Age Pattern and Teeth Abnormality Observed in Working Donkeys in Selected Districts of Sidama Zone, Southern Ethiopia

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Abstract: Cross sectional study was conducted from November, 2010 up to April, 2011 in Dale, Shebedino and Hawassa districts in southern Ethiopia; to estimate age pattern of donkeys; identify teeth abnormality and understand community perception. Five hundred fifty donkeys were sampled from selected districts proportionally. Fifty seven percent were cart and 43% packing donkeys. Age pattern ranged from one year up to 20 years and above. Community perception showed an average age estimate by community increases as conventional age estimate increases. Age pattern indicated that 27.3% samples were within 8-10years and 27.5% were within 12-17 years age groups; the remaining lies below and above the indicated age group. Donkeys above 12 years age group were mainly engaged in cart than pack; with significant difference (p< 0.05). Twelve percent teeth abnormality were observed, of these 41.8%, 31.3% and 26.9% were in Hawassa, Dale and Shebedino districts, respectively; with significant difference (p<0.05). Nine type of teeth abnormality recorded; worn teeth (38.8%) followed by fracture (10.5%), diastema (8.95%) were the major ones. Poor relationship observed between body condition score and teeth abnormality (p=0.52); but significant (p<0.05) number of teeth abnormality recorded in old age group. Twelve focus group discussions indicated that estimated productive life of pack donkeys had median of 13 and mode of 15 years, whereas cart donkeys had median 10 and mode 8years. Estimated life expectancy showed that longer age observed in pack donkey's than carts. In conclusion the age pattern ranges from 1year up to more than 20years.various types of teeth abnormality recorded, of these worn teeth were dominant in older age group. Pack donkeys had longer age than carts. Therefore: creating awareness and regular teeth assessment is paramount important.

Key words: Age Pattern · Teeth Abnormality · Donkeys · Dale · Shebedino · Hawassa · Ethiopia

INTRODUCTION

Donkey is domesticated animal under the member of the family equidae. There are about 44 million donkeys worldwide. China ranks first with about 11 million equids and followed by Pakistan, Ethiopia and Mexico [1].

The most principal adaptation of the donkey is because of natural ability to endure a degree of dehydration about equal to 30% their body weight and to minimize absorption of solar heat and are well adapted in dry arid environment [2, 3]. Their browsing behavior on plants that contains high levels of hard silicates results in exposure of teeth to greater attrition forces, prone to wear and tear than those of domestic horse [2].

Donkey's role in various energy sources is highly admirable and cannot be ignored, because they are the main source of low cost and easily available traction power. Their basic functions include transportation of passenger and agricultural products using pack and/or cart is well recognized both in urban and rural areas. Despite such valuable contribution, the welfare of donkeys is not properly addressed. Such neglect is not only in humane, but also lowers working efficiency leading to a very low economic return to their owners [4]. Although there is an increase in mechanization throughout the world, donkeys are still well deserving of the name beast of burden with their inherent ability to thrive in harsh and mountainous environments in developing countries like Ethiopia[5].

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Equine dentistry is a very important but until recently rather neglected area of equine practice, consequently with many equines suffering from undiagnosed, painful dental disorder [3].

The ageing of donkeys from their dentition involves the assessment of numerous dental criteria [6]. The dental criteria have considerable advantages in that they provide relatively accurate age finding [7]. Although only small numbers of aged donkeys are present in more wealthy countries, about 95% of the world's population donkeys involved in agriculture, transport and small industries in developing countries, where millions of families depend on them for their livelihood [5]. The donkeys at the donkey sanctuary in Devon have an average life expectancy of 27 years over than recorded in many developing countries [4]. Age determination is more accurate in younger donkeys and involves recognition of the type of teeth present and an assessment of stage of eruption [8]. 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, tartar, worn, displaced, retained and hooked teeth [3].Therefore; this study was conducted to estimate age pattern of pack and cart working donkeys and identify teeth abnormality in sampled donkeys; appreciate community perception on productive lifespan and life expectancy of working donkeys.

