

Full Length Research Paper

Do dental abnormalities predispose horses to colic?

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Evaluation of dental abnormalities were carried out on a group of 74 polo horses with history of colic (colicky group) and another group of 70 randomly selected polo horses with no history of colic (non-colicky group) under similar environmental and management condition at Lagos Polo Club, Lagos, Nigeria in order to investigate probable correlation between dental abnormalities, routine dental care and predisposition to colic. Visual examination of the horses' oral/dental status was carried out after adequate physical and chemical restraint with intravenous administration of 2% xylazine hydrochloride at dose rate of 1.1 mg/kg body weight. Structured interview of handlers and review of dental health records where available were carried out to investigate routine dental care. One-way analysis of variance (ANOVA), Pearson correlation and linear multiple regression analysis were used to find out associations between dental abnormalities, routine dental care and colic. Thirty-eight (38) horses (51.4%) among the colicky group had dental abnormalities ranging from overjet (4.8%) to dental attrition (26.2%), while twenty-two (22) horses (29.7%) among the non-colicky group had dental abnormalities. Dental caries and sharp enamel point had significant difference ($p < 0.05$) on colic in horses and were positively correlated with colic. There were also positive significant correlation between fractured tooth and overjet ($r = 0.908$) and malposition and overjet ($r = 0.944$), respectively. Age and sex had no significant correlation with dental abnormalities and predisposition to colic, while local breeds were found to be more predisposed to colic due to dental abnormalities ($p < 0.05$). There was also a significant difference ($p < 0.05$) in horses that had no routine dental care and colic. In conclusion, this study indicates that dental caries and sharp enamel points are predisposing factors for colic in horses. Although not all forms of dental abnormalities predispose horses to colic, routine dental examination and care would be beneficial for early diagnosis and prevention of dental abnormalities that may predispose to colic.

Key words: Colic, horses, dental abnormalities, predisposed to colic.

INTRODUCTION

Colic is an important manifestation of gastro-intestinal problems in horses (Adeyefa, 1990) and it is the most prevalent cause of death and second only to lameness in terms of economic losses (Adeyefa, 1990; Cohen and Woods, 1999; NAHMS, 1998; Hillyer et al., 2001). The

incidence of colic has been reported to range from 3.5 to 26% in different countries (Kaneene et al., 1997; Hillyer et al., 2001; Akinrinmade and Olusa, 2009) and some of the identified predisposing factors for colic are age, breed, diet and feeding practices, weather, exercises

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and previous history of colic among others (Uhlinger, 1992; Kaneene et al., 1997; Tinker et al., 1997; Cohen et al., 1999; Hillyer et al., 2001; Traub-Dargatz et al., 2001; Hudson et al., 2001).

Although, dental abnormalities have been perceived to be associated with occurrences of colic (Dabareiner, 1988; Easley, 1996; Ferraro et al., 2006; Olusa and Akinrinmade, 2009), no study has specifically investigated the role of dental abnormalities as a risk factor for colic in horses. Dental abnormalities are common occurrences in horses (Easley, 1996) and any dental problem that makes eating difficult could affect the general body condition of the animal (Henderson, 1990; Easley, 1996). The equine teeth are hypsodont teeth with long anatomic crown much of which are held reserved sub-gingivally in the alveolar bone (Dixon and Du Toit, 2011). Once fully formed, the tooth no longer grows in length but continue to erupt throughout life as occlusal wear takes place. Dental attrition and sharp enamel points are two of the most common dental abnormalities that occur especially in older horses due to irregular wears of the occlusal surfaces of the grinding teeth (Ferraro et al., 2006; Peters, 2006; Olusa and Akinrinmade, 2009). Although, it is generally believed that improperly masticated roughages and concentrates may lead to poor digestibility and subsequent impaction of the small colon or ceacum (Easley, 1996; Dabareiner, 1988; Ferraro et al., 2006), there are no sufficient findings to prove whether or not dental abnormalities could predispose horses to colic. Furthermore, although dental floating is a common routine dental care performed on horses, its beneficial role in apparently healthy horses has however not been ascertained (Carmalt et al., 2004; Carmalt and Allen, 2008).

