<0.05). It was determined that testosterone hormone levels change with respect to season and different physiological periods.

Table III.V. Descriptive statistics and comparison results belonging to testosterone hormone values in (male) White Goat sex groups and months

Months	Age 2 (n:3)			Age 4 (n:6)			General (n:9)		
	$\overline{X} \pm S_{\overline{X}}$	Min.	Max.	$\overline{X} \pm S_{\overline{X}}$	Min.	Max.	$\overline{X} \pm S_{\overline{X}}$	Min.	Max.
January	2.66±1.03 **c**	0.26	5.75	1.00±0.42 **e**	0.35	1.78	2.11±0.73 **d**	0.26	5.75
February	2.54±0.77 **c**	1.05	6.25	1.58±0.16 **de**	1.29	1.86	2.22±0.52 **d**	1.05	6.25
March	2.31±0.63 **c**	1.16	5.25	2.69±1.45 **cde**	0.84	5.56	2.44±0.59 **cd**	0.84	5.56
April	2.16±0.54 **c**	1.25	4.72	1.99±0.73 **cde**	0.97	3.40	2.10±0.41 **d**	0.97	4.72
May	1.34±0.43 **c**	0.04	2.31	4.36±2.82 **bcde**	1.12	9.97	2.35±1.00 **cd**	0.04	9.97
June	2.15±0.92 **c**	0.09	6.45	5.94±4.15 **bcd**	1.19	14.20	3.42±1.48 **cd**	0.09	14.20
July	4.04±1.40 **bc**	0.59	8.59	6.25±3.07 **bc**	1.94	12.20	4.77±1.32 **bcd**	0.59	12.20
August	5.40±2.01 **bc**	0.58	14.20	6.04±1.77 **bcd**	4.00	9.56	5.61±1.40 **bc**	0.58	14.20
September	8.03±1.31 **ab**	4.52	12.00	7.67±3.12 **ab**	2.40	13.20	7.91±1.24 **ab**	2.40	13.20
October	10.66±1.23 **a**	5.55	14.60	11.22±4.74 **a**	1.75	16.50	10.84±1.59 **a**	1.75	16.50
November	7.41±2.28 **ab**	1.62	16.25	8.64±2.08 **ab**	4.52	11.20	7.82±1.60 **ab**	1.62	16.25
December	2.94±0.91 **c**	0.92	6.00	2.03±0.17 **cde**	1.85	2.37	2.63±0.61 **cd**	0.92	6.00
General	**4.30±0.47**	**0.04**	**16.25**	**4.95±0.80**	**0.35**	**16.50**	**4.52±0.41**	**0.04**	**16.50**

*** :** The difference between the averages having different small letters in each column, is significant (p<0.05)

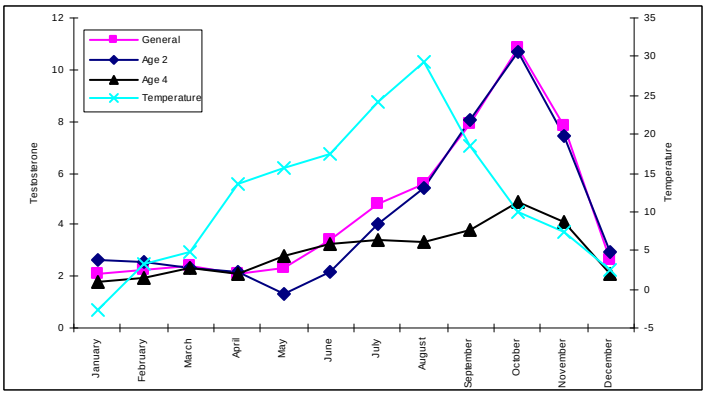

Figure III.II. Yearly variation of testosterone hormone and temperature

Table III.VI. Descriptive statistics and comparison results belonging to seasonal testosterone values in White Goat age groups

		Age 2 (n:3)	Age 4 (n:6)	General(n:9)
		$\overline{X} \pm S_{\overline{X}}$	$\overline{X} \pm S_{\overline{X}}$	$\overline{X} \pm S_{\overline{X}}$
Testosterone	**Spring**	1.94±0.32 **b**	3.01±0.93 **c**	2.29±0.39
	Summer	3.86±1.28 **b**	6.04±2.95 **b**	4.60±0.80
	Fall	8.70±0.72 **a**	9.17±2.55 **a**	8,86±0.87
	Winter	2.71±0.76 **b**	1.54±0.09 **c**	2.32±0.35

*** :** The difference between the averages having different small letters in each column, is significant (p<0.05)

Table III.VII. Descriptive statistics and comparison results belonging to testosterone values in White Goat age groups with respect to physiological periods

		Age 2 (n:3)	Age 4 (n:6)	General (n:9)
		$\overline{X} \pm S_{\overline{X}}$	$\overline{X} \pm S_{\overline{X}}$	$\overline{X} \pm S_{\overline{X}}$
Testosterone	**Sexual session**	8.70±0.72 **a**	9.17±2.55 **a**	9,38±1.04
	Pregnancy	2.71±0.76 **b**	1.54±0.09 **c**	3.44±0.51
	Post-partum	1.94±0.32 **b**	3.01±0.93 **c**	2.22±0.52
	Lactation	3.86±1.29 **b**	6.07±2.97 **b**	4.60±0.80

