WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Glucosinolate Biosynthesis in Transgenic Plants: Its Potential Application in Human Health

Shouvik Das[1], Srinjoy Chatterjee[2]

[1]Department of Biotechnology, The Amity University, India.
[2]*Department of Dentistry, The West Bengal University of Health Sciences, India.*

ABSTRACT :-

This Paper highlights the previous researches and the potential of harnessing transgenic plants for glucosinolate biosynthesis in healthcare management. Glucosinolates are bioactive compounds with antioxidant, antimicrobial, antifungal, and anticancer properties that can be found in cruciferous plant species. By genetically modifying these plants to enhance glucosinolate production, a renewable and cost-effective source of these compounds can be created.

Keywords:- Glucosinolate , Transgenic Plants, Anti-Cancer, Human Health.

Introduction:-

The previous researches which had already carried out on glucosinolates were mainly focused on the glucosinolates biosynthesis in plants and using it as a bio-pesticide for growing insect and pest resistant crops. Still now the exact metabolic pathways by which glucosinolates kill cancerous cells are not yet fully understood and may vary depending on the type of cancer and the specific glucosinolate compound involved but however, several mechanisms had been proposed or hypothesized.

A Brief Discussion on Previous Researches :-

There are limited preclinical research on the potential effects of transgenic fruits that are engineered to contain high concentrations of glucosinolates, which are natural compounds found in some vegetables that have been linked to cancer prevention in studies. However, there is currently no clinical data available on the use of these transgenic fruits as a natural therapeutic method for cancer in humans. Most of the studies on the potential health benefits of glucosinolates have been done in animal or cell culture models, and while some promising results have been reported, it is important to note that these findings have not yet been replicated in human clinical trials.

The safe concentration level of glucosinolates for human consumption is not well established, as it can vary depending on a number of factors such as an individual's age, gender, weight, health status, and overall dietary intake. However, studies suggest that consuming moderate levels of glucosinolates from dietary sources, such as cruciferous vegetables (e.g., broccoli, kale, cauliflower), is generally safe and may even provide health benefits. The concentration of glucosinolates in these vegetables can vary widely depending on factors such as variety, growing conditions, and preparation method, but generally ranges from 5-100 micromoles per gram. However, it is important to note that the bioavailability and activity of glucosinolates can be influenced by factors such as cooking and processing methods, as well as individual variations in digestion and metabolism. For example, boiling or overcooking cruciferous vegetables can reduce the concentration of glucosinolates, while chopping or chewing can enhance their release and activity.

S.NO.	TOPIC OF THE PAPER/ARTICLE				SYNOPSIS
1.	Glucosinolate metabolism and its control			[1]	The research paper provides an overview of the biosynthesis, catabolism, and regulation of glucosinolates, a class of sulfur-containing compounds found in cruciferous plants. The paper discusses the importance of glucosinolates in plant defense against herbivores and pathogens, as well as their potential health benefits for humans. The authors describe the biosynthetic pathway of glucosinolates, including the role of key enzymes and transcription factors in controlling their production. The paper also highlights the mechanisms involved in the

