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Comparative Analysis on The Overall Visual Quality of Green Gram Microgreens

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ABSTRACT

Microgreens are young vegetable greens, harvested between 10 to 14 days from seeding. Though microgreens are small in stature, they contain extremely high levels of powerful vitamins, minerals and health supporting components. Since microgreens are easy to grow at home with minimal supplies, they can be a great source of daily nutritional requirements.They also possess various health promoting factors and are considered as functional foods.Microgreens boast distinctive flavour and are used to enhance the visual appeal of the main dishes and salads. If the microgreens are stored and packaged properly by controlling the moisture and temperature, they can have an improved shelf life. Poor post storage conditions can result in the rotting of leaves. However, literature on the sensorial parameters of microgreens remains limited. In this study, the overall visual quality of green gram microgreens grown in different media were analysed.

Keywords: Microgreens, Green gram, Overall Visual Quality, Sensorial parameters, Mechanical damage

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INTRODUCTION

Microgreens are the new emerging specialty food products as potential functional foods, which are gaining popularity and increased attention nowadays (Mir et al. 2017). Frequently called as "vegetable confetti," microgreens are young, tender greens, packed with micronutrients and bioactive compounds (Treadwell et al. 2020). Although they are small, microgreens have delicate textures and distinctive flavours (Choe et al. 2018). According to Renna and Paradiso (2020) microgreens can be produced indoors, in limited space growing systems as a sustainable form of cultivation, using substrates from renewable sources. Common microgreens are grown mainly from mustard, cabbage, radish, buckwheat, lettuce, spinach, etc. However, they typically have a short shelf life due to rapid product deterioration (Mir et al. 2017). This study was conducted to evaluate the overall visual quality of microgreens. The microgreen variety used in this study was green gram.

Materials and Methods

High yielding variety seeds of green gram were raised to produce microgreens in plastic trays with perforations for drainage. The media (m) used for cultivation were -

- m0 - Control
- m1 - Tissue paper
- m2 - Cocopeat
- m3 - Cocopeat with soil
- m4 - Soil
- m5 – Burlap

The seeds were soaked overnight before broadcasting on the trays filled with two inches of medium. Water was sprinkled to keep the surface moist. The seeds germinated on the second day and sprouts were formed on the next day. The microgreens were harvested after the first leaves had fully expanded and before the true leaves had emerged. Plate 1 shows the green gram microgreens grown on different media, just before harvesting.

The harvested greens were rinsed in tap water and then spread in a paper towel to remove the excess water from the leaves. The leaves with no moisture were stored in refrigerator (Temperature - 4^{0}C and relative humidity - 100%) in plastic containers. Sensorial parameters of the refrigerated greens were then examined by a panel, at various intervals up to 9 days.

Results and Discussion

The plants were analysed for their visual quality on the 1st, 3rd, 6th, and 9th days after harvest, by a team of twelve trained testers. The following visual attributes: colour, freshness, mechanical damage, brightness, and general appearance were analysed using the Qualitative Descriptive Analysis (QDA) (Oliveira et al. 2013). The ranked sensory scores were compared using the Kruskal Wallis test. The hedonic rating scale ranging from 9 to 1 was used to indicate the rankings of colour, freshness, brightness and general appearance; '9' indicated the best acceptable score and '1',the least acceptable. As for mechanical damage, the scoring was

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reversed from 1 to 9;'1'indicating less damage and '9' referring to most damage.

When microgreens are harvested, they have high respiration rate (Chandra et al. 2012). Mir et al. (2017) stated that the shelf life of microgreens is 3 to 5 days at ambient temperature. In this study, on day 1, it was observed that, colour of green gram microgreens grown in m4 had the highest mean score of 8.750 and there was no significant difference between the colour of microgreens grown in m2 and m3. The p value for the scores for colour was found to be 0.014 for day 1. The highest mean score for freshness was also observed in m4 (9.000) and the p value was 0.002; the highest mean score for brightness was again observed in m4 (8.750) and the p value was 0.026 for day 1. In case of mechanical damage, the lowest mean score indicating less damage (1.167) with p value of 0.038 was obtained for m4, as shown in Table 1. The highest mean score for general appearance of green gram microgreens for day 1, was found to be 8.667 with a p value of 0.002 for m4. Harvested microgreens must be kept cold to maintain quality. Depending on cultivar and storage conditions, quality may be maintained for over 14 days (Turner et al. 2020).

Table 1: Mean Scores of Sensory Evaluation – Colour, Freshness, Mechanical Damage and Brightness of Green gram microgreens

Treat-ment	Colour				Freshness				Mechanical Damage				Brightness			
	D1	D3	D6	D9	D1	D3	D6	D9	D1	D3	D6	D9	D1	D3	D6	D9
m0	7.667	7.333	5.667	1.50	8.333	6.333	3.750	1.417	1.750	3.917	6.750	8.417	8.000	7.000	5.750	1.417
m1	8.083	7.667	6.250	2.25	8.500	7.583	5.417	2.667	1.417	3.583	6.167	7.083	8.167	7.667	6.250	2.917
m2	8.500	8.000	7.000	3.50	8.833	8.000	5.917	3.833	1.333	3.250	5.833	6.583	8.333	7.833	6.667	4.750
m3	8.583	8.167	7.500	4.25	8.917	8.250	7.250	5.917	1.333	3.083	5.500	4.167	8.667	8.167	6.917	5.833
m4	8.750	8.417	8.250	5.50	9.000	8.583	8.167	6.583	1.167	2.250	3.917	3.667	8.750	8.333	8.000	7.500
m5	8.083	7.833	6.500	3.75	8.583	7.667	6.833	4.833	1.667	3.500	6.417	5.000	8.167	7.583	6.583	5.250
KW χ2 Value	14.211	21.616	49.461	57.392	19.105	46.139	58.307	61.495	11.759	23.995	44.435	61.027	12.764	28.394	45.123	61.999
p Value	0.014	0.001	0	0	0.002	0	0	0	0.038	0	0	0	0.026	0	0	0

