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The Ameliorative Effects of Nanoencapsulated Triterpenoids from Petri-Dish Cultured Antrodia cinnamomea on Reproductive Function of Diabetic Male Rats

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Abstract : Male reproductive dysfunction is predominantly due to insulin resistance and hyperglycemia result in inflammation and oxidative stress. Furthermore, nanotechnology provides an alternative approach to improve the bioavailability of natural active food ingredients. Therefore, the aim of this study were to investigate nanoencapsulated triterpenoids from petri-dish cultured Antrodia cinnamomea (PAC) nanoparticles whether it could increase the bioavailability; in addition, the anti-inflammatory and anti-oxidative effects could more effectively ameliorate the reproductive function of diabetic male rats. First, PAC encapsulated in chitosan-silica nanoparticles (Nano-PAC) were prepared by biosilicification method. Scanning electron micrographs confirm the average particle size is about 30 nm, and the encapsulation efficiency is 83.7% by HPLC. Diabetic male Sprague-Dawley rats were induced by high fat diet (40% kcal from fat) and streptozotocin (35 mg/kg). Nano-PAC was administered by oral gavage in three doses (4, 8 and 20 mg/kg) for 6 weeks. Besides, metformin (300 mg/kg) and nanoparticles (Nano) were treated as the positive and negative control respectively. Results indicated that 4 mg/kg Nano-PAC administration for 6 weeks improved hyperglycemia, insulin resistance, and also reduced advanced glycation end products in plasma. In addition, 8 mg/kg Nano-PAC ameliorated morphological of testicular seminiferous tubules, sperm morphology and motility, reactive oxygen species production and mitochondrial membrane potential. Moreover, 20 mg/kg Nano-PAC restored reproductive endocrine system function and increased KiSS-1 level in plasma. In plasma or testis anti-oxidant superoxide dismutase, glutathione peroxidase and catalase were increased whereas malondialdehyde, as well as pro-inflammatory cytokines tumor necrosis factor-α, interleukin-6, and interferon-gamma, decreased. Most importantly, 8 mg/kg Nano-PAC down-regulated the oxidative stress induced c-Jun N-terminal kinase (JNK) signaling pathway. Our study successfully nanoencapsulated PAC to form nanoparticles and low-dose Nano-PAC improved diabetes-induced hyperglycemia, inflammation and oxidative stress to ameliorate the reproductive function of diabetic male rats.

Keywords : Antrodia cinnamomea, diabetes mellitus, male reproduction, nanoparticles
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