JIVS JOURNAL OF ISTANBUL VETERINARY SCIENCES

The effect of mating method and mating season on the number of puppies and some reproductive parameters in Pomeranian dogs

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Research Article

Volume: 6, Issue: 1
April 2022
Pages: 1-5

ABSTRACT

In the present study, the 3-year breeding behavior of the parent dogs in a Pomeranian farm was followed, and the effects of season and breeding method (mating or artificial insemination) on their reproductive performance were investigated. The gestation period was 62.4 days, the age at which sexual maturity is reached was 404.4 days and the average period between two estruses was found as 205.2 days. The mean number of offspring, and the mean number of male and female puppies were found as 3.4, 2.15 and 1.4 respectively. The stillbirth rate was found as 1.4% and death rate up to 1 year 16.7%. The pregnancy rate, the average number of female puppies, the number of stillbirths and the total number of offspring were found to be similar in naturally and artificially inseminated females (P>0.05). While 47.6% of estruses were seen in the spring -summer months, 52.4% were seen in the autumn-winter months (P>0.05). The mating season did not affect the number of female offspring, the stillbirth rate or the total number of offspring (P>0.05). However, when compared to the spring-summer months, the mortality rate of puppies within 1 year of their birth was found to be significantly higher in the females showing estrus in the autumn-winter season (P<0.01).

Keywords: artificial insemination, mating season, Pomeranian dogs, reproductive parameter

Article History

Received: 03.01.2022
Accepted: 08.02.2022
Available online: 12.02.2022

DOI: https://doi.org/10.30704/http-www-jivs-net.1052870

To cite this article: Özmen, M. F. (2022). The effect of mating method and mating season on the number of puppies and some reproductive parameters in Pomeranian dogs. ***Journal of Istanbul Veterinary Sciences, 6*(1),** 1-5. **Abbreviated Title*: J. İstanbul vet. sci.***

Introduction

The interest in owning dogs, which started as a hobby for people, has become even more popular with the COVID - 19 pandemic. The decrease of socializing and the increase in the time spent at home during the pandemic have resulted in changes in human psychology and behavior. It has been determined that keeping pets has a protective effect against the psychological effects of the pandemic (Akalın et al., 2020). The increasing demand for dog ownership has increased the number of dog producing enterprises both in the world and in our country. The large numbers of offspring obtained in one birth and the low cost of feeding and care compared to farm animals make it desirable to breed these animals. Due to the increasing demand for high-priced purebred dogs as pets, dog owners today often consult veterinarians for solutions for fertility problems (Fontbonne, 2011; Zubair, 2014). The increasing dog population and developing canine medicine reveal the need for detailed knowledge of the reproductive physiology and endocrinology of dog breeds. Detailed elucidation of the reproduction of both male and female dogs will contribute positively to dog breeding (Ülgen and Soylu, 2000). Many studies have been conducted on the topic

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of reproduction in numerous animal species that have economic benefits. As a result of these studies, some methods have been developed to solve the reproductive problems of these animals. However, studies on the reproductions of animals kept as pets, which are looked after for different purposes, are not at the desired level compared to other animal species. Knowing the reproductive characteristics of dogs, which constitute an important number of pet animals, would be useful in solving reproductive problems that may occur in these animals (Ülgen and Soylu, 2000). Genetic changes in dogs, which occur throughout many years, have caused structural and reproductive differences as well as phenotypic (height, weight, figure, etc.) changes among dog breeds. Although many studies have been conducted on topics related to reproduction in dogs, some areas have not been fully clarified (Sundqvist et al., 2006).

The breed known as Pomeranians, Pomeranian dog or boo is a Spitz type dog breed named after the historical Pomeranian Region of Central Europe (at present, the part of Northern Poland and East Germany). When we look at the physical characteristics of this breed, which has no distinctions between males and females in regards to weight and height measurements, we see that their heights vary between 18 and 30 cm and that their weights vary between 1.4 and 3.2 kg. Depending on the conditions they live in, Pomeranians can live 12 to 16 years. They are among the 25 most popular dog breeds in the USA (AKC, 2022). The popularity of Pomeranian dogs has increased after 2009, especially with the aid of social media (Hutchinson, 2014). It is necessary to learn the reproductive characteristics of these dogs and to carry out breeding studies in the light of the obtained information. This information is very important for commercial businesses that breed pure-bred dogs as well as animal owners who keep these dogs at home and veterinarians. To the authors' knowledge, there are a few information on reproductive properties of Pomeranian breed in literature, however, there is no comprehensive study similar to the present study. This study was performed to investigate the effects of the age of the first use of Pomeranian breed female dogs in mating, the length of gestation periods, the length of periods between two estruses, the average number of offspring, the average number of female and male puppies, stillbirth rates and death rate up to 1 year as well as breeding season and insemination method on certain reproductive characteristics.

Material and methods

Experimental protocols and animal care were approved by Dicle University Health Sciences Research and Application Center Ethics Committee. Document number: 2021/103303.

