



TONGUE ROLLING STEREOTYPY IN CATTLE – ETIOLOGICAL, EPIDEMIOLOGICAL AND CLINICAL INVESTIGATIONS

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Summary

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The present studies were carried out to establish the causes for appearance, prevalence, age- and sex-related features, the frequency and 24-hour pattern of clinical signs accompanying the tongue rolling stereotypy in cattle. The animals were distributed in 2 groups: group I (n=1055) – control animals that did not demonstrate the tongue play orosthenic syndrome and group II (n=48) – cattle manifesting this stereotypy. Both groups were uniform with regard to age, breed, body condition and sex. They were placed under equal housing conditions (animal hygiene parameters, feed quantity and quality) and activity regimens (walks, feeding etc.). It was found out that the causes for demonstration of the tongue rolling hyperactivity in cattle were the deprivation from food and boredom, due to deficiency of environmental stimuli. The studied stereotypy was observed in cattle in different age groups – suckling and weaned calves, as well as heifers, including pregnant ones. The tongue play activity was no longer exhibited by heifers after calving and moving into the basic herd of lactating cows. The highest intensity (up to 80%) of this orosthenic syndrome was manifested before the morning feeding, between 9.00 and 12.00 AM. Most commonly, the tongue rolling activity was found out in heifers between 13 to 25 months of age. The studied oral stereotypy was not accompanied with changes in measured clinical parameters – rectal body temperature, pulse and respiratory rates, rumen movements, as well as in other activities e.g. rumination, eructation, appetite, sentience, locomotion etc.

Key words: age and sex features, cattle, clinical signs etiology, prevalence, tongue rolling (play)

INTRODUCTION

The orosthenic syndrome is a set of oral activities classified as obsessive-compulsive disorders. They are repetitive, permanent and unusual behavioural abnormalities out of what is deemed normal for the different animal species (McMillan,

2005). It is assumed that the manifestations of abnormal behaviour are directly associated to specific rearing conditions and animal selection (Damasio, 1999; Vučinič & Lazič, 2008). In cattle, the various forms of hyperactivity of the ton-

gue (licking, rolling etc.) are most commonly seen because of tongue prehensility in this animal species, e.g. strong inclination for grabbing things with the tongue due to the nature of feeding (Veissier *et al.*, 1998; Mattiello *et al.*, 2002; Baumont *et al.*, 2006). Most authors (Seo *et al.*, 1998a; Wemelsfelder & Lawrence, 2001; Bokkers & Koene, 2001; Ishiwata *et al.*, 2008; Marekova *et al.*, 2008; İssi *et al.*, 2009) affirm that the main reasons for appearance of this obsessive-compulsive disorder are the lack or restricted time spent on pasture, rearing in excessively small spaces; abomasal ulcerations in calves, lack of variety of external stimuli, feeding a fibre-deficient fodder, boredom, postpartum hypocalcaemia etc. The frequency of tongue rolling decreases as the diversity of external stimuli increases, but could lead to suppression of other oral physiological activities as rumination, grazing and suckling (Wiepkema, 1995; Wemelsfelder & Lawrence, 2001; Prodanovič *et al.*, 2013a,b). The disorder could affect up to 8% of cattle (Marekova *et al.*, 2008), or more than 10% (Sato *et al.*, 1994a), attaining 13.33% of the population (Prodanovič *et al.*, 2013a,b). Cattle within a wide age range are affected: from 6 months to 6 years of age (Sato *et al.*, 1994a; Karatzias *et al.*, 1995; Seo *et al.*, 1998a; Okatan *et al.*, 2008; Rushen, *et al.*, 2007).

The orosthenic syndrome in cattle could be manifested as licking various surfaces or body parts (both own and of other animals), and urine drinking (Shahhosseini, 2013). “Tongue play” involves opening of the mouth, tongue rolling, flicking it outside the mouth and performing multiple rapid various movements of various intensity, direction (rolling, twisting) and frequency (Sato *et al.*, 1994a; Seo *et al.*, 1998a; Rushen *et al.*,

2008). These movements are occasionally accompanied by noisy swallowing of air and saliva (Webb *et al.*, 2016). In some instances of tongue rolling manifestation, biting and licking of various surfaces, most frequently wooden and metal rails, doors, boxes etc. could be observed (Sato *et al.*, 1994a,b; Karatzias *et al.*, 1995).

