INTRODUCTION

The precorneal tear film (PTF) is extremely important for the maintenance of the ocular surface health. Its functions include primary oxygen source to the avascular cornea, removal of debris and exfoliated cells through drainage, lubricant between the eye lids and a source of protective antimicrobial proteins. The PTF is described as a three structurally and functionally unique layers consisting of lipid, aqueous and mucin components. The cornea is extremely vulnerable to injury during general anesthesia when the palpebral reflex and the corneal reflex cannot protect the eye from drying, from corneal abrasions or from other corneal injuries. Dry corneal epithelium may be easily desquamated and removed by the normal movement of the eyelids that can cause painful postanesthetic ulcers of the cornea (Gelatt, 2013). The objective of this study was to investigate the correlation between the duration of gas anesthesia with isoflurane and the reduction of tear production in geriatric patients. The hypothesis was that longer the anesthetic duration would cause a lower postanesthetic tear production.

MATERIALS AND METHODS

The study was conducted on 15 canine patients of different ages, belonging to different breeds. The patients were anesthetized for different surgical procedures: ovariohysterectomy, castration, mammaryctomy, cistotomy (Table 1). Physical examination, complete blood count and ophthalmic examination on both eyes were performed. Patients did not receive any ocular medication and had no abnormalities during examination. Aqueous tear production was measured in millimetres per minute by use of the Schirmer Tear Test (STT) by placing the tear test strip in the ventral conjunctival fornix approximately one-third of the distance from the lateral to medial canthus (Fig. 1).
The objective of this study was to investigate the correlation between duration of gas anesthesia with isoflurane and the reduction of tear production in geriatric patients. The study was conducted on 15 dogs (8 males and 7 females, ages between 9 and 14 years old) that were presented at the Faculty of Veterinary Medicine of Bucharest between September 2012-2013. The study included patients of different ages, belonging to different breeds.

### MATERIALS AND METHODS

Anesthesiologists. Patients premedication was made with Midazolam 0.2 mg/kg and Butorphanol 0.2 mg/kg injected intramuscularly (IM) or intra venously (IV). All patients had Schirmer Tear Test (STT) readings taken prior to induction (Costea, 2015). Intermittent positive-pressure ventilation (IPPV) was initiated by use of a volume-cycled ventilator delivering 12 breaths/minute to achieve a target end-tidal CO₂ of 35-45 mm/Hg. Oxygen flow was initially delivered at 2 L/minute with the vaporizer set to achieve an end-tidal concentration of 2.0% isoflurane within 10 minutes of induction (Costea, 2015). After the target concentration was achieved, oxygen flow was decreased to (500+10/kg) L/minute. Crystalloid solutions were administered at 3-5 ml/kg/hour IV throughout anesthesia.

At the end of the surgery, the isoflurane was turned off and the Schirmer Tear Test was performed. Afterwards, the residual inhalant anesthetic was flushed from the breathing circuit. IPPV was discontinued and patients were extubated when they began to breathe spontaneously and to reject the endotracheal tube (Costea, 2016). After STT was measured, an ocular lubricant was applied to each of the patient’s eyes to protect the cornea.

### RESULTS AND DISCUSSIONS

Mean tear production for Schirmer Tear Test measurement in all patients at baseline for the right and the left eyes were 20 mm/min +/- 5 mm/min (Figure 2). From the total of 15 dogs: 3 dogs that were under isoflurane anesthesia for less than 30 minutes had a final STT of 15 mm/min +/- 3 mm/min compared with those in which anesthesia time exceeded 30-40 minutes where the final STT was 5 +/- 3 mm/min (Table 2). Aqueous tear production was reduced in patients during anesthesia and returned to baseline values immediately in the recovery period, for all the cases.

