Giant Oyster Mushroom Pleurotus giganteus (Agaricomycetes) Enhances Adipocyte Differentiation and Glucose Uptake via Activation of PPARγ and Glucose Transporters 1 and 4 in 3T3-L1 Cells

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ABSTRACT: The edible mushroom Pleurotus giganteus was tested for its effect on adipocyte differentiation and glucose uptake activity in 3T3-L1 cells. The basidiocarps of P. giganteus were soaked in methanol to obtain a crude methanol extract and then fractionated to obtain an ethyl acetate extract. In this study, cell proliferation was measured using an MTT assay, lipid accumulation using an Oil Red O assay, and glucose uptake using a fluorescence glucose uptake assay. Gene expression was measured via real-time polymerase chain reaction analysis with TaqMan primer. Ethyl acetate extract significantly enhanced adipogenic differentiation and glucose uptake in 3T3-L1 adipocytes via the expression of sterol regulatory element-binding protein, peroxisome proliferator-activated receptor γ, and phosphatidylinositol 3-kinase/Akt. Glucose uptake was facilitated by the highly expressed glucose transporters Glut1 and Glut4. Taken together, these results suggest that P. giganteus ethyl acetate extract has an insulin-sensitizing effect on adipocytes and has potential as an adjuvant for the management of type 2 diabetes.

KEY WORDS: adipocyte, glucose transporters, glucose uptake, medicinal mushrooms, Pleurotus giganteus, type 2 diabetes mellitus

ABBREVIATIONS: 2-NBDG, 2-(N-(7-nitrobenz-2-oxa-1,3-diazol-4-yl)amino)-2-deoxyglucose; Dexamethasone; DM, differentiation medium; DMEM, Dulbecco’s modified Eagle’s medium; DMSO, dimethyl sulfoxide; ELISA, enzyme-linked immunosorbent assay; FBS, fetal bovine serum; IBMX, 3-isobutyl-1-methylxanthine; MTT, 3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyl tetrazolium bromide; PBS, phosphate-buffered saline; PCR, polymerase chain reaction; PI3K, phosphoinositide 3-kinase; PPARγ, peroxisome proliferator-activated receptor γ; SREBP, sterol regulatory element-binding protein

I. INTRODUCTION

Type 2 diabetes mellitus is rapidly increasing in Malaysia and worldwide.1 It is generally characterized by insulin resistance, insulin insensitivity, and insufficient uptake of glucose. Adipocytes are one of the target tissues specialized to synthesize triglycerides during periods of an abundant food supply and to mobilize them via lipolysis when there is an energy deficit.2 Abnormal adipocyte differentiation affects glucose and lipid metabolism, and is the main cause of insulin resistance.