Investigation on combined influence of selenium and zinc on sub lethal arsenic induced hexokinase variations in various brain regions of three fresh water teleosts

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Abstract
In the present investigation the author intend to study the sub lethal influence of arsenic (heavy metal) in presence of selenium and zinc on hexokinase in various brain regions viz. cerebrum diencephalon cerebellum and medulla oblongata in L. rohita, C. batrachus and C. punctatus under chronic study.

Keywords: Arsenic, selenium, zinc, hexokinase and brain region

Introduction
The natural water bodies are subjected to continuous contamination and it is just the outcome of modernization. Due to their stable and persistent existence posing a serious threat to the biota and depleted biota affect the yield of economically and nutritionally important aquatic species and this in turn causing depletion in productivity and at last the yield of natural water bodies i.e. loss to consumers of the lake and revenue to the nations too. Such revenue and yield loss may indirectly affect the health of consumer (human beings) and finally making sick and infections prove situation which is unhealthy to all in the globe. [El-Shebly 2009, Gopal krishnan & Rao 2005]
The present scenario expects more productivity and more yield to get national revenue and to led disease/dysfunction free life by maintaining a balance between industrial production and proper treatment of waste before effluent disposal and to have global abiotic /biotic standards of the water bodies. [Eshak et al. 2010, Fernandez & Olalla et al. 2000, Froese 2009, Gujawat 2005].
At present people are devising new strategies to contain contamination either by nature i.e. through some detoxification i.e. chelating agents. Hence in the present investigation the investigator would like to investigate the influence of selenium and zinc on metal caused toxicity i.e. arsenic on hexokinase in different brain regions (cerebrum, diencephalon, cerebellum and medulla oblongata) in *Labeo rohita* (Ham), *Clarias batrachus* (Linn) and *Channa punctatus* (Bloch) on a comparative approach from a tropical habitat.

Material and Methods

Determination of safety and sub lethal concentration
Safety and Sub lethal concentrations of Arsenic were determined on *Labeo rohita, Clarias batrachus* and *Channa punctatus* by the Probit Analysis Method (Finney, 1971). Higher concentration of arsenic were used and slowly reduced the amount of concentration to know the Le 50/100 value for 96 hour exposure.

Enzyme Assay
**Result and Discussion**

The sub-lethal arsenic effect was studied on differential distribution of hexokinase in various brain regions (cerebrum, diencephalon, cerebellum and medulla oblongata) in presence of two chelators i.e. selenium and zinc and recorded the highest fall in hexokinase in diencephalon at 08 hrs, followed by cerebrum at 16 hrs, medulla oblongata at 24 hrs and cerebellum at 24 hrs in comparison to *C. batrachus* (diencephalon at 08 hrs, cerebrum at 16 hrs, medulla oblongata at 24 hrs and cerebellum at 16 hrs) and in *C. punctatus* (diencephalon at 08 hrs, cerebrum at 24 hrs, medulla oblongata at 24 hrs and cerebellum at 16 hrs) The enzyme fall i.e. hexokinase during sub-lethal exposure in presence of chelating agents under short time exposure is comparatively less than the exposure with single chelating agent in all the fish species selected and in all the brain regions identified for investigation. Among the regions of the brain it is in diencephalon maximum changes recorded and in cerebellum minimum changes were recorded. Between the fish species, *L. rohita* registered optimum changes than in *C. batrachus* and *C. punctatus*. 

**Graph 1:** Different brain regions of (A) *L. rohita* (B) *C. batrachus* (C) *C. punctatus*

**Table 1:** Combined influence of selenium and zinc on sub-lethal arsenic induced Hexokinase variations in various brain regions in three freshwater teleosts

<table>
<thead>
<tr>
<th>Name of Species</th>
<th>Regions of the brain</th>
<th>Sub-lethal (Arsenic) exposure</th>
<th>Sub-lethal (Arsenic) exposure with selenium and zinc</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Control 8hrs 16hrs 24hrs</td>
<td>% of F/R</td>
<td>Control 8hrs 16hrs 24hrs</td>
</tr>
<tr>
<td><em>Labeo rohita</em> (Ham.)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cerebrum</td>
<td>0.386±0.069 0.239±0.032 0.196±0.014</td>
<td>49</td>
<td>0.386±0.039 0.279±0.042 0.216±0.038</td>
</tr>
<tr>
<td>Diencephalon</td>
<td>0.239±0.032 0.166±0.016 0.138±0.024</td>
<td>52</td>
<td>0.239±0.029 0.178±0.042 0.158±0.026</td>
</tr>
<tr>
<td>Cerebellum</td>
<td>0.210±0.019 0.152±0.014 0.119±0.012</td>
<td>43</td>
<td>0.210±0.019 0.196±0.026 0.162±0.018</td>
</tr>
<tr>
<td>Medulla oblongata</td>
<td>0.324±0.028 0.252±0.032 0.174±0.042</td>
<td>46</td>
<td>0.324±0.040 0.266±0.036 0.191±0.022</td>
</tr>
<tr>
<td><em>Clarias batrachus</em> (Linn.)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cerebrum</td>
<td>0.361±0.042 0.236±0.042 0.202±0.018</td>
<td>44</td>
<td>0.361±0.038 0.248±0.042 0.216±0.032</td>
</tr>
<tr>
<td>Diencephalon</td>
<td>0.254±0.038 0.164±0.019 0.132±0.028</td>
<td>48</td>
<td>0.254±0.038 0.198±0.024 0.166±0.040</td>
</tr>
<tr>
<td>Cerebellum</td>
<td>0.169±0.024 0.134±0.013 0.104±0.014</td>
<td>38</td>
<td>0.169±0.022 0.122±0.019 0.108±0.010</td>
</tr>
<tr>
<td>Medulla oblongata</td>
<td>0.282±0.032 0.216±0.021 0.163±0.019</td>
<td>42</td>
<td>0.282±0.034 0.206±0.021 0.174±0.017</td>
</tr>
<tr>
<td><em>Channa punctatus</em> (Bloch)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cerebrum</td>
<td>0.294±0.042 0.196±0.014 0.173±0.021</td>
<td>41</td>
<td>0.294±0.042 0.236±0.024 0.185±0.026</td>
</tr>
<tr>
<td>Diencephalon</td>
<td>0.214±0.014 0.144±0.012 0.121±0.013</td>
<td>43</td>
<td>0.214±0.024 0.176±0.027 0.152±0.016</td>
</tr>
<tr>
<td>Cerebellum</td>
<td>0.154±0.026 0.122±0.026 0.098±0.009</td>
<td>36</td>
<td>0.154±0.018 0.146±0.016 0.103±0.010</td>
</tr>
<tr>
<td>Medulla oblongata</td>
<td>0.246±0.036 0.198±0.032 0.150±0.021</td>
<td>39</td>
<td>0.246±0.019 0.232±0.034 0.206±0.014 0.159±0.024</td>
</tr>
</tbody>
</table>

Values are mean ± SDM of 7 Replicates. The data was subjected to test of ANOVA and Superscripts a-e indicates that p > 0.01, 0.02, 0.03, 0.04 & 0.05.

*F-Fall /R-Rise
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References