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Ginger value addition: A promising strategy for improving farmers' income and livelihood

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Abstract

This paper delves into the potential benefits of processing ginger, an agricultural commodity known for its short shelf life, in order to enhance its value. Traditionally valued for its medicinal properties in addressing various ailments such as pain, nausea, and vomiting, ginger's year-round accessibility opens avenues for producers to establish small- or large-scale processing facilities. With the ability to be stored at room temperature for approximately ten days, ginger proves to be a versatile ingredient for creating processed goods with extended shelf life. By encouraging farmers to adopt food processing techniques, such as making pickles, squash, and ginger powders, rather than adhering to traditional practices of selling raw ginger, this study aims to demonstrate the potential revenue boost and risk reduction for producers. Crop processing not only enhances profits for farmers but also empowers both rural and urban women. The article underscores the advantages of processing agricultural products, highlighting the disparities between selling them before and after processing. This shift towards value addition through processing can be a transformative step for farmers, offering sustainable economic benefits and fostering innovation in the agricultural sector.

Keywords: Ginger, value added products, cost benefit ratio, sensory evaluation, and shelf-life study

Introduction

In the fiscal year 2023, India anticipates a substantial increase in ginger production, projecting a yield of 2.43 million metric tons (Statista, 2023) [4]. Recognized for its numerous health benefits, ginger has been utilized for centuries as a natural remedy and flavor enhancer owing to its ability to alleviate pain, nausea, and vomiting. The efficacy of ginger in addressing various health concerns has been extensively investigated through randomized clinical trials, focusing particularly on its antiemetic properties in diverse situations (Li *et al*., 2019; Weimer *et al*., 2012; Ensiyeh *et al*., 2009) [5, 13, 2]. The chemical composition of ginger encompasses a spectrum of bioactive compounds, including terpenes, vitamins, and minerals (Sharifzadeh *et al*., 2018; Mohomoodally *et al*., 2021) [10, 6]. Among these, gingerols emerge as primary constituents, showcasing a spectrum of biological actions such as antibacterial, antioxidant, and anti-neuroinflammatory effects (Kubra *et al*., 2012) [3].

Table 1: Health benefits of ginger nutrients

Nutrient	Nutrient Value per 100 g	Health Benefits
Calories	80	Provides energy
Carbohydrates	18 g	Regulates blood sugar levels
Fiber	2 g	Improves digestion, promotes satiety
Protein	2 g	Helps build and repair tissues
Fat	1 g	Provides essential fatty acids
Vitamin C	5 mg	Antioxidant, boosts immune system
Vitamin B6	0.2 mg	Promotes brain function, mood regulation
Potassium	415 mg	Regulates blood pressure, maintains fluid balance
Magnesium	43 mg	Supports bone health, improves sleep quality
Zinc	0.6 mg	Supports immune system, wound healing

Recent research has intensified exploration into ginger's potential anticancer properties and its capacity to mitigate chemotherapy-induced fatigue, nausea, and vomiting, ultimately contributing to an enhanced quality of life (Nile

et al., 2015; Mao *et al*., 2019; Crichton *et al*., 2019) [8, 7, 1]. A detailed analysis of the nutrients present in 100 grams of ginger reveals a rich nutritional profile, supporting various health benefits, is listed in Table 1. Beyond its well-known soothing properties, ginger's fiber content promotes digestion and induces a sense of satiety, while its carbohydrates contribute to blood sugar regulation. The lipids in ginger provide essential fatty acids, supporting tissue growth and repair, while the proteins aid in these processes as well. The presence of significant amounts of vitamin B6 enhances mood control and cognitive function, complemented by the antioxidant prowess of vitamin C, fortifying the immune system (Lee, 2013) [4].

Furthermore, the mineral composition of ginger, including magnesium for bone health and improved sleep quality, potassium for blood pressure regulation and fluid balance, and zinc for immunity and wound healing, underscores its holistic health benefits. The collective impact of these nutrients' positions ginger as a multifaceted contributor to health, encompassing anti-inflammatory effects, digestive enhancement, and alleviation of nausea and vomiting (United states Department of Agriculture., 2022).

Materials and Methods

In November 2022, a comprehensive study was undertaken at the JP College of Engineering, Tenkasi, aimed at enlightening ginger farmers on value-added product manufacturing. A selection of twenty ginger farmers from the Tenkasi district in Tamil Nadu participated in this training, where they gained practical insights into crafting pickles, candies, ginger powder, and squash. The training included hands-on sessions and demonstrations emphasizing correct and hygienic production methods. Additionally, the study incorporated shelf-life assessments and sensory evaluations. Rigorous scientific calculations were employed to determine the gross income, gross cost, and net income for each product, contributing to a holistic understanding of the economic aspects of value-added ginger products.

