HYPER ABSORPTION OF CARBOHYDRATES THROUGH SMALL INTESTINE IN DIABETES MELLITUS DUE TO INCREASED BRUSH BORDER HYDROLYSES ACTIVITIES

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Summary: In diabetes there is increased Lactose and Starch absorption due to increased Lactase and Amylase activities. After Insulin administration for a long period the Lactose absorption is greatly enhanced.

Key words: hyper absorption of carbohydrates brush border hydrolyses and diabetes

INTRODUCTION

It has been reported that experimental diabetes doubles the absorption of starch and oleic acid substances enjoying active transport access into the intestinal mucosa (1). Stimulation of jejunal secretion of Amylase Invertase, Peptidase and Phosphatase activity was observed in hyperthyroid dog (4). Later on increased Sucrase activity in diabetes was also observed (6). In streptozotocin diabetic rat stimulation of brush border hydrolyses was detected (2). Hyper activity of oligosaccharidase like Lactase, Sucrase and Maltase were also observed in alloxan diabetes as well as after prolonged insulin therapy (9). Deranged carbohydrate metabolism due to stimulation of brush border hydrolyses in human diabetic subject has been reported (5). Further it was observed that there was increased amylase activity of pancrease and small Intestine in alloxan diabetes (10). Comparative studies on the effect of streptozotocin and alloxan diabetes on Small Intestine and Pancreatic carbohydrases activities, showed that the stimulatory effect of Streptozotocin on Lactase, Sucrase Maltase and Amylase activities were more profound as compared to alloxan diabetes (11). This problem was undertaken in order to explore the possibility of such
stimulation of enzyme activity in human diabetic patients and also to find out to what extent the enhanced activity of Lactase, Maltase and Amylase was altered after Insulin therapy.

MATERIALS AND METHODS

5 normal subjects and 6 diabetic patients before and after insulin therapy were selected for lactose tolerance test while 4 normal subjects and 10 diabetic subjects were selected for starch absorption test. The selection of the patients were done in different hospitals in Calcutta. A standard glucose curve was prepared as described by Sharma and Ghosh (10). For lactose absorption test fasting blood (2 c.c.) was drawn from the antecubital vein from one group of normal, Diabetic and Diabetic subjects undergoing prolonged insulin therapy for a long period. 40 gms of Lactose was given with luke warm water to each subject and subsequent post prandial blood was drawn at the interval of 60 and 90 min. Similarly starch absorption test was performed on another group of normal and diabetic subjects after giving 200 gms of boiled starch to each patient and the blood samples were drawn at the intervals of 30, 60, 90 and 120 min. Serum sugar level was measured as described earlier (9, 5) and the results have been discussed in Table I and II and Fig. 1 and 2 for comparison.

RESULTS

In diabetes there was stimulation of the enzyme Lactase which is evidenced by rise of post prandial serum sugar level and increased height of the lactose absorption curve as compared to normal subjects. After Insulin therapy the height of the curve was further elevated. Similarly increased starch absorption in diabetic subjects is suggestive of increased amylase activity in diabetes mellitus (Table II and Fig. 2).

DISCUSSION

It is evident from the above study that there is increased Lactose and Starch absorption due to enhancement of Lactase and Amylase activities after Insulin administration for a long period the lactose absorption is greatly increased as compared to normal subjects. In normal subjects with this test the blood sugar level was found to be raised slightly above the control level even at the respective peak effect of post prandial response and is reached control value by 1.5 hrs. But in diabetic subjects, blood glucose level in both tests were elevated markedly by and upto 2 hrs of post prandial study none of them showing any
TABLE I: Lactose absorption test in diabetes mellitus before and after Insulin therapy with ± S.D. and nature of ‘+’.

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Fasting</th>
<th>60 mins after lactose feeding</th>
<th>90 mins after lactose feeding</th>
<th>After insulin therapy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal mean with ± S.D.</td>
<td>56.8±12.45</td>
<td>82.4±14.8</td>
<td>76.4±13.20</td>
<td>—</td>
</tr>
<tr>
<td>Universal Mean</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>60</td>
</tr>
<tr>
<td>Experimental mean with ± S.D.</td>
<td>102.66±36.08</td>
<td>152±26.54</td>
<td>152±32.98</td>
<td>153.3±16.30</td>
</tr>
<tr>
<td>Nature of ‘t’</td>
<td>&gt;0.01</td>
<td>&lt;0.01</td>
<td>&lt;0.01</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Result</td>
<td>(—)</td>
<td>+</td>
<td>+</td>
<td>+++</td>
</tr>
</tbody>
</table>

(—) = Insignificant
(+) = Significant
++ = Highly significant
+++ = Extremely high significant
S.D. = Standard deviation.

TABLE II: Starch absorption test with ± S.D. with nature of ‘t’.

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Fasting</th>
<th>30 mins after starch feeding</th>
<th>60 mins after starch feeding</th>
<th>90 mins after starch feeding</th>
<th>120 mins after starch feeding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal mean with standard deviation</td>
<td>84.75±14.27</td>
<td>123±20.94</td>
<td>117±22.42</td>
<td>116.5±42.53</td>
<td>117±49.28</td>
</tr>
<tr>
<td>Experimental mean with ± S.D.</td>
<td>163.16±47.35</td>
<td>244.66±43.52</td>
<td>210.66±51.58</td>
<td>93.33±54.20</td>
<td>165±11.94</td>
</tr>
<tr>
<td>Nature of ‘t’</td>
<td>0.01 (—)</td>
<td>0.01 (+)</td>
<td>0.01 (+)</td>
<td>0.01 (—)</td>
<td>0.01 (—)</td>
</tr>
<tr>
<td>Result</td>
<td>(—)</td>
<td>+</td>
<td>+</td>
<td>(—)</td>
<td>(—)</td>
</tr>
</tbody>
</table>

(—) = Insignificant
(+) = Significant
S.D. = Standard deviation.
tendency of depression. The lactose absorption after prolonged insulin therapy is also increased as compared to diabetes. This observation further supports the work undertaken in animals by the previous workers (9, 10, 6, 2, 5). Thus it is clear from the tolerance test, following insulin treatment that there is not only post prandial rise of serum sugar level in diabetes but also further aggravated after prolonged insulin therapy. As prolonged insulin therapy helps in the biosynthesis of protein which is the chief source of enzyme for-
In Diabetes Insulin will be given when the blood sugar level is too high or in Diabetic Ketoacidosis for immediate lowering of blood sugar level. When the blood sugar level is controlled it would be wiser to use oral hypoglycemic drugs as a maintenance therapy. The research is still in progress in this laboratory and will be reported subsequently.

ACKNOWLEDGEMENTS

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REFERENCES