

FeNomen: Fertility in national Norwegian horse breeds.

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The three national Norwegian horse breeds, the Dole horse, the Fjord horse, and the Nordland/Lyngen horse are all listed on the FAOs list of endangered breeds. Decreasing population sizes and risk of rapid accumulation of inbreeding is a concern. The number of covered mares has decreased by 37 to 45 percentage points in the past decade compared to the one preceding it.

In 2019 the available breeding populations consisted of ~2500 Dole horses, ~2800 Fjord horses (in Norway) and ~1600 Nordland/Lyngen horses, respectively (Norsk Hestesenter, 2020). However, only ~15% of the available mares are covered each year. Natural covering is the most common breeding method used for the Dole, the Fjord, and the Nordland/Lyngen horses, either by hand mating or by natural cover at pasture. Since 2004, artificial insemination has been used to breed a limited number of Fjord mares each year.

The number of covered mares each year is a measure of the breeding activity in a population, whereas the foaling rate (i.e. number of live born foals divided by the number of covers) is a crude measure of the reproductive performance. The foaling rates the past two decades has ranged between 50 and 62% for the Dole, 50 and 65% for the Fjord and 58 and 76% for the Nordland/Lyngen horse. In comparison, average foaling rates after natural covering are reported to be 68% in Icelandic horses, 68% in Shetland ponies and 82% in Thoroughbreds (van Buiten et al., 1998; Davies Morel and Gunnarsson, 2000; Hanlon et al., 2012).

It is therefore timely that the Swedish-Norwegian Foundation for Equine Research have funded the project FeNomen: Fertility in native Norwegian horse breeds. The project is a collaborative project between the Faculty of Veterinary Medicine, the Faculty of Biosciences (both Norwegian University of Life Sciences) and the partners the Norwegian Horse Association, the Norwegian Fjord Horse Center and the National Center for Nordland/Lyngen horse. Representatives from each of the breeding organizations functions as a reference group for the project. The project will start in October 2021.

The project is divided into four parts.

Trends and risk factors

The first part will use registry data from the Norwegian Horse Association (the body responsible for registration of horses of national Norwegian breeds). We want to investigate factors that limit reproductive performance, which may include age of mare and stallion, fertility status (e.g. maiden, barren, foal previous year) and factors related to shared ancestry. This analysis aim to identify factors associated with breeding outcome at the population level but is not suited to assess cause and effect at an individual level.

Genetic analysis

Part 2 deals with genetic analysis. In small populations the risk of inbreeding and genetic causes of reduced fertility must be considered. Deleterious mutations in genes important for normal embryo development could result in early embryonic death. As this happens before pregnancy is possible to detect, it will appear as reduced fertility. Recessive mutations can accumulate in small populations. Unrelated individuals are unlikely to carry the same single recessive mutation, however when mating two individuals with shared ancestry the likelihood of the same recessive mutation being inherited from a common ancestor is higher (Charlesworth and Willis, 2009). To identify genes which negatively impact reproductive performance we need to collect DNA for a large population (approximately 800 horses). As a first step, we have decided to do this in the Fjord horse because we have access to previous genotypes, allowing us to add to those. Building on the experiences and knowledge derived from this project, future projects can repeat the work in the other native breeds.

Breeding management.

Reproduction involves more than simply genetic components; breeding management is important and therefore part 3 will be a small-scale pilot study on reproductive disorders. The pilot study will be used to evaluate the feasibility of recruitment of patients, and to assess procedures and diagnostic tools. Endometritis (Uterine inflammation) is considered one of the most important reproductive condition of horses and the most common cause of embryonic loss before day 35 in normally cycling mares. International studies have estimated that between 10 and 20% of mares subjected to breeding are affected by endometritis (Riddle et al., 2007; Davies Morel et al., 2013). The diagnosis is most common in barren mares (28%), followed by foaling mares (17%), and least likely to occur in maiden mares (5%) (Riddle et al., 2007). Studies show that foaling rates are reduced with 10% to 25% in mares with the endometritis compared to healthy mares.

The mares included will receive ultrasonographic examination of uterus and the ovaries, and bacteriological, cytological, and endometrial (biopsy) evaluation. We also aim to examine a few stallions. Low concentration of progressively motile spermatozoa, and high percentages of abnormal spermatozoa has been shown to affect stallion fertility negatively (Morrell et al., 2008; Love, 2011). Part 3 will be reserved for Dole mares and stallions.

Part 4 consists of communicating results from the project out to horse owners, breeders and the horse sector in general. The Norwegian Horse Association, the Norwegian Fjord Horse Center, the National Center for Nordland/Lynge horse and the breeding organizations are of course central partners here.

Mutation: alteration in the genome

Dominant mutation: need one copy to have effect

Recessive mutation: need two copies of the similar mutation to have effect

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