

Product Development and Organoleptic Assessment of Lotus Stem (*Nelumbonucifera*) Milkshake

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Abstract: Lotus stem (*Nelumbonucifera*) is an indigenous vegetable confined to selective cuisines of South East Asia. Lotus stem is a nutritionally balanced food. It is low in fat, low in sugar and high in protein, minerals and vitamins. Lotus stem has been proven to exhibit anti-microbial, antipyretic, anti-viral and anti-fungal activity. The alkaloids in lotus stem have been proven effective in the management of diseases like hypertension, type-2 diabetes and various viral and fungal infections. The benefits of lotus stem are unexplored by majority of the culinary populations of the world. The consumption of lotus stem is recommended in to enhance the physiology and biochemistry of the individual. The benefits of lotus stem are unexplored by majority of the culinary populations of the world. Lotus stem in addition to its nutritional benefits is an extremely versatile ingredient. Its mild sweet flavor renders it suitable to be incorporated in various recipes. An edible product using lotus stem was developed. The product is a toffee-flavored milkshake using lotus stem as the main ingredient. The product thus developed was organoleptically assessed in comparison with conventional Sapodilla/roseberry/ mudapple (*Manikarazapota*) fruit milkshake. This was achieved by a thorough sensory evaluation procedure involving 31 semi-trained panelists. The panelists also answered a detailed questionnaire based on several non-invasive and invasive sensory parameters. The non-invasive section of the questionnaire ascertained the awareness of the nutritional benefits of lotus stem among panelists. The invasive section of the questionnaire focused on determining product acceptability, product VFM and its commercial marketability. Future prospects include developing more innovative recipes from lotus stem for commercial marketing and also assessing the role of lotus stem in the therapeutic management of various lifestyle diseases.

Keywords: Lotus stem milkshake, novel product development, sensory evaluation, VFM

I. Introduction

Food is one of the basic necessities of life. Food appeals to the senses, nourishes the body and satiates the soul. Since ancient times, food is recognized as the most superior source of human wellness. Food is also acclaimed as the foundation of human health. Thus, there is no doubt that food is the epicenter of human living. Thus, mealtimes at home or in communities became an important facet of human life. During meals, there is an exchange of emotions, viewpoints that increases bonding. Also, food is synonymous with religious festivities and is synonymous with sanctity. Thus food is not just a medium of nourishment, but also a mode of elevating the physical, emotional and spiritual quotient of an individual. Thus, for all these reasons, food is indeed the gateway to health.

Modern lifestyles are fast-paced and hectic. There is no time for a breather, let alone dedicated and regular mealtimes. This has led to the human population compromising their health due to inadequate and imbalanced nutrition. To somewhat address this problem; a new trend has evolved in the field of food science and technology that is the development of convenience foods. Convenience foods as the name suggests are food products developed which are poised on the fulcrum of consumer convenience. These foods promise to greatly reduce the time required in procuring, processing and preparation of foods. Innovative foods labeled ready to eat, ready to cook, instant foods are all prominent examples of convenience foods. Due to this manufacturing initiative, consumers do not have to skip meals, as these foods can be easily consumed on the go.

However, as humans are psychosocial and highly intellectual, there is a cognitive and emotional association with food. Food is only aptly consumed when it precisely appeals to all the senses- sight, smell, taste, touch and also auditory. Thus, innovative products promising maximum consumer convenience are rendered useless if they do not meet the criteria of organoleptic acceptability. Thus, Sensory Evaluation, the science of measurement and quantification of organoleptic acceptability using the senses is the one of foundations of product development.

II. Sensory Evaluation

Organoleptic analysis (or sensory evaluation) is a scientific discipline that applies the principles of experimental designs and statistical analysis to the use of human senses (sight, smell, taste, touch and hearing) for the purpose of evaluating consumer products.

This is especially relevant as the human system's sensory output has 4 important characteristics:

- Each sense is governed by specific biochemical activities and is capable of individual action.
- There is a synergistic effect of one or more senses in which case the biochemical effect is more sophisticated.
- The response to the stimulus by the sense is mediated through nervous transmission and is based on previous neural input i.e. memory.
- Sensory evaluation has many applications where the input governs both positive and negative responses.

Quality is the ultimate criteria for the desirability of any food product to the consumer. Sensory quality, as ascertained by the techniques of sensory evaluation, is a parameter of great importance to both the processor and the consumer. To the processor since it attracts consumers and the consumers since it satisfies the aesthetic and gustatory sense.

