INTERNATIONAL SUMMIT ON DIABETES, ENDOCRINOLOGY, AND METABOLIC DISORDERS

Komal Chauhan

National Institute of Food Technology Entrepreneurship and Management (NIFTEM), Kundli, Haryana, India, 131028

Microgreens with Iron and Zinc Fortification Ameliorate Oxidative Stress in a Streptozotocin-Nicotinamide Diabetic Model

Abstract

The growing incidence of metabolic disorders such as diabetes and obesity has become a global health concern, necessitating the exploration of dietary interventions with functional and therapeutic benefits. Among these, microgreens have gained significant attention for their rich phytochemical composition and antioxidant properties. Additionally, iron and zinc are critical micronutrients that play a vital role in maintaining metabolic health and mitigating oxidative stress. This study aimed to evaluate the combined therapeutic potential of microgreens and iron and zinc fortification in modulating oxidative stress and metabolic dysfunction in streptozotocin-nicotinamide (STZ-NA)-induced diabetic models.

The research was conducted in three phases. The first phase involved a comprehensive evaluation of the selected microgreens, including cereal grasses (wheat, barley, sorghum), brown and green seaweeds (Sargassum fusiforme, Ulva lactuca), and leafy vegetables (taro Colocasia esculenta L. and kenaf Hibiscus cannabinus L.). These plant sources were analyzed for their proximate composition, phytochemical profile, and in vitro antioxidant properties. The findings revealed a high concentration of bioactive compounds, including phenolics, flavonoids, and carotenoids, contributing to their strong antioxidant activity. Additionally, iron and zinc fortification was integrated into value added products to enhance their micronutrient density. The fortified samples demonstrated improved bioavailability and synergistic effects in antioxidant potential, making them promising candidates for therapeutic applications.

In the second phase, in vivo experiments were conducted using male Wistar rats, divided into obesogenic (high-fat diet-induced) and diabetogenic (NA-STZ-induced) groups. Over a nine-week period, dietary supplementation with microgreens and fortified formulations was administered, and its impact on serum and hepatic biomarkers was assessed. The results indicated a significant reduction in hyperglycemia, dyslipidemia, and oxidative stress markers in the treated groups. The most pronounced effects were observed in groups supplemented with S. fusiforme and U. lactuca combined with iron and zinc fortification.

ISBN: 978-1-917892-09-4

doi.org/10.51219/URForum.2025.Komal-Chauhan

Notably, these interventions enhanced insulin sensitivity, reduced hepatic lipid accumulation, and improved antioxidant enzyme activity. Histopathological examinations further confirmed the protective role of microgreens and mineral fortification, demonstrating tissue restoration and reduced inflammation in pancreatic and hepatic cells.

The final phase focused on the development of functional food products by incorporating microgreens and fortified ingredients. Various formulations, including fortified biscuits, energy bars, and mixes, were designed to provide enhanced nutritional and antioxidative benefits. Sensory evaluations indicated high acceptability, with formulations enriched with microgreens and fortified with iron and zinc exhibiting improved taste, texture, and shelf stability. Physicochemical assessments revealed increased protein, fibre, and micronutrient content, making these products suitable for long-term dietary inclusion. In conclusion, this study underscores the potential of microgreens and iron and zinc fortification as natural, functional interventions for managing diabetes and oxidative stress. Their combined impact on metabolic health highlights their role as promising nutraceuticals in addressing chronic diseases through sustainable dietary solutions.

Keywords: Microgreens, Iron, Zinc,Fortification, Oxidative Stress, Streptozotocin, Nicotinamide, Diabetes Mellitus

Biography: Dr. Komal Chauhan is a distinguished academician and researcher in the field of Food Science and Nutrition. She holds a Ph.D. in Food Science and Nutrition from Banasthali University, Rajasthan, and has consistently demonstrated academic excellence as a scholarship holder and Gold Medallist at the Master's level.

Her diverse upbringing across various regions of India has enriched her academic and professional outlook, shaping her into a versatile and dynamic educator. Dr. Chauhan began her teaching career at S.D. College, Ambala Cantt, followed by a tenure at Banasthali University. Currently, she serves as the Dean of Research and Outreach at NIFTEM, where she also leads the Centre for Food Research Analysis and the Centre of Excellence for Food Fortification, in addition to her role as Professor in the Department of Food Science and Technology.

With over two decades of teaching and research experience, Dr. Chauhan has made significant contributions in the areas of Nutraceuticals and Functional Foods, Nutritional Biochemistry, Malnutrition, and Non-Communicable Diseases including diabetes, cardiovascular diseases, and obesity. She has actively collaborated on numerous projects funded by prestigious organizations such as UNICEF, UGC, DST, SERB, FSSAI, and various state and central government agencies including the Ministry of Tribal Affairs (MP), Department of Women and Child Development (Kerala), and the Department of Sports and Youth Affairs (Kerala).

Dr. Chauhan has edited three books and authored several book chapters. She has also published and presented extensively in national and international journals and conferences. Her strong industry linkages and focus on applied research have resulted in the transfer of more than 30 food technologies, underscoring her commitment to innovation and public health impact.

ISBN: 978-1-917892-09-4