Dual Enzyme Inhibition and Antiglycation Activity of the Ayurveda Polyherbal Decoction in Type 2 Diabetes Mellitus

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Abstract

Type 2 diabetes mellitus (T2DM) is commonly managed with herbal formulations in Ayurveda and Traditional Medicine. Balabilvashunti (BBS) Ayurveda Polyherbal decoction, prepared from *Sida alnifolia* (L.) Ugbor, *Aegle marmelos* (L.) Corrêa root bark, and *Zingiber officinale* Roscoe rhizome, is traditionally prescribed for T2DM. This study investigated the antidiabetic potential of BBS through inhibition of carbohydrate-hydrolyzing enzymes and protein glycation. BBS was prepared using the classical decoction method and converted into spray-dried and freeze-dried powders. *In-vitro* assays were performed to evaluate α-amylase and α-glucosidase inhibitory activity, as well as protein antiglycation, with acarbose and rutin serving as positive controls. Both spray-dried and freeze-dried powders showed strong α-amylase inhibition, with IC_{50} values of 4.54 ± 0.07 mg/mL and 5.01 ± 0.17 mg/mL respectively, compared with acarbose (61.45 ± 2.01 µg/mL). Moreover, for α-glucosidase inhibition, IC_{50} values were 2.38 ± 0.09 mg/mL (spray-dried) and 2.82 ± 0.11 mg/mL (freeze-dried), outperforming acarbose (454.23 ± 1.89 µg/mL). Antiglycation activity was moderate, with IC_{50} values of 528.36 ± 15.27 µg/mL (spray-dried) and 445.46 ± 8.66 µg/mL (freeze-dried), compared to rutin (316.78 ± 12.43 µg/mL). These results confirm the dual inhibitory activity of BBS on α-amylase and α-glucosidase, supporting its traditional use in T2DM. Although antiglycation effects were less pronounced, the findings highlight BBS as a promising candidate for standardized phytopharmaceutical development in diabetes management.

Keywords

Ayurveda, Traditional Medicine, Balabilvashunti, type 2 diabetes mellitus, α-amylase inhibition, α-glucosidase inhibition, antiglycation, phytopharmaceuticals.