International Journal of Food Science and Nutrition
ISSN: 2455-4898
Impact Factor: RJIF 5.14
www.foodsciencejournal.com
Volume 2; Issue 6; November 2017; Page No. 109-114

Effect of nutritional, physiochemical and sensory properties on the development of bread with incorporation of wheat grass powder

[*1] Pragati Jain, [3] Sangita Borah, [2] Karuna Singh
[1] M.Sc. Student, Amity Institute of Food Technology, Amity University, Noida, Uttar Pradesh, India
[2] Assistant Professor, Amity Institute of Food Technology, Amity University, Noida, Uttar Pradesh, India
[3] Assistant Professor, Institute of Good Manufacturing Practices India, Noida, Uttar Pradesh, India

Abstract
Wheat grass (*Triticum aestivum*) known as the whole and green food with nutritional properties like have all amino acid in one food, rich in minerals, vitamins and rich in different anti-oxidants which are helpful of the humans. Wheat grass is also known to be the best ayurveda medicine as it is loaded multiple nutrients like vitamin A, E, K, C and minerals like calcium, iron, magnesium etc. It is best known to cure various diseases and deficiencies that cannot be met with food intake. With numerous nutritional and health benefits, the present work was conducted with an objective to study the nutrient composition, physicochemical properties and sensory analysis of both wheat grass powder and the bread formulated with the incorporation of wheat grass powder. In the study, different concentrations of breads are prepared and based on sensory analysis final composition was optimized to prepare the final bread for further analyses. From proximate analysis, the content of moisture, ash, fat, protein, crude fibre, iron, vitamin C were recorded as 34.40%, 1.98%, 11.04%, 9.05%, 0.47%,3.16% and 80.64% respectively. Besides, sensory analysis showed that the bread prepared with 5% wheatgrass powder showed maximum score amongst others. Hence, the maximum limit for adding the wheat grass powder was optimized to be 5% along with the addition of milk powder and orange peel powder in order to mask grassy flavour of wheatgrass powder and to enhance overall flavour of the bread in addition to other nutritional benefits.

Keywords: wheatgrass powder, orange peel powder, physicochemical properties, vitamin c, iron, etc.

1. Introduction
Bread is most important, affordable and easy snacking food which came into existence thousands of years ago. Bread is known to be the introduction of bakery product which is also a successful experiment by Egyptians over 12000 BC. It is known to be the most convenient and accepted food in the world (Udeme *et al.*, 2014) [10]. During the past, many experiments were conducted to improve the nutritional value of bread like fiber rich, sugar free, antioxidant rich bread and fat free breads. The renewed costumer's interest in the consumption of nutritional value is the key lead to health benefit. The use of white flour derived from the processing of whole wheat grain, which is aimed at improving the aesthetic value of white bread, has led to drastic reduction in the nutritional density and fibre content of white bread.
Therefore, the concentrations used in making the bread with incorporation of wheat grass powder has been an important factor in developing a new product with less cost and more benefits. Wheat grass contains about 70% chlorophyll which is often referred to as the blood of plant life because the chlorophyll functions as equal to haemoglobin as both share similar structure with a difference of magnesium present in chlorophyll and iron present in haemoglobin. (Jain and Jain, 2014) [7]. When wheat grass is consumed in any food product it reduces access acidity in the blood (Rashida, *et al.*, 2014) [8]. The 70% of chlorophyll present in wheat grass when consumed act as a saver within the body and help in prevention of illness. Moreover, wheat grass is known for its therapeutic value since ancient times the nutrients present in wheat grass helps to promote health and healing. Regular consumption of wheat grass powder also eliminates toxin from body, reduce cholesterol, improves digestion and balances blood sugar. With such immense health benefits, the present study was aimed to optimise the formulation of wheat grass bread of satisfying appearance, textural and structural attributes and to study the shelf life, physicochemical and nutritional properties of the developed wheat grass bread.

2. Materials and Method
Raw Material
Refined flour, Wheat grass powder, Salt, sugar and oil were procured from local supermarkets of Noida, UP. The packets were received in plastic sealed packets. Once opened were kept in air tight container at ambient temperature to prevent contamination and spoilage. All chemicals were of quality graded and all the instruments used for analysis were properly calibrated.

