Short Communication

Schirmer Tear Test 1 as a method to measure tear production value in normal Kintamani dogs

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Abstract

Keratoconjunctivitis sicca (KCS) is a dry eye condition due to an inadequacy of the eyes to produce tears. This condition can be diagnosed using the Schirmer Tear Test 1 (STT1). The Kintamani dog, a Chinese Chow Chow-derivate, is now popular globally to be kept by dog lovers. This study aims to determine the normal value of tear production in Kintamani dogs. Forty eyes from above one-year-old twenty Kintamani dogs were used in this study. Tear production value was measured using STT1 strip. The result showed that the mean of tear production in Kintamani dogs was 23.37±4.415 mm/min. Statistically, there was no significant difference between the right eye and left eye and between sexes. In summary, tear production value in Kintamani dogs is not affected by sex and is higher than other breeds.

Keywords: Kintamani dog, Schirmer Tear Test 1 (STT1), tear production value

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Introduction

Recently, the Kintamani dog was recognized internationally as a native dog of Indonesia and is known to originate from a Chinese Chow Chow breed (Puja *et al*., 2005). These days, the Kintamani dog attracts many dog lovers not only from its place of origin, Kintamani, Bali but also overseas. This Chow Chow-derivate is now competing in many dog shows. One of the parameters that is rated is health status.

Eyes are the window on the world both for humans and animals, not only as a source of sight-seeing but also functioning as an organ to secrete tears. Thus, it is important to take care of the eyes. The preocular tear film is composed of three layers: 1) The outermost consisting of lipids produced by the tarsal glands secreted by the orbital gland (60%); 2) The third eyelid gland (40%); and 3) The innermost one, which consists of hydrated glycoprotein mucin (Ribeiro *et al*., 2008). Tears function to maintain the health and the normal function of the cornea and conjunctiva (Dodi, 2015). Particularly, the function of the tear is to lubricate, act as nutrient for the cornea, remove debris from the corneal surface and in antibacterial action (Hartley *et al*., 2006). Inadequacy of the eyes to produce tears will cause dry eye, which is known as keratoconjunctivitis sicca (KCS). The disease, which is also known as dry eye syndrome, is a lacrimal apparatus pathology condition (Dodi, 2015). Permanent damage to the cornea can occur due to impairment of one or more preocular tear film layers and thus will cause severe KCS (Ribeiro *et al*., 2008). A study by Barnett and Joseph (1987) reported that female dogs are more susceptible to experimental drug-induced KCS than male dogs. Therefore, eyes should be taken care of by the owner to prevent any clinical manifestations.

Examination of the eyes can be done in many ways and one of them is the Schirmer Tear Test (STT). Dodi (2015) defined STT as the measurement of the lacrimal secretion quality. This test is commonly used both in humans and animals as a basic ophthalmology test for tear production. For the Kintamani dog, there is still no record about any tear production value studies with STT1. It will be complicated a veterinarian to diagnose for an ophthalmic disorder. Hence, this study will give a record of tear production value in normal Kintamani dogs using STT1.

Materials and Methods

This study used 40 eyes of 20 captive-purebred Kintamani dogs with an age-median of 2.25 years old (mean±std= 2.85±2.55); 11 intact males and 9 intact females, which were located in Bali, Indonesia. The use of Kintamani dogs in this study was approved by the Ethics Committee, Faculty of Veterinary Medicine, Udayana University (No. B/97/UN.14.2.9/PT.01.04/ 2021). The dogs were selected through observing normal ophthalmological status without any abnormalities.

Every dog was restrained and an STT strip (Schirmer Strip, Medical Equipment India, India) was inserted into the central area of ventral conjunctiva of both eyes without any anesthetic (Fig. 1). This method is known as STT1 (Savini *et al*., 2008). In this study, each right eye of each dog was tested first for STT1. The strip was taken out after a minute from the conjunctiva and the level was seen by looking at the marker on a millimeter (mm) scale. Data was recorded.

Data was then analyzed with an independent *t*-test to compare the tear production between the right eye and left eye and between male and female. The analysis was performed with SPSS Program Ver. 22 (IBM® Company, USA).

