

How to Cite:

Suganya, P., Rajmohan, R., Bharathwaj, V. V., Dhamodhar, D., Prabu, D., & Prashanthi, M. R. (2022). Influence of body mass index on oral health among equines in Tamilnadu, India: A cross sectional study. *International Journal of Health Sciences*, 6(S2), 2302–2311. <https://doi.org/10.53730/ijhs.v6nS2.5333>

Influence of body mass index on oral health among equines in Tamilnadu, India: A cross sectional study

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Abstract---Aim: The aim of this study is to analyze the association of body mass index and oral health status among equines in Tamilnadu, India Materials And Methods: A descriptive study was conducted among 108 horses from blue cross of Tamilnadu and various veterinary colleges based on simple random sampling method. The body mass index of horses were recorded Henneke Body Condition

Scoring and their oral health status were examined. The collected data was analyzed and tabulated using chi-square test. P value <0.05 was considered to be statistically significant. Results: There was a statistically significant relation was found between gingivitis (P<0.001), calculus (P=0.004), dental caries (P=0.004), plaque (P=0.007), dental erosion (P<0.001) and BMI. Conclusion: The body mass index have a strong impact on the oral health of horses. Proper nutritional measures should be taken to overcome the problem.

Keywords---oral health, equines, body mass index, nutrition, dental caries.

Introduction

Oral diseases had been designated as the most recurrently diagnosed clinical conditions in animals. They can be subdivided into conditions that affect the tooth, periodontium and other oral surfaces. Nutrition plays a decisive role in tooth development, gingival and oral tissue integrity, bone strength, prevention and management of oral diseases [1]. Caries results from bacterial decay of the tooth structure brought about by the release of acids from oral bacteria fermenting carbohydrates on the tooth surface. Therefore, a diet high in highly refined and easily fermentable carbohydrates will favor the development of caries. As western civilization progressed, our diet changed to include the types of foods that would promote decay and so caries became a widespread and serious concern. It is only recently that the use of fluoride and improved oral hygiene practices has brought about a decline in the incidence of caries in human mouths [2].

Many owners are unaware that dogs may also be subject to caries. Though the incidence of caries in dogs is lower than it has been in humans, it does occur and we must watch for areas at risk or already undergoing decay and recommend such preventive or restorative treatments as are reasonable. Factors which must be in place for caries to develop include: natural tooth structure with susceptible surface exposed to the oral environment, complex indigenous microflora, and food ingested by mouth. There are many modifying factors as well, which influence the location of the lesion [1, 2].

Horse teeth are subject to continuous wear that is replaced by tooth eruption throughout the animal's life, which means that minor issues with posture and occlusion can cause chronic dental problems. Periodontal disease has long been recognized as a common and painful equine oral disorder and its substantial welfare impact was acknowledged at the start of the twentieth century being described as "the scourge of the horse's mouth" [3,4]. More recently, studies have shown the presence of periodontitis in up to 75% of horses [5,6] with prevalence increasing with advancing age. A dental survey noted that classical (i.e. plaque-induced) periodontal disease was rare in horses, but periodontal disease induced by food impaction due to abnormal spacing between the cheek teeth was common [7]. The condition is often associated with the presence of Diastema in the buccal surface of posterior teeth [8] and can also be present secondary to other oral

