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A Preliminary Study on Dental Health Problems and Associated Risk Factors on Donkeys in Ada'a and Dugda Districts

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Abstract: A cross sectional study was conducted from October 2013 to April, 2014 in Ada'a and Dudga districts, East Shoa, Oromia Regional State, Ethiopia; to investigate dental health problems and associated risk factors in 400 donkeys under the supervision of DHWP (Donkey health and welfare project). Structured questionnaire and dental examination were employed in this study. Out of 400 people interviewed on donkey dental health only 11 (2.75%) had knowledge as donkeys can get dental health problem, which was to low as compared to other donkey's health problems. A total of 400 donkeys were randomly sampled, 250(62.5%) and 150(37.5 %) from Ada'a and Dugda, respectively. Donkeys from Ada'a and Dugda were used for packing and cart purpose, respectively. Out of 400 examined donkeys 253 (63.25%) were found with different types of dental abnormalities. Nineteen types of dental health abnormalities were identified; calculus (20.5%) followed by sharp enamel points (15.5%), gingivitis (11%), teeth overgrowth (9%) and hooks (7.3%) were the major ones. Out of 253 donkeys with dental abnormalities majority of them 102(40.32%), 72(28.46%) and 41(16.20%) had one, two and three dental abnormalities, respectively. The average of dental abnormalities among donkey with problem was 2.19±1.42. Analysis of the risk factors in donkeys revealed a significant (p=0.0001) difference in occurrence of dental problem in bit use donkeys were about five times more than the chance of its occurrence in donkeys without bit use (OR=5.3, 95%CI=3.2, 8.9) where as the odds of colic case were more than four times in donkeys with dental abnormalities compared to donkeys without dental abnormality (OR=3.97, 95% CI=2.36, 6.6). This study suggests that dental health problems were prevalent in study areas. Therefore, in clinical examination of donkeys' health dental problems should be considered.

Key words: Ada'a · Dental Health Problem · Donkeys · Dugda · Ethiopia · Risk Factors

INTRODUCTION

Donkeys' teeth are hypsodont which continually erupt throughout the life of the animal by a dynamic process of periodontal ligament remodeling. At the time of eruption there are no true roots and teeth are thus divided into apical and coronal regions, but most of the crown lies within the alveolus. True roots are formed gradually over a period of approximately 2 years after eruption. Donkeys have 36-44 permanent teeth, with this variation due to presence or absence of 1st premolars or canines. The 2nd-4th premolars and molars are collectively referred to as cheek teeth. The clinical crown of the caudal cheek teeth (10, 11) are orientated rostral and those of the rostral cheek tooth (06) are orientated caudally to ensure that the cheek teeth are spaced tightly against each other to act as a single functional unit [1].

Equine dentistry is a very important but until recently rather neglected area of equine practice, consequently with many equines suffering from undiagnosed, painful

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dental disorders [2]. The dental criteria have considerable advantages in that they provide relatively accurate age finding [3]. Age determination is more accurate in younger donkeys and involves recognition of the type of teeth present and an assessment of stage of eruption [4]. Apart from the use of age estimation, teeth play an important role in protection, prehension and digestion process of feed by animals. Any abnormality on the teeth leads to poor feeding ability that compromise health and working efficiency. Major abnormalities reported by scholars were parrot mouth, diastema, worn, displaced, retained and hooked teeth [2].

The major dental diseases in equines are teeth overgrowth, diastema, shear mouth, parrot mouth, infundibular decay [5, 6]. Additionally, Retention of deciduous incisors, fractures and supernumerary incisors may also be seen. Senile diastema of the incisors may also be seen in older donkeys and are also often associated with periodontal disease, although this is highly unlikely to cause quidding or weight loss. The most common problem with canine teeth is the accumulation of calculus and, in extreme cases; this may be associated with gingivitis and even periodontal disease [7].

Donkeys with dental disease may present with accumulation of food in their cheek, halitosis, chewing slowly whilst making slurping noises, quidding (Dropping boluses of partially chewed food), head tilting, tooth grinding, spilling, difficulty nipping grass with incisors, strong smelling mouth, nasal discharge, excessive salivation, behavioral changes (Irritability, aggression, crib biting, food packing, whole grains or long stem fiber in faeces, colic episodes or, in extreme cases, weight loss. Other clinical signs such as facial swelling, draining facial tracts and unilateral nasal discharge may also be indicative of dental related disease. Cheek palpation may be useful in identifying food pocketing, dental-related swellings and the presence of pain. A full mouth speculum, such as the Haussmann's gag, a good head light and dental mirror is essential to perform a thorough oral examination. The use of a gum plate with the speculum, rather than the standard bit plate, may be more comfortable for smaller donkeys. A head rest or suspended dental halter is also required to ensure the head is suitably elevated for examination and treatment [8].