(1) Raw materials

The procurement of fresh ginger roots took place at the Surandai local markets, a prominent vegetable cultivation hub in the Tenkasi district. Following the purchase, the ginger roots were transported to the JP College of Engineering in Tenkasi using suitable and efficient means of transportation.

(2) Procedure for preparation

The initial stage involved pre-treatment procedures for the gingers, encompassing the removal of their outer skin and soaking in a 2 percent salt water solution for 20 minutes. Subsequently, the gingers underwent cleaning with a cloth and rinsing with potable water. The food was then appropriately shaped and sized through chopping. Blanching, a crucial pre-treatment step involving brief immersion in boiling water for five to seven minutes, was necessary for various processing stages. Following blanching, the gingers were rinsed with cold water and either dried or directed towards further processing, contributing to the creation of value-added products.

(A) Ginger Powder preparation method: Initially, the gingers were subjected to pre-treatment involving immersion in a 2 percent saltwater solution for 20 minutes, followed by washing and towel-drying. Post-skin removal, the gingers underwent blanching, draining, and were subsequently sliced into 3 mm thick pieces, arranged in trays. The sliced gingers then underwent an eight-hour drying process at 40 °C using a solar dryer. After complete drying, the ginger slices were sieved and crushed into powder form. This meticulous process ensured the transformation of fresh ginger into a versatile and convenient powder suitable for various culinary applications and value-added products.

(B) Ginger candy preparation method

Following the cleaning process, the ginger roots underwent slicing into uniform cubes, intended for the production of ginger candy. The cubes underwent blanching in a 2% saltwater solution as an initial treatment. Subsequently, a sugar syrup of 45° Brix was prepared and allowed to cool to room temperature. Post-blanching, the ginger cubes were immersed in the sugar syrup, supplemented with 1% citric acid for preservation, for a duration of 48 hours. After extraction from the sugar syrup, the ginger cubes underwent an eight-hour drying process at 40 °C using a solar dryer, completing the meticulous preparation for ginger candy production.

(C) Ginger Squash preparation method

Initiate the preparation by peeling and blanching the ginger, allowing it to cool. Subsequent steps involve mashing the ginger to form a sauce, combining it in a 2:1 ratio with sugar and ginger juice. Once sugar dissolution is achieved, introduce 2% cardamom powder, stirring until the mixture reaches 45° Brix. Conclude by incorporating 1% citric acid, stirring, and allowing the blend to cool. After filtration, transfer the mixture into an airtight container. This detailed process yields a flavourful ginger concoction, demonstrating the fusion of various ingredients to create a harmonious and palatable sauce.

(D) Ginger pickle preparation method:

Commencing the preparation, fresh gingers underwent a pre-treatment involving a 20-minute soak in a 2% saltwater solution before being delicately sliced into small pieces. In a pot, gingelly oil was heated, and the chopped ginger was cooked for ten minutes. Subsequently, cumin seeds, dried chilies, garlic, asafoetida, and salt were dry roasted and ground. A blend of these spices, in a 4:1 ratio with the cooked ginger, was combined, along with the addition of 1% citric acid. The resulting mixture was exposed to sunlight for two hours daily over three days, covered with a muslin cloth, allowing for the infusion of Flavors and aromatic richness.

