



## Mating Behavior and Hormone Profile in Melatonin Treated Goat Bucks

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### ABSTRACT

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In this study, the effects of melatonin implant treatment before the breeding season on melatonin (M) and testosterone (T) hormone levels, and the mating behavior and performance, were determined in Turkish Saanen goat bucks. Four head of bucks and 50 head of goats were used. The bucks were randomly divided into two groups and they were treated with 3 implants with 18 mg melatonin. The half of female goats were also implanted with melatonin (18 mg/goat). A total of 13 blood samples were collected before the melatonin implant (Day 0) and on the 21<sup>st</sup>, 42<sup>nd</sup>, 63<sup>rd</sup>, 94<sup>th</sup>, 129<sup>th</sup>, 157<sup>th</sup>, 185<sup>th</sup>, 213<sup>rd</sup>, 251<sup>st</sup>, 275<sup>th</sup>, 307<sup>th</sup>, and 335<sup>th</sup> days after the implant. Hormone analyses were performed using ELISA method and in animal species specific hormone kits. Mating was carried out for 10 minutes, and the mating behaviors of the bucks and does were recorded. While the treatment (MI) group had an overall means of melatonin hormone level of 526.3 ng/L, the control (C) group had a melatonin hormone level of 199.0 ng/L in overall (P=0.0224). The testosterone hormone level in the MI group was 12.7 nmol/L on average, and it was 6.13 nmol/L in the C group (P=0.2137). The MI group had significantly higher melatonin hormone levels in the summer, autumn, and spring than the C group, and significantly higher testosterone hormone levels in all seasons (P≤0.05). While M hormone had the highest level of MI and C groups in March, T hormone was highest of MI group in April and C group in March. Mating behaviors and the duration of mating were similar in the groups of bucks (P>0.05). A high statistically significant positive correlation coefficient (r=0.678) was determined between melatonin hormone and testosterone hormone (P<0.0001). In addition, there was a significant and positive correlation coefficient between hormone levels and the frequency of tongue-lapping (P=0.0134), sexual vocalization behavior (P=0.0199) in the MI group. In conclusion, the treatment of melatonin implants before the breeding season significantly increased the levels of M and T hormones and positive effects on frequency of mating behavior in Turkish Saanen goat bucks.

## Melatonin Uygulanan Tekelerde Aşım Davranışları ve Hormon Profili

### MAKALE BİLGİSİ

### ÖZ

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**Anahtar Kelimeler**

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İmplant  
Melatonin  
Testosteron  
Seksüel davranış