Sensory quality is a combination of different sensors of perception coming onto play in choosing and rating a food; which are as follows:

- Appearance- which can be judged by the eye; for example parameters like color, size, shape, uniformity and absence of defects are of first importance in food selection.
- Kinesthetics, the next important attribute concerns texture and consistency.
- Flavor, which embraces the sense of taste, smell and feelings. Odor assessment is done by sniffing food before putting it in the mouth. In – the- mouth assessment of flavor is done by putting food into the mouth and assessing the combinations of sensation.
- After taste measurements is done with sensations perceived after food is swallowed or rinsed in the mouth. The important considerations being that independent judgment in an atmosphere of relaxed concentration and free from any distraction should be possible.

Trained panel evaluations are used to detect and describe organoleptic characteristics of food products.

Sensory evaluation is basically used for:

- Ingredients processing or packaging evaluation.
- Shelf life testing.
- Competitive comparisons.
- Research applications.

A quality test panelist must meet certain requirements before he participates in a sensory evaluation exercise:

1. No consumption of tobacco or food 2-3 hours before sensory evaluation is carried out.
2. Good health.
3. Absence of taste-blindness.
4. High degree of personal integrity.
5. Average sensitivity.
6. Intellectual curiosity and interest in sensory evaluation process.

III. Assessment Of Organoleptic Acceptability Of Lotus Stem Milkshake

For this study, a milkshake using lotus stem was developed as the product for evaluation. This milkshake aimed to be low-calorie, highly nutritive drink, which elevates the natural flavor and biochemical benefits of lotus stem. In order to project the organoleptic appeal and acceptability of the nutritive lotus stem product, sensory evaluation was carried out with a semi-trained panel. A panel comprising of **31** panelists (biostatistically significant number of panelists) were chosen for evaluation.

Panelists were to answer a detailed questionnaire based on both non-invasive and invasive parameters. Non-invasive parameters assessed the general awareness of the consumer w.r.t. the various nutritional qualities of lotus stem, its incorporation into desserts and the acceptability of the idea of a dessert being made from lotus stem. In the invasive section of the questionnaire, panelists graded the samples based on various sensory

attributes. It also focused on the marketability of the product, its value for money, consumer preferences for product consumption and the overall acceptability of the lotus stem milkshake.

For this research, a comparative sensory evaluation between 2 samples was carried out; i.e. between Lotus stem milkshake and Sapodilla/roseberry/ mudapples (*Manikarzapota*) fruit milkshake. Samples were presented in the following order to the panelists:



Figure 1- Sample A: Sapodilla milkshake



Figure 2- Sample B: Lotus stem milkshake garnished with powdered fried lotus stem

3.1 Data Analysis:

3.1.1 Non-invasive data analysis:

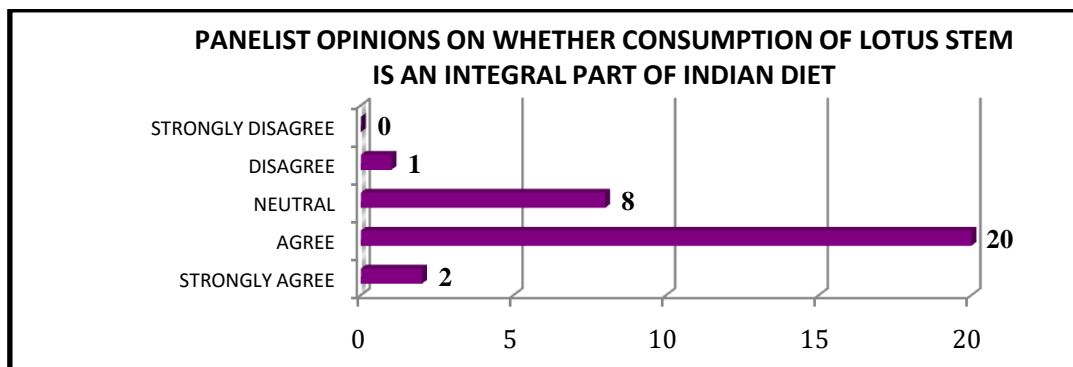


Figure 3- Panelist opinions on whether consumption of lotus stem is an integral part of Indian diet

