Evaluation of Tear fluid secretion and Intraocular Pressure in normal Merinos Sheep and Saanen Goats

C. T. İŞLER1*, M. E. ALTUĞ1, S. KILIÇ2

1Mustafa Kemal University, Faculty of Veterinary Medicine, Department of Surgery, 31040, Hatay, TURKEY.
2Fırat University, Faculty of Veterinary Medicine, Department of Surgery, Elazığ, TURKEY.

*Corresponding author : cafer.isler@gmail.com

SUMMARY

This study aimed at determining the effects of the species, sex and age on normal tear secretion and intraocular pressure (IOP) in normal Merinos sheep and Saanen goats, and assess the effect of topically applied atropine on tear secretions in these species. The study used a total of 80 healthy Merinos sheep, Saanen goats, Merinos lambs and Saanen kids of 20 in each. The sheep and goat aged between 1-2.5 years and the lambs and kids between 15-20 days. The lambs and kids consisted of females and males of equal numbers. Tear secretion and intraocular pressure (IOP) were measured with Schirmer Tear Test (STT) and Schiotz Tonometry, respectively. All measurements were performed prior to and five minutes after the instillation of two-four eye drops of atropine sulfate between 6 and 10 p.m for three consecutive days.

The present results demonstrated that with regard to tear secretion and IOP the differences between sheep and lambs, and that between goats and kids were statistically significant (p < 0.001) whereas the differences between the sheep and goats was non-significant (p > 0.05). On the other hand, the values of tear secretion and IOP in the lambs and kids were significantly lower (p < 0.001) than those of sheep and goats. It was determined that sex variation did not significantly influence the IOP and STT values (p > 0.05).

En conclusion, on a constaté que la différence entre les valeurs SL et PIO chez les moutons et agneaux, et chez les chèvres et cabris était significative (p<0.001); mais que la différence entre les moutons et les chèvres ne l'était pas (p>0.05). D'autre part, on a trouvé que les valeurs SL et PIO chez les agneaux et les cabris étaient significativement inférieures que chez les moutons et les chèvres (p<0.001); que le sexe n'avait pas d'influence sur les valeurs SL et PIO (p>0.05); que l'atropine avait diminué significativement la sécrétion lacrymale chez tous les sujets(p<0.001).

Keywords: Tear secretion, intraocular pressure (IOP), atropine, small ruminants.

Mots-clés : La sécrétion lacrymale, la pression intraoculaire, atropine, petits ruminants

Introduction

Knowledge of normal reference ranges of intraocular pressure (IOP) and tear secretion are of importance for the diagnosis and treatment of ocular diseases such as keratitis, keratoconjunctivitis, anterior uveitis and glaucoma in domestic animals [8, 15, 17]. Lacrimal secretion prevents drying of the ocular surface and ensures to expel foreign materials from the eye [3]. Schirmer tear test (STT) is of critical importance in the diagnosis of corneal and conjunctival disorders and measures tear secretion using special paper strips [2]. STT measurements can be affected by individual performance, placement of the strips in the conjunctival sac and the diversities of paper strips [7, 16, 18].

IOP emerges as a result of the interaction between the fibrous layers of the eye and the secretion of the humor aqueous (HA). Depending on the balance between the secretion and the drainage of HA, IOP is maintained within certain physiologic ranges under normal circumstances. IOP can be measured indirectly with the Schiotz indentation tonometer or with the application Tonopen® and may exceed normal values in certain diseases such as glaucoma [4, 7, 17].

