Does oral administration of the amino acid tyrosine affect oestradiol-17\(\beta\) concentration and sexual behaviour in the bitch?

S. Spankowsky, W. Heuwieser, S. P. Arlt

**Context**
Oral administration of the amino acid tyrosine has been recommended in order to improve fertility and especially to improve copulation behaviour in female dogs; however, evidence to support this is poor. The objective of this study was to determine whether oral administration of tyrosine has an effect on oestradiol-17\(\beta\) concentrations and oestrous behaviour in the bitch.

**Main conclusion**
After receiving 100 mg/kg/day tyrosine during heat, bitches showed neither an increase in oestradiol-17\(\beta\) levels nor improvement of copulation behaviour.

**Approach**
The mean concentration (sd) of oestradiol-17\(\beta\) on the day of ovulation has been previously calculated as 164.4 (54.3) pmol/l. It was hypothesised that the concentration would increase by more than 40 pmol/l (to 204.4 pmol/l) in the treatment group at ovulation, compared to the control group. Fifty bitches were randomly allocated to one of two groups in which each dog received 100 mg/kg/day of either tyrosine or a placebo, orally, between day 3 and day 9 of heat.

Every two to three days, a gynaecological examination was performed and blood samples were taken to determine oestradiol-17\(\beta\) and progesterone concentrations. Routine gynaecological examination consisted of visual inspection, vaginoscopy and cytological evaluation of a stained vaginal smear. The day of ovulation was estimated by clinical findings and according to the specifications of the laboratory once progesterone values exceeded 12.7 nmol/l. The mean concentration (sd) of oestradiol-17\(\beta\) was 164.4 (54.3) pmol/l. It was hypothesised that the concentration would increase by more than 40 pmol/l (to 204.4 pmol/l) in the treatment group at ovulation, compared to the control group.

**Results**
Clinical findings and concentrations of progesterone and oestradiol-17\(\beta\) were allocated into four distinct, time-related intervals: day of ovulation ± one day, two to four days before ovulation, five to seven days before ovulation and eight days before ovulation. The mean day (sd) of ovulation was 11.4 (1.94) days after onset of prooestrus (11.4 [1.96] days in the treatment group and 11.5 [1.96] days in the placebo group). In the treatment group (n=25), 22 bitches were mated, two bitches did not accept the male and in one case the male did not show any interest; 17 bitches (68 per cent) whelped. In the placebo group (n=25), four bitches showed poor copulation behaviour, but all were mated; 20 bitches (80 per cent) whelped.

The observed copulation behaviour did not differ between the groups. No differences in volume and visual nature of vaginal discharge were observed. At the day of ovulation, mean oestradiol-17\(\beta\) concentration was 165.4 pmol/l in the treated group pmol/l and 162.2 pmol/l in the placebo group. No significantly different levels of oestradiol-17\(\beta\) were found before ovulation (Table 1).

**Interpretation**
The study comprised a pool of privately owned dogs of several breeds. Therefore, an assumption has to be made that owners administered the tyrosine or placebo according to the study protocol and completed the questionnaire conscientiously. In addition, a different stud dog was introduced to each bitch. This may also have had an influence on the collected data. This situation, however, represents reality. Serum hormone concentrations observed during the study were similar to those reported by others. The results of this study indicate that oral administration of tyrosine between day 3 and day 9 of heat did not alter visual signs of heat or copulation behaviour and did not elevate oestradiol-17\(\beta\) levels.

**Significance of findings**
In this study tyrosine did not improve signs of heat or copulation behaviour. Differences between these results and those of others might be due to the number of animals, the lack of randomisation, blinding and a control group and consequently a possible placebo effect in the studies describing positive effects. Nevertheless, patient eligibility criteria in this study did not include a history of failure to breed, mate preference or a disininterest of the bitch, because a sufficient number of animals would not have been achievable in the designated period of investigation. Consequently, the effect of tyrosine on a group of bitches with mating problems should be investigated in further trials.

**TABLE 1: Mean level of oestradiol-17\(\beta\) at different time intervals related to ovulation after oral application of tyrosine or placebo**

<table>
<thead>
<tr>
<th>Days relative to ovulation</th>
<th>Mean (sd) level of oestradiol-17(\beta) (pmol/l)</th>
<th>Tyrosine</th>
<th>Placebo</th>
</tr>
</thead>
<tbody>
<tr>
<td>± 1</td>
<td>162.2 (89.7)</td>
<td>25</td>
<td>163.4 (88.6)</td>
</tr>
<tr>
<td>–2 to –4</td>
<td>306.4 (91.0)</td>
<td>24*</td>
<td>274.7 (82.4)</td>
</tr>
<tr>
<td>–5 to –7</td>
<td>214.9 (83.7)</td>
<td>25</td>
<td>214.8 (86.6)</td>
</tr>
<tr>
<td>≥8 or more</td>
<td>205.3 (177)</td>
<td>15*</td>
<td>205.9 (116.7)</td>
</tr>
</tbody>
</table>

* One blood sample was lost in laboratory. Resampling was not possible due to expired time conditions.
** Eight bitches in the control group and 10 in the tyrosine group ovulated five to seven days after first examination. Therefore no data is available in the time period more than seven days before ovulation for these dogs.
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