

Comparative Effects of Zinc and Omega-3 Fatty Acids with Simvastatin in Hyperlipidemic Albino Rats

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Abstract

Background

Dyslipidemia is a major metabolic abnormality commonly present in diabetes mellitus and is associated with cardiovascular diseases and chances of morbidity and mortality are high. Omega-3 fatty acids and zinc have been reported to possess lipid-lowering and antioxidant properties. Simvastatin remains one of the most commonly prescribed drugs for the treatment of hyperlipidemia.

Objective

To compare the effects of zinc and omega-3 fatty acids with simvastatin on lipid profile in hyperlipidemic albino rats.

Materials and Methods

This experimental study was conducted in the Department of Pharmacology, M. Islam Medical College, Gujranwala. Twenty albino rats were divided into four groups containing five animals each. Hyperlipidemia was induced using a high-fat diet, while diabetes was induced through intraperitoneal administration of streptozotocin. Group 1 received zinc, Group 2 received omega-3 fatty acids, Group 3 received a combination of zinc and omega-3 fatty acids, and Group 4 received simvastatin. Serum lipid profiles were assessed at baseline and after 30 days of treatment. Data were analyzed using SPSS version 30.

Results

All treatment groups demonstrated improvement in lipid profile parameters. The combination therapy group showed greater reduction in serum cholesterol, triglycerides, LDL, and VLDL levels compared with individual therapies. The effects observed in the combination group were comparable to those of simvastatin.

Conclusion

Combined administration of zinc and omega-3 fatty acids produced significant improvement in lipid parameters and may serve as a potential alternative therapeutic approach for the management of hyperlipidemia.

Keywords: Hyperlipidemia, Omega-3 fatty acids, Zinc, Simvastatin, Dyslipidemia, Albino rats

Introduction

Diabetes mellitus a well-known chronic metabolic disorder which is characterized by persistent high levels of Glucose in blood and it the result of impaired insulin secretion, insulin action of insulin, or both. The clinical background reviewed in this paper shows that in addition to abnormal glucose metabolism, patients with diabetes often have concurrent dyslipidemia, which increases their risk of developing atherosclerosis and ischemic heart disease. Cardiovascular complications are one of the leading causes of death among this population.

Omega-3, a polyunsaturated fatty acid sourced from marine products such as fish oil, has been confirmed in previous studies to lower triglyceride levels, while possessing anti-inflammatory and anti-atherosclerotic properties that enable it to exert cardiovascular protective effects.

Zinc is an essential trace element and it is important for the human body. It participates in a wide range of enzyme-mediated metabolic processes, and supports antioxidant defense and cellular integrity; zinc deficiency can trigger oxidative stress and metabolic disorders, and this association is particularly prominent among patients with diabetes.

Statin- a group of lipid-lowering drugs such as simvastatin exert their therapeutic effects by inhibiting HMG-CoA reductase, can lower low-density lipoprotein cholesterol, and reduce the risk of cardiovascular disease. While long-term statin therapy produces lipid-regulating therapeutic effects, it is associated with adverse reactions, leading the academic community to explore alternative or adjunctive intervention schemes.

The present study intends to assess the effects of zinc, Omega-3 fatty acids, and simvastatin on albino rats with hyperlipidemia.

Materials and Methods

The experiment will be carried out at the Department of Pharmacology, M. Islam Medical College, Gujranwala, over a 4-week period, and has obtained approval from the institutional ethics committee.

This study selected 20 healthy albino rats, which were randomly divided into 4 groups of 5 rats each. Diabetes was induced in the rats via intraperitoneal injection of streptozotocin, and hyperlipidemia was induced by feeding the rats a high-fat diet for 1 week.

Study Groups

- **Group 1:** Zinc-treated group
- **Group 2:** Omega-3 fatty acid-treated group
- **Group 3:** Combination therapy group (Zinc + Omega-3 fatty acids)
- **Group 4:** Simvastatin-treated group

In this study, blood samples were collected on Day 1 and Day 30 of the experiment, respectively. Blood lipid profiles, which include total cholesterol, triglycerides, HDL, and LDL, as well as blood glucose levels, were tested to confirm the successful establishment of the diabetic model.

The samples were sent to the pathology laboratory of M. Islam Teaching Hospital, where testing was performed using Randox assay kits. All data were analyzed via SPSS 30, results are presented as mean values, and a p-value of <0.05 was defined as statistically significant.

Results

Serum Cholesterol Levels

Groups Day 1 Day 30 P-value

Group 1	290	210	0.05
Group 2	300	200	0.05
Group 3	295	180	0.05
Group 4	290	150	0.05

Serum Triglyceride Levels

Groups Day 1 Day 30 P-value

Group 1	260	220	0.06
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Groups Day 1 Day 30 P-value

Group 2	255	200	0.05
Group 3	260	160	0.05
Group 4	250	150	0.05

Serum HDL Levels**Groups Day 1 Day 30 P-value**

Group 1	40	38	0.07
Group 2	45	42	0.05
Group 3	40	44	0.05
Group 4	44	44	0.05

Serum LDL Levels**Groups Day 1 Day 30 P-value**

Group 1	35	30	0.08
Group 2	40	26	0.06
Group 3	36	24	0.05
Group 4	35	20	0.05

Serum VLDL Levels**Groups Day 1 Day 30 P-value**

Group 1	30	26	0.08
Group 2	32	26	0.07
Group 3	34	22	0.05
Group 4	34	20	0.05

This study observed that serum lipid parameters improved in all treatment groups. The lipid-lowering effect of the combined intervention of zinc and Omega-3 outperformed either single therapy, and was comparable to that of simvastatin.

Discussion

The present study demonstrated that zinc and omega-3 fatty acids significantly improved lipid profile parameters in hyperlipidemic albino rats. The combination therapy produced greater reductions in serum cholesterol, triglycerides, LDL, and VLDL levels compared with individual treatments.

A large body of existing prior relevant research has found that Omega-3 fatty acids can reduce serum triglyceride concentrations and improve cardiovascular health by decreasing hepatic triglyceride synthesis and enhancing endothelial function. The conclusions our research team reached regarding the benefits of supplementing this substance in populations with dyslipidemia are consistent with the aforementioned reports.

Zinc has multiple positive effects on human lipid metabolism. Its antioxidant activity can alleviate oxidative stress linked to diabetes and hyperlipidaemia, and it also participates in multiple enzyme pathways related to lipid metabolism and cellular protection.

This study finds that the combination of zinc and omega-3 fatty acids yields enhanced therapeutic effects. While simvastatin, a commonly used clinical drug, has a stronger lipid-lowering effect, this combination therapy delivers comparable efficacy with fewer potential side effects.

This study has limitations including a small sample size and a short study period. Future research should expand the study population, and carry out experimental and clinical research to validate the current conclusions.

Conclusion

The combination of zinc and omega-3 fatty acids really helped lower the fats in the blood of albino rats with high levels of fat. The results were similar to the drug simvastatin in ways. This is important because it means that using zinc and omega-3 fatty acids together could be an alternative or extra treatment for people with high levels of bad fats, in their blood.

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