A link between dental problems and impaction colic is very strong that dental disease can adversely affect the ability to adequately masticate feed for subsequent digestion and may result in long fibers entering the large colon, predisposing donkeys to intestinal tract obstruction [9]. Charter veterinary hospital group [10] indicated that Weight loss, poor body condition, infections of the sinuses, behavioral problems of the donkeys can also arise as consequence of dental problems.

Dental disease in donkeys has recently been well documented in UK, but there is no published information or research on dental health problems of donkeys in Ethiopia. Therefore, the current study is intended to identify major donkey's dental problems and associated risk factors. The objectives of this study were:

- To assess major dental health problems of donkeys in Ada'a and Dugda districts
- To investigate risk factors to dental health problems.

MATERIALS AND METHODS

Study Area: This study was conducted from October, 2013 to April, 2014 in Ada'a and Dugda districts, East Shoa, Oromia regional state, central Ethiopia, DHWP stationary or satellite clinics. Ada'a is one of the districts found in east shoa Zone of Oromia Regional State, 47km south east of Addis Ababa. It is located 90°N Latitude and 40°E longitude of 1880m above sea level in the central highlands of Ethiopia. It has an annual rain fall of 1151.6mm of which 84% is in the long rainy season (June to September). The dry season extends from October to February. The mean annual maximum and minimum temperatures are 30.7°c and 8.5°c, respectively. The mean relative humidity is 61.3% [11]. Dugda is one of the *woredas* in the Oromia Region of Ethiopia. It was part of the former woreda of Dugda Bora later on which was divided into Bora and Dugda woredas. The altitude of this woreda ranges from 1500 to 2300 meters above sea level. Dugda district of Ethiopia located about 134 km South of Addis Ababa along road to hawassa. The long rainy season in the area is between June and October, while the long dry season lasts from October to February. The mean minimum and maximum temperature in the area ranges from 14 to 27ºC. The average altitude is 1650m above sea level, with an average rainfall of 716mm [12].

Study Animal and Study Protocols: All working donkeys irrespective of their age, sex and body condition which those came at donkey health and welfare project clinics in Ada'a and satellite clinics in Dugda district were included in the study. The total sample size of 384 was determined based on simple random sampling methods with estimated prevalence of 50% and absolute precision of 5% [13].

$N = 1.96^2(XP_{exp}(1-P_{exp})/d^2$, Where: N=required sample size, P_{exp}=expected prevalence, d=desired absolute precision

Accordingly, the calculated sample was 384 donkeys. However, to increase precision 400 donkeys were included in the study.

Questionnaire Survey: The questionnaire survey was conducted to obtain appropriate information about people's knowledge of the health problems of donkeys and targeted on dental health problem and associated risk factors in Ada'a and Dugda districts. The questionnaire format contained the owners' status, donkey management conditions and clinical signs and risk factors for dental health disorders. Cross-sectional type of study was used in the study.

Physical Examination: General physical examinations of systems were conducted to rule out systemic infections and recorded (PR, HR, RR) and any physical abnormalities were noted.

Dental Examination: Before oral examination donkeys were properly restrained using halter. For evidence of facial swelling, jaw trauma and mandible inter space palpation was carried out. Mouth gag was placed in oral cavity to eliminate chewing and tongue motion. Then, complete oral examination started by odor detection and oral cavity was flushed by water to avoid odor, to remove food matter and debris. The teeth (All aspect of the incisor, canine, premolar and molars) were inspected using a bright head light or torch and any abnormalities such as teeth overgrowth, gingivitis, periodontal pockets, trauma, diastema, decay, caries, calculus, fractures, over bite, under bite, dental loss, buccal ulcers, hooks and others were recorded on dental examination form using modified triadic system to identify specific teeth on which abnormality was encountered [14].

Data Analysis: All collected information obtained from questionnaire survey and dental examination were entered into excel spread sheet and analyzed using SAS 9.2 version software. The P-value <0.05 was set to be significant.

RESULTS

A total of 400 donkey's owners were interviewed for questionnaire and the outcome revealed that 279 (69.8%) owners had general knowledge on donkey health problems. However, only11 (2.75%) had known as donkey can get dental health problem which was very low when compared to other donkey health problems. The proportions of people's knowledge about donkeys' health problems were tetanus 72(18%), hyena bite 113(28.25%), colic 169(42.25%), dystocia 40(10%), continuous emaciation 97(24.25%), dental health problem 11(2.75%), lameness 153(38.25%), back sore 104(26%).