The present study was conducted at a farm in the city of Diyarbakır in south eastern of Turkey. This region is situated at 37°55'01"N latitude, and 40°16' 46"E longitude, and at an altitude of 660 m. The age of the first use of the dogs (n: 21) in mating, the gestation periods, the periods between two estruses, the average number of offspring, the average number of female and male offspring, the stillbirth rate and the death rate up to 1 year were noted for 3 years and mean values were calculated. In order to determine the effect of the breeding season on the number of offspring born, bitches mated in spring and summer months were assigned into the first group (n:10) and those that mated in autumn and winter months were assigned into the second group (n:11) and the number of offspring, the number of female puppies, stillbirth rates and the number of offspring that died after less than a year were noted down. The bitches that were confirmed to be in oestrus by vaginal smear application were divided into 2 groups in order to determine whether the method of mating affect the offspring. Intravaginal artificial insemination using fresh sperm (2nd fraction) taken by the hand massage method which had spermatological values of motility ≥ 80 and normal morphology ≥%80 (Baran et al. 2003), was applied to the first group (n:6) at least 2 times with an interval of 2 days. After insemination the clitoris was massaged for at least 5 minutes. In the second group (n:14), natural inseminations were performed at least 2 times with an interval of 2 days. The pregnancy rates, the numbers of female puppies, the stillbirth rates and the total number of offspring were recorded.

Statistical analysis: Comparisons between the two groups were made using the Mann Whitney U Test. SPSS 21 package program was used in the analysis.

Results

The reproductive characteristics investigated within the scope of the study are given in Table 1. Accordingly, the age of first use in mating was found as 404.4 days, the average period between two estruses was found as 205.2 days, the average number of offspring was found as 3.4, the average number of male offspring was found as 2.15, the average number of female puppies was found as 1.4, the stillbirth rate was found as 1.4% and death rate up to 1 year 16.7%.

The effects of the mating season on reproduction are given in Table 2. It was determined that the mating season did not affect the number of female puppies, the number of stillborn offspring, and the

Table 1: Some reproductive characteristics of Pomeranian females

Investigated characteristics	Mean values
Age at sexual maturity (days)	404.4 ± 130.50
Interval between two oestrus (days)	205.2 ± 35.43
Duration of pregnancy (days)	62.4 ± 2.67
Number of offspring	3.4 ± 0.93
Number of male offspring	2.15 ± 0.86
Number of female offspring	1.4 ± 1.43
Number of stillborn (rate)	0.05 ± 0.22 (1.4%)
Number of death by 1 year old (rate)	0.6 ± 1.21 (16.7%)

Values are expressed as mean ± SD.

total number of offspring (P>0.05). However, the mortality rate up to the age of 1 was higher in the offspring of dogs mated in autumn-winter months than in the offspring of those mated in spring-summer months (P<0.05). The results of the effects of the insemination method on reproduction are given in Table 3. It was determined that there was no difference in the pregnancy rate, the number of female puppies, the number of stillborn offspring and the total number of offspring in naturally mated or artificially inseminated Pomeranian dogs (P>0.05).

Discussion

The reproductive characteristics of female dogs show a significant difference from those of other domesticated mammal species. Dogs are traditionally non-seasonal monoestric animals that show estrus once or twice a year. Considering that normal females show estrus every 5-7 months, it is calculated that they can be fertile for about 14 days a year (Grundy et al., 2002). Additionally, the uterus in dogs needs 2-6 months (130-150 days) for endometrial regeneration or involution whether they are pregnant or not (Al-Bassam et al., 1981; Freshman, 1991). The interval between two estruses varies between 5 and 11 months, with an average of 7 months in domestic dogs and 12 months in non-domestic dogs. Female dogs enter an obligatory anestrus period of approximately 4-5 months following the dioestrus, which lasts approximately 58-75 days (Soderberg, 1986; Beijerinka et al., 2003; Nak et al., 2012). In our study, the average time between 2 estruses was found to be 205.2 days, which is approximately 7 months. The prolongation of the estrus cycle and the variability of the time between estruses may be due to the varying durations of anestruses in different dog breeds as indicated by Cirit et al. (2017).

Female dogs reach puberty between 6-24 months of age and show their first estrus at approximately 10-12 months of age (Soderberg, 1986; Nak et al., 2012). In our study, it was determined that the average age of bitches used in the first mating was 404.4 days.

Table 2. Some reproductive characteristics of Pomeranian females according to estrus season

Investigated characteristics	Estrus season		P
	Spring-Summer	Autumn-Winter	
Number of female offspring	1.40 ± 0.54	1.36 ± 0.36	> 0.05
Number of stillborn (rate)	0.0 ± 0.00 (%0)	0.09 ± 0.091 (2.9%)	> 0.05
Total offspring number	3.7 ± 0.33	3.2 ± 0.23	> 0.05
Number of death by 1 year old (rate)	0.10 ± 0.10 (2.7%)	1.0 ± 0.47 (31.4%)	< 0.01

Values are expressed as mean ± SE.

