Van Veterinary Journal

https://dergipark.org.tr/tr/pub/vanvetj

Cite this article as: **Sağlam K, Düz E (2023).** Measurement of Tear Production in Van Cats with the Phenol Red Thread Test. *Van Vet J*, 34 (1), 14-17. DOI: https://doi.org/10.36483/vanvetj.1191721

ISSN: 2149-3359 **Original Article** e-ISSN: 2149-8644

Measurement of Tear Production in Van Cats with the Phenol Red Thread Test

Kamil SAĞLAM[1,*] Erkan DÜZ[2]

[1] *Ondokuz Mayis University, Faculty of Veterinary Medicine, Department of Surgery, 55139, Samsun, Türkiye*
[2] *Van Yuzuncu Yil University, Gevas Vocational School, Veterinary Department, 65080, Van, Türkiye*

Received: 20.10.2022 Accepted: 21.12.2022

ABSTRACT The aim of this study is to determine normal tear secretion levels in healthy Van cats by PRT test and to investigate the relationship between tear level and gender and age. Twenty adult Van cats, who were brought to the clinic and found to be healthy after examination, were included in the study. These cats were tested without the use of any medicine. The cats who took part in the experiment ranged in age from two to five years, with a mean age of 3.25±1.07. There were 12 female cats and 8 male cats in the group. Commercial kits were utilized for the testing. The mean PRT value for the Van cat was determined as 12.3±1.895 (9-18) mm/15 sec. Males had a mean of 11.875±1.246 (10-13) mm/15 sec. and females had a mean of 12.583±2.234 (9-18) mm/15 sec. There was no statistically significant difference in the mean of males and females in the group and no difference as age increased (p>0.05). In conclusion, the PRT test findings in this study can be used as reference values in the diagnosis of eye diseases affecting the tear production ability of Van cats.

Keywords: *PRT test, Tear production, Van cats.*

ÖZ

Van Kedilerinde Gözyaşı Üretiminin Fenol Kırmızısı Emdirilmiş İplik Testi ile Ölçülmesi

Bu çalışmanın amacı, sağlıklı Van kedilerinde normal gözyaşı salgı düzeylerinin PRT testi ile belirlenmesi ve gözyaşı düzeyi ile cinsiyet ve yaş arasındaki ilişkinin araştırılmasıdır. Çalışmada kliniğe getirilen ve muayene sonrası sağlıklı olduğuna karar verilen yirmi erişkin Van kedisi yer aldı. Bu kediler herhangi bir ilaç kullanılmadan test edildi. Deneye katılan kedilerin yaşları iki ile beş yıl arasında değişmekte olup, ortalama yaş 3.25±1.07'dir. Grupta 12 dişi ve 8 erkek kedi vardı. Test için ticari kitler kullanıldı. Van kedisi için ortalama PRT değeri 12.3±1.895 (9-18) mm/15 sn olarak belirlendi. Erkeklerde ortalama 11.875±1.246 (10-13) mm/15 sn. dişilerde ise ortalama 12.583±2.234 (9-18) mm/15 sn. olarak ölçüldü. Grupta dişi ve erkek ortalamaları arasında istatistiksel olarak anlamlı bir fark bulunmadı ve yaş arttıkça fark yoktu (p>0.05). Sonuç olarak, bu çalışmadaki PRT testi bulguları Van kedilerinin gözyaşı üretme kabiliyetini etkileyen göz hastalıklarının tanısında referans değer olarak kullanılabilir.

Anahtar Kelimeler: *Gözyaşı üretimi, PRT test, Van kedileri.*

INTRODUCTION

The PRT test has been used to define and publish normal PRT reference values in various animals (Biricik et al. 2003; Alkan et al. 2004a; Kılıç and Kulualp 2012; Gilgers 2017; Kulualp et al. 2019) and humans (Ghislandi and Lima 2016). In Turkey, the Van cat breed is legally protected, and it is one of the well-known breeds. It is a native breed of eastern Turkey's Van Lake region. It has white coat and golden or blue eyes. Van cats sometimes have different colored eyes (Ates 2000).

Adequate tear secretion is required for the maintenance of eye health. A decrease in the amount of tear is defined as dry eye or keratoconjunctivitis sicca (KCS) and is corneal and conjunctival inflammation (Martin 2010). When dry eye is suspected, measuring the quantity of tears is an important diagnostic tool (Piccione et al. 2008). It has been reported that the breed variable influences tear secretion of animals, and that even when the same tests are used, the results obtained differ depending on the breed (Saito and Kotani 2001; Alkan 2004b; Kulualp 2019). KCS is typically diagnosed due to clinical changes, and Schirmer tear test (STT) levels. When clinically misdiagnosed as KCS, it can lead to more severe eye damage (Alkan et al. 2004a). As a result, full ocular and clinical findings are sometimes used for determining primary reason for KCS, while hematological work or different manipulations may be required to provide a definitive diagnosis (Maggs et al. 2017).

