

Development of Germinated Wheat Flour (*Triticum Aestivum* L.) Products Fortified with Pumpkin Seed and Beet Green Powder and their Nutritional Evaluation

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Abstract: *Partial replacement of germinated wheat flour with pumpkin seed and beet green powder rich in protein, energy, fat and calcium will increase nutrient content and diversify utilization of pumpkin seeds and beet greens. The Staple foods of a region can lack particular nutrients due to the soil of the region or from inherent inadequacy of a normal diet. Therefore, fortification of food products has been an important tool, not only to manage or prevent specific nutritional deficiencies, but also to promote a general state of well-being in different populations, and possibly, to prevent certain chronic diseases. Three traditional products were developed i.e. laddu, mathri and cookies in the proportion of 100:0:0, 90:5:5, 80:10:10 and 70:15:15 of wheat, pumpkin seeds and beet green respectively. The aim of the study was to develop germinated wheat flour products fortified with pumpkin seed and beet green powder and to evaluate their physico-chemical attributes i.e. moisture, ash, fat, protein, carbohydrate, dietary fiber, energy, iron and calcium.*

Keywords: Germinated wheat flour, pumpkin seed flour, beet green powder, fortification of food products, nutritional evaluation

1. Introduction

The consumption of fortified cereal foods has become very popular but staple foods of a region can lack particular nutrients due to the soil of the region or from inherent inadequacy of a normal diet. Therefore, fortification of food products has been an important tool, not only to manage or prevent specific nutritional deficiencies, but also to promote a general state of well-being in different populations, and possibly, to prevent certain chronic diseases. Development of healthy fortified food products is necessary as people are getting more conscious about health today and are giving importance to healthy eating. Wheat flour is already packed with healthy fats, proteins, vitamins, minerals and dietary fiber but germination increases the nutritional value and converts carbohydrate into natural sugar decreasing the amount of mucus. Beet greens are most nutrient- rich part of the plant and provide amazing health benefits. People generally use it in soups, sauces, salads, etc. to add flavor. It cannot be consumed directly. But, it can be used in the powdered form in cooking and baking healthy foods. Likewise, pumpkin seeds can also be consumed in the powdered form. Germinated wheat flour was used to develop products because it is more nutritious and has higher crude protein, crude fat, and thiamine and riboflavin concentrations. Sprouted grain flour has a longer shelf-life than regular whole grain flour. Sprouting is easy and can be done without sophisticated equipment. The sprouts can be kept for a few days to over a week under refrigeration. Pumpkin seeds and beet greens were used to fortify the germinated wheat flour products with 10%, 20% and 30% levels of fortification. Popular Indian snacks, Laddu, mathri and cookies were developed in order to diversify the use of pumpkin seeds and beetroot leaves which are usually

discarded as waste. Pumpkin seeds have been discovered to contain a rich repertoire of nutrients such as proteins, unsaturated fatty acids, phenolic acids; carotenoids possess hypoglycemic properties and could assist in maintaining glycemic control. Beet leaves are nutritionally rich in fiber, protein, carbohydrate, vitamins and minerals that help to prevent ameliorate various disorders including memory impairments. Germination of cereals is a way not only to produce fermentable extract for the brewing and distilling industries, but can be also a way to produce ingredients enriched with health promoting compounds. Grains are global dietary staples that when consumed in wholegrain form, offer considerable health benefits compared with milled grain foods, including reduced body weight gain and reduced cardiovascular and diabetes risks.

2. Materials and Methods

Procurement of raw materials

Raw materials for the development of products were procured from different sections. Wheat was procured from Section of Rabi Cereals, EBR department of Chandra Shekhar Azad University of Agriculture and Technology, Kanpur. Beet greens were procured from local market of Kanpur. Pumpkin seeds were procured online.

Preparation of flour and powder

Flour and powder were prepared by using simple methods i.e., cleaning, washing, germinating, drying and grinding.

Preparation of Products

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conducted to develop laddu, cookies and mathri because these are Indian foods and so their acceptance is more as compared to that of any new product. These new variations are a way to eat Indian foods in a healthy way. Products were prepared in four variants (T₀, T₁, T₂ and T₃) using germinated wheat flour with the fortification of pumpkin seed and beet green powder in the ratio of 100:0:0, 90:5:5, 80:10:10 and 70:15:15. Pumpkin seed powder was obtained from cucurbita spp. seeds containing 49.05g/100g fat, 30.23g/100g protein and 10.71g/100g of total carbohydrates. Beet green powder was obtained from leaves of beta vulgaris L. containing 0.1g/100g fat, 2.2g/100g protein and 4.3g/100g of total carbohydrates.

