Germinated *Triticum Aestivium* under microgravity: A new candidate for type 1 diabetes therapy
• Every 10 seconds, one person dies from diabetes-related complications.

• Diabetes mellitus is a major risk factor for cardiovascular disease which is the first leading cause of death.
- Due to high mortality rate from diabetic complications and current diabetes medications may lead to kidney and liver complications
- we looked for a local natural plant germinated under microgravity to be used as an alternative therapy.
Importance of microgravity studies

- No research had been done in therapeutic potential of germinated *Triticum aestivum* under microgravity conditions.

- Although germinated *Triticum aestivum* under normal condition (under gravity) showed promising results, our results under microgravity conditions showed high concentrations of natural polyphenols and flavonoids with high antioxidant activities.
Methodology
A 3D-clinostat (built in our lab) will be used at different rotations/minute revolving plants in three-dimensions to create a microgravity conditions.
• Grains of *T. aestivum* will be germinated under gravity and microgravity at 4 rotations/minute conditions for 10 days.

• Suitable amounts of the powdered plant materials will be extracted by soxhlet extraction technique.
The antioxidant activity of the extracts will be evaluated using hydrogen peroxide and nitric oxide scavenging activities.

Diabetes was induced in rats by single intraperitoneal administration of STZ (65 mg/kg body weight). Plant extracts at the doses of 100 mg/kg body weight was orally administered to both diabetic and non-diabetic animals for a period of 24 days. After completion of experimental duration serum, liver and pancreas were used for evaluating biochemical (glucose, insulin, lipid profile, kidney function and liver function parameters) and histopathological changes.
Figure: 1 Total Phenolic content of germinated *Tritium aestivum* grains

![Graph showing the comparison of total phenolic content between microgravity and gravity conditions. The graph indicates that there is a significant difference in the phenolic content under microgravity compared to gravity.](image-url)
Figure: 2 Total flavonoid content of germinated *Triticum aestivum* grains
Table 1: Antioxidant Potential of *Triticum aestivum*

<table>
<thead>
<tr>
<th>Plant extracts</th>
<th>H$_2$O$<em>2$ Scavenging IC$</em>{50}$ (µg/ml)</th>
<th>NO-scavenging IC$_{50}$ (µg/ml)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Germinated under Gravity</td>
<td>25±3.9</td>
<td>55±7.68</td>
</tr>
<tr>
<td>Germinated under Microgravity</td>
<td>13±5.8</td>
<td>34±4.69</td>
</tr>
<tr>
<td>Ascorbic acid</td>
<td>44±2.1</td>
<td>58±2.4</td>
</tr>
</tbody>
</table>

**Values represented in the results are mean±SD (n=3); linear regression analysis was used to calculate IC$_{50}$ value.**
Reduction in blood glucose levels in different groups over the period of study

Days of treatment

Blood glucose levels (mg/dl)

Day 0
Day 6
Day 12
Day 18
Day 24

Control
STZ only
Microgravity
Gravity
Metformin
Effect of germinated *Triticum aestivum* on the lipid profile, liver functions and kidney function parameters

<table>
<thead>
<tr>
<th>Test</th>
<th>Control</th>
<th>STZ only</th>
<th>Microgravity</th>
<th>Gravity</th>
<th>Metformin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Triglycerides</td>
<td>0.63±0.08</td>
<td>0.85±0.17</td>
<td>0.6±0.15</td>
<td>0.55±0.06</td>
<td>0.6±0.1</td>
</tr>
<tr>
<td>cholesterol</td>
<td>1.68±0.19</td>
<td>2.18±0.34</td>
<td>1.75±0.31</td>
<td>1.86±0.33</td>
<td>1.64±0.14</td>
</tr>
<tr>
<td>HDL</td>
<td>0.98±0.06</td>
<td>1.47±0.24</td>
<td>1.14±0.12</td>
<td>1.14±0.10</td>
<td>0.97±0.04</td>
</tr>
<tr>
<td>LDL</td>
<td>1.08±0.29</td>
<td>2.06±0.35</td>
<td>1.11±0.19</td>
<td>1.16±0.62</td>
<td>1.31±0.13</td>
</tr>
<tr>
<td>creatinine</td>
<td>34.4±0.13</td>
<td>100.6±8.50</td>
<td>37.8±2.03</td>
<td>43.2±1.43</td>
<td>34.1±1.08</td>
</tr>
<tr>
<td>urea</td>
<td>6±0.8</td>
<td>25.8±2.3</td>
<td>10.6±1.2</td>
<td>9.1±2.1</td>
<td>8.2±1.7</td>
</tr>
<tr>
<td>SGOT</td>
<td>129±10.2</td>
<td>373.5±16.3</td>
<td>132.4±11.6</td>
<td>160.5±17.2</td>
<td>158.6±14.3</td>
</tr>
<tr>
<td>SGPT</td>
<td>63±4.20</td>
<td>210.7±14.1</td>
<td>45.2±3.60</td>
<td>59.4±6.10</td>
<td>62.3±7.20</td>
</tr>
</tbody>
</table>
Effect of germinated *Triticum aestivum* on the glycosylated hemoglobin, insulin and C-peptide levels

<table>
<thead>
<tr>
<th>Group</th>
<th>Glycosylated Hemoglobin (HbA1C) %</th>
<th>Insulin (µLU/mL)</th>
<th>C-peptide (ng/mL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>5.55±0.21</td>
<td>2.6±0.2</td>
<td>0.047±0.0032</td>
</tr>
<tr>
<td>Microgravity</td>
<td>5.45±0.33</td>
<td>3.04±0.35</td>
<td>0.053±0.0022</td>
</tr>
<tr>
<td>Gravity</td>
<td>6.02±0.23</td>
<td>2.4±0.12</td>
<td>0.040±0.0021</td>
</tr>
<tr>
<td>Metformin</td>
<td>5.65±0.14</td>
<td>2.54±0.21</td>
<td>0.045±0.0010</td>
</tr>
<tr>
<td>Streptozotocin</td>
<td>8.85±0.24</td>
<td>1.2±0.03</td>
<td>0.039±0.0015</td>
</tr>
</tbody>
</table>
A: Control
B: STZ
C: Microgravity
D: Gravity
E: Metformin
• Our results in germinated *Triticum aestivum* under microgravity showed a promising new drug without any side effects and with less manufacturing cost for diabetic treatment.

• This method can be used to explore the therapeutic potential for other diseases.
Thank you
References


