Development and proximate analysis of wheatgrass (*Triticum aestivum*) powder incorporated muffins

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Abstract

In response to increasing consumer demand for functional foods with health-enhancing properties, the present study explores the incorporation of wheatgrass powder (*Triticum aestivum*) into muffins to enhance their nutritional value.

Wheatgrass powder was incorporated at 2%, 4%, and 6% levels into muffin formulations, replacing an equivalent amount of refined wheat flour, resulting in three treatments (M1, M2, and M3) alongside a control sample (M0). Standard baking procedures were followed, and the nutritional quality of the muffins was analysed.

The results revealed a significant ($p \leq 0.05$) increase in ash, crude protein, and crude fibre content with higher levels of wheatgrass incorporation. Ash content increased from 2.56% in M0 to 2.68% in M3, reflecting the mineral richness of wheatgrass. Crude protein content rose significantly from 8.5% in the control to 10.29% in M3, while crude fibre content doubled from 1.5% to 3.0%, enhancing the product's dietary fibre profile. Moisture content showed a significant decrease from 19.17% in M0 to 16.84% in M3, potentially improving shelf life. However, fat content remained statistically unaffected across all formulations.

This study demonstrates that wheatgrass can effectively be used to develop nutritionally superior muffins with enhanced protein and fibre content, making them a promising functional bakery product suitable for health-conscious consumers. The findings highlight the potential of plant-based fortification in improving mainstream food products.

Keywords: *Functional food, Muffins, Proximate analysis, Wheatgrass*

Introduction

In recent years, there has been a growing emphasis on the development of functional foods that not only provide basic nutrition but also offer health-promoting benefits (Vignesh, A., *et al*, 2024). Among such functional ingredients, wheatgrass (*Triticum aestivum*) has gained significant attention due to its rich nutritional profile and therapeutic properties (Choudhary, S., et al, 2021). Known for its high content of chlorophyll, vitamins (A, C, and E), minerals, enzymes, and amino acids (Mishra, N., 2025), wheatgrass has been traditionally used as a dietary supplement to improve immunity, detoxification, and overall health (Tsai, C. C., et al.,2013).

Bakery products, especially muffins, are widely accepted by consumers of all age groups due to their palatability, convenience, and variety (Yadav, K. C.,2022). However, conventional muffins made from refined wheat flour often lack dietary fibre and essential micronutrients (Panchal, F. R. (2022). Incorporating wheatgrass into muffins presents a novel approach to enhance their nutritional quality, thereby transforming them into functional bakery products.

The present study aims to develop wheatgrass-incorporated muffins and evaluate their proximate composition, including moisture, protein, fat, ash, fibre, and carbohydrate content. By integrating wheatgrass into a popular bakery item, this research seeks to promote healthier food choices and explore the feasibility of utilizing plant-based supplements in mainstream food products.

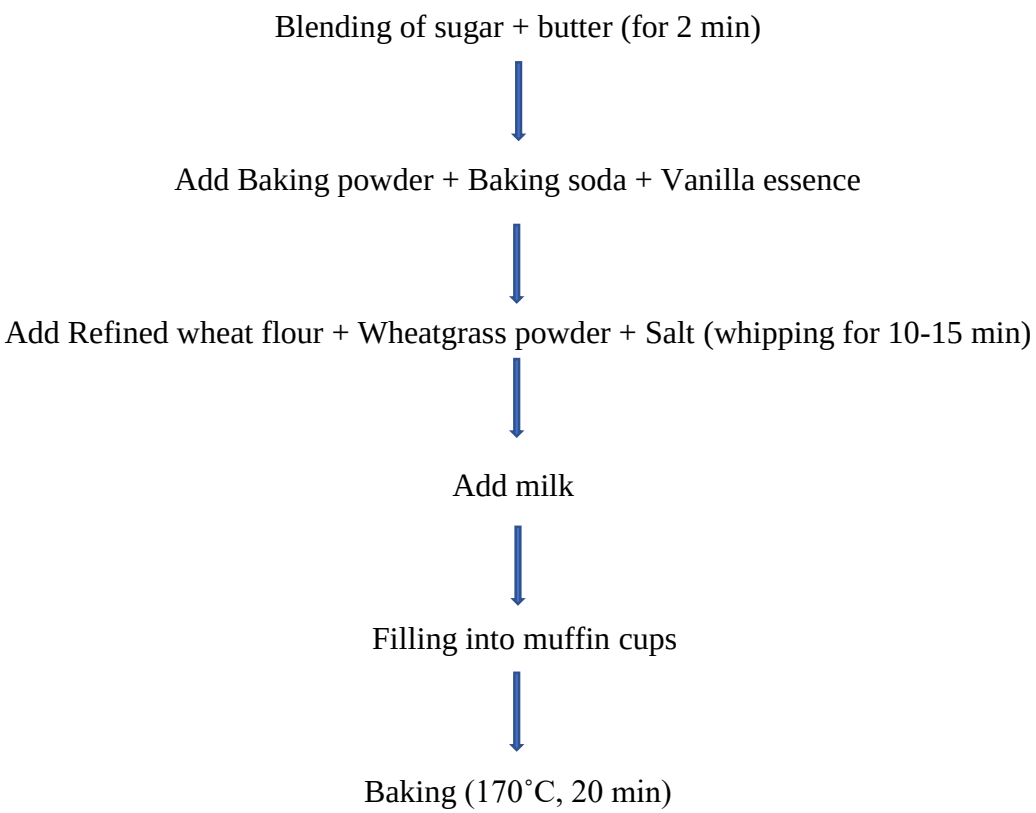
Methodology

Wheatgrass powder was prepared by researcher earlier and it was incorporated in the muffins at 2,4 and 6% level so that muffins formula included refined wheat flour and wheatgrass powder in the ratio of 98:2, 96:4 and 94:6 respectively. While, control muffins were made by refined wheat flour only in addition to butter, sugar, milk, baking powder, baking soda and salt etc. Control muffins were named M0, wheatgrass powder incorporated muffins were named M1, M2 and M3 for 2,4 and 6% incorporated muffins respectively. All materials have been explained in Table 1.