Some studies [7, 17] have investigated IOP and tear secretion in some sheep and goat breeds. It was reported that in healthy Sanjabi sheep aged 2-3 years [7], the average tear secretion was 18.52 ± 2.55 mm/min and the average IOP value measured with application tonometry was 9.37 ± 2.45 mmHg. Among Brazilian Saanen goats [17], tear secretion values on days 45, 180 and 549 were found to be 10.38 ± 0.23, 14.83±0.33 and 13.80±0.66 mm/min, respectively; IOP values measured with application tonometry on the same days were reported to be 8.03 ± 0.68, 9.15 ± 0.19 and 9.79 ± 0.27 mmHg, respectively. However, more reference information is needed for these animals since IOP and tear secretion are affected by many factors including breed varieties and ecological environment [7]. Mydriatics are widely used in the treatment of the disorders of the anterior segment of the eye and for routine evaluation of the posterior segment ocular structures [6].
The current literature indicates that there are limited number of studies about IOP and tear secretion in sheep and goats, with no specific reference addressing these parameters on Saanen goat and Merinos sheep.

In this study, we aimed to compare IOP and tear secretion of Saanen goats, Merinos sheep as well as their offspring and to determine whether these parameters are affected by species, sexes and ages with and without topical atropine administration.

Materials and Method

ANIMALS

The study was performed on 20 Merinos sheep and 20 Saanen goats aged 1-2.5 years, and on 20 lambs and 20 kids (10 females, 10 males) of 15-20 days old. These animals were divided into 8 groups as shown in Tables 1 and 2.

EXPERIMENTAL DESIGN

Prior to the study, all animals underwent thorough clinical and ophthalmoscopic examinations, of which the healthy cases were selected as candidates for the experimentation. The tear secretion and IOP were measured using STT (Schirmer-Tränentest*, Germany) and Schiotz Tonometer (ST) (Riester, Schiotz Tonometer, 5112, Germany), respectively. All measurements were performed on the subjects prior to and five minutes after the instillation of atropine sulfate (Vetaş, Turkey) between 6 and 10 p.m. for three consecutive days. The first priority was given to the measurements of adult animals in order not to hinder them from grazing. All measurement procedures were carried out by the same investigator. The measurements of tear secretion were performed on the animals restrained in standing position and that of IOP on supine position. Tear secretion and IOP measurements were performed bilaterally on each animal and their average values were recorded. Tear secretion was measured with the STT strips placed in the lower conjunctival fornices of the eyes. The strips were left in place for one minute and then the part moistened with tear was recorded as STT value. For lambs and kids, 2 drops of atropine sulfate were given, whilst 4 drops of atropine sulfate were instilled to the eyes of the sheep and goats. IOP was measured with Schiotz tonometry placed perpendicularly onto the cornea. At each measurement three successive IOP readings from the right and left eyes were obtained, their arithmetical means were recorded and subsequently these data were recalibrated with standard Schiotz tonometry table.

STATISTICAL ANALYSES

The statistical analyses of the data obtained were assessed on SPSS ver.17.0 software. The comparisons between two independent groups were done with Independent Samples T-Test, the comparisons among more than two groups were performed using One-way ANOVA and Post-hoc Tukey tests. The results of the statistical analyses were presented as mean±standard deviation (mean±SD) and the significance level was set to be p<0.05, p<0.001 and p<0.005.

Results

The detail statistical evaluation of tear secretion and IOP values measured prior to and 5 minutes after instillation of atropine sulfate on days 1, 2 and 3 in sheep, goats, lambs and kids are presented in Table 1, and their average values for the three successive days are presented in Table 2. These results indicated a non significant difference (p>0.05) between IOP and tear secretion values of sheep and goats in terms of species and age. On the other hand, it was found that tear secretion and IOP values of lambs and kids were significantly lower than those of the sheep and goats (p<0.001) and that gender did not affect IOP and tear secretion values (p>0.05). It was also found that topical atropine sulfate instillation significantly reduced tear secretion in all animals (p<0.001).

Discussion

Normal tear secretion and IOP values have been reported in many domestic species [3, 4]. However, there are only few reports about normal values of these variables in sheep and goats [7, 17]. The present study tried to determine whether species, age and sex can affect tear secretion and IOP value, and topical atropine can influence tear secretion in Merinos sheep and Saanen goats, two common small ruminant breeds in our country.