Formulation of Bread
The basic formulations used for preparation of breads have been outlined in the Table 1. The breads were prepared with the incorporation of different concentrations of wheatgrass powder along with other ingredients concentration. As wheatgrass has a strong grassy flavour, to combat that various

concentrations of orange peel powder, milk powder and butter in place of normal vegetable oil was used. Prepared bread was tested and analysed against the control bread (with addition of wheatgrass powder). Based on the sensory analysis, the best combination was determined and final analyses have been carried out. The recipe was repeated in many trials, altering the quantities of ingredients in definite proportions, which produced similar results of the product. Thus, the recipe of the product was standardized.

Table 1: Different combination of bread baked

Ingredients	WGB1 (g)	WGB2 (g)	WGB3 (g)	WGB4 (g)	WGB5 (g)	WGB6 (g)
RW flour	99	98	97	96	95	94
WG powder	1	2	3	4	5	6
Butter	6	6	6	6	6	6
Yeast	3	3	3	3	3	3
Salt	1	1	1	1	1	1
Sugar	5	5	5	5	5	5
Milk powder	5	10	15	20	30	50
Orange peel powder	1	2	3	4	6	8

Bread Making Process

The pre-weight ingredients were mixed properly. The yeast and sugar were dissolved in water at temperature 35 °C. Mixture of raw materials was added to obtain uniform dough and the dough was allowed for proofing for 1 hour followed by transferring of dough to a lightly floured surface and pressed gently using fingertips. The dough is then shaped into rectangle and folded from all four sides and placed into the mould. The dough was again kept in greased baking mould for second proofing for about 30 minutes. The dough is then kept in a pre-heated oven for baking at 200-220°C for 20-30 minutes. Once the baking completes, the bread is cooled to room temperature, cut into slices and wrapped in foil.

Physical Analysis of Raw Material

The water and oil absorption capacities were determined by the method of Sosulski *et al.*, 1976. The bulk density was determined according to the method described by Okaka and Potter 1977. The True density and Tapped density were determined. The gluten content of wheat four was determined by ISI method.

Chemical Analysis

Moisture, ash and crude fibre content of the flour and wheat grass powder samples was determined by methods described by AOAC (2000) [1]. Fat content is determined by USDA method. Protein content was analysed by standard kjeldhal method. Vitamin C in wheat grass powder is determined by 2, 6-dichlorophenol indophenol (DCPIP) titration method as described by Dinesh, *et al*, 2015 [3]. Determination of iron is done by microwave digestion method.

Sensory Analysis

The final best sample was prepared and stored in the 4 different bottles. A group of 5 members were asked to evaluate the product based on their likings. The panel members were the faculty and students of IGMPI, Noida. The sensory attributes such as appearance, taste, texture, hand feel and overall acceptability were scored at 7-days interval. 9-point hedonic scale was used to find the acceptability of the product. The scores were 9- like extremely; 8- Like very much; 7-like moderately; 6 Like slightly; 5-Neither like nor dislike; 4- dislike slightly; 3- Dislike, moderately; 2-Dislike very much; 1-dislike extremely.

3. Result and Discussions

The ingredients used for the preparation were analysed for both physical and chemical properties. Six breads have been prepared containing 1%, 2%, 3%, 4%, 5% and 6% of wheat grass powder in combination with refined wheat flour. All the prepared breads were subjected to sensory evaluation to optimise different sensory attributes (colour, texture, taste, flavour and overall acceptability) and based on sensory evaluation the best combination was selected, the final bread was prepared and was subjected to further analyses.

Physical Analysis of Raw Materials

Water and Oil Absorption Capacity

Table 2 depicted both refined wheat flour and wheatgrass powder analysis for water and oil absorption capacity. The water absorption capacity was found to be higher in wheatgrass powder while, refined wheat flour has higher oil absorption capacity. Figure 1 represents the trend of water and oil absorption capacity of refined wheat flour and wheatgrass powder.

