Lipoic acid attenuates high-fat-diet-induced oxidative stress and B-cell-related immune depression.

Cui J, Xiao Y, Shi YH, Wang B, Le GW.

State Key Laboratory of Food Science and Technology, School of Food Science and Technology, Jiangnan University, Wuxi 214122, PR China.

OBJECTIVE: This study investigated whether spleen oxidative stress induced by a high-fat diet (HFD) influences the expression of genes involved in B-cell activation, thus leading to B-cell-related immunosuppression.

METHODS: Male C57BL/6 mice were randomly assigned to one of three groups with eight mice in each group. The control group consumed an ordinary diet (4.9% fat, w/w). The other two groups were fed an HFD (21.2% fat) and an HFD plus 0.1% lipoic acid (LA). After 10 wk, plasma and spleen oxidative stress biomarkers including superoxide dismutase, catalase, glutathione peroxidase, total antioxidant capacity, reduced glutathione/oxidized glutathione ratio, and malondialdehyde were examined. The B-cell-related immune function was evaluated by examining the number of B cells, and the apoptotic percentages of splenic lymphocytes were determined by flow cytometry. Furthermore, the B-cell activation and reactive oxygen species scavenger-related genes differentially expressed between mice fed an HFD and those fed an HFD supplemented with LA were identified through complementary DNA microarray.

RESULTS: The HFD induced marked decreases in the number of B cells and significantly increased the apoptotic percentages of splenic lymphocytes, accompanied by oxidative stress and increased oxidative damage, in the plasma and spleen. In addition, complementary DNA array analysis results showed that the HFD induced the decreased expression of genes associated with antioxidant defense, such as superoxide dismutase-3 (1.5-fold), metallothionein-1 (3.03-fold), glutathione peroxidase-5 (17.15-fold), and peroxiredoxin-4 (1.5), and B-cell activation, such as immunoglobulin heavy chain 6 (2.46-fold), immunoglobulin κ-chain (1.74-fold), Fc receptor (1.41-fold), and RAS-related C3 botulinum substrate-1 (7.46). The LA supplement prevented the buildup of oxidative stress and upregulated related gene expressions.

CONCLUSION: These results indicate a role for LA as a possible effective supplement with an HFD to prevent the development of oxidative stress and to attenuate B-cell damnification by increasing the gene expression of the B-cell receptor signaling pathway.

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