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Bu çalışmada, aşım sezonu öncesinde melatonin uygulamasının Türk Saanen ırkı tekelerde melatonin (M) ve testosteron (T) hormon seviyeleri ile aşım davranışı ve performansına etkisi belirlenmiştir. Çalışmada dört baş teke ve 50 baş keçi kullanılmıştır. Çalışmada tekeler şansa bağlı olarak iki gruba ayrılarak 18 mg melatonin (M) içeren 3 adet implant yapılmıştır. Benzer şekilde keçilerin yarısına da melatonin implantı (18 mg/keçi) uygulanmıştır. Çalışmada melatonin implantı öncesi (0. Gün), implant sonrası 21., 42., 63., 94., 129., 157., 185., 213., 251., 275., 307. ve 335. Günler olmak üzere toplam 13 defa kan örneği alınmıştır. Hormon analizleri ELISA yöntemi kullanılarak ve hayvan türüne özgü hormon kitleriyle yapılmıştır. Çiftleştirmeler 10 dk. süreyle yapılmış, erkek ve dişilerde eşeyssel davranışlar gözlenmiştir. Tekelerde muamele (MI) grubu genel ortalama 526.3 ng/L M hormon seviyesine sahip olurken, kontrol (C) grubu 199.0 ng/L M hormon seviyesine sahip olmuştur (P=0.0224). MI grubunda T hormon seviyesi ortalama 12.7 nmol/L olurken, C grubunda ise 6.13 nmol/L olmuştur (P=0.2137). Tekelerde yaz, sonbahar ve ilkbahar mevsimlerinde M hormonu seviyeleri, T hormonunda ise tüm mevsimlerde MI grubu C grubundan önemli ölçüde daha yüksek hormon seviyelerine sahip olmuştur (P≤0.05). MI ve C gruplarında mart ayında yüksek düzeyde M hormonu olurken, T hormonu MI grubunda en yüksek nisan ayında, C grubunda mart ayında belirlenmiştir. Tekelerde aşım sırasındaki eşeyssel davranışlar ile aşım süreleri gruplara göre benzer gerçekleşmiştir (P>0.05). Çalışmada, melatonin hormonu ile testosteron hormonu arasında pozitif yönde yüksek ve istatistiksel olarak önemli korelasyon katsayısı (r=0.678) belirlenmiştir (P<0.0001). Ayrıca MI grubunda hormon seviyeleri ile dil çıkarma sıklığı (P=0.0134) ve seksüel ses sıklığı (P=0.0134) arasında önemli önemli düzeyde ve pozitif yönde korelasyonlar belirlenmiştir. Sonuçta, Türk Saanen keçisi tekelerinde üreme mevsiminden önce melatonin implantı M ve T hormon düzeylerini önemli ölçüde artırmış ve aşım davranışı sıklığı üzerinde olumlu etkiler yapmıştır.

**Introduction**

While estrus synchronization is carried out in farm animals, the libido levels and practices in male animals are often neglected. However, the libido levels and reproductive performance of male animals must be at a sufficient level to complete the mating successfully in a short time in the synchronization of estrus in females. Different lighting programs, feeding arrangements, and exogenous hormone applications are used to increase libido levels in the out-of-season breeding in bucks (Kumar and Purohit, 2009; Zarazaga et al., 2009).

Melatonin applications, a hormone application for off-season breeding in animals, is under the control of nervous, hormonal, and enzymatic systems with photoperiodic interaction of melatonin synthesis secreted from the pineal gland in the brain (Zarazaga et al., 2009). In domestic goat breed mating in short photoperiods, the changes observed in gonadal function, and the seasonal stimulations of the hormones (GnRH, FSH and LH, etc.) controlling it, show a gender dependence. Also, the direct effect of exposure is lower in males than females. While sexual activity in females is usually interrupted during long days, it can continue uninterrupted

throughout the year in males. Besides, sexual activity levels in males on short days may be higher than on long days. It was determined that libido and reproductive hormone levels of goat breeds, which were at high levels in August-March in Mediterranean countries, were at low levels in the other months (Kumar and Purohit, 2009). It was reported that the hormone levels of melatonin, GnRH, FSH, LH, estrogen, testosterone, and progesterone changed significantly according to the season and photoperiod in Angora goat bucks (Pehlivan et al., 2017).

While hormone levels are known to significantly affect reproductive behavior in animals, courtship behavior can be an important indicator of libido in goats (Tölu and Savaş, 2010; Darwish and Mahboud, 2011; Karaca et al., 2016). Studies on reproductive performance, mating behavior and hormone levels of melatonin implants in dairy goat bucks are limited. Moreover, the effect of the melatonin implant on hormone levels throughout the year is also an important point. In this study, the effect of melatonin implant application in the out-of-breeding season on melatonin (M) and testosterone (T) hormone levels, mating behavior, and performance in Turkish Saanen goat bucks was determined.

## Material and Methods

This study was conducted within the framework of the procedure and ethical rules of Çanakkale Onsekiz Mart University Animal Experiments Local Ethics Committee no. 2018/12-13.

