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Research Article

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Valorization of Pumpkin Based Products for Small and Medium Food Business Operations

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ABSTRACT

Global food security and economic growth is largely depending on agriculture as it one of the most renewable wealth in the world. However it is noted that many plant species are still unexplored and underutilized. This strategy emphasis an earnest need to concentrate on research in diversification and popularization of such underexplored crops. In this scenario the current study initiates to analyze how valorization of an underutilized vegetable like pumpkin and further its technology transfer helps in promoting small and medium food business operations. Pumpkin based confectionery, beverage and preserved items were optimized and the technological know-how of the same were transferred to the prospective entrepreneurs and agricultural students in the study locale. New entrepreneurs were empowered as an outcome of the study likewise it also opened a scope for better returns for the self-help groups in the rural area with minimal input cost.

Keywords: *Valorization, Pumpkin, Agriculture, Vegetables*

INTRODUCTION

It is a proud fact that India is the second largest producer of fruits and vegetables after China. However, the latest estimates by Central Institute of Post-Harvest Engineering and Technology (CIPHET), Ludhiana, revealed that only 2 percent of the perishable horticultural produce is processed into value added products and upto 18% of the produce is wasted as a result of the poor management practices (NABARD, 2014).

A close watch on health statistics of the population underscore certain perceptible changes in the recent dietary pattern among which the most emphasized one has been the necessity for increased inclusion of fruits and vegetables in the diet. India has abundant fruits and vegetable cultivation, however all cultivated vegetables are not explored to the fullest.

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The abundant species of fruits and vegetables which could ensure food security and income generation sustainably, are unfortunately the least explored crops. Pumpkin is one such underexploited vegetable which requires value addition in terms of product expansion, improved shelf stability and efficient utilization thus preventing wastage. The prominent varieties of pumpkin found in India are Arka suryamukhi, Arka chandan, CM-14, CM-350 and NDPK-4 (Kallo et al., 2006). The edible portion of the vegetable varies from 70-86% depending on the variety (Wills, 1987). According to the data from Indian Food Composition Tables (2017) pumpkin is a good source of carotene (135-527 µg /100 g), calcium (23mg), total folates (24µg) while it also contains moderate levels of vitamin C (8mg) and protein (0.8-2%).

The nutritional profile of pumpkin showcases that the vegetable is a potential agent in providing nutrition security among the rural populace. Studies have proposed the underutilization of these type of vegetables will have an immediate consequences on the nutritional status and food security of the poor (Dansi et al., 2012). Hence it is important to enhance the utilization of underexplored horticultural crops like pumpkin for facing the multifaceted challenges like increasing population, unemployment and environmental degradation. The livelihood for eighty-five percent of the rural families relay on agro related activities (Williams & Haq, 2002). Therefore valorization of these crops are being encouraged to diversify the existing products focusing attention on food habits and health practices.

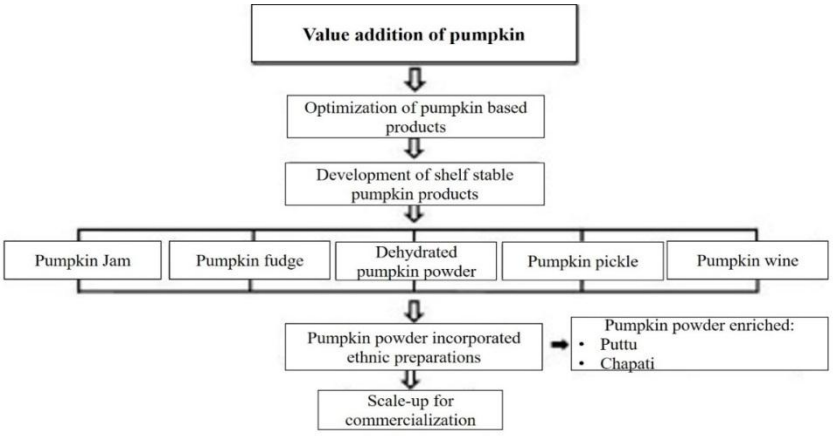
Promotion of readily scalable and economically feasible products with minimum requirement of skill and maximum shelf stability is highly appreciable in the current food processing/ preservation sector. Processing and value addition of underutilized crops helps in ensuring its availability throughout the year and also reduce the wastage due to inappropriate post-harvest handling. A plethora of research have been conducted in processing of fruits and vegetables into shelf stable products like jam, preserve, confectionery, beverage, candy, dehydrated and pickled products. Nevertheless, such products based on pumpkin received little attention from research and extension services, in this regard the current study administered technology transfer sessions on pumpkin based products for ensuring its commercial adoption.

