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Animal Welfare Related to Evaluate Intraocular Pressure in Anatolian Buffaloes: Preliminary Report

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Abstract: One of the main cause of stress in livestock is the vision problems. The goal of this study was to determine Intraocular Pressure (IOP) in Anatolian Buffaloes (AB) by means of applanation tonometry using Tono-Pen XL for the investigation of a stress factor in welfare of the anatolian buffaloes. A total of 2118 eyes were examined from 1059 apparently healthy AB aged between 1 and 8 years old from both sexes. IOP of AB were measured with Tono-Pen XL three times for each eyes in the morning at noon and in the evening during afternoon examination. IOPs of the left eyes were found to be 22.05±2.68 mmHg (range 16.5-27.3 mmHg) whereas the right eyes were 22.07±2.68 mmHg (range 16.1-27.0 mmHg). Comparison of the tonometry between the right and left eyes of AB showed no significant difference. IOP was decreased in accordance with the age of the animal. To the knowledge, this is the 1st report of tonometrical investigation performed in AB. It was determined that IOP for AB could be 22.05±2.68 mmHg (range 16.1-27.3 mmHg).

Key words: Anatolian buffaloe, intraocular pressure, applanation tonometry, Tono-Pen XL, age, Turkey

INTRODUCTION

Water buffaloes belong to Bovidae family in terms of zoological point of view are divided into two groups as African and Asian buffaloes. Asian ones are further subdivided into 2 groups as wild and domesticated buffaloes. Domestic buffaloes are classified as river and swamp buffaloes (Van den Berg, 1990). Anatolian Buffaloes (AB) cluster within the river type belonging to the Mediterranean group (Cockrill, 1974). Since, animal welfare aims a life away from undesired feelings like pain, suffering and stress, absence of stress response is accepted as an indicator for welfare mood in animals. Welfare status of an animal depends primaril on how the animal feels and claims that an animal's welfare is compromised only to the extent that the animal suffers (Duncan and Petherick, 1991). Stress has usually been conceived as a reflex reaction that occurs ineluctably when animals are exposed to adverse environmental conditions and which is the cause of many unfavourable consequences, ranging from discomfort to death (Dantzer and Mormede, 1983). Intraocular Pressure (IOP) of AB is the area that has not been exclusively studied so far however reports on cattle related to IOP and tonometry are available but scarce (Gerometta *et al*., 2004; Gum *et al*., 1998; Passaglia *et al*., 2004). Tonometry is a method that using indentation, applanation or rebound techniques and is employed to measure IOP indirectly. Schiotz (Friedenwald, 1937) and Tono-Pen XL (Minckler *et al*., 1987) developed many years ago are commonly used technologies even today. Last three decades, electronical devices have been frequently used however Schiotz indentation tonometry almost 100 years old is still the choice for clinicians (Kontiola, 1997). Applanation tonometers in dogs such as MacKay-Marg, Mentor pneumotonography and Tono-Pen XL devices are reliable options but only the latter two is commercially available (Dziezyc *et al*., 1992; Gelatt *et al*., 1981; Priehs *et al*., 1990).

Tono-Pen XL is an electro- mechanical device that measures the IOP without penetration to the eyes. Although, the Tono-Pen XL was developed for human subjects, the principles of its operation may well apply to eyes of many species. A growing number of researchers and veterinary clinicians are using Tono-Pen instrument to measure IOP in non-human animals (Passaglia *et al*., 2004). The objective of this study was to evaluate and determine IOP for AB using Tono-Pen tonometry (applanation tonometry) since, the data search on this field in the available literature was unrewarding.

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Table 1: Criteria used for health status of Anatolian water buffaloes in this study

Parameters	Healthy	Not healthy
Posture	Normal	Hamped etc.
Temperament	Bright, responsive	Calm, agitated
Appetite	Good	Low or uninterested to food
Body condition	Good	Weak or cachectic
Body temperature (°C)	38-39.5*	Lower or higher values than 38-39.5*
Hear appearance	Smooth, Shiny, Birght	Dull, disorganized, dilapidated
Heart beat/min	70-85*	Lower or higher values than 70-85*
Mucosal appearance	Pinkish	Pale, anaemic, heamorrhagic
Feaces consistency	Solid, physiologic	Watery, semi-solid, very solid
Feaces odour	Aromatic	Pungent
Respiratory system evaluation	Soft blowing sounds, longer and louder on inspiration than on expiration	Audible pathologycal tracheal and lung evaluation sounds, coughing and nasal discharge
Respiration rate min^{-1}	12-28*	Lower or higher values than 12-28*