<table>
<thead>
<tr>
<th>Crt. No.</th>
<th>BREED</th>
<th>AGE</th>
<th>GENDER</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Poodle</td>
<td>14 years</td>
<td>♂</td>
</tr>
<tr>
<td>2</td>
<td>Pekinese</td>
<td>13 years</td>
<td>♂</td>
</tr>
<tr>
<td>3</td>
<td>Half breed</td>
<td>13 years</td>
<td>♂</td>
</tr>
<tr>
<td>4</td>
<td>Golden Retriever</td>
<td>12 years</td>
<td>♂</td>
</tr>
<tr>
<td>5</td>
<td>Poodle</td>
<td>12 years</td>
<td>♂</td>
</tr>
<tr>
<td>6</td>
<td>Maltese Bichon</td>
<td>12 years</td>
<td>♂</td>
</tr>
<tr>
<td>7</td>
<td>Bichon</td>
<td>11 years</td>
<td>♂</td>
</tr>
<tr>
<td>8</td>
<td>Great Dane</td>
<td>11 years</td>
<td>♂</td>
</tr>
<tr>
<td>9</td>
<td>Cocker</td>
<td>11 years</td>
<td>♂</td>
</tr>
<tr>
<td>10</td>
<td>Mini Schnautzer</td>
<td>10 years</td>
<td>♂</td>
</tr>
<tr>
<td>11</td>
<td>Schitzu</td>
<td>10 years</td>
<td>♂</td>
</tr>
<tr>
<td>12</td>
<td>Cross breed</td>
<td>10 years</td>
<td>♂</td>
</tr>
<tr>
<td>13</td>
<td>Cross breed</td>
<td>10 years</td>
<td>♂</td>
</tr>
<tr>
<td>14</td>
<td>Bichon</td>
<td>9 years</td>
<td>♂</td>
</tr>
<tr>
<td>15</td>
<td>Cross breed</td>
<td>9 years</td>
<td>♂</td>
</tr>
</tbody>
</table>

After the test strip was inserted, the eyelids were gently held closed for 1 minute, at which time the STT was read and recorded. Testing was performed bilateral (Fig. 2). Before each test was done, the inferior cul-de-sac was gently swabbed with a cotton- tipped applicator to remove accumulated tears and mucus. Tear production was measured at baseline (before intubation) and immediately after the isoflurane was turned off.

Anesthesia was induced with Propofol (4-6 mg/kg IV). Intermittent positive-pressure ventilation (IPPV) was initiated by use of a volume-cycled ventilator delivering 12 breaths/minute to achieve a target end-tidal CO₂ of 35-45 mm/Hg. Oxygen flow was initially delivered at 2 L/minute with the vaporizer set to achieve an end-tidal concentration of 2.0% isoflurane within 10 minutes of induction (Costea, 2015). After the test strip was inserted, the eyelids were gently held closed for 1 minute, at which time the STT was read and recorded. Testing was performed bilateral (Fig. 2). Before each test was done, the inferior cul-de-sac was gently swabbed with a cotton- tipped applicator to remove accumulated tears and mucus. Tear production was measured at baseline (before intubation) and immediately after the isoflurane was turned off.

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The decreased intra-anesthetic lacrimation observed in the present study may be attributable to vagolytic or sympathomimetic effects of the gas anesthetic (Ding, 2003). Because vagolytic and sympathetic activity were not measured in this study they cannot be definitively ruled out as factors. Decreased intra-anesthetic lacrimation may be described as a blockade of trigeminal function associated with anesthetic depth. Lachrymal secretion is mostly dependent on afferent sensory function of the trigeminal nerve, followed by an efferent motor response by the facial nerve (Acosta et al., 2004). The anesthetic depth may have abolished trigeminal sensory function in a way similar to the effect of inhalant anesthetics on other afferent input, thereby disabling a lacrimal response. Once the patient was able to stand, indicating the return of the afferent and efferent nerve function, sensory input from the trigeminal nerve was likely restored, resulting in normal tear production (Acosta et al., 2004). Intra-anesthetic tear production may have also been caused by lagophthalmos. This is not the cause of decreased aqueous tear production but it is a condition that accelerates tear evaporation via decreased blinking. Dogs with lagophthalmia may have a rapid evaporation of tear film from the corneal surface because of increased corneal exposure or decreased tear film quality (lipid or mucin). Tear evaporation was not evaluated during or immediately following anesthesia so, Schirmer Tear Test readings could not be correlated with tear film break-up time data (Tzubota, 1998). Duration of anesthesia in the present study had a causal relationship with decreased postanesthetic tear production in geriatric dogs. This reveals that procedures longer than 30 minutes cause a decrease in tear production. The hitch of lagophthalmos was not controlled in this present study; no effort was made to close the dogs’ eyes during anesthesia. Future studies investigating the effect of lagophthalmos on intra-anesthetic aqueous tear production may include STT and tear film break-up time measurement in geriatric dogs with one eyelid taped closed and one eyelid left open during general anesthesia.

