



NUTRITIONAL AND ORGANOLEPTIC EVALUATION OF VALUE ADDED PRODUCTS MADE BY INCORPORATING FRESH CABBAGE OUTER LEAVES AND STEMS

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ABSTRACT: *Green leafy vegetables are used since ancient periods as a source of food as they contain many nutrients and minerals which are helpful in maintaining human health. Cabbage (*Brassica oleracea* or *B. oleracea* var *Capitata*, var. *tuba*) is a member of the genus *Brassica* and the mustard family, *Brassicaceae*. Several other cruciferous vegetables (sometimes known as *colecrops*) are considered cultivars of *B.oleracea*, including broccoli, collard greens, Brussels sprouts, kohlrabi and sprouting broccoli. We only use upper portions of the leaves and throw away the remaining parts of the leaves like stems and roots. These stems, peels and roots are known as kitchen waste. We can incorporate these to develop value added products. Cabbage stems and outer leaves were washed and blanched. Fresh cabbage outer leaves and stems were added at 10, 20 and 25g into the Parantha and mathri. All the samples were subjected to sensory and physiochemical evaluation.*

Keywords: *Incorporation, sensory, evaluation, product, development.*

I. INTRODUCTION

Vegetables are the fresh, edible and succulent parts of herbaceous plants. They are considered as special food crops owing to their valuable food ingredients that can be effectively utilized by the body. They contain appreciable amount of vitamins and minerals which are highly beneficial for the maintenance of health and prevention of diseases. They also contain high amount of dietary fibre and a minimal amount of protein [2, 10] *Brassica oleracea* var. *capitata* L. is an herbaceous green leafy vegetable belonging to the *Brassica* genus, of the *Brassicaceae* family with several other crop species including Brussels sprout, broccoli, cauliflower, kale and kohlrabi.



It has a defined taste and crunchy texture, with a characteristic compact head in which the leaves snug against each other [4], and colours ranging from pale or light green to dark green [3]. It is an excellent source of a variety of vitamins, minerals and dietary fibre [7], and has been ranked by the food and Agriculture Organization among the top twenty vegetable crops grown worldwide, establishing it as an important food source globally.

According to the 2007 World Health Report unbalanced diets with low vegetable intake and low consumption of complex carbohydrates and dietary fiber are estimated to cause some 2.7 million deaths each year, and were among the top 10 risk factors contributing to mortality [9]. The exact mechanisms by which vegetable consumption reduces human diseases have not yet been fully understood, however the general consensus among physicians and nutritionists is that phytonutriceuticals in vegetables are responsible for mitigating some of these diseases.

II. METHODS AND MATERIALS

2.1 Procurement of raw materials: - The raw materials for the product development were collected from the Women's Hostel kitchen of SHIATS.

2.2 Experimental site: - The present investigation was carried out in the Nutrition Research, Laboratory of the Department of Foods and Nutrition, Ethelind School of Home Science, SHIATS, Allahabad.

2.3 Development of food products: - Three food products (*Parantha, and mathri*) were prepared with fresh cabbage outer leaves and stems. For each product, the basic recipe (control T₀) had three variations, T₁, T₂, T₃ respectively, where the amount of one or more ingredients was varied.

2.4 Nutritional composition of fresh cabbage -.Proximate analysis- Chemical estimation of moisture, ash, protein, fat, fiber and carbohydrate, mineral content was done by standard procedure.



2.5 Sensory evaluation- Sensory evaluation of the food products for their acceptability was done by a panel of 5 judges. The score card based on the 9 point Hedonic Scale was used for sensory evaluation on the basis of evaluation of attributes like Colour and Appearance, Body and Texture, Taste & Flavour and Overall Acceptability (Shrilakshmi, 2010).

2.6 Statistical analysis- Analysis of variance technique (ANOVA), Critical Difference and t-test were used to analyse the data (Gupta and Kapoor, 2002).

2.7 Determination of nutritive value: The nutritional value obtained by the chemical analysis of the fresh and dehydrated stems and leaves will be computed as well as food composition tables by [2] will be used to determine the nutritive value of the product prepared.