MATERIAL AND METHODS

Study Area Description: The study was conducted in southern Ethiopia at Hawassa town, Dale and Shebedino districts of Sidama zone from November 2010 to April 2011. Hawassa, Dale and Shebedino districts are located around 275kms far away from Addis Ababa in southern direction. The altitude ranges from 1790-2950 m.a.s.l. The area receives an average annual rainfall ranging from 800-1500 mm with minimum and maximum mean temperature of 12.6°C and 30°C and with mean relative humidity of 51.8%. The total donkey population of Sidama zone is estimated to be 54,066.

The climate in all study area is characterized by long rainy season from June to September accounting for 75% of total rainfall; a short rainy season ranges February/March to April/May and a dry season from October to January [9].

Study Animal and Design: The study design was cross sectional study on pack and cart donkeys found in three selected districts (Hawassa, Dale and Shebedino) of Sidama zone. All study animals were male. Female donkey was not observed in the study population because the owners usually own male donkeys for the purpose of transportation and believing that male donkeys are more energetic and have endurance than female. In general there is no trend of reproduction of donkeys in the area. Donkeys for this study were selected regardless of work type, body condition, sex and age.

Sample Size Determination: The total sample size of 384 was determined based on simple random sampling methods [10] with estimated prevalence of 50% and absolute precision of 5%. However, as this research is the first in its kind in the country, sample size was increased up to 550 in order to generate reliable information. In addition, 12 focus group discussions with local communities were conducted in selected villages of the study area to estimate productive life and life expectancy of working equines.

Sampling Strategy: Five hundred fifty (550) pack and cart donkeys were sampled using systematic random sampling. The sample size were proportionally divided into three districts based on donkey population found in each districts; accordingly, 110(20%), 219(39.8%) and 221 (40.2%) were allocated for Hawassa, Shebedino and Dale districts, respectively. Individual sample was taken from veterinary clinics, market, mill house and village. These sampling sites were used alternatively ones every week in order to provide equal sampling opportunity and sample were taken until the sample size attained.

Study Methodology: During sampling activities the consent of animal owner was asked before each sampling procedure conducted. If the animal owner is not willing, then opportunity was given to the next willing animal owner. The same procedure was continued steadily until the sample size attained throughout study period. All sampled animals were physically restrained by animal owner and causal worker. Mouth was thoroughly examined for the presence of any feed pack on teeth. If there is feed pack on teeth, it was removed; not to interfered age estimation and abnormal teeth identification. Dental abnormalities was also observed and recorded. Age was estimated using teeth eruption according to Jill [6] and Dacre *et.al* [7]. Data about teeth

abnormalities, body condition score and work type, age estimate by researcher and by animal owner were recorded, simultaneously.

A total of twelve focus group discussions were conducted in selected kebeles of study area. In each group there were a minimum of six and a maximum of eight animal owners were participated. The groups were selected using key informants (kebele leaders) where the key informant identified cluster of communities. Focus group discussion was elicited by providing main issues about age estimate. Each group was allowed to estimate productive life and expectancy life of working donkey and categorized according to their work type. Each member in the group has listed their own age estimation of donkey for productive life and expectancy life and then the listed age estimate ranked with group agreement. Accordingly, each group has ranked the age estimated by the group member for both productivity life and life expectancy in pack and cart donkeys. Ranking was conducted by the group agreement using piles of 30 beans, where large proportion piles was given to the most agreed age estimate and then followed by less number of piles for the second age estimate. Based on focus group discussion finding the first three ranked age estimate were used for data analysis, where range, mode and median of the ranked age estimate were calculated.

Data Analysis: Raw data were entered into a Microsoft excel spread-sheet. Descriptive statistics was utilized to summarize data. The STATA-9[11] software was used for data analysis. Age estimate by direct observation were compared with body condition score and other factor.

Dental abnormality against with body condition and age group, work type was analyzed. The test result considered to be significant when $p < 0.05$ at 95% confidence interval.

RESULTS

In this particular study 550 male donkeys were examined for age group pattern of working donkeys in the area. Among this it was found that 130(23.6%), 202(36.7%) and 209(38.0%) were under the age of less than five, between five to twelve and above twelve years of age, respectively. Nine of them were not grouped in neither of the age categories because of dental problems, where it was difficult to estimate the age of sampled animals; but the kind of teeth abnormality in these animals were recorded.

