Influence of parity and litter size on gestation length in beagle dogs

Makoto Seki, Norio Watanabe, Kenyo Ishii, Yoh-ichi Kinoshita, Takehiro Aihara, Shuji Takeiri, Takeshige Otoi

Abstract

This study was conducted to investigate the effects of parity and litter size on gestation length in beagle bitches. The mean duration of the initial elevation (> 2 ng/mL) in progesterone concentrations after the onset of proestrus was shorter (P < 0.05) in bitches without (nulliparous) whelping experience than in bitches with (multiparous) whelping experience (6.9 d versus 8.0 d). When calculated as the interval between the day of initial elevation in progesterone concentrations and the day of whelping, the gestation length in the nulliparous bitches was noted to be similar to that in the multiparous bitches (64.3 d versus 64.2 d). No significant correlation between gestation length and litter size was observed in any of the bitches. Our results indicate that the gestation length in beagle bitches is not affected by parity or litter size.

Résumé

Cette étude a été réalisée afin d’étudier les effets de la parité et de la taille de la portée sur la durée de la gestation chez des chiennes Beagle. La durée moyenne de l’augmentation initiale (> 2 ng/mL) de la concentration de progestérone après le début du proestrus était plus courte (P < 0.05) chez les chiennes sans expérience de mise-bas (nullipare) que chez les chiennes avec expérience de mise-bas (multipare) (6,9 j versus 8,0 j). Lorsque calculé comme l’intervalle entre le premier jour de l’élévation des concentrations de progestérone et le jour de la mise-bas, la durée de la gestation chez les chiennes nullipares a été notée comme étant similaire à celui des chiennes multipares (64,3 j versus 64,2 j). Aucune corrélation significative entre la durée de la gestation et la taille de la portée n’a été observée chez aucune des chiennes. Nos résultats indiquent que la durée de la gestation chez les chiennes Beagle n’est pas affectée par la parité ou la taille de la portée.

(Traduit par Docteur Serge Messier)
were calculated as the interval between the day of first mating and the day of whelping or the interval between the day of the initial elevation in plasma progesterone concentrations and the day of whelping. The plasma progesterone concentrations were measured using an enzyme-linked immunosorbent assay (ELISA) kit (enzyme-immunoassay practice P kit; Kawasaki Mitaka K.K., Mitaka, Tokyo, Japan). The intra-assay coefficients of variation for samples with high, medium, and low concentrations of progesterone were 6.5%, 5.9%, and 5.1%, respectively. The interassay coefficients of variation for the same samples were 7.1%, 7.4%, and 6.9%, respectively. The sensitivity of the assay was 0.25 pg/well. The first day at which the plasma progesterone concentrations exceeded 2 ng/mL was recorded as the day of initial elevation in progesterone, which was considered to be the day of the LH peak (10).

Differences between nulliparous and multiparous bitches with regard to the duration of the initial elevation in plasma progesterone concentrations (> 2 ng/mL) after the onset of proestrus and litter size were evaluated using an independent Student’s t-test. The mean values of gestation length were analyzed by analysis of variance (ANOVA) using the general linear models (GLM) procedure of SAS (SAS for Windows, version 9.1; SAS Institute Japan, Tokyo, Japan). The statistical model included the type of bitches, litter size, and the two-way interactions. Since significant interactions were not observed between the type of bitches and litter sizes, they were excluded from the model. Single linear regression analysis was used to examine the relationship between gestation length and litter size; further, we determined the correlation coefficient of the relationship. The data are expressed as mean ± standard deviation (s). Differences with a probability value (P) of ≤ 0.05 were considered significant.

As shown in Table I, the mean duration of the initial elevation in progesterone concentrations after the onset of proestrus was significantly shorter (P < 0.05) in the nulliparous bitches than in the multiparous bitches (6.9 d versus 8.0 d). When calculated as the interval between the day of first mating and the day of whelping, the gestation length of the nulliparous bitches tended to be shorter (P < 0.1) than that of the multiparous bitches (62.2 d versus 63.2 d). However, no significant difference was observed between the gestation length of nulliparous and multiparous bitches (64.3 d versus 64.2 d) when this parameter was calculated as the interval between the day of initial elevation in progesterone concentrations and the day of whelping. The mean litter size did not differ between the 2 groups (Table I). Further, no significant correlation (P > 0.05) between gestation length and litter size was observed in any of the bitches (Figure 1).

The present study supported the observations of previous studies that parity does not influence gestation length when the latter is calculated as the interval between the day of initial elevation in progesterone concentrations and the day of whelping (2,11). However, we found that, when gestation length was calculated as the interval between the day of first mating and the day of whelping, it tended to be shorter by approximately 1 d in the nulliparous bitches than in the multiparous bitches. It has been reported that the mean duration of proestrus and estrus is significantly shorter in bitches experiencing their first reproductive cycle than in those experiencing their second reproductive cycle (12,13). Moreover, Wildt et al (13) demonstrated that the duration of the LH surge after the onset of proestrus was shorter by approximately 1 d in pubertal bitches than in multiparous bitches. Similarly, in the present study, we found that the duration of the initial elevation in progesterone concentrations after the onset of proestrus was shorter by 1 d in the nulliparous bitches than in the pubertal bitches.

