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The excerpt below is from a study as referenced above:

P. canariensis is a kind of traditional medicine which has long been used to effectively treat obesity and diabetesl by local people. In the present findings, we evaluated the antidiabetic effect of AL-H on SD and MD induced by STZ. Our date clearly showed hypoglycemic activity and glucose tolerance pattern was significantly altered comparable to that of glibenclamide. This activity improved glucose tolerance suggesting a decrease in insulin resistance and helping to maintain blood glucose levels steady which may indicate certain induction of peripheral utilization of glucose.

Streptozotocin is known for its selective pancreatic islet beta cells cytotoxicity and has been widely used to induce diabetes mellitus. Besides alteration in the carbohydrate and lipid metabolism, rats treated with STZ also exhibited reduced total protein and liver glycogen levels, increased liver glucose transfer, and decline in liver glycogen content in STZ diabetic rats [37]. From glucose tolerance test it has been indicated that this extract did not execute the antihyperglycemic effect by modulating the absorption of glucose in the intestine. In glucose loaded rats AL-H inhibited significantly the rise of glycemia. This improved glucose tolerance and also suggests that a decrease in insulin resistance and maintenance of blood glucose levels may indicate induction of increased peripheral utilization of glucose [37].

Furthermore, the attenuating effect of this extract on experimental physiological symptoms of streptozotocin-induced severe and mild diabetes has been confirmed here by the study of glucose-6-phosphatase activity in liver, as well as the quantification of glycogen in liver and skeletal muscle, which are very important indicators of diabetes mellitus. In our study, the hexane extract of AL-H seeds had a beneficial effect in terms of peripheral glucose utilization.

Control of hepatic glucose (HGO) may occur through regulation of gluconeogenesis or glycogenolysis. However, the common final pathway of glucose uptake and release involved the phosphorylation and dephosphorylation of glucose via GK and G6Pase, respectively [38]. In this study, AL-H caused a marked increase in hepatic glycogen content in STZ-induced diabetic mice, which indicates that mice may decrease HGO by increasing glycogen content. In addition, P. canariensis decreased G6Pase activity and increased GK activity in liver, which indicates that this can be an increase in hepatic glucose uptake and decrease in hepatic glucose release. Therefore, this study strongly suggests that P. canariensis enhances hypoglycemic activity probably by reducing HGO via decreasing G6Pase activity and increasing GK activity. One of the key enzymes in the catabolism of glucose is hexokinase, which phosphorylates glucose and converts it into glucose-6-phosphate. The increased activity of hexokinase can promote glycolysis and increase utilization of glucose for energy production [39]. The administration of P. canariensis to the diabetic mice increased the activity of hepatic hexokinase causing an increase in glycolysis. The hepatic glycogen was found to be increased in both liver and skeletal muscle in diabetic rats and suggested also a reduction in glycogenolysis and an increase in glycogenesis.

Insulin deficiency is associated with hypercholesterolaemia and hypertriglyceridaemia. STZ-induced diabetes showed increased plasma levels of cholesterol, triglyceride, free fatty acid, and phospholipids. Insulin deficiency or insulin resistance could be responsible for dyslipidaemia because insulin increases fatty acid as well as triglyceride synthesis in adipose tissue and liver. It inhibits lipolysis, partly via dephosphorylation (and hence inactivation) of lipases [40]. Insulin deficiency leads to fall in lipoprotein lipase activity. In our study, STZ mice showed hypercholesterolaemia and hypertriglyceridaemia and the treatment with AL-H significantly decreased both cholesterol and triglyceride levels. STZ induction of

diabetes in mice leads to lipid peroxidation. TBARS are an index of endogenous lipid peroxidation and oxidative stress as an intensified free radical production. TBARS levels in both liver and kidney of diabetic control group were high and were significantly reduced upon administration of the hexane extract. These findings supported the hypothesis that P. canariensis improved insulin sensitivity.

We studied the antioxidant effect of the AL-H extract over tissue oxidative markers. Diabetic mice showed a significant reduction in SOD, CAT, GSH, and GPx in hepatic and renal tissues as a result of a persistent oxidative stress. One of the main consequences of chronic hyperglycemia is the enhanced oxidative stress resulting from the imbalance between production and neutralization of reactive oxygen species (ROS), in particular, the diabetes-associated free radical injury, accumulation of lipid peroxidation products, depletion of GSH, decrease in GSH/GSSG ratio, and downregulation of key antioxidant enzymes [40]. Accordingly, we measured a decrease in GSH in the liver of diabetic mice, probably due to a higher demand, following the diabetes-induced oxidative stress. The glutathione system, SOD, GPx, GSH, and CAT comprise the most important endogenous antioxidant defense against ROS-induced damage of the cell membrane. SOD protects tissues from oxygen free radicals by catalyzing the removal of free radical superoxide anion ; GPx and CAT were shown to be responsible for the detoxification of significant amounts of H2O2. In addition, administration of AL-H extract showed increased activities of SOD, GPx, and CAT after 30 days of treatment in STZ rats indicating that the AL-H extract can reduce reactive oxygen free radicals and improve the activities of the antioxidant enzymes [41]. The enhanced activities of the antioxidant enzymes promoted by AL-H protect against STZ-induced damage; therefore, hyperglycemia does not develop. The protection against lipid peroxidation offered by GPx and the effect of AL-H on this enzyme appear to be relevant responses to ROS-induced membrane damage [42].

The effects of the AL-H on transaminase (i.e., ALP, SGPT, and SGOT) activity was also studied in hyperlipemic mice. Transaminases are important enzymes for the study of liver toxicity. ALP is found predominately in the liver, with lesser quantities in the kidneys, heart, and skeletal muscles. As a result, ALP is a more specific indicator of liver inflammation than SGPT and SGOT and may also be elevated in diseases that affect other organs, such as the heart and muscles. Our results indicate that only treatment with the AL-H of hyperlipemic mice reduced the activity of these enzymes, suggesting that this extract effectively reduced the toxic effect on these enzymes. These results suggest that P. canariensis prevents oxidative stress, acts as a suppressor of liver cell damages and inhibit, the progression of liver dysfunction induced by chronic hyperglycemia. AL-H extract has a potent effect over antioxidant enzymes activities in pancreatic tissue, enhancing them compared to diabetic control.

P. canariensis improves glucose metabolism by reducing insulin resistance and by protecting pancreatic -cells from oxidative stress and exhibited excellent hypoglycemic activity, enhancing glucose uptake by adipose and muscle tissues, along with beneficial lipid regulation ability. A reduction in the activities of SGOT, SGPT, and ALP in plasma and an increase in glucokinase and HK and a decrease in G6Pase indicated the hepatoprotective role. We demonstrated that daily consumption of P. canariensis tended to suppress body weight in fatty mice with hypertriglyceridemia. Although the effect of P. canariensis is important, it is interesting that P. canariensis suppressed body weight without affecting food consumption. P. canariensis possesses lipid lowering effect in obesity-induced mice, as well as its weight-reducing ability. Due to the promising effects of P. canariensis in STZ-induced diabetes mice and diet-induced obesity, further studies are sought in order to determine the active principle from this plant.

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