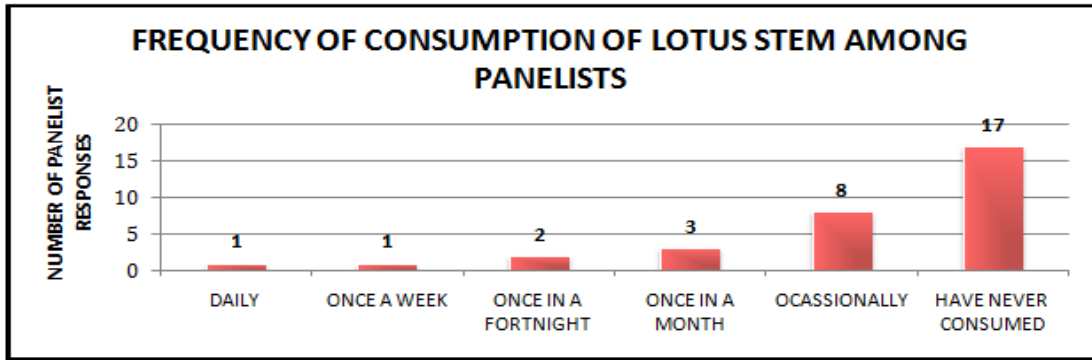


Figure 4- Frequency of lotus stem consumption among panelists.

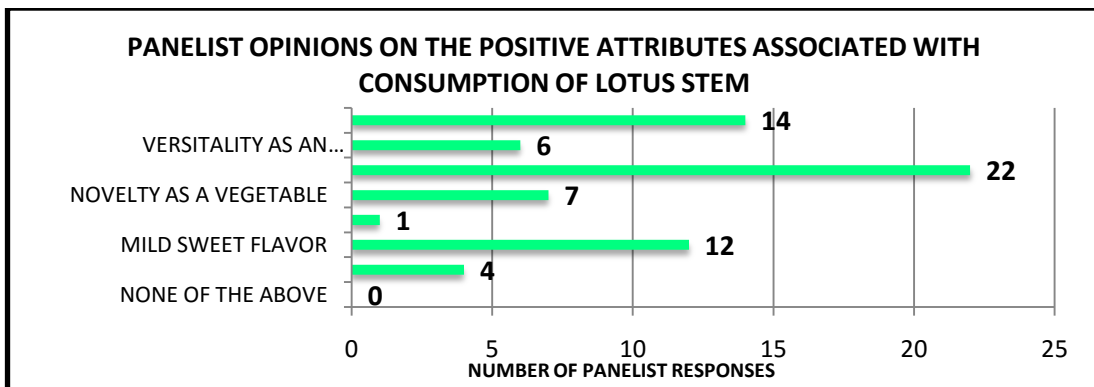


Figure 5- Panelist opinions on the positive attributes associated with the consumption of lotus stem.

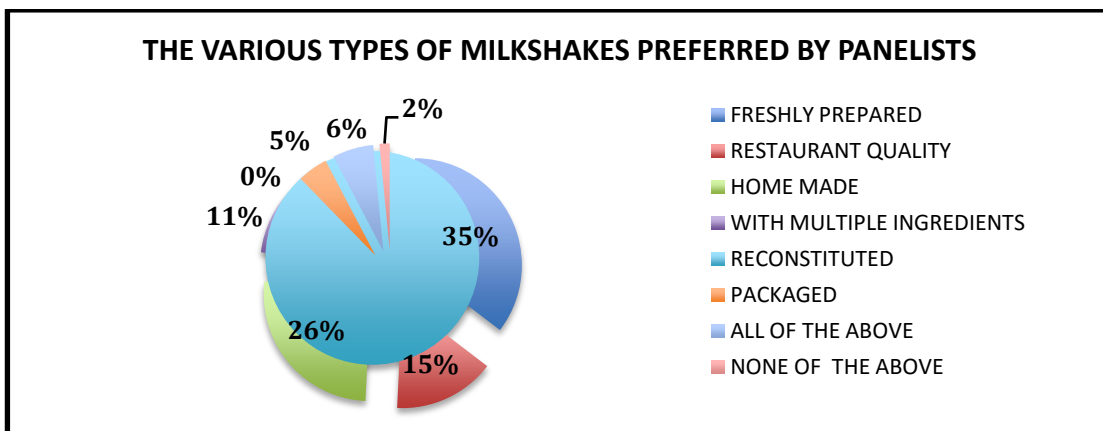


Figure 6- Panelist opinions on the various types of milkshakes preferred by panelists.