This study was carried out with 50 goats and 4 Turkish Saanen goat bucks in the Animal Production Research Unit of the Faculty of Agriculture at Canakkale Onsekiz Mart University, Turkey. Average live weight was 58.33 kg and body condition score was 2.70 (0-5) in 1.5-2.5 year goat bucks. The goats were 1.5-6.5 years age old, average live weight was 42.94 kg and body condition score was 2.70. On June 26 (initial experiment), ear subcutaneous implants (Regulin®) containing 18 mg of melatonin were applied to half of the females and males. Melatonin implants of 1 implant to females and 3 implants to males were applied. The application was carried out by a private veterinary clinic. The supplementary feeding (flushing) with grain barley was implemented for all the female and male animals for 60 days. The female and male goats were arranged in two groups, the treatment group implanted with melatonin (MI), and the control group (C) without melatonin. During the breeding period, the goats were fed with a daily ration at the level of 1.3 times the energy need for survival, and the bucks with a daily ration at the level of 1.2 times the energy need for survival (NRC, 2007). On August 1, a teaser buck was introduced into the herd for estrus control. The goats whose estrus was determined were mated according to the groups in a controlled manner. The mating was limited to a total of 10 minutes and mating records were taken by the direct observation method and a video camera. Mating took place in the area fenced by the 2.5 x 3.5 m (width x length) pen. While 2 observers made direct observations, 1 observer recorded with a video camera. All observations were taken at a distance of 2-3 m from the observation area. The matings were done according to male x female mating pairings arranged according to treatment and control groups in the morning and evening hours. If does displayed estrus behavior in the morning, then mating took place in the evening and when estrus signs were displayed, they copulated next morning. Mating behavior observations were made in the first mating of the goats, and no behavioral observations were made in the returning goats. Mating behaviors of the males and

females, and the number and duration of copulations with ejaculation, were determined during mating (Tölü and Savaş, 2010; Konyalı et al., 2011). The mating behaviors observed were the frequency of anogenital sniffing, foreleg striking, tongue-lapping, sexual vocalization, and sexual head-forward in mating. While mating behaviors were observed as frequency of anogenital sniffing, foreleg striking, tongue-lapping, sexual vocalization, and sexual head-forward, the mating performance was evaluated as ejaculation duration in mating.

In the study, a total of 13 blood samples were collected before the melatonin implant (Day 0; initial experiment) and on the 21<sup>st</sup>, 42<sup>nd</sup>, 63<sup>rd</sup>, 94<sup>th</sup>, 129<sup>th</sup>, 157<sup>th</sup>, 185<sup>th</sup>, 213<sup>rd</sup>, 251<sup>st</sup>, 275<sup>th</sup>, 307<sup>th</sup> and 335<sup>th</sup> days after the implant. The blood samples were taken from the *Vena jugularis* between 9-12 am. The blood samples were centrifuged at 3500 rpm for 10 minutes. Then the blood serums were transferred to sterile storage tubes and stored in a deep freezer at -20 °C until hormone analysis. Hormone analyses were performed using the enzyme-linked immunosorbent assay (ELISA) method (Tölü et al., 2017). Thermo Scientific Multiskan FC Microplate Reader was used for analysis. Melatonin and testosterone hormone analyses were performed in animal-specific commercial hormone kits. Analyses were performed according to the recommended procedures of the hormone kits. Hormone analyzes were performed in two parallels.

### ***Statistical analyses***

Analysis of variance was analyzed after applying logarithmic transformation ( $y+10$ ) to the hormone data. The model included groups (MI, C), seasons (summer, autumn, winter, spring), control days (1,...,13), interactions, and animal effects. In addition, the hormone value determined before the melatonin implant was covariant in the model. The square root transformation ( $\sqrt{y+10}$ ) was applied to mating behavior data. The model included groups (MI, C), the goat courtship index (seeking back, turn of the buck, touching of male's genitalia, sniffing, tail wagging), which is the sum of the mating behavior as covariant and animal effects in buck mating behavior analysis. The Tukey test was used for *post hoc* analysis. Pearson correlation coefficients ( $r$ ) were determined between mating behaviors and copulation durations with the hormone levels of melatonin and testosterone. All analyses were carried out in the SAS (1999) statistical package program.