disorders such as supernumerary, displaced or rotated teeth [9]. Dropping of feed (quidding) and difficulty eating are the main clinical signs [10], although these can be subtle and easily overlooked. More recent clinical studies have reinforced the importance of equine periodontitis, currently recognized as a common and very painful equine dental disease [8, 10]. Two forms of periodontal disease exist, namely gingivitis and periodontitis. Gingivitis is completely reversible and is recognized by the classic signs of bleeding, inflammation, redness and swelling of the gums. Periodontitis attacks the deeper structures that support the teeth, damaging the surrounding bone and periodontal ligament, resulting in tooth loss. Despite the importance of this condition there have been few recent studies into its aetiopathogenesis. Bacteria have been shown to be the causative agents in feline, canine and human periodontal disease and so it is highly likely they play a crucial role in the pathogenesis of the equine condition. Involvement of bacteria in equine periodontal disease was recently acknowledged [11, 12]. However, understanding of the equine oral microbiome is limited and merits further study and little is known about the role bacteria play in equine periodontitis [11]. Studies in other species have estimated that around 50% of oral bacteria cannot be cultured by conventional approaches due to nutritional and fastidious growth requirements [13] and thus the number and variety of bacterial species present in the oral microbiome has been greatly underestimated to date.

Dental health plays a crucial role in maintaining the general health not only for humans but also for animals. The oral health of horse should be given utmost important for the overall well-being of horses. No previous studies have been conducted based on the oral health of horses. Hence, this present study aims to evaluate the impact of BMI on oral health status of horses among various breeds in Tamilnadu.

Materials and Method

A cross-sectional study was conducted among horses to evaluate the influence of body mass index on oral health status among various breeds of horses in Tamilnadu. The study was conducted for a period of 2 months, from February 2021 to March 2021 until the desired sample of subjects were recruited for the study. The ethical approval of this study was obtained from the Department of Public health dentistry. The sample size was calculated to be 108 by setting a confidence level 95% and margin of error as 5%. A total of 108 horses were recruited from blue cross and various Veterinary colleges in Tamilnadu based on the simple random sampling method. Before conducting the study the permission was obtained from the official head of blue cross of India, Chennai by explaining the objectives of the study in a detailed manner and the owner of the horses were asked to fulfil the consent form.

The questionnaire consists of demographic data such as breed name, age and sex, were obtained. The body mass index of the horses was recorded using Henneke Body Condition Scoring [14]. This system uses a scale of 1 through 9, determining body weight and ideal condition where 1 represents an extremely emaciated horse and 9 represents a grossly obese one. Areas of the body that are examined include the shoulder and elbow region, the ribs, the withers, the loin and tailhead region, and the crest of the neck. Horses with body condition scores

under 5 were considered underweight, scores equal to 5 were considered normal, scores equal to or greater than 7 are considered overweight, while those with scores equal to or greater than 8 are considered obese.

The oral health status of horse such as dental caries, dental erosion, calculus, plaque and periodontitis were recorded using DMFT index, plaque index and AVDC classification, tooth erosion index, gingival index and oral lesions scoring system. The collected data was tabulated and analyzed using descriptive statistics and chi-square test.

Results

The Normality tests, Kolmogorov-Smirnov and Shapiro-Wilks tests results reveal the study followed normal distribution. Therefore, to analyze the data, parametric test was applied. Descriptive statistics was performed using Frequency and percentage distribution. To find the association between the oral health status and body mass index, chi square test was performed. To analyze the data SPSS (IBM SPSS Statistics for Windows, Version 26.0, Armonk, NY: IBM Corp. Released 2019) is used. Significance level is fixed as 5% ($\alpha = 0.05$). P-value <0.05 is considered to be statistically significant.

Table 1: Prevalence of oral health parameters among horses

Oral health parameters	Percentage wise distribution of variables			
	Normal (%)	Mild (%)	Moderate (%)	Severe (%)
Gingivitis	19.4	54.6	25.9	0
Calculus	0	47.2	25.9	26.9
Oral lesions	94.4	5.6	0	0
Dental caries	20.4	79.6	0	0
Plaque	0	18.5	74.1	7.4
Dental erosion	21.3	60.2	18.5	0
Dental trauma	96.3	3.7	0	0
Gingival recession	38.9	61.1	0	0
Attrition	11.1	88.9	0	0
Periodontal disease	11.1	81.5	7.4	0

Table 1 depicts the frequency and percentage of oral health parameters of equines.

