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Stereotypic behaviours and mating success in domestic mares

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ABSTRACT

Stereotypies are often associated with suboptimal environments. However, their adaptive significance remains under debate. The aim of this study was to relate the occurrence of stereotypies in breeding mares to their mating success. The overall, first and second cycle conception rates, inter-cycle interval and the number of cycles per conception were compared between stereotypic mares ($n = 31$) and non-stereotypic mares ($n = 83$). Mares were mated by 9 stallions which were equally balanced between the two groups. Rectal palpation and ultrasound were used to monitor the follicular state of the mares and to confirm pregnancy. The relationship between the occurrence of stereotypies and mating success was analyzed using a multivariate logistic regression. χ^2 tests were used to compare independent variables' distribution between the two groups of mares. Stereotypic mares had a significantly lower overall conception rate (55% *vs.* 84%, $p = 0.0018$), first-cycle conception rate (26% *vs.* 54%, $p = 0.0214$) and second cycle. This was still the case when only one type of stereotypic behaviour was considered. Thus, weaving mares ($n = 26$) had a lower overall (58% *vs.* 81%, $p = 0.034$) and first cycle (33% *vs.* 64%, $p = 0.005$) conception rate well as a significantly higher number of cycles per conception (2, 0 ± 0.9 in stereotypic *vs.* 1.5 ± 0.8 in control mares, $p = 0.037$) as compared to non stereotypic mares ($n = 31$). There was no difference between weaving and control mares in inter-cycle intervals (26.1 ± 7.7 in weaving mares *vs.* 23.9 ± 6.6 in control mares, $p = 0.74$). These findings suggest a lowered fitness in stereotypic mares. To our knowledge, this is the first study relating the occurrence of stereotypies to fertility in horses. The findings that fertility may be impaired in stereotypic animals have important implications and deserve further consideration to elucidate the processes involved.

1. Introduction

The occurrence of stereotypic behaviours (defined as repetitive, unvarying and apparently functionless behaviour patterns (Mason, 1991)) is an intriguing phenomenon. They occur only in captive/domestic conditions (over 85 million farm, laboratory and zoo animals worldwide (Mason and Latham, 2004)) where they are associated with suboptimal environments. However, their potential function/adaptive significance remains under debate (Cooper and Albentosa, 2005).

These behaviours have been suggested to reflect poor welfare (e.g. Broom, 1983) and chronic stress (Mason, 1991) and therefore could be expected to be associated with a lowered reproductive success (Dobson and Smith, 2000). On the other hand, if they allow animals to cope better with challenging environment (Mason and Latham,

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2004), and have some adaptive value, one would expect reproductive success to be better in stereotypic animals (Mason, 1991). Indeed reproductive success seems to be higher in stereotypic minks (Jeppesen et al., 1990; Jeppesen et al., 2004) and bank voles (Schønecker, 2009). However variations may occur according to mink farms (Svendsen et al., 2007), and lower body weight (due to increased exercise) may constitute a confounding variable (Jeppesen et al., 2004). In a recent study, Jones et al. (2010) found that stereotypic rhabdomys females had a much higher reproductive success (i.e. they produced more offspring, which grew faster and had better survival) than non stereotypic females. The important physical exercise due to their locomotor stereotypies (circuit running, somersaulting, etc.) may have change the muscular mass and may again be another confounding variable (Jones et al., 2010). The potential positive impact of stereotypic behaviours on reproductive success remains therefore an important debate, and research on more species is strongly needed.

Horses are an interesting species to investigate as, on one hand, the prevalence of stereotypic behaviour may be high in some environments (those, for example, with limited access to high-fibre forage or social contact (McGreevy et al., 1995)), on the other hand precise measures of their reproductive state can be performed, enabling investigation of the very early breeding stages in mares. Moreover, it has been shown that in free ranging conditions, stallions showed often an excellent fertility and very high conception rates (85% from the first estrus) (Bristol, 1982; McDonnell, 2000). Reproductive success is lower in the domestic situation where many matings are usually needed before the mare becomes pregnant. Therefore, breeding success in mares may be altered at very early stages.

