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N-acetyl-L-cysteine mitigates diabetes-induced impairments in sciatic nerve

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Abstract

Diabetic neuropathy is a consequence of long-term hyperglycemia. The emergence of neuronal condition is a result of hyperglycemia-induced oxidative stress. In the present study, streptozotocin-induced diabetes exhibited notable decrease in the levels of phospholipids, glycolipids, gangliosides, and triglycerides in the sciatic nerve. The alterations in lipids resulted in increase in cholesterol to phospholipid ratio in sciatic nerve of diabetic animals. This ratio is crucial and determines the rheological properties of membranes and resulted in substantial reduction in the activity of membrane-bound enzymes; Ca²⁺ + ATPase and acetylcholinesterase. Histological examination of the cross-section of the sciatic nerve in diabetic mice revealed axonal atrophy and disarrayed myelin sheath. The potential therapeutic impact of N-acetyl Cysteine (NAC), a powerful antioxidant, on a rat model of diabetic neuropathy was evaluated. NAC was administered to rats in drinking water for a period of 8 weeks. The results indicate that administration of NAC restored lipid composition; ratio of cholesterol to phospholipids, the activity of membrane linked enzymes, and improved the structural defects in sciatic nerve. NAC plays protective role against diabetes-induced alterations in lipid composition in sciatic nerve membranes leading to improvement in structure and function of membranes. Overall, the findings suggest NAC as a potential therapeutic strategy in preventing diabetic neuropathy and other diabetic complications. © 2025

Author Keywords

Diabetes; Enzymes; Lipids; N-acetylcysteine; Neuropathy; Sciatic Nerve. Membrane

Index Keywords

acetylcholinesterase, acetylcysteine, antioxidant, cholesterol, drinking water, ganglioside, glucose, glycolipid, lipid, malonaldehyde, myelin, phospholipid, streptozocin, triacylglycerol; animal experiment, animal model, animal tissue, Article, controlled study, diabetes mellitus, diabetic neuropathy, diagnostic test accuracy study, enzyme activity, enzyme assay, flow kinetics, histology, histopathology, hyperglycemia, lipid composition, male, neuropathy, nonhuman, oxidative stress, rat, sciatic nerve

Chemicals/CAS

acetylcholinesterase, 9000-81-1; acetylcysteine, 616-91-1, 89344-48-9; cholesterol, 57-88-5; glucose, 50-99-7, 84778-64-3, 8027-56-3; lipid, 66455-18-3; malonaldehyde, 542-78-9; streptozocin, 18883-66-4

Tradenames

ImageJ software; MS Excel 2007 software, Microsoft

Manufacturers

Microsoft

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