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FORMULATION AND SENSORY EVALUATION OF RECIPES PREPARED BY INCORPORATING MORINGA LEAVES POWDER

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ABSTRACT:

Moringa oleifera is universally referred to as the miracle plant or the tree of life. Moringa has begun to be recognized and developed in Indonesia as a product with economic value and industrial potential. Moringa powder, utilized to fortify various food processed products. Considering the nutritional importance of the moringa, the present study was planned to utilize moringa leaves powder in the formulation of already popularize traditional food products to make them more nutritious. For the evaluation six traditional food products were chosen namely sev, namakpara, mathari, chakali, moong dal pakoda and masala puri. The evaluation was conducted by preparing all six experimental food products by utilizing moringa leaves powder. To see the acceptance of the recipes sensory evaluation was conducted by the panel of six judges. The food products under control category were prepared by incorporating 100% of traditional ingredients and in experimental food products 3 gm of moringa leaves powder were incorporated. After sensory evaluation, the raw scores of the sensory evaluation were tabulated and the student's "t" test was applied to draw the statistical interpretation. The result of the test showed the insignificant difference at both the level ($p < 0.01$) in all the six recipes (control & experimental). The calculated nutrient content of all the six experimental recipes were high i.e. energy, protein, carbohydrate, fat, calcium, β Carotine, vitamin C, phosphorous, iron and sodium. It is concluded that moringa leaves powder can be incorporated in a certain amount in deep fried food products to improve the macro and micro nutrient intake.

Keywords: *Moringa Leaves Powder, Sensory Evaluation, β Carotine.*

INTRODUCTION :

Moringa oleifera is universally referred to as the miracle plant or the tree of life. Moringa oleifera is one of the vegetables of the Brassica order and belongs to the family Moringaceae. The Moringaceae is a single genus family with 13 known species (Purkait T. & Dutta N. 2020).

The Moringa plant derives this name based on its uses, particularly with regard to medicine and nutrition. It is a plant native to the sub-Himalayan tracts of India, Pakistan, Bangladesh and Afghanistan. Almost all the parts of this miracle tree have been found to be very useful. Leaves are used as forage, tree trunk for making gums, owe nectar in honey and powdered seeds for water purification. Moringa plant provides a rich and rare combination of zeatin, quercetin, kaempferol and many other phytochemicals. It is also a very important plant well known for its medicinal value (Purkait T. & Dutta N. 2020).

Medicinal plant research and applications are expanding each day due to therapeutic phytochemicals, which can stimulate the progress of novel medicines. Most plant-based phytochemicals, e.g., carotenoids, phenolic acids, flavonoids, tannins, saponins, alkaloids, and glucosinolates, have beneficial effects on well-being and avoidance of malignancy. Phytochemicals are widely recognized for preventing and reducing chronic diseases risk (e.g., cancer cardiovascular and neurological) and for beneficial medication in treating these diseases (Kashyap P. et al 2022).

Moringa oleifera is often promoted as a promising plant to combat malnutrition. The products of the so-called "miracle tree" are also discussed for medicinal usage (Grosshagauer S. et al 2021). The Moringa was claimed to be 'the most nutrient-rich plant yet discovered'. Moringa has been used to treat problem such as skin infection, asthma, blackheads, blood impurities, bronchitis, catarrh, chest congestion, cholera and many other illnesses (Abdull R.F. A. et al 2014).

The leaves are outstanding as a source of vitamin A, B group and C (when raw), and are among the best plant sources of minerals. They contain more iron than "kontonmire", seven times the vitamin C in oranges, four times the calcium in milk, four times the vitamin A in carrots, two times, the protein in milk and three times the potassium in bananas. They are excellent sources of protein, but poor in carbohydrates and fats, thus making them one of the best plant foods available in nature (Sengev I. A. et al. 2013).

Methodology

The experiment was carried out by preparing food products in two ways that is control and experimental**.** The control recipes were prepared by using traditional ingredients and the experimental recipes were prepared by adding moringa leaves powder. Moringa Oleifera leaves were collected from Mansar, Ramtek. For making powder of the leaves following steps were followed.

After making the powder standardization of recipes was done. All the experimental products were prepared with the addition of 3 gm moringa leaves powder for one serving. The palatability evaluation of the recipes was conducted by the panel of six judges. They judged the recipes on the scale of six parameters that are appearance, colour, texture, flavour, taste and acceptability. Nutritive value of all prepared recipes was calculated using Food Composition Table by Gopalan C. (2017). Results of sensory evaluation were collected and student's't' test was applied to see the significant difference in control and experimental recipes.

RESULTS AND DISCUSSION:

In this study following food products were standardized & prepared with incorporation of moringa leaves powder sev, mathari, namakpara, chakli, moong dal pakoda and masala puri. Palatability evaluation was conducted and the result of the test is presented in table no. 2.

