

THE EFFECT OF FLAVONOIDS IN DIABETES MANAGEMENT

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Abstract: *Diabetes mellitus is a chronic metabolic disorder characterized by hyperglycemia due to impaired insulin secretion, insulin resistance, or both. Oxidative stress, inflammation, and β -cell dysfunction play crucial roles in the pathogenesis of diabetes. Flavonoids, a group of polyphenolic compounds found in various plants, have demonstrated potential antidiabetic properties through their antioxidant, anti-inflammatory, and insulin-sensitizing effects.*

Keywords: *Diabetes mellitus, flavonoids, oxidative stress, insulin resistance, polyphenols, antidiabetic agents.*

Objective: *This study aims to review the potential benefits of flavonoids in diabetes management, focusing on their mechanisms of action and therapeutic potential.*

Introduction. Flavonoids such as quercetin, rutin, epicatechin, hesperidin, and anthocyanins have shown promising effects in diabetes management. They improve glucose uptake, enhance insulin secretion, reduce oxidative damage, and modulate key signaling pathways like PI3K/Akt and AMPK. Quercetin, for example, protects pancreatic β -cells from oxidative stress and enhances insulin sensitivity, while anthocyanins contribute to better glucose homeostasis by regulating inflammatory cytokines.

Flavonoids are a diverse group of phytonutrients found in fruits, vegetables, and other plant-based foods. They exhibit strong antioxidant, anti-inflammatory, and anti-diabetic properties, making them a promising natural approach to diabetes management.

1. Quercetin

- **Effect:** Enhances insulin secretion, improves glucose uptake, and reduces oxidative stress.

- **Sources:** Apples, onions, berries, green tea.

2. Kaempferol

• **Effect:** Protects pancreatic beta-cells, reduces hyperglycemia, and modulates inflammatory pathways.

- **Sources:** Kale, spinach, tea, broccoli.

3. Epicatechin

• **Effect:** Improves insulin sensitivity, reduces lipid peroxidation, and enhances glucose metabolism.

- **Sources:** Dark chocolate, green tea, apples.

4. Luteolin

• **Effect:** Inhibits inflammatory markers, regulates glucose levels, and supports pancreatic function.

- **Sources:** Celery, thyme, green peppers.

5. Naringenin

• **Effect:** Enhances lipid metabolism, improves insulin signaling, and protects against diabetic complications.

- **Sources:** Citrus fruits, tomatoes, grapefruit.

Mechanisms of Action

• **Antioxidant activity:** Reduces oxidative stress in pancreatic cells.

• **Anti-inflammatory effects:** Lowers pro-inflammatory cytokines linked to insulin resistance.

- **Insulin sensitization:** Enhances glucose uptake by peripheral tissues.

• **Pancreatic protection:** Prevents beta-cell apoptosis and promotes insulin secretion.

Conclusion: Flavonoids represent a promising natural therapeutic approach for diabetes management due to their multifaceted mechanisms of action. Further clinical studies are needed to establish their efficacy, optimal dosages, and potential for integration into conventional diabetes treatments.

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