

Investigation of the Age of Native Neonatal Calves with Positive Menace Response and Pupillary Light Reflex under Traditional Farming Conditions

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Abstract

Menace response and pupillary light reflex are used as part of the ophthalmic and neurological examinations in animals. This study was conducted to investigate the menace response and pupillary light reflex in native calves that were not separated from their mothers after birth and had traditional rearing conditions. Thirty healthy native calves were included in the study. The menace response was assessed by applying a non-tactile visual threat to each eye. The direct pupillary light reflex was tested by shining a bright light into each eye and observing constriction of the pupil in the ipsilateral eye. Calves were observed after birth until the menace response and pupillary light reflex were well present. The pupillary light reflex was positive in all calves in the first test performed after birth. The menace response developed in the age range of 3 to 6 days in calves and this response developed earlier in male than female calves. According to the results of previous study, none of the calves developed a menace response during the time they were housed in individual stalls. The present study indicated that development of menace response in traditionally reared calves (housing with their mothers in a common pen) was observed on the 6th day after birth.

Key word: Calf, Neonate, Eye, Menace response, Pupillary light reflex

Introduction

Menace response and pupillary light reflex (PLR) are used as part of the ophthalmic and neurological examinations in animals (Constable, 2004; Constable et al, 2017). The menace response is done by approaching the threatening movement of the finger towards the eyes, and the positive response is expressed by the immediate closing of the eyelids. The finger must advance towards the eye, without touching the tactile hairs of the eyelids or creating air turbulence that can be felt by the animal (Constable et al, 2017; Featherstone and Heinrich, 2021).

The afferent arm of the menace response includes retina, optic nerves, optic chiasm, optic tract, lateral geniculate nucleus, and internal capsule to occipital lobe of the cerebrum, and the efferent arm consists of motor cortex, ipsilateral pons, contralateral nucleus of the facial nerve in the medulla oblongata, the facial nerve and orbicularis oculi muscle (Constable et al, 2017; Featherstone and Heinrich, 2021). The ascending pathway of the PLR includes retina, optic nerves and chiasm, and oculomotor and pretectal nuclei in the midbrain, and the descending motor

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pathway of PLR consists of oculomotor nerve, ciliary ganglion, and constrictor pupillae muscle (Constable et al, 2017).

The menace response is an acquired cortical response (Featherstone and Heinrich, 2021) and is highlighted in a study performed on the menace response in industrially kept dairy calves, which showed that individually reared calves developed the menace response more slowly than calves reared in a group setting. Also, the calves did not have a positive menace response as long as they were kept individually (Raofi et al, 2009). Unlike the menace response, the PLR is a subcortical reflex and is present in dairy calves and foals (Enzerink, 1998; Leiva et al, 2011) immediately after birth, but this test is positive in lambs and goat kids 20 hours after birth (Raofi et al, 2011).

Considering the importance of the menace response and PLR in neurological and ophthalmic examinations in neonatal calves and the need to obtain more information about these two tests in newborn animals, this study was performed to investigate the menace response and PLR in native calves that were not separated from their mothers after birth and had traditional rearing conditions.

Materials and Methods

This study was conducted in traditional farms having average 5 native cattle around Tehran. In these farms, the neonatal calves were not separated from their mothers after birth and ate colostrum and milk directly from the mother's udder. The cows and their calves were kept in a common pen. These cows were not taken to the pasture and were kept in a closed pen. Due to low milk production, these cows were mostly intended for meat production.

Thirty healthy calves (15 female and 15 male) were included in the study. Calves born with dystocia or with congenital and hereditary defects, and premature calves were not included. Also calves suffered from any diseases were excluded during the

study. Calves' behavior, movements and ability to adopt to their environment were observed as the primary methods of determining their visual function. Calves were studied daily from 30 minutes after birth until the menace response and PLR were well reached.