Age Estimate Comparison Between Animal Owner and Conventional Methods: The average results of animal owner age estimate was compared with conventional methods and six age group categorization used ; it was observed that there was relatively an average age estimate increment, as conventional age category increases as shown in Figure 1. According to the result observed, there was relatively over estimation by animal owners on the first three age category and the rest category match with conventional average age estimate.

Body Condition Score and Teeth Abnormality in Three Selected Districts: As shown on Table 1. Among poor body condition donkeys, 22.2% had dental abnormality, where as medium body condition score and good
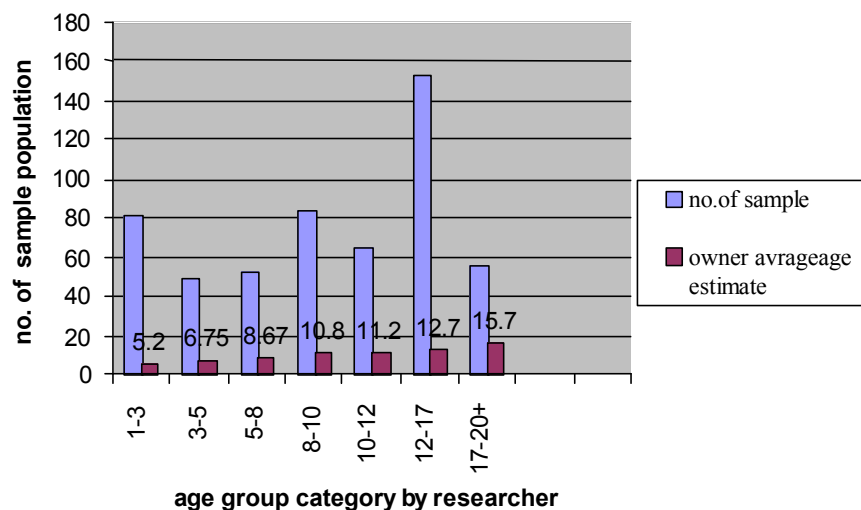

Fig. 1: Comparison between an average age estimate by animal owner and conventional age categorization by researcher

Table 1: prevalence of teeth abnormality in different body condition score category and selected districts

BCS	No Sampleno.	abnormal teeth	%, 95%CI	X^2	p-value
Poor	54	12	22.2[12.5, 35.9]		
Medium	271	32	11.8 [8.0, 16.9]		
Good	225	23	10.2 [6.7, 15.1]	5.9	0.052
District					
Hawassa	110	28	25.5[17.8, 34.8]		
Dale	221	21	9.5[6.11,14.4]		
Shebedino	219	18	8.2 [5.1,12.9]	22.9	0.01
Total prevalence of teeth abnormality	550	67	12.2[8.7- 18.2]		

Table 2: Distribution of work type in selected three districts of Sidama zone

		Work type		
Districts	No of sample	Pack (%)	Cart (%)	Level of significant
Hawassa	110	0	110(100%)	P<0.05 cart animals
Dale	221	157(71.1%)	64(28.9%)	P<0.05 pack animals
Shebedino	219	78(35.6%)	141(64.4%)	P<0.05 Cart animals

Table 3: Prevalence of poor body condition score in three selected districts of Sidama zone

District	No of sample	Poor BCS	%, 95%CI	X^2	p-value
Hawassa	110	14	12.7		
Dale	221	20	9.1		
Shebedino	219	20	9.1	1.5	0.51
Total	550	54	9.8		

Table 4: proportion of work type in different age category and their relative significant association.

		Work type and their percentage			
Age category	Sampled animals	Pack	Cart	X^2	p-value
Un estimated	9	4(44.4)	5(55.6)	0.11	0.74
1-3	82	49(59.8)	33(40.2)	3.03	0.08
3-5	49	24 (49.1)	25(50.9)	0.02	0.84
5-8	53	22(41.5)	31(58.5)	1.49	0.22
8-12	150	65(43.3)	85(56.8)	2.69	0.10
12-17	151	54(35.8)	97(74.4)	21.65	0.001
17-20+	56	18(32.1)	38(67.9)	6.37	0.01
Total	550	236(42.9) `	314(57.1)	10.87	0.001

body condition score donkeys had 11.8 % and 10.2% prevalence, respectively. The difference in teeth abnormality was not significant with x^2 calculated 5.94 and p= 0.052. On the other hand, high percent of dental abnormality were encountered in Hawassa district with 25.5% and Dale and Shebedino districts had the prevalence of 9.5%, 8.2%, respectively. There was a significant difference between Hawassa and the remaining two districts p<0.05.