MATERIALS AND METHODS

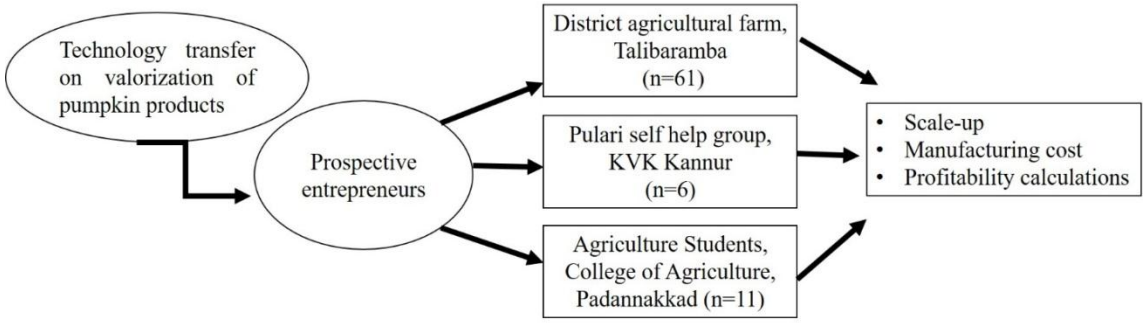
The current project was a collaborative work by Krishi Vigyan Kendra, Kannur and College of Agriculture, Padannakkad functioning under Kerala Agricultural University. The pumpkin (*Cucurbita moschata*) variety utilized for the present study was *Arka Suryamukhi* which is a high yielding variety released from the Indian Institute of Horticultural Research, Bangalore. The small sized, flat-round orange coloured fruits that are suitable for growing in Kerala condition during September – January were procured from farms of the respective institutions.

EXPERIMENTAL DESIGN

Phase I:



Phase II:



The study focused on optimization of value added products from pumpkin and its technology transfer for commercialization. The major products developed were pumpkin jam, fudge, pickle, wine and dehydrated pumpkin powder. These products were purposively chosen as it requires minimal technology and skill for commercial upscaling among the populace who are interested in food entrepreneurship. Portions of dehydrated pumpkin powder were further utilized in development of ethnic formulae blends like puttu and chapathi mixes. Puttu and chapathi were selected for optimization of formulae blends as these are the major items included on a weekly basis in the menu of every individual.

The training programme for the current study were organized in District agricultural farm, Taliparamba, Pulari self-help group functioning in association with Krishi Vigyan Kendra (KVK), Kannur and Agriculture graduates enrolled for an experiential learning programme on 'Processing and Value Addition of Horticultural Crops' in College of Agriculture, Padannakkad Kasaragod. These beneficiaries were purposively chosen so as to ensure immediate scale-up of these products in small scale level. Thus the present study could serve as a pilot phase to understand the feasibility and challenges accompanied by such initiatives at a larger scale.

RESULTS AND DISCUSSION

Phase I

Each final product is an outcome of extensive optimization methodologies in which various processing techniques and ingredient combinations were experimented for screening the ideal formulae with best organoleptic characteristics.

Pumpkin jam

The pumpkin pulp were mixed with sugar, pectin, acidulant (E330 at 0.25%) along with a pinch of cardamom for flavor and cooked until the total soluble solids reached 64˚Brix (determined using refractometer). The end point of the process were determined by the drop test.

Fig. 1: Production process for making pumpkin jam

Pumpkin fudge & candy

Fudge

The ripe pumpkin were blanched with addition of preservative (E224) and pureed. The puree was mixed with equal quantities of sugar and butter and heated till the temperature reached 116 ˚C. Beating the mixture while it cools aided in acquiring smooth and creamy consistency. The pumpkin fudge was best kept in the freezer with a shelf life of three months, however for a softer texture the product could also be refrigerated. Regardless of the cold storage followed, thawing before consuming is recommended.

Candy

Slices of ripe pumpkin were soaked in 2% potassium metabisulphite solution for two minutes and then in sugar syrup (prepared with addition of sugar, water, citric acid). Cook the vegetable in sugar syrup till TSS 75˚ Brix and 106 ˚C temperature. Soak the fruit for 7 days and then drain the sugar syrup and dry the soaked pumpkin in shade to get pumpkin candy.

Pumpkin pickle

Good quality pumpkin without contusions were washed, peeled and cut in to brunoise (3mm). Apposite portions of oil, vinegar, spices and condiments were added to the formulae. The shelf life of thus prepared pickle was found to be 3 months when packed in air tight pouches.

