The Pharma Innovation Journal 2023; 12(10): 771-774

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2023; 12(10): 771-774

www.thepharmajournal.com
Received: 01-07-2023
Accepted: 04-08-2023

Mulakala Geeta Bhabani
Lovely Professional University, Phagwara, Punjab, India

Corresponding Author:
Mulakala Geeta Bhabani
Lovely Professional University, Phagwara, Punjab, India

To study the effect of germination conditions on the nutritional and microbial quality of microgreens

Mulakala Geeta Bhabani

Abstract
Microgreens are nutrient-rich young plants harvested during their early growth stages, known for their intense flavors, vibrant colors, and various health advantages. A study investigated the impact of ultrasonic treatment on black carrot microgreens and found significant enhancements in germination rate, length, phenolic and flavonoid content, beta carotene, chlorophyll, and carotenoid content. Although antioxidant activity and ascorbic acid levels were affected by treatment time and temperature, the sensory attributes remained unaffected. The research indicates that using ultrasonic treatment can be a safe and effective approach to improve the safety and quality of microgreens, offering potential benefits in producing these nutritious and flavorful miniature plants.

Keywords: Microgreen, ultrasound, nutritional compound, antioxidant activity

Introduction
Microgreens are young plants harvested when their first true leaves appear. They grow quickly in trays or containers using hydroponics or soil methods, taking 7 to 21 days. Popular varieties include amaranth, beets, kale, radish, and Swiss chard, with many others available. Microgreens are rich in bioactive compounds like phenolic compounds and GABA, boosting their antioxidant properties. Ultrasound, when combined with other methods, can eliminate foodborne bacteria. To make the most of ultrasound in sprout production, optimize treatment parameters and integrate genomics, proteomics, transcriptomics, and metabolomics.

Material and Methods
The research was undertaken at Lovely Professional University, specifically in the Department of Food Technology and Nutrition, which is part of the School of Agriculture located in Phagwara, Punjab. The study centered on the utilization of black carrot seeds and involved the use of an ultrasonic bath sonicator for experimentation.

Ultrasound Seed Treatment
A total of 16 ultrasonic exposures were carried out, each at a frequency of 40 kHz. In each treatment, 60 black carrot seeds were used, and this entire process was replicated three times. On average, the weight of 60 black carrot seeds was 991.3 mg. The experimental design followed a Completely Randomised Design (CRD), with three repetitions for each seed sample. For a duration of six hours, the seeds were soaked in a solution of distilled water. Subsequently, 60 seeds from each treatment were meticulously selected, placed in muslin fabric bags in duplicate, and submerged in the tank of a sonicator bath. Before commencing the ultrasound treatment, the tank was filled with distilled water that had been preheated for 25 minutes.

Production of Microgreens
Microgreens were cultivated in an ideal climate-controlled environment inside a state-of- the-art polyhouse, utilizing a growth medium composed of vermicompost and coco peat. Prior to sowing, the seeds underwent sonication treatment, and each treatment was replicated three times. The seeds were manually sown into plastic seedling trays, each containing 98 compartments. A total of sixteen trays were prepared for each treatment and placed on thermocol stands within the polyhouse.
After sowing, the microgreens were initially irrigated manually and later by an automated irrigation system to ensure optimal growth conditions.

No fertilizers or fertigation were utilized throughout the growing season. The polyhouse was meticulously maintained to provide optimal environmental conditions in terms of temperature, humidity, and air circulation. The microgreens were harvested once the first true leaves had developed.