## **Results**

### ***Hormone analyses***

The hormone values of the bucks, which were randomly distributed according to age, live weight, and body condition score at the beginning of the experiment, differed significantly in the treatment (MI) and control (C) groups (Table 1). The treatment group (MI) had 4.39 times higher levels of melatonin (M) hormone and approximately 3.65 times higher levels of testosterone (T) hormone than the control (C) group ( $P \leq 0.0136$ ).

Table 1. Means  $\pm$  standard error and P values of melatonin (ng/L) and testosterone (nmol/L) hormone of Turkish Saanen goat bucks in initial experiment (Day 0)

*Tablo 1. Türk Saanen tekelerinde deneme başındaki (0. gün) melatonin (ng/L) ve testosteron (nmol/L) hormon değerlerine ait ortalama  $\pm$  standart hata ve P değerleri*

Hormone/Group	Treatment	Control	P
Melatonin (ng/L)	893.7 $\pm$ 301.94	203.5 $\pm$ 41.19	0.0136
Testosterone (nmol/L)	21.9 $\pm$ 6.50	6.0 $\pm$ 1.41	0.0125

It was observed that the melatonin implant significantly affected serum M hormone levels before the breeding season (Table 2). Group MI had approximately 2.5 times higher levels of M hormone than group C (P=0.0224). Also, group MI had approximately 2 times higher T hormone levels than group C (P=0.2137). The initial hormone values significantly affected the levels of T hormone measured throughout the study (P=0.0028). T hormone levels varied significantly according to the season (P=0.0022).

M hormone levels differed significantly in summer (June, July, August), autumn (September, October, November) and spring (March, April, May) compared to groups MI and C (Fig. 1). M hormone levels of group MI had a significantly higher level of M hormone than group C (P $\leq$ 0.05). T hormone levels were significantly higher in group MI than group C in all seasons (P $\leq$ 0.05). It was observed that the concentrations of both hormones were similar in summer and autumn, decreased in winter, and increased to very high values, especially in group MI, in the spring.

Table 2. Overall mean  $\pm$  standard errors and P\* values of melatonin (ng/L) and testosterone (nmol/L) hormones in Turkish Saanen goat bucks according to the groups

*Tablo 1. Türk Saanen tekelerinde gruplara göre melatonin (ng/L) ve testosteron (nmol/L) hormon değerlerine ait genel ortalama  $\pm$  standart hata ve P değerleri*

Factor	Group (G)			Season (S)	G x S	IE
	Treatment	Control	P	P	P	P
Melatonin (ng/L)	526.3 $\pm$ 74.71	199.0 $\pm$ 25.75	0.0224	0.1220	0.4168	0.5752
Testosterone (nmol/L)	12.7 $\pm$ 1.68	6.13 $\pm$ 0.56	0.2137	0.0022	0.6950	0.0028

\*: Logarithmic (y+10) transformation was applied to the data; IE: Initial experiment.

It was observed that the M hormone fluctuated especially in group MI throughout the year in Turkish Saanen goat bucks (Fig. 2). Group C followed a more stable course than group MI in terms of hormone levels, especially in T hormone all through the year. The M and T hormone levels of group MI continued at almost all control days. Group MI had a slightly lower value than group C only in the measurement of M hormone in December and in the measurement of T hormone in March. The sudden increase of both hormone levels in March was a remarkable measurement of the bucks in group MI.