- **Appearance:** From the above table it is observed that there is no major difference seen in the scores of appearance of control & experimental namakpara and moong dal pakoda. But the appearance of sev, mathari, chakali & masala puri showed minor difference. The result of student's't' test also showed insignificant difference at both the levels of significance ($p>0.05$).
- **Colour:** There is no observable difference had seen in the colour of control & experimental namakpara, mathari & moong dal pakoda. But in the rest of the recipes i.e. sev, chakali & masala puri minor difference was observed and the result of student's't' test also showed insignificant difference ($p>0.05$).
- **Texture:** Only markeable difference was observed in the texture of the chakali among other food products and the result of student's't' test was 1.39 ($p>0.05$) which was insignificant.
- **Flavour:** All the food products got good score except chakli. But it also showed insignificant difference ($p>0.05$).
- **Taste:** The score of taste of control & experimental namakpara, moong dal pakoda & masala puri was same. But in the control &

experimental sev, mathari & chakali a little difference was observed in the scores but the result of student's't' test was insignificant ($p>0.05$).

• **Acceptability:** The scores of control & experimental sev, namakpara, mathari, moong dal pakoda & masala puri showed near about same scores. This shows that these products are highly acceptable. The chakali showed slight difference in control and experimental scores and the result of student's't' test showed insignificant difference ($p>0.05$). Energy (Kcal):- The energy of the control recipes ranged from 236.82 kcal (Namakpara) to 458.20 kcal (Chakali) per 100 g, whereas the values of experimental recipes showed a higher variation, ranging from 238.84 kcal to 1107.22 kcal. A substantial difference was observed in *Chakali,* where the energy content increased more than two-fold (458.20 → 1107.22 kcal). This could be attributed to the absorption of frying oil during preparation. For other products, such as *Sev, Namakpara, Mathari, Pakoda,* and *Masala Puri*, the differences between control and experimental energy values were minimal, indicating a close agreement between theoretical and actual values when oil absorption was limited. Protein (g):- Protein content did not vary significantly between control and experimental values. *Moong dal pakoda* recorded the highest protein content (17.20–17.39 g/100 g), confirming its nutritional advantage as a legume-based product. Other food products such as *namakpara, mathari,* and *masala puri* had relatively low protein values (5–6 g/100 g), which is expected as they are primarily cereal-based. The minimal variation suggests that protein content is less affected by the frying process compared to fat and energy. Fat (g):- Fat content showed a notable difference between control and experimental values. *Chakali* exhibited the most drastic increase, from 13.23 g (Control) to 86.54 g (Experimental), reflecting significant oil absorption during frying. Similarly, *sev, namakpara, mathari,* and *masala puri* demonstrated an increase of 2–3 g compared to control values. *Moong dal pakoda*, however, showed only a marginal rise in fat content. These findings emphasize that the actual frying process substantially alters the lipid profile of the product, leading to higher energy density.

β Carotine (µg):- β Carotine values were consistently higher in all experimental food products. For instance, *mathari* increased from 3.65 µg (Control) to 529.91 µg (Experimental), and *moong dal pakoda* from 480.86 µg to 1007.12 µg. This difference may be due to oil fortification or carotenoid retention during frying, which is not reflected in control values. Vitamin C content was negligible in most snacks, except in *moong dal pakoda*, where experimental analysis reported 10.27 mg, likely due to the contribution of fresh ingredients (onion, coriander, etc.) used in the batter.

Minerals

• Calcium (mg): Ranged between 19.76–113.35 mg/100 g, with the highest in *Chakali* and *Pakoda*.

• Iron (mg): The iron content of experimental food products is observed more as compared with control food products that are (Sev moderate levels were observed across food products, with *pakoda* again showing the highest values (4.2–4.3 mg). The same trend was reported by Haniff & Chamberlain in 2013, the iron content of dried leaves powder made by various methods of dehydration was 19-24 mg per 100g of leaf powder which was 95-96 percent higher than fresh leaves.

• Potassium (mg): Highest in *moong dal pakoda* (941–953 mg), reflecting the legume origin.

• Sodium (mg): Very high in all fried food products, especially *pakoda* (19–20 mg) and *sev* (11 mg), which may raise health concerns regarding regular consumption.

CONCLUSION:

In this study six recipes were prepared by incorporating moringa leaves powder. It is concluded that the experimental recipes which were prepared by adding moringa leaves powder were more nutritious as compared with the control recipes. We can successfully incorporate dried moringa leaves powder in recipes like sev, namakpara, mathari, chakali, moong dal pakoda and masala puri. Many more recipes can be prepared and used as a supplementary food where vitamin A deficiency is a common problem. Moringa leaves are cheaper and easily available. Awareness regarding its utilization in diet is important.

