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V Manohar Shashank
College of Food Science and Technology, Rudrur, Nizamabad, Telangana, India

P Sai Kiran
College of Food Science and Technology, Rudrur, Nizamabad, Telangana, India

B Sunil
College of Food Science and Technology, Rudrur, Nizamabad, Telangana, India

A Anand Kumar
College of Food Science and Technology, Rudrur, Nizamabad, Telangana, India

Salla Sowjanya
College of Food Science and Technology, Rudrur, Nizamabad, Telangana, India

Corresponding Author:
V Manohar Shashank
College of Food Science and Technology, Rudrur, Nizamabad, Telangana, India

Development of multigrain cookies by incorporating wheatgrass powder

V Manohar Shashank, P Sai Kiran, B Sunil, A Anand Kumar and Salla Sowjanya

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Abstract
Wheatgrass at young green stage is a powerhouse of nutrients and phytochemicals. With an aim to develop wheatgrass enriched health foods. Ayurveda describes it as immunomodulator, antioxidant, astringent, laxative, diuretic and antibacterial. Wheatgrass is used for the treatment of acidity, colitis, kidney malfunction, swelling wounds and vitiated conditions. Wheatgrass (*Triticum aestivum*) belongs to the family of Poaceae, which has many medicinal values and health benefits. They are excellent source of vitamin, minerals, antioxidant, amino acids, protein, chlorophyll and active enzymes. In the present study wheat was processed and grown as grass. This grass was dried in shade and powdered to obtain wheatgrass powder. Dried powder of wheatgrass was incorporated in cookies.
In India cookies are widely consumed and most popular bakery products compared to conventional wheat flour cookies. The present investigation is undertaken on the utilization of wheat flour, ragi flour, bajra flour, Bengal gram flour, barley flour, oat flour, along with wheat grass powder for the preparation of protein rich and iron rich cookies. A product development with wheat grass and nutrient analysis is an attempt to find out the nutrient composition of wheat grass powder even under processing of baking at the temperature of 100 to 150 ºC cookies were prepared in various percentages at 5%, 10%, 20% and 30% to the changing food needs and socio economic pattern cookies which offer a good nutrition and better taste.
The functional properties, sensory properties of cookies were studied. Cookies with 5% wheat grass powder have shown greater acceptability in the sense of color and taste. The overall acceptability score in sensory evolution. We are found to be maximum for cookies prepared with incorporation of 5% wheat grass powder.
There is high nutritional value for these cookies when compared with control sample cookies which were accepted by semi panelists. There is a protein, carbohydrate, fat, ash and moisture values are 12.77%, 65.690%, 18.09%, 0.26% and 3.176% respectively were developed by incorporation of wheat grass powder. In Cost Analysis of cookies, it was noted that the cost of raw materials remains highest i.e. 83.30% of the total production cost, and processing cost remains at second place i.e. 12.474% of the total production cost of cookies.

Keywords: Wheatgrass, cookies, sensory evolution, wheat grass powder and cost analysis

Introduction
The people in the developing countries consume mostly wheat, maize and rice as a staple food that are poor sources of various nutrients and minerals. (Mathur *et al.*). Green foods like cereal grasses including Alfa alfa, Barley Grass, wheat grass etc, could be very useful in providing nutrients like vitamins, proteins, minerals and antioxidants, which are researched for numerous health benefits in USA, East Asian countries and Central Europe. (Ashish *et al.*).
By taking the green foods as diet can improve nutrient balance and also humans found many plants which are good for treating ailments and curing serious health problems like cancer, diabetes, thalassemia and atherosclerosis. They are kind of alternative medicine that is inexpensive and has no side effects. For example:- wheat grass, curcumin, aloe vera, green tea etc. (Rana *et al.*).
Wheat grass (*Triticum aestivum* L) belonging to poaceae family has healing properties and a great therapeutic potential due to presence of many beneficial contents including chlorophyll, But A, C, E and B complex, Bio- flavonoids, Minerals (Calcium and Magnesium), Iron and 17 amino acids. (Walter).

Wheat grass juice also contains flavonoid indole, anti-aging and anti-inflammatory potential properties. The flavonoid indole synthesis of enzymes which deactivate carcinogens in liver. Wheat grass juice also helps in elimination of toxins from body maintains sugar balance, promotes healthy hair, prevents tooth decay, improves digestion and reduce pressure. (Marawari).