Table 2: Showing Water and Oil Absorption Capacity

Parameter	RWF	WGP
Water absorption capacity (%)	79.5	95.0
Oil absorption capacity (%)	47.3	30.0

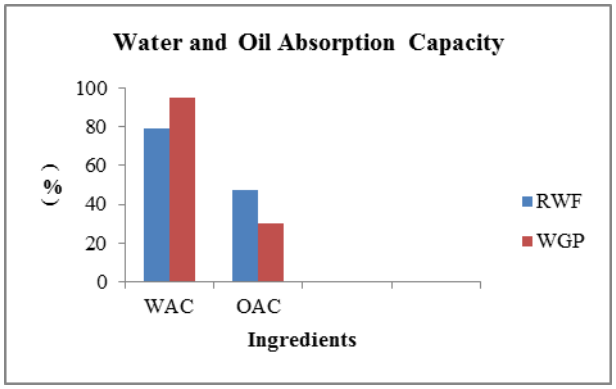


Fig 1: Water and Oil absorption

Table 3 depicted bulk density i.e. the ability of powder to flow. Tapped density is the limiting density attained after tapping. From the density analysis, wheatgrass powder was found to have maximum bulk, tapped and true density as compared to refined wheat flour. The true density for refined wheat flour was considerably higher i.e. 1.31 g/ml as compared to the wheatgrass powder. Figure 2 represents the trend of bulk density, tap density and true density of refined wheat flour and wheatgrass powder.

Table 3: Showing Densities of Refined Wheat Flour and Wheatgrass Powder

Parameters	Wheat flour	Wheatgrass Powder
Bulk density (g/ml)	0.61	0.32
Tapped density (g/ml)	0.88	0.50
True density (g/ml)	1.31	6.66

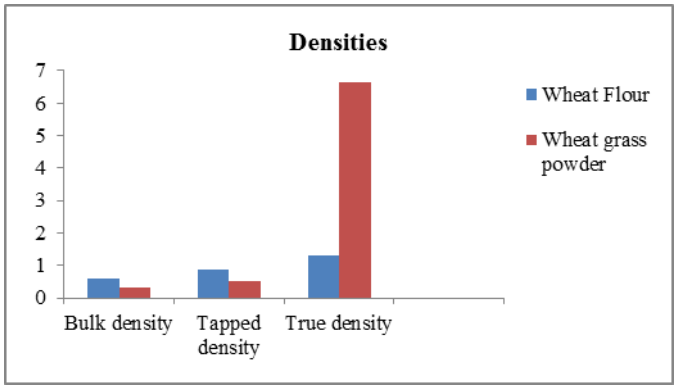


Fig 2: Densities of Refined Wheat Flour and Wheat Grass Powder

Determination of Gluten Content

Table 4 depicted gluten content which protein represent in wheat flour that increases the elasticity of the flour helping the dough to rise while baking, keeps its shape and often gives the final product a chewy texture. The amount of gluten in flour is considered as an index of protein content. Gluten content was not determined for wheatgrass powder as, it doesn't contain any gluten. The refined wheat flour used for bread making was analysed for both dry and wet gluten content and was found to be 17.67% and 34.28% respectively. The higher gluten content indicates that the flour used is hard flour with high protein content.

Table 4: Showing Gluten Content

Parameter	Gluten Content (%)
RWF	34.28 (Wet gluten)
	17.67 (Dry gluten)