Oral stereotypies are much more frequent in cattle reared intensively in tie stalls, entirely indoor (Redbo, 1990; 1992; Lindström & Redbo, 2000) deprived from grazing naturally on a pasture (Rushen *et al.*, 2008; Doyle & Moran, 2015). It is demonstrated that cattle reared on pastures spend almost 9 hours daily grazing. The lack of pasture decreases also the time spent ruminating, which further reduces the engagement of cattle (Redbo *et al.*, 1996; Redbo & Nordblad, 1997; Baumont *et al.*, 2006; Corazzin *et al.*, 2010). Rearing in tie stalls largely prevents the locomotion of animals (Broom & Fraser, 2015), and this restriction induces a serious frustration (Juhis & Debreceni, 1999; Wemelsfelder & Lawrence, 2001).

When the intervals among the different feedings are large, the state of “expectation of feeding” in intensively reared cattle occurs (Sandem *et al.*, 2002). The animals have more time between meals, hence the occurrence of boredom (Veissier *et al.*, 1998; Baumont *et al.*, 2006). The type and amount of fodder is essential for onset of the tongue play oral hyperactivity in cattle. It was proved that feeding mainly concentrate or mixing the concentrate with silage and finely ground roughage decreases the time of feed intake, which increases the risk from lack of engagement of animals (Mattiello *et al.*, 2002; Doyle & Moran, 2015). The frequency of the activity decreases substantially after inclusion of unground rough-

age (hay and straw) in the ration of animals.

The studies carried out in 3 farms in Elazig (Turkey) with 15 cattle showing tongue rolling (play) did not demonstrate statistically significant changes in clinical parameters (rectal body temperature, heart rate, respiratory rate and rumen movements) (İssi *et al.* 2009).

Tongue rolling in calves is most frequently seen when they are reared in severely restricted areas (Rushen & De Passille, 1995). It was shown that the frequency of tongue rolling correlated with the presence of abomasal ulcerations. In suckling or growing calves, oral stereotypies occurred consequently to suppressed sucking reflex (Seo *et al.*, 1998; Fröberg & Lidfors, 2009). This is most commonly the case when feeding milk occurs once or twice, instead of 3–4 times a day. Another cause is the early inclusion of roughage and concentrate, which replaces both the frequency and amount of fed milk (Fröberg *et al.*, 2007; Fröberg & Lidfors, 2009). The possibility for enhancing the bouts of the stereotypy increases especially when the roughage is cut in pieces (under 5 cm) (Seo *et al.*, 1998). The same researchers reported that in growing calves reared in groups, tongue play was not observed unlike animals, reared individually. According to other reports (Morisse *et al.*, 1999; Mattiello *et al.*, 2002; Webb, 2014) the cause for the appearance of oral stereotypies in suckling calves is their exclusive feeding a milk replacer or milk, hence disengagement of attention as an important element in the etiology of the disorder (Friend, 1991; Redbo, 1992).

The absence of data in our country about the prevalence of this oral stereotypy was the motive for performing the presented survey aimed at investigation of

causes for onset, incidence, age- and sex-related features and clinical signs accompanying tongue rolling in cattle. The results would be useful for introduction of adequate practical measures of therapy and prevention through management and control of animal health and consequently, productive and reproductive performance of cattle.

MATERIALS AND METHODS

Animals

The surveys were conducted in 5 cattle farms from different regions of the country, as well as in patients of the Farm Animal Clinic to the Faculty of Veterinary Medicine, Trakia University – Stara Zagora, originating from affected farms.

Cattle were allotted in 2 groups – Group I (n=1055): control animals that did not demonstrate the tongue play oros-thenic syndrome and Group II (n=48): cattle manifesting this stereotypy. The animals from Group II were with similar age, breed, body condition and sex. They were placed under equal housing conditions (animal hygiene parameters, feed quantity and quality) and activity regimens (walks, feeding etc.). Cows were reared in tie stalls, indoor; heifers – in a similar production system but with possibility for spending some time in walking yards twice daily (in the morning and in the afternoon). Suckling calves were housed in individual pens.

Methods of examination

Detailed history was recorded for all cattle. A special attention was paid to the following: since when was the abnormal activity present, its duration, diurnal pattern, the importance of various environmental stimuli – feeding, milking, walk-

ing, grazing, available space (area of walking yards, feeding width etc.), physiological condition (pregnancy, lactation) etc. A special attention was paid to data regarding the age, sex, breed, hygienic conditions, type and regimen of feeding.

Some clinical parameters were measured in all animals manifesting the tongue rolling oral hyperactivity and all healthy controls – rectal body temperature (via electronic thermometer GT 2038 Geratherm Medical, Germany), heart rate and arterial blood pressure (electronic device Omron, Japan), respiratory rate and rumen movements, colour of visible mucous coats, appetite, thirst, general condition, sentience, locomotion, urination and defecation (using routine clinical diagnostic methods).