Growth Parameters

Several characteristics were assessed to evaluate the germination and growth performance of microgreens, including: Germination Percentage: This measures the percentage of viable seeds that successfully sprout under specific conditions and is calculated using the formula: Germination Percentage = (Number of Germinated Seeds / Total Number of Seeds) * 100. It is an essential factor in assessing overall seed quality. Germination Rate: This assesses how quickly viable seeds germinate and start growing under favorable germination conditions. The Germination Rate Index (GRI) is determined by calculating the average number of days it takes for the seeds to germinate. In conclusion, this study undertook a comprehensive analysis of microgreens, focusing on key components and antioxidant activity. Several analytical methods were employed to assess the nutritional and antioxidant properties of these tiny greens, shedding light on their potential health benefits. Firstly, the study investigated the ascorbic acid content. This essential vitamin, known for its antioxidant properties, was determined using a meticulous process involving the mixing of the material with 4% oxalic acid, subsequent filtration, and titration with 2,6-dichlorophenol indophenol. This step helped quantify the concentration of ascorbic acid, a vital component contributing to the nutritional quality of microgreens. Secondly, the Total Phenolic Content (TPC) was evaluated. Gallic acid served as a reference standard to create a calibration curve. Various concentrations of gallic acid solutions were prepared and mixed with reagents to initiate a reaction. After an incubation period and subsequent measurement of absorbance, the TPC was determined. This analysis provided insights into the presence of phenolic compounds, which are renowned for their antioxidant and health-promoting properties. Thirdly, the study assessed the Total Flavonoid Content (TFC). To achieve this, a stock solution of quercetin was prepared and used to create a calibration curve. Different concentrations of quercetin were produced by dilution and mixed with specific reagents. After a defined incubation period, the absorbance at a particular wavelength was measured. This step allowed for the determination of flavonoid content, which is associated with various health benefits. Furthermore, the DPPH Free Radical Scavenging Activity was examined. Similar to the TFC analysis, quercetin was used to establish a calibration curve. The extract was combined with reagents, and after a specific reaction time, the absorbance was measured. This assessment provided insights into the microgreens' potential to scavenge free radicals, indicating their antioxidant activity and potential health-related benefits. Statistical analysis was conducted using a Completely Randomised Design (CRD). The results were presented as mean values with standard deviations (SD), providing a comprehensive overview of the data. The LSD pair-wise comparison test was employed to determine significant differences between mean values. This rigorous statistical approach ensured the reliability and robustness of the study's findings.

Results and Discussion

In this study, the impact of ultrasonic treatment on black carrot microgreens was investigated comprehensively. The findings revealed significant enhancements in germination percentage and rate when subjected to ultrasonic treatment, with the most favorable outcomes observed at 11 minutes of treatment at 30 °C. Moreover, ultrasonic treatment led to changes in seed structure, potentially contributing to improved germination rates. However, there was a reduction in the ascorbic acid content in the microgreens post-treatment, especially at higher temperatures and longer durations. On the positive side, ultrasonic treatment notably increased the levels of total phenolics and flavonoids, indicating the potential health benefits of consuming these microgreens. Furthermore, the study highlighted a substantial increase in antioxidant activity, attributed to ultrasonic treatment, which facilitated the release and extraction of bioactive compounds. Overall, these findings underscore the potential of ultrasonic treatment in enhancing the nutritional and antioxidant properties of black carrot microgreens, making them a promising option for health-conscious consumers and researchers alike.

Conclusion

To summarize, the study demonstrated the positive effects of ultrasound treatment on black carrot microgreens. Ultrasound improved germination rates, growth, and nutrient content without compromising sensory attributes. Treated microgreens showed longer lengths, higher nutritional value, and increased appeal. The method also proves beneficial for breaking seed dormancy in certain plant species, simplifying the germination process. Overall, the findings suggest that ultrasound holds promise as an efficient and alternative technique for enhancing microgreens' quality and cultivating a wider range of plant species.

References

1. Adriana M, Florina-Maria G. (N.D.). Stage of Knowledge on Cultivation of Microgreens Plants Stadiul Cunoaşterii Asupra Cultivării Plantelor Legumicole Microgreens. www.Greenharvest.Com.Au/Downloads/Sproutingbooklet.Pdf
2. Blando F, Marchello S, Maiorano G, Durante M, Signore, A, Laus MN, *et al*. Bioactive Compounds and Antioxidant Capacity in Anthocyanin-Rich Carrots: A Comparison Between the Black Carrot and The Apulian Landrace "Polignano" Carrot. Plants. 2021;10(3):564.
3. Božić A, Milošević S. (N.D.). Tourism In Function of Development of The Republic of Serbia Tourism and Rural Development (Tisc 2020)-Thematic Proceedings I 94 Microgreens in Gastronomic Offer of Belgrade Restaurants.
4. Caracciolo F, El-Nakhel C, Raimondo M, Kyriacou MC, Cembalo L, De Pascale S, *et al*. Sensory Attributes and Consumer Acceptability of 12 Microgreens Species. Agronomy, 2020, 10(7). Https://Doi.Org/10.3390/Agronomy10071043
5. Chilingirov V. (N.D.). Study of The Effect of Ultrasound on Vegetable Crops in Different Exposures. 2018;62:403-408
6. Dalal D, Mainani R, Thakker R, Solanki H. A Study of Selected Microgreens in Soil-Less Media. International Association of Biologicals and Computational Digest.