**CONCLUSIONS**

All geriatric dogs in this study had a decreased intra-anesthetic tear production during isoflurane anesthesia. Ocular lubricant or tear replacement should be used as a corneal protectant for patients that are going to be under gas anesthesia with isoflurane for more than 30 minutes.

<table>
<thead>
<tr>
<th>Crt. No.</th>
<th>Anesthetic Duration (hour)</th>
<th>Baseline</th>
<th>STT after isoflurane was turned off</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>25 minutes</td>
<td>OD 15 mm/min, OS 15 mm/min</td>
<td>OD 12 mm/min, OS 12 mm/min</td>
</tr>
<tr>
<td>2</td>
<td>25 minutes</td>
<td>OD 20 mm/min, OS 18 mm/min</td>
<td>OD 18 mm/min, OS 15 mm/min</td>
</tr>
<tr>
<td>3</td>
<td>30 minutes</td>
<td>OD 20 mm/min, OS 15 mm/min</td>
<td>OD 15 mm/min, OS 15 mm/min</td>
</tr>
<tr>
<td>4</td>
<td>40 minutes</td>
<td>OD 15 mm/min, OS 15 mm/min</td>
<td>OD 5 mm/min, OS 5 mm/min</td>
</tr>
<tr>
<td>5</td>
<td>45 minutes</td>
<td>OD 15 mm/min, OS 25 mm/min</td>
<td>OD 0 mm/min, OS 10 mm/min</td>
</tr>
<tr>
<td>6</td>
<td>1 hour</td>
<td>OD 20 mm/min, OS 15 mm/min</td>
<td>OD 0 mm/min, OS 0 mm/min</td>
</tr>
<tr>
<td>7</td>
<td>1 hour</td>
<td>OD 15 mm/min, OS 15 mm/min</td>
<td>OD 0 mm/min, OS 0 mm/min</td>
</tr>
<tr>
<td>8</td>
<td>1 hour</td>
<td>OD 20 mm/min, OS 25 mm/min</td>
<td>OD 10 mm/min, OS 10 mm/min</td>
</tr>
<tr>
<td>9</td>
<td>1 hour</td>
<td>OD 20 mm/min, OS 18 mm/min</td>
<td>OD 5 mm/min, OS 5 mm/min</td>
</tr>
<tr>
<td>10</td>
<td>1 h 10 min</td>
<td>OD 18 mm/min, OS 15 mm/min</td>
<td>OD 0 mm/min, OS 0 mm/min</td>
</tr>
<tr>
<td>11</td>
<td>1 h 15 min</td>
<td>OD 15 mm/min, OS 15 mm/min</td>
<td>OD 5 mm/min, OS 5 mm/min</td>
</tr>
<tr>
<td>12</td>
<td>1 h 15 min</td>
<td>OD 15 mm/min, OS 10 mm/min</td>
<td>OD 0 mm/min, OS 0 mm/min</td>
</tr>
<tr>
<td>13</td>
<td>2 hours</td>
<td>OD 15 mm/min, OS 15 mm/min</td>
<td>OD 5 mm/min, OS 5 mm/min</td>
</tr>
<tr>
<td>14</td>
<td>2 hours</td>
<td>OD 15 mm/min, OS 12 mm/min</td>
<td>OD 7 mm/min, OS 5 mm/min</td>
</tr>
<tr>
<td>15</td>
<td>2 h 15 min</td>
<td>OD 15 mm/min, OS 15 mm/min</td>
<td>OD 5 mm/min, OS 0 mm/min</td>
</tr>
</tbody>
</table>
postanesthetic tear production in geriatric dogs.

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induced by selective stimulation of corneal and

conjunctival sensory nerve fibers. Invest Ophthalmol

Vis Sci;45:2333–2336. 27.


Propofol induction anesthesia for central venous

catheterization in dogs with renal failure. Journal of

Biotechnology, Volume 208, Supplement, Pages

S42–S43.

Costea Ruxandra, 2016. Anaesthesia considerations for

critically ill patients. EJCAP volume 26 (3).


control of the mouse lacrimal gland. Invest


Ding C, Walcott B, Keyser KT 2007. The alpha1- and

beta1-adrenergic modulation of lacrimal gland


concentrations of isoflurane do not block the

sympathetic nervous system activation from


Evaluation of aqueous tear production in dogs

following general anesthesia. J Am Anim Hosp

Assoc; 36:427–430.