On day 3, the highest mean score for colour was found to be 8.417 for m4 with a p value of 0.001, m4 had the highest mean score for freshness also, which was 8.583, it also had the highest mean score for brightness, which was 8.333 on day 3. For mechanical damage, the lowest mean score was observed for m4 (2.250) and the p value as found to be zero. This indicated that there was least damage in m4 and there was a significant difference between m4 and others. For the general appearance of green gram microgreens on day 3, the highest mean score was 8.583 which was observed in m4 as shown in Table 2.

Table 2: Mean Scores of Sensory Evaluation – General Appearance of Green gram microgreens

Treatment	General Appearance			
	D1	D3	D6	D9
m0	7.833	6.917	5.250	1.500
m1	8.000	7.583	6.083	3.250
m2	8.250	8.000	6.333	5.333
m3	8.583	8.250	6.833	6.083
m4	8.667	8.583	8.167	7.583
m5	7.833	7.667	6.500	5.583
K W χ2 Value	19.198	37.781	48.528	60.255
p Value	0.002	0	0	0

There are no food code requirements for microgreens, but preliminary studies suggest that microgreens should be stored at temperatures of ≤5 °C (Kou et al. 2013; Xiao et al. 2014). Microgreens freeze rapidly if held below 0 °C, causing substantial physical damage. Microgreens resistant to chilling injury can be held at temperatures as low as 1 °C (Berba and Uchanski 2012).

On day 6, the lowest mean score for colour was observed in m4 (2.250) and the p value was found to be zero as shown in Table 1. The highest mean score for colour was found to be 8.250 whereas the highest mean score for freshness was 8.167 and the highest mean score for brightness was observed to be 8.000 for m4 in day 3. In case of mechanical damage, the least damage score was found to be 3.917 in m4. There was a significant difference observed in general appearance of green gram microgreens of different treatments for day 6 and the highest mean was observed in m4 (8.167). Although high humidity is necessary to prevent dehydration, it also promotes microbial growth and decay. Thus, a combination of adequate cold chain and suitable modified atmosphere packaging (MAP) are essential to reduce respiration rates, prevent moisture loss, reduce environmental contamination, and inhibit growth of spoilage and pathogenic

Fig. 1: Green gram microgreens grown in different media

Fig. 2: Green gram microgreensgrown in m4

microorganisms (Berba and Uchanski 2012).

On day 9, it was observed that, colour of green gram microgreens grown in m4 had the highest mean score of 5.50. The highest mean score for freshness was observed to be 6.583 and the highest mean score for brightness was observed to be 7.500 for m4 in day 9. In case of mechanical damage, the lowest mean score was 3.667 indicating less damage with a p value of zero for m4 as shown in Table 1. The highest mean score of general appearance in green gram microgreens for day 9 was seen for m4 (7.583) and there was significant difference in the values between the different treatments. A delicate balance is required to maintain temperature, moisture, and atmosphere that optimize the quality retention and shelf life of microgreens, while discouraging growth of spoilage of microbes and human pathogens (Turner et al. 2020).

The moisture content, tannins, polyphenols, flavonoids fibre present in the green gram microgreens grown in soil were analysed, and the values are given in Table 3.

The calcium, iron, β-carotene, Vitamin C and Total minerals content of m4 microgreens were also analysed using suitable laboratory techniques. Green gram microgreens (m4) exhibit a significant calcium content of 30.42 mg, while their Vitamin C content is around 1.3 mg.

Table 3: Nutritional Composition of Green gram microgreens grown in m4

Nutritional Parameters	m4
Moisture (%)	88.23
Tannins (mg)	1.48
Polyphenols (mg)	0.46
Flavonoids (mg)	1.99
Fibre (g)	2.14
Calcium (mg)	30.42
Iron(mg)	1.33
β-carotene (µg)	27.01
Vitamin C (mg)	1.3
Total minerals (g)	0.33

CONCLUSION

Based on the results obtained it was found that the green gram microgreens grown in m4 (soil) (Plate 2) had the highest mean scores for colour, freshness, mechanical damage, brightness, and general appearance on the all the observed days. This indicates that soil is the medium most suitable for obtaining quality micro greens from green gram.

In recent years, micro scale vegetables have become increasingly popular for homemade food preparations (Galieni et al. 2020). Research has explored preharvest and postharvest interventions, such as calcium treatments, modified atmosphere packaging, temperature control, and light, to maintain quality, augment nutritional value, and extension of shelf life (Turner et al. 2020). Therefore, further research is needed to optimize both production and storage conditions to improve the safety, quality and shelf life of microgreens, as they can address the demands of various categories of consumers like vegans or raw-foodists (Renna and Paradiso 2020).

CONFLICT OF INTEREST

All the author both individually and collectively, affirms that they do not possess any conflicts of interest either directly or indirectly related to the research being reported in the publication.

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