*Dalir-Naghadeh *et al.* (2006)

MATERIALS AND METHODS

In this study, a total of 2118 eyes from 1059 apparently healthy AB between 1 and 8 years of age from both sexes were used from different farms located in Afyonkarahisar region, Turkey. Since, water buffaloes show aggresive behaviour towards unfamiliar persons apart from their owners for a period of 3 months prior to the study farms were visited everyday at the same time by researchers to be accepted by the animals to produce reliable measurements. According to the owners, none of the buffaloes had medications at least 2 months before the study. All animals were examined for the health status whether they had diseases or not (Table 1). In addition, gynaecologic evaluation was carried out to make sure that animals were not pregnant. Animals that were cachectic, excessively fat or having suspected infectious diseases were not included in the study.

Animals were physically restrained in a chute. Nasal clips were used for some aggressive animals. Eyes were closely examined and defined that there were no diseases associated with the eyes. To exclude any corneal diseases that could interfere with sound opthalmalogical examination, eyes were stained with fluourescene and Schirmer tear test I was performed. Any cornea absorbed minute amount of fluourescene and tear production <15 mm were not included in the study. Study was carried out for 3 months between March and May 2009. For the measurment of IOP both eyes were locally anaesthesized with 5% proparacain HCl (Alcaine, Alcon Istanbul, Turkey). Eyelids were manually retained applying lowest pressure then the Tono-Pen instrument (TonoPen-XL, Medtronic Solan, USA) was calibrated everyday, it was used. Latex head of the Tono-Pen XL was changed after every 100 applications. The same person (KP) performed the tonometry throughout the study. Three measurements were done for each eyes during morning, noon and evening evaluations. Student t test was used for the differences between the right and left eyes and Pearson correlation analysis was used for the differences between the age and IOP of the animals. Significant level was set at $p<0.05$.

RESULTS AND DISCUSSION

The minimum and maximum IOP values were shown in Table 2. According to the data minimum IOPs were 16.50 mmHg for the left eye and 16.10 mm Hg for the right eye whereas maximum IOPs were 27.30 mmHg for the left eye and 27 mmHg for the right eye. The average IOP for the left eye was 22.05±2.68 mmHg and it was 22.07±2.68 mmHg for the right eye. There was no statistically significant differences in IOP between the left and right eyes ($p>0.05$). The age of the animals were varied from 1-8 years. The relationship between age and IOP was shown in Fig. 1 and Table 3. There was a negative correlation between the age and IOP. This difference was significant ($p<0.05$).

This is the 1st report on IOP determination of AB in the literature according to the knowledge. Reports on ocular tonometry in cattle are also infrequent since, the incidence of spontaneous glaucomas are rare (Mertel *et al*., 1996; Miller and Gelatt, 1991).

Gum (1991) compared IOP in normal dairy cows by applanation tonometry using Mackay-Marg tonometer. In their part I study of Holstein Friesian (n = 15) and Jersey (n = 17) cattle the mean IOP was 27.5±4.8 mmHg (range 16-39 mmHg) for both breed indicating no statistically significant difference (Gum *et al*., 1998). According to their part 2 study of Holstein Friesian (n = 15) and Jersey (n = 12) cattle the mean IOPs by Mackay-Marg and TonoPen-XL tonometry were 28.2±4.6 mmHg (range 19-39 mmHg) and 26.9±6.70 mmHg (range 16-42 mmHg), respectively. Comparison of these two tonometers produced no significant differences. Similarly in an equine study, no significant difference was also observed between IOP measurements by Mackay-Mark and Tono-Pen tonometers (Kitazawa and Horie, 1975).

Table 2: The highest and lowest IOP for Anatolian water buffaloes

Factors	Left eye	Right eye	Mean
Number of animals	1059.00	1059.00	-
Mininum IOP	16.50	16.10	16.30
Maximum IOP	27.30	27.00	27.15
Mean IOP	22.05	22.07	22.06
Standard deviation	2.68	2.68	2.68

Table 3: IOP of Anatolian water buffaloes according to the age

		IOP±SD	
Age	No. of animals	Right eye	Left eye
1.0	216	22.55±0.18	22.54±0.18
1.5	20	22.66±0.59	22.75±0.58
2.0	268	22.37±0.16	22.24±0.16
2.5	1	23.40±2.65	23.60±2.65
3.0	168	22.17±0.20	22.16±0.20
3.5	1	21.30±2.65	21.10±2.65
4.0	129	21.80±0.23	21.74±0.23
5.0	63	21.60±0.33	21.60±0.23
5.5	7	21.50±1.00	21.60±1.00
6.0	87	20.94±0.28	20.93±0.28
6.5	14	22.18±0.71	22.19±0.71
7.0	61	21.54±0.34	21.57±0.34
7.5	7	20.06±1.00	20.20±1.00
8.0	17	21.93±0.64	21.97±0.64