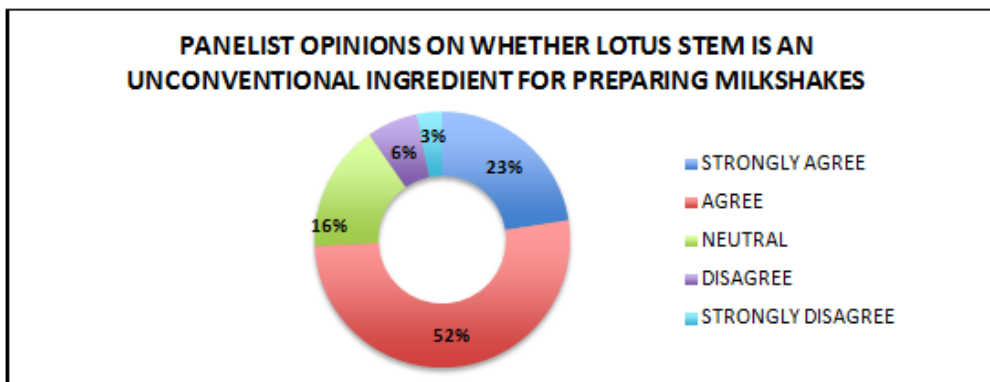


Figure 7- Panelist opinions on whether lotus stem is an unconventional ingredient for preparing milkshakes.

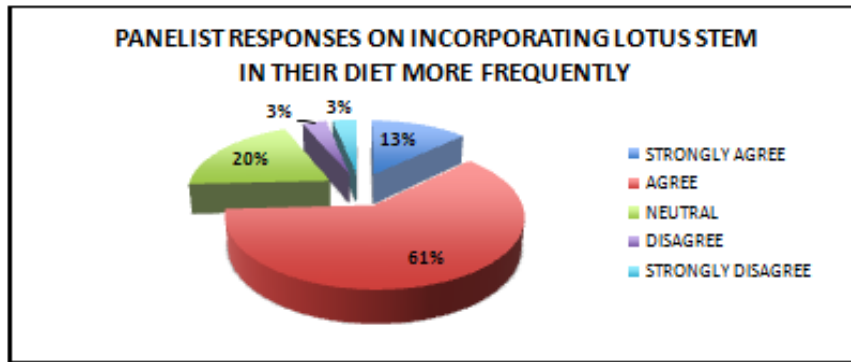


Figure 8- Panelist responses on whether they would like to incorporate lotus stem more frequently in their diet.

3.1.2 Invasive data analysis:

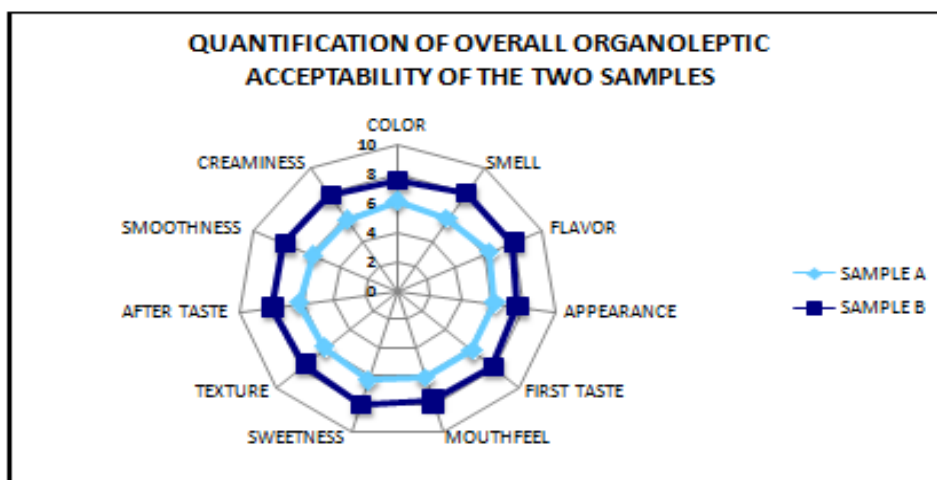


Figure 9- Quantification of the overall organoleptic acceptability of the two samples.

