Effect of rutin on TNF-α-induced insulin resistance in 3T3- L1 adipocytes

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Introduction

Obesity has become a growing epidemic globally and a burden to the health care system due to its association or contribution to the development of other chronic diseases. The excessive accumulation of fat in adipocytes or expansion of the adipocytes results in dysfunctional adipocytes which leads to the expression and secretion of cytokines, specifically pro-inflammatory cytokines such tumor necrosis factor alpha (TNF-α) and interleukin-6 (IL-6) which cause inflammation. Moreover, chronic inflammation has been linked with the development of insulin resistance which is a hallmark for type 2 diabetes. Rutin is a naturally occurring flavonoid found in various plants species with known therapeutic effects such as antioxidants, anti-diabetic and anti-inflammatory. This study aims to investigate whether rutin can ameliorate TNF-α-induced insulin resistance and inflammation in 3T3- L1 adipocytes.

Methodology

3T3-L1 preadipocytes were cultured, differentiated into mature adipocytes, and used to evaluate the effect of rutin on TNF-α-induced insulin resistance and inflammation. Mitochondrial activity was assessed using MTT assay. Lipid accumulation and lipolysis were evaluated using Oil Red O and glycerol release assay kit, respectively. Inflammation was evaluated using ELISA. Gene expression was assessed using quantitative real-time PCR (targeting genes associated with fat browning, inflammation, lipid metabolism). western blot was used to analyse the expression of proteins associated with insulin signalling.

Results

TNF-α-induced insulin resistant adipocytes and rutin treatment did not show any significant change on the mitochondrial activity. There was a decrease in lipid accumulation and an increase in lipolysis by TNF-α, however, administration of rutin reversed these effects. Rutin was able to ameliorate inflammation evident by a decrease in inflammatory cytokines IL-6 and TNF-α. Furthermore, fat browning markers peroxisome proliferator-activated receptor (PPARγ), PR-domain containing 16 (PRDM16), and lipid oxidation gene Carnitine palmitoyl transferase I (CPT1) was upregulated by treatment with rutin.

Conclusion

Thus far this study has shows that rutin can ameliorate TNF-α-induced inflammation and activate fat browning which could be the mechanism through which rutin ameliorates obesity and associated disorders.