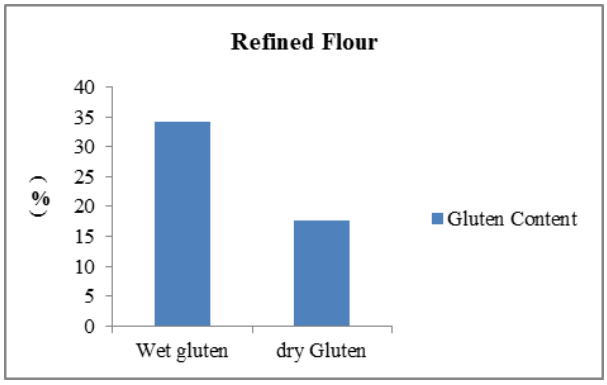


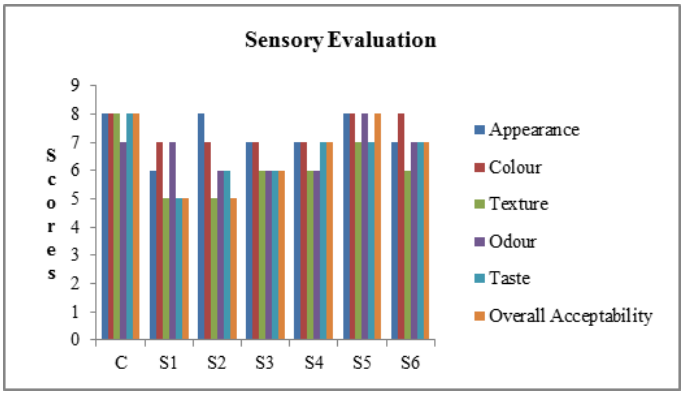
Fig 3: Gluten Content of Refined Flour

Optimization of Bread by Sensory Evaluation

Table 5 depicted the sensory evaluation of all the different samples were carried out by 7 semi trained panel members. On the basis of sensory score the formulation was optimized. The analysis indicated that there were considerable differences in flavour, textures and the overall acceptability between control bread and bread containing different concentration of wheatgrass powder. With the increase in the level of wheatgrass powder in the formulation, the sensory scores for colour, texture, appearance and flavour of bread differed considerably. As the wheatgrass has a typical grassy flavour, other ingredients like orange peel powder, milk powder and butter in place of vegetable oil has been incorporated to mask wheatgrass flavour. Up to 5% incorporation of wheatgrass powder the grassy flavour has been observed to be masked successfully, but beyond that on further increasing wheatgrass powder there was impact on volume expansion, formation of proper crump and crust structure. The bread crumb was found to be very dense without/little air pockets. With all added ingredients, the 5% wheatgrass powder incorporated bread scored maximum overall acceptability value.

Table 5: Showing Sensory Evaluation

Parameter	S1 (0%)	S2 (1%)	S3 (2%)	S4 (3%)	S5 (4%)	S6 (5%)	S7 (6%)
Appearance	8	6	8	7	7	8	7
Colour	8	7	7	7	7	8	8
Texture	8	5	5	6	6	7	6
Odour	7	7	6	6	6	8	7
Taste	8	5	6	6	7	7	7
Overall Acceptability	8	5	5	6	7	8	7



Where, S1 to S6 = Different concentrations of breads from 0% to 6%
C = Control bread

Fig 4: Sensory Evaluation of different conc. of bread

Chemical Analysis of Raw Material

Proximate Analysis

Table 6 depicted the moisture contents of the wheatgrass powder were almost similar with slight increase in moisture content in refined wheat flour as shown in table 5. The ash content of refined flour is considerably lower than wheat grass powder i.e. 0.5% as compared to 14.5% in wheatgrass powder. Similarly, fat, protein and crude fibre content in wheatgrass powder was found to be higher as compared to refined wheat flour. From the analysis, it is clear that, wheat grass powder is good source of protein, minerals and crude fibre which are important nutrient for normal body functions. These proximate composition values are somewhat close to the values as obtained by Jain and Jain, 2014 [7] per 100 gm of wheatgrass powder sample.

Table 6: Showing Proximate Compositions of RWF and WGP

Nutrient	RWF (%)	WGP (%)
Moisture	8.93	8.37
Ash	0.50	14.5
Fat	1.39	2.76
Protein	10.43	13.54
Crude fibre	1.78	3.27
Carbohydrate	76.96	60.83