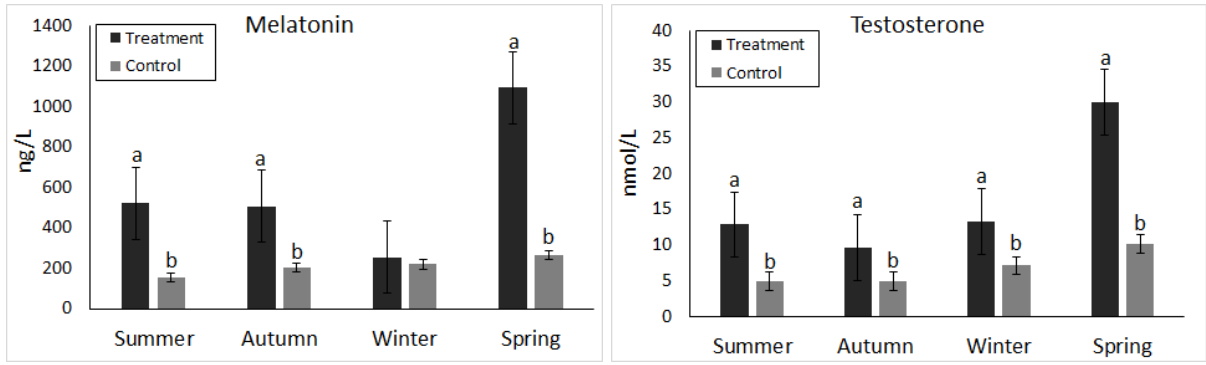


Figure 1. Mean, standart error bars and significance levels of melatonin (ng/L) and testosterone (nmol/L) hormones in Turkish Saanen goat bucks according to the season and groups (Difference between averages shown with different letters in each hormone and season is statistically significant,  $P \leq 0.05$ )

Şekil 1. Türk Saanen tekelerinde mevsim ve gruplara göre melatonin (ng/L) ve testosteron (nmol/L) hormon değerlerine ait ortalama, standart hata ve önem seviyeleri (Herbir hormon ve mevsimde farklı harflerle ortalamalar arasındaki farklılık istatistiksel olarak önemlidir,  $P \leq 0,05$ )

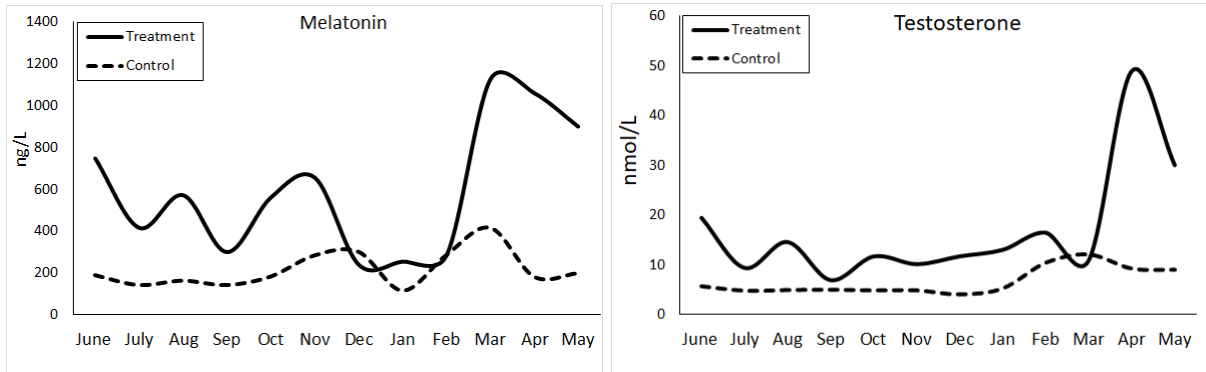


Figure 2. Change of means of melatonin (ng/L) and testosterone (nmol/L) hormones according to the months in Turkish Saanen goat bucks

Şekil 2. Türk Saanen tekelerinde aylara göre ortalama melatonin (ng/L) ve testosteron (nmol/L) hormon değerlerinin değişimi

### **Mating behavior and hormone analyses in mating period**

M and T hormone levels did not show a statistically significant difference according to the MI and C groups when estrus was intense on the 21<sup>st</sup>, 42<sup>nd</sup>, and 63<sup>rd</sup> days after melatonin implant (Table 3). Group MI had higher levels of M and T hormones than group C on all these control days. M and T hormone levels on the 21<sup>st</sup>, 42<sup>nd</sup>, and 63<sup>rd</sup> days after melatonin implantation (except for T hormone on the 63<sup>rd</sup> day) were significantly affected by the initial hormone values of the experiment.