Dry eye is formed by several conditions, and it is a condition with multiple causes and occurs in species

✉ *Corresponding author: kamil.saglam@omu.edu.tr

where appropriate test intervals are unknown, diagnosing dry eye is often challenging and complex (Moor et al. 2009; Selk Ghaffari et al. 2017).

Several methods are useful to measure the decrease in tear production that causes dry eye. The Schirmer tear test (STT) is the most commonly used of these (Collins et al. 1994; Kaswan et al. 1995). The Schirmer test has drawbacks as varying healthy levels between species, taking a long time to administer, and causing negative eye influence due to the big test strip (Ghishlandi and Lima 2016). For these reasons, the phenol red impregnated cotton yarn test (PRT) was created as different method to STT (Biricik et al. 2003). The PRT test has the advantage of stimulating low-grade reflex tears in a short period of time as 15 seconds. A 75 mm long thread with a 3 mm twist at one end is impregnated with phenol red, a pH indicator, for the PRT test. For 15 seconds, the thread is inserted into the conjunctival fornix (Hamano et al. 1983; Saito and Kotani 2001).

There was no study that examined the amount of tear production specific to Van cats in the literature review. The aim of this study is to determine normal tear secretion levels in healthy Van cats by PRT test and to investigate the relationship between tear level and gender and age.

MATERIAL AND METHODS

Ethical approval for this study was obtained from Van Yuzuncu Yil University Animal Experiments Ethical Board on 11.01.2022 with the number 2755.2122-604.01.02-2630. This study included 20 healthy Van cats, 8 male and 12 females, aged 2 to 5 years, coming to the veterinary clinic. Clinical examination of the cats revealed no systemic or eye disorders. A helper manually restrained the cats. Aggressive cats were excluded from the study. The study did not use of any sedatives or anesthetics. The same researcher and an assistant carried out all tests in August and September, between 12-15 pm, at 25-30 °C air temperature and 20-30% humidity. The test eye was chosen at random (Oria et al. 2015). The test used sterile cotton threads of 75 mm length that had been treated with phenol red and had folded ends of 3 mm (Zone-Quick; AYUMI Pharmaceutical Corp. Tokyo, Japan).

Each cat's eyelids were opened with the fingers for the measurement, and the PRT test thread was inserted into the lateral fornix of the lower eyelid at a distance of around one third (Figure 1). After waiting for 15 seconds for the thread to become wet with tears, it was removed. With the aid of the millimetric ruler on the yarns' packaging, the yellow of the phenol red-impregnated yarn and the wet region, which turns orange red due to the effects of slightly alkaline tears, were measured immediately (Sebbag et al. 2015).

Figure 1. Measurement of tear secretion in a Van cat using a PRT test thread.

Statistical Analysis

IBM SPSS for Windows, ver. 23 was used to analyze the study's data. The Shapiro Wilk test was used to determine whether the data followed the normal distribution. Power analysis of the data was performed. To compare PRT values that did not exhibit a normal distribution by gender, the Mann Whitney U test was performed. The association between advancing age and PRT levels was investigated using the Spearman correlation coefficient, one of the non-parametric techniques. The threshold for significance was set at $p<0.05$. The descriptive statistics of the mean amount of tear production in the study group and the standard deviation of the mean were calculated. The group means were calculated, and the correlation between PRT values and gender and age was assessed.

RESULTS

The PRT values in the study are given Table 1. Group mean tear PRT value for healthy Van cats was determined as 12.3±1.895 (9-18) mm/15 sec. According to gender, the mean value was 12.583±2.234 (9-18) mm/15 sec. in females and 11.875±1.246 (10-13) mm/15 sec. in males. The group's average age was found to be 3.25 ±1.07. Males had a mean age of 3.125±1.246 while females had a mean age of 3.333±0.985.

Table 1. PRT and age comparisons by gender**.**

	Mean± SD.	Median (min-max)	Mean±SD.	Median (min-max)	Mean± SD.	Median (min-max)	p*
PRT (mm/15sec)	12.583± 2.234	12 (9 - 18)	11.875± 1.246	12 (10- 13)	12.3 ± 1.895	12 (9 - 18)	0.577
Age	3.333 ± 0.985	3 (2 - 5)	3.125 ± 1.246	3 (2 - 5)	3.25 ± 1.07	3 (2 - 5)	0.512
	Female (n=12)		**Male (n=8)**		**Total (n=20)**		

There was no statistically significant difference in PRT median values based on gender (p=0.577). Males had a median value of 12 while females also had a median value of 12 (p=0.577). Similarly, no statistical difference in median age values was found (p=0.512). Males had a median age of three, while females also had a median age of three.