In this study 155(38.75%) female and 245(61.25%) male donkeys were examined for dental health problems in Ada'a and Dugda districts. Donkeys were primarily used for packing in Ada'a district where as for cart pulling purpose in the Dugda districts. In total, from oral cavity examinations of four hundred donkeys' nineteen types of dental abnormalities were encountered: calculus (20.5%), sharp enamel points (15.5%), gingivitis (11%), teeth overgrowth (9%) and hooks (7.3%). The dental abnormalities like displaced teeth (0.59%) and periodontal pockets (0.79%) were encountered with the lowest frequency than other abnormalities identified during examination.

Out of 253 donkeys with different dental abnormalities 102(40.32%) of them carried single dental abnormality event, 72(28.46%) and 41(16.20%) carried two and three mixed dental abnormalities in which highest (ten) different mixed cases were observed in one donkey (Figure 1). The average of the dental abnormalities among donkey with problem was 2.19±1.42 (Figure 2).

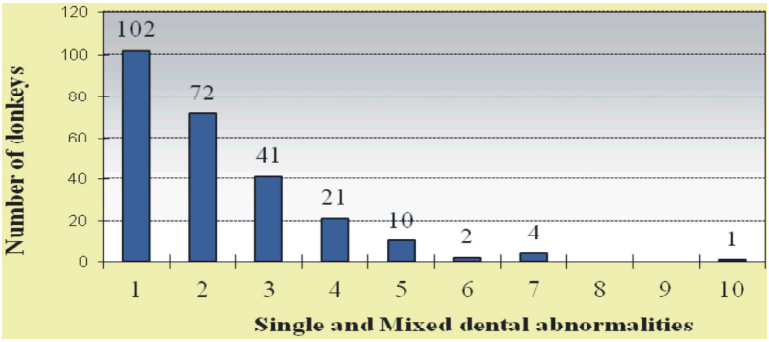

Fig 1: Frequency of single and mixed dental abnormalities (N=253)

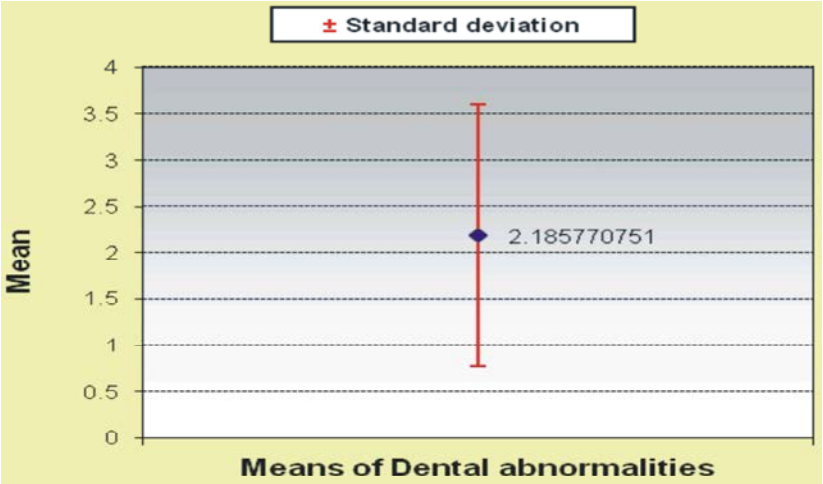

Fig 2: Average of dental abnormalities among donkeys with problems (N=253)

Table 1: Frequency and means of dental problems in different body condition score categories in selected districts (N=253)

Body condition scores	Number of animal dental health problem positive	Mixed dental abnormalities Mean ±SD
Poor	16(6.3%)	4.19±1.56
		2.48±1.48
Moderate	60(23.7%)	
Good	147(58.1%)	1.96±1.24
Fat	30(11.9%)	1.6±0.99

Table 2: Distribution of work type in selected two districts (N=400)

		Work type	
Districts	No. of sample	Pack	Cart
Ada'a	250	250(100%)	0
Dugda	15	0	150(100%)

Table 3: The proportion of study area with sex and age of donkeys (N=400)

	Sex		Age		
Districts	Female	Male	Young	Adult	Old
Ada'a (n=250)	48%	52%	25.6%	45.2%	29.2%
Dugda (n=150)	23.3%	76.7%	13.3%	66.7%	20%

According to the recent study in Ada'a and Dugda districts from a total of 253 donkeys 16(6.3%, 60(23.7%), 247(58.1%), 30(11.9%) were poor, moderate, good and fat in body condition scores, respectively. This study revealed that dental health problems were majorly observed in poor body condition with average 4.19±1.56 (Table 1).

