

- cholesterol,
- 2) its resultant increased excretion of cholesterol in bile, and
 - 3) due to a decreased activity of the enzymes acyl coenzyme A oxidase and 3-hydroxy-3-methylglutaryl coenzyme A reductase (HMG-CoA reductase),¹⁴ the former being a coenzyme in fatty acid metabolism, and the latter the rate-controlling enzyme in the mevalonate (cholesterol producing) pathway.

Effect on Fatty Acid Oxidation

In correlation with its lipid-lowering effect and its benefits in lipid metabolism, sesame intake has exhibited a positive effect on hepatic fatty acid β -oxidation, and has been demonstrated to decrease the hepatic lipogenic activity. A dose dependent increase in the mitochondrial activity rate has been observed in animals given a sesamin supplemented diet. For example, when a 0.5% sesamin diet was integrated, approximately double the rate of mitochondria activity was observed. In addition, peroxisomal activity was also increased in a dose dependent manner, exhibiting a greater than ten-fold increase when supplemented with a 0.5% sesamin diet.¹⁵

Both sesamin and episesamin are recognized for their ability to increase both the activity level and gene expression of enzymes involved in fatty acid oxidation, as well as to decrease both the activity and gene expression of hepatic lipogenic enzymes, by as much as 50%, when compared to a lignan-free diet.¹⁶ When viewed with the addition of fish oil, both the peroxisomal palmitoyl-CoA oxidation rate and acyl-CoA oxidase activity levels were distinctly higher. Examination revealed that this combination resulted in increased expression of the enzymes involved in fatty acid oxidation, specifically of the peroxisomal fatty acid oxidation enzymes.^{17,18} Other studies in animals revealed that a diet consisting of 0.2% sesamin, episesamin or sesamol (sesame lignans) resulted in modification of the mRNA levels of many of the enzymes involved in hepatic fatty acid oxidation, as well as in the modification of “proteins involved in the transportation of fatty acids into hepatocytes and their organelles, and in the regulation of hepatic concentrations of carnitine, CoA and malonyl-CoA.”¹⁹ In addition to its effect on palmitoyl-CoA and acyl coenzyme A oxidase, sesamin was also noted to amplify the action of numerous other hepatic fatty acid oxidation enzymes, including carnitine palmitoyl-transferase, acyl-CoA dehydrogenase, 3-hydroxyacyl-

CoA dehydrogenase, enoyl-CoA hydratase and 3-ketoacyl-CoA thiolase, as well as to improve, in a dose-dependent manner, the activity of 2,4-dienoyl-CoA reductase and Δ^3 , Δ^2 -enoyl-CoA isomerase, both of which are involved in the auxiliary pathway for β -oxidation of unsaturated fatty acids.¹⁵

The sesame lignans modified not only the mRNA levels of many enzymes involved in hepatic fatty acid oxidation, but also those of proteins involved in the transportation of fatty acids into hepatocytes and their organelles, and served to regulate the hepatic concentrations of carnitine, CoA and malonyl-CoA.¹⁹

In addition to the above noted actions, sesamin is also a non-competitive inhibitor of Δ^5 -desaturase,²⁰ and has been demonstrated to inhibit the conversion of DGLA to arachidonic acid. As a consequence of this action, it decreases the formation of the proinflammatory 2-series prostaglandins (PGE₂),²¹ and also exerts an anti-inflammatory response by decreasing the level of AA and the ensuing production of eicosanoids.²² This action has been confirmed in animal studies which demonstrated significantly lower levels of PGE₂ in conjunction with sesamin use.^{23,24} It also exerts anti-inflammatory activity by virtue of its ability to attenuate TNF- α .²⁵

Action as an Antioxidant

As noted above, sesame possesses antioxidant activities. These characteristics have primarily been attributed to its free radical scavenging ability. Sesamol, a sesame isolate, was reported to have “profound free radical scavenging activity” in the DPPH bioassay, as well as in a brine shrimp lethality assay test. In fact, it demonstrated an even greater antioxidant capacity than resveratrol. (The percentage/ratio of trans-resveratrol, the active component of resveratrol, was not reported in this study.) Also reported in this study was sesame’s ability to result in a 50% reduction in skin papillomas in mice, following induction by a tumor promoter.²⁶

Using second order rate constant, Suja KP, et al. assessed the antioxidant activity of sesame compounds. They reported sesamol as possessing the highest rate constant, and greatest free radical scavenging activity of the compounds tested. Included in this assay were the controls alpha-tocopherol, and butylated hydroxytoluene (BHT), a synthetic antioxidant. The activity of sesamol was even greater than alpha-tocopherol, 4.00 ± 0.006 vs. 3.71 ± 0.009 , respectively,

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