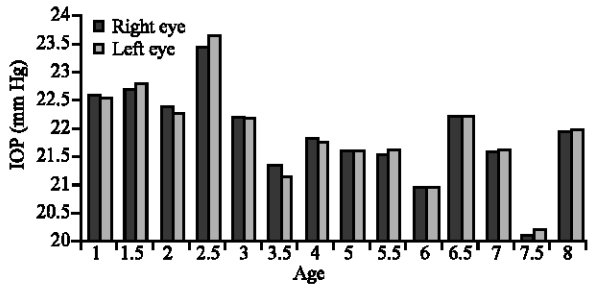

Fig. 1: IOP of Anatolian water buffaloes according to the age

Factors that effecting IOP are various. In humans, it was shown that differences in diurnal and nocturnal IOP can be as high as 3-6 mmHg. This fluctutation could be 30 mmHg even 50 mmHg in glaucoma cases (Hoskins and Kass, 1989). Diurnal variation of IOP in man is the maximum between morning and noon and minimum between the late night and the early hours of the morning. However in some cases, peak IOP was observed at noon or in the evening and this indicated inconsistent diurnal variation (Hoskins and Kass, 1989; Thurmon *et al*., 1996). IOP during winter was found to be showing higher seasonal variation (Thurmon *et al*., 1996). For 3 weeks after the last steroid application increased IOP could be noted in cattle (Gerometta *et al*., 2004).

Blinking of the eyelids and eye movements have been associated with IOP since blinking increased IOP as much as 10 mmHg and eyelid compression caused 90 mmHg elevation in IOP (Thurmon *et al*., 1996). Anaesthetic agents such as trichloroethylene decreased IOP (McClure *et al*., 1976). Studies in normal horses without sedation and topical nerve block of eyelid showed that the mean IOP by Mackay-Marg tonometry was 28.6±4.8 mmHg (Van der Woerdt *et al*., 1995) and it was 20.6±4.7 mmHg for the left eye and 20.4±3.7 mmHg for the right eye (Trim *et al*., 1985). In addition normal horses with topical anaesthesia and auriculopalpebral nerve blocks the mean IOP was 17.1±3.9 mmHg for the left eye and 18.4±2.2 mmHg for the right eye (Woelfel *et al*., 1964).

In the study, tonometry was performed in the morning at noon and in the evening hours to eliminate diurnal variations. As confirmed by the owners, none of the animals recieved steroids or derivatives therefore, any theurapeutics was not required. Under this circumstance there were no occasions to have effect on IOP values. Before Tono-Pen XL evaluation, application of topical anaesthesia provided animals to react the mechanical irritation with a minimum response.

The topical anaesthetic used in this study is the choice for IOP measurements. However, topical anaesthesia may cause a drop in IOP. To the experience because animals could not remain stable during manipulation, restraint of animals and topical anaesthesia should be necessary for the eye tonometry evaluation. We believe that clinicians intend to measure IOP using topical anaesthesia need reference values for AB that was generated in this study.

Not only advanced age directly but also obesity and pulse rate can indirectly affect IOP. It was shown that in young calves anterior chamber manometric and tonometric values were lower (Gum, 1991; Miller *et al*., 1990). However in humans, IOP was decreased as age increased in both sexes (Thurmon *et al*., 1996). Moreover, it is not clear whether this is the case for all mammals. In the study, drop in IOP was increased in concordance with the age of the animal. IOP was 22.55±0.18 mmHg at the age of 1 whereas, it was 21.95±0.642 mmHg at the age of 8 indicating drop of almost 1.5 unit. Despite the fact that statistical analysis of findings produced significant data, the decrease of 1-2 units in IOP was considered nonsignificant clinically. Due to absence of available reports on IOP values for AB up to date which tonometers could be the choice for measurement of IOP was problematic in the study. Therefore, we preferred to use Tono-Pen previously shown to be reliable and noninvasive application in various species (Gelatt and MacKay, 1998; Gum *et al*., 1998; Passaglia *et al*., 2004). Tono-Pen XL tonometer with combination of topical anaesthesia may be the simple methodology for the diagnosis of tonometric disorders in AB.

CONCLUSION

From results, it is founded that the data generated here for the first time showing IOP of AB as 22.06±2.68

mmHg (range 16.1-27.3 mmHg) could be beneficial criterion for clinicians and researchers who are interested in the field.

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