Lucrări ştiinţifice **Zootehnie şi Biotehnologii**, vol. **41 (2)** (**2008**), Timişoara

NEWER ASPECTS IN THE AGE-DEPENDING ALTERATION OF HORSE TEETHING

ASPECTE NOI CU PRIVIRE LA SCHIMBĂRILE DEPENDENTE DE VÂRSTĂ ALE DENTIŢIEI CALULUI

GÁSPÁRDY A., SIMONYI ZSÓFIA, ESZES F., BODÓ I.

Szent István University, Faculty of Veterinary Science, Institute for Animal breeding, Nutrition and Laboratory animal science, Budapest, Hungary

The authors give a short orientation about the age related parameters of incisors based on the literature. They tell about their own investigation of two conventional (cup depth and its yearly abrasion) and of two first applied (relative abrasion and area of dental table) parameters. The previous literature evaluated the parameters in question in two different ways: time period or frequency analysis. The authors introduced a new method: the linearly-corrected row data which is processed by analysis of variance. Their elaboration reaches altogether 107 individuals, three horse types (English Thoroughbred, English Half-breed and pony), and two genders (mare, stallion + gelding).

The cup depth at the levelling is the shallowest in the ponies (2 mm), while it is deeper in the Half-breeds (5 mm) and in the Thoroughbreds (4.4 mm). This deviation can be explained by body size differences between breeds. The degree of the absolute and the relative abrasion of the cup can be associated with the early utilisation (racing) and with the intensive feeding (concentrate). The area of the dental table is the largest in the pony, and the smallest in the Thoroughbred. The reason for the slowest abrasion observed in the ponies can be explained not only by the more traditional feeding but also by the bigger occlusive surface. The authors assume that the selection for the early utilisation of the English Thoroughbred resulted in an automatic change of the well inherited chronology of dentition; more early matured animals producing, in relation to the chronology of dentition.

In this breed the general refinement of the whole organism, but especially of the bone system manifests in the narrowing of the teeth also.

Keywords: cup depth, dental table, English Thoroughbred, Pony breeds, early maturity

Introduction

Since ancient times the age determination of the horse by their teeth played an important role. First written source is arisen from *Xenophon* (ca. B.C. 430-354; *Περι Ιππικης*; 13). A large part of the modern literature (e.g. 2, 3, 12, 16 and 18) dealing with this topic draws a distinction between breeds. Also the feedstuff composition has a great impact on the wearing of the teeth. Nevertheless, the time

of first eruption and change of the teeth is the most heritable parameter in this field. Today, the importance of the age evaluation by the teeth in the everyday life is decreased due to accurate control of identity (using certificates based upon the precise data recording and animal markings). In some cases however its knowledge is still important e.g. to check the given data, to acquire a health-certificate at time of sale, to detect fraudulent manipulations, and to control the teething. According to the immemorial experiences approximately twelve parameters come up in the age determination by teething in horses, nowadays. In most of the cases the lower incisors should be used, because here the age-depending changes are much more reliable than in upper ones (e.g. 6 and 23), and which are - at the same time - easier to evaluate.

1. Eruption of milk teeth. The eruption of the teeth means that, both the labial and lingual border become discernible (e.g. 8 and 14). Foals are generally born without teeth, but the corner incisor (i_3) will be erupted by six months of age also.

2. Eruption of permanent teeth. The change begins with the milk teeth falling out and ends with the levelling of permanent ones. The permanent central (I_1), intermediate (I_2) and corner incisor (I_3) appears at 2.5, 3.5 and 4.5 year of age, respectively. Teeth of upper jowl are replaced earlier than teeth of lower jowl (e.g. 24). Time for levelling takes approximately half a year.

3. Cup depth and its wear. The enamel invagination of the masticatory surface, the cup, is present on the lower and on the upper incisors at an average of 6 and 12 mm deep, respectively (e.g. 1, 4, 5 and 20). Wear occurs to a depth of 2 mm per year so the cup disappears in three years: thus, when the cup disappears from the lower I_1, I_2 and I_3 the animal is approx. 6, 7 and 8 years old, respectively (e.g. 10, 19 and 25).