Nigeria has about 200,000 horse population (Bourn, 1992; FAOSTAT, 2008) and in a previous study conducted among athletically fit polo horses converged during a polo tournament, high prevalence of dental abnormalities was found (Olusa and Akinrinmade, 2009). In another study, colic was found to have a high incidence rate of 14.5% and routine dental practices are often neglected (Akinrinmade and Olusa, 2009). The aim of this study therefore is to investigate if dental abnormalities and lack of routine dental care could predispose horses to colic.

MATERIALS AND METHODS

Dental examination were carried out and compared within two groups of horses. Group A consists of 74 horses with history of colic (colicky group), while group B consists of 70 randomly selected horses with no history of colic (non-colicky group), both from a total horse population of about 340 horses. The horses were kept under similar environmental and management conditions at the Lagos Polo Club, Lagos, Nigeria. Owners consent was taken and the protocol was approved by the Research and Ethics Committee of the College of Veterinary Medicine, University of Agriculture, Abeokuta, Nigeria. The horses were physically restrained in wooden crush and sedated with intravenous administration of 2% xylazine hydrochloride at dose rate of 1.1 mg/kg body weight. The

mouth of the horses was flushed with clean water using drenching gun. The lips were parted and dental examinations were carried out on each horse by two veterinarians as previously described (Olusa and Akinrinmade, 2009). Abnormalities were regarded as any malformation or a state of being unlike the normal condition. A list and definition/description of dental abnormalities investigated and found were as follows: (1) Dental attrition: an occlusal wear of tooth surface; (2) Dental caries: presence of cavities in the infundibulum of tooth which usually contains food debris that promotes bacteria activities; (3) Fracture tooth: any tooth split into two or more parts. The split part(s) could be missing or still present; (4) Gingivitis: an acute or chronic inflammation of the gums generally characterized by congestion and swelling; (5) Hook tooth: portion of dominant lower or upper caudal or cranial cheek teeth overhanging the opposite teeth; (6) Sharp enamel points: these are sharp projections that generally form on the buccal side of the upper cheek teeth and the lingual side of the lower cheek teeth, causing lacerations or ulcers on the cheeks or tongue; (7) Malposition: an improper setting of a tooth in its root socket. The condition may affect more than one tooth and such malpositioned teeth may be prone to secondary dental disorders; (8) Overjet: is a condition in which upper incisors protrude in front of lower incisors, but the upper and lower incisors still make some level of contact with each other.

The age of the horses were estimated according to Parker (2003) and grouped into one of three groups, namely, those below 5 years old as group I (< 5 years); those between 5 and 10 years old as group II (5-10 years) and those above 10 years old as group III (> 10 years). Breeds and sex were determined and geldings were regarded as males in this study. Structured interview of handlers and review of dental health records where available, were used to investigate routine dental care. Data were analyzed by SPSS (16.0 Version). Types of dental abnormalities observed were presented in percentages, while inferential statistics of one-way analysis of variance (ANOVA), linear multiple regression and pearson correlation were carried out in order to analyze association between dental abnormalities, routine dental care and colic within and between the two groups. A 95% confidence interval was used and values were taken as statistically significant at ($P < 0.05$).