Assoc; 175:585–586.

Molly K. Shepard, DVM; Peter J. Accola, DVM; Luis A.

Lopez, MVZ; Michael R. Shaughnessy; Erik H.

Hofmeister, DVM, MA, 2011. Effect of duration

and type of anesthetic on tear production in dogs


rate variability in sevoflurane and nitrous oxide

anesthesia: effects of respiration and depth of


Picker O, Scheeren TWL, Amdt JO 2001. Inhalation

anaesthetics increase heart rate by decreasing

cardiac vagal activity in dogs. Br J

Anaesth;87:748–754.

Powell CC, Martin CL 1989. Distribution of cholinergic

and adrenergic nerve fibers in the lacrimal glands


Tangkrisanavinont V 1984. Stimulation of lacrimal

secretion by sympathetic nerve impulses in the


Tzubota K. 1998. Tear dynamics and dry eye. Prog Retin

Eye Res;17:565–596
ANIMAL PRODUCTION, PUBLIC HEALTH AND FOOD QUALITY CONTROL
EVALUATION OF DIFFERENT TYPES OF BEER QUALITY AND CONSUMERS’ SAFETY

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Abstract

In the context of high consumption of different types of beer and given the consumer demand regarding the food safety, the purpose of this study was represented by the quality control of these products using physicochemical methods. The data revealed information regarding pH value, alcohol content, carbon dioxide content, value of the original, real and present extract, energetic value and foam quality determination. The results showed an uniformity of data from lots of the same sort, which proved a core in applying of the quality management system. In conclusion, it can be said that products obtained in the studied unit meet quality requirements imposed by applicable standards and consumption of these products presents no risk of physicochemical nature.

Key words: beer, food safety, quality, physicochemical analyse.

INTRODUCTION

Beer was discovered thousands of years ago and became a very often consumed beverage for its refreshing and pleasant taste, but also as a reason to relax, meet with friend and social interaction (Walton, 2006).

A moderate beer consumption of around 330 millilitres per day for women and two beers for man brings a real benefit for health, reducing the risk of diabetes, osteoporosis and cardiovascular disease (Banu et al., 2011).

It is considered that consumption of beer and wine are more beneficial than drinking sparkling wine or distilled beverages (Tăpăloagă, 2012).

In this context, this paper presents an analysis of 3 different types of beer and quality parameters and legislative requirements.

MATERIALS AND METHODS

The material was represented by 40 samples of two types of pale lager, divided into 2 groups for each type, depending on the time of sampling and 10 samples of flavoured beer who have undergone physical and chemical analyzes, respectively measuring of pH, alcohol content, carbon dioxide content, value of the original, real and present extract (Anton Paar method), energetic value and foam quality determination (Hartong method). The sampling scheme is shown in Table 1.

Table 1. Sampling scheme

<table>
<thead>
<tr>
<th>Type</th>
<th>Group 1</th>
<th>Group 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type 1 pale lager</td>
<td>10 samples</td>
<td>10 samples</td>
</tr>
<tr>
<td>Type 2 pale lager</td>
<td>10 samples</td>
<td>10 samples</td>
</tr>
<tr>
<td>Type flavoured beer</td>
<td>10 samples</td>
<td></td>
</tr>
</tbody>
</table>

RESULTS AND DISCUSSIONS

Taking into account the fact that for the 2 types of pale lager were obtained a large number of results, we presented the average for each type of analyse. For the flavoured type, the results were presented for each sample.

Regarding the quality of the type 1 pale lager for both groups (group 1.1 and 1.2), all results are within the limits imposed by the standard, the pH should be between 4.1 to 4.4, with average obtained 4.34 (figure 1), alcohol content had an average value of 4.94% compared to limits of 4.3 to 5.8% (figure 1) concentration of CO2 varied between 5.1% and 5.5%, the average value being 5.5% (figure 1).

The maximum value of original extract imposed by producer is 11,25˚P, which means that the analyzed beers were within the limits with an average of 11.04 ˚P, the real extract should be between 3.56 and 3.47 ˚P, the studied beers have an average of 3,46˚P, the present extract has a value of 1.65 ˚P, being the limits imposed by the manufacturer (figure 2).