As shown in Table 2 proportion of work type of donkeys vary in study area, where in Hawassa district all sampled animals were engaged in carting, where as in Dale there was high proportion of donkeys were engaged for pack and low proportion were cart donkeys. In Shebedino there was high proportion of cart animals than pack animals. The difference between work type was significant in all districts (p<0.05).

As shown on Table 3 the prevalence of poor body condition score in Hawassa were 12.73 % and it was 9.1% and 9.1% in Dale and Shebedino districts, respectively. There was no significant difference (p>0.05) in poor body condition score between the three districts, despite significant difference in teeth abnormality in working donkeys of Hawassa town. This might be associated with the type of feeding style.

Table 5: Age group proportion in selected districts of Sidama zone

	District				
Age category	Hawassa	Dale	Shebedino	Total	Proportion
Un estimated					
1-3	5(55.5)	3(33.33)	1(11.11)	9	1.6
3-5	12(14.6)	39(47.56)	31(37.8)	82	14.9
5-8	14(28.6)	18(36.73)	17(36.7)	49	8.9
8-12	7(13.2)	16(30.18)	30(56.6)	53	9.6
12-17	21(14)	58(38.66)	71(47.33	150	27.3
17-20+	34(22.5)	70(46.66)	47(31.12)	151	27.5
	17(30.4)	17(30.33)	22(39.28)	56	10.3
Total	110(20.0)	221(40.2)	219(39.8)	550	

Table 6: Type of teeth abnormality observed in different age category

		Age group category		
Teeth abnormality	Sampled animals	<10 years	10-20 years	> 20years
Diastema	6	2	4	-
Displaced teeth	2	-	-	-
Fractured teeth	7	5	2	-
Hook teeth	4	2	2	-
Loss of teeth	1	1	-	-
Parrot teeth	5	5	-	-
Retained teeth	5	5	-	-
Tartar	8	1	6	1
Worn teeth	26	-	-	26
Buccal ulcer	3	1	1	1
Total	67	22(32.8%)	15(22.4%)	28(41.8%)

Table 7: The effect of teeth abnormality on body condition of studied animals

		Body condition score category		
Type of teeth abnormality	No sample	Poor	Medium	Good
Diastema	6	1	4	1
Displaced teeth	2	-	1	1
Fractured teeth	7	1	2	4
Hook teeth	4	-	1	3
Loss of teeth	1	-	-	1
Parrot teeth	5	2	2	1
Retained teeth	5	-	3	2
Tartar	8	3	1	4
Worn teeth	26	5	16	5
Buccal ulcer	3	-	2	1
Total	67	12(17.9)	30(44.8)	22(32.8)

Table 8: Productivity years and life expectancy of pack and cart donkeys as estimated by focus group discussion.

Type of work life span	No.of group	Range of estimate	Mode	Median
Pack 1. Productivity Life 2. Life expectancy	1212	8-2015-30	1520	1320
Cart 1. productivity life 2. life expectancy	1212	6-2010-25	815	1015

Teeth Abnormality in Different Age Groups and Work Types: There was significantly high proportion of older age group involved in cart pulling donkeys (p<0.05) than pack donkeys. As indicated in Table 4 up to age group 8-12 there was no significant difference (p>0.05) between pack and cart animals, but in older age group above 8-12 showed significantly high proportion of cart donkeys were involved (p<0.05) than pack donkeys. It was observed that older age group has showed high proportion of teeth abnormality.

As shown on Table 5: there is significant difference (p= 0.001) in age group pattern of donkeys and majority of the sampled donkey almost 54.7% of them lie within the range of 8-17 years of age group; where as 1.64% of the donkeys were difficult to determine their age due to dental abnormalities. All age group were observed in three selected area.

As shown on Table 6. Aged donkeys have high prevalence of dental abnormality with 41.8% lies at the age category above 20 years old. Especially, worn teeth were almost observed in age group above 20 years. This might be associated with wearing of teeth due to long period of service; where as other abnormality mainly associated with congenital defect except fracture and buccal ulcer this can happen at any age group which is associated with external environment.