The trace of the age-depending changes just as an estimation (control) of age are further based on the following parameters: *4. Enamel spot, 5. Dental star, 6. Shape of the dental table, 7. Proportion of dental table's diameters, 8. Incisive arcade, 9. Dental arch, 10 Hook., 11. Galwayne's groove, 12. Tooth length* (e.g. 7, 9, 11 and 15). According to our aim, we dispense with the review of them.

Our study intended on the one hand to investigate new aspects (area of dental table and relative yearly abrasion), on the other hand to adopt new methods (linear fore-correction and effects in the model) in the data processing.

Materials and Methods

Our investigation was carried out in 5 studs; data were collected from altogether 107 horses in the years 2005 and 2006. Horses, which showed vices which caused the irregular wearing, and teething faults were excluded from the study. Our investigation covered three horse breeds (types): 1. English Thoroughbred (medium-sized light horse with early maturity and quick metabolism; n = 38), 2. Hungarian Half-bred (bigger–framed, heavier and quieter, later maturing horses with Thoroughbred blood proportion; n = 44), and 3 ponies (namely 12 Welsh Ponies and 13 Haflingers).

First, the cup depth on all measurable lower incisors was determined. In those same horses, where we had the opportunity to repeat the data collection within half a year, their averages were taken into consideration. A plasticine model was taken from the dental table of all the evaluated teeth. After that, from this protuberant model, a scaled planar picture was created by using a copy machine on which the area of the dental table was measurable. The size of this area was determined by planimeter (22). Any differences which were found between stallions and geldings, we merged them together in the data processing.

Within the frame of a fore-correction, from the raw data *adjusted cup depth* values (for the levelling and for the wearing of a two-year-long period; 3-4-5 and 5-6-7 years of age, respectively) were calculated by linear regression. In addition, we calculated the *average yearly wear*. Similarly to the above mentioned fore-correction, the *adjusted area of dental table* values for three consecutive ages (for the levelling, for the wearing of a two-year-long period and for twelve years of age) was created. The effects influencing the parameters investigated were established in analysis of variance by the following single-trait general linear model (21):

$Trait_{ijk} = B_i + G_j + I_k + \varepsilon_{ijk}$

B_i = fix effect of the breed (1-3; Thoroughbred, Half-bred, pony)

G_j = fix effect of the gender-category (1-2; stallion + gelding, mare)

I_k = fix effect of incisor's type (1-3; central, intermediate, corner)

ε_{ijk} = error.

After the analysis, the relative yearly wear was calculated, with the production of a percentage figure of the cup abrasion. Here we used Chi^2-test.

Results and Discussions

Table 1 presents the results gotten in cup depth. The cup depth is deeper in male (stallions + gelding) than in female horses, which could be explained by larger body size of the male sex; however the difference was not significant ($p = 0.177$). The average yearly wear was more similar by gender.

Regarding the breed, the cup depth at the levelling was the shallowest in ponies (2 mm), while it was the deepest in Half-breeds (5 mm); with the value of the Thoroughbreds (4.4 mm) being close to the value of the Half-breeds. Reason for this difference between breeds can basically be attributed to their size-difference. The average yearly wear is smaller in ponies then in horses (Thoroughbred and Half-bred). The degree of the yearly wear can be associated with the beginning of the utilisation and with the volume and composition of the feedstuff. The Thoroughbreds run races at a young age and are fed intensively with concentrates. So it is not surprising that their teeth are worn down quicker. In the case of Half-breeds we got nearly the same values, which can be explained by its origin (Thoroughbred relatedness) and by its similarly early and intensive utilisation