Since breed, sex, age, body weight, skull structure, ecological environment in which the animals are bred, are the factors affecting tear functions, all these individual and environmental factors should be taken into consideration to assess tear secretion accurately [5,20]. A possible reason why normal tear secretion differs between various animal species can be the fact that every animal species has conjunctival recesses of different sizes and eyelids of different anatomic shape [12, 13]. Although there are some reports [9, 10, 14, 21] denoting disadvantages of STT strips(e.g. eye irritation), we did not observe any similar complication during and after this procedure provided that sterile STT strip is accurately placed.

Some investigators reported [1, 13, 14, 21, 23] that tear secretion and IOP values of male animals were higher than those of female animals, whilst other authors [19, 22], denoted that sex did not have any effect on these variables. In agreement with the later authors, we found that sex did not affect tear volume and IOP in Merinos lambs and Saanen kids (p>0.05). On the other hand, we did not find any statistically significant differences between IOP and tear secretion levels of the adult sheep and goats, which were 1-1.5 and 2-2.5 years old, in terms of species and age (p>0.05). Moreover, we found that tear secretion and IOP values of lambs and kids were significantly lower than those of adult sheep and goats (p<0.001, Table 1). That tear secretion levels of lambs and
The tear secretion levels reported by GHAFFARI et al [7] conform well with the average value (18.24±1.89 mm) of the current study in Merinos sheep aged 2-2.5 years contrary to marked difference between the values of these two studies with those of RIBEIRO et al [17] and BROADWATER et al [4]. As previously mentioned, the cause of this difference can be related to individual performance, placement of the strips in the conjunctival fornix and the diversities of filter papers [5,7,17,19]. With regard to IOP values, an alteration of about 30-50% can be observed.

### Table I: The values (Mean±SD) of normal STT, STT with topical atropine instillation (STTa), and normal IOP in the sheep, goat, lamb and kids measured for 3 days.

<table>
<thead>
<tr>
<th>Groups</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test</td>
<td>Sheep</td>
<td>Sheep</td>
<td>Goats</td>
<td>Goats</td>
<td>Lambs, F</td>
<td>Lambs, M</td>
<td>Kids, F</td>
<td>Kids, M</td>
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<tr>
<td>Days</td>
<td>1-1.5 yrs</td>
<td>2-2.5 yrs</td>
<td>1-1.5 yrs</td>
<td>2-2.5 yrs</td>
<td>15-20 days</td>
<td>15-20 days</td>
<td>15-20 days</td>
<td>15-20 days</td>
</tr>
<tr>
<td>STT</td>
<td>18.40±2.19</td>
<td>18.80±1.82</td>
<td>17.66±2.12</td>
<td>18.66±1.71</td>
<td>17.33±1.54</td>
<td>16.80±1.85</td>
<td>15.26±1.09</td>
<td>14.33±1.58</td>
</tr>
<tr>
<td></td>
<td>18.53±1.98</td>
<td>17.86±2.12</td>
<td>18.24±1.68</td>
<td>17.51±1.52</td>
<td>16.06±1.52*</td>
<td>15.51±1.61*</td>
<td>14.22±1.75*</td>
<td>14.42±1.45*</td>
</tr>
<tr>
<td>STTa</td>
<td>11.33±4.81</td>
<td>11.60±2.13</td>
<td>12.00±1.96</td>
<td>12.13±2.29</td>
<td>9.80±1.20</td>
<td>8.80±1.33</td>
<td>9.73±1.27</td>
<td>10.06±1.09</td>
</tr>
<tr>
<td></td>
<td>11.43±2.61</td>
<td>11.86±1.40</td>
<td>12.06±2.08</td>
<td>9.26±0.96</td>
<td>9.00±0.75</td>
<td>8.00±0.75</td>
<td>9.00±1.00</td>
<td>0.90±1.00</td>
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<tr>
<td>IOP</td>
<td>19.84±1.70</td>
<td>21.31±3.40</td>
<td>19.74±3.76</td>
<td>20.10±4.43</td>
<td>18.64±4.30</td>
<td>16.45±4.15</td>
<td>15.33±4.61</td>
<td>18.38±4.04</td>
</tr>
</tbody>
</table>

