Flavonoids as Antidiabetic and Anti-Inflammatory Agents: A Review on Structural Activity Relationship-Based Studies and Meta-Analysis

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Abstract

Flavonoids are a group of naturally occurring polyphenolic secondary metabolites which have been reported to demonstrate a wide range of pharmacological properties, most importantly, antidiabetic and anti-inflammatory effects. The relationship between hyperglycaemia and inflammation and vascular complications in diabetes is now well established. Flavonoids possessing antidiabetic properties may alleviate inflammation by reducing hyperglycaemia through different mechanisms of action. It has been suggested that the flavonoids' biochemical properties are structure-dependent; however, they are yet to be thoroughly grasped. Hence, the main aim of this review is to understand the antidiabetic and anti-inflammatory properties of various structurally diverse flavonoids and to identify key positions responsible for the effects, their correlation, and the effect of different substitutions on both antidiabetic and anti-inflammatory properties. The general requirement of flavonoids for exerting both anti-inflammatory and antidiabetic effects is found to be the presence of a C2–C3 double bond (C-ring) and hydroxyl groups at the C3', C4', C5, and C7 positions of both rings A and B of a flavonoid skeleton. Furthermore, it has been demonstrated that substitution at the C3 position of a C-ring decreases the anti-inflammatory action of flavonoids while enhancing their antidiabetic activity. Correlation is discussed at length to support flavonoids possessing essential pharmacophores to demonstrate equipotent effects. The consideration of these structural features may play an important role in synthesizing better flavonoid-based drugs possessing dual antidiabetic and anti-inflammatory effects. A meta-analysis further established the role of flavonoids as antidiabetic and anti-inflammatory agents.

Author keywords

anti-inflammatory; antidiabetic; correlation; flavonoids; structure–activity relationship study

Indexed keywords

EMTREE drug terms

4 chromanone derivative; acacetin; advanced glycation end product; aldehyde reductase; alpha glucosidase inhibitor; alpinetin; antidiabetic agent; antiinflammatory agent; apigenin; boesenbergin B; cardamomin; catechin; cesioside; chalcone; chalcone derivative; chrysin; cyclooxygenase 2 inhibitor; diosmetin; epicatechin; epigallocatechin; eriodyctiol; fisetin; flavanone; flavanonol derivative; flavone; flavone derivative; flavonoid; flavonol; galangin; genistein; hesperidin; hydroxyl group; hypoletin; indometacin; insulin receptor; isoflavone; isoorientin; isopanduratin; isorhamnetin; isoscutellarein; isovitexin; kaempferol; kaempferol derivative; leukotriene B4; luteolin; luteolin 7 glucoside; myricetin; naringenin; orientin; panduratin A; peroxisome proliferator activated receptor gamma; phenol derivative; phloretin; pinocembrine; pinostrobrin; plant medicinal product; protein tyrosine phosphatase 1B; pyridine; quercetin; quercetin derivative; rhamnetin; sophoflavescenol; stereolensin; taxifolin; thromboxane B2; unclassified drug

EMTREE medical terms

antidiabetic activity; antiinflammatory activity; chemical structure; Chinese medicine; diabetes mellitus; diabetic complication; drug isolation; drug structure; human; hyperglycemia; inflammation; medicinal plant; meta analysis; Morus alba; Murraya; Murraya panniculata; nonhuman; pathophysiology; pharmacophore; Review; Sedum; structure activity relation; traditional medicine

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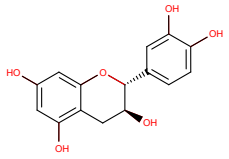
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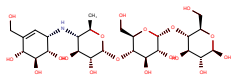
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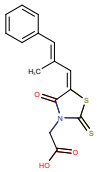
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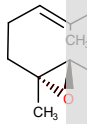
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catechin	13392-26-2, 154-23-4

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