

Distribution of sexes within the left and right uterine horns of cattle

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Abstract

In cattle, limited data are available regarding the sex ratio of the offspring in relation to the horn of gestation. Therefore, the objective of this study was to evaluate the sex ratio of fetuses gestated in the left and right uterine horns of cattle (*Bos taurus*, *Bos indicus* and crosses). The distribution of male and female fetuses in the left and right uterine horn was analyzed on gravid, abattoir-derived reproductive tracts and artificially inseminated crossbred cows. The total number of fetuses/calves and the sex of the fetuses/calves gestated in each uterine horn were used as the end point for side comparisons using the Glimmix Procedure. Of 64 gravid reproductive tracts evaluated, 29 (45.3%) pregnancies occurred in the left uterine horn, whereas 35 (54.7%) occurred in the right. The sex ratio (% males) of fetuses in the left uterine horn (37.9%) was significantly lower than the sex ratio detected in the right uterine horn (65.7%). Of 113 pregnancies evaluated in artificially inseminated heifers, 53 (46.9%) occurred in the left uterine horn, whereas 60 (53.1%) occurred in the right uterine horn. The sex ratio of calves gestated in the left uterine horn (35.8%) was significantly lower than the sex ratio of calves gestated in the right uterine horn (63.3%). In conclusion, in these experiments, a significantly greater proportion of males were gestated in the right uterine horn of cattle and a greater proportion of females in the left uterine horn. Further investigation is needed to determine the mechanisms underlying the observed disparity of the expected sex ratio within the uterine horns of cattle.

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1. Introduction

Asymmetric distribution of the sexes within the uterus of pregnant mammals has been described in numerous laboratory species. A larger number of female fetuses has been reported in the right uterine horn compared with the left uterine horn of the rabbit [1], whereas in the mouse [2] and Mongolian gerbil [3], more male fetuses have

been detected in the right uterine horn. In contrast, Clark et al. [4] failed to detect any sexual segregation within the uterine horns in the mouse, whereas Bruce and Norman [5] and Herbert and Bruce [6] also failed to find a statistical difference in the sex ratio between the left and right uterine horns in the rat. The partial segregation of sexes noted in the uterus of the gerbil, rabbit, and mouse suggested some consistent lateral asymmetry either between the left and right uterine horns or the left and right ovaries in these species. Lateral asymmetry of ovaries and uterine horns has been reported in numerous mammals, including the rat, mouse, hamster, mountain viscacha, giant fruit bat, brush possum, rat kangaroo, antelope, and waterbuck [7].

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In farm animal species, ovarian and uterine asymmetries have been observed in horses, sheep, goats, and cattle. Arthur [8] described ovarian activity in the mare and noted a greater proportion of Corpus luteum (CL) present on the left ovary compared with the right. Henning [9] and Casida et al. [10] reported that the right ovary in sheep produced more CL than did the left ovary. Similarly, in the goat, Taneja [11] and Basu et al. [12] reported that the right ovary was more active than the left ovary, having a greater number of large follicles. Furthermore, Lyngset [13] found that in the goat, CL were predominately observed on the right ovary compared with the left ovary in both single and multiple ovulations. Reese and Turner [14] detected the CL in the right ovary more often than in the left ovary of heifers, and Rajakoski [15] reported a significantly higher number of follicles ≥ 5 mm in the right ovary than in the left ovary in mature cows. Vázquez et al. [16] noted that the percentage of male fetuses in the left uterine horn was lower than in the right uterine horn of gravid, abattoir-derived bovine reproductive tracts.

In cattle, Skjervold and James [17] observed that across herds, the sex ratio increased with the milk yield of the dam. However, across individuals within herds, high milk yields were associated with reduced sex ratios. Time of insemination has been reported to influence the sex of the offspring in cattle. Riddle [18], Wehner et al. [19], Wells [20], and Martinez et al. [21] reported altered sex ratios relative to breeding time, similar to those observed in white-tailed deer. Additionally, Ostrowski [22] reported significantly more female calves in heifers that were estrus synchronized with prostaglandin $F_{2\alpha}$ ($PGF_{2\alpha}$) and gonadotropin-releasing hormone (GnRH) compared with that in heifers synchronized with $PGF_{2\alpha}$.

In cattle, limited information is available regarding the sex ratio of the offspring in relation to the uterine horn of gestation. Therefore, the specific objective of this study was to determine the sex ratio of fetuses and calves gestated in the left and right uterine horns in cows (*Bos taurus*, *Bos indicus* and crosses).

2. Materials and methods

2.1. Animal care

Animals were handled in accordance with the U.S. Department of Agriculture Guide for the Care and Use of Agricultural Animals in Research. All procedures were approved by the Louisiana State University Agricultural Center Institutional Animal Care and Use Committee.

2.2. Experiment 1

The distribution of male and female fetuses in the left and right uterine horns of gravid, abattoir-derived reproductive tracts was investigated. Complete reproductive tracts, including the ovaries, oviducts, uterus, cervix, vagina, and external genitalia, were collected from all pregnant females processed, regardless of age, breed, or gestational duration, in a local abattoir. The gravid tracts for this experiment were collected from mixed-breed beef and dairy cows.

2.2.1. Horn of gestation verification

Reproductive tracts were placed onto a table for examination to determine the uterine horn of gestation, as assessed by a single technician. Appropriate orientation of the tracts was ensured based on the greater curvature of the uterine horn and the correct alignment of the external genitalia. Gravid reproductive tracts in which the horn of gestation could not be determined due to advanced gestational length or incomplete tracts were not used.

2.2.2. Sex determination

After the horn of gestation was recorded, an incision was made along the length of the uterine horn, and the fetus was dissected from the fetal membranes and removed from the uterus. The sex of the fetus was determined by visual inspection of the external genitalia. Any fetus in which the sex could not be determined due to short gestational length was not used in this study.

2.3. Experiment 2

A group of artificially inseminated, crossbred beef heifers were evaluated over a 2-yr period ($n = 180$) to determine the effect of horn of gestation on the sex ratio of calves. The nulliparous females in this study consisted of various crosses of Angus, Brangus, Brahman, Hereford, and Simmental breeds. All experimental animals were in excellent health and good body condition at the onset of treatment. Animal age ranged from 14 to 16 mo with a mean (\pm SEM) of 14.8 ± 0.3 . Body weights ranged from 272 to 375 kg with a mean (\pm SEM) of 320.6 ± 54.9 kg.

2.3.1. Synchronization and insemination protocol

Heifers were synchronized and artificially inseminated using the OvSynch protocol, previously reported by Pursley et al. [23]. Briefly, all females were given (im) 100 μ g GnRH (Cystorelin; Merial Limited,

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