Levels of antioxidant enzymes and organ integrity in diabetic rats

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Description

Diabetes mellitus (DM) is a chronic metabolic disorder of multiple aetiology, and characterized by high blood glucose levels and abnormalities in carbohydrate, protein and fat metabolism. The resulting hyperglycemia may lead to irreversible damage, dysfunction and failure of various organs that may lead to mortality. Due to the limitations of current therapies and consistent increases in DM related deaths, there remains interest in cost effective alternate treatments. Therefore, the objective of this study was to investigate the effects of low (Musa sapientum and Ipomea batatas), medium (Dioscorea cayenensis and Musa paradisiaca) and high (Dioscorea alata and Colocasia esculenta) glycemic index (GI) diets on normal as well as diabetic rats. The three diets were fed to Sprague-Dawley rats and the biochemical variables and organ histology assessed at the end of the twelve weeks study. Increase plasma levels of glucose, VLDL, MDA and pancreatic degeneration were observed in the diabetic control group. In addition, levels of HDL and the activities of SOD, CAT, GSH-Px were decreased in the diabetic rats when compared to the normal control group. The consumption of low and medium GI foods lowers postprandial blood glucose levels, increase HDL, SOD, CAT, GSH-Px, decrease MDA levels and improved the histoarchitecture of pancreatic islets in diabetic rats. There was no notable change in TC, TG and organ weight. Our findings suggest that it may be possible to improve glycemic control, suppress oxidative stress and reverse histopathological changes in the pancreas caused by diabetes mellitus in rats.

Diabetes is a chronic metabolic disorder that leads irregularities in carbohydrate, fat and protein metabolism. It poses a major global public health treat and its prevalence is rapidly increasing. It is of significant public importance because of the associated physiological complications, which includes dysfunction in organs such as pancreas, intestine, liver and kidney [1,2].

In this study, high-fat diet-fed animals administered low dose streptozotocin were used to investigate the potential of GI diets as a low cost method of managing diabetes. The use of this type 2 diabetes animal model enables the opportunity to conduct detailed and mechanistic assessments, such as histopathology that is challenging or impossible to execute in clinical trials. Postprandial hyperglycemia and low level of HDL are well-known indicators of type 2 diabetes that may cause life-threatening complications [3]. In the present study, blood glucose levels in the diabetic groups were consistently higher than the non-diabetic groups. However, the GI diets did not revert the hyperglycemia after twelve weeks. This may be due to the damage of the β-cells and the reduced insulin sensitivity in tissues caused by streptozotocin and existing hyperglycemia [4]. It is however important to note that, the diabetic animals fed the low GI diet had the lowest level of hyperglycemia throughout the study when the diabetic groups are compared. It has been reported that this change may be due to reduction in hepatic glucose output and increase in peripheral glucose uptake. Significant changes in total cholesterol, triglycerides and lipid metabolism was not observed. However, increase levels of HDL was observed in diabetic group administered low GI diet. Increased level of HDL in the blood is commonly reported as cardio protective.

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HDL help to transport cholesterol to the liver from peripheral tissues and from macrophages associated with cholesterol deposits within the vascular walls. According to Bays, HDL may also protect the cardio vascular system by having direct antioxidant and anti-inflammatory actions on the walls of blood vessels. The findings of our study agrees with that reported by Tiwari, where increase in HDL was observed when diabetic rats were administered a composite extract from leaves and fruits of medicinal plants. In a cross-sectional study of British adults, also described the beneficial effects of low GI diets on HDL, thereby reducing the risk of type 2 diabetes and other cardio vascular complications.

Conclusion

The consumption of low and medium GI foods lowers postprandial blood glucose levels, increase HDL, SOD, CAT, GSH-Px, decrease MDA levels and improved the histoarchitecture of pancreatic islets in diabetic rats. There was no notable change in TC, TG and organ weight. Our findings suggest that it may be possible to improve glycemic control, suppress oxidative stress and reverse histopathological changes in the pancreas caused by diabetes mellitus in rats.

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