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## Factors influencing the occurrence of ocular neoplasms in cattle and buffaloes

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### Abstract

The present study was conducted in 117 bovine cases suspected for neoplasia, including 114 cattle and 3 buffaloes. Data about the animal including history, clinical signs, nutritional status, type of husbandry, climatic conditions, age, sex and breed were collected. The size, location, shape, colour and any changes related to the tumours were recorded. The highest incidence of ocular tumours was recorded in 3 to 6 years age group followed by 7 to 10 years and in Holstein Friesian crossbred followed by Jersey crossbred cattle. The highest occurrence was noticed in females and the highest incidence was recorded during the summer season. The maximum number of tumours was found located in the third eyelid followed by whole eye involvement. The occurrence of ocular tumours was more in the left eye and in the animals reared under semi-intensive management system and allowed for grazing. The findings in the present work suggest a multifactorial etiology to ocular neoplasms.

**Keywords:** Factors, occurrence, ocular neoplasms, cattle, buffaloes

### 1. Introduction

Squamous cell carcinoma is the most commonly occurring neoplasm affecting the bovine eye (Sivaseelan *et al.*, 2008) [19]. Bovine ocular squamous cell carcinoma (BOSCC) or “Cancer eye” is a primary neoplasm of epithelial origin that may occur in different ocular and periocular tissues including the palpebral skin, corneal and conjunctival epithelial surfaces, third eyelid and limbus. It occurs with high frequency in cattle all over the world (Tsujita and Plummer, 2010) [20], and it is the leading cause of enucleation among all other ocular diseases (Schulz and Anderson, 2010) [18]. Its occurrence is highest during summer and lowest during winter. It is commonly seen in beef cattle in comparison to dairy cattle because of exposure to more sunlight (Radostits *et al.*, 2000) [15]. Hereditary factors, age and dietary habits, ultraviolet light and circumocular pigmentation are the major epidemiologic risk factors for tumour development and have all been reported to play a role in the etiopathogenesis of bovine ocular squamous cell carcinoma. In addition, the etiology has been linked to several viral agents, especially bovine papilloma virus and bovine herpes virus type 1 and 5 (Prasanna Lakshmi *et al.*, 2020) [11]. The present work was carried out to study the influence of different factors in the occurrence of ocular tumours in cattle and buffaloes.

### 2. Materials and Methods

A total of 117 suspected cases of neoplasia which includes 114 cases in cattle and three in buffaloes brought to the Large Animal Surgical Outpatient Ward, Veterinary Clinical Complex, Veterinary College and Research Institute, Namakkal and Veterinary dispensaries in and around Namakkal, Tamil Nadu were observed during the period from April 2021 to November 2022. Data about the animal including history, clinical signs, nutritional status, type of husbandry, climatic conditions, age, sex and breed were collected. The size, location, shape, colour and any changes related to the tumours were recorded.

### 3. Results

In the present study, out of 117 cases, the highest incidence was recorded in 3 to 6 years age group (68.38 Percent) followed by 7 to 10 years (27.35 percent) (Table 1). The highest incidence of ocular neoplasia with 74.35 percent (n= 87) was recorded in Holstein Friesian crossbred cattle (Table. 2) followed by 19.66 percent (n=23) in Jersey crossbred cattle and among them, 97.44 percent (n=114) were female animals (Table.3).

Out of 97.44 percent (n= 114) female animals, 36.84 percent (n=42) were pregnant. The highest incidence was noticed in the summer season (47.01 percent) followed by monsoon (36.75 percent) (Table 4). The highest number of tumours were found in the third eyelid (36.75 percent) followed by whole eye involvement (18.81percent) and in the limbus (17.10 percent) (Table. 5 and Fig 1.). The incidence was highest in the left eye (44.44 percent) (Table 6). Out of 117 cases, the pigmentation in the eyelid was found lacking in 3.41 percent (n=4) of animals (Fig 2.). In the present study, about 61.54 percent (n=72) of animals with ocular tumours had black coloured head with white patches on the forehead and face. About 70.08 percent of animals were maintained under the semi-intensive system of management and allowed for grazing.

