RELATIONSHIP OF FRUCTOSE AND FRUCTOSE PHOSPHATE ESTERS IN THE ACCESSORY SEX ORGANS OF THE MOUSE*

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Fructose metabolism in the mammalian accessory sex organs is dependent on androgen (Mann, 1964). Fructose can be formed via either a phosphorylated or a non-phosphorylated metabolic pathway and several of the enzymes found in either of these pathways have been demonstrated to be dependent upon male sex hormone. Aldose reductase and ketose reductase are reduced after castration (Samuels, Harding & Mann, 1962); phosphatase (Stafford, Rubenstein & Meyer, 1949) and phosphofructokinase (Singhal, 1967) are similarly affected by androgens.

While fructose itself is readily lost from accessory sex structures after castration, less is known of the effects of androgen loss on the fructose phosphate esters such as fructose-6-phosphate (F-6-PO\(_4\)) or fructose-1,6-diphosphate (F-1,6-diPO\(_4\)). Fructose and fructose phosphate esters were therefore studied at short intervals after castration. Changes in the phosphatases were also investigated.

Tissues (anterior prostate or coagulating glands) were rapidly removed, frozen between sections of solid CO\(_2\), weighed and homogenized in 6 % perchloric acid. Homogenates were neutralized and perchlorate was precipitated by the addition of K\(_2\)CO\(_3\). Aliquots of the filtered supernatant were used for the enzymic measurement of fructose, F-6-PO\(_4\), and F-1,6-diPO\(_4\) (Klotsh & Bergmeyer, 1963). Reaction rates were determined by the formation of DPN from DPNH at 340 nm. Alkaline phosphatase was measured (Bessey, Lowry & Brock, 1946) in supernatants (900 g for 30 min.) obtained from aqueous homogenates (0·5 %, w/v). Enzyme activity was expressed as Sigma units/10 mg. tissue (Baily & Pincus, 1967) or as Sigma units/mg. protein. Proteins were determined by the method of Lowry, Rosebrough, Farr & Randall (1951).

Fructose levels fall rapidly after castration (Thomas & Strauss, 1965; Toner & Baillie, 1966). Table 1 shows that fructose is significantly lowered by about 60 % 3 days after castration, but F-6-PO\(_4\) and F-1,6-diPO\(_4\) remain essentially unchanged. The phosphate esters are apparently less sensitive to castration than fructose itself. It is of interest to note that fructose is present in much larger quantities than either of the two phosphate esters, and that there is about 15 times more F-6-PO\(_4\) than F-1,6-diPO\(_4\).

The above observations, taken together with the fact that the alkaline phosphatase

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activity was not markedly affected by castration (Table 1), lead us to suggest that at
least a major portion of fructose must normally be formed via the non-phosphorylated
pathway. The exact extent cannot be stated until the post-castration changes in
aldose and ketose reductase activity have been examined.

Table 1. Fructose, fructose phosphate esters and alkaline phosphatase in the anterior
prostates of normal and castrated rats (means ± S.E.)

<table>
<thead>
<tr>
<th>Animals</th>
<th>F-1,6-diPO₄</th>
<th>F-6-PO₄</th>
<th>Fructose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>5-14 ± 0-29 (5)†</td>
<td>78-9 ± 15-1 (7)</td>
<td>1310-4 ± 333-3 (8)</td>
</tr>
<tr>
<td>Castrated for:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 days</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>3 days</td>
<td>4-23 ± 0-58 (2)</td>
<td>87-2 ± 6-5 (8)</td>
<td>422-2 ± 110-1 (8)*</td>
</tr>
<tr>
<td>4 days</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

Alkaline phosphatase: Sigma units‡

<table>
<thead>
<tr>
<th>Animals</th>
<th>per 10 mg. wet wt</th>
<th>per mg. protein</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>3-85 ± 0-22 (61)</td>
<td>1-79 ± 0-19 (16)</td>
</tr>
<tr>
<td>Castrated for:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 days</td>
<td>3-86 ± 0-25 (18)</td>
<td>1-92 ± 0-17 (6)</td>
</tr>
<tr>
<td>3 days</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>4 days</td>
<td>2-92 ± 0-24 (18)</td>
<td>1-62 ± 0-22 (6)</td>
</tr>
</tbody>
</table>

* Significantly lower than normal (P < 0-05).
† Number of separate determinations in parentheses.
‡ μmoles p-nitrophenol liberated/hr./unit weight of tissue or protein.

REFERENCES

Methuen and Co.