In the present study, we measured precise breeding indicators (follicular status, ultrasound examination of pregnancy) and compared the overall conception rate, first and second service conception rates, inter cycle intervals, between stereotypic and non stereotypic horses (adult broodmares, all living in the same conditions at the time of the study) (see also Benhajali et al., 2013). If stereotypic behaviours influence reproductive success either way (lowered fitness due to stress or improved fitness due to better coping), one would expect this influence to act already at these early stages. The study is divided into two parts: the first part is an overall approach where all types of repetitive behaviours and foaling and non foaling mares are included. The second part aims at investigating more precisely the potential relation between one precise (and most frequent) type of stereotypic behaviour (weaving) and reproductive success in non foaling mares, as foals at foot seem to diminish the prevalence of stereotypic behaviours (especially weaving) in broodmares (Benhajali et al., 2010).

2. Materials and methods

2.1. Overall

2.1.1. Study site and housing conditions

Purebred Arabian mares were observed at the national stallion breeding facility of Sidi Thabet, located 20 km from Tunis. Mares are brought to this facility every year in order to breed with the stallions housed there. In general, mares remain in the facility until they become pregnant. They were housed in individual stalls where they received barley grains (4 kg/day) and hay every morning and evening and freshly cut grass once a day. Roughage was therefore available most of the day time. The routine in this facility did not enable the horses to be turned out. Stalls (5×3 m) were straw bedded and visual contact with conspecifics was possible from the upper parts of the stall doors.

2.1.2. Terminology

The stereotypic behaviours noted corresponded to those described in a variety of studies and had the common feature of consisting of repetitive movements (i.e. uninterrupted series) performed without any specific goal (e.g. Mills, 2005).

- Weaving: obvious lateral swaying, movement of head, neck, forequarters and sometimes hindquarters.
- Box walking: repetitive tracing of a route within the stable.
- Head nodding: repetitive bobbing of the head up and down.
- Door kicking: repetitive kicking of the door.
- Lip snapping: repetitive snapping of lips.

2.1.3. Behavioural observations

The experiment was conducted between 15th March and 15th July 2005. Horses were behaviourally screened everyday from 30th March to 15th May 2005 (46 days) to confirm them as either control or stereotypic. Observations were made by a single observer using instantaneous scan sampling (Altman, 1974). Twice a day (once in the morning before feeding and once in the evening after feeding), the observer walked along the stalls and noted the behaviour (stereotypic behaviour/not stereotypic behaviour) of each mare at the instantaneous time of her passage. Since stereotypic behaviour was only produced while the horses had the head at the door or outside (unpublished data), there was no need to interfere by looking inside the stalls. A total of 10,488 scans (part 1) and 5242 scans (part 2) was recorded (92 scans/mare) and mares were classified as “stereotypic” or “non stereotypic” (presenting or not stereotypic behaviour). The lowest rate of stereotypic behaviour being 5% of their scans, being stereotypic meant having been observed at least 4 times performing it. The majority of stereotypic mares were observed to perform stereotypical behaviour between 7 and 12 times (see results). No mare performed 1–3 times stereotypies which means there was no ambiguity.

2.1.4. Reproduction management and data collection

All the mares were mated or inseminated between the 23rd March and 15th July 2005 using 9 stallions housed in the facility. Stallion distribution was balanced between the two groups of mares ($\bar{X} = 2.9 \pm 2.7$ mare/stallion in stereotypic mares and $\bar{X} = 3.4 \pm 2.8$ in control mares, $\chi^2 = 7.2$, $p = 0.51$). Estrus was detected once every 48 h by teasing (mares were presented individually to one stallion in a yard) in early morning. Mares detected in estrus were