**Table 1:** Age-wise incidence of ocular neoplasms in cattle and buffaloes

S. No.	Age of animals	No. of animals	Percentage
1.	0-2 years	03	2.56
2.	3-6 years	80	68.38
3.	7- 10 years	32	27.35
4.	>10 years	02	1.71
	Total	117	100

**Table 2:** Breed-wise incidence of ocular neoplasms in cattle and buffaloes

S. No.	Breed of animals	No. of animals	Percentage
<b>Cattle</b>			
1.	Holstein Friesian cross bred	87	74.35
2.	Jersey cross bred	23	19.66
3.	Hallikar	02	1.71
4.	Pulikulam	01	0.86
5.	Alambadi	01	0.86
<b>Buffalo</b>			
6.	Graded Murrah	03	2.56
	Total	117	100

**Table 3:** Sex-wise incidence of ocular neoplasms in cattle and buffaloes

S. No.	Sex of animals	No. of animals	Percentage
1.	Male	03	2.56
2.	Female	114	97.44
	Total	117	100

**Table 4:** Season-wise incidence of ocular neoplasms in cattle and buffaloes

S. No.	Season	No. of animals	Percentage
1.	Summer (March- June)	55	47.01
2.	Monsoon (July- October)	43	36.75
3.	Winter (November – February)	19	16.24
	Total	117	100

**Table 5:** Location of ocular neoplasms in cattle and buffaloes

S. No.	Location of tumour	No. of animals	Percentage
1.	Third eyelid/ Nictitating Membrane	43	36.75
2.	Whole eye involvement	22	18.81
3.	Limbus/ Corneo- scleral junction	20	17.10
4.	Third eyelid and lower eyelid	08	6.84
5.	Upper eyelid	06	5.13
6.	Lower eyelid	06	5.13
7.	Limbus and third eyelid	03	2.56
8.	Third eyelid and upper eyelid	02	1.71
9.	Cornea	02	1.71
10.	Upper and lower eyelid	02	1.71
11.	Sclera	01	0.85
12.	Limbus and lower eyelid	01	0.85
13.	Third, upper and lower eyelid	01	0.85
	Total	117	100



**Fig 1:** Ocular squamous cell carcinoma in the limbus of a crossbred HF cow



**Fig 2:** Ocular squamous cell carcinoma in third eyelid of a crossbred HF cow lacking eyelid pigmentation

**Table 6:** Involvement of eye in ocular neoplasms in cattle and buffaloes

S. No.	Eyes affected	No. of animals	Percentage
1.	Left eye	52	44.44
2.	Right eye	47	40.17
3.	Both the eyes- Bilateral	18	15.39
	Total	117	100

**Table 7:** Etiological factors for ocular neoplasms

S. No.	Parameters	No. of animals	Percentage	
1.	Pigmentation of eyelid	Black	113	96.58
		White	04	3.42
2.	Pigmentation of head and face	Black with white patches on head and face	72	61.54
		White with coloured patches in head and face	26	22.22
		Black head and face	08	6.84
		Coloured head and face	08	6.84
		White head and face	03	2.56
3.	Type of feeding and Management	Extensive- allowed for grazing	16	13.68
		Semi- intensive-grazing and stall feeding	82	70.08
		Intensive- stall feeding	19	16.24

#### 4. Discussion

In the present study, the highest incidence was noticed in 3 to 6 years age group followed by 7 to 10 years which is in accordance with the findings of Prasanna Lakshmi *et al.* (2020)<sup>[11]</sup> who reported the highest incidence in the age group of above 5 years and could be due to longer exposure of adult animals to radiation. The highest occurrence of eye cancer was observed during the summer season. The incidence in cattle is greatest in those geographic areas with the longest hours of sunlight per year and ultraviolet radiation (Jubb *et al.*, 1993)<sup>[7]</sup>. Exposure to sunlight is a factor in the development of the lesions (Carlton and McGavin, 2002; Sastry and Rao, 2002)<sup>[2, 17]</sup>. Chahory *et al.* (2002)<sup>[4]</sup> also suggested that the greater frequency of ocular squamous cell carcinoma is due to UV radiation which is believed to be the primary carcinogen.