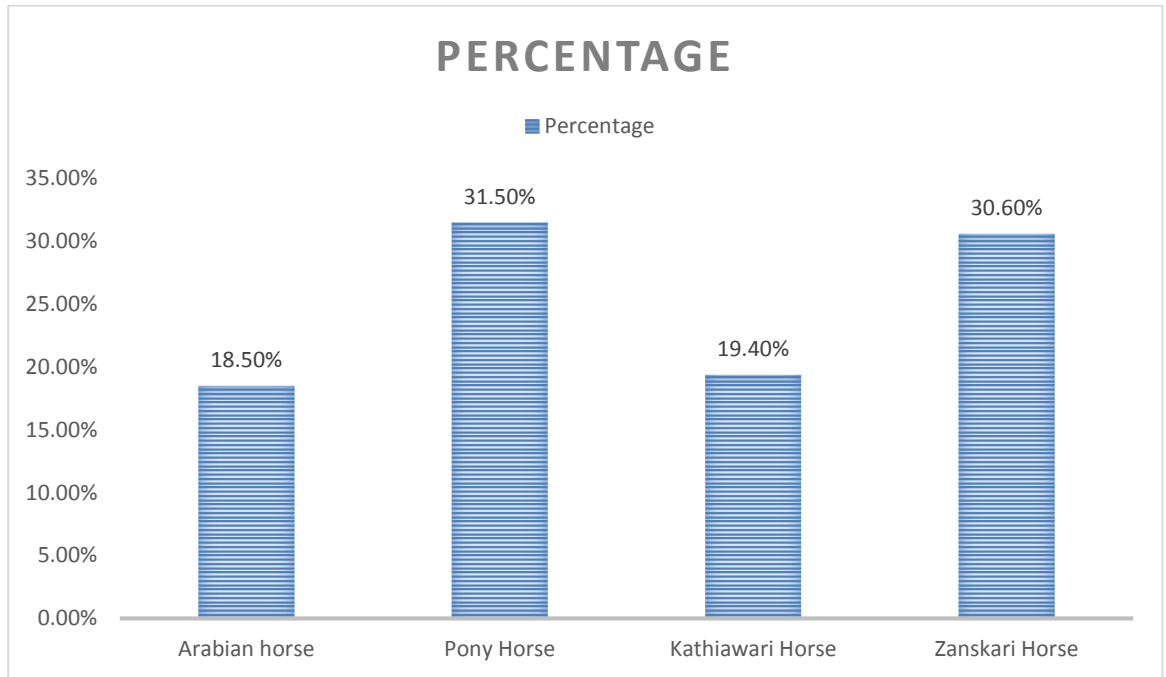
Table 2: Association of oral health status and body mass index among horses

ORAL HEALTH PARAMETERS	VARIABLES	BODY MASS INDEX			P-VALUE
		Normal (n)	Overweight (n)	Obese (n)	
Gingivitis	Normal	15	6	0	<0.001*
	Mild	15	28	16	
	Moderate	4	18	6	
	Severe	0	0	0	

Calculus	Normal	0	0	0	0.004*
	Mild	14	22	15	
	Moderate	15	13	0	
	Severe	5	17	7	
Oral lesions	Normal	32	49	21	0.97
	Mild	2	3	1	
	Moderate	0	0	0	
	Severe	0	0	0	
Dental caries	Normal	13	8	1	0.004*
	Mild	21	44	21	
	Moderate	0	0	0	
	Severe	0	0	0	
Plaque	Normal	0	0	0	0.007*
	Mild	2	17	1	
	Moderate	29	31	20	
	Severe	3	4	1	
Dental erosion	Normal	14	9	0	<0.001*
	Mild	11	34	20	
	Moderate	9	9	2	
	Severe	0	0	0	
Dental trauma	Normal	32	51	21	0.618
	Mild	2	1	1	
	Moderate	0	0	0	
	Severe	0	0	0	
Gingival recession	Normal	11	19	12	0.229
	Mild	23	33	10	
	Moderate	0	0	0	
	Severe	0	0	0	
Attrition	Normal	5	5	2	0.721
	Mild	29	47	20	
	Moderate	0	0	0	
	Severe	0	0	0	
Periodontal disease	Normal	7	5	0	0.05
	Mild	25	41	22	
	Moderate	2	6	0	
	Severe	0	0	0	

