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Effect of nanoliposome containing quercetin on the differentiation of 3T3-L1 cells

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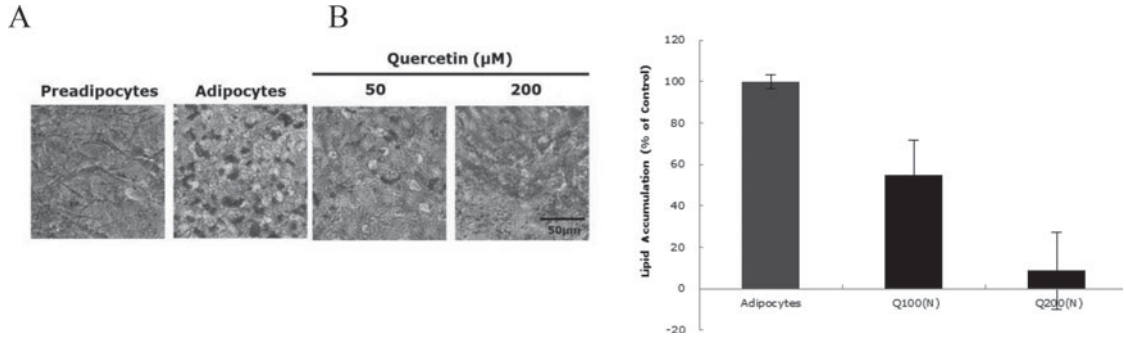
Quercetin is one of the most well-known dietary flavonoids with antioxidant activity, and it also exerts anti-adipogenic activity by activating adenosine monophosphate-activated protein kinase (AMPK) signaling pathway in 3T3-L1 preadipocytes, while the quercetin-induced apoptosis of mature adipocytes was mediated by modulation of the ERK and JNK pathways[1]. We previously reported that nanoliposome could efficiently incorporate lipid soluble valuable nutrient[2]. In the present study, nanoliposome containing quercetin was prepared, and consequently its effect on the differentiation of 3T3-L1 cells was evaluated.

After preparation of multilamellar vesicles containing 700 mM of quercetin with soybean phosphatidylcholine, the vesicles were passed through MiniExtruder using a polycarbonate filter with a pore size of 80 nm. The 3T3-L1 preadipocytes were cultured in DMEM supplemented with 10% (v/v) fetal calf serum. 3T3-L1 cells were grown until confluence and 2 days post-confluent 3T3-L1 cells (designated as Day 0) were simulated to differentiate. 3T3-L1 cells were treated with test samples between Day-2 to Day 2 (96 h). Oil Red O (ORO) staining was employed to qualitative and quantitative analysis of lipid accumulation in 3T3-L1 cells. Cells were fixed with 3% (v/v) formaldehyde for 1 h at room temperature and stained with ORO solution followed by three times wash with distilled water. Plates image were obtained using a scanner for qualitative documentation. The stain was also extracted from the cells using DMSO and measured absorbance at 490 nm for qualitative analysis of lipid accumulation. All data are obtained from three individual experiments ($n = 9$).



As illustrated in Fig. A, we examined the effect of a 96 h treatment (Day-2 to Day 2) of post-confluent 3T3-L1 cells with 50 and 200 μM of quercetin on adipogenesis. Quercetin treatment from Day-2 to Day 2 resulted in a dose-dependent inhibition of adipogenesis of 3T3-L1 cells as judged by ORO staining at Day 7. Approximately 40% of inhibition adipogenesis was observed in 50 μM quercetin treated adipocytes. To test whether nanoliposome containing quercetin could modulate adipogenesis, 3T3-L1 cells were exposed to differentiation medium to induce adipogenesis in the presence of nanoliposome containing 100 and 200 μM quercetin. As showed in Fig. B, nanoliposome containing quercetin efficiently suppressed adipogenesis of 3T3-L1 cells. Taken together, our findings provide that the nanoliposome may be an effective delivery system for the development of functional food or nutraceuticals using quercetin to prevent obesity.

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