The highest number of ocular neoplasia was recorded in the Holstein Friesian crossbred cattle followed by Jersey crossbred cattle as reported earlier by Carvalho *et al.* (2005)<sup>[3]</sup>, Gharagozlou *et al.* (2007)<sup>[6]</sup> and Fornazari *et al.* (2017)<sup>[5]</sup>. In the present study, three cases of ocular neoplasia were reported in buffaloes. The availability of different breeds in a particular geographical location would predispose certain breeds to get affected. The incidence was higher in crossbred animals since the crossbred population is high in this area as reported by Prasanna Lakshmi *et al.* (2020)<sup>[11]</sup>.

The highest incidence of eye cancer was noticed in 97.54 percent of female animals and 2.56 percent of male animals which is in accordance with the earlier reports of Gharagozlou *et al.* (2007)<sup>[6]</sup>, Schulz and Anderson (2010)<sup>[18]</sup> Ramesh Sidhan, (2017)<sup>[16]</sup> and Prasanna Lakshmi *et al.* (2020)<sup>[11]</sup>. The highest occurrence of ocular tumours was noticed in the left eye which is in accordance with Radhakrishnan *et al.* (1999)<sup>[14]</sup> and Kalirajan and Senthilkumar (2016)<sup>[8]</sup> whereas Gharagozlou *et al.* (2007)<sup>[6]</sup>, Fornazari *et al.* (2017)<sup>[5]</sup>, Maan *et al.* (2019)<sup>[9]</sup> and Priyanka *et al.* (2021)<sup>[12]</sup> recorded the highest incidence in the right eye.

In the present study, the occurrence of ocular tumours was found more in the third eyelid which is in accordance with the findings of Carvalho *et al.* (2005)<sup>[3]</sup>, Kalirajan and Senthilkumar (2016)<sup>[8]</sup> and Prasanna Lakshmi *et al.* (2020)<sup>[11]</sup> whereas Priyanka *et al.* (2021)<sup>[12]</sup> recorded the highest occurrence with whole eye involvement. The incidence of ocular squamous cell carcinoma was noticed unilaterally in 84.61 percent of animals and bilaterally in 15.39 percent of animals. These findings concurred with the observations of Gharagozlou *et al.* (2007)<sup>[6]</sup> and Muste *et al.* (2012)<sup>[10]</sup>, who reported higher incidence unilaterally than bilateral occurrence. The eyelid pigmentation was present in 96.58 percent of animals whereas only 3.42 percent of animals lack

eyelid pigmentation. Anderson *et al.* (1977)<sup>[1]</sup> reported that tumours have developed in partially pigmented eyelids and concluded that lesions develop primarily in unpigmented areas.

A higher incidence of ocular squamous cell carcinoma was observed in animals which are reared under semi-intensive system of management where the animals are allowed for grazing in addition to stall feeding. This finding concurred with Tsujita and Plummer (2010)<sup>[20]</sup> who suggested that those animals which are maintained on high levels of nutrition had a higher incidence of tumours and a greater number of affected sites per animal, higher incidences at younger ages and more progressive disease. These findings indicate a possible physiologic effect of high levels of nutrition on tumour development. The present study also concurred with the observations made by Muste *et al.* (2012)<sup>[10]</sup> and Ramesh Sidhan (2017)<sup>[16]</sup>.

#### 5. Conclusion

The incidence of ocular neoplasms is more common in the summer season and the highest occurrence is recorded in Holstein Friesian crossbred cattle with or without circumocular pigmentation which indicates that the occurrence of ocular squamous cell carcinoma is multifactorial which includes age, breed, hereditary, sunlight exposure, grazing and environmental and managerial factors.

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