III. RESULTS AND DISCUSSION

Table1 data shows the nutritional composition of fresh cabbage outer leaves and stems as per 100g. Moisture was 90.7%, ash was 0.62g, protein was 0.83g and dietary fibre was 2.48g respectively. Comparative value of fresh cabbage per 100g as given by Gopalan *et al.*, 2011 is moisture 91.9 percent, ash 0.6g, protein 1.8, carbohydrates 4.6g, fat 0.1g, dietary fiber 2.8.

The results of sensory evaluation of parantha and mathri prepared with fresh cabbage outer leaves and stems are listed in (table 2 and table 3).

Table.2 shows that the mean sensory scores of *parantha* in relation to colour and appearance indicates that T₁ and T₀ had the highest score 8.6 followed by T₂ (7.6) and T₃ (7.2). It is quite obvious from the table that the treatment T₀(100 percent *wheat flour*) and T₁ (*wheat flour* + fresh grated cabbage stems) was liked very much whereas treatment T₃ *wheat flour* + fresh grated cabbage stems was liked moderately regarding the colour and appearance of *parantha*.

Table.3 shows that the mean sensory scores of *mathri* in relation to colour and appearance indicates that T₁ had the highest score 8.8 followed by T₀ (8.2) T₂ (7.8) and T₃ (6.9). It is quite obvious from the table that the treatment T₁(white refines flour+ fresh grated cabbage outer leaves and stems) was liked very much whereas treatment T₃ *wheat refined flour* + fresh grated



cabbage outer leaves and stems was liked moderately regarding the colour and appearance of *mathri*

Table.2 shows that the mean sensory scores of *parantha* in relation to body and texture indicates that T₁ had the highest score 8.73 followed by T₀ (8.46), T₂ (7.4) and T₃ (6.9). It is quite obvious from the table that the treatment T₁ (*wheat flour*+ fresh grated cabbage outer leaves and stems) was liked very much whereas treatment T₃ of *wheat flour* + fresh grated cabbage outer leaves and stems was liked moderately regarding the body and texture of *parantha*.

Table.3 shows that the mean sensory scores of *mathri* in relation to body and texture indicates that T₁ had the highest score 8.6 followed by T₀ (8.2), T₂ (7.4) and T₃ (6.4). It is quite obvious from the table that the treatment T₁ (*white refined flour*+ fresh grated cabbage outer leaves and stems) was liked very much whereas treatment T₃ of *white refined flour* + fresh grated cabbage outer leaves and stems was liked moderately regarding the body and texture of *mathri*.

Table.2 shows that the mean sensory scores of *parantha* in relation to taste and flavour indicates that T₁ had the highest score 8.6 followed by T₀ (8.4), T₂ (7.4) and T₃ (6.7). It is quite obvious from the table that the treatment T₁ (*wheat flour*+ fresh grated cabbage outer leaves and stems) was liked very much whereas treatment T₃(*wheat flour*+ fresh grated cabbage outer leaves and stems) at the ratio 100:25 of wheat flour+ fresh grated cabbage outer leaves and stems was liked moderately regarding the taste and flavour of *parantha*.

Table.3 shows that the mean sensory scores of *mathri* in relation to taste and flavour indicates that T₁ had the highest score 8.6 followed by T₀ (8.5), T₂ (7.4) and T₃ (6.4). It is quite obvious from the table that the treatment T₁ (*white refined flour*+ fresh grated cabbage outer leaves and stems) was liked very much whereas treatment T₃(*white refined flour*+ fresh grated cabbage outer leaves and stems) at the ratio 100:25 of wheat flour+ fresh grated cabbage outer leaves and stems was liked moderately regarding the taste and flavour of *mathri*.

Table.2 shows that the mean sensory scores of *parantha* in relation overall acceptability indicates that T₁ had the highest score 8.6 followed by T₀ (8.48), T₂ (7.4) and T₃ (6.93). It is quite obvious



from the table that the treatment T₁ (*wheat flour*+ fresh grated cabbage outer leaves and stems) was liked very much whereas treatment T₃(*wheat flour*+ fresh grated cabbage outer leaves and stems) at the ratio 100:25 of wheat flour+ fresh grated cabbage outer leaves and stems was liked moderately regarding to overall acceptability.

