Curcumin and its role in blood sugar management

With the discovery that curcumin has an effect on glycemia, a number of papers have been published to discuss the ability of curcumin in controlling blood glucose in various studies. Pre-clinical studies reported that curcumin was able to prevent body weight loss, reduce the levels of glucose, haemoglobin (Hb), and glycosylated hemoglobin (HbA1C) in blood.

Diabetes and inflammation

Inflammation is now recognized as one of the main contributors to diabetes and may be ameliorated by diminishing the underlying causes. The beneficial effect of curcumin on diabetes may be due to its ability to trigger up the immune system. Margina et al. showed that curcumin limited the release of proinflammatory factors, such as MCP-1 from endothelial and immune cells in human cell lines in the presence of high glucose. These effects were more obvious during the late stages of diabetes.

Sharma et al. showed that curcumin suppressed the activities of T- and B-lymphocytes and macrophages. In U937 monocytes, curcumin inhibited IL-6, IL-8, MCP-1, and TNF-α secretion in response to high glucose (35mM). These effects were also reflected in STZ-induced diabetic rats, which exhibited significantly reduced blood levels of IL-6, MCP-1, TNF-α, glucose, HbA1C, and oxidative stress.

Curcumin treatment significantly inhibited degradation of IκB and NF-κB activity, which is useful to reduce macrophage infiltration and prevent proinflammatory cytokines (TNF-α and IL-1β) from releasing and downregulate ICAM-1, MCP-1, and TGF-β1 protein expression in diabetic nephropathy.

Curcumin improved peripheral insulin resistance in insulin-resistant mice by reducing NF-κB/RelA DNA-binding activity, decreasing mRNA level of TNF and IL-6, and enhancing IL-4 production in hepatic TNF/iNOS-producing dendritic cells and adipose tissue macrophages.

Diabetes and Antioxidant activity

Increasing evidence demonstrates that increased levels of circulating ROS are involved in diabetes. Hyperglycemia causes autoxidation of glucose, glycation of proteins, and activation of polyol metabolism. These changes accelerate ROS generation and increase oxidative chemical modification of lipids, DNA, and proteins in various tissues. Curcumin caused antioxidant effects through several mechanisms.
Clinical Study

A randomized, double-blinded, placebo controlled trial included subjects (n = 240) with criteria of prediabetes to evaluate the role of curcumin in preventing Type 2 diabetes (T2DM). After 9 months of treatment, 16.4% of subjects in the placebo group were diagnosed with T2DM, while none were diagnosed with T2DM in the curcumin-treated group. In addition, the curcumin-treated group showed a better overall function of b-cells that are responsible for insulin production.

Relevant molecular targets for Curcumin

<table>
<thead>
<tr>
<th>Glycemia</th>
<th>TNF-α, FFA, NF-κB, TBARS, PPAR-γ, LPL, and Nrf2</th>
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<tr>
<td>Liver disorders</td>
<td>Lipid peroxidation, Glucose metabolism</td>
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<td>Diabetic neuropathy</td>
<td>Cataracts; retinopathy, cognitive deficits, and hyperalgesia</td>
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<td>Diabetic nephropathy</td>
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<td>Vascular diseases</td>
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<tr>
<td>Pancreatic β-cell dysfunction</td>
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</tbody>
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References

3. Margina et al., 2013. Food and Chemical Toxicology. doi: 10.1016/j.fct.2013.02.046
4. Sharma et al., Clinical and Experimental Immunology. doi: 10.1111/j.1365-2249.2006.03257.x

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