

Abstract

# Next Generation of Bee Feed by Biomimetic Formulation of a Hydrocinnamic Acid <sup>†</sup>

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Honeybees, *Apis mellifera*, play an important role in the global ecology and economy. Honeybees produce various products (honey, pollen, royal jelly, beeswax, propolis) used for human wellness. Moreover, these insects are essential as pollinators of crops [1]. One major problem the honeybees face is the nutritional imbalance related to habitat loss and the abuse of agrochemicals. The nutritional imbalance occurs when bees are limited to harvesting nutrients from natural sources, or in the case of the excessive settlement of honey by humans. In this case, beekeepers should come to the aid of bees with an additional supply of nutrients. The bee feed substitutes used by beekeepers are those based on sugar, such as inverted sugar syrup, starch syrup, or high fructose corn syrup (HFCS), which do not provide essential nutrients for honeybees [2]. The main aim of this research was the use of hydroxycinnamic acids (i.e., ferulic acid) specific to plant cell walls, including pollen grains, as a nutraceutical supplement for bees. The role of these hydroxycinnamic acids (HCA) is to directly activate the defense system in bees and stimulate the development of fructophilic lactobacilli [3]. This combined activation enhances the defense and detoxification systems at the level of each bee and at the level of the whole colony. Three different concentrations of ferulic acid (AF) were mixed with isoglucose syrup. The antioxidant activity (AOA) of the samples was assayed using five spectrophotometric methods: radical scavenging activity (ABTS and DPPH) and reducing antioxidant power (CUPRAC, FRAP, and PFRAP). The prebiotic activity of the samples was evaluated on a strain of *Lactobacillus plantarum* DSM 1055 and *Lactococcus lactis* DSM 20729. The AOA of syrup enriched in HCA showed an exponential increase, directly related to HCA concentrations by all the colorimetric methods analyzed. Our product showed higher prebiotic activity with almost 19% at the concentration of 0.125 mg/g of AF after 72 h of incubation in the case of *L. plantarum*, compared with simple isoglucose syrup. In the case of *L. lactis*, the value of prebiotic activity was around 10% after 72 h of incubation. Our preliminary results showed that isoglucose syrup enhanced with HCA indicated that it can be used as a nutraceuticals supplement for bee feed, due to its AOA and prebiotics activity. We need to continue the study with other strains of lactobacillus isolated from bee gut microbiota.

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