Table.3 shows that the mean sensory scores of *mathri* in relation overall acceptability indicates that T₁ had the highest score 8.6 followed by T₀ (8.5), T₂ (7.5) and T₃ (6.5). It is quite obvious from the table that the treatment T₁ (*wheat refined flour*+ fresh grated cabbage outer leaves and stems) was liked very much whereas treatment T₃(*wheat refined flour*+ fresh grated cabbage outer leaves and stems) at the ratio 100:25 of *wheat refined flour* + fresh grated cabbage outer leaves and stems was liked moderately regarding to overall acceptability. The same results was found in the study conducted Swati *et.al* (2012) that when the level of incorporation of greens increased beyond the accepted levels in preparations, the mean scores for the organoleptic evaluation for appearance, color, texture, taste, flavour and overall acceptability decreased.

Table 4 indicates that the nutritive value of '*parantha*' with and without incorporation of fresh grated cabbage stems at different levels i.e. 10 percent, 20 percent, and 25 percent of T₁, T₂ and T₃ respectively. Results revealed that highest energy, protein and fat was found in T₀ (192), T₀ (6.0), T₀ (10.85), respectively followed by T₁, T₂ and T₃. Carbohydrates content was found to be highest in T₀ (35.00). Iron and total carotene content was high in T₀ (2.45), T₃ (23.12)/ 100g respectively. Sadhna *et al.* (2001) reported 12.99 per cent protein and 5.7 per cent fat in spinach *paranthas* on dry matter basis.

Table 5 indicates that the nutritive value of '*mathri*' with and without incorporation of fresh grated cabbage stems at different levels i.e. 10 percent, 20 percent, and 25 percent of T₁, T₂ and T₃ respectively. Results revealed that highest energy, protein and fat was found in T₃ (361), T₃ (5.70), T₃ (20.53), respectively followed by T₂, T₁ and T₀. Carbohydrates content was found to be highest in T₃ (38.28). Iron and total carotene content was high in T₃ (1.55), T₃ (26.9)/ 100g respectively. The *Khichari* and *Mathri* containing leaf powder have been reported to contain



25.73 per cent and 9.19 per cent protein (Malhotra et al., 2002). Swati et al.,(2012) reported that fresh vegetable mathri have 3.5g protein, 4.09g iron and 76.4 g carbohydrate respectively.

Table 6 shows the “t” values of between control and the best treatment for *parantha*. The table indicates a significant difference between the nutrient content of the control (T0) and the best treatment (T1) as the calculated value of “t” which is found to be 17.14 for fiber content, 145 for fat , 47.76 for total-carotene, 6.18 for protein content, 18.37 for energy content was higher than the tabulated value of “t” which is 2.77 at 5% probability level indicating that there is significant difference between the nutrients content of control (T0) and best treatment (T1) with regard to protein, dietary fiber, energy, and total-carotene. However, a non-significant difference in the 2.6 and 1.78 for carbohydrate and iron content respectively was found.

Table7 shows the “t” values of between control and the best treatment for *mathri*. The table indicates a significant difference between the nutrient content of the control (T0) and the best treatment (T1) as the calculated value of “t” which is found to be 29.39 for dietary fiber content, 9.79 for iron , 98.92, 3.67 for total-carotene content, 3.67 for fat content was higher than the tabulated value of “t” which is 2.77 at 5% probability level indicating that there is significant difference between the nutrients content of control (T0) and best treatment (T1) with regard to iron, dietary fiber and total-carotene. However, a non-significant difference in the 1.37, 2.63 and 2.44 for protein, carbohydrate and energy content respectively was found.

IV. CONCLUSION

The value addition enriched the nutritive value of traditional recipes appreciably. There was a substantial increase in the nutritional value of food products. It may be concluded that fresh cabbage outer leaves and stems may be incorporated in the daily diets of vulnerable section of the populations.