Table 3. Mean  $\pm$  standard errors and P\* values of melatonin (ng/L) and testosterone (nmol/L) hormones according to the groups and days after melatonin implantation in Turkish Saanen goat bucks

Tablo 3. Türk Saanen tekelerinde melatonin implantından sonraki günler ve gruplara göre melatonin (ng/L) ve testosteron (nmol/L) hormon değerlerine ait ortalama  $\pm$  standart hata ve P değerleri

21 <sup>st</sup> day	Group			IE
Hormone/Group	Treatment	Control	P	P
Melatonin (ng/L)	416.2 $\pm$ 124.04	141.1 $\pm$ 27.56	0.6446	0.0205
Testosterone (nmol/L)	9.4 $\pm$ 2.38	4.82 $\pm$ 0.81	0.3790	0.0075
42 <sup>nd</sup> day	Treatment	Control	P	P
Melatonin (ng/L)	758.2 $\pm$ 316.01	178.12 $\pm$ 43.91	0.3026	0.0013
Testosterone (nmol/L)	15.0 $\pm$ 4.42	4.9 $\pm$ 1.17	0.2731	0.0003
63 <sup>rd</sup> day	Treatment	Control	P	P
Melatonin (ng/L)	387.0 $\pm$ 141.04	146.2 $\pm$ 14.63	0.9240	0.0392
Testosterone (nmol/L)	14.2 $\pm$ 5.70	5.0 $\pm$ 1.12	0.8644	0.0851

\*: Logarithmic (y+10) transformation was applied to the data; IE: Initial experiment.

The mean values of mating behaviors and ejaculation times determined during hand mating observations are given in Figure 3 according to MI and C groups. While the mating behaviors of the bucks were slightly higher in group MI than in group C, the mean mating durations were similar in both groups (P>0.05).

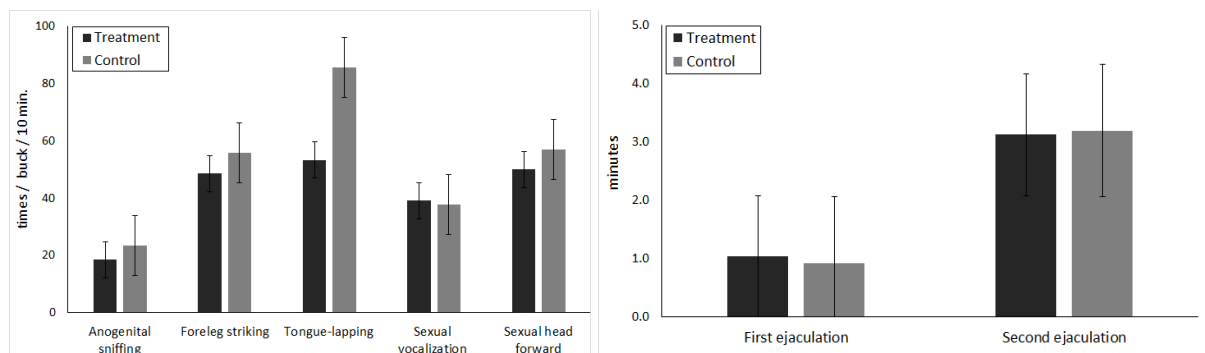


Figure 3. Means and standart error bars of mating behaviors (times / buck / 10 min.) and duration of ejaculation (min.) according to the groups in Turkish Saanen goat bucks

Şekil 3. Türk Saanen tekelerinde gruplara göre aşım davranışları (kez /teke /10 dk.) ve ejakülasyon sürelerine (dk.) ait ortalamalar ve standart hataları

