

Research Letter

Animal scientists and cattle farmers should take note of persistent frenulum (skew penis) as a heritable defect

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Abstract

This research letter discusses a heritable defect of the penis in cattle, known as persistent frenulum. The condition results in a skew penis, that prevent bulls from mating naturally with cows. Although veterinarians in South Africa are familiar with this condition, it seems that animal scientists are not. The condition is briefly described, and it is indicated that it is caused by a single recessive allele. The condition can be corrected surgically, but this is not recommended, since it is a heritable defect. Animal scientists should take note of this condition and advice farmers accordingly.

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There are many functional traits that have a genetic basis and one of these functional traits is discussed in this research letter. Selection on functional traits is important because it can reduce the occurrence of genetic defects. It is important to realize that selection does not create new alleles, but that it can increase or decrease the frequency of specific alleles.

A single allele determines some of the functional defects in cattle, which is usually recessive. This means that the animal must have two copies of the allele before the defect is observed. Both the sire and dam must therefore carry the allele. In many cases, there is also incomplete penetrance, which means that not all animals that have two copies of the allele necessarily display the defect (Bosman & Scholtz, 2010). However, even if they do not show the defect, the causal allele can still be transmitted from the carrier parent to its offspring. Bulls that are reproductively and structurally sound should be selected for breeding. Furthermore, the bull must be free of abnormalities that impair his ability to produce enough mobile, morphologically normal sperm. Finally, the bull must be able to successfully mate with a cow.

Recently, we observed a bull trying to mate with a cow, but he could not penetrate the cow. To us it appeared that the penis was skew (it looked like a fishhook) and we thought the bull had broken its penis. We contacted our veterinarian to examine the bull. She immediately identified it as a condition known as persistent frenulum and indicated that she can rectify it, but also mentioned that it is a heritable condition.

The frenulum, a collagen-like band of connective tissue, is present at birth and attaches the penis to the penile portion of the foreskin. The attachment should begin to break up from 4 weeks of age and should be completely broken by the age of 8 to 11 months (Wolfe, 2018). If the band does not break, the penis is skew, and the bull cannot penetrate the cow during mating (see Figure 1). This condition limits the protrusion of the penis or causes the protruded penis to deviate ventrally (Noakes, et al., 2001). The result is that intromission may be prevented, and the pregnancy rate is very low.

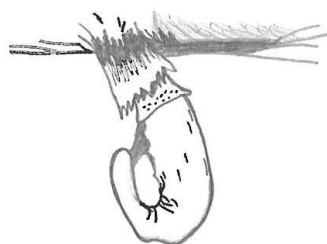


Figure 1 Illustration of the fishhook shaped penis caused by the condition known as persistent frenulum

This defect can be easily repaired surgically, by tying off the connective tissue on both sides and then cutting it (Wolfe & Rodning, 2009). Veterinarians sometimes perform such operations. Even if the condition can be corrected surgically, such bulls should preferably not be used for breeding at all, and definitely not in stud herds because the condition is believed to be heritable. If the bull is of good genetic merit, it can be used on commercial cows, but all male progeny should be castrated or slaughtered. Since both the afflicted bull's parents are proven carriers of the causal allele, the ideal would be to slaughter both. One half of the offspring from these two parents would be carriers of the deleterious allele as well and should perhaps also be slaughtered. However, it will be difficult to convince farmers to do this.

Several reports suggest that a single autosomal recessive allele determines the condition (Elmore *et al.*, 1978; Elmore, 1981; Wolfe & Rodning, 2009; Wolfe, 2018). Christmas *et al.* (2001) examined the breeding soundness of more than 1,200 yearling Angus bulls, to determine the heritability of and genetic relationships among breeding soundness traits. The heritabilities for scrotal circumference were high, for percentage of abnormal sperms moderate, and for sperm motility low. A near to zero heritability for semen white blood cells, persistent frenulum, and penile warts were reported. However, the zero heritability for persistent frenulum is expected since it is caused by a single allele, and quantitative genetic evaluations cannot be performed to estimate the heritability of traits caused by single alleles.

The condition has been reported in dairy bulls (Monke & Lahmers, 2018), in Angus and Beef Shorthorn bulls (Carrol *et al.*, 1964) and Brangus, Santa Gertrudis, Beefmaster, and Hereford bulls (Gill, undated). It has also been identified in male dogs (Parkinson & McGowan, 2019) and boars (Althouse, 2007, Foster 2017). Saunders & Ladds (1978) examined the genital tracts of 968 slaughtered bulls for defects of a congenital or developmental nature. The overall occurrence of such lesions was 7%, of which 0.5% comprised of persistent penile frenulum. Spitzer *et al.* (1998) subjected 862 yearling beef bulls to a breeding soundness examination at completion of performance testing programs over a period of 5 years. Out of the 862 bulls, a total of 109 bulls were classified as unsatisfactory, with 16.5% of these bulls exhibiting persistent penile frenulum.

The bull we identified had a "crumpled" sheath as shown in Figure 2, which may indicate that the penis is skew. However, it is important that such a bull be examined by a veterinarian to confirm this. This bull was subsequently slaughtered, and the penis dissected. A picture of the dissected skew penis is given in Figure 3.



Figure 2 Illustration of the crumpled sheath of the bull that had persistent frenulum



Figure 3 Dissected penis to demonstrate the condition of persistent frenulum

Following the observation we made; the condition was discussed with a number of animal scientists in South Africa and none of them was aware of this condition or that it is heritable. Beef cattle farmers that we interacted with were also not aware of this condition. In contrast, veterinarians are aware of this condition and that it is heritable. The fact that very little information on this condition in livestock is published in recent peer reviewed scientist journals related to animal science indicates that it is neglected and that the animal science community is not aware of it. Most of the articles on the condition are published in books or journals that are related to veterinary sciences. Since this condition is not properly researched from an animal science perspective, it is difficult to put it into context of current knowledge and literature.

The aim of this research letter is to bring the condition under the attention of animal scientists in South Africa, so that they can advise farmers to be wary of the condition. Since the condition was observed in a bull that was purchased at an auction where stud bulls were sold, it indicates that it is present in the seed stock industry in South Africa. The fact that it is heritable is of concern.

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Authors' contributions

M.M. Scholtz: Saw the bull with the skew penis, discussed it with the veterinarian, initiate the investigation and the writing of the research letter. F.J. Jordaan: Assisted with the examination of the bull and took the lead in slaughtering the bull and the dissection of the penis. Both contributed to the development of the research letter.

Declaration of conflict of interest

There is no conflict of interest.

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