RESULTS

The sex, breeds and age distribution of the two groups of horses are as shown in Table 1. A total of forty-two (42) dental abnormalities were found in thirty-eight (38) horses (51.4%) out of the seventy-four (74) colicky horses examined for oral/dental soundness, while in the non-colicky group, a total of twenty-six (26) dental abnormalities were found in twenty-two (22) horses (29.7%). Table 2 compares the types of dental abnormalities found in the 2 groups of horses, while Table 3 presented the prevalence of dental care. Dental caries [$F(2, 3) = 13.000$] and sharp enamel point [$F(1, 4) = 21.000$] had significant difference ($p < 0.05$) on colic in horses and are positively correlated with colic (Table 3). There were also positive significant correlation between fractured tooth and overjet ($r = 0.908$) and malposition and overjet ($r = 0.944$), respectively (Table 4). Age and sex had no significant correlation ($p > 0.05$) with dental abnormalities and predisposition to colic, while local breeds were found to be more predispose to colic due to dental abnormalities ($p < 0.05$) (Table 5). Only 6% of respondents to the self-conducted structured interview provided routine

Table 1. Sex, breed and age distribution of colicky and non-colicky horses.

Group of horses	Sex		Breed			Age (Years)		
	Male	Female	Argy	Local	ND	<5	5-10	>10
Colicky horses	25	49	25	38	11	14	36	24
Non-colicky horses	33	37	28	33	9	26	29	15
Total	58	86	53	71	20	40	65	39

Argy: Argentine thoroughbred; Local: Arab, Chad, Sudanese, Dangola and their crosses; N.D: Not determined.

Table 2. Comparison of prevalence of some dental abnormalities in colicky and non-colicky horses.

S/N	Dental abnormalities	Colicky horses {No/Prevalence (%)}	Non-colicky horses {No/Prevalence (%)}
1	Dental attrition	11 (26.2)	9 (34.6)
2	Dental caries	3 (7.1)	2 (7.7)
3	Fracture tooth	4 (9.5)	1 (3.8)
4	Gingivitis	5 (11.9)	2 (7.7)
5	Hook tooth	6 (14.3)	4 (15.4)
6	Malposition	3 (7.1)	1 (3.8)
7	Overjet	2 (4.8)	0 (0)
8	Sharp enamel point	8 (19.0)	7 (26.9)
	Total	42 (100)	26 (100)

Table 3. Prevalence of routine dental care in colicky and non-colicky horses.

Dental care	Colicky horses {No/Prevalence (%)}	Non-colicky horses {No/Prevalence (%)}	Total
Routine dental care (at least once in 12 months)	5 (6.8)	8 (11.4)	13
No dental care	69 (93.2)	62 (88.6)	131
Total	74	70	144

dental care to their horses. There was a significant difference ($p < 0.05$) in horses that had no routine dental care and colic.

DISCUSSION

The result of this study showed that only dental caries and sharp enamel points are significantly associated with colic and are capable of predisposing affected horses to colic. Not all forms of dental abnormalities had any significant association with colic. Dental attrition is an occlusal wear of tooth surface which begins when opposing teeth come into occlusion and their occlusal surfaces grinds off each other (Baker, 1991; Kene and Agbo, 1998; Kene and Uwagie-Ero, 2001; Dixon et al., 2011). The degree of wear usually depends on the type of tooth, the species of animal and the texture of food material being chewed (Jubb et al., 1993) and any asymmetry in the position of the jaw or of the teeth could result

unto uneven dental wear (Dixon et al., 2011). Although dental attrition has the highest prevalence in both groups of horses studied, it was not significantly associated with colic ($p > 0.05$). It could thus have been more of physiological rather than pathological origin (Kene and Uwagie-Ero, 2001). Dental attrition is thus not a predisposing factor for colic.

Dental caries had significant difference in predisposition to colic in horses. Caries is characterized by destruction of the calcified dental tissue with bacterial fermentation action of the food debris hidden in cavities in the infundibulum of the affected cheek tooth (Dixon et al., 2011). Although the most common type of dental caries identified in equine teeth is maxillary cheek teeth (CT) infundibularcemental caries with prevalence ranging from 13 to 100% in horses over 12 years of age (Colyer, 1906; Honma et al., 1962; Dixon et al., 2000; Brigham and Duncanson, 2000), high level of severe peripheral dental caries involving all classes of teeth (incisors, canines and CT) have also been found in horses (Dixon et al., 2011).