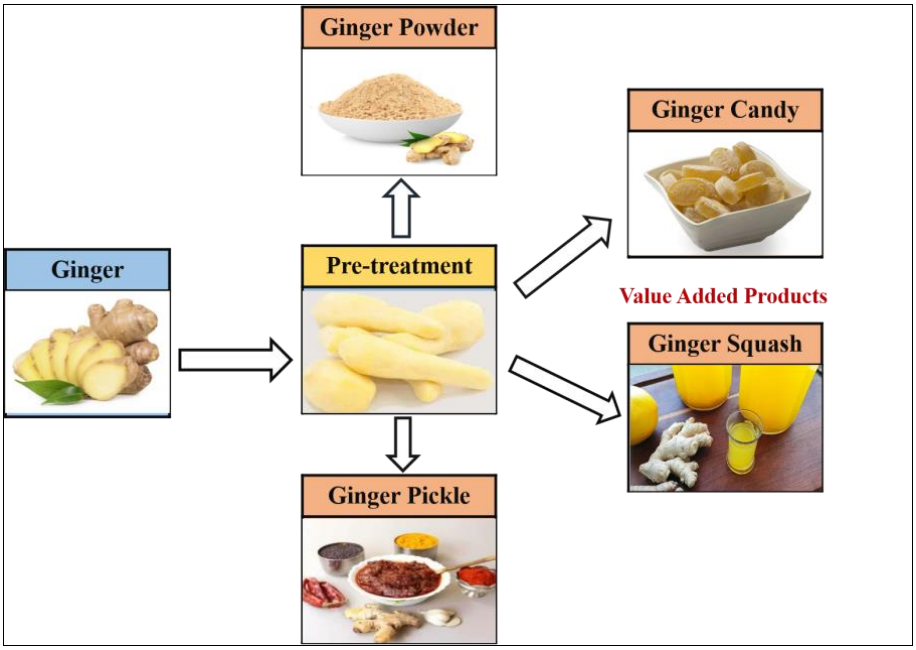

Fig 1: The entire process of value-added product preparation from fresh Ginger

Results and Discussion

Table 2 provides a comprehensive comparison between raw ginger and various processed ginger products, including ginger powder, candy, squash, and pickles, along with evaluations of sensory attributes and shelf-life analysis. Unprocessed ginger costs vary, starting from Rs. 25/kg at the farm gate, contingent upon the type. Notably, the production of 50 kg of ginger powder necessitates 500 kg of raw ginger. This detailed analysis encompasses cost dynamics, product variations, and the quantities involved in the processing of diverse ginger items, offering valuable insights into the economic aspects of ginger-based products.

Table 2: Benefit Cost Ratio, Sensory evaluation scores and Shelf-life study of value-added Ginger products Versus Raw Ginger

Ginger value-added products	Production (Kg)	Gross Income	Gross Cost	Net Income (Rs.)	BCR	Consumer acceptability	Shelf life (days)
Ginger Powder	50 (Rs.500/Kg)	25000	7900	17100	3.2	4.7	90
Ginger Candy	50 (Rs.700/kg)	35000	10200	24800	3.4	4.8	120
Ginger Pickle	50 (Rs.300/kg)	15000	3600	11400	4.2	4.8	120
Ginger Squash	50 (Rs.200/kg)	10000	3200	6800	3.1	4.8	240
FP*: Raw Ginger	50 (Rs.25/kg)	1250	500	750	2.5		15

*FP-Farmer Practice

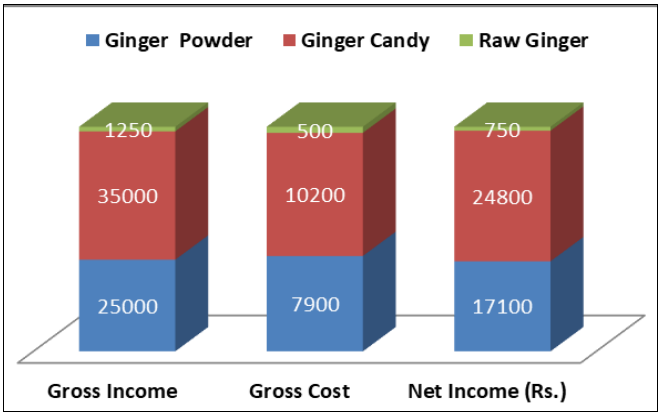

Fig 2: Benefit Cost Ratio of workings of Ginger powder, Candy Vs Ginger without processing

Figure 4 illustrates the Benefit Cost Ratio (BCR) values for various processed ginger products in contrast to raw ginger. The highest BCR, reaching 4.2, was observed for ginger pickle, trailed by 3.4 for ginger candy, and 3.1 each for squash and ginger powder. In comparison, raw ginger yielded a BCR value of 2.5. This representation accentuates the economic viability of different processed ginger items, with ginger pickle exhibiting the highest benefit-cost ratio among the evaluated products.