Fig. 2: production process for making pumpkin pickle

Pumpkin wine

The pumpkin wine was prepared using Saccharomyces cerevisiae as a fermenter with addition of sugar for 3 months fermentation period at 30-35˚C. The pumpkin, sugar and yeast mixture were stirred on consecutive days during the initial period of fermentation. On finishing the fermentation cycle the wine was syphoned and bottled.

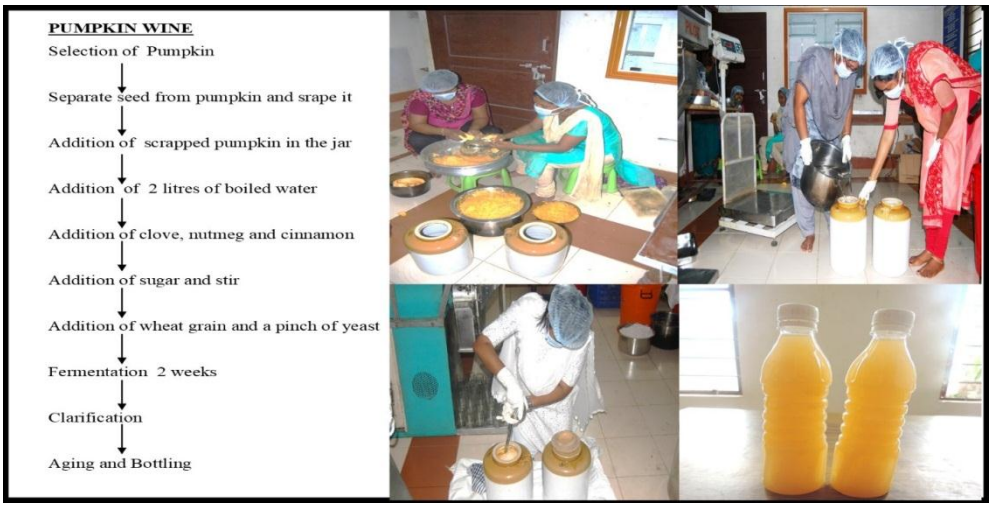


Fig. 3: production process for making pumpkin wine

Dehydrated pumpkin powder

The ripened pumpkins were washed, peeled and blanched at 75˚C for 15 minutes, further the blanched slices were dipped in 1% E224 solution for 10 minutes and drained. The slices were spread into trays of hot air oven and dried at 60˚C for 12hours. The dried pumpkin were then powdered.

Fig. 4: production process for making pumpkin powder

Applications of pumpkin powder

The pumpkin powder obtained on dehydration and pulverization of ripe pumpkins were utilized for enriching the major ethnic breakfast preparations like steamed rice/wheat cake (Puttu) and Indian flat bread (Chappathi). These preparations were purposively chosen for enrichment due to its wide acceptance among all age groups of the population. The optimization of pumpkin enriched steamed cake and Indian flat bread mix were through trial error method. The ideal proportion of the formulae were finalized based on its organoleptic characteristics viz., appearance, colour, flavor, texture, taste on a 5-point scale (excellent -5, good-4, fair-3, poor-2, very poor-1) and overall acceptance determined using a 9 point hedonic rating scale (like extremely-9, like very much-8, like moderately-7, like slightly-6, neither like nor dislike-5, dislike slightly-4 dislike moderately-3, dislike very much-2, dislike extremely-1).

Table 1: Mean values of organoleptic qualities of pumpkin powder based ethnic recipes

Treatments	Organoleptic Characteristics					
	Appearance	Colour	Flavour	Taste	Texture	Overall acceptance
Steamed rice cake (Rice Puttu) Control (100% Rice flour)	5	5	5	5	5	9
T1 (80%rice + 20% pumpkin powder)	4	4	4	4	5	8
T2 (70% rice+30% pumpkin powder)	4	4	4	4	4	8
T3 (60% rice+40% pumpkin powder)	3	4	3	3	2	6
Steamed wheat cake (Wheat Puttu) Control (100% Wheat flour)	5	5	5	5	5	9
T1(80% wheat + 20% pumpkin powder)	4	4	4	4	4	8
T2 (70% wheat +30% pumpkin powder)	4	4	4	4	4	8
T3 (60% wheat + 40% pumpkin powder)	2	4	2	2	2	4
Indian Flat bread Control (100% wheat flour)	5	5	5	5	5	9
T1 (80% wheat flour +20% pumpkin powder)	5	5	5	5	5	9
T2(70% wheat flour +30% pumpkin powder)	4	4	4	4	4	8
T3 (60% wheat + 40% pumpkin powder)	4	4	4	3	4	7

