Oxamic Acid Effect on Lactate Release in Rat Fat Cells
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Introduction
- The purpose of this experiment was to observe the effects of oxamic acid on adipocyte metabolism of lactate.
- Adipocytes, fat cells, are active in our bodies metabolism and produce a significant amount of lactate, especially in those who are insulin resistant.
- During fasting, gluconeogenesis converts lactate to pyruvate.
- Weight and Type 2 diabetes have a direct relationship with basal lactate concentration (DiGirolamo, M, Newby, FD, Lovejoy, J, 1992).
- Previous experiments with dichloroacetate (DCA) showed promising, yet not strong, control of lactate release in adipocytes. Both DCA and Oxamic acid are analogues of acetic acid but use different mechanisms to influence lactate release.
- DCA activates pyruvate dehydrogenase while oxamic acid inhibits lactate dehydrogenase.
- The lactate can be oxidized for energy by lactate dehydrogenase which produces NADH and pyruvate.

Methodology
- Epididymal fat pads from rats were digested enzymatically and isolated using centrifugation.
- Samples were divided into test tubes and incubated with 1mM glucose, insulin, and three different concentrations of oxamic acid (0mM, 1mM and 10mM) for 1, 2, and 3 hours.
- A lactate assay was performed by adding lactate dehydrogenase to the samples producing NADH and pyruvate. The amount of NADH was measured using a diode array spectrophotometer at absorbance of 340nm (Gasic, S, Tian B, Green, A, 1999).
- Samples were compared against a standard solution (1mM sodium lactate). The standard lactate solution yielded 0.490 absorbance at 340 nm.

Hypothesis
With higher oxamic acid concentration a lower lactate concentration will be produced by adipocytes.

Results
- Samples produced the following amounts of lactate.
  - 0mM oxamic acid: 1 hour incubation yielded 0.27mM lactate, 2 hr-0.26mM, 3hr-0.45mM.
  - 1mM oxamic acid: 1hr-0.27mM, 2hr-0.34mM, 3hr-0.4mM.
  - 10mM oxamic acid: 1hr-0.16mM, 2hr-0.29mM, 3hr-0.28mM.

Limitations
- We were not able to replicate our finding after changing the brand of LDH used. The first LDH used was from bovine muscle, we then proceeded to use a more potent LDH from rabbit muscle. In theory the higher concentration of LDH should have produced higher concentrations of NADH. Unfortunately our proceeding trials produced no NADH.
- During a trial on standard solutions we received the yields listed in the table below.
- This indicates human error may be a factor in the preparation of fat cells, buffers, or enzymes. Within the time available we were not able to find a solution to the problem.

Standard Trials with known Lactate Acid concentrations (10mM) to test effectiveness of oxamic acid.

<table>
<thead>
<tr>
<th>Standard trial</th>
<th>5 mM Oxamic acid</th>
<th>2 mM Oxamic acid</th>
<th>1 mM Oxamic acid</th>
<th>0 mM Oxamic acid</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.11080</td>
<td>0.13591</td>
<td>0.34343</td>
<td>0.40044</td>
</tr>
<tr>
<td>2</td>
<td>0.19965</td>
<td>0.14559</td>
<td>0.35518</td>
<td>0.37255</td>
</tr>
</tbody>
</table>

Conclusions and Future Work
- The higher the concentration of oxamic acid the lower the concentration of lactate after incubation for 1, 2 and 3 hours.
- This shows preliminary evidence oxamic acid may lower the concentration of lactate produced in adipocyte metabolism.
- Lower basal lactate concentrations due to oxamic acid may decrease the chance of insulin resistance.
- Further study is needed to solidify our finding.

Literature Cited