Figure 1 Insertion of Schirmer Tear Test 1 (STT1) strip into the central area of ventral conjunctiva of each eye in Kintamani dogs

Results and Discussion

The production value of tears in Kintamani dogs is presented in Table 1. It shows that the female has a higher tear production value than the male, yet it shows no significant difference ($P > 0.05$). In this study, the right eye had a higher tear production value than the left eye but there was no significant difference ($P > 0.05$). The table also shows that the mean of tear production value in Kintamani dogs is 23.37±4.415 mm/min.

This study used the STT1 method which is a measuring a tear-reflex product without anesthesia (Savini *et al*., 2008). Hamor *et al*. (2000) defined STT1 as an estimate of basal and reflex aqueous tear production. The test value can be used to diagnose KCS in a dog that shows clinical signs (Hartley *et al*., 2006), if the measurement result is <5 mm/min (Dodi, 2015). KCS in dogs can be caused by several things, including congenital, metabolic, infectious, drug-induced, neurogenic phenomena and radiation, iatrogenic, idiopathic and immune-mediated causes (Dodi, 2015). In that study, KCS could also be divided into 3 stages based on clinical signs: 1) Initial; 2) Intermediate; and 3) Final.

In this present study, we did not use wild Kintamani dogs due to their aggressive behavior and uncontrolled environment. Captive-purebred kintamani dogs are hard to find and their inaccessibility inhibits gathering data (and requires owners' consent). Thus, we used only 20 captive-purebred Kintamani dogs in this study.

Table 1 Tear production value using STT1 in Kintamani dogs

Sex	Right Eye (mm/min)	Left Eye (mm/min)	Mean (mm/min)
Male (n=11)	23.27±4.962[a]	23.27±6.513[a]	23.27±4.885[ǂ]
Female (n=9)	24.11±6.133[a]	22.89±4.885[a]	23.50±4.054[ǂ]
Mean	23.65±5.383	23.10±5.693	23.37±4.415

Note: Different alphabet superscript in a column shows a significant difference ($P < 0.05$) and ǂ superscript in a column shows no significant difference ($P > 0.05$).

The result of our study corroborates the study of Dodi (2015) that reported the normal tear production value in dogs is >15 mm/min. This study also had a similar result to the study of Hartley *et al*. (2006), where females had a higher value than males. The analysis result of significance between the right eye and left eye had a similar result with the report of Hamor *et al*. (2000), which did not differ significantly in 5 different dog breeds. They also mentioned that the different result is reflected from the study design, whereas in this study we conducted the test on the left eye prior to the right eye.

This current study has higher tear production than the study of Hamor *et al*. (2000), which was evaluating tear production in 5 different dog breeds (Beagle: 20.2±2.5 mm/min; Labrador Retriever: 22.9±4.1 mm/min; English Springer Spaniel: 20.7±3.2 mm/min; Golden Retriever: 21.8±3.7 mm/min; and Shetland Sheepdog: 15.8±1.8 mm/min). The different results of STT value might have been influenced by the different type of skull based on breed which could affect corneal sensitivity (Barrett *et al*., 1991).

In this study, sex makes no significant difference in STT1 value. Studies of Hamor *et al*. (2000), and Hartley *et al*. (2006), reported similar results that sex was not associated with STT1 value. The higher result in female dogs could be affected by various stages of the estrus cycle and pregnant and lactating animals which have the effect of sex hormones on tear production and function in animals (Hartley *et al*., 2006). Intact dogs, which we used in this study, might not have the protective effects on tear production of sex hormones to be predisposed to KCS development (Hamor *et al*., 2000).

The study of Broadwater *et al*. (2010), reported that juvenile dogs, <6 months old, had lower tear production (19.0±6.1 mm/min) than our result, where we used older dogs than their study. However, another study found that there were no significant differences by age in tear production values ranging 6 months to 11 years old in several dog breeds (Hamor *et al*., 2000). Lower tear production in juvenile dogs could be caused by nerves that innervate the lacrimal gland and the lacrimal gland tissue which might not have been completely developed yet (Broadwater *et al*., 2010).

In conclusion, the tear production value of normal Kintamani dogs is 23.37±4.415 mm/min which is higher compared to the other dog breeds. Sex is known not to have any affect on tear production value in normal Kintamani dogs. Moreover, STT1 can determine the tear production value to support veterinarians diagnose and monitor eye disease progression in Kintamani dogs. The authors recommend for further studies to add a greater number of samples in the future to gain more statistical power.

Conflict of interest: The authors declare there is no conflict of interest in this study.

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