2022;1(2):228-230.
7. Deore A, Athmaselvi KA, Venkatachalapathy N. Effect Of Ultrasound and Microwave Pretreatment on Sprouting, Gaba, Bioactive Compounds, and Other Physicochemical Properties of Sorghum. Grain & Oil Science and Technology; c2023.
8. Dhaka AS, Dikshit HK, Mishra GP, Tontang MT, Meena NL, Kumar RR, *et al*. Evaluation Of Growth Conditions, Antioxidant Potential, And Sensory Attributes of Six Diverse Microgreens Species. Agriculture. 2023;13(3):676. Https://Doi.Org/10.3390/Agriculture13030676
9. Di Gioia F, De Bellis P, Mininni C, Santamaria P, Serio F. Physicochemical, Agronomical and Microbiological Evaluation of Alternative Growing Media for The Production of Rapini (*Brassica rapa* L.) Microgreens. Journal of the Science of Food and Agriculture. 2017;97(4):1212-1219. Https://Doi.Org/10.1002/Jsfa.7852
10. Ebert AW. Sprouts and Microgreens—Novel Food Sources for Healthy Diets. In Plants, 2022, 11(4). Mdpi. Https://Doi.Org/10.3390/Plants11040571
11. El-Nakhel C, Ciriello M, Formisano L, Pannico A, Giordano M, Gentile BR *et al*. Protein Hydrolysate Combined with Hydroponics Divergently Modifies Growth and Shuffles Pigments and Free Amino Acids of Carrot and Dill Microgreens. Horticulturae. 2021;7(9):279.
12. Ghoora MD, Haldipur AC, Srividya N. Comparative Evaluation of Phytochemical Content, Antioxidant Capacities and Overall Antioxidant Potential of Select Culinary Microgreens. Journal of Agriculture and Food Research, 2020, 2. Https://Doi.Org/10.1016/J.Jafr.2020.100046
13. Giordano M, Petropoulos SA, Kyriacou MC, Graziani G, Zarrelli A, Rouphael Y, *et al*. Nutritive And Phytochemical Composition of Aromatic Microgreen Herbs and Spices Belonging to The Apiaceae Family. Plants, 2022, 11(22). Https://Doi.Org/10.3390/Plants11223057
14. Islam MZ, Park BJ, Lee YT. Effect of Salinity Stress on Bioactive Compounds and Antioxidant Activity of Wheat Microgreen Extract Under Organic Cultivation Conditions. International Journal of Biological Macromolecules. 2019;140:631-636. Https://Doi.Org/10.1016/J.Ijbiomac.2019.08.090
15. Kim HJ, Feng H, Kushad MM, Fan X. Effects Of Ultrasound, Irradiation, And Acidic Electrolyzed Water on Germination of Alfalfa and Broccoli Seeds and Escherichia Coli O157: H7. Journal Of Food Science. 2006;71(6):M168-M173.
16. Koley TK, Singh S, Khemariya P, Sarkar A, Kaur C, Chaurasia SNS, *et al*. Evaluation Of Bioactive Properties of Indian Carrot (*Daucus carota* L.): A Chemometric Approach. Food Research International. 2014;60:76–85. Https://Doi.Org/10.1016/J.Foodres.2013.12.006
17. Kou L, Luo Y, Yang T, Xiao Z, Turner ER, Lester GE, *et al*. Postharvest Biology, Quality and Shelf Life of Buckwheat Microgreens. Lwt. 2013;51(1):73-78. Https://Doi.Org/10.1016/J.Lwt.2012.11.017
18. Kyriacou MC, Rouphael Y, Di Gioia F, Kyratzis A, Serio F, Renna M, *et al*. Micro-Scale Vegetable Production and The Rise of Microgreens. In Trends in Food Science and Technology. Elsevier Ltd. 2016;57:103-115. Https://Doi.Org/10.1016/J.Tifs.2016.09.005
19. Liu HK, Li ZH, Zhang XW, Liu YP, Hu JG, Yang CW, *et al*. The Effects of Ultrasound on The Growth, Nutritional Quality and Microbiological Quality of Sprouts. In Trends in Food Science and Technology Elsevier Ltd; 2021;111:292-300. Https://Doi.Org/10.1016/J.Tifs.2021.02.065