All data were processed using a statistical software (Statistica 6.0 for Windows, StatSoft Inc. USA, 1993). The differences between groups were evaluated by means of Student's test at a level of significance $P < 0.05$.

RESULTS

Our studies have shown that the tongue play activity affected from 3 to 18% of the total population of surveyed farms, with average rate of 4.6%.

The abnormal activity was most prevalent in heifers aged from 13 to 25 months, affecting up to 26% of animals from this age group. From a total number of 218 animals in this group, 37 demonstrated the oral hyperactivity (12.3%).

In the group of growing calves (aged from 3 to 12 months), 4 animals demonstrating tongue rolling were detected out of 112 calves (average rate of 3.6%). The orosthenic syndrome was also detected in 2 suckling calves out of total 87 (2.3%).

In cattle older than 25 months ($n=638$), tongue rolling was seen in 5 animals – frequency of 0.8%.

The diurnal pattern of the abnormal behaviour involving 3 intervals: morning (from 6.00 AM to 2.00 PM), afternoon (from 2.00 PM to 11.00 PM) and evening (from 11.00 PM to 6.00 AM), showed that the tongue rolling activity was most prevalent in the morning (73%), compared to the other two periods – afternoon (18%) and evening (9%). Within the morning period, the syndrome was manifested exclusively between 6.00 and 1.00 AM, where 63% of cases were observed. During that period, the animals were in a state of “expectation of meals” before the morning feeding or, the stereotypy was observed 2–3 hours after feeding.

In more than 80% of cases, the hyperactivity in heifers was observed when the animals were in the walking yards and only in 20% – indoor.

In over 90% of animals, prolonged oral hyperactivity episodes (from 10 to 40 min) consisted of repetitive tongue rolling interrupted by 2 to 4 short pauses of about 30 s to 5–10 min. The tongue rolling itself had a variable duration: from 10 to 20 seconds (64% of cases), from 20 to 30 seconds (28% of cases) and more than 30 seconds in 8% of cases. In one animal, the highest duration of 80 seconds was registered.

„Tongue play“ was manifested with flicking of the tongue outside the mouth and performing several twisting movements with it. In 4 heifers from 13 to 25 months of age (10.5%) and 2 cows aged > 26 months (40%), these clinical symptoms were accompanied by licking and biting of metal equipment in pens or in walking yards.

During the entire survey period (2016–2018), no cases of tongue rolling

Table 1. Changes in rectal body temperature, heart and respiratory rates, ruminal motility rate in control cattle (Group I, n=1055) and cattle demonstrating tongue rolling (Group II, n=48). Data are presented as mean ± SEM

	BTT (°C)	Heart rate (min ⁻¹)	Respiratory rate (min ⁻¹)	Ruminal motility rate (min ⁻⁵)
Group I (healthy)	36.22±0.19	86.41±6.13	19.54±2.95	9.3±0.8
Group II (tongue rolling)	36.69±0.21 ^{ns}	91.16±7.51 ^{ns}	21.47±2.17 ^{ns}	9.7±0.6 ^{ns}

n.s. – non-significant differences between groups.

were found out in male cattle and in calved females (both cows and heifers). All animals exhibiting the tongue play stereotypy (and respective controls) were from Black-and-White and Holstein breeds or their crosses.

The oral hyperactivity detected in pregnant heifers was no more present after calving. Similar change was established in calves after their introduction on pastures during the spring-summer season.

The measured clinical parameters (rectal body temperature, heart and respiratory rates, ruminal motility rate) did not differ significantly between healthy controls and cattle manifesting the orosthenic syndrome ($P>0.05$) (Table 1).

Furthermore, no changes were found out in the general condition of the tongue rolling groups regarding appetite, thirst, colour of visible mucous coats, general behaviour, locomotion, sentience, defecation, urination, frequency of eructation and rumination.

DISCUSSION

In line with previous reports (Redbo & Nordblad, 1997; Prodanovič *et al.*, 2013a,b) in 80% of observed tongue rolling episodes were manifested when animals were “expecting meals” and about 2

hours after the morning feeding (from 9.00 to 12.00 AM). The predominance of this activity during that part of the day could be explained with the longer period of time (2–3 hours and even more) between the evening and morning offering of feed. This allows for more prolonged time spent not engaged e.g. boredom periods. The observed tongue rolling episodes in different categories of cattle was characterised with repetitiveness and sequence of the activity. Further, movements were not triggered by a specific cause, had no obvious goal or benefit for the animals. All this allowed determining the stereotypy as an oral obsessive-compulsive disorder similar to the licking of lips in men.

