

## The Effect of Insemination Time, Season and Insemination Method on Calf Gender in Holstein Cattle

Gokhan Gokce (Corresponding author)

Cukurova University, Faculty of Agriculture, Department of Animal Science, Adana, Turkey

E-mail: gokhan046@gmail.com

<https://orcid.org/0000-0001-6980-8989>

G. Tamer Kayaalp

Cukurova University, Faculty of Agriculture, Department of Animal Science, Adana, Turkey

E-mail: tamer.kayaalp@gmail.com

<https://orcid.org/0000-0003-2193-848X>

Serap Goncu

Cukurova University, Faculty of Agriculture, Department of Animal Science, Adana, Turkey

E-mail: serapgoncu66@gmail.com

<https://orcid.org/0000-0002-0360-2723>

### Abstract

The aim of this article is to determine the effect of insemination time, season and insemination method on calf gender in cattle. In the study, 792 records of inseminations and calving data between 2010-2019 were evaluated. The onset of estrus was determined based on mounting behavior. Inseminations were carried out between 0-6, 6-12, 12-18 hours after the onset of estrus. At the same time, inseminations were evaluated according to the seasons. Of the inseminations, 582 were artificial insemination and 210 were natural insemination. While insemination time and insemination method had no effect on calf gender, seasonal effect was found to be significant.

**Keywords:** Holstein, Insemination Time, Gender

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### 1. Introduction

The desire to control the gender of animals is more or less as old as domestication. There are many beliefs on this subject from antiquity to the present day. This process, which has attracted the attention of mankind since the beginning of written history and started with empirical methods, seems to keep scientists busy for a longer time, although it continues with highly developed methods today (Kara and Bekyurek, 2020).

Probability theory states that the secondary gender ratio, the male to female ratio at birth, is 50:50 (Khan, 2015). However, predetermining the gender of the offspring to be born in dairy cattle breeding brings some advantages in breeding. Gender determination allows the production strategies and biotechnological work programs of dairy farms to be planned in advance (Erten and Yilmaz, 2012). In addition, it is clear that any practice affecting the gender ratio will contribute to the rapid increase of genetic capacity in animal breeding.

Many factors have been associated with differences in gender ratios of mammals. These factors include diet, season, illness, hormone levels, insemination time, social status, stress, and age. Variation in gender ratio in response to environmental or physiological conditions can give animals the ability to adapt and thus help ensure the survival of the species. Manipulating conditions that affect the gender ratio to produce preferably male or female offspring will provide economic benefits to livestock producers. However, the reports in the literature and the marked differences between species make it difficult to determine what factors might have contributed to changes in gender ratio in livestock (Huck et al. 1993; Krackow and Burgoyne, 1998; Pratt et al. 1987; Verme and Ozoga, 1981).

The aim of this study is to investigate whether there is dependence between insemination time, season, and insemination method and calf gender.

## 2. Material and Method

In the study, 792 records of inseminations and births that took place between 2010-2019 in Çukurova University Faculty of Agriculture Research and Application Farm Dairy Cattle Unit were evaluated. Detection of heat was routinely determined by technicians three times a day by observation. The onset of estrus was determined on the basis of mounting behavior. Inseminations were carried out between 0-6, 6-12, 12-18 hours after the onset of estrus. At the same time, inseminations were evaluated according to the seasons (Spring; March, April, May, Summer; June, July, August, Autumn; September, October, November, Winter: December, January, February). Of the inseminations, 582 were artificial insemination and 210 were natural insemination. The data were evaluated using the Chi-Square dependency test in the SPSS 22V package program.

## 3. Results

### 3.1. Insemination Time Gender

The relationship between insemination time and gender is given in Table 1. In the inseminations performed within 0-6, 6-12 and 12-18 hours after the onset of estrus, the ratio of female-male offspring was determined as 50.2-49.8%, 52-48% and 47-53%, respectively. Although the obtained results show that proportionally more females are obtained in early insemination, the dependence between insemination time and gender was not statistically significant ( $p>0,05$ ).