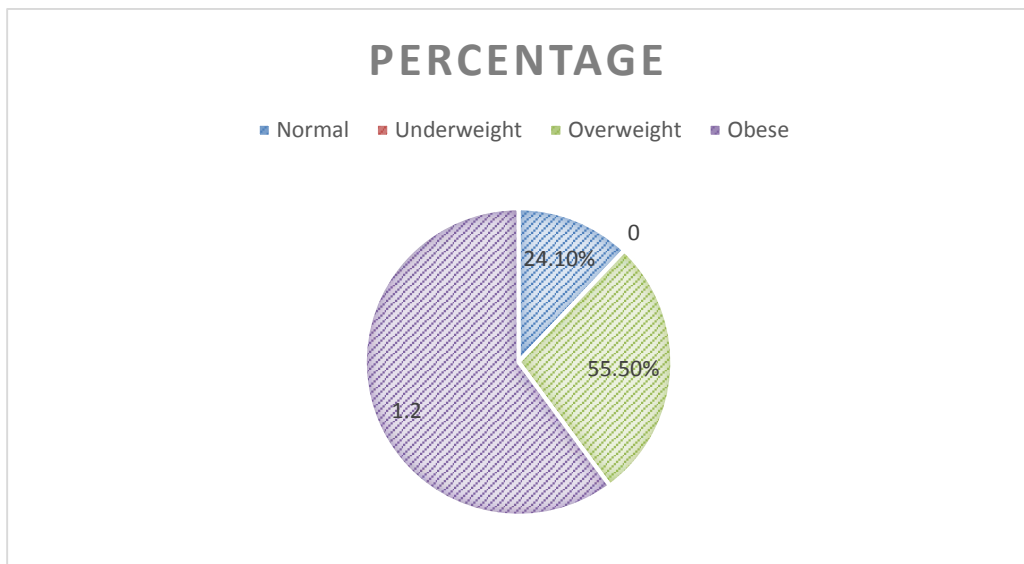
Table 2 depicts the association of body mass index and oral health status among horses. There was a statistically significant relation was found between gingivitis ($P<0.001$), calculus ($P=0.004$), dental caries ($P=0.004$), plaque ($P=0.007$), dental erosion ($P<0.001$) and BMI.

Graph 1: Percentage wise distribution of various horse breeds included in the study



Graph 1 depicts the frequency and percentage of various horse breeds involved in the study.

Graph 2: Percentage wise distribution of body mass index among horses



Graph 2 depicts the percentage and frequency of body mass index among horses. Majority of the horses are overweight (55.5%).

Discussion

Oral health plays a crucial role in maintaining the overall health of people including animals. The body mass index have a major impact on oral health due to intake of unhealthy foods and lifestyle habits. Various studies had conducted regarding the oral health status of horses. This present study focused on the association of body mass index and oral health of horses. Periodontal disease and dental caries are the two major oral health problems among equines. The previous study conducted by Kennedy et al in the year 2016 had discussed about the association of micro-organisms with periodontal disease and oral health among horses and concluded that the microbiomes associated with equine oral health and periodontitis are distinct.