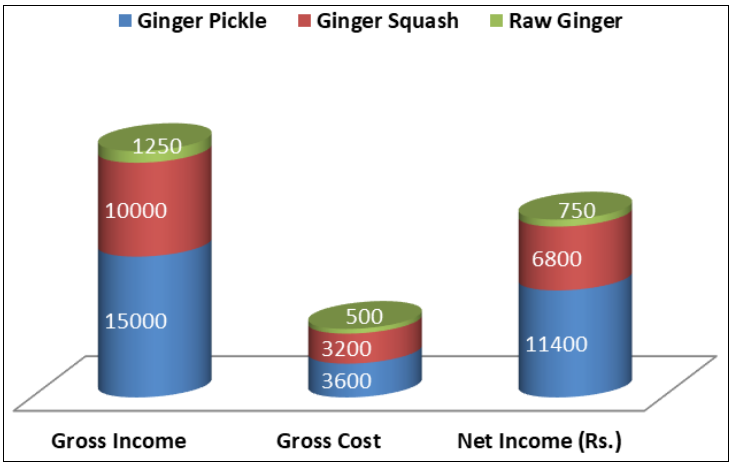

Fig 3: Benefit Cost Ratio of workings of Ginger powder, Candy Vs Ginger without processing

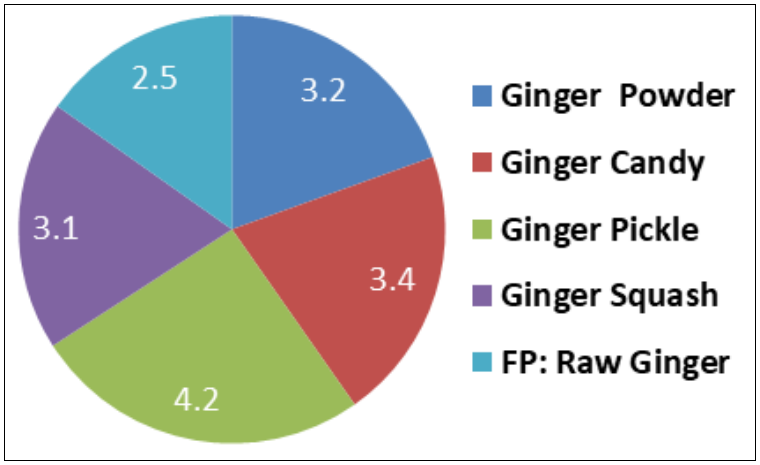

Fig 4: Benefit Cost Ratio of Ginger Value added products

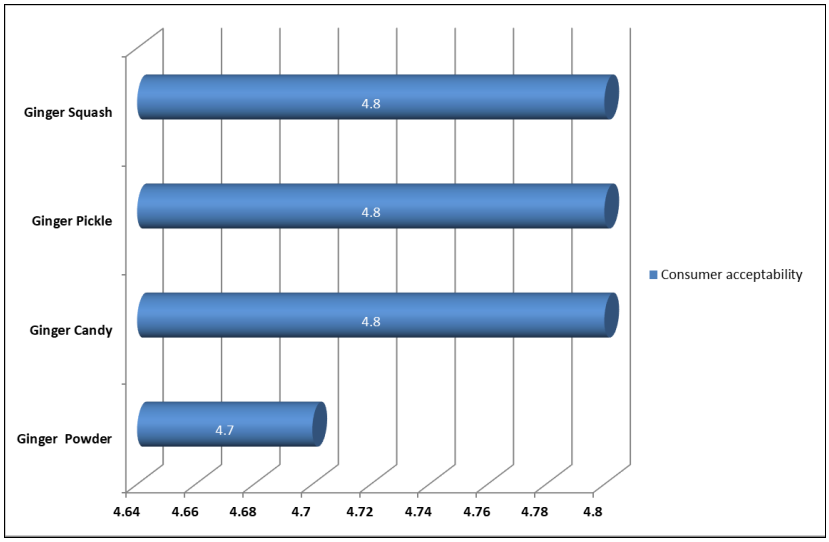

Fig 5: Mean Sensory Evaluation results – Overall acceptability of the different value added products developed from Ginger

Presenting the outcomes of the sensory evaluation for processed ginger products, Figure 5 encapsulates the results of a study where twenty-five semi-trained panellists assessed items based on colour, appearance, aroma, taste, texture, and overall acceptability, utilizing a five-point hedonic scale. Notably, the processed items received remarkably high ratings, indicating strong positive perceptions across all sensory attributes. Furthermore, the data revealed that these favourable scores remained consistent even after 270 days of storage, with evaluations conducted at intervals of 0, 90, 180, and 270 days, affirming the sustained quality and sensory appeal of the processed ginger products over an extended storage period.