**Table 1.** Number of female, male offspring and gender ratio by insemination time

insemination time /hours	Female	Male	Female %	Male %	X <sup>2</sup>	SD	p
0-6	151	150	50.2	49.8	3,705	2	0,150
6-12	89	83	52	48			
12-18	149	170	47	53			

### 3.2. Season and Gender

The relationship between season and gender is given in Table 2. Considering inseminations according to the seasons, the rates of female and male offspring obtained from these inseminations were determined as 46-54% in spring, 35-65% in summer, 56-44% in autumn and 58-42% in winter, respectively. The results obtained showed that more male offspring were obtained in the warmer months. At the same time, this difference was found to be statistically significant.

**Table 2.** Number of female and male offspring and gender ratio by seasons

Seasons	Female	Male	Female %	Male %	X <sup>2</sup>	SD	p
Spring	98	115	46	54	18,448	3	0,000
Summer	34	64	35	65			
Autumn	106	84	56	44			
Winter	168	123	58	42			

### 3.3. Insemination Method and Gender

The relationship between insemination method and gender is given in Table 2.

**Table 3.** Female, male numbers and gender ratio according to the insemination method

Insemination method	Female	Male	Female %	Male %	X <sup>2</sup>	SD	p
Artificial insemination	277	305	47	53	0,033	1	0,872
Natural mating	101	109	48	52			

It was determined that the female-male ratio was 47-53% in the offspring born as a result of artificial insemination, and the female-male ratio was 48-52% as a result of natural mating. A dependency between insemination method and gender could not be determined statistically ( $p>0,05$ ).

#### 4. Discussion

Different results were reported in studies examining the offspring gender of the insemination time. Some researchers stated that more female offspring were obtained with early mating and more male offspring were obtained with late mating (Martinez et al. 2004; Tefsu et al. 2014; Rorie, 1999; Verme and Ozoga, 1981; Wehner et al. 1997). On the contrary, some researchers found that there was no relationship between insemination time and offspring gender ratio (Ballinger, 1970; Bayril and Yilmaz, 2013; Bayril et al. 2016; Demiral et al. 2007; Foote, 1977; Pursley et al. 1998; Roelofs et al. 2006 Rorie et al. 1999).

Similarly, in our study, it was found that there was no relationship between insemination time and calf gender.

In this study, the dependency between season and offspring gender was found to be statistically significant ( $p<0,05$ ). It was determined that the number of male calves increased with the increase of air temperature. Similar results to these results have been reported by some other investigators (Roche et al. 2006; Singh et al. 2004; Skjervold et al. 1978).

Roche et al., 2006 reported that the physiology that supports the relationship between season and gender is unknown, but this change in gender ratios is nutrition, pre-pregnancy maternal body condition score. Trivers-Willard (1973) argues that if the environmental conditions are limited, the parents will give importance to the female individuals for the survival of the species, and the opposite happens when the environmental conditions are good.

On the other hand, some researchers reported that there was no relationship between season and offspring gender (Goshu and Singh, 2013; Lari, 2006; Mukherjee et al. 2000; Kaygisiz and Vanlı, 2008; Rahman et al., 2002; Yilmaz et al. 2010).

In our study, a statistically significant relationship was not detected in the offspring born as a result of artificial insemination, although numerically more males were obtained ( $P>0.05$ ).

Some researchers stated that the number of male offspring increased with artificial insemination (Berry and Cromie, 2006), some researchers stated that the number of female offspring increased (Arega and Chalchissa, 2019; Bekele, 2005; Tesfu et al., 2014) and some researchers stated that artificial insemination did not affect the offspring gender reported (Delesa et al., 2014; Khan et al., 2015; Tesfu et al., 2014).

As a result, it was determined that insemination time and insemination method did not affect calf gender in cattle, but season had an effect on calf gender.

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