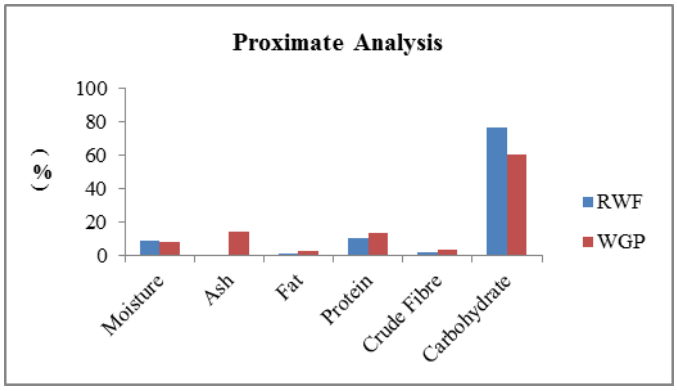


Fig 5: Proximate Analysis of Refined flour and Wheat grass powder

Vitamin C and Iron Content in wheat grass powder

Table 7 depicted the content of iron and vitamin C in the sample. 5g of test sample was found to have iron content 234.51 mg and vitamin C content is 185.62 mg. According to Runjala and Murthy, 2015 the iron content with 100g of sample biscuit are taken and content was found 5.22mg and according to Jain and Jain, 2014 [7] with 2g of sample of wheat grass juice containing 1.04mg.

Table 7: Vitamin C and Iron Content

Parameters	Content (mg)
Iron	234.51 mg
Vitamin C	185.62 mg

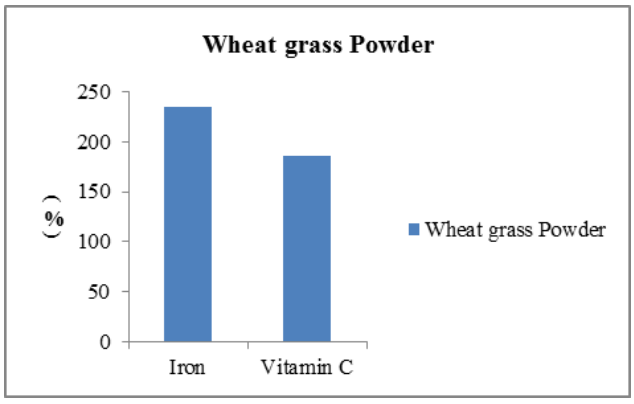


Fig 6: Vitamin C and Iron Content in wheat grass powder

Chemical analysis of bread

Proximate Analysis

Table 8 depicted comparative proximate analysis, increased moisture content of the treated breads suggested that an appreciable amount of water was bound wheatgrass and other flavor masking ingredients were added into bread.

Table 8: Comparative Proximate Analysis

Nutrient	Control Bread (%)	WGB (5%)
Moisture	34.21	34.40
Ash	1.06	1.98
Fat	5.28	11.04
Protein	7.67	9.05
Crude fibre	ND	0.47
Carbohydrate	51.78	43.53

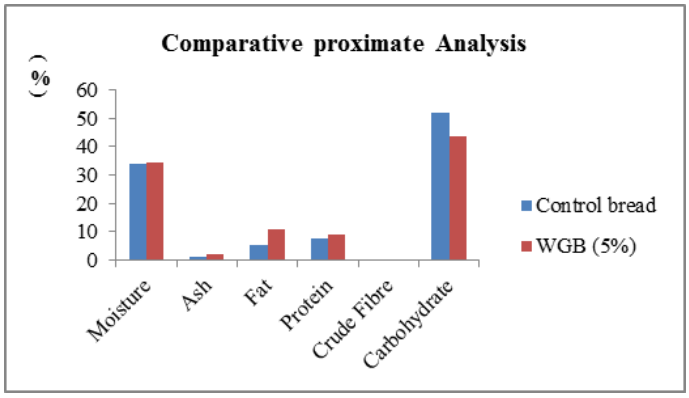


Fig 7: Proximate Analysis of bread

The bread made up from refined flour and adding of 5 g of wheat grass powder is selected from the different concentrations that are prepared. The bread also included milk powder and orange peel powder in order to enhance the flavour of the bread. The shelf of the bread was also been observed and the scores are given accordingly, the bread starts to have sour taste and on fourth day there is microbial growth is seen.

The moisture content of the control bread and wheat grass bread is almost same. In a study it shows that the size and appearance of the bread is same but the moisture content is more because the use of pectin or phenolic extracts (Anusooya S. Sivam, 2011) [2].