When the relationship between age and PRT was tested using Spearman rank correlation, it was found that there was no statistically significant relationship (r=0.045; p=0.852). In females, the relationship between age and PRT was r=-0.123, while in males, the relationship was r=0.069. Both of these values were not statistically significant (p values of 0.702 and 0.871, respectively).

DISCUSSION AND CONCLUSION

Many researchers have reported average PRT values in healthy cats (Brown et al. 1997; Oria et al. 2015; Sebbag et al. 2015). Age, gender, race, lacrimal system diseases, topical and systemic drugs, stress, environmental temperature, and humidity can all have an impact on tear secretion (Beech et al. 2003; Margadant et al. 2003; Piccione et al. 2008; Ghaffari et al. 2010, Ghaffari et al. 2012; Maggs et al. 2017; Dedousi et al. 2019). It has been reported that the stress of ophthalmic evaluation manipulation in cats can result in disorders that reduce tear production (Ghaffari et al 2012). The short duration of the PRT test and the minimal discomfort it causes are regarded as significant advantages (Hamano et al. 1983; Ghislandi and Lima 2016). Some authors reported the mean amount of tear production in cats by PRT as follows: Maggs et al. 2017 reported it as 23 mm/15 sec, Oria et al. 2015 as 27.95±4.79 (26.49 - 29.41) mm/15 sec, Sebbag et al. 2015 as 29 mm/15 (15-37) mm/15 sec, and Brown M. et al. 1997 as 23.04±2.23 mm/15 sec. In the present study, the mean amount of tear produced in healthy Van cats was determined as 12.3±1.895 (9-18) mm/15 sec by PRT test. The normal amount of tears produced in healthy Van cats is quite low compared to previous studies. Because the study was conducted on hot summer days, it could have been influenced by seasonal environmental conditions.

Dry eye has been reported to occur in advanced ages in humans and dogs (Barnett 1988; Vashisht and Singh 2011; Ghishlandi and Lima 2016; Rajaei et al. 2019). In their Schirmer tear test (STT) study, Sendhas et al. reported similar results in elderly cats (Sandhas et al. 2018). In this study, the relationship between increasing age and PRT was not statistically significant in either males or females (p values 0.702 and 0.871, respectively). Because of the young age of the Van cats in the study, it was thought that age-related dry eye had not yet occurred.

Rajaei et al. 2019, found no relationship between gender and tear production in their study with STT in cats. Gender did not affect PRT values in cats, according to Sebbag et al. 2015). In this study, there was no statistically significant difference in mean PRT values by gender between males and females (p=0.577). Gender-related findings are consistent with the data provided by the researchers (Sebbag et al. 2015).

Although PRT has traditionally been based on the principle that yellow cotton thread turns orange or light red when wetted with alkaline tears (Hamano et al. 1983), thread color change in this study was not always very pronounced and the color change was very slight as reported by Sebbag et al. 2015. However, wetness could still be detected (Figure 1).

As a result of the PRT test, the normal amount of tear production and reference range in healthy Van cats were determined. In conclusion, the PRT test findings in this study can be used as reference values in the diagnosis of eye diseases affecting the tear production ability of Van cats.

CONFLICTS OF INTEREST

The authors declare that there is no conflict of interest for this study.

AUTHOR CONTRIBUTIONS

Idea / Concept: KS, ED
Supervision / Consultancy: KS
Data Collection and / or Processing: KS, ED
Analysis and / or Interpretation: KS, ED
Writing the Article: KS
Critical Review: KS

REFERENCES

Alkan F, Izci C, Tepeli C, Koc Y (2004a). Evaluation of the Schirmer tear test in clinically normal Turkish hunting dogs. *Vlaams Dier Tijd schrift*, 73, 263-279.

Alkan F, İzci C, Tepeli, C, Koç Y (2004b). Evaluation of the Schirmer tear test in two Turkish breeds of shepherd dogs. *Revue Méd Vét*, 155 (2), 67-70.

Ates CT (2000). Investigation of Morphological and Physiological Properties of the Distribution of Single-Eye Van Cat. Ph.D. thesis, Institute of Health Sciences, Van Türkiye.

Barnett K (1988). Keratoconjunctivitis sicca: sex incidence. *J Small Anim Pract*, 29, 531–534.

Beech J, Zappala RA, Smith G, Lindborg S (2003). Schirmer tear test results in normal horses and ponies: effect of age, season, environment, sex, time of day and placement of strips. *Vet Ophthalmol*, 6, 251–254.

Biricik HS, Oğuz H, Köse M (2003). Kuzularda gözyaşı sekresyonunun iplik testi ile klinik olarak değerlendirilmesi. *F Ü Sağ Bil Vet Derg*, 17, 211-215.