Table I. Comparison of duration of the initial elevation in progesterone (P) concentrations, gestation length, and litter size between nulliparous and multiparous bitches

<table>
<thead>
<tr>
<th>Bitches</th>
<th>Number of bitches examined</th>
<th>Duration of the initial elevation in P levels (day)</th>
<th>Gestation length (day)</th>
<th>Litter size</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Mating</td>
<td>P level</td>
</tr>
<tr>
<td>Nulliparous</td>
<td>29</td>
<td>6.9 ± 2.3a</td>
<td>62.2 ± 2.5</td>
<td>64.3 ± 1.2</td>
</tr>
<tr>
<td>Multiparous</td>
<td>60</td>
<td>8.0 ± 1.7b</td>
<td>63.2 ± 2.2</td>
<td>64.2 ± 1.9</td>
</tr>
</tbody>
</table>

Bitches were mated twice on Days 9 and 12 after the onset of proestrus. Values are expressed as mean ± standard deviation (s).

Differences between nulliparous and multiparous bitches with regard to the duration of the initial elevation in plasma progesterone concentrations (> 2 ng/mL) after the onset of proestrus.

Figure 1. The correlation between gestation length, calculated as the interval between the day of initial elevation in plasma progesterone concentrations and the day of whelping, and litter size. The correlation between gestation length and litter size in all bitches, including the nulliparous (●) and multiparous (○) bitches, was analyzed.

The data are expressed as mean ± standard deviation (s). Differences with a probability value (P) of ≤ 0.05 were considered significant.

As shown in Table I, the mean duration of the initial elevation in progesterone concentrations after the onset of proestrus was significantly shorter (P < 0.05) in the nulliparous bitches than in the multiparous bitches (6.9 d versus 8.0 d). When calculated as the interval between the day of first mating and the day of whelping, the gestation length of the nulliparous bitches tended to be shorter (P < 0.1) than that of the multiparous bitches (62.2 d versus 63.2 d). However, no significant difference was observed between the gestation length of nulliparous and multiparous bitches (64.3 d versus 64.2 d) when this parameter was calculated as the interval between the day of initial elevation in progesterone concentrations and the day of whelping. The mean litter size did not differ between the 2 groups (Table I). Further, no significant correlation (P > 0.05) between gestation length and litter size was observed in any of the bitches (Figure 1).

The present study supported the observations of previous studies that parity does not influence gestation length when the latter is calculated as the interval between the day of initial elevation in progesterone concentrations and the day of whelping (2,11). However, we found that, when gestation length was calculated as the interval between the day of first mating and the day of whelping, it tended to be shorter by approximately 1 d in the nulliparous bitches than in the multiparous bitches. It has been reported that the mean duration of proestrus and estrus is significantly shorter in bitches experiencing their first reproductive cycle than in those experiencing their second reproductive cycle (12,13). Moreover, Wildt et al (13) demonstrated that the duration of the LH surge after the onset of proestrus was shorter by approximately 1 d in pubertal bitches than in multiparous bitches. Similarly, in the present study, we found that the duration of the initial elevation in progesterone concentrations after the onset of proestrus was shorter by 1 d in the nulliparous bitches than in the pubertal bitches.
multiparous bitches. These findings indicate that ovulation after the onset of proestrus may occur earlier in nulliparous bitches than in multiparous ones. Therefore, the shorter gestation length, calculated as the interval between the day of first mating and the day of whelping, in the nulliparous bitches than in the multiparous bitches may result from earlier ovulation after the onset of proestrus.

In the present study, no difference in litter size was noted between the nulliparous and multiparous bitches. Further, no correlation was observed between gestation length and litter size in these bitches. Our results are in agreement with those of previous studies that have indicated that litter size does not influence gestation length (5,7); these studies include one study that used 36 beagle bitches (5) and another that had 63 bitches representing 19 breeds (7). Eilts et al (11) have suggested that small samples with limited statistical power may not be able to detect an association between litter size and gestation length. They used large sample sizes (308 bitches representing 4 breeds) and reported that litter size affects gestation length; further, they showed that litters of 4 or less are more likely to be associated with a long gestation length. Therefore, further studies involving larger sample sizes may be required to determine the influence of litter size on gestation length in the beagle bitches.

In conclusion, our results indicate that gestation length in beagle dogs is not affected by parity or litter size. However, when calculated as the interval between the day of first mating to the day of whelping, gestation length tends to be approximately 1 d shorter in nulliparous bitches than in multiparous ones. This indicates that ovulation in nulliparous bitches may occur earlier than that in multiparous bitches.

References