The menace response was assessed by applying a non-tactile visual threat to each eye. This was achieved by swiftly advancing a finger towards the eye, without touching the face or eyelashes and avoiding the creation of air turbulence as far as possible. A rapid blink with closure of the palpebral fissure in the eye under test was classified as a positive result. All tests were repeated at least three times and the result was considered positive when the response was consistently present. All examinations were carried out on both eyes.

The direct pupillary light reflex was tested by shining a bright light (flashlight) into each eye and observing constriction of the pupil in the ipsilateral eye. The reflex was recorded positive when pupillary constriction was seen.

A Sigma Stat version 2 statistical package was used for data analysis. The Mann-Whitney test was performed to compare the groups, and $P < 0.05$ was considered significant.

Results

Pupillary light reflex was positive in all calves in the first test performed after birth. The menace response first developed in calves at the age of 3 days and the last calf in which the menace response developed was 6 days old (minimum 3 days old, maximum 6 days old, median: 4 days old). The menace response developed in most calves at 4 days old (9 calves) and 5 days old (9 calves) and this response developed earlier in male (4 ± 1 days) than female (5 ± 1 days) calves ($P < 0.05$). The menace response developed in most male calves at 3 days old and in most female calves at 5 days old. The results of the study are summarized in Figures 1 and 2.

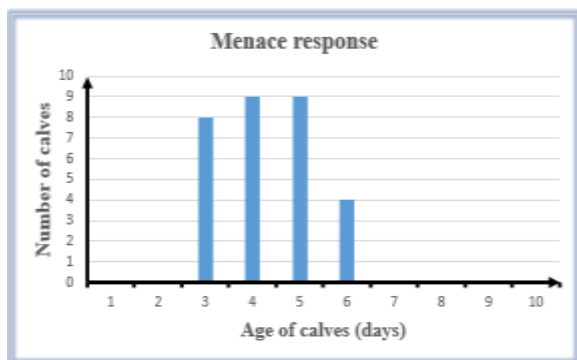


Figure 1: Development of menace response with age in calves

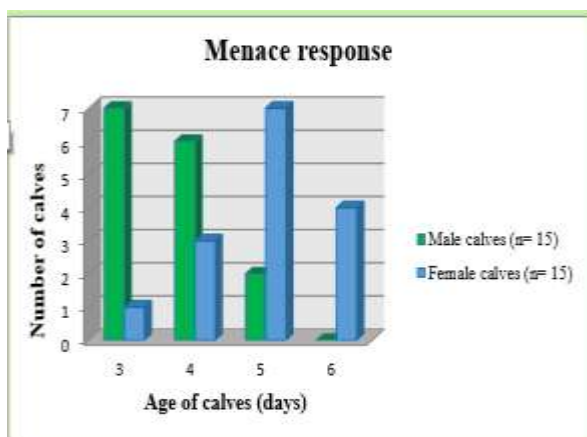


Figure 2: Development of menace response with age in male and female calves

Discussion

The menace response develops in different species at different times after birth. In our study, the menace response developed between 3 and 6 days of age. Constable et al (2017) have mentioned that most calves had a menace response by 5 to 7 days after birth. Lambs and kids had developed menace responses by 8 ± 3 and 14 ± 2 days, respectively (Raofi et al, 2011). In puppies and kittens, menace response developed at approximately 12 weeks of age (Ofri, 2017), the 3–4 weeks of age cases had been described (Lavelly, 2006). The menace response in foals was mostly developed at the age of 12 to 14 days (Adams and Mayhew, 1984; Leiva et al, 2011). However in one study, the menace response developed in foals at 9 days old (Enzerink, 1998). Differences between species may be attributed to differences in living conditions (Raofi et al, 2011).

According to the results of our study, traditionally reared native calves may not develop a menace response until six days after birth. This finding is important from a clinical view, and clinicians who perform ophthalmic or neurological examination in calves under 6 days old should keep this finding in mind. However, the menace response develops at an older age in dairy calves housed individually and under different housing conditions (Raofi et al, 2009). This finding was shown in a study conducted on dairy calves; in that study, the menace response was developed after moving calves from an individual stall to group pens. According to the above-mentioned materials, it is important to interpret the time of developing the menace response based on the housing conditions of neonatal animals, and in calves with similar housing conditions to our study (keeping the calves with their mothers) the menace response appears in 6 days old calves, but this finding cannot be attributed to calves with different housing conditions (such as dairy calves with individual housing).

