IJFANS INTERNATIONAL JOURNAL OF FOOD AND NUTRITIONAL SCIENCES
ISSN PRINT 2319 1775 Online 2320 7876
 UGC CARE Listed (Group -I) Journal Volume 12, Iss 1, 2023

COMPARATIVE EVALUATION OF Nigella sativa: A REVIEW OF ITS ANTIDIABETIC AND ANTIOXIDANT PROPERTIES

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ABSTRACT:
Nigella sativa, commonly known as black seed, has garnered significant attention due to its potential health benefits. This review assesses existing research focused on the comparative antidiabetic and antioxidant properties of *Nigella sativa*. It examines studies investigating the impact of *Nigella sativa* extracts and oil on controlling blood sugar levels and enhancing antioxidant enzyme activity in diabetic models. The review evaluates the effectiveness of different preparations of *Nigella sativa* and explores the potential mechanisms that underlie its therapeutic effects. By synthesizing findings from diverse studies, this review aims to offer a comprehensive overview of the current evidence regarding *Nigella sativa*'s role in managing diabetes and its antioxidant properties.

INTRODUCTION

Pancreas Anatomy

The pancreas is an elongated organ, typically light tan or pinkish in color, situated retroperitoneally along the posterior abdominal wall, spanning from the second part of the duodenum to the spleen. It features a head on the right side encircled by the duodenum, a tapering body extending slightly upward, forming the main bulk of the organ, and a tail that rests adjacent to the spleen [1].

Histological Structure of the Pancreas

The pancreas is primarily composed of exocrine and endocrine cells, which collectively constitute up to 98% of its composition. Exocrine pancreatic acinar cells are organized into lobules that contribute to the ductal system, eventually converging into the main pancreatic duct. This duct typically merges with the common bile duct at the ampulla of Vater, forming a short single duct that enters the duodenum [2]. The endocrine portion of the pancreas comprises hormone-producing cells arranged in clusters known as the islets of Langerhans. These cells secrete hormones directly into the bloodstream, bypassing the pancreatic ductular system[3].

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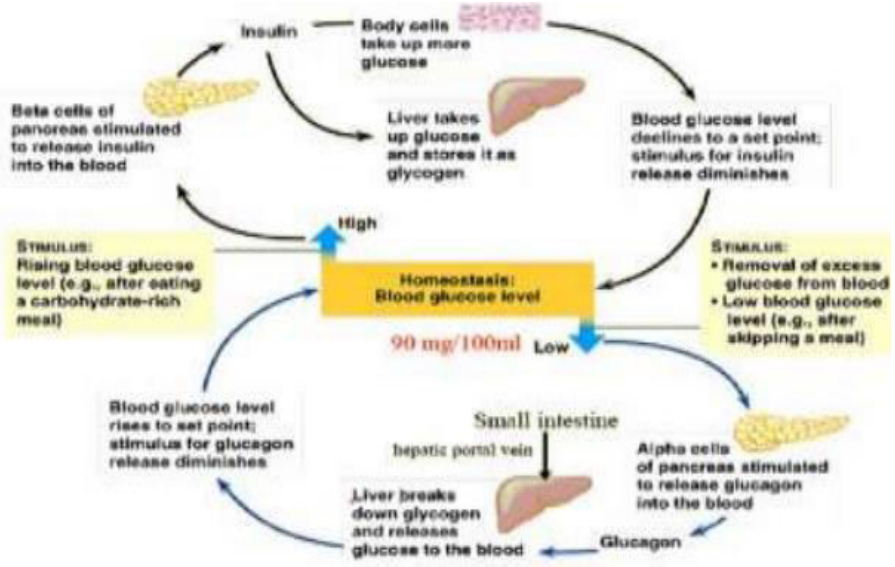

Figure 1: The Role of Pancreas In The Body

PANCREAS FUNCTION

a) Exocrine Function

Pancreatic acinar cells are responsible for producing digestive enzymes such as amylase, lipase, colipase, phospholipase, and protease[4]. These enzymes are stored within secretory granules in the acinar cells and are released via exocytosis. Most of these enzymes are activated in the duodenum after secretion from the pancreas [5].