					catabolism of glucosinolates, including the role of myrosinase and its interaction with glucosinolate hydrolysis products. Overall, the paper provides a comprehensive overview of the current knowledge on glucosinolate metabolism and its regulation.
2.	Glucosinolates in *Brassica* vegetables : The influence of the food supply chain on intake, bioavailability and human health			[2]	The paper reviews the current knowledge on the bioavailability and metabolism of glucosinolates, as well as the effects of cooking, storage, and processing on their content and bioactivity. The authors also discuss the potential health benefits of glucosinolates, including their role in cancer prevention, cardiovascular health, and immune function.
3.	Regulation of glucosinolate biosynthesis			[3]	The review article provides an in-depth overview of the mechanisms involved in the regulation of glucosinolate biosynthesis in plants. The paper discusses the complex network of transcription factors, signaling molecules, and environmental cues that interact to control the expression of genes involved in glucosinolate biosynthesis. The author also discuss on how the regulation of glucosinolate biosynthesis is ecologically relevant for plants, how it is controlled by transcription factors, and how this transcriptional machinery interacts with hormonal, environmental, and epigenetic mechanisms. The paper highlighted the main factors of glucosinolate regulation, MYB and basic helix–loop–helix transcription factors, as well as the plant hormone jasmonate, which together with other hormones and environmental signals allow the coordinated and rapid regulation of glucosinolate genes. The authors also included the current understanding of the role of epigenetic modifications, such as DNA methylation and histone modifications, in the regulation of glucosinolate biosynthesis. Overall, the paper provides a detailed overview of the current state of research on the regulation of glucosinolate biosynthesis and the potential implications for plant biology.
4.	Glucosinolate Biosynthesis and the Glucosinolate–Myrosinase System in Plant Defense			[4]	This review paper highlighted the current knowledge on the biosynthesis and function of glucosinolates in plant defense against herbivores and pathogens. The author describes the biosynthetic pathway of glucosinolates and the role of different enzymes and regulatory factors in their production. It also focused the role of the glucosinolate-myrosinase system in plant defense, including the activation of glucosinolates by myrosinase enzymes and the production of toxic hydrolysis products that act as insect deterrents. The paper has specifically given emphasize on a new glucosinolate biosynthesis pathway to kill the pests, the “mustard oil bomb”. So, the author clearly explained this that, with the help of these defense mechanisms will not only allow us to harness the benefits of this group of natural metabolites for enhancing pest control in Brassicales crops but also to transfer the “mustard oil bomb” to non-glucosinolate producing crops to boost their defense and thereby reduce the use of chemical pesticides.
5.	The Roles of Cruciferae Glucosinolates in Disease and Pest Resistance			[5]	The research paper describes the current understanding of the roles of glucosinolates in plant defense against pests and diseases. The authors describe the chemical structure and biosynthesis of glucosinolates and their hydrolysis products, which have been shown to exhibit toxic effects on herbivores and pathogens. The paper

					highlights the role of myrosinase enzymes in the hydrolysis of glucosinolates and the subsequent production of bioactive compounds such as isothiocyanates, nitriles, and thiocyanates. The authors also describe the effects of environmental factors, such as light, temperature, and nutrient availability, on glucosinolate biosynthesis and plant defense. The paper further discusses the potential use of glucosinolates and their derivatives in pest and disease management, including their effects on plant-parasitic nematodes, fungal pathogens, and insect pests. Overall, the paper provides a comprehensive overview of the current knowledge on the roles of glucosinolates in plant defense and their potential applications in agriculture.

Conclusion :-

It is highly required to carry out the research on engineering glucosinolate biosynthesis in transgenic plants, its metabolic pathway analysis and potential applications in human health as it will focus on these important aspects:-

The exact metabolic pathway involved to kill the cancerous cells by the glucosinolates in different types of cancer.

Producing the higher conc. of glucosinolates in the transgenic plants to initiate its antioxidant, antimicrobial, antifungal and anticancer property in humans.

Use of the fruit produced from the transgenic plant as a natural therapy towards the treatment of various cancer types instead of synthetic chemotherapeutic drugs.

Establishing a safe concentration level of glucosinolates for human consumption which will induce anti-cancerous property.

Providing a clinical data after human clinical trials and comparing the efficiency of this natural therapy over the chemotherapeutic drugs as these synthetic drugs has its own side effects.

References

[1] “Glucosinolate metabolism and its control” by C Douglas Grubb et al.

[2] “Glucosinolates in Brassica vegetables: the influence of the food supply chain on intake, bioavailability and human health” by Ruud Verkerk et al.

[3] “Regulation of glucosinolate biosynthesis” by Simon Mitreiter et al.

[4] “Glucosinolate Biosynthesis and the Glucosinolate–Myrosinase System in Plant Defense” by Shweta Chhajed ,Islam Mostafa ,Yan He ,Maged Abou-Hashem , Maher El-Domiaty and Sixue Chen.

[5] “The Roles of Cruciferae Glucosinolates in Disease and Pest Resistance” by Zeci Liu, Huiping Wang, Jianming Xie, Jian Lv, Guobin Zhang, Linli Hu, Shilei Luo, Lushan Li, and Jihua Yu.