Pearson correlation coefficients (r) between M and T hormones on the 21<sup>st</sup>, 42<sup>nd</sup>, and 63<sup>rd</sup> days after melatonin implantation, with mating behavior and duration of ejaculation, are given in Table 4. A common value was used for the M and T hormones, since the r value between M and T hormones during the mating period was 0.999 and significant in groups MI and C (P<0.0001; data not shown). Pearson correlation coefficients between M and T hormones at 13 control days were determined to be r=0.678 (P<0.0001; data not shown). Pearson correlation coefficients of r=0.487 (P=0.0134) and r=0.462 (P=0.0199) were determined between the hormone level with frequency of tongue-lapping and the sexual vocalization behaviors in group

MI, respectively. The  $r$  value between mating behaviors and mating durations was non-significant in both groups.

Table 4. Pearson correlation coefficients ( $r$ ) and  $P$  values between hormone levels with mating behaviors and duration of ejaculation in Turkish Saanen goat bucks

*Tablo 4. Türk Saanen tekelerinde hormone seviyeleri ile aşım davranışları ve ejakülasyon süreleri arasındaki Pearson Korelasyon Katsayıları ( $r$ ) ve  $P$  değerleri*

Traits	Treatment		Control	
	$r$	$P$	$r$	$P$
Frequency of anogenital sniffing	-0.052	0.8045	-0.407	0.0833
Frequency of foreleg striking	0.183	0.3811	0.203	0.4027
Frequency of tongue-lapping	0.487	0.0134	0.246	0.3091
Frequency of sexual vocalization	0.462	0.0199	0.396	0.0929
Frequency of sexual head forward	0.277	0.1794	0.314	0.1892
First ejaculation (min.)	0.348	0.0879	0.226	0.3518
Second ejaculation (min.)	0.219	0.2907	0.127	0.6024

## Discussion

In the study, the fact that the number of bucks per group was two and the hormone levels were determined by a single measurement appears to be a weakness (Table 1). It can be said that the use of hormone values as the initial value of the experiment as a covariant in the statistical analysis of the hormone analyzes significantly improved the estimation of the differences between groups. However, in such studies, groups can be formed with a larger number of hormone samples at the beginning of the experiment.

### *Hormone analyses*

Melatonin implants significantly affected the levels of M hormone in Turkish Saanen goat bucks before the breeding season (Table 2). While the MI group had a mean of 526.3 ng/L M hormone levels, the C group had mean 199.0 ng/L M hormone levels ( $P=0.0224$ ). The mean T hormone level was 12.7 nmol/L in group MI and 6.13 nmol/L in group C ( $P=0.2137$ ). It has been determined that the hormone level of melatonin varies between 6.27 pg/ml and 10.32 pg/ml according to the month in Angora goat bucks (Pehlivan et al., 2017). The highest M hormone levels were determined as 2.11 ng/ml in the treatment group and 0.87 ng/ml in the control group at the 2nd week in Shiba goats (Samir et al., 2020). In Damascus goat bucks, while T hormone in the breeding season was determined as 20.01 ng/ml and 2.84 ng/ml in the groups with and without melatonin implant during the breeding season, respectively, it was determined in the groups out of the breeding season as 17.97 ng/ml and 13.22 ng/ml, respectively (Ramadan et al., 2009). Donmez et al. (2004) reported that T hormone on the 30<sup>th</sup> and 70<sup>th</sup> days from the melatonin implant in Angora goat bucks was 1.45 ng/ml and 2.25 ng/ml for the melatonin group, and 0.69 ng/ml and 1.32 ng/ml for the control group, respectively.