The ash content of the wheat grass bread is higher than the control bread due to more vitamin and mineral content present in wheat grass than refined flour bread. The study shows that using sour dough will increase the ash content of the bread because the use of oats as an additional ingredient results in high ash content (Blaženková L., *et al*, 2015) [4].

The fat content of the wheat grass bread is more due to use of milk powder and orange peel powder than control bread. The study shows that the use of fat can be avoided so as to have a fat free bread due to use of different flours in bread (Doğan S. I., *et al*, 2012) [5].

The protein content of the wheat grass bread is higher than the control bread due to more ingredients present in wheat grass than refined flour bread. The study results in with use of oats with more of sour dough would result in high protein content (Blaženková L., et al, 2015) [4].

The bread having wheat grass powder has more of crude fibre than control bread. The studies shows that crude fibre present along with dietary fibre but is not digested in the body and also the food have less of crude fibre present. Also the cooking method also results in amount of crude fibre present in the food (Anusooya S. Sivam, 2011) [2].

Vitamin C and Iron Content

Table 9 depicted Vitamin C content present in 5% wheat grass bread which was 80.64mg/gm. The iron content of the bread with 5% wheat grass was found to be 3.16mg per 100g of bread.

Table 9: Vitamin C and Iron Content of WGB

Parameters	Content (mg/100gm)
Iron	3.16
Vitamin C	80.64

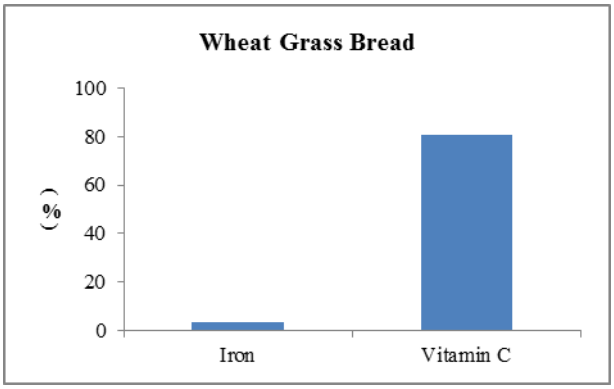


Fig 8: Iron and Vitamin C of final bread

Sensory evaluation

Table 10 depicted the product prepared bread with incorporation of wheat grass powder is been evaluated by 10 panellists and scores are given on basis of the following points:

Table 10: Comparative Sensory Analysis of Control and WGB

Parameter	C (0%)	WGB (5%)
Appearance	8	8
Colour	8	8
Texture	8	7
Odour	7	7
Taste	8	7
Overall Acceptability	8	8

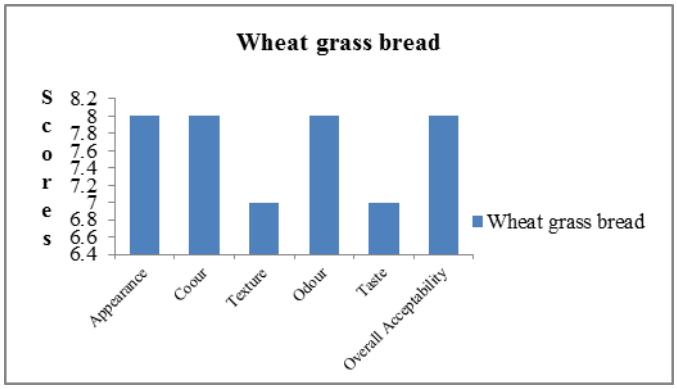


Fig 9: Sensory Evaluation of Bread (5%)

- **Appearance:** the appearance of the bread was appealing, baking technique is unique make it acceptable by the consumers.
- **Colour:** Colour is very important aspect in food as it increases the visual appearance, increases the anxiety to eat a new product.
- **Texture:** Texture of the bread was soft as the bread should be, the green colour also gives an appeal of having green food in diet is incorporated as it increases the nutritional content of the bread.
- **Odour:** The smell of the bread gives feel of grass but by adding milk powder and orange peel powder gives a pleasant odour.
- **Taste:** Taste of the bread increases by increase of wheat grass and it is acceptable by consumer or not is according to them.
- **Overall acceptability:** The overall acceptability matters a lot for the new product and all the above points are been considered.