Objectives

To select ingredients for the developing Macro-Micro nutrient rich cookies using wheat grass powder.
To develop the cookies and analyze the cost of production.
To study the nutrient composition of the developed cookies.
To conduct the acceptability studies by consumers on the developed cookies.

Material and Methods

The present chapter devoted to describe in detail about the methods and procedures used in the study to accomplish the requirement of the objectives of the study.
The present study was carried out in Department of Food process Technology and Department of Food Chemistry and Nutrition, College of Food Science and Technology, Rudrur.

Raw Materials

Raw materials for wheatgrass incorporated multigrain cookies

Raw materials like ragi, whole wheat, barley, soy bean, jowar, bajra, Bengal gram and oats. Were purchased from the local market at Rudrur, and wheat grass powder is prepared in College of Food Science and Technology, Rudrur.

Other Ingredients

Other ingredients *viz*. jaggery, baking powder and milk were procured from the local market at Rudrur.

Production of wheatgrass

Good quality wheat grains are selected and cleaned properly. The wheat grains were soaked in cold water for 12 h, due to soaking the wheat grains become tender and reduce the phytin content of wheat. After 12 h of soaking the water was strained and soaked grains were tied in wet woven cloth for 12 h. Water was sprinkled over the cotton cloth at least thrice during germination period. During this process, enzymes get activated thus increasing the availability of nutrients and digestibility. It also increases non-essential amino acids and vitamins like riboflavin, niacin and biotin. (Jensen).
After germination wheat was sowed a shady place. Wheat can grow in all temperatures, shady place is preferred to avoid excess nutrient loss due to exposure to direct sunlight. (Ben and Goldin).
Wheat grass was harvested for powdering, when the plant reaches 16- 26 cm in height. Harvested wheat grass was dried in a dehumidified air dryer or tray drier. The drying temperature is 55±1 °C for 2 h and relative humidity of 18±1% were adopted during the present investigation in order to prevent quality loss due to higher drying temperature. Dried wheat grass was ground using a hammer mill under ambient conditions. The ground sample of wheat grass was collected from the outlet of hammer mill. The powder was passed through the sieve of 250 microns to get the fine powder. (Rahman *et al.*).

Formulation of multigrain atta

Source: - Arya *et al.* 2013 [4]. Health benefits and novel uses of multigrains.

Formulation of product

Firstly, the studies on different ingredients and stages of processing were required to be standardized. With this intention, the product details are given as follows in Table 2.
Formulation of wheatgrass incorporated multigrain cookies

Table 1: Ingredients and control

Ingredients (g)	Control	T1	T2	T3	T4
Multigrain atta	100	95	90	80	70
Wheat grass powder	-	5	10	20	30
Jaggery powder	50	50	50	50	50
Shortening	60	60	60	60	60
Milk (ml)	5	5	5	5	5
Baking powder	3	3	3	3	3

Method for preparation of wheatgrass incorporated multigrain cookies

The cookies were prepared using the following method shown in Fig. 1 (Khetrapaul *et al.*, 2012) with standard control recipe (Kamaliya and Kamaliya, 2001) and formulated trials (Table 3) For test samples, the refined multigrain flour in the formulation was replaced with wheat grass powder @ 5, 10, 20 and 30 percent (w/w) as shown in Table 3.

