EFFECT OF OESTROGEN AND PROGESTERONE ON PHYSICAL PROPERTIES OF RABBIT OVIDUCT FLUID

CHARLES E. HAMNER AND SHARON B. FOX

Division of Reproductive Biology, Department of Obstetrics and Gynecology, University of Virginia Medical School, Charlottesville, Virginia

(Received 24th October 1967)

Since oviduct fluid acts as a medium for spermatozoa and ova during fertilization and early cleavage, this investigation was undertaken to determine any changes that occur in specific gravity, viscosity, osmolarity or dry matter content of rabbit oviduct fluid as the hormonal state changes from oestrogen to progesterone domination after fertilization.

Five New Zealand white rabbits (4.5 to 5.0 kg) were ovariectomized and oviduct fluid collecting flasks were installed (Hamner & Williams, 1965). The animals were injected subcutaneously with 1.0 μg oestradiol cypionate (ocp)/kg/day in 1.0 ml cottonseed oil (cso) for 7 days, 0.5 μg ocp/kg/day plus 0.5 mg progesterone/kg/day in 1.0 ml cso for the next 5 days, 1.0 mg progesterone/kg/day in 1.0 ml cso for the next 8 days and 1.0 ml cso alone for the last 4 days. The treatments were then repeated. The oviduct fluid was collected each day, using sterile precautions, centrifuged at 1500 g for 5 min to remove any cellular debris and stored at 4°C in a sealed tube until analysed. Duplicate samples were analysed from each rabbit for each hormonal treatment. Specific gravity was determined as a ratio of the mass of oviduct fluid to the mass of an equal volume of water at 24°C. Dry matter content was determined by the reduction in weight of an oviduct fluid sample after being placed in an oven for 4 hr at 105°C and then cooled to 24°C in a desiccator. Viscosity was measured by observing the flow of oviduct fluid in a Cannon-Manning semi-micro viscometer. Osmolarity was calculated from the freezing point depression of oviduct fluid in an osmometer.

There was no significant change in specific gravity or viscosity of the oviduct fluid under any hormonal treatment (Table 1). However, the osmolarity of oviduct fluid from ocp-injected rabbits was significantly lower than in control animals (cso-injected). The dry matter of oviduct fluid in progesterone-injected rabbits was significantly higher than in ocp, or ocp plus progesterone-injected rabbits.

During the oestrogen treatment, the average secretion rate of oviduct fluid was 1.2 ml/day/oviduct; oestrogen plus progesterone injection reduced the secretion rate by 50%, while progesterone alone reduced the secretion rate to one-sixth (0.2 ml/day/oviduct).

Because of the influence that substances transported to the oviduct lumen could have on conception, the role of active transfer of constituents from the oviduct epithelium to the tubal lumen needs considerable study. The fact that
dry matter content and osmolarity of oestrogen-treated rabbit oviduct fluid is low and that oestrogen greatly enhances secretion rates supports the hypothesis that transudation contributes significantly to oviduct fluid at oestrus.

Table 1

<table>
<thead>
<tr>
<th>Physical property</th>
<th>Treatment</th>
<th>Oestrogen</th>
<th>Progesterone + oestrogen</th>
<th>Progesterone</th>
<th>Cottonseed oil</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specific gravity</td>
<td></td>
<td>0.996 ± 0.006*</td>
<td>0.997 ± 0.009</td>
<td>0.996 ± 0.009</td>
<td>0.997 ± 0.006</td>
</tr>
<tr>
<td>Viscosity (Poise)</td>
<td></td>
<td>0.0112 ± 0.0000</td>
<td>0.0109 ± 0.0001</td>
<td>0.0111 ± 0.0002</td>
<td>0.0110 ± 0.0001</td>
</tr>
<tr>
<td>Osmolarity (m-osmols)</td>
<td></td>
<td>352 ± 12</td>
<td>383 ± 12</td>
<td>376 ± 17</td>
<td>388 ± 13†</td>
</tr>
<tr>
<td>Dry matter</td>
<td></td>
<td>11.9 ± 0.2</td>
<td>12.4 ± 0.3</td>
<td>14.8 ± 0.6‡</td>
<td>13.4 ± 0.8</td>
</tr>
</tbody>
</table>

* Values are means ± standard error for ten determinations for each hormonal treatment.
† Osmolarity in oCP-injected rabbits significantly lower than in control animals (cottonseed oil-treated rabbits). $P < 0.05$ by $t$-test (Snedecor, 1961).
‡ Dry matter in progesterone-treated rabbits significantly higher than in oestrogen-treated rabbits. $P < 0.01$ by $t$-test.

Histological studies have shown that the oviduct is oedematous with the lymphatic system greatly expanded at oestrus (Anderson, 1927; Lombard, Morgan & Menutt, 1950).

This investigation was supported by the National Institutes of Child Health and Human Development Grant HD01672. Appreciation is expressed to Dr Zimbelman, the Upjohn Company, for donation of oestradiol cypionate and progesterone.

REFERENCES