Another study conducted by Baker in the year 1970 [5] and Ireland et al [6] in the year 2012 had concluded that 75% of horses had periodontal problems and it was found to be increases with advanced age. The study conducted by Enlund et al in the year 2020 had discussed about the periodontal status among canines and concluded that the prevalence of periodontitis among canines was 80% [18]. In the current study, the overall prevalence of periodontitis among horses was found to be 88.8%. This might be due to the improper feeding habits and irregular maintenance of oral health. Periodontitis attacks the deeper structures that support the teeth, damaging the surrounding bone and periodontal ligament, resulting in tooth loss. Equine periodontal disease usually starts with impaction of food, gingival inflammation, diastema formation and due to periodontal pocket formation. This process proceeds toward the dentoalveolar space, causing detachment of tooth supporting periodontal fibers. In the current study, the prevalence of gingivitis among equine was 80.5%. The unhealthy inflammatory precedes to the development and rapid progression of periodontal problems. The deepening of periodontal pocket paves the pathway for food impaction which rapidly increases the rate of progression of periodontal problems among horses. Diet plays a crucial role in maintaining the oral health among horses. The body mass index of horses was found to be statistically significant with gingivitis and periodontitis.

Equine peripheral caries (PC) is an increasingly recognized disorder that causes premature wear of teeth and dental fractures and thus has major welfare implications. Little information is available on its prevalence or severity in UK horses and there are no proven associations with any risk factors. The study conducted by Borkent et al [19] in the year 2017 had discussed about the prevalence of peripheral caries among equines in United Kingdom and concluded that the prevalence of peripheral caries was 51.7%. Another study conducted by Borkent et al [20] in the year 2017 had discussed the prevalence of dental caries among equine in United Kingdom and concluded that the 45.5% of horses had dental caries prevalence. In the current study, the dental caries prevalence among horses was found to be 79.6%. The dental caries was found to be statistically significant with body mass index of equines ($P=0.004$). The dental caries

prevalence was found to be higher in the present study; this might be due to improper dietary habits and lack of proper oral hygiene measures.

The study conducted by Dixon et al in the year 2000 had discussed about the traumatic disorders among equines. Out of 400 horses, 6.5% of horses had traumatic fracture of teeth and 11% of horses had dental wear abnormalities [21]. In the current study, 3.7% of horses had dental trauma and 78.7% of equines had dental erosion. The dental erosion was found to be statistically significant with body mass index of horses ($P < 0.001$) whereas no significant relation was found between dental trauma and body mass index of horses ($P = 0.6$).

The body mass index have a high impact on oral health among both human and animals. The study conducted by Hamasha et al in the year 2019 had discussed about the association of BMI and oral health among adults in Saudi and concluded that there were no statistically significant relation was found between body mass index and periodontal pocket whereas the dental caries was found to be statistically significant with body mass index [22]. This was in line with the present study that the dental caries was statistically significant with dental caries whereas the periodontal pocket and gingival recession was not statistically significant with body mass index of equines.

The study conducted by Benguigui et al in the year 2012 had discussed the relationship between body mass index and oral health and concluded that the body mass index was found to be statistically significant with pocket depth and plaque index and there was no relationship found with periodontitis, gingival index and BMI [23]. Another study conducted by Abdul et al [24] and Mansi et al [25] in the year 2021 had conducted the study on oral health status among dogs and concluded that majority of canines had more prevalence of gingivitis. This was similar with the present study that equines had more prevalence of gingivitis. In this study, the body mass index was found to be statistically significant with gingivitis and plaque index whereas the body mass index was not significant with periodontitis. Overall analysis of this study reveals that the body mass index have a great impact on oral health of equines. The limitation of this study are only a small number of samples was obtained further longitudinal studies should be conducted to get more appropriate results. There might be a chance of confounding bias due to change in lifestyle and dietary habits.

Conclusion

The oral health plays a pivotal role in maintaining the good general health of animals. The dietary food habits is primordial factor and had a direct relation with oral health. The intake of unhealthy diet and lifestyle habits increase the risk of obesity which might enhance the risk of many systemic diseases including oral health related diseases. Proper measures such as health diet, physical exercise and regular dental check-ups of equines should be followed under the guidance of equine care takers to overcome the problem.

Acknowledge: Nil

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