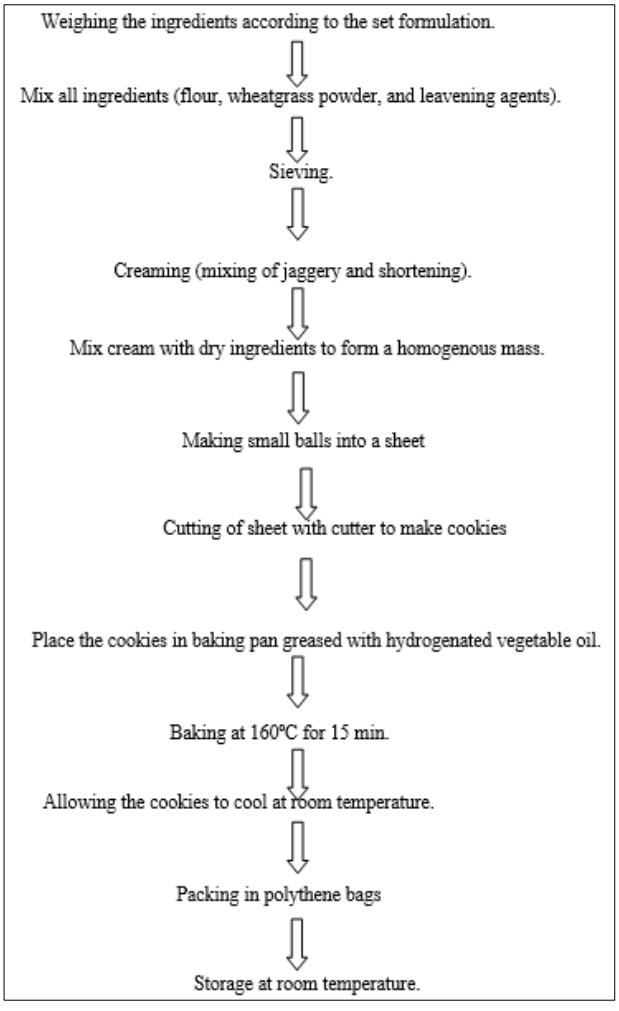

Fig 1: Flow sheet for Preparation of Cookies

Results and Discussion

Proximate composition of cookies: It was observed that the highest moisture content of cookies recorded for sample T4 is 5.43% whereas the lowest value recorded for sample T1 i.e. 3.176%. The highest Carbohydrate content of sample was found in sample T1 i.e. 65.690% whereas the lowest value was recorded for sample T4 i.e. 50.313%. The carbohydrate content decreased from sample T1 to T4 because of the levels of wheat grass powder incorporation. The results are shown in figure. Incorporation of wheat grass powder significantly increased the protein content of sample while maximum value was observed for T4 (21.99%) sample. The Fat content in the sample are also increased from T1 to T4 i.e. from 18.09% to 19.92%. And the Ash content in the samples is also increased from T1 to T4 i.e. from 0.26% to 1.97%. Similar type of results observed by Suneetha Runjala *et al.*, (2013) [14] and Nihir Soni *et al.*, (2018) [18]. Cookies were prepared by incorporation of wheat grass powder in different levels.

Table 2: Show the parameter values

S. No.	Parameter	Values			
		T1	T2	T3	T4
1	Moisture (%)	3.176±0.055	4.133±0.077	5.08±0.046	5.43±0.051
2	Protein (%)	12.77±0.09	14.4±0.078	18.22±0.041	21.99±0.08
3	Carbohydrates (%)	65.690±0.22	62.55±0.15	55.538±0.29	50.313±0.45
4	Fat (%)	18.09±0.05	18.473±0.08	19.87±0.07	19.92±0.03
5	Ash (%)	0.26±0.03	0.54±0.02	1.07±0.05	1.97±.020

Organoleptic evaluation of cookies

Sensory evaluation acceptance tests were performed for cookies. Which were formulated by the addition of wheat in different proportions to know the acceptability of prepared products. The acceptance scores were assigning for various sensory parameters like appearance, colour, flavour, taste, texture and overall acceptability.

Cost Analysis of cookies

The techno economic feasibility study is to determine the technical feasibility and financial viability of the products to assess the risk associated factors and enumerate imminent actions that are required to be taken. It helps to give detailed evaluation of a project.

Cost Analysis of cookies (100 g)

Table 3: Techno economic feasibility of Cookies

Materials	Rate (Rs) /kg	Quantity (kg)/ kg cookies	Cost (Rs) /(1kg)
Multi grain	50	0.95	47.5 (20.735)
Wheat grass powder	300	0.05	15 (6.548)
Jaggery powder	65	0.5	32.5 (14.187)
Shortening	140	0.6	84 (36.669)
Milk (ml)	50	0.05	2.5 (1.092)
Leavening agent	300	0.03	9 (3.929)
Total raw material cost			190.5 (83.160)
Processing cost @15% of the raw material cost			28.575(12.474)
Packaging Cost / kg			10 (4.366)
Total production cost/kg			229.075(100)

Conclusion

By the incorporation of wheat grass in the multigrain biscuits there is increase in carbohydrates, proteins, fat, ash and other proximate values.

In sensory evaluation process most acceptable formulation in cookies is T1 because these formulations show best results in overall acceptability of products. From the analysis of the table 4.3 it was noted that the cost of raw materials remains highest i.e. 83.30% of the total production cost, and processing cost remains at second place i.e. 12.50% of the total production cost of cookies.

It is concluded that the cost of the cookies majorly dependent on the raw materials. On the basis of overall acceptability in sensory evaluation of cookies T1 sample is most acceptable due to its colour, taste and appearance. The T1 sample cookies contain 12.77% of protein, 65.69% of carbohydrates, 3.176% moisture content, 0.26% Ash and 18.09% of Fat respectively.

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