One of the factors that play a role in developing the menace response in calves is their environmental condition, such as being kept in groups. The calves kept in groups showed the menace response earlier than the calves kept individually. It seems that environmental conditions such as group housing or keeping the calf with its mother create more visual threats so the calf quickly learns to close its eyelids in response to these threats (Raofi et al, 2009). However, environmental conditions are not the only factors involved in developing the menace response; other factors such as species, gender and some other unknown factors may also contribute to developing the menace response. In our study, the menace response developed earlier in male than female calves. A previous study has shown that female goat kids develop menace response more rapidly than their male counterparts and this difference was attributed to the differences in the temporal

development of learning ability between the sexes (Raoofi et al, 2011). The results of this study indicated that, in lambs, there was no difference between the two sexes in developing a menace response. As mentioned earlier, the difference between the two sexes in our study may have been due to the difference in learning ability between the two sexes. However, it is not possible to comment on this with certainty; so, the explanation of this difference requires further study.

In foals, PLR has been shown to be present immediately after birth (Adams & Mayhew, 1984; Enzerink, 1998) but it was sluggish and incomplete for several days

(Leiva et al, 2011; Lester, 2020). Lambs and goat kids had a PLR within 20 hours of birth (Raoofi et al, 2011). In our study, all calves had a positive PLR test immediately after birth. A similar finding was mentioned in a previous study on dairy calves (Raoofi et al, 2009).

The PLR appeared in calves immediately after birth, and the development of menace response in traditionally reared calves (housing with their mothers in a common pen) was observed on the 6th day after birth. These findings should be considered when performing neurological and ophthalmic examinations in newborn calves.

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Conflict of Interest

The authors declare no conflict of interest.

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بررسی سن مثبت شدن پاسخ تهدیدی و رفلکس مردمک به نور در گوساله‌های نوزاد بومی در شرایط پرورش سنتی

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چکیده

پاسخ تهدید و رفلکس مردمک به نور به عنوان بخشی از معاینات عصبی و چشمی در دام‌ها استفاده می‌شوند. این مطالعه برای بررسی پاسخ تهدید و رفلکس مردمک به نور در گوساله‌های بومی انجام گرفت که پس از تولد از مادران خود جدا نشده بودند و به صورت سنتی پرورش داده می‌شدند. ۳۰ گوساله بومی سالم وارد مطالعه شدند. پاسخ تهدید با نزدیک کردن دست به صورت تهدیدآمیز و بدون تماس با چشم و صورت دام ارزیابی شد. رفلکس نوری مردمک با تاباندن نور به چشم‌ها و مشاهده تنگ شدن مردمک در چشم همان سمت تابش نور تست شد. گوساله‌ها از زمان تولد تا زمان ایجاد کامل پاسخ تهدید و رفلکس مردمک به نور مورد تست قرار گرفتند. رفلکس مردمک به نور در همه گوساله‌ها در نخستین تست انجام گرفته پس از تولد مثبت بود. پاسخ تهدید در سن ۳ تا ۶ روز ایجاد شد و این پاسخ در گوساله‌های نر نسبت به گوساله‌های ماده زودتر ایجاد شد. بر اساس مطالعه قبلی، تا زمانی که گوساله‌ها در جایگاه انفرادی نگهداری می‌شوند، پاسخ تهدیدی در آن‌ها منفی است اما تحقیق حاضر نشان داد که این پاسخ در گوساله‌هایی که به صورت سنتی (همراه مادر در جایگاه مشترک) نگهداری می‌شوند در روز ۶ بعد از تولد مثبت می‌شود.

کلمات کلیدی: گوساله، نوزاد، چشم، پاسخ تهدید، رفلکس مردمک به نور

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