Ameliorating Effects of Bone Marrow Transplantation and Zinc Supplementation on Physiological and Immunological Changes in γ-Irradiated Rats

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ABSTRACT

Purpose: The present study was carried out to determine the prophylactic impact of zinc sulphate administration to irradiated rats treated with bone marrow transplantation (BMT) as indicated by the hematological and immunologic response as well as oxidative stress.

Material and methods: Rats were injected orally with zinc sulphate, 10 mg/Kg body wt, daily for 2 weeks before whole body 5 Gy gamma irradiation and intravenous injection of bone marrow cells, one hour post irradiation.

Results: The results revealed a significant decrease in red blood cells (RBC), white blood cells (WBC), haematocrit (%), and red blood cell mean corpuscular haemoglobin (MCH) and mean corpuscular haemoglobin concentration (MCHC) in irradiated rats. The decrease in the percentage of lymphocytes of bone marrow was significantly decreased compared to the control group.

Conclusion: Protection with Zn, enforcing significant innate immune responses, could trigger and augment adaptive immune responses by BMT which suggests its use to protect against radiation hazards.

Keywords: BMT; gamma irradiation; zinc sulphate;

RESULTS

Table 1: Effect of BMT and Zn Supplementation on Some Blood parameters: Total Red Blood Cells, Total White Blood Cells and Lymphocytes, in Irradiated and Non-irradiated Rats.

<table>
<thead>
<tr>
<th>Groups</th>
<th>RBCs (10^6/µl)</th>
<th>WBCs (10^3/µl)</th>
<th>Lymphocytes (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>7.32±0.38</td>
<td>6.04±0.57</td>
<td>44.8±0.37</td>
</tr>
<tr>
<td>CBM</td>
<td>6.92±0.31</td>
<td>5.14±0.42</td>
<td>36.4±0.73</td>
</tr>
<tr>
<td>CZN</td>
<td>6.74±0.43</td>
<td>6.14±0.44</td>
<td>38.6±0.62</td>
</tr>
<tr>
<td>R</td>
<td>5.0±0.3</td>
<td>2.92±0.46</td>
<td>22.2±0.86</td>
</tr>
<tr>
<td>R + BM + Zn</td>
<td>6.18±0.27</td>
<td>3.52±0.45</td>
<td>31.4±0.25</td>
</tr>
<tr>
<td>R + Zn</td>
<td>6.32±0.46</td>
<td>5.14±0.31</td>
<td>37.6±0.35</td>
</tr>
<tr>
<td>R + BM + Zn</td>
<td>6.54±0.44</td>
<td>4.60±0.73</td>
<td>39.4±0.56</td>
</tr>
</tbody>
</table>

Values are expressed as mean ± S.E. c: Significant difference compared to control. r: Significant difference compared to R group.

Animals and Methods

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Mature male albino rats of pure strain Rattus norvegicus (180-300g). Animals were randomly assigned into 6 groups:

1. Control: rats were housed and fed during the experimental period.
2. Rats injected with BMT cells through the caudal vein (CBM).
3. Rats received orally 10mg/Kg body weight of zinc sulphate as a single daily dose for 14 successive days (CZN).
4. Rats exposed to 5 Gy whole body gamma rays (R).
5. Rats exposed to 5 Gy gamma rays and treated with BMT one hour after irradiation (R + BM).
6. Rats received 10mg/Kg body weight of zinc sulphate for 14 successive days before 5 Gy irradiation (R + Zn).
7. Rats received orally 10mg/Kg body weight of zinc sulphate as a single daily dose for 14 successive days before irradiation and treated with BMT one hour after irradiation (R + BM + Zn).

Animals were sacrificed after 14 days from treatment, irradiation or pre-irradiation treatment and BMT.

Conclusion

The present findings confirmed protective potential of zinc sulphate administration against the severity of radiation induced disturbance and in enforcing allogenic bone marrow transplantation and the immune response. Zinc should be further evaluated for its radioprotective potential in a clinical setting.