b) Endocrine Function

The islets of Langerhans consist of five main types of cells, each producing different hormones. Beta (B-) cells are the most common and secrete insulin, while alpha (α-) cells produce glucagon, delta (D-) cells produce somatostatin, PP cells produce pancreatic polypeptide, and enterochromaffin cells produce serotonin. Other hormones identified in the endocrine pancreas include gastrin-releasing peptide, neuropeptide Y, and galanin, which act as neurotransmitters in the neurogastrointestinal axis [6].

Insulin

Structure

Pancreatic cells from both the exocrine and endocrine pancreas are closely interconnected, lacking basal membranes. Peri-insular acini, which surround the islets, contain a greater number of zymogen granules compared to acini located farther from the islets. The proximity of insulin also influences the morphology of peri-insular acini[7]. This relationship has led to the concept of the insulin-acinar axis, suggesting that islet peptides regulate acinar cell function. Peri-insular acini are exposed to high concentrations of islet hormones due to the extension of efferent vessels from the islets into the surrounding exocrine pancreas. Insulin, produced by beta cells in the Islets of Langerhans in the pancreas, is a peptide hormone named after the Latin word "insula," meaning island [8].

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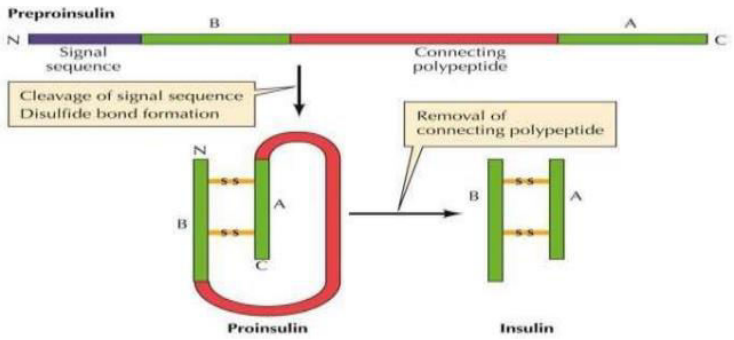

Figure 2: Structure of Insulin

Insulin secretion by beta cells occurs in two distinct phases: a rapid, triggered phase and a slower, sustained release phase[9]. The rapid triggered phase is stimulated by various factors including glucose, glucagon-like peptide-1 (GLP-1), glucose-independent insulinotropic peptide (GIP), adrenaline acting via β2 receptors, and specific amino acids such as arginine, leucine, acetylcholine, and cholecystokinin (CCK) [10].