Table 1: Ingredients used in the preparation of muffins

Sr no.	Ingredients	B0	B1	B2	B3
1.	Refined wheat flour (g)	100	98	96	94
2.	Wheatgrass powder (g)	00	2	4	6
3.	Butter (g)	50	50	50	50
4.	Baking powder (g)	4	4	4	4
5.	Baking soda (g)	1	1	1	1
6.	Salt (g)	0.4	0.4	0.4	0.4
7.	Sugar (g)	50	50	50	50
8.	Milk (ml)	50	50	50	50
9.	Vanilla essence (ml)	1	1	1	1

Baking schedule followed for the preparation of buns:



Nutritional analysis:

Wheatgrass powder incorporated muffins were analysed for proximate analysis (moisture, ash, crude protein, crude fibre and crude fat) according to AOAC 2000.

Result and discussion

Table 1: Proximate composition of wheatgrass powder incorporated muffins (per 100g)

	Moisture (%)	Ash (g)	Crude fat (g)	Crude protein (g)	Crude fibre (g)
M0	19.17 ± 0.35	2.56 ± 0.05	19.78 ± 0.29	8.5 ± 0.28	1.5 ± 0.03
M1	18.5 ± 0.20	2.60 ± 0.02	19.34 ± 0.31	9.15 ± 0.07	2.19 ± 0.19
M2	17.69 ± 0.31	2.64 ± 0.01	19.23 ± 0.30	9.6 ± 0.20	2.5 ± 0.05
M3	16.84 ± 0.18	2.68 ± 0.02	19.14 ± 0.26	10.29 ± 0.33	3.00 ± 0.20
C.D.($p \leq 0.05$)	**0.50**	**0.05**	**NS**	**0.45**	**0.26**

Values are Mean± S.D. of three independent determinations.

C.D.- Critical difference

A significant ($p \leq 0.05$) decrease in moisture content was observed with increasing levels of wheatgrass incorporation. The control sample (M0) exhibited the highest moisture content (19.17%), which progressively declined to 16.84% in M3 (6% wheatgrass). This reduction may be attributed to the high fibre content of wheatgrass, which possibly interferes with water retention capacity of the muffin matrix. The reduction in moisture could influence the texture and shelf-life of the muffins, potentially leading to a firmer crumb and longer shelf stability.

The ash content of the wheatgrass-incorporated muffins showed a progressive increase with the rising levels of wheatgrass powder incorporation. The control sample (M0) recorded an ash content of 2.56 g**,** which increased to 2.60 g**,** 2.64 g**,** and 2.68 g in treatments M1, M2, and M3, respectively. The increase in ash content is attributed to the higher mineral content

present in wheatgrass, which is known to be a rich source of essential minerals such as calcium, magnesium, iron, and potassium. The statistical analysis showed that the differences in ash content among the treatments were significant at C.D. ($P \leq 0.05$) = 0.05, indicating that wheatgrass incorporation had a notable effect on the mineral composition of the muffins. This enhancement in ash content demonstrates the potential of wheatgrass in improving the nutritional value of bakery products by enriching them with vital minerals.

There were no statistically significant differences (NS) in crude fat content across all treatments, with values ranging from 19.14g to 19.78g. This indicates that the addition of wheatgrass did not notably alter the lipid content of the muffins. The slight fluctuations observed are likely due to natural variability rather than treatment effect.

A significant increase in crude protein content was recorded with higher wheatgrass inclusion (C.D. = 0.45). The protein content rose from 8.5g in M0 to 10.29g in M3. Wheatgrass is a known source of plant-based protein, and its addition likely contributed to the elevated protein levels in the enriched muffins. This improvement enhances the nutritional value of the product, making it more suitable for health-conscious consumers seeking higher-protein bakery alternatives.

Crude fibre content increased significantly ($p \leq 0.05$) from 1.50 g in the control to 3.00 g in M3. The inclusion of wheatgrass notably enriched the muffins with dietary fibre, which plays a vital role in promoting digestive health and satiety. The linear trend in fibre enhancement suggests that even at lower inclusion levels (2% and 4%), wheatgrass can substantially improve the fibre profile of muffins.

Conclusion

The study concludes that incorporating wheatgrass into muffins significantly enhances their nutritional value, particularly in terms of protein, dietary fibre, and mineral content, without adversely affecting fat composition. As wheatgrass levels increased, moisture content decreased, which may positively influence shelf life. The findings affirm wheatgrass as a valuable functional ingredient for bakery products, transforming traditional muffins into healthier alternatives. This approach offers a practical and appealing way to improve everyday food choices through plant-based fortification. Overall, wheatgrass-incorporated muffins

present a promising functional food option for health-conscious consumers seeking nutrient-rich bakery products.

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