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Short communication

Effect of time of artificial insemination on embryo sex ratio in dairy cattle

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Abstract

The objective of the present study was to examine whether different intervals between insemination and ovulation have an influence on the sex of seven-day-old embryos in dairy cattle. Cows were inseminated once with semen of one of two bulls of proven fertility between 36 h before ovulation and 12 h after ovulation. Time of ovulation was assessed by ultrasound at 4-h intervals. In total, 64 embryos were determined to be male or female. Of these 64 embryos, 51.6% were female. The sex ratio in the various insemination–ovulation intervals (early: between 36 and 20 h before ovulation; intermediate: between 20 and 8 h before ovulation; late: between 8 h before and 12 h after ovulation) did not significantly differ from the expected 1:1 sex ratio (50, 50 and 55% females, respectively). Bull (Bull A and B) and Parity (primiparous and multiparous) had no influence on the expected 1:1 sex ratio either. The number of cell cycles was similar for male and female ($P = 0.23$) embryos when quality of the embryo ($P < 0.0001$) was included in the model.

The results of this study indicate that, in cattle, the interval between insemination and ovulation does not influence the sex ratio of seven-day-old embryos.

Keywords: Dairy cattle; Artificial insemination; Ovulation time; Sex ratio

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1. Introduction

Numerous efforts have been made to alter the sex of calves by varying time of insemination (Pursley et al., 1998; Martinez et al., 2004). It has been suggested that early inseminations (i.e. far before ovulation) would result in more female calves whereas late inseminations (i.e. close to ovulation) would result in more male calves, due to different timing of capacitation and survival time of the X- and Y-chromosome bearing spermatozoa in the female reproductive tract (Martinez et al., 2004). However, several other studies offer contradicting explanations for potential effects of varying insemination time on sex ratio (Rorie, 1999). Previous studies have varied insemination time relative to visually observed estrus (Ballinger, 1970; Gebicke Harter et al., 1977; Martinez et al., 2004), using mounting behavior (Rorie et al., 1999), and intravaginal conductivity (Wehner et al., 1997) all of which probably do not predict time of ovulation very accurately (Roelofs et al., 2003, 2005a). In those studies, sex ratio was assessed in the calves born. It is not possible to differentiate between differences in fertilization or (early) embryonic death by X- or Y-chromosome bearing spermatozoa by using calves born. If indeed timing of capacitation and hence survival time of the X- and Y-chromosome bearing spermatozoa is different, the interval between insemination and ovulation could alter the sex ratio. Therefore, to study effects of insemination time on embryo sex ratio, it would be better to inseminate according to actual time of ovulation.

The objective of the present study was to investigate whether different intervals between insemination and ovulation (assessed by using repeated ultrasound) have an effect on the sex of seven-day-old embryos in dairy cattle.

2. Materials and methods

2.1. Animals, feed and housing

Data were collected from a herd of about 80 lactating Holstein–Friesian cows over a period of one and a half years. Parity of the animals varied between one and six and the animals were 76.4 ± 19.8 days (mean $\pm$ S.D.) in lactation, with a range of 43–120 days. The cows were fed an ad libitum mixture of grass silage, corn silage and mineral supplements, and concentrates were given according to production level (Central Animal Feed Bureau-Standards, 2000). The animals were housed in free stalls with a concrete slatted floor. The cows were milked by an automated milking system (Liberty, Prolion, Vijfhuizen, The Netherlands). Three hundred and five-day milk production was 8024 ± 1285 kg (mean $\pm$ S.D.).

2.2. Insemination

Frozen–thawed semen doses of two bulls with proven fertility, derived from 11 ejaculates per bull, were used. Cows were inseminated once at different times after onset of estrus (assessed by pedometers (Roelofs et al., 2005b) or visual observation). Time of insemination was estimated to be from 36 h before ovulation to 12 h after ovulation. All artificial inseminations were performed by the same person.

2.3. Ultrasonography

The ovaries of the cows were examined rectally using a scanner with a 7.5 MHz sector transducer (Scanner 200, Pie Medical, Maastricht, The Netherlands). The reproductive tract was not