## Ameliorating effect of eugenol on hyperglycemia by attenuating the key enzymes of glucose metabolism in streptozotocin-induced diabetic rats

Subramani Srinivasan · Gajendren Sathish · Mahadevan Jayanthi · Jayachandran Muthukumaran · Udaiyar Muruganathan · Vinayagam Ramachandran

Received: 26 June 2013/Accepted: 13 September 2013/Published online: 28 September 2013 © Springer Science+Business Media New York 2013

Abstract Epidemiological studies have demonstrated that diabetes mellitus is a serious health burden for both governments and healthcare providers. This study was hypothesized to evaluate the antihyperglycemic potential of eugenol by determine the activities of key enzymes of glucose metabolism in streptozotocin (STZ)-induced diabetic rats. Diabetes was induced into male albino Wistar rats by intraperitoneal administration of STZ (40 mg/kg body weight (b.w.)). Eugenol was administered to diabetic rats intragastrically at 2.5, 5, and 10 mg/kg b.w. for 30 days. The dose 10 mg/kg b.w. significantly reduced the levels of blood glucose and glycosylated hemoglobin (HbA1c) and increased plasma insulin level. The altered activities of the key enzymes of carbohydrate metabolism such as hexokinase, pyruvate kinase, glucose-6-phosphate dehydrogenase, glucose-6-phosphatase, fructose-1,6-bisphosphatase, and liver marker enzymes (AST, ALT, and ALP), creatine kinase and blood urea nitrogen in serum and blood of diabetic rats were significantly reverted to near normal levels by the administration of eugenol. Further, eugenol administration to diabetic rats improved body weight and hepatic glycogen content demonstrated the antihyperglycemic potential of eugenol in diabetic rats. The present findings suggest that eugenol can potentially

e-mail: sivaseenu77@gmail.com

G. Sathish · M. Jayanthi

ameliorate key enzymes of glucose metabolism in experimental diabetes, and it is sensible to broaden the scale of use of eugenol in a trial to alleviate the adverse effects of diabetes.

**Keywords** Eugenol · Glucose · Diabetes mellitus · Streptozotocin

## Introduction

Diabetes mellitus is a disease due to abnormality of glucose metabolism and it is mainly linked with low plasma insulin level or insensitivity of target organs to insulin and results in chronic hyperglycemia, a clinical hallmark of diabetes [1]. Defects in glucose metabolic machinery and consistent efforts of the physiological system to correct the metabolic imbalance pose an over exertion on the endocrine system leading to the disruption of endocrine control. Deterioration of endocrine control exacerbates the metabolic disturbances by altering glucose metabolic enzymes which leads to hyperglycemia [2]. The sustained hyperglycemia leads to a further impairment of insulin production by  $\beta$ cells the so-called glucose toxicity [3]. Hyperglycemia occurring in diabetes does not only damage cellular proteins, membrane lipids and nucleic acids, but also increase the rate of onset of disease complications.

Diabetes mellitus affects around 8.3 % of the adult population globally there are 366 million people currently known to have diabetes which is estimated to grow to 552 million by 2030 [4]. India has got 62.4 million people live with diabetes and 77.2 million people are on the threshold leading as diabetic capital of the world [5]. Liver is an insulin-sensitive organ mainly involved in the regulation of glucose metabolism and is responsible for disposal of up to

S. Srinivasan  $(\boxtimes) \cdot J$ . Muthukumaran  $\cdot U$ . Muruganathan  $\cdot V$ . Ramachandran

Department of Biochemistry and Biotechnology, Faculty of Science, Annamalai University, Annamalainagar 608002, Tamilnadu, India

Postgraduate and Research Department of Biochemistry, Adhiparasakthi College of Arts and Science, G. B. Nagar, Kalavai 632506, Vellore Dist, Tamil Nadu, India