Brown, M. H., Brightman, A. H., Butine, M. D., & Moore, T. L. (1997). The phenol red thread tear test in healthy cats. *Vet and Comp Ophthalmol*, 7 (4), 249-252.

Collins BK, Johnson PJ, Moore CP, Collier LL (1994). Immune-mediated keratoconjunctivitis sicca in a horse. *Vet and Comp Ophthalmol*, 4 (2) 61-65.

Dedousi A, Karatzia MA, Katsoulos PD (2019). Reference values of Schirmer tear test in sheep and the effect of season on the test results. *Acta Vet Hung*, 67 (4), 553-560.

Ghaffari MS, Hajıkhanı R. Sahebjam F, Akbareın H, Gdezardy H (2012). Intraocular pressure and schirmer tear test result in clinically normal Long-Eared Hedgehogs (Hemiechimus auritus): reference values. *Vet Ophthalmol*, 15, 206-209.

Ghaffari MS, Malmasi A, Bokaie S (2010). Effect of acepromazine or xylazine on tear production as measured by Schirmer tear test in normal cats. *Vet Ophthalmol*, 13 (1), 1-3.

Ghislandi GM, Lima GC (2016). Comparative study between phenol red thread test and the Schirmer's test in the diagnosis of dry eyes syndrome. *Rev Bras Oftalmol*, 75, 438-442.

Gilgers BC (2017). Equine Ophthalmology. Third Edition. Ames, Iowa, USA. John Wiley & Sons Inc, 1-39.

Hamano H, Hori M, Hamano T et al. (1983). A new method for measuring tears *Clao*, 9 (3), 281–289.

Kaswan RL, Bounous D, Hirsh SG (1995). Diagnosis and management of keratoconjunctivitis sicca. *Vet Med*, 90, 539–560.

Kılıç S, Kulualp K (2012). Farelerde modifiye evaporatif kuru göz (kg) modelinin bazi klinik parametreler yönünden değerlendirilmesi. *F Ü Sağ Bil Vet Derg*, 26, 21-26.

Kulualp K, Yurdakul İ, Kılıç S (2019). Kangal Irkı Köpeklerde Fenol Kırmızısı Pamuk İpliği Testi (FKPT) Kullanılarak Fizyolojik Aköz Gözyaşı Üretim Miktarının Belirlenmesi. *Harran Üniv Vet Fak Derg*, 8, 64-69.

Maggs D, Miller P, Ofri R (2017). Slatter's Fundamentals of Veterinary Ophthalmology E-Book. (pp. 193-495). Elsevier Health Sciences.

Margadant DL, Kirkby K, Andrew SE et al. (2003). Effect of topical tropicamide on tear production as measured by Schirmer's tear test in normal dogs and cats. *Vet Ophthalmol*, 6, 315–320.

Martin CL (2010). Lacrimal system. In: Ophthalmic Disease in Veterinary Medicine, (pp. 219-240). Manson Publishing Ltd, London.

Moore JE, Graham JE, Goodall EA et al. (2009). Concordance between common dry eye diagnostic tests. *Br J Ophthalmol*, 93, 66-72.

Oriá A, Martins Filho E, Raposo AC, Araújo N, Junior DG (2015). Lacrimal production of cats: Schirmer tear test, phenol red thread tear test and endodontic absorbent paper point. *Enciclopedia Biosfera.* 11 (22), 2085-2091.

Piccione G, Giannetto C, Fazio F et al (2008). Daily rhythm of tear production in normal horse. *Vet Ophthalmol*, 1, 57–60.

Rajaei SM, Faghihi H, Williams DL, Aftab G (2019). Evaluation of tear production using the Schirmer tear test I in healthy cats; effect of age, life stage, sex, breed and neuter status. *Vet Rec*, 184 (26), 799.

Saito A, Kotani T (2001). Estimation of lacrimal level and testing methods on normal beagles. *Vet Ophthalmol*, 4, 7-11.

Sandhas E, Merle R, Eule, JC (2018). Consider the eye in preventive healthcare–ocular findings, intraocular pressure and Schirmer tear test in ageing cats. *J Feline Med Surg*, 20 (12), 1063-1071.

Sebbag L, Kass PH, Maggs DJ (2015). Reference values, intertest correlations, and test-retest repeatability of selected tear film tests in healthy cats. *J Am Vet Med Assoc,* 246 (4), 426-435.

Selk Ghaffari M, Sabzevari A, Ghamsari S, Shad H (2017). Determination of reference values for intraocular pressure and Schirmer tear test results in clinically normal domestic donkeys (Equus asinus). *Vet Rec*. 181, 565.

Vashisht S, Singh S (2011). Evaluation of Phenol Red Thread test versus Schirmer test in dry eyes: A comparative study. *Int J App Basic Med Res*, 1, 40-42.