As it was observed in this study teeth abnormality were not directly related with body condition score. This could be associated with the type of feed given to these working animals. Most of them were cart donkeys, where they usually given chopped sugar cane and crop residue like nughe cake, wheat bran etc, which does not need strong effort to chew feed as shown in Table 7.

Focus Group Discussion: Twelve focus group discussions were involved in selected districts and have shown age estimate in pack and cart animals. The result indicates that productive years and life expectancy in pack donkeys showed relatively high median of 13 and 20 years, respectively. In cart donkey productive years and life expectancy shown median of 10 and 15years. There is relatively high age estimate in pack animals than cart animals. This difference might be due to severe overload stress on cart donkeys as shown in Table 8.

DISCUSSION

A detailed assessment of the gross socio economic importance of the pack and cart pulling donkeys in the study revealed that the donkey plays major role for the urban and rural communities in the study area. Many individuals engaged in cart driver and use as a means of existence or lively hood. In the rural farmers /Individuals use them for pack to carry goods from farm and/or market to home and visa vise. The farmers/ cart drivers call their donkey "Isuzu" of the poor. This is because they use their donkey to transport goods as well as themselves.

In general participants in the focus group discussion (FGD) indicated that the donkey can with stand harsh environmental and management conditions. However the major problem that donkey is facing are lack of feed because many owners are not buying feed for them. This may partly be due to they are poor or partly due to carelessness to their donkey. Overloading, biting which ultimately results in wound infliction, which is of a major welfare issue. Harnessing problem in cart pulling and back sore due to loading of hot flour at the back is also major problem of pack donkeys in the study area.

During study period age and sex pattern indicated that donkeys in the selected area are very important; where age at first work starts as early as one year; however majority of sampled animals were old age group. This might indicates that donkeys were very important contributors in daily livelihood of community and were usually kept for a long period of time. There was a match between average age estimate and conventional age estimate, however, individual owners had estimated differently with great variation from the average estimate. Most of the communities use tooth eruption and teeth worn, especially canine teeth used as reference to estimate age of animals. In equine they consider the animals is fully matured when canine teeth erupts. On the other hand, all sampled animals were also male. This was not because of purposive sampling procedure, rather all the study population were male in selected districts. This might indicate that donkeys are kept only for transportation or work rather than for reproduction purpose.

The overall teeth abnormality compared with total sample in each body condition score category indicated in Table 1; which shows 22.22% of donkeys with poor body condition score had dental abnormalities which is about twice of the donkey with medium body condition score (11.8%) and good body condition score (10.2%) abnormalities; with p= 0.052 indicating there is slight significant difference in body condition score with dental abnormality. However, in Table 7 indicates that there is no direct effect of teeth abnormality on body condition score.

Study in India showed that body condition seems to have the closest correlation with teeth abnormal score of the animal with significance level (r=0.639). That is poor teeth could lead to poor welfare and which conversely could lead to poor body condition score [12]. In extreme dental abnormalities, decreased feed and possibly in efficient feed digestion and utilization may eventually occur, leading to weight loss. However, this is only associated with severe dental disorder or oral trauma. Therefore, the absence of weight loss does not indicate absence of dental disease [4] and vice-versa. I this study teeth abnormality might not be severe and /or feed type given to the animals might be suitable for their affected teeth. Some of the association of poor /abnormal teeth condition with poor body condition of animal could be due to: Inability to eat enough because of discomfort, inability to masticate feed properly and constant pain in the mouth irritating the animals [12].

There is no significant difference in the body condition score between the study districts. This may be due to similarity in feeding and management system. Wheat bran is the most common feed in combination with other additional daily feed in three districts. Most of the sampled donkeys scored body condition medium (49.27%) and good (40.9%).

The age pattern of working donkey in the study area ranges from 1 up to 20+ years of age, out of these 27.3% and 27.5% were within age group 8-12 and 12-17 years, respectively; with significantly high proportion (P<0.05) as compared to other age groups. Majority of working donkeys' age in the study area lies within the range of 8-17years. Similar study were done and found that the average life expectancy of donkeys in developing countries lie between 8-13years [5]. The donkey in the donkey sanctuary in Devon has average life expectancy of 27 years over double with that of recorded in many of developing countries [4]. The short life span of donkey in the study districts might be due to serious welfare problem such as management problems including food shortage, improper shelter, long working time and distance, at early age loading, disease, biting which ultimately results in wound development. These all problems might be associated with poor awareness of the users/owners. Many owners agree on that "the donkey will be fed if there is work available otherwise allowed to graze on pasture without any supplementation.

