PERSPECTIVE

Metabolic illness treatment using polydatin's pharmacological effects

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ABSTRACT

Chronic conditions known as metabolic diseases (MDs) significantly reduce patients' quality of life while also placing a significant financial burden on them. A growing body of research indicates that Polydatin (PD), a significant resveratrol glucoside, is present in a wide variety of plants and has demonstrated promising results in treating metabolic disorders.

INTRODUCTION

Type 2 Diabetes (T2DM), obesity, hyperlipidemia, Atherosclerosis (AS), gout, and Non-Alcoholic Fatty Liver Disease (NAFLD) or Non-Alcoholic Steatohepatitis (NASH) are only a few of the metabolic illnesses that have emerged as significant global public health concerns. T2DM, one of the most prevalent Metabolic Diseases (MDs), is a chronic, lifestyle-related syndrome that affects millions of people worldwide. It is defined by elevated blood glucose content. Worldwide, 415 million people have been diagnosed with diabetes, and by 2040, the figure is expected to reach over 600 million, according to the International Diabetes Foundation (IDF). Additionally, the occurrences of mortality, disability, and the overall economic burden are greatly impacted by its consequences. Insulin resistance is exacerbated by T2DM, which is attributable to obesity. According to estimates from the World Health Organization, the proportion of obese adults has increased more than sevenfold during the past 40 years (WHO, 2017). Major risk factors for T2DM include hyperlipidemia, atherosclerosis, an insufficient supply of calories, insulin resistance, and fat buildup. One of the most prevalent inflammatory arthritides in the world, gout is strongly linked to cardiovascular disease and chronic kidney disease. It is brought on by sustained hyperuricemia and the development of Monosodium Urate (MSU) crystals. NAFLD is a chronic liver condition that affects 17 to 51% of persons globally. MDs can benefit from a variety of therapy, including changing their way of life, eating a healthy diet, exercising regularly, and using medications. MDs are typically treated with drugs such biguanides, statins, and glucocorticoids, but they can have a number of side effects, including gastrointestinal distress, hypoglycemia, liver dysfunction, weight gain, and cardiovascular damage. Traditional Chinese Medicine (TCM), for example, uses herbal remedies as a different approach to control metabolism and current medication research. In order to treat MDs, it is advisable to find more all-natural medications with minimal side effects. The main substance of *Polygonum Polygonaceae*, which is widely utilized in traditional medicine in many nations, particularly in China and Japan, is polydatin (PD). MDs can be effectively treated with PD, a natural substance. However, *Polygonum cuspidatum Sieb. et Zucc.* (Polygonaceae) indications are currently solely based on custom and long-standing use. These difficulties have long been ignored by earlier studies and reviews, and there hasn't been a thorough analysis that takes into account the pharmacology research on PD used by MDs. The current study intends to conduct a thorough evaluation of the literature on the pharmacological effects of PD in the treatment of MDs both in vivo and in vitro in order to determine its effectiveness and potential future applications. Numerous studies have shown that PD has positive biological effects on MDs. The pharmacological actions and associated molecular mechanisms of PD in the management of T2DM, AS, hyperlipidemia, NAFLD, and gout are comprehensively summarized in our review. Researchers discovered that oral administration of PD (50 m g/k g body weight) for 28 days

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dramatically improved lipid metabolism, glucose tolerance, and insulin secretion in diabetic rats. PD reduced lipid peroxidation, enhanced antioxidant capacity, and reduced pancreatic inflammation. Additionally, co-treatment with PD increased anti-oxidant, anti-apoptotic, and cell function indicators in RINm5F cells through its antioxidant effects in a dose-dependent manner, conserved cell viability, and decreased ROS generation. With respect to insulin and an anti-inflammatory cytokine (IL-10) levels, polydatin significantly reduced the levels of FBG, PBS, HbA1c, the renal advanced glycation end product (AEG), and pro-inflammatory cytokines (TNF-, IL-6, and IL-18) in the kidneys of diabetic rats with early progressive DN taking PD medication PD has been shown to have an anti-diabetic impact, decrease oxidative stress, reduce renal inflammation through the suppression of NF-B and AGEs-related signaling expression, and improve renal dysfunction in diabetes models. This study also showed that PD improved renal dysfunction in these models. By inducing glucose uptake and amplifying glucose utilization, polydatin can reduce the insulin protective state of HepG2 cells, which is important for controlling the AMPK/LDLR pathway. Studies have shown that polydatin could activate the protein kinase B (Akt) signaling pathway, which controls glucose and lipid metabolism, to increase Insulin Receptor Substrate (IRS) phosphorylation. In addition, polydatin might boost LDLR levels by suppressing PCSK9 expression and blocking the interaction between PCSK9 and LDLR, which might enhance lipid and glucose metabolism in db/db mice and PA-induced insulin-resistant HepG2 cells. In HF-fed rats, polydatin dramatically increased the HOMA-IR, glucose tolerance, and FFA levels. Additionally, polydatin may significantly lower plasma levels of insulin and leptin and reverse aberrant adiponectin levels in rats fed HF. Inflammation plays a significant role in the pathogenesis of T2DM, and subclinical chronic inflammation is a common feature correlated with the natural course of diabetes. Levels of inflammatory biomarkers have been shown to be associated with diabetes and its complications as well as cardiovascular diseases. Additionally, through activating the PPAR-NO signaling pathway, polydatin could reverse the endothelium-dependent relaxation of the rat aortic rings and reduce the oxidative stress brought on by high glucose levels. In particular, polydatin significantly reduced ICAM-1, TGF-b1, and FN protein expression in high glucose-treated GMCs and STZ-induced diabetic rats, indicating that the anti-inflammatory and antifibrotic properties of polydatin were strongly related to reducing the activation of the NF-B pathway. Proinflammatory mediators and acute-phase proteins, such as Interleukin 1 (IL-1), Monocyte Chemoattractant Protein 1 (MCP-1), C-Reactive Protein (CRP), and Tumor Necrosis Factor (TNF-), were considerably downregulated in diabetic rats after PD therapy. Additionally, polydatin shown great selectivity for GLUT1 and GLUT4 and impressively suppressed SGLT1/2. Furthermore, it improved urine glucose excretion and dramatically and dose-dependently reduced hyperglycemia in diabetic rats. In addition, polydatin may lessen renal oxidative stress, mitochondrial dysfunction brought on by DN, diabetic cardiomyopathy, and diabetic renal fibrosis.