Table 4. Effects of dental abnormalities on colic in horses.

Dental abnormality	ANOVA	Sum of squares	df	Mean square	F	Sig.
Dental attrition	Between groups	1.333	2	0.667	0.333	0.740
	Within groups	6.000	3	2.000		
	Total	7.333	5	-		
Dental caries	Between groups	4.333	2	2.167	13.000	0.033
	Within groups	0.500	3	0.167		
	Total	4.833	5	-		
Fractured tooth	Between groups	2.333	2	1.167	0.778	0.534
	Within groups	4.500	3	1.500		
	Total	6.833	5	-		
Gingivitis	Between groups	1.333	2	0.667	1.333	0.385
	Within groups	1.500	3	0.500		
	Total	2.833	5	-		
Hook tooth	Between groups	1.333	2	0.667	1.000	0.465
	Within groups	2.000	3	0.667		
	Total	3.333	5	-		
Malposition	Between groups	5.333	2	2.667	4.000	0.142
	Within groups	2.000	3	0.667		
	Total	7.333	5	-		
Overject	Between groups	1.333	2	0.667	1.000	0.465
	Within groups	2.000	3	0.667		
	Total	3.333	5	-		
Sharp enamel	Between groups	7.000	2	3.500	21.000	0.017
	Within groups	0.500	3	0.167		
	Total	7.500	5	-		

Dental caries: dental caries had significant difference on colic in horses, since $F(2, 3) = 13.000$, $p < 0.05$. Sharp enamel: sharp enamel had significant difference on colic in horses, since $F(1, 4) = 21.000$, $p < 0.05$.

Certain feed diet such as diet low in pH and consisting largely of simple carbohydrates like processed maize and low roughages have been reported to predispose to caries (Dixon et al., 2011). Infundibular and peripheral caries occurring in equine teeth can predispose affected teeth to an increased rate of occlusal wear, tooth fracture, and apical infection (Dixon et al., 2011). These anomalies will invariably make mastication of feed materials

incomplete and subsequent feed indigestion which could then result into colic. These pathologies may therefore further substantiate the association found between horses with dental caries and the increased tendency to develop colic found in this study. In view of the high incidence of dental caries which has been reported in ruminants in Nigeria (Kene and Agbo, 1988; Kene and Uwagie-Ero, 2001) and recent studies which put the

Table 5. The relationship between dental abnormalities in colicky and non colicky horses.

Correlation	Dental attrition	Dental caries	Fractured tooth	Gingivitis	Hook tooth	Malposition	Overjet	Sharp enamel
Dental attrition	1							
Dental caries	0.224	1						
Fractured tooth	0.612	0.493	1					
Gingivitis	0.366	0.585	0.720	1				
Hook tooth	-0.270	0.664	0.349	0.759	1			
Malposition	0.636	0.784	0.800	0.512	0.270	1		
Overjet	0.674	0.581	0.908*	0.542	0.200	0.944**	1	
Sharp enamel	0.000	0.581	0.489	0.759	0.800	0.270	0.200	1

*Correlation is significant at the 0.05 level (2-tailed). **Correlation is significant at the 0.01 level (2-tailed). There was a positive significant correlation between fractured tooth and overjet with $r = 0.908$, at $p < 0.05$. There was a positive significant correlation between malposition and overjet with $r = 0.944$, at $p < 0.01$

prevalence of dental caries in horses in Nigeria at 3.5 to 7.7% (Akinrinmade and Olusa, 2009; Olusa and Akinrinmade, 2009), more emphasis should be placed on routine dental care in all species and in particular in horses to forestall colic and economic losses.

Sharp enamel points may lead to soft tissue ulceration of the buccal mucosal and in severe cases biting problems and quidding (Dixon et al., 2011). The significant association found between sharp enamel points and colic in this study could substantiates the perceptions that pain caused by injured sharp enamel points on the buccal mucosal may results in reduced feed intake and hence poor body condition and poor athletic performance.