To quantify the organoleptic acceptability of the two samples, panelists were asked to score invasive parameters on a scale of 0 to 9. The individual scores for each parameter were collated and analyzed. The trend of data arising out of analysis of panelist scores is presented above as a web diagram. Sample B (lotus stem milkshake) has received higher average ratings (advancing more towards the maximum rating 9) as compared to Sample A (Sapodilla milkshake). The trend of the above data ascertains that the invasive sensory parameter profile of sample B (lotus stem milkshake) is superior over Sample A (Sapodilla milkshake). It is also observed from the above diagram that Sample A (Sapodilla milkshake) was also moderately accepted by panelists.

A higher web profile indicates that the sensory profile of the product is appealing to the masses and thus shows scope to be mass-marketed as a novel product.

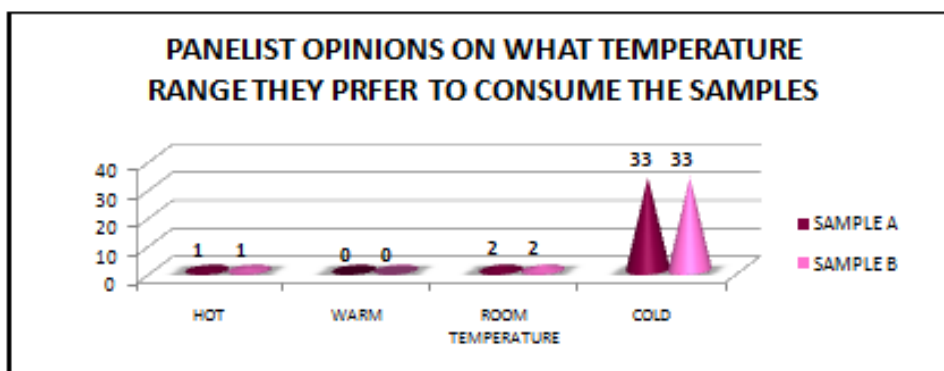


Figure 10- Panelist opinions on what temperature range they prefer to consume the two samples.

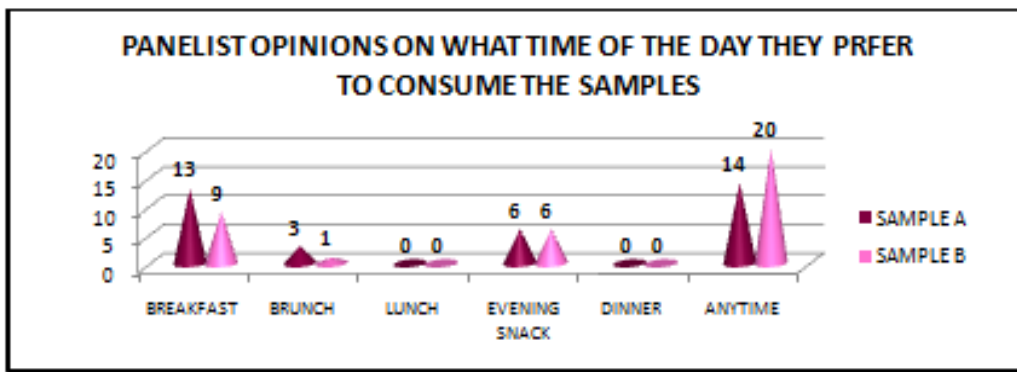


Figure 11- Panelist opinions on what time of the day they prefer to consume the samples.

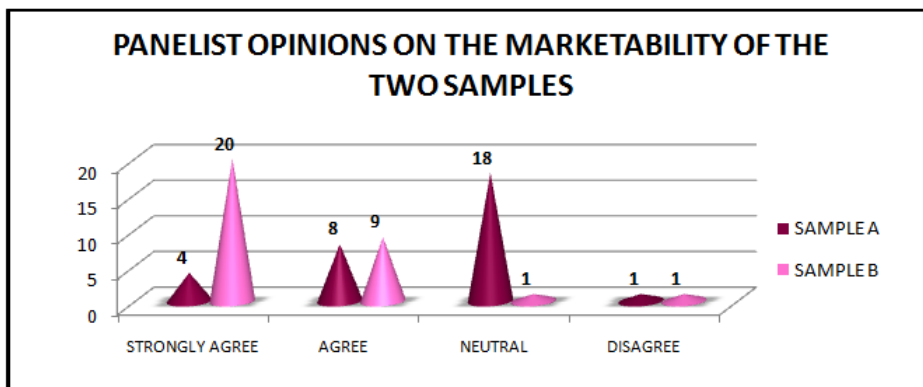


Figure 12- Panelist opinions on the marketability of the two samples.