It was difficult to estimate the age of 1.64% sampled donkey due to dental abnormality. Furthermore, certain teeth abnormality was associated with age; especially there was high worn teeth abnormality in older age group.

These might be associated due to wear and tear of teeth during their life time that resulted on dental abnormality in old donkeys. Study indicates that other than congenital dental abnormalities, worn teeth abnormality was significantly associated with age groups but not with body conditions score. In this study 41.8% the dental abnormalities were encountered at the age group above 20, with significant difference (P<0.001) than other age group, the finding agrees with [13]. Research findings have also indicated that aged donkey has significantly high dental disease prevalence [14]. Proportions of dental abnormality were 25.5%, 9.5%, 8.2% in Hawassa, Dale and Shebedino districts, respectively. The proportion in Hawassa was twice that of the proportion in Dale and Shebedino districts. Significantly high proportion of dental abnormality was observed in Hawassa (p<0.05) than Dale and Shebedino districts. This might be associated with intensive work in the city which can expose for accidental tear and wear.

The overall prevalence of dental abnormality in working donkeys were 12.2%, of these 38.8% of the abnormalities were worn teeth mainly on old age group followed by tartar (11.94%), fracture (10.45%), diastemata(8.95%), parrot mouth (7.46%), Retained teeth(7.46%), hook teeth (5.97%), buccal ulcer (4.48%), displaced teeth (2.98%) and loss (1.5%). The high proportion of worn teeth might be due to the old age of donkey which is physiological but considered as abnormality because it cause problem on feeding resulting inefficient feed intake and digestion [4, 7].

The result on the graph shows as the conventional age estimate increases, there were an increase the average age estimate by owners in each age group category. However, the range of age estimate by owners was wide as compared to conventional ageing methods. This indicates that animal owners had little knowledge and/or had little information about age estimation of donkey while they were buying. The main reason of discrepancy between conventional ageing method and owners age estimate might be all donkeys in the study area bought from other place, they are not breed in the area and hence the information about age were scanty.

The range of Productivity life age estimate by focus group discussion (FGD) was 8-20 and 6-20years for pack and cart donkeys, respectively. In addition, for the life expectancy the range was 15-30 and 10-25 for pack and cart donkeys, accordingly. This range is short, when compared to the 6-52 recorded in the donkey sanctuary [4], but agrees with 8-13years [5]. The mode was 15 and 8

for the productivity life of pack and cart pulling donkeys, in the same way. It was 20 and 15 for the life expectancy of pack and cart pulling donkey, correspondingly. The median of productivity life was 13 and 10 and life expectancy was 20 and 15, for pack and cart donkeys, respectively. The mean age of donkeys was 31.1 and the median was 31 [15-17]; which is highly varies with the estimated range, median and mode in the focus group discussion.

The finding was short productivity life and life expectancy, which might be due to poor management system. However, further research has to be conducted in order to clear out vague information.

CONCLUSION

This study has shown that age pattern of working donkeys involves from one year up to above 20 years of age; this indicate that there is no age limitation, even animals starts at early age. Aged animals showed high proportion of worn teeth abnormality as compared to younger age groups indicating that worn teeth abnormality is associated with wear and tear of teeth during their life time. There was no direct relationship between teeth abnormality and body condition score in this study; however, when the problem is much more severe it can affect the body condition of the animals, since it can impair normal chewing process. In addition there was no significant age variation between work types except that most of the older age group was cart donkeys and were found in Hawassa town.

Focus group discussion has indicated that pack donkeys do have relatively long productivity life and life expectancy than cart donkeys. This was associated with frequent stress and overworking in case of cart donkeys.

Based on the above conclusion the following are recommended.

- Strong intervention has to be conducted to change the attitude of community about better management and creating awareness towards health care of donkeys.
- Regular oral examination for any dental abnormality and providing appropriate treatment is very important, as teeth abnormality can totally affects health and work efficiency.

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