As shown in the Table 2 the distribution of work type of working donkeys involved in the study was 37.5% cart and 62.5% packing donkeys in Dugda and Ada'a districts, respectively. It was not because of study procedure, but the donkey from Ada'a was mainly engaged in packing where as donkeys from Dugda site was engaged in cart pulling task.

The proportion of male donkeys in Dugda district included in study was more than three times those of female donkeys. The proportion of male and female was almost equal in Ada'a district (Table 3).

The current study had shown dental health problems were majorly seen in poor body condition donkeys as compared to other body condition scores. Out of 19 examined donkeys with poor body condition score 16 (84%) of them had dental abnormalities. There was a significant difference between age groups, bit use, work type, districts and recent colic history in occurrence of dental health problems (p-value <0.05) (Table 4).

Table 4: The prevalence of dental health problems in different sex, age groups, BCS, districts, work types, bit use and history of recent colic

	No. of animals sampled as dental abnormality positive	X^2	P-value	OR(95% CI)
Sex				
Female (n=155)	96(61.3%)			
Male (n=245)	157(63.3%)	0.072	0.79	
Age				
Young (n=84)	22(26.2%)			
Adult (n=213)	146(67.14%)	68.7	0.0001	
Old (n=103)	85(82.5%)			
BCS				
Poor (n=19)	16(6.32%)			
Moderate (n=107)	60(23.72%)	6.19	0.103	
Good (n=227)	147(58.1%)			
Fat (n=47)	30(11.86)			
Districts				
Ada'a (n=250)	128(50.59%)	41.65	0.0001	
Dugda (n=150)	125(49.41)			
\Work type				
Pack (n=250)	128(50.59%)	41.65	0.0001	
Cart (n=150)	125(49.41%)			
Bit use				
Yes (n=144)	122(48.22%)	44.63	0.0001	5.3(3.2, 8.9)
No (n=256)	131(51.78%)			
Recent Colic history				
Yes (n=126)	104(41.11%)	29.4	0.0001	3.97(2.36, 6.6)
No (n=274)	149(58.89%)			

Table 5: Types of dental health abnormalities observed in different age categories of donkeys

		Age group category				
Dental health problems	No. of dental health problem investigated	Young (%)	Adult (%)	Old (%)	X^2	P-value
Teeth overgrowth	43	9.3	23.3	67.4	43.8	<.0001
Shear mouth	9	0	6.82	13.63	8.59	0.0136
Gingivitis	44	9.1	56.8	34.1	4.68	0.0065
Teeth loss	32	3.13	65.2	31.2	6.57	0.038
Periodontal pocket	4	0	25	75	5.26	0.072
Hook	37	5.4	45.9	48.7	13.4	0.0013
Diastema	12	0	33.3	66.7	11.6	0.0031
Decay	28	3.6	14.3	82.1	50.12	0.0001
Caries	10	10	0	90	22.5	0.0001
Calculus	104	0.96	47.1	51.9	64.9	0.0001
Teeth fracture	22	27.3	40.9	31.8	1.5	0.972
Trauma	25	16	56	28	0.37	0.83
Over bite	11	9.1	72.7	18.2	1.8	0.418
Under bite	12	0	25	75	16.1	0.0003
Sharp enamel points	62	0	58.1	41.9	22.97	0.0041
Buccal ulcer	19	5.3	63.1	31.6	2.92	0.234
Displaced teeth	3	33.3	0	66.7	3.81	0.149
Wolf teeth	14	21.4	57.2	21.4	0.14	0.093
Wave mouth	9	0	0	100	26.55	0.0001
Teeth abrasion	8	37.5	12.5	50	5.53	0.063

Table 6: Dental health problems and bit use

Dental health problems	No. of dental health problems	Bit use		X^2	P-value
		Yes (%)	No (%)		
Teeth overgrowth	43	27.9%	72.1%	1.37	0.24
Shear mouth	9	0%	100%		
Gingivitis	44	27.3%	72.7%	1.63	0.20
Teeth loss	32	65.6%	34.4%	13.25	0.0003
Periodontal pocket	4	0%	100%		
Hook	37	27%	73%	1.45	0.23
Diastema	12	33.33%	67.67%	0.04	0.85
Decay	28	25%	75%	1.58	0.21
Caries	10	0%	100%		
Calculus	104	35.6%	64.4%	0.01	0.92
Fracture	22	40.9%	59.1%	0.24	0.62
Trauma	25	76%	24%	18.52	0.0001
Overbite	11	0%	100%		
Under bite	12	0%	100%		
Sharp enamel points	62	35.5%	64.5%	0.009	0.93
Buccal ulcer	19	78.9%	21.1%	15.97	0.001
Displaced teeth	3	0%	100%		
Wolf teeth	14	50%	50%	1.23	0.26
Wave mouth	9	0%	100%		
Teeth abrasion	8	100%	0%	14.51	0.0001

The present study revealed that teeth overgrowth, shear mouth, gingivitis, teeth loss, hook, Diastema, decay, caries, calculus, under bite, sharp enamel points and wave mouth were significantly different among age categories in which occurrence increase with age ($P< 0.05$) (Table 5).