Table 3. Effects of natural breeding and artificial insemination on reproductive performance

Investigated characteristics	Natural mating	Artificial insemination	P
Pregnancy rate	100%	100%	> 0.05
Number of female offspring (rate)	1.3 ± 0.36 (43%)	1.7 ± 0.67 (38%)	> 0.05
Number of stillborn (rate)	0.1 ± 0.07 (2%)	0.0 ± 0.00 (0%)	> 0.05
Total number of offspring	3.3 ± 0.25	3.8 ± 0.31	> 0.05

Values are expressed as mean ± SE.

The gestation period in dogs is considered to be the time between the first mating and parturition. This period has a very wide range and varies between 57 days and 72 days, but takes an average of 62-64 days (Concannon et al., 1983). Although the length of these periods can differ depending mainly on breed, the age of the animal, the number of parturition and the number of offspring born as well as the season, inconsistent results were reported in some previous studies (Jöchle and Andersen, 1977). Although in a previous study (Okkens et al., 1993) it has been reported that the gestation period may vary in dogs of different breeds, no effect of breed on gestation period has also been reported in another study conducted by Linde-Forsberg et al. (1999). Okkens et al. (2000) reported that the gestation period was 62.8 ±1 days for West Highland White Terriers, 60.4 ±1.7 days for German Shepherds, 60.9 ±1.5 days for Labrador Retrievers, and 61.4 ± 1.0 days for Dobermanns in their study of dogs of different breeds. Baran et al. (2003) reported that the average gestation period after insemination with fresh semen

was found as 64.62 days for German shepherds, Labradors and Pointer dogs in their study, similar with the above mentioned studies.

Linde-Forsberg (2000) reported that the yield of offspring obtained from artificial insemination and natural breeding are similar. In our study, the pregnancy rates, the average number of female puppies, the number of stillbirths and the total number of offsprings were found to be similar in females who were mated and artificially inseminated (P>0.05). However, although there was no statistical difference, the total number of offspring (3.8 and 3.3) and the rate of female puppies (43% and 38%) of females who underwent artificial insemination were found to be numerically higher than the naturally mated females (P>0.05). The numerically higher pregnancy rate in artificially inseminated females may be due to the fact that the artificial insemination was repeated at least 2 times with an interval of 2 days according to the vaginal smear results, and clitoral massage was performed by lifting the back of the dog for 5 minutes after AI. It has been reported that the massage applied to the clitoris after insemination gives a feeling of mating (Baran et al. 2003), causes oxytocin release and contractions in the smooth muscles of the genital system (Çoyan and Tekeli, 1996). Smith et al. (2019) reported that the breeding characteristics of domestic dog breeds show differences, and the average number of offspring born at a single birth in 60 dog breeds was 5.55 wherease this number was 2.4 for Pomeranian dogs. Evans and Adams (2010) reported the average number of offspring for Pomeranian dogs as 1.93 (168/87). In our study, the average number of offspring of artificially inseminated dogs was found as 3.4. The reason for higher average number of offspring in our study may be due to the fact that, because of the enterprise is for commercial purposes, careful monitoring of estrus and the fact that the bitches are mated or inseminated at least two times with an interval of two days. There is no data that can explain why female offspring was slightly higher in numbers in artificially inseminated bitches than matings in our study.

In our study, 14% of estrus in female dogs occurred in February, 29% in March, 10% in April, 5% in July, 5% in August, 14% in September, 14% in October, 5% in November and 5% in December. While no estrus was observed in January, May and June, approximately one-third of all estruses throughout the year were observed in March. Seasonally, 47.6% of the dogs showed estrus in the spring-summer months and 52.4% showed estrus in the autumn-winter months (P>0.05). Seasons of estruses did not affect the number of female offspring, the stillbirth rate or the total number of offspring (P>0.05). Compared to the spring-summer seasons, the offspring of the females showing estrus in the autumn-winter seasons were found to have a significantly higher mortality rate under the age of 1 (P<0.01). This may be due to the adverse effects of the winter season, such as cold and rainy weather conditions.

Conclusion

At the end of the present study, the mean values for investigated characteristics of Pomeranian bitches were determined. The duration of pregnancy was 62.4 days, the age of sexual maturity was 404.4 days, the length of interval between two estruses was 205.2 days, the number of offspring was 3.4, the number of male puppies was 2.15, the number of female puppies was 1.4, the stillbirth rate was 1.4%, and death rate up to 1 year 16.7%. In addition, the mating season did not affect the number of female puppies, the number of stillborn and the total number of offspring (P>0.05) but that the mortality rate up to the age of 1 was higher in the offspring of dogs mated in autumn-winter seasons than in the offspring of those that mated in spring-summer seasons (P<0.05). There was no difference between the naturally mated and the artificially inseminated Pomeranian bitches in the pregnancy rates, the number of female puppies, the number of stillborn and the total number of offspring (P>0.05), but it was determined that numerically more offspring could be obtained by application of artificial insemination with fresh semen to Pomeranian dogs with confirmed heat.

Acknowledgements

The authors appreciate to Prof. Dr. Ömür Koçak for contributing to the formation of the statistical data of the study.

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