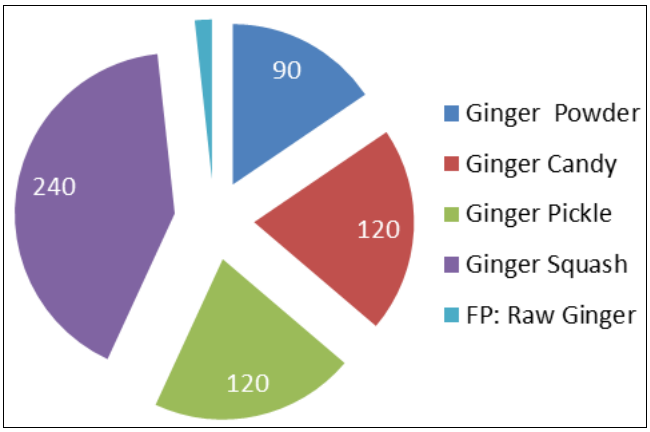

Fig 6: Shelf life study of different value added products of Ginger

Figure 6 illustrates the findings of the shelf-life analysis, contrasting processed ginger products with raw ginger. The investigation delves into the longevity and stability of these products over time.

Ginger, a widely utilized spice in global cuisines, faces a significant challenge due to its brief shelf life of only 15 days at room temperature. This limitation poses financial hurdles for farmers, particularly during periods of fluctuating demand and pricing. However, by employing suitable processing technologies and adhering to product standardization, ginger can be transformed into high-value goods with an extended shelf life. This transformation not only addresses the economic challenges faced by farmers but also opens avenues for increased revenue, offering a sustainable solution to leverage the full potential of this versatile spice in the market.

Leveraging value-added technology for ginger not only mitigates losses during price reductions but also elevates the living standards of rural residents. As noted by V. Saradha Ramadas (2011) [9], the creation of value-added products from ginger has the potential to quadruple farmers' income, diminish marketing risks, eliminate ginger waste, and introduce novel items for off-season availability. This approach not only addresses economic challenges but also fosters sustainable rural development, providing farmers with diversified income sources and enhancing overall livelihoods.

One of the primary advantages of transforming ginger into high-value products lies in the substantial financial gains it offers. As evidenced by the study, the benefit-cost ratio (BCR) of processed ginger products surpasses that of fresh ginger. Notably, ginger pickles exhibited the highest BCR at 4.2, followed by ginger candies (3.4), squash (3.1), and ginger powder (3.1). In contrast, fresh ginger recorded a BCR of 2.5. This compelling data underscores the potential for farmers to mitigate marketing risks and achieve a twofold increase in income by embracing the transformation of ginger into high-value items, showcasing the economic viability of such endeavours.

In contrast to raw ginger, processed ginger products not only boast an extended shelf life but also hold the potential to amplify farmers' earnings. The conundrum faced by farmers, struggling with the burden of labour and transportation costs during peak seasons characterized by low ginger prices, can be alleviated through enhanced knowledge. Training initiatives covering the nutritional benefits of ginger, post-harvest handling, food processing, and value addition empower farmers to explore value-added opportunities. Consequently, the creation of value-added goods from ginger emerges as a promising avenue to uplift the living standards of rural communities and farmers, offering a sustainable solution to economic challenges.

Finally, the transformation of ginger into high-quality products could potentially yield positive health outcomes. Ginger, renowned for its anti-inflammatory and antioxidant properties, offers a spectrum of health benefits. The conversion of ginger into diverse products not only enhances its accessibility but also broadens the population that can avail themselves of these health advantages, thereby contributing to the overall well-being of a larger community.

Conclusion

This paper aims to underscore the economic advantages associated with transforming ginger into premium products. According to the research, the processing of ginger into items such as pickles, sweets, squash, and powders yields a higher market value compared to fresh ginger. Beyond commercial gains, this conversion process has the potential to generate positive impacts on the economy, society, and health.

Beyond financial gains, the conversion of ginger into high-value products holds the promise of yielding social benefits. The study suggests that implementing value-added technology for ginger can mitigate losses during market downturns, enhance earnings for female farmers, and serve as a catalyst for small-scale entrepreneurs in both rural and urban settings. These value-added ginger products also contribute to elevating living standards in rural areas, minimizing ginger waste, and fostering employment opportunities.

The findings of this research highlight the far-reaching positive effects that converting ginger into premium products can have on the economy, society, and health. The study draws attention to the economic potential of ginger and its versatility in being transformed into a range of high-value items. To optimize the value and sustainability of ginger production, stakeholders such as farmers, food processors, and policymakers can glean valuable insights from the study's findings.

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