Artificially managed environmental conditions by the anthropological factor result in inhibition of needs and emergence of activities that compensate for the lack of comfortable environment (Phillips, 2002; Corazzin *et al.*, 2010). It was proved that the incidence of emergence and manifestation of the orosthenic syndrome was directly proportional to the magnitude of environmental restricting factors (Seo *et al.*, 1998; Wilson *et al.*, 1999; Mattiello *et al.*, 2002; Fröberg & Lidfors, 2009).

Most of researchers believe that the oral stereotypies on cattle indicated that

they were reared in a compromised social environment, they felt “non-satisfied” from being unable to perform their physiological activities specific for natural behaviour (Sandem *et al.*, 2002; Latham & Mason, 2010; Broom & Fraser, 2015).

Our data support the statements of Redbo & Nordblad (1997) and Phillips (2002) that the duration and frequency of feeding was among the main causes for observed oral stereotypies in cattle. The shorter the duration and frequency of feeding, the higher the probability for observing oral hyperactivities is (Redbo *et al.*, 1996). It is assumed that such a behaviour was a sign of poor welfare (Lindström & Redbo, 2000) and an expression of a psychological need from oral manipulations of feeds. Cattle need a long sensory and oral stimulation from feed passing through the mouth to trigger the negative feedback against motivation for feeding.

Most commonly, the tongue rolling orosthenic activity was observed in heifers from 13 to 25 months of age – up to 26% of subjects from this age group. Then followed groups of growing calves (3 to 12 months of age)– 3.6%, suckling calves – 2.3% and cows > 25 months of age (pregnant heifers) – 0.8%. According to our studies, neither lactating cows nor male cattle exhibited this oral hyperactivity.

The prevalence of tongue rolling was by more than 80% increased when the animals were in walking yards, compared to inside barns.

Our data are comparable to those of Ishiwata *et al.* (2008) and İssi *et al.* (2009), with respect to reported average duration of the oral hyperactivity episodes with pauses included – about 15–20 min.

This study has shown that usually the tongue rolling hyperactivity was initially exhibited by one animals and affected

very rapidly other individuals from the group due to “imitation”. This hypothesis was further supported by the fact that tongue rolling was no longer demonstrated when the animals were removed from the group or conditions were altered. What is more, the new environment where the animals were placed, was less favourable with regard to hygienic conditions, amount and quality of fodder. Data from our studies were in line with those of Mason & Rushen (2006), who affirmed that cattle reared in barns stopped completely the demonstration of oral stereotypies after being moved in free areas without tethering or if allowed to graze on pastures.

We agree with the opinion of Stein *et al.* (1994) and McMillan (2005) that the main reason for occurrence of tongue rolling (tongue play) in calves was suckling deficiency. Our observations, comparable to those of de Passillé (2001) concluded that this was due to drinking milk from a bucket or dummy-teat with a very large opening, hence dissatisfaction of the suckling reflex which continued to manifest after the feeding as well. When the containers for milk were later used for offering drinking water, animals drank with increased thirst which could result in water intoxication (Binev, 2010a,b,c).

The lack of changes in studied clinical parameters supported earlier literature reports (Ishiwata *et al.* 2008; İssi *et al.* 2009), yet differed from increased heart rates reported by Seo *et al.* (1998a,b).

In conclusion, the causes for demonstration of the tongue rolling pathological activity in cattle were the deprivation from food and boredom, due to deficiency of environmental stimuli. The studied stereotypy was observed in cattle from different age groups – suckling and weaned calves, as well as heifers, including pregnant

ones. The tongue play activity was no longer exhibited by heifers after calving and moving into the basic herd of lactating cows. It was neither exhibited when the animals were moved to other premises with different hygienic conditions and different feeding regimen. The highest intensity (up to 80%) of this orosthenic syndrome was manifested before the morning feeding, between 9.00 and 12.00 AM when the animals were “bored” and “expecting meals”. Most commonly, the tongue rolling activity was found out in heifers between 13 to 25 months of age – up to 26% of animals from this group followed by growing calves (3 to 12-month-old) – 3.6%, suckling calves – 2.3% and periparturient pregnant heifers > 25 months of age – 0.8%. One question still remains open, e.g. why only female individuals demonstrate the tongue rolling activity.

The studied oral stereotypy was not accompanied with changes in measured clinical parameters – rectal body temperature, pulse and respiratory rates, rumen movements, as well as in other activities e.g. rumination, eructation, appetite, sentience, locomotion etc.

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