Table 1: The cup depth and the average yearly abrasion on lower incisors

Effect	n	Cup depth (mm) at the levelling LSM	SEM	two years after LSM	SEM	Yearly abrasion, absolute (mm) relative (%)* LSM	SEM	%
Gender:		p=0.177		p=0.177		p=0.848	p=0.624	
Stallion +gelding	55	3.99	0.22	2.13	0.22	0.93	0.03	23.3
mare	52	3.51	0.28	1.65	0.28	0.93	0.03	26.5
Breed (type):		p<0.001		p=0.006		p<0.001	p=0.678	
Half-bred	44	4.99	0.25	2.62	0.25	1.10	0.03	22.0
Thoroughbred	38	4.41	0.23	1.94	0.23	1.23	0.03	27.9
pony	25	1.97	0.40	1.11	0.40	0.46	0.04	23.4
Incisor-type:		p<0.001		p=0.005		p<0.001	p=0.031	
central (I_1)	34	3.51	0.35	1.06	0.35	1.26	0.04	35.9
intermediate (I_2)	44	3.33	0.26	2.01	0.26	0.66	0.03	19.8
corner (I_3)	29	4.41	0.30	2.61	0.30	0.87	0.04	19.7

* *Chi^2-test*

(show jumping). Ponies are generally kept on pasture or fed on basic fodder, and its rearing is also more traditional, however its utilisation is less exhausting. The relative yearly wear was the strongest in Thoroughbreds.

The cup depth differs according to incisor-type as well: it is always the deepest on the corner incisor. The quickest abrasion is observable on the central incisors, which is in accordance with other literature (e.g. 11 and 17).

From the Table 2 it is obvious that there are remarkable differences in the area of dental table by breed as well as by tooth-type. Sexual dimorphism could not be found in the results. Ponies have the largest occlusive surface, while Thoroughbreds has the smallest one.

Table 2: Area of the occlusive surface by aging

Effect	n	Area of the occlusive surface (cm^2) at the levelling LSM	SEM	two years after LSM	SEM	at twelve years of age LSM*	SEM**
Gender:		p=0.784		P=0.784		p=0.784	
Stallion +gelding	55	0.488	0.012	0.482	0.012	0.457	0.012
mare	52	0.484	0.011	0.478	0.011	0.452	0.011
Breed (type):		p=0.042		P=0.008		p<0.001	
Half-bred	44	0.475	0.013	0.467	0.013	0.438	0.013
Thoroughbred	38	0.467	0.014	0.455	0.014	0.411	0.014
pony	25	0.517	0.015	0.517	0.015	0.514	0.015
Incisor-type:		p<0.001		P<0.001		p<0.001	
central (I_1)	34	0.492	0.013	0.467	0.013	0.381	0.013
intermediate (I_2)	44	0.550	0.014	0.543	0.014	0.521	0.014
corner (I_3)	29	0.417	0.015	0.429	0.015	0.481	0.015

The slower abrasion in ponies can be explained not only by the different feeding but also by the larger dental table.
The intermediate incisor can be characterized by having the largest, the corner incisor by having the smallest dental table at the levelling. The area of the dental table decreases by age on the I_1 and I_2 – in accordance with their anatomical shape -, and - on the contrary to this – it increases on the I_3 (at least at the investigated 12 years of age). This fact can partly be explained by the not totally sheer position of the dental table on tooth-spindle.

Conclusions

In our study, the cup depth at the levelling in horses (Thoroughbred, Half-bred) was remarkable shallow (4.5-5 mm) compared to the values ("at least 6 mm") presented in the literature. Probably, we are right, and these horses have really shallow cup. If the intact cup depth of about 6 mm is true, therefore the tooth should have erupted, and/or began to wear earlier to become 4.5-5 mm by 3 years of age. According to this, we suppose that the selection for early utilisation of the light horses (Thoroughbreds and Half-breeds) resulted in an automatic change of the well inherited chronology of dentition; in producing earlier matured animals regarding the original chronology.
Results gotten from the area of dental table pointed out the general refinement in the Thoroughbred as an entire organism, but especially that change of the bone system manifests in the narrowing of the tooth also.
The area of the dental table is inadaptable in the everyday routine of age determination, but it characterizes well the differences between incisors, and it can successfully be used in zoological researches. Unfortunately, the relative yearly abrasion did not show serious differences in its first application.
We keep our data processing method (fore-correction with linear regression and influencing factors) very practicable. This method becomes especially important when there are only a few individuals of variant ages available.