Fig 9: Final Bread Composition

4. Summary and Conclusion

Bread consumption is increasing throughout the world, affordable and cost effective. There are so many varieties of bread present in markets not only by any one company but many companies supply the same flavour with different composition of ingredients. The use of varieties of flour is now a new trend for the breads.

Bread is a stable food of people in India but also in other parts of world. It is prepared with refined flour, oil/butter, yeast, sugar, salt and water. Bakery products are easy but the cooking time and ingredients change the composition and method of preparing it. The main idea for the study was to increase the nutritional aspect of the bakery product bread. The study started by experimenting and exploring of different ingredients that can enhance the flavour and taste of the bread. Wheat grass powder is a full food which fulfils the daily nutritional requirements.

There are many studies done with wheat grass powder in bakery products like biscuits, cookies, muffins. The property with each bakery product is different so as the use of wheat grass. The main focus upon is incorporation of the powder to give a new product.

Physical and proximate analysis is done which included ash, moisture, protein, fat, carbohydrates and crude fibre. The other analysis done was iron and vitamin C. Sensory evaluation was done with each concentration of the bread to know the better product among them and the points included for evaluation are Appearance, odour, taste, flavour, texture and overall acceptability by 10 panellists.

From the analysis it is concluded that the incorporation of wheat grass powder less than 6 percent will be acceptable by

the consumers and will have nutritional properties. Integrated use of orange peel powder and milk powder also change of ingredients like oil to butter has given a good taste and resulted in increase the quality of bread. The Shelf life of the bread was conducted and sensory evaluation was also done, by the end of third day the growth of microbes was observed.

5. Acknowledgement
The research work is done the IGMPI institute. The authors thank the Director of the Institute and Amity University for providing necessary facilities to carry out the work.

6. References

1. A.O.A.C. *Official methods of analysis* 17th edition, Gaithersburg, Maryland, USA, 2000.
2. Anusooya S Sivam, *et al*. Physicochemical Properties of Bread Dough and Finished Bread with Added Pectin Fiber and Phenolic Antioxidants. A publication of the Institute of food technologist, 2000; 2011.
3. Dinesh B, *et al*. Determination of Ascorbic Acid Content in Some Indian Spices. International Journal of Current Microbiology and Applied Science. 2015 Vol. 4, ISSN: 2319-7706.
4. Blaženková L, *et al*. Development of Innovative Health Beneficial Bread using a Fermented Fibre-glucan Product. Food Analysis, Food Quality and Nutrition, 2015.
5. Doğan SI, *et al.* Determination of the bread-making quality of fl ours using an automatic bread machine. Turk J Agric For. 2012; 36.
6. Appiah F, *et al*. Physicochemical and functional properties of bean flours of three cowpea (Vigna unguiculata L. Walp) varieties in Ghana. African Journal of Food Science. 2011; 5(2):100-104.
7. Jain B, Jain N. Nutitional Composition, Phyto chemical Analysis Product Development From Green Food Triticum Aestivum. Indian journal of Ancient Medicine and Yoga. 2014; 7(1).
8. Rashida Rahman, *et al*. Effects of Wheat Grass Powder Incorporation on Physiochemical Properties of Muffins. International Journal of Food Properties. 2015; 18.
9. Runjala S, Dr. Murthy YLN. Product Development with Wheat Grass and Nutrient Analysis. International Journal of Science and Research (IJSR). 2016; 5(10).
10. Udeme Joshua Josiah Ijah, *et al*. Microbiological, Nutritional, and Sensory Quality of Bread Produced from Wheat and Potato Flour Blends. Hindawi Publishing Corporation International Journal of Food Science. 2014.
11. Adebowale YA, *et al*. Functional and physicochemical properties of flours of six *Mucuna* species. African Journal of Biotechnology. 2005; 4(12):1461-1468.