M: Male, F: Female

Significant when compared the group 1 (a: p<0.05, b: p<0.01, c: p<0.001), group 2 (d: p<0.05, e : p<0.01, f: p<0.001), group 3 (g : p<0.05, h : p<0.01, j: p<0.001), group 4 (k: p<0.05, m: p<0.001), group 5 (n: p<0.05, p: p<0.005) or group 6 (r: p<0.05), with others in the same line.

### Table II: Normal STT, STTa and normal IOP values (Mean±SD) obtained from all animals for three days.

<table>
<thead>
<tr>
<th>Groups</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
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</thead>
<tbody>
<tr>
<td>Test</td>
<td>Sheep</td>
<td>Sheep</td>
<td>Goats</td>
<td>Goats</td>
<td>Lambs, F</td>
<td>Lambs, M</td>
<td>Kids, F</td>
<td>Kids, M</td>
</tr>
<tr>
<td>Days</td>
<td>1-1.5 yrs</td>
<td>2-2.5 yrs</td>
<td>1-1.5 yrs</td>
<td>2-2.5 yrs</td>
<td>15-20 days</td>
<td>15-20 days</td>
<td>15-20 days</td>
<td>15-20 days</td>
</tr>
<tr>
<td>STT</td>
<td>18.55±1.98</td>
<td>18.24±1.89</td>
<td>17.86±1.96</td>
<td>18.91±1.68</td>
<td>16.06±1.52*</td>
<td>15.51±1.61*</td>
<td>14.22±1.75*</td>
<td>14.42±1.45*</td>
</tr>
<tr>
<td></td>
<td>11.58±3.89*</td>
<td>11.24±1.74*</td>
<td>12.02±1.52*</td>
<td>12.17±1.98*</td>
<td>9.17±1.15*</td>
<td>8.88±0.93*</td>
<td>8.8±1.6*</td>
<td>9.2±1.5*</td>
</tr>
<tr>
<td>IOP</td>
<td>19.86±2.36</td>
<td>20.40±3.53</td>
<td>19.79±3.90</td>
<td>19.89±4.35</td>
<td>18.54±3.72</td>
<td>16.46±4.25*</td>
<td>16.53±4.30*</td>
<td>16.43±4.33*</td>
</tr>
</tbody>
</table>
seen to exist between the former three studies and ours. This situation can be explained by the breed varieties and regional ecological diversities[7,11] as well as the instruments used for measurement of IOP in both studies. GHAFFARI et al [7] have used applanation tonometry (Tono-PenVetTM) whereas the present study performed this measurement with Schiotz tonometry.

In our study, when we compared the groups with and without atropine, we found that atropine decreased significantly tear volume in all groups (Table I, p<0.001). That atropine reduced significantly tear volume in sheep, goats, lambs and kids in this study was found to be consistent with statistically significantly decreased tear secretion level with a single dose of 1% tropicamide, a topical mydriatic agent, in clinically normal horses [6], and with acepromazine or xylazine in normal cats [5].

In conclusion, whilst there was no significant differences between sheep and goats in terms of IOP and tear volume levels (p>0.05), the differences between sheep and lambs and between goats and kids were found to be significant (p<0.001). On the other hand, it was denoted that tear volume and IOP levels of lambs and kids were significantly lower than that of adult sheep and goats (p<0.001); that sex did not have an effect on IOP and tear volume levels (p>0.05) and atropine reduced significantly the amount of tears in all animals (p<0.001).

References