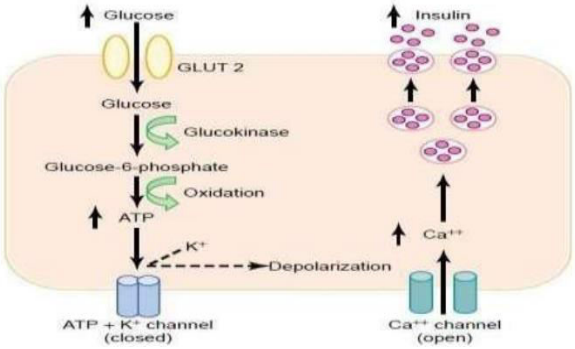

Figure 3: Insulin Release and its Action

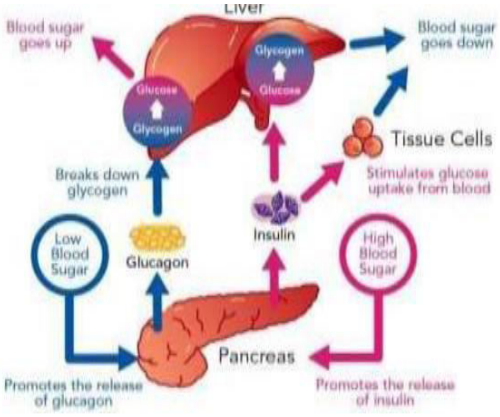

Figure 4: Mechanism of Blood sugar

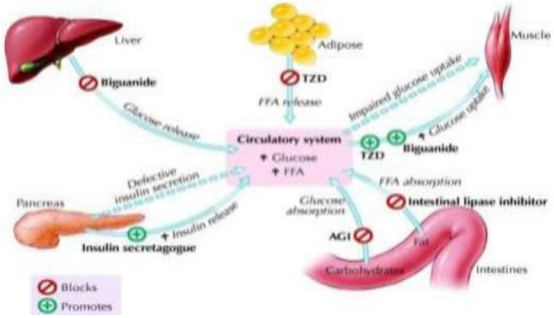

Figure 5: Major Mechanisms and Targets of Antidaibetic drugs

Major target organs and mechanism of actions of orally administered anti-hyperglycemic agents in type II diabetes mellitus [11]

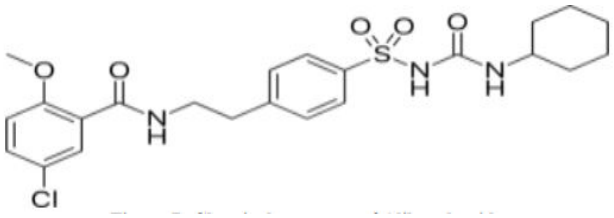

Figure 6: Chemical structure of Glibenclamide

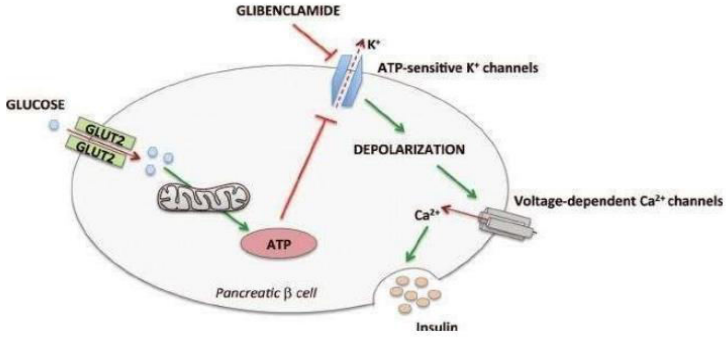

Figure 7: Mechanism of Glibenclamide

PLANT PROFILE *Nigella sativa*

Nigella sativa L. (N. sativa) is a small shrub (20-90 cm in tall) under the botanical family, Ranunculaceae [12]. It is native to Southern Europe, North Africa and Southeast Asia; cultivated in many countries in the world like Middle Eastern, Mediterranean region, South Europe, India, Pakistan, Syria, Turkey, Saudi Arabia [13].

Figure 8: *Nigella sativa* L. (N. sativa)

CONCLUSION

This study explored the antidiabetic and antioxidant properties of *Nigella sativa* 's methanolic extract. Various active components present in *Nigella sativa* were investigated for their potential antidiabetic effects. The research demonstrates that the methanolic extract of *Nigella sativa* provides significant protection against alloxan-induced diabetes. In the study, levels of cholesterol (Ch), triglycerides (TG), and low-density lipoprotein (LDL) were observed to increase, while high-density lipoprotein (HDL) levels decreased in the diabetic group compared to the control group induced with alloxan. Treatment with *Nigella sativa* methanolic extract resulted in decreased levels of cholesterol, TG, and LDL, and increased HDL levels compared to the diabetic control group, indicating the plant's hypolipidemic effects. In rats treated with Glibenclamide, a standard antidiabetic medication, similar reductions in Ch, TG, and LDL levels and increased HDL levels were observed with the administration of *Nigella sativa* extract at a dose of 1200 mg/kg compared to the diabetic control. This hypolipidemic effect is likely due to the inhibition of fatty acid synthesis facilitated by *Nigella sativa*.

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