From this study the prevalence of buccal ulcer was higher in cart donkeys used bit during riding than cart donkeys didn't use bit and in pack donkeys. There was significant difference in teeth loss, trauma, buccal ulcer and teeth abrasion in between the use of bit or not use bit for riding of donkeys ($p<0.05$) which higher cases were seen in donkeys with bit (Table 6). This bit mainly affects premolar tooth of number (306 and 406) (Table 6).

DISCUSSION

In this study, the result of the questionnaire survey indicated that only 11(2.75%) owners out of four hundred had knowledge as donkey can get dental health abnormalities which was very low as compared to knowledge on other donkeys' health problems. This difference probably is explained by the lack of awareness creation on dental health and invisibility of the dental abnormalities.

The overall Prevalence of different dental abnormalities was found to be 63.25%.this findings was higher when compared with Fernando-Martinez *et al*. [15] that reported lower prevalence (16%). This might be due to donkeys in this study engaged in cart pulling or bit use and variation in management of donkeys. Statistically significant association ($P<0.05$) was observed between different age groups of donkeys in prevalence of the dental abnormalities. This difference might be due to demineralization of teeth as age advanced. This finding strongly agree with the report of [15] who reported dental disorders are more likely to occur in old animals. In this study there was no significant association ($p>0.05$) between sexes of donkeys and dental abnormalities. Statistically there was significant association ($P<0.05$) between work type and dental abnormalities. This Study revealed that donkeys engaged in cart pulling with bit in mouth have higher chance to develop dental abnormalities when compared with other work type. This probable due to the fact that constant irritation by bit in the mouth severely damage soft tissue of oral cavity, gums and teeth. An odds ratio of 5.3 indicated that the odds of occurrence of dental problem in bit use donkeys were about five times more than the chance of its occurrence in donkeys without bit use.

The current study indicated statistically significant association between dental problem and recent colic history ($p<0.0001$). An odds ratio of 3.97 showed that the odds of colic case were more than four times in donkeys with dental abnormalities compared to donkeys without dental abnormality.

Up on oral cavity examinations of 400 donkeys' nineteen types of dental abnormalities were indentified: calculus (20.5%), sharp enamel points (15.5%), gingivitis (11%), teeth overgrowth (9%) and hooks (7.3%). The dental abnormalities like displaced teeth (0.59%) and periodontal pockets (0.79%) were encountered with the

lowest frequency than other abnormalities mentioned in the examination of total animals included in the study.

Regarding mixed dental abnormalities, out of the total of 253 donkeys positive for different dental problems, 102(40.32%), 72(28.46%) and 41(16.20%) donkeys had one, two and three dental abnormalities, respectively. The mean dental abnormalities among donkeys with problem was found to be 2.19±1.42 with highest average mixed dental problems was seen in the poor body condition donkeys 4.19±1.56 where as lowest average was recorded in fat body condition donkeys 1.6±0.99.

In this study the prevalence of buccal ulcer was higher in cart donkeys used bit during riding than cart donkeys didn't use bit and in pack purpose donkeys. The bit used on working donkey was significantly associated with Buccal ulcer and teeth abraded by bit in mouth ($p<0.05$).

CONCLUSION

In general dental health problems were found prevalent in the study areas and have great impact on body conditions of donkeys by causing oral discomfort, limiting mastication, digestibility of the feed and then reduce proper utilization of nutrients. Current study showed donkeys with dental health abnormality have higher likelihood ratio to develop colic. Again usages of not properly designed metal bit for riding of donkeys will favor donkeys to develop different dental abnormalities. Therefore, consideration of the dental health problem in animal health examination activities play great role to improve health and welfare of the donkeys.

Based on the above conclusion, the following recommendations are indicated: Owners should be educated on donkey health problems such as dental health abnormalities, colic, tetanus and other health disorders; old and donkeys with poor body condition should be considered for dental abnormalities while clinical case handling; usage of improperly designed metal bit in oral cavity for riding should be avoided; donkey with colic case should be examined for dental abnormalities and properly managed; further research should be carried out on dental health of donkeys in comprehensive way.

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