In the present study, T hormone was determined as 14.2 nmol/L and 5.0 nmol/L for groups MI and C, respectively, after melatonin implantation in bucks (Table 3). T hormone levels were found to be significantly higher in bucks with continuous lighting and melatonin



implants than in control bucks with natural lighting in Alpine goat bucks (Delgadillo et al., 2016). T hormone levels in Turkish Saanen goat bucks varied significantly according to the season (Table 2). M and T hormone levels differed significantly according to group x season (Fig. 1). Group MI had significantly higher levels of M hormone in summer, autumn and winter, and T hormone in all seasons compared to group C ( $P \leq 0.05$ ). While the highest levels of M and T hormones were observed in the spring, the lowest levels were estimated for the M hormone in the winter and the T hormone in autumn. T hormone levels in bucks in Spain differed significantly according to summer, autumn, winter, and spring and were determined as 10.60 nmol/L, 3.58 nmol/L, 2.14 nmol/L and 4.49 nmol/L, respectively (Arrebola and Abecia, 2017). In another study on bucks in Spain, T hormone differed significantly in summer, autumn, winter and spring and was determined as 10.00 ng/ml, 8.11 ng/ml, 3.24 ng/ml and 3.84 ng/ml, respectively. Also, the authors found high levels of T hormone in July-November, and low levels between December and June (Gallego-Calvo et al., 2015).

High levels of M and T hormones, especially in April-May, were determined in groups MI and C in Turkish Saanen goat bucks (Fig. 2). While the highest T hormone level of Alpine goat bucks was determined in April, the lowest T hormone level was determined in August in Brazil (Dias et al., 2017). The lowest T hormone levels of Khalkhali goat bucks were determined in April, May and June in the northwest region of Iran (Abdi-Benemar et al., 2018). Although the highest M hormone of Angora goat bucks in Turkey was determined in December, and the highest T hormone was determined in October, the lowest values were determined in M and T hormones in July and May, respectively (Pehlivan et al., 2017).

### ***Mating behavior and hormone analyses in mating period***

On the 21<sup>st</sup>, 42<sup>nd</sup>, and 63<sup>rd</sup> days after melatonin implantation in Turkish Saanen goat bucks, group MI had higher levels of M and T hormones than group C on all control days (Table 3). In group MI, the frequency of tongue-lapping and sexual vocalization behaviors was found to be  $r=0.487$  and  $r=0.462$  between hormone levels, respectively. Mating behaviors and ejaculation durations determined during hand mating observations were similar in groups MI and C (Fig. 3).

Turkish Saanen goat bucks exhibited an average of 18-86 sexual behaviors during 10 minutes of hand-mating (data not shown). It was found that in Creole goat bucks, those with melatonin implants exhibited significantly higher anogenital touching, sniffing and sexual mouth activities compared to the control groups (Delgadillo et al., 2002). In another study, sniffing, touching, foreleg striking and sexual vocalization behaviors were observed at a significantly higher frequency in the melatonin implanted group compared to the control group of bucks in the Mediterranean climate zone (Zarazaga et al., 2019).

### **Conclusions**

It was observed that the application of melatonin implants before the breeding season significantly increased the levels of M and T hormones in Turkish Saanen goat bucks. Group MI, which had high hormone levels at the beginning of the experiment, maintained its superiority, especially in the M hormone, throughout the year.

It would be expected from the commercial product used for the melatonin implant that the melatonin hormone and sexual hormones would reach their peak levels between 40-60 days

after the implant. This occurred in the hormone analysis performed on the 21<sup>st</sup>, 42<sup>nd</sup> and 63<sup>rd</sup> days after melatonin implantation in Turkish Saanen goat bucks.

In the study, a significantly high positive Pearson correlation coefficient was determined between the M hormone and T hormone. Testosterone levels were determined to have a significant effect on hormone levels with the melatonin implant application. Therefore, testosterone hormone levels can be increased with melatonin implants before the breeding season in Turkish Saanen goat bucks.

Mating behaviors during mating and ejaculation were similar in the groups of Turkish Saanen goat bucks. In group MI, a significant  $r$  was found between hormone levels and the frequency of tongue-lapping and sexual vocalization behaviors.

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