Bibliography

1. **Bodó, I., W. Hecker** (1992): *Lótenyésztők kézikönyve*; Mezőgazda Kiadó, Budapest, 79-81.
2. **Bolte, A.** (1995): *Untersuchungen zur Zahnalterbestimmung beim Arabischen Vollblutfperd*, Diss. Med. Vet., Freie Universität Berlin
3. **Brömler, K.** (1954): *Die Alterbesstimmung beim Kleinpferd auf Grund der Zahnentwicklung und –Abnutzung*, Diss. Med. Vet., München
4. **Csukás, Z.** (1949): *Az emlősök életkorának meghatározása*; Különlenyomat a Phylaxia Állami Oltóanyagtermelő Intézet oltási tájékoztatóit tartalmazó 1949. évi könyvecskéből, 145-148.
5. **Fehér, Gy.** (1980): *A háziállatok funkcionális anatómiája*; Mezőgazdasági Kiadó, Budapest, 305-307.

6. **Habermehl, K.H.** (1975): *Die Alterbestimmung bei Haus- und Labortieren*; 2. Aufl., Verlag Paul Parey, Berlin und Hamburg
7. **Hámori, D.** (1946): *Lótenyésztés*, Athaeneum, Budapest, 102-110.
8. **Kovácsy, B., K. Monostori** (1892): *A ló és tenyésztése*. Koczányi és Vitéz, Kassa 719.
9. **Mcmullan, W.C.** (1983): *Dental criteria for estimating age in horse*, Equine Pract, 5. 36 - 43.
10. **Mikecz, B.** (1936): *Lóismeret-vezérfonal*, Monopol Könyvkiadó Vállalat, Budapest, 25-33.
11. **Muylle, S., P. Simoens, H. Lauwers** (1996): *Aging horses by an examination of their incisor teeth: an (im)possible task?*, Vet. Rec., 138. 295 - 301.
12. **Muylle, S., P Simoens, H Lauwers, G. van Loon** (1999): *Age determination in Mini-Shetland Ponies and donkeys*; J. Vet. Med. Ser. A, 46 (7). 421 - 429.
13. **Nemes, J.** (2006): *Xenophón: Peri Hippikés. A lovaglás művészete az ókori Athénban*, Akadémiai Kiadó, Budapest, 132.p.
14. **Pessina, J.J.** (1811): *Über die Erkenntniß des Pferdealters aus den Zähnen*, Wien
15. **Richardson, J.D., J.G. Lane, K.R. Waldron** (1994): *Is dentition an accurate indication of the age of a horse?*, Vet. Rec., 135 (2). 31-34.
16. **Rieden, S.** (2003): *The evaluation of the age by the dentition for Warmblood, South-German Coldblood and the Thoroughbred Horses*, Diss., Szent István Egyetem Állatorvos-tudományi Kar, Budapest
17. **Rieger, I.** (1987): *Untersuchungen zur Zahnalterbestimmung beim Englischen Vollblut (Galopper)*, Diss., Fachbereich Vet. Med., Freie Universität, Berlin
18. **Rosenberger, F.** (1955): *Irregularitäten im Zahlwechsel bei spätreifen Pferderassen*, Wiener Tierärztliche Mschr., 42. 549-553.
19. **Schandl, J.** (1955): *Lótenyésztés*; Mezőgazda Kiadó, Budapest, 77-82.
20. **Schwerdt, H.** (1909): Beiträge zur Lehre vom Zahnalter des Pferdes, Diss. Med. Vet., Bern, Rud. Bechtold & Comp., Wiesbaden, 12.
21. **StatSoft, Inc.** (2005): *STATISTICA (data analysis software system), version 7.1*. www.statsoft.com.
22. **Simonyi, Zs., Zs.K. Faragó, B. Szemere, L. Jávorka, A. Gáspárdy** (2007): *Newer experiences on age related changes of horse teething*. Magyar Állatorovosok Lapja, Budapest, 129. 455 - 463.
23. **Tormay, B.** (1862): *Lófogtan vagy a ló életkorának meghatározása*, Pest
24. **Tormay-Krenmüller, K.** (1831): *A fogakról, különösen a hasznos házi emlős állatokat tekintve, azoknak életkorok megismerése végett*, Pest
25. **Wellmann, O.** (1917): *A lovak életkorának meghatározása*. Állatorvosi Lapok, Budapest, XL. évf., 21. sz., 133-136.