Maternal supplementation of diabetic mice with thymoquinone protects their offspring from abnormal obesity and diabetes by modulating their lipid profile and free radical production and restoring lymphocyte proliferation via PI3K/AKT signaling.

Gamal Badr, Mahmoud MH, Farhat K, Hanan Waly, Zin Al-Abdin O, Rabah DM.

Abstract:

BACKGROUND: Epidemiological studies have shown that the offspring of mothers who experience diabetes mellitus during pregnancy are seven times more likely to develop health complications than the offspring of mothers who do not suffer from diabetes during pregnancy. The present study was designed to investigate whether supplementation of streptozotocin (STZ)-induced diabetic pregnant mice with thymoquinone (TQ) during pregnancy and lactation improves the risk of developing diabetic complications acquired by their offspring. METHODS: Three groups of pregnant female mice were used: non-diabetic control dams (CD), diabetic dams (DD), and diabetic dams supplemented with TQ (DD + TQ) during pregnancy and lactation (n = 10 female mice in each group). RESULTS: Our data demonstrated a marked decrease in the number of neonates born to DD, and these neonates showed a marked increase in their mean body weight (macrosomic pups) compared to those born to CD and DD + TQ. The induction of diabetes during pregnancy and lactation resulted in macrosomic pups with several postpartum complications, such as a marked increase in their levels of blood glucose, free radicals, plasma pro-inflammatory cytokines (IL-1beta, IL-6, and TNF-alpha), and lipids, and a tendency toward abnormal obesity compared to the offspring of CD. By contrast, macrosomic offspring born to DD exhibited a marked reduction in plasma cytokine levels (IL-2, -4 and -7), an obvious reduction in the number of circulating lymphocytes, decreased proliferation of superantigen (SEB)-stimulated lymphocytes and aberrant AKT phosphorylation. Interestingly, the supplementation of DD with TQ during pregnancy and lactation had an obvious and significant effect on the number and mean body weight of neonates. Furthermore, TQ significantly restored the levels of blood glucose, insulin, free radicals, plasma cytokines, and lipids as well as lymphocyte proliferation in the offspring. CONCLUSIONS: Our data suggest that the nutritional supplementation of DD with the natural antioxidant TQ during pregnancy and lactation protects their offspring from developing diabetic complications and preserves an efficient lymphocyte immune response later in life.

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