*** :** The difference between the averages having different small letters in each column, is significant (p<0.05)

IV. Results and Recommendations

In this research, the thyroid hormones (T3 and T4) and testosterone hormone values collected from 14 female (2, 3 and 4 years of age) and 9 male (2 and 4 years of age) during a 12-month (January through December) period, have been analyzed and the results are given below:

Changes of T3 and T4 Hormones

Annual Change
The general averages of T3 and T4 hormones during the months January through December have been determined to be, respectively, T3: 106.07±5.28, 109.57±7.24, 105.14±5.96, 100.67±6.19, 99.02±5.66, 97.24±3.60, 90.80±2.88, 87.74±5.38, 103.34±5.76, 110.48±8.48, 125.23±7.24, 114.32±6.56 ng/dl, and, T4: 4.54±0.20, 4.63±0.17, 4.44±0.28, 3.90±0.31, 3.46±0.20, 2.96±0.16, 2.64±0.17, 2.45±0.14, 4.75±0.27, 5.56±0.24, 6.45±0.35, 5.18±0.53 µg/dl.

Change depending on Age
The general averages of T3 and T4 hormones in each age group of White Goats of 2,3,4 years of age during a period of one year, have been determined to be 105.04±2.80, 105.53±4.96, 102.14±2.30 ng/dl and 4.22±0.17, 4.14±0.19, 4.36±0.17 µg/dl respectively. In the scope of these values, differences between the age groups are statistically insignificant.

Change depending on Sex
General average values of T3 and T4 hormones in female and male White Goat groups have been determined to be 104.98±2.23, 102.82±3.05 ng/dl and 4.18±0.11, 4.36±0.20 µg/dl respectively. In the scope of these values, differences between the sex groups are statistically insignificant.

Change depending on Temperature
It has been determined that the environmental temperatures measured one year round affects the T3 and T4 hormone levels. While there is a decrease in these hormone levels with increasing environmental temperature, there is an increase in hormone levels with decrease in environmental temperature. These findings obtained are consistent with the literature.

Humidity Effect
It has been determined that the relative humidity values measured one year round affects the T3 and T4 hormone levels. Generally, while there is a decrease in these hormone levels with decreasing humidity level, there is an increase in hormone levels with increase in humidity.

Temperature Humidity Index
According to the temperature-humidity index results calculated using the wet and dry thermometer values belonging to the 15th day of each month of the one year period that the blood samples were collected; it was determined that the animals were relaxed (meaning they were not stressed by temperature) all year round except August, and they were stressed by temperature in August.

Seasonal Change
T3 and T4 hormone levels were decreased with transition from spring to summer. They were increased with transition from summer to fall. Although they were decreased with transition from fall to winter, their levels were observed to be high. These findings are consistent with the literature.

Change in Different Physiological Periods (Sexual session, Pregnancy, Post-partum, and Lactation)
In different physiological periods (sexual session, pregnancy, post-partum, and lactation) of White Goats, while there is not any difference between age and sex groups in the scope of T3 and T4 hormone levels, the differences between T3 and T4 hormone levels in different physiological periods of each group have been found to be statistically significant (p<0.05).

Changes in Testosterone Hormone

Annual Change
The annual variation of monthly general average values of testosterone hormone in male White Goats are 2.11±0.73, 2.22±0.52, 2.44±0.59, 2.10±0.41, 2.35±1.00, 3.42±1.48, 4.77±1.32, 5.61±1.40, 7.91±1.24, 10.84±1.59, 7.82±1.60, and 2.63±0.61 ng/dl respectively. In the scope of these values, the difference between the general averages was found to be statistically significant (p<0.05). The annual average testosterone value was found to be 4.52±0.41 ng/dl.

Change depending on Age
The general average values of testosterone hormone levels in male White Goats of 2 and 4 years of age were respectively 4.30±0.47 and 4.95±0.80 ng/dl. In the scope of these values, the difference was found to be statistically insignificant. Nevertheless, the monthly difference for each age group was determined to be statistically significant (p<0.05).

Seasonal Change
The seasonal (spring, summer, fall, winter) general average values of testosterone hormone levels in male White Goats were respectively 2.29±0.39, 4.60±0.80, 8,86±0.87 and 2.32±0.35 ng/dl. The general average value of the testosterone hormone levels showed similarity for the winter and the spring, increase starting with the summer and the highest value in the fall.

Change in Different Physiological Periods (Sexual session, Pregnancy, Post-partum, and Lactation)
The general averages of testosterone hormone levels for male White Goats in different physiological periods were determined to be 9,38±1.04, 3.44±0.51, 2.22±0.52 and 4.60±0.80 ng/dl respectively. The general average value of the testosterone hormone levels showed similarity for the pregnancy and the post-partum periods, increase starting with the lactation period and the highest value in the sexual session period.

V. References

Todini, L. 2007. Thyroid hormones in small ruminants: effects of endogenous, environmental and nutritional factors. The Animal Consortium, 997-1008.

Yılmaz, B. 1999. Hormonlar ve Üreme Fizyolojisi. A.Ü.Veteriner Fak. Fizyoloji Anabilim Dalı. 1. Basım, Ankara.