

Comparable Benefits of Stingless Bee Honey and Caffeic Acid in Mitigating the Negative Effects of Metabolic Syndrome on the Brain

ABSTRACT

There is mounting evidence that metabolic syndrome (MetS) contributes to the development of neurodegenerative disorders such as Alzheimer's disease. Honey, which has been used for generations, is high in antioxidants and has been demonstrated to benefit the brain and mental health by reducing oxidative stress and boosting cognitive outcomes. Honey from the stingless bees of *Heterotrigona itama* has been found to have higher phenolic content compared to other types of honeys. The aim of this study is to investigate the effects of stingless bee honey (SBH) supplementation and to compare it with a pure form of antioxidant, caffeic acid (CA), on MetS parameters and inflammatory markers in the brains of MetS-induced rats. A total of 32 male Wistar rats were divided equally into groups of control, high-carbohydrate high-fructose (HCHF) diet (MetS), HCHF + SBH supplemented (1 g/kg) (SBH), and HCHF + CA supplemented (10 mg/kg) (CA) groups. The total duration for SBH and CA supplementation was eight weeks. The HCHF diet was found to promote hypertension, hyperglycemia, and hypertriglyceridemia, and to increase brain TNF- α levels. Supplementation with SBH and CA significantly reversed ($p < 0.05$) the hyperglycemic and hypertensive effects of the HCHF diet. Although both supplemented groups showed no significant changes to serum HDL or TG, SBH significantly reduced ($p < 0.05$) brain TNF- α levels and increased ($p < 0.05$) brain BDNF levels. Immunohistochemistry investigations of neurogenesis (EdU) and apoptosis (TUNEL) on the cornu Ammonis 1 (CA1) and dentate gyrus (DG) areas of the hippocampus showed no changes with SBH and CA supplementation compared to the control. These findings suggest that SBH and CA have the potential to mitigate HCHF-induced MetS effects and possess neuroprotective abilities.