3. Results and Discussion

Table 1: Nutritional evaluation of germinated wheat flour laddu fortified with pumpkin seed and beet green powder (Per 100g)

Nutrients	Nutrient Value Of Treatments			
	T ₀	T ₁	T ₂	T ₃
Energy (Kcal)	508.45	517.7	526.95	536.2
Protein (g)	7.32	8.46	9.38	10.31
Carbohydrates (g)	64.32	67.82	71.37	74.92
Fat (g)	21.34	23.69	26.05	28.41
Dietary Fiber (g)	2.40	2.78	3.17	3.55
Calcium (mg)	74.15	76.50	81.85	87.2
Iron (mg)	3.74	4.09	4.45	4.81
Moisture (g)	29.85	30.45	30.88	30.98
Ash (g)	10.45	10.47	10.53	10.62

Table 1.1: Mean Score of nutritional evaluation of germinated wheat flour laddu fortified with pumpkin seed and beet green powder

Parameters	Protein (%)	Fat (%)	Carbohydrate (%)	Iron (%)	Calcium (%)	Fiber (%)	Moisture (%)	Ash (%)
T ₀	7.28	20.64	63.70	3.31	73.64	1.90	29.80	10.2
T ₁	8.20	22.54	67.12	3.80	75.76	2.32	30.43	10.3
T ₂	9.14	22.90	70.64	4.14	80.72	2.80	30.86	10.5
T ₃	9.78	27.64	73.80	4.48	86.58	2.84	30.92	10.7
SE (diff.)	0.06	0.17	0.24	0.08	0.15	0.06	0.308	0.23
CD	0.12	0.34	0.48	0.16	0.306	0.12	0.62	0.46

Table 2: Nutritional evaluation of germinated wheat flour mathri fortified with pumpkin seed and beet green powder (Per 100g)

Nutrients	Nutrient Value Of Treatments			
	T ₀	T ₁	T ₂	T ₃
Energy (Kcal)	384.10	393.35	402.60	411.85
Protein (g)	7.32	8.24	9.16	10.08
Carbohydrates (g)	33.26	39.42	40.31	43.86
Fat (g)	21.50	23.85	26.21	28.57
Dietary Fiber (g)	1.78	2.16	2.55	2.93
Calcium (mg)	28.72	33.35	39.42	44.77
Iron (mg)	2.14	2.50	2.80	3.21
Moisture (g)	30.27	30.32	30.39	30.41
Ash (g)	11.42	11.44	11.68	11.73

Table 2.1: Mean score of nutritional evaluation of germinated wheat flour mathri fortified with pumpkin seed and beet green powder

Parameters	Protein (%)	Fat (%)	Carbohydrate (%)	Iron (%)	Calcium (%)	Fiber (%)	Moisture (%)	Ash (%)
T ₀	7.18	20.64	32.76	1.90	27.84	1.54	30.26	11.43
T ₁	7.96	22.90	35.90	2.34	33.04	1.88	30.35	11.45
T ₂	8.82	25.47	39.86	2.64	38.24	2.34	30.58	11.73
T ₃	9.64	27.82	43.12	2.92	43.84	2.42	30.63	11.81
SE (diff.)	0.08	0.17	0.15	0.07	2.41	0.08	0.2	0.24
CD	0.16	0.34	0.306	0.14	4.91	0.16	0.4	0.48

The experiment was laid out in Factorial Completely Randomized Design (CRD). The experiment compares the value of a response variable based on the different levels of that primary factor. All the chemical analysis was done using methods prescribed under AOAC 2000. The protein content was determined by micro-kjeldahl method. Crude protein content was calculated by multiplying the estimated total nitrogen content with a factor of 5.57. Fat content of products was determined by soxhlet extraction method. Moisture content of products was determined by standardized method. Ash comprises the mineral content of food and feeding stuff, which can be determined by igniting a known amount of dried material in muffle furnace. Utilizable carbohydrate

was determined by differences between 100 and total sum of the percentage of fat, moisture, ash and protein content. Results revealed significant differences in the nutritional value of prepared products i.e., laddu, mathri and cookies. Mean score of nutritional value of laddu and mathri increased with increase in levels of fortification as shown in table 1.1 and 2.1. Also there was significant difference at critical difference of five and one percent level of significance. Nutritional evaluation of laddu, cookies and mathri was done for various constituents like; moisture, ash, protein, fat, carbohydrate, iron, calcium and dietary fiber. Nutrient content of products with 30% level of fortification was higher as compared to that of other products. Nutritional

analysis of developed products revealed increasing levels of energy, fat, protein, iron, calcium, dietary fiber, moisture and ash with increase in fortification levels (10%, 20% and 30%).

4. Conclusions

On the basis of results of the present study, it is concluded that pumpkin seed and beet green powder can be supplemented in wide range of food products. It adds variety as well as new taste in Indian foods. Nutrient content of products with 30% level of fortification was higher as compared to that of other products. It was found that all the fortified products had better nutrition.

5. Recommendations

On the basis of conclusions, pumpkin seed and beet green powder at 30% level of fortification in the preparation of various healthy recipes can be recommended to improve the nutritional value of diets to eradicate malnutrition in children. These products can also be included in supplementary feeding programmes. Education can be imparted to village women regarding use and importance of pumpkin seeds and beet greens which are commonly discarded as waste. Keeping in view the nutritional value of pumpkin seeds and beet greens, it can be recommended to food industries to fortify their foods with pumpkin seed and beet green powder to improve nutritional value of products.

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