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Table No.1: The Nutrient Compositions of Leaves, Leaf Powder, Seeds and Pods (Thapa K. et al. 2019)

Nutrient	Fresh Leaves	Dry Leaves	Leaf Powder	Seed	Pods
Calories (kcal)	92	329	205	-	26
Protein (g)	6.7	29.4	27.1	35.97 ± 0.19	2.5
Fat (g)	1.7	5.2	2.3	38.67 ± 0.03	0.1
Carbohydrate (g)	12.5	41.2	38.2	8.67 ± 0.12	3.7
Fibre (g)	0.9	12.5	19.2	2.87 ± 0.03	4.8
Vitamin B1 (mg)	0.06	2.02	2.64	0.05	0.05
Vitamin B2 (mg)	0.05	21.3	20.5	0.06	0.07
Vitamin B3 (mg)	0.8	7.6	8.2	0.2	0.2
Vitamin C (mg)	220	15.8	17.3	4.5 ± 0.17	120
Vitamin E (mg)	448	10.8	113	751.67 ± 4.41	–
Calcium (mg)	440	2185	2003	45	30
Magnesium (mg)	42	448	368	635 ± 8.66	24
Phosphorus (mg)	70	252	204	75	110
Potassium (mg)	259	1236	1324	–	259
Copper (mg)	0.07	0.49	0.57	5.20 ± 0.15	3.1
Iron (mg)	0.85	25.6	28.2	–	5.3
Sulphur (mg)	–	–	870	0.05	137

Table No. 2: Mean Palatability Score of Food Products

Sr. No.	Name of the Product	Variation	Appearance	Colour	Texture	Flavour	Taste	Acceptability
1.	Sev	Control	9.55	9.55	8.72	9.22	9.38	8.88
		Experimental	9.22	9.22	8.72	9.22	9.22	8.88
		Student's 't' test	0.66	0.66	0	0	0.36	0
2.	Namakpara	Control	9.16	9.16	9.16	9.28	9.28	9.28
		Experimental	9.16	9.16	9.16	9.28	9.28	9.28
		Student's 't' test	0	0	0	0	0	0
3.	Mathari	Control	9.55	9.22	8.72	9.22	9.38	8.88
		Experimental	9.22	9.22	8.72	9.22	9.22	8.88
		Student's 't' test	0.66	0	0	0	0.36	0
4.	Chakali	Control	9.55	9.55	9.44	9.66	9.55	9.55
		Experimental	9.83	9.83	9.83	9.83	9.83	9.83
		Student's 't' test	1.16	1.16	1.39	0.70	1.16	1.16
5.	Moong Dal Pakoda	Control	9.83	9.83	9.83	9.83	9.83	9.83
		Experimental	9.83	9.83	9.83	9.83	9.83	9.83
		Student's 't' test	0	0	0	0	0	0
6.	Masala Puri	Control	9.66	9.66	9.66	9.66	9.66	9.66
		Experimental	9.55	9.55	9.66	9.66	9.66	9.66
		Student's 't' test	1.37	1.37	0	0	0	0

Table No. 3: Nutritive Value of Food Products [Control (C) & Experimental (E)]

Name of the food product		Energy (kcal)	Carbohydrate (gm)	Protein (gm)	Fat (gm)	Vitamin C (mg)	β Carotine (ug)	Calcium (mg)	Iron (mg)	Phosphorus (mg)	Potassium (mg)	Sodium (mg)
Sev	C	307.56	39.23	12.44	10.49	0	90.32	25.38	3.29	183.65	516.06	11
	E	309.58	39.39	12.63	12.63	3.24	616.58	34.8	3.42	186.92	527.97	11.28
Namakpara	C	236.82	32.26	5.38	9.15	0	4	25.03	2.19	160.39	170	1.72
	E	238.84	32.42	5.57	11.29	3.24	530.26	34.45	2.32	163.66	181.91	2
Mathari	C	252.59	37.31	5.28	8.77	0	3.65	19.76	1.02	57.89	88.5	1.47
	E	254.61	37.47	5.47	10.91	3.24	529.91	29.18	1.15	61.16	100.41	1.75
Chakali	C	458.2	67.96	14.39	13.23	0	53.03	103.93	4.17	244.05	522.4	11.44
	E	1107.22	68.12	14.58	86.54	3.24	579.29	113.35	4.3	247.32	534.31	11.72
Moong Dal Pakoda	C	350.11	44.18	17.2	15.73	7.03	480.86	58.44	4.2	302.48	941.27	19.7
	E	352.13	44.34	17.39	15.87	10.27	1007.12	67.86	4.33	306.78	953.18	19.98
Masala Puri	C	240.31	32.55	5.52	9.31	0.03	11.96	29.64	2.36	164.78	188.36	1.91
	E	242.33	32.71	5.71	11.45	3.27	538.22	39.06	2.49	168.05	200.27	2.2