

1 Regulation of lipid metabolism and anti-inflammatory effects of kombucha

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4 Outline

5 I. Introduction

6 II. *Drosophila* models of the anti-inflammatory and anti-obesity mechanisms of kombucha
7 tea produced by *Camellia sinensis* leaf fermentation

8 III. Kombuchas from green and black teas reduce oxidative stress, liver steatosis and
9 inflammation, and improve glucose metabolism in Wistar rats fed a high-fat high-fructose
10 diet

11 IV. Conclusions

12 Abstract

13 The 2017-2020 National Nutrition and Health Survey in Taiwan revealed that 50.7% of
14 adults were overweight or obese, primarily due to high-fat and high-fructose diets, which can
15 also trigger inflammatory diseases. Kombucha, a fermented beverage made from black tea,
16 yeast, acetic acid bacteria, and lactic acid bacteria, is rich in bioactive compounds with potential
17 benefits for improving diabetes, protecting the liver, antioxidant effects, anti-inflammatory
18 properties, and anticancer potential. This report aims to explore the effects of black and green
19 tea kombucha on regulating lipid metabolism and reducing inflammation. In *Drosophila* with
20 Lipid storage droplet-1 dysfunction-induced inflammation, kombucha significantly reduced
21 reactive oxygen species production, inhibited the expression of c-Jun N-terminal kinases
22 inflammatory pathway genes (*Eiger*, Toll-like receptors, *Spatzle*, *Upd1*, and *Upd3*), and
23 promoted the expression of the lipase gene *bmm*, thereby decreasing inflammation and
24 triglyceride accumulation. In Wistar rats fed a high-fat, high-fructose diet, kombucha
25 effectively regulated abnormal glucose metabolism and the expression of lipid synthesis-
26 related genes such as sterol regulatory element-binding protein 1c, acetyl-coA carboxylase,
27 carnitine palmitoyltransferase 1, and adiponectin-receptor 2. It also reduced fat accumulation,
28 improved hepatic steatosis, enhanced plasma superoxide dismutase, catalase activities, and
29 total antioxidant capacity, while lowering nitric oxide levels and the neutrophil-to-lymphocyte
30 ratio, thereby mitigating inflammation. In conclusion, these findings suggest kombucha has
31 potential anti-obesity and anti-inflammatory bioactivity for future health applications.

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