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Table: 1 Nutritional composition of fresh cabbage outer leaves and stems as per 100g

Nutrients	Fresh cabbage leaves and stem
Moisture %	90.7
Ash (g)	0.62
Protein (g)	0.83
Fat (g)	0.3
Carbohydrate (g)	5.15
Iron (mg)	0.8
Total carotene (mg)	57.39
Dietary fiber (g)	2.4

Table 2: Average sensory score of different parameters in control and treated sample of fresh grated cabbage outer leaves and stems “Parantha”

Parameters	T ₀	T ₁	T ₂	T ₃	Result
	Mean± SE	Mean±SE	Mean±SE	Mean±SE	
Colour and appearance	8.6±0.08	8.6±0.44	7.6±0.08	7.2±0.11	S
Body and texture	8.4±0.08	8.7±0.07	7.4±0.44	6.9±0.12	S
Taste and flavour	8.4±0.08	8.6±0.08	7.4±0.18	6.7±0.17	S
Overall acceptability	8.4±0.09	8.6±0.12	7.4±0.09	6.9±0.12	S



Table3: Average sensory score of different parameters in control and treated sample of fresh grated cabbage outer leaves and stems “mathri”

Parameters	T ₀	T ₁	T ₂	T ₃	Result
	Mean± SE	Mean±SE	Mean±SE	Mean±SE	
Colour and appearance	8.2±0.18	8.8±0.08	7.8±0.08	6.9±0.07	S
Body and texture	8.2±0.44	8.6±0.12	7.4±0.12	6.4±0.12	S
Taste and flavour	8.5±0.07	8.6±0.12	7.4±0.17	6.4±0.17	S
Overall acceptability	8.3±0.12	8.6±0.12	7.5±0.05	6.5±0.12	S

Table: 4. Average nutrients content in control and treated sample of ‘mathri’ with fresh grated cabbage stems.

Nutrients	Control	Treatments		
	T ₀	T ₁	T ₂	T ₃
Energy (Kcal)	354	357	358	361
Carbohydrate (g)	37	37.52	38.03	38.28
Protein (g)	5.5	5.58	5.66	5.70
Fat (g)	20.45	20.48	20.51	20.53
Dietary fiber (g)	0.15	0.39	0.63	0.75
Iron (mg)	1.35	1.43	1.51	1.55
Total carotene (µg)	12.5	18.24	23.98	26.9



Table: 5 Average nutrients content in control and treated sample of ‘Parantha’ with fresh grated cabbage stems.

Nutrients	Control	Treatments		
	T ₀	T ₁	T ₂	T ₃
Energy (Kcal)	192	177	163	159
Carbohydrate (g)	35	32.29	30.02	29.02
Protein (g)	6	5.52	5.13	4.96
Fat (g)	10.85	9.89	9.09	8.74
Dietary fiber (g)	0.95	1.09	1.19	1.24
Iron (mg)	2.45	2.3	2.18	2.12
Total carotene (µg)	14.5	18.4	21.65	23.12

Table 6. Comparison between nutrient content of control and best treatment of *Parantha* prepared from fresh grated cabbage stems.

Nutrients	T ₀	T ₁	Difference (t ₀ -t ₁ =D)	t (calculated)	t (tabulated value at 5%)	Results
Energy	192	177	15	18.37	2.77	S
Carbohydrate	35	32.29	2.71	1.78	2.77	NS
Protein	6	5.52	0.48	6.18	2.77	S
Fat	10.85	9.89	0.96	145	2.77	S



Dietary fiber	0.95	1.09	0.14	17.14	2.77	S
Iron	2.45	2.3	0.15	2.6	2.77	NS
Total carotene	14.5	18.4	3.9	47.76	2.77	S

Table7. Comparison between nutrient content of control and best treatment of *Mathri* prepared from fresh grated cabbage stems.

Nutrients	T₀	T₁	Difference t (t₀-t₁=D)	t (calculated)	t (tabulated value at 5%)	Results
Energy	354	357	3	2.44	2.77	NS
Carbohydrate	37	37.52	0.52	2.63	2.77	NS
Protein	5.5	5.58	0.08	1.37	2.77	NS
Fat	20.45	20.48	0.03	3.67	2.77	S
Dietary fiber	0.15	0.39	0.24	29.39	2.77	S
Iron	1.35	1.43	0.08	9.79	2.77	S
Total carotene	12.5	18.24	5.74	98.92	2.77	S
