Oxygen Consumption by Liver and Kidney Slices of *Uromastix hardwickii*

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1. The carbohydrates were oxidized at a significantly faster rate by the kidney than by the liver slices of *uromastix*.

2. The amount of oxygen consumed by the liver and kidney slices of *uromastix* is of the similar magnitude.

The oxidation of foodstuff is the main source of energy required by the animals for muscular activity, performance of external work, biosynthetic processes and the maintenance of body temperature by homeothermic animals. Higher forms of life like vertebrates which have to carry out a larger number of biochemical and synthetic processes as compared to microorganisms and other lower animals require more energy and thus utilise carbohydrates in a number of ways. As the higher animals have to meet the greater energy requirement, they oxidise carbohydrates completely. Extensive work has been done on carbohydrate metabolism in mammals¹⁻⁴. Oxygen consumption studies in reptiles have been restricted to intact animals⁵⁻⁶. The present work is concerned mainly with the oxygen consumption and carbohydrate oxidation by the liver and kidney slices of *Uromastix hardwickii*.

### Materials and Methods

1. Animals: The lizards, *Uromastix hardwickii* were collected from fields in Karachi region and were kept in wooden boxes until used. The animals of both sexes were used and were kept without food for several days before the experiments. The animals were collected and used during the period May to October which is the active period of these animals.

2. Tissue slicing: The animals were sacrificed by placing the supine position on a wooden operating board and were cut open. The left elongated lobe of the liver and the two kidneys were used for the preparation of slices. The slices were cut free hand with a razor blade between two frosted glass slides. The thickness of the slices was approximately 0.5 mm and were kept chilled in normal saline till used.

3. Studies with tissues slices: a) Determination of total carbohydrate content: At zero time before the studies with the Warburg respirometer started a known amount of slices was transferred to a tube containing 2 ml 30% warm KOH and digested in a boiling water bath. The digest was made to a known volume and total carbohydrate content determined by anthrone method⁷.

b) Oxygen consumption: Tissue slices of known weight (150—200 mg) were transferred to Warburg flasks containing 2.5 ml 0.019 M reptilian phosphate buffer pH 7.4, according to Mäher *⁸ and 0.1 ml 20% (w/v) NaOH was added to the central well. The flasks along with the manometers were transferred to water bath at 37 °C and the oxygen consumption of the slices was noted at various time intervals over a period of three hours. Air was used as gas phase. At the end of incubation period, the slices and the medium were analysed for total carbohydrates.

### Results

The total carbohydrate content of the liver and kidney slices of *uromastix* at zero time and at the end of 3 hours of incubation period is shown in Table I. The average total carbohydrate content of liver slices at zero time was 3008 µg % and at the end of three hours incubation it was found to be 2902 µg %. Thus a % drop in total carbohydrate content in three hours was 3.5. The average total carbohydrate content of kidney slices at zero time and after 3 hours incubation was 438 and 370 µg %, respectively, thus a percentage drop in total carbohydrate content was about 15.2.

Table II and Fig. 1 show the time course of oxygen consumption by the *uromastix* liver and kidney.

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IN VITRO OXYGEN CONSUMPTION BY UROMASTIX

Table I. Total carbohydrate content of liver and kidney slices of uromastix at zero time and at the end of three hours incubation. The values are expressed in terms of μg glucose/100 mg tissue.

<table>
<thead>
<tr>
<th>Tissue</th>
<th>Initial Carbohydrate Level</th>
<th>Final Carbohydrate Level</th>
<th>Difference</th>
<th>% Drop</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liver</td>
<td>3008 ± 73.8*</td>
<td>2902 ± 70.3</td>
<td>105.9 ± 2.9</td>
<td>3.53%</td>
</tr>
<tr>
<td>Kidney</td>
<td>438 ± 4.60</td>
<td>370 ± 4.60</td>
<td>68.0 ± 3.23</td>
<td>15.20%</td>
</tr>
</tbody>
</table>

* Mean ± S.E. Each value is a mean of six observations.

Table II. Time course of oxygen consumption by uromastix liver and kidney slices by Warburg respirometer.

<table>
<thead>
<tr>
<th>Time [min]</th>
<th>Liver</th>
<th>Kidney</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>28.25 ± 3.17*</td>
<td>24.82 ± 1.72</td>
</tr>
<tr>
<td>60</td>
<td>53.31 ± 6.44</td>
<td>45.95 ± 3.99</td>
</tr>
<tr>
<td>90</td>
<td>72.47 ± 8.98</td>
<td>65.93 ± 5.11</td>
</tr>
<tr>
<td>120</td>
<td>92.27 ± 11.0</td>
<td>85.71 ± 6.75</td>
</tr>
<tr>
<td>150</td>
<td>110.77 ± 12.87</td>
<td>105.46 ± 9.09</td>
</tr>
<tr>
<td>180</td>
<td>129.79 ± 15.67</td>
<td>125.66 ± 14.19</td>
</tr>
</tbody>
</table>

* Mean ± S.E. Each value is a mean of eight observations. Each value represents μl oxygen consumed/100 mg tissue wet wt.

Fig. 1. Oxygen consumption by liver and kidney slices of uromastix. (O—O) total O2 uptake by liver slices, (x—x) total O2 uptake by kidney slices, (o—o) O2 uptake by liver slices at each 30 min interval, (x—x) O2 uptake by kidney slices at each 30 min interval.

125.6 μl/100 mg in case of kidney slices. Although the oxygen consumption in both the tissues is very similar, the utilization of carbohydrate for the oxidative purpose is much less in the case of liver than in the kidney. It is possible that other constituents like lipids are also simultaneously being oxidised in the liver. It is not surprising because the lipid content of the liver is high. Moreover during hibernation the liver lipid content of this reptile is greatly increased while the liver carbohydrate and blood sugar levels are maintained. The elevated esterified and non-esterified fatty acid levels in plasma of uromastix also suggest a higher utilization of lipids. Higher specific activities of succinate dehydrogenase and glucose-6-phosphate dehydrogenase in kidney than in liver have been reported recently. Thus kidney can utilise carbohydrates to a greater extent through oxidative mechanisms as compared to liver. Our results of oxygen consumption studies and total carbohydrate content during the period of three hours incubation further support the greater ability of kidney to utilise carbohydrate as compared to that of liver.

Discussion

The incubation studies with the liver and kidney slices of uromastix have shown that the total carbohydrate content of the tissue decrease with time (Table I). During the period of three hours incubation, there is a very little drop (3.5%) in the case of liver while in kidney the drop is significant (15.2%). During the same course of time, the oxygen consumption by these tissue slices has been steady.

Moreover during hibernation the liver lipid content of this reptile is greatly increased while the liver carbohydrate and blood sugar levels are maintained. The elevated esterified and non-esterified fatty acid levels in plasma of uromastix also suggest a higher utilization of lipids. Higher specific activities of succinate dehydrogenase and glucose-6-phosphate dehydrogenase in kidney than in liver have been reported recently. Thus kidney can utilise carbohydrates to a greater extent through oxidative mechanisms as compared to liver. Our results of oxygen consumption studies and total carbohydrate content during the period of three hours incubation further support the greater ability of kidney to utilise carbohydrate as compared to that of liver.

7 F. W. Fales, J. Biol. Chemistry 193, 113 [1951].
8 M. J. Maher, Endocrinology 74, 994 [1964].