Dental abnormalities are of major importance in the UK and the US where survey had shown that 10% of equine practice time is spent on dental related work in UK and it is the third most common equine medical problem encountered by large animal practitioners in the US (Traub-Dargatz et al., 1991; Dixon et al., 2011). Equine dentistry is an important but often neglected area of equine veterinary practice in Nigeria and elsewhere (Peters et al., 2006; Olusa and Akinrinmade, 2009) as only 6% of respondents to the structured interview practice some form of routine dental care on their horses. The non-significant difference for other forms of dental abnormalities found in both the colicky and non-colicky horses in this study may suggest that not all dental irregularities are major determinant factor in horses' abilities toprehend, masticate and digest their feeds. Since other factors such as fermentation are known to take part in the complex processes of digestion, the presence of some dental abnormalities alone may not sufficiently result into compromise in the gastrointestinal tract functions as to result into colic.

A positive significant correlation found between fractured tooth and overjet and malposition and overjet may suggest that the presence of one dental abnormality often encourage or predispose to development of more abnormality. Overjet is a condition in which upper incisors

protrude in front of lower incisors, while malposition is an improper setting of a tooth in its root socket. Malposition could affect more than one tooth and such malpositioned teeth may be prone to secondary dental disorders. The non-symmetry of the dental arcade in overjet and malposition might be a factor responsible for its tendency to fracture.

Age and sex had no significant correlation with dental abnormalities and predisposition to colic while local breeds were found to be more predisposed to colic due to dental abnormalities ($p < 0.05$). This finding might be accidental as local breeds were more represented (49.3%) in the sampled population and they are usually not given the preferential treatment (like dental floating) accorded to the more expensive imported Argentine thoroughbred horses. Dental abnormality can be found in all age categories and both sexes of horses.

Routine dental care such as periodical mouth wash with warm saline and more important and common dental floating or rasping has been performed on horses for hundreds of years (Scrutchfield, 1999). Dental floating are generally performed to: (1) relieve discomfort associated with oral soft tissue injuries caused by sharp enamel points; (2) reduce dental elongations, which place stress on affected teeth and jaws; (3) improve mastication and digestion of feedstuffs; (4) alleviates stresses on abnormally worn teeth; and (5) prevent discomfort and improve performances in the horse wearing a bit and bridle (Knottenbelt, 1999; Gatta et al., 1995; Carmalt et al., 2004; Carmalt and Allen, 2008; Easley, 2011). Although dental floating is being performed on a regular basis, controversy exist regarding its clinical usefulness in apparently healthy horses as there is very little scientific evidence to support this practice (Scrutchfield, 1999; Carmalt et al., 2004; Carmalt and Allen, 2008; Easley, 2011). In this study, there was a significant difference ($p < 0.05$) in horses that had no routine dental care and colic. Sharp enamel points are common dental abnormalities in horses and are easily recognizable during routine dental examination. Reduced feed intake

and improperly chewed roughages due to pain elicited on the buccal cavity secondary to lacerations or ulcers on the cheeks or tongue caused by sharp enamel points could result into quidding, choke, chronic colic and general unthriftiness (Easley, 1996; Ferraro et al., 2006). Since dental rasp or floating could be used to effectively correct sharp enamel points (Scrutchfield, 1999), routine dental examination and care are therefore essential for sound dental health.

In conclusion, this study indicates that dental caries and sharp enamel points are predisposing factors for colic. Although not all forms of dental abnormalities predispose horses to colic, routine dental examination and care would be beneficial for early diagnosis and prevention of dental abnormalities that may predispose to colic. There is minimal published knowledge on the normal bacteriology of the equine mouth and even less on bacteria that incite dental caries formation. More studies to investigate the aetio-pathogenesis of identified dental abnormalities in colic are therefore recommended.

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Conflict of Interest

The author(s) have not declared any conflict of interests.

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