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Utilization of dehydrated moringa oleifera and Solanum nigrum leaves for the preparation of value added pasta

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Abstract
Value addition of food products by incorporating underutilized crops is a best way to add their nutritional benefits in the daily diet of humans to combat with various degenerative diseases. The study was carried out with objectives to access the sensory attributes and cost of the prepared value added pasta prepared by utilization of Refined wheat flour, dehydrated Solanum nigrum and Moringa oleifera leaves at 90:5:5 percent, 85:5:10 percent and 85:10:5 percent level referred to as T_1, T_2, T_3 respectively and the control T_0 was made with basic ingredients without incorporation of leaves mixture. Sensory evaluations for prepared products were done by using the 9-point hedonic scale. Data obtained were statistically analyzed by using analysis of variance (ANOVA), critical difference (CD). In context with organoleptic attributes, the treatment T_2 of product *Pasta* made from dehydrated leaves mixture(refined wheat flour+ *Moringa oleifera* + *Solanum nigrum* leaves with the ratio of 85:10:5) were most acceptable in comparison with other treatments. And the cost of *Pasta* ranged from Rs. 13.24 to Rs. 12.94.

Keywords: *moringa oleifera*, *Solanum nigrum*, underutilized crops, value addition

1. Introduction
Underutilized crops often considered as minor/neglected/under exploited crops were once grown more widely or intensively, but are falling into disuse for a variety of agronomic, genetic, economic and cultural reasons. Farmers and consumers are using these crops less, because they are in some way not competitive with other species in the same agricultural environment. *Solanum nigrum and Moringa oleifera* are underutilized plant species constituting various medicinal and nutritional properties. *Solanum nigrum* is a medicinal plant belonging to family *Solanaceae*. Makoi and Black nightshade are the common names for it. It is known to possess various biological activities like antibacterial, antifungal, anti-inflammatory, anticancer, anti-oxidant, antipyretic and cytotoxic activity [1]**.** *Moringa oleifera* is the only genus in the family *Moringaceae*. Its common name is drumstick and sehjan. It is a multi-purpose herbal plant used as human food and an alternative for medicinal purposes worldwide. It has been identified by the researchers as a plant with numerous health benefits including nutritional and medicinal advantages. *Moringa oleifera* contains essential amino acids, carotenoids in leaves, and components with nutraceutical properties, supporting the idea of using this plant as a nutritional supplement or constituent in food preparation [2]**.**

2. Objectives
To assess organoleptic attributes and cost of the prepared value added *Pasta*

3. Materials and Methods
The experiments was carried out in the Nutrition Research Laboratory, Department of Foods and Nutrition Ethelind School of Home Science, Sam Higginbottom Institute of Agriculture Technology and Sciences, Allahabad.

Procurement of raw materials
Healthy fresh leaves of *Solanum nigrum* and *Moringa oleifera* for the experiment were collected from the university campus of the SHIATS.

Preparation of dehydrated green leaf powder (*Solanum nigrum* and *Moringa oleifera* leaves) [3]

Leaves (Free from insects and diseases) Washing
↓
Blanching for 3 minutes with water containing 2%salt and 10%citric acid
↓
Drain out with excess water
↓
Spreading on flat aluminium trays
↓
Tray drying at 60 - 65° C. 15 hours for (*Solanum nigrum*) and 8 hours for (Moringa *oleifera*)
↓
Dehydration till the moisture become 6 – 8 %
↓
Grinding into powder
↓
Storage (At ambience temperature in dry place)

(***Source*:** Srivastava and Kumar, 2009)

Fig 1: Flow diagram of dehydration of leaves

Treatment and Replications of the *Pasta*
***Pasta* incorporated dehydrated leaves.**

- **Control (T_0):** 100 percent of refined wheat flour.
- **Treatment (T_1):** 90 percent refined wheat flour, 5 percent *Solanum nigrum* and 5 percent *Moringa oleifera*.
- **Treatment (T_2):** 85 percent refined wheat flour, 5 percent *Solanum nigrum* and 10 percent *Moringa oleifera*.
- **Treatment (T_3):** 85 percent refined wheat flour, 10 percent *Solanum nigrum* and 5 percent *Moringa oleifera***.**

Sensory evaluation of the prepared *Pasta* was done with the help of 9 point Hedonic Scale [4].

Cost of the prepared product was calculated taking into account the cost of individual raw ingredients used in the preparation of the food product at the prevailing market price. The data obtained from sensory evaluation were statistically analyzed by using analysis of variance technique (two way classifications) and critical difference [5].