20. Martínez-Zamora L, Castillejo N, Artés-Hernández F. Ultrasounds And a Postharvest Photoperiod to Enhance the Synthesis of Sulforaphane and Antioxidants in Rocket Sprouts. Antioxidants. 2022;11(8):1490.
21. Mir SA, Shah MA, Mir MM. Microgreens: Production, Shelf Life, and Bioactive Components. In Critical Reviews in Food Science and Nutrition Taylor And Francis Inc. 2017;57(12):2730-2736. Https://Doi.Org/10.1080/10408398.2016.1144557
22. Neto L, Millan-Sango D, Brincat JP, Cunha Luí M, Valdramidis VP. Impact of Ultrasound Decontamination on The Microbial and Sensory Quality of Fresh Produce, Food Control; c2019. Doi: Https://Doi.Org/10.1016/J.Foodcont.2019.04.047.
23. Niroula A, Khatri S, Timilsina R, Khadka D, Khadka A, Ojha P. Profile of Chlorophylls and Carotenoids of Wheat (*Triticum aestivum* L.) And Barley (*Hordeum vulgare* L.) Microgreens. Journal of Food Science and Technology. 2019;56(5):2758-2763. Https://Doi.Org/10.1007/S13197-019-03768-9
24. Okokon EJ, Okokon EO. Proximate Analysis and Sensory Evaluation of Freshly Produced Apple Fruit Juice Stored at Different Temperatures and Treated with Natural and Artificial Preservatives. Global Journal of Pure and Applied Sciences. 2019;25(1):31. Https://Doi.Org/10.4314/Gjpas.V25i1.5
25. Phuyal N, Jha PK, Raturi PP, Rajbhandary S. Total Phenolic, Flavonoid Contents, And Antioxidant Activities of Fruit, Seed, And Bark Extracts of Zanthoxylum Armatum Dc. Scientific World Journal; c2020. Https://Doi.Org/10.1155/2020/8780704
26. Re R, Pellegrini N, Proteggente A, Pannala A, Yang M, Rice-Evans C. Antioxidant Activity Applying an Improved Abts Radical Cation Decolorization Assay. Free Radical Biology and Medicine. 1999;26(9-10):1231-1237.
27. Renna M, Paradiso VM. Ongoing Research on Microgreens: Nutritional Properties, Shelf-Life, Sustainable Production, Innovative Growing and Processing Approaches. In Foods Mdpi Multidisciplinary Digital Publishing Institute. 2020, 9(6). Https://Doi.Org/10.3390/Foods9060826
28. Saengha W, Karirat T, Buranrat B, Matra K, Deeseenthum S, Katisart T, *et al*. Cold Plasma Treatment on Mustard Green Seeds and Its Effect on Growth, Isothiocyanates, Antioxidant Activity and Anticancer Activity of Microgreens. Int. J Agric. Biol. 2021;25:667-676.
29. Senevirathne GI, Gama-Arachchige NS, Karunaratne AM. Germination, Harvesting Stage, Antioxidant Activity and Consumer Acceptance of Ten Microgreens. Ceylon Journal of Science. 2019;48(1):91. Https://Doi.Org/10.4038/Cjs.V48i1.7593
30. Toscano S, Cavallaro V, Ferrante A, Romano D, Patané

C. Effects Of Different Light Spectra on Final Biomass Production and Nutritional Quality of Two Microgreens. Plants. 2021 Jul 31;10(8):1584. Https://Doi.Org/10.3390/Plants10081584

31. Treadwell DD, Hochmuth R, Landrum L, Laughlin, W. (N.D.). Microgreens: A New Specialty Crop 1; c2020. Https://Edis.Ifas.Ufl.Edu.
32. Wani S, Basir SF. Analysis Of Antioxidant Acitivity, Total Phenolic and Total Flavonoid Contents of Allium Sativum, Mentha Arvensis and Murraya Koenigii. Int. J. Adv. Res. Sci and Eng. 2018;7(4):2632-2646.
33. Yang H, Gao J, Yang A, Chen H. The Ultrasound-Treated Soybean Seeds Improve Edibility and Nutritional Quality of Soybean Sprouts. Food Research International. 2015;77:704-710.