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Effects of maternal high-fat diet and green tea extract Intake on autophagy in the liver of adult rat offspring

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It has been shown that a high-fat diet for pregnant and lactating mother rats and post-weaning pups induces abnormal lipid metabolism in the liver of mature pups, which is ameliorated by green tea extract (GTE) consumption in lactating mother rats [(1)]. It has been recently shown that autophagy plays an important role in lipid metabolism in the liver [(2,3)]. In this study, we examined the effects of long-term high-fat diet intake in mothers and pups on autophagy function in the liver during the maturation period of the pups and the effects of GTE intake in mother rats.

Pregnant Wistar rats were divided into 3 groups. In the FFF group, fed a high-fat diet (45% fat) to mother rats in gestation and lactation period and post-weaning male offspring. In the FGF group, fed a high-fat diet during pregnancy of mother rats, and a high-fat diet containing 0.24% GTE during lactation. Besides, post-weaning male offspring, were fed a high-fat diet. As a control group, the CCC group fed a control diet (13% fat) to the mother rats of gestation and lactation and post-weaning male offspring. Offspring rats of each group were bred to 51 weeks of age and sacrificed under ether anesthesia and then livers and blood were collected. The levels of autophagy-related proteins were measured using Western blotting. Lipid concentrations in the liver were measured using commercially available assay kit. Statistical analysis was performed using one-way ANOVA, followed by a multiple comparison test.

Compared to the control diet (CCC) group (15.9 ± 2.66 mg/g wet tissue, (mean±SEM, n = 6)), triglyceride (TG) concentrations in the liver were significantly higher in the high-fat diet (FFF) group (29.6 ± 6.22), ($p < 0.05$). While plasma TG concentrations in FFF group (87.8 ± 10.38 mg/dl) were significantly lower than the CCC group (150.5 ± 9.36), ($p < 0.05$). However, the high-fat + GTE diet (FGF) group did not differ from the CCC group. The FFF group showed significantly higher levels of phosphorylated-p62 (109.2 ± 0.93%), which transports unwanted substances to the sequestration membrane and is degraded by autophagy, than the CCC group (100.0 ± 1.52), ($p < 0.01$). But the FGF group showed significantly lower levels of phosphorylated-p62 (93.2 ± 1.69) compared to the FFF group, ($p < 0.01$). Both Lamp2 and vamp8, which are important for the fusion of autophagosomes and lysosomes, were significantly higher in the FFF group and lower in the FGF group than in the CCC group ($p < 0.05$).

These results suggest that high-fat diet intake of mother rats during gestation and lactation as well as in the post-weaning male offspring causes TG accumulation in the liver during the maturation period of the littermates and stagnates the degradation of unwanted substances by autophagy in the liver.

GTE intake in lactating mother rats was effective in improving hepatic lipid metabolism and autophagy function.

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