As per Table 1, among the various treatments for rice and wheat steam cake, T1 and T2 received better scores for organoleptic characteristics and overall acceptance while T3 received least acceptance. The treatment T1 had only a tad difference with respect to the control while T2 produced a prominent yet acceptable colour, flavor and taste to the steamed cakes. The remarks of the panelist on the organoleptic characteristics revealed that the combination T2 had a sweet taste when compared to control and T1. Even though T3 had gained an overall acceptance score of 6, it was not recommended to be an ideal formula for the optimization of rice steamed cake as it failed to provide appropriate texture to the product. Addition of seventy percent pumpkin powder was acceptable in rice as well as wheat steamed cake combinations.

With regards to the various formulations utilized for the development of pumpkin enriched Indian flat bread, the combination T1 (80% wheat flour +20% pumpkin powder) was on par with the control (100% wheat flour).On increasing the concentration of pumpkin powder a slight reduction in organoleptic and overall acceptance scores were observed. However both combinations (T2 & T3) were acceptable by the consumers. Hence the combination T3 (60% wheat + 40% pumpkin powder) was chosen as the ideal formulation for the Indian flat bread.

Fig. 5: control Vs selected combination of steam cake

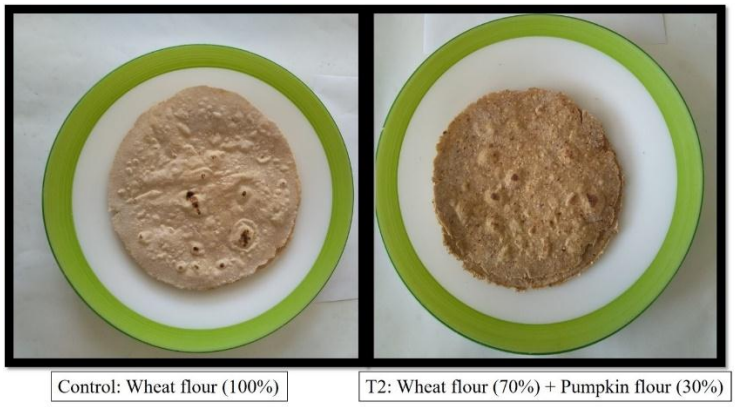


Fig. 6: control Vs selected combination of Indian flat bread

Phase II: Pilot scale commercialization

The valorization and pilot scale commercialization of pumpkin based products were implemented through members of self-help groups and students of College of Agriculture, Padannakkad. The seed initiative in the form of infrastructure and machinery for each unit was provided by the respective institutes where the units are currently functioning. The technical know-how were given to these groups through method demonstration. Alongside explaining the scope for value addition of pumpkin, a knowledge transfer session on health benefits of pumpkin were also conducted. Unit selling price for the jam, pickle and fudge were rupees 200.00, 175.00 and 100.00 respectively. Although the three units obtained profit from value added products of pumpkin, the product through output was better for Self Help Groups at District Agricultural Farm (DAF) followed by Krishi Vigyan Kendra (KVK) while the student entrepreneur cell experienced comparatively lesser rate of sales (Table 2). The reduced rate of sales could be attributed to the lesser point of sales for the students-run unit. The Food Safety and Standards Authority's registration enhanced the sales of the products developed from KVK and DAF. On account of the successful completion of the pilot product development and marketing, these self-help groups have taken up the value addition of pumpkin on a regular basis along with their other products.

Table 2: Total output obtained by each unit from value added pumpkin products per production cycle

Production unit	Item produced	Quantity produced (kg)	Production cost (in Rupees)	Gross income	Net profit
District Agricultural Farm	Jam	500	33500	100000	66500
	Pickle	50	1250	8750	7500
Pulari Self Help Group (KVK Kannur)	Jam	100	6700	20000	13300
	Pickle	10	250	1750	1500
Experiential Learning Unit (College of Agriculture Padannakkad)	Pickle	7	175	1225	1050
	Fudge	5	250	500	250

CONCLUSION

The pilot study on value addition of pumpkin and further its commercial scaling up proved to be profitable for small and medium business food operators who requires cost effective technology with minimal labor. The value addition of pumpkin enhanced its consumption from a culinary vegetable to confectionery and beverage as well. Pumpkin being a good source of carotenoids will also aid in reduction of vitamin A deficiency among the populace. Thus the products formulated in the current study could be readily absorbed by food entrepreneurs.

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