Blood Glucose and Serum Insulin Response in Protein-energy Malnutrition Following Nutritional Rehabilitation


*Department of Pediatrics, Institute of Medical Sciences, Banaras Hindu University, Varanasi, India
**Division of Endocrinology, Institute of Medical Sciences, Banaras Hindu University, Varanasi, India

Summary

Fifteen children with protein-energy malnutrition and eight healthy children between the ages of 6 months and 60 months were studied for blood glucose and serum insulin levels in the fasting state and 120 minutes following oral glucose load. The measurements were repeated after normalization of the body weight following 6 weeks of nutritional rehabilitation. The fasting blood glucose increased significantly in the post-treatment period and became comparable to the control value. The abnormal blood glucose response to oral glucose load also normalized. The serum insulin level rose significantly \( (p < 0.001) \) in the post-treatment period but failed to normalize. The response to oral glucose load was similar. The observed lower insulin response, despite normoglycemia, after 6 weeks of nutritional rehabilitation indicates persistence of hormonal imbalance which may need a longer duration of rehabilitation for full recovery.

Malnutrition is known to induce a variety of metabolic disturbances, some of which may be mediated through dysfunction of the endocrine glands. The endocrinial changes may play a major role in the process of adaptation to the acute or chronic stress of protein and calorie deficiency. In an earlier study,\(^1\) we reported lower fasting blood glucose and serum insulin levels in malnourished children. Following oral glucose load, there were higher blood glucose and lower serum insulin levels suggesting an impaired glucose tolerance. Some of the above patients were re-evaluated following nutritional rehabilitation. We report our findings.

Patients and Methods

Fifteen children with protein-energy malnutrition (marasmus, 12; kwashiokor, 3) aged 6–60 months, were studied for blood glucose and serum immunoreactive insulin levels in the fasting state and 120 minutes after oral glucose load at diagnosis. Eight children in the same age group served as controls. The study subjects, selection criteria, and method of collection of samples were the same as reported earlier.\(^1\) After 6 weeks of nutritional rehabilitation, the parameters were re-measured when the children attained a weight of more than 80 per cent of the 50th centile of Harvard standard and were without any clinical manifestations of malnutrition.

Blood glucose was estimated by the glucose oxidase method and serum immunoreactive insulin by radio-immunoassay using the kit (RIA-K-1) marketed by Isopharm Radio Pharmaceuticals Division, BARC, Bombay. Student's \( t \)-test was used to analyse the data for statistical significance.

Results

The pre- and post-treatment blood glucose and serum insulin levels in the fasting state and after oral glucose load are presented in Table 1.

The mean fasting blood glucose level was significantly lower \( (p < 0.001) \) in malnourished children at diagnosis. Six weeks after therapy, it showed a significant improvement and became comparable to the control value. Two hours following oral glucose load, the mean blood glucose level, which was higher at diagnosis \( (p < 0.01) \), also normalized. However, the mean serum insulin level, though showing a significant rise \( (p < 0.01) \), still remained significantly lower than the control value \( (p < 0.001) \). Somewhat similar was the response following oral glucose load.

Discussion

The present study showed that following 6 weeks of nutritional rehabilitation and restoration of normal body weight, the fasting blood glucose as well as the blood glucose response to oral glucose load normalized. However, the serum insulin response was not similar to that of blood glucose level. Although the serum insulin level rose significantly in the post-treatment period, it continued to remain subnormal, indicating a persistence of hormonal imbalance despite normoglycemia in these children. Similar observations were made by Becker,\(^2\) who reported persistently abnormal insulin levels in a...
TABLE 1
Mean blood glucose and serum insulin levels (mean ± 1 SD) in malnourished children in the fasting state and 120 min after oral glucose load

<table>
<thead>
<tr>
<th>Groups</th>
<th>n*</th>
<th>Blood glucose (mg/dl)</th>
<th>Serum insulin (μU/ml)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Fasting</td>
<td>Post-glucose</td>
</tr>
<tr>
<td>Control</td>
<td>8</td>
<td>76.5 ± 9.9</td>
<td>83.0 ± 10.8</td>
</tr>
<tr>
<td>Malnutrition</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>pre-treatment</td>
<td>15</td>
<td>55.3 ± 6.5**</td>
<td>99.6 ± 13.4*</td>
</tr>
<tr>
<td>post-treatment</td>
<td>15</td>
<td>72.8 ± 5.7</td>
<td>79.7 ± 5.5</td>
</tr>
</tbody>
</table>

* n = number of cases.
Statistical comparison (vs. control): *p < 0.01; **p < 0.001.

short-term follow-up of 3–6 weeks. In many of their patients insulin secretion remained subnormal or even deteriorated after nutritional status had greatly improved. Only 2–10 months later did the levels normalize. In contrast, in another study the authors observed normalization of insulin level after 4–8 weeks of nutritional therapy.

The present study suggested that 6 weeks of treatment and normalization of body weight is not representative of a full recovery from malnutrition. The biochemical and cellular abnormality perhaps remains for a longer period, resulting in persistent impairment of insulin release.

References