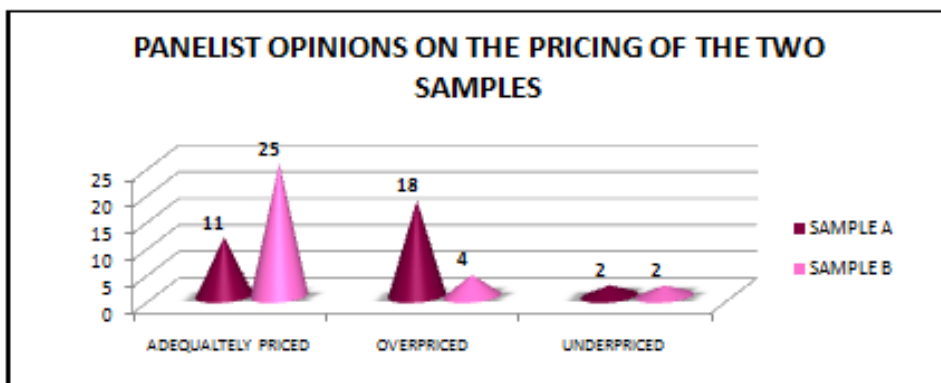


Figure 13- Panelist opinions on the pricing (thus value for money) of the two samples.

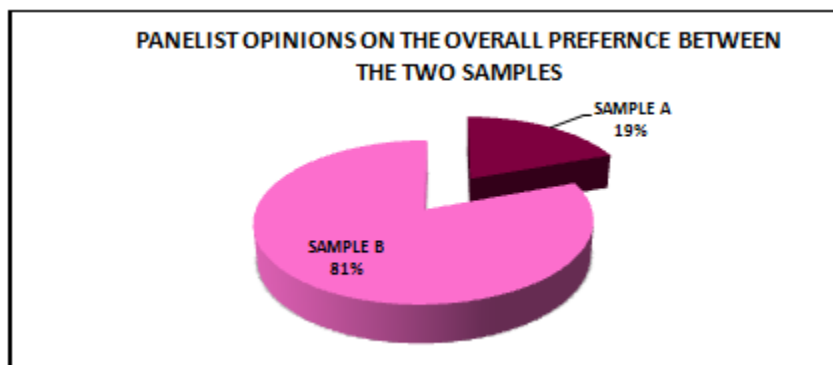


Figure 14- Panelist opinions on their overall preference between the two samples.

IV. Results

- Around 65% of panelists agreed that consumption of lotus stem is an integral part of Indian cuisine.
- Around 55% of panelists had never consumed lotus stem before.
- 71% panelists believed that lotus stem is mainly consumed for its health benefits.
- 35% panelists preferred to consume freshly prepared milkshakes.
- 68% panelists agreed that lotus stem is an unconventional ingredient for preparing milkshakes.
- 74% panelists agreed that they would like to incorporate lotus stem more frequently on their diet.
- When the invasive parameters of both samples were compared, Sample B obtained higher ratings, thus was rendered more organoleptically favorable against Sample A.
- 92% of panelists preferred to consume both samples cold.
- 94% of the panelists preferred Sample B to be marketed.
- 81% Panelists ascertained that the pricing of Sample B is appropriate and it exhibits high VFM (value for money).
- 81% of panelists overall preferred Sample B to Sample A.

V. Conclusion

The trends of results of sensory evaluation confirm that there is minimum awareness about the health benefits of consumption of lotus stem. It is evident that consumption of lotus stem among a small proportion of people is basically because of their cultural food habits. Consumption of lotus stem is a matter of chance, but not by choice, as determined by the detailed analysis of the questionnaires. The sensory evaluation involving the semi-trained panelists exhibited high organoleptic acceptability for the product developed from lotus stem. Also, VFM aspects of the product were evaluated, and the product developed ascertained high VFM.

Lotus stem shows promise as one of those foods whose regular consumption enhances psychosomatic well being in addition to preventing diseases. Manufacturers thus need to exploit the dual benefits of versatility and balanced nutrition of lotus stem and try to incorporate lotus stem in their existing products or develop innovative products. Lotus stem could also be used commercially as a neutral-tasting food fortifier with no direct threat to consumer health and safety.

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