4. Results and discussion

Table 1: Organoleptic characteristics of the value added *Pasta* developed by incorporation of dehydrated leaves mixture

Treatment	Colour and Appearance	Body and Texture	Taste and Flavour	Overall Acceptability
T_0	7.8	7.6	7.8	7.8
T_1	7.6	7.4	7.4	7.5
T_2	8.3	7.73	8.2	7.89
T_3	6.56	6.43	6.2	6.3
Result	S	S	S	S
P<0.05,C.D	0.407	0.645	0.445	0.35

S=Significant, NS=Non Significant

The organoleptic scores obtained by "*Pasta*" made from dehydrated leaves mixture shows that in context with colour and appearance, treatment T_2 had the highest score (8.3) followed by T_0(7.8, T_1(7.6()and T_3(6.56). Regarding Body and Texture Treatment T_2 had the highest score (7.73) followed by T_0(7.6), (T_1(7.4 and T_3(6.43. In Context with Taste and Flavour treatment T_2 had the highest score (8.2) followed by T_0 (7.8), T_1 (7.5) and T_3 (7.3). That in context with overall acceptability, treatment T_2 had the highest score (7.89) It is revealed from the results that Treatment T_2 was liked very much whereas T_0, T_1, T_3 was moderately liked by the panel of judges. There is significant difference between the control and treatments indicating that the addition of different proportions of fresh leaves mixture affects the overall acceptability of the prepared products as the colour and appearance, body and texture, taste and flavour everything changes as the amount of dehydrated leaves mixture varies.

A study on "Enhancement of functional properties of Indian fermented food through incorporation of *Moringa oleifera* leave" found that incorporation with 10% incorporation of *M. oleifera* leaves was accepted in colour and appearance in terms of sensory parameters [6].

A study on **"**Quality Evaluation of Nutritious Chocolate and Halawa Tahinia Produced with Moringa (*Moringa oleifera)* Leaves Powder" reported that *Moringa oleifera* leaf powder may be blended with cocoa powder at levels as high as 10% of the *Moringa oleifera* leaf powder without adversely affecting baking performance of chocolate [7].

A study on "Standardization and Organoleptic Evaluation of Drumstick (*Moringa oleifera*) Leaves Incorporated Into Traditional Indian Recipes" incorporated 20 g of freshly blanched *Moringa oleifera* leaves in Indian recipes, and found that all recipes were overall acceptable by the panel of judges [8].

Table 2: Average cost of pasta per 100 g of dry ingredients.

Ingredients	T_0		T_1		T_2		T_3	
	Quantity (g)	Cost (Rs)	Quantity (g)	Cost (Rs)	Quantity (g)	Cost (Rs)	Quantity (g)	Cost (Rs)
Refined Flour	100	2	90	1.8	85	1.7	85	1.7
Capsicum	10	1	10	1	10	1	10	1
Carrot	10	1	10	1	10	1	10	1
Cabbage	10	1	10	1	10	1	10	1
Oil	15ml	1.74	15	1.74	15	1.74	15	1.74
Redchilli powder	1	1.5	1	1.5	1	1.5	1	1.5
Tomato	10	1	10	1	10	1	10	1
Onion	20	2	20	2	20	2	20	2
Tomato sauce	12	2	12	2	12	2	12	2
Moringa oleifera leaves	-		5		10		5	
Solanum nigrum leaves	-		5		5		10	

Table no 2. Shows that the total cost of *pasta* per 100g for treatment T_0 is Rs.13.24, T_1 is Rs. 13.04, T_2 is Rs. 12.94and T_3 is Rs. 12.94. It is therefore concluded that the treatment T_0 has the highest cost and due to 100% incorporation of refined wheat flour while in treatments, T_1 has the highest cost in comparison withT_2 and T_3 because the ratio of refined wheat flour varies in different treatments and treatment T_1 have the high level of incorporation of refined wheat flour in comparison with other treatments which affects the cost of the products.

5. Summary and Conclusion

It is concluded that dehydrated leaves of *Moringa oleifera* and *Solanum nigrum* leaves can be successfully utilized for the development of *Pasta*. On the basis of sensory evaluation treatment T_2 (refined wheat flour+ *Moringa oleifera*+ *Solanum nigrum* leaves with the ratio of 85:10:5) was found best in context with overall acceptability and the cost of *Pasta* ranged from Rs. 13.24 to Rs. 12.94, treatment T_2 and T_3 had the lowest cost as compared with other treatments.

6. Recommendation

Incorporation of *Moringa oleifera* and *Solanum niugrum* leaves in snacks increases their nutritive value and functional properties. This is good for therapeutic purposes and can be included in the diets of people with various micronutrient deficiencies and malnutrition. It is recommended to be included in the diet of all age groups because of its health benefits. They are inexpensive source of value addition, for enhancing the micronutrient content and reaping their benefits.

Fig 2: Value added *Pasta* made by incorporation of dehydrated leaves mixture prepared at different ratios named as T_0, T_1, T_2, T_3,

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