RESEARCH PAPER

Development and acceptance of Vanilla bean paste of The Spices of Fiji

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ABSTRACT

Product development and value-addition of locally grown crops into processed food commodities suitable for the local supermarket is limited. Through the "Pacific Horticultural and Agricultural Market Access" programme of Secretariat of the Pacific Community (SPC-PHAMA), the project aimed at developing shelf stable vanilla bean pastes for human consumption with the use of dried vanilla beans sourced and cultivated at the Spices of Fiji plantation.

Ten (10) prototypes of SpiceFiji vanilla bean paste were formulated, chemically and microbiology tested and evaluated through descriptive profiling and consumer acceptance test that helped determined the final product formulation. Two popular commercial vanilla bean pastes (Com1 and Com2) were used as comparison in the identification and determination of the degree of consumer acceptability of two vanilla bean paste finalists SpiceFiji (SpiceFiji1 and SpiceFiji2).

Overall, results revealed that the newly developed vanilla bean paste SpiceFiji1 ranked first, followed by SpiceFiji2 as second and then followed by vanilla pastes of the two competitors brands (Com1 and Com2). The differences observed between the four vanilla pastes on appearance, colour, aroma, flavour, texture and aftertaste revealed a highly significant difference ($P < 0.001$) using Kruskal Wallis test. SpiceFiji1 outperformed the Com1 brand on five sensory attributes, i.e. appearance ($P < 0.05$), colour ($P < 0.01$), flavour ($P < 0.001$), texture ($P < 0.001$) and aftertaste ($P < 0.001$) which were highly significant. Aroma was the only sensory attribute that showed no significant difference between SpiceFiji1 and Com1 which may be interpreted as similarity in aroma. Similarly, when SpiceFiji1 was compared with Com2, all of the sensory attributes showed a highly significant difference ($P < 0.001$) revealing superiority of SpiceFiji1 over Com2.

Microbial tests and other tests that verified the safety of vanilla bean pastes for human consumption confirmed their stability and shelf life of 24 months. The data gathered and the success of this project proved the greater potential in developing world-class products from home grown crops in Fiji. However, strengthening collaboration with government and academic institutions in the realization of their role in producing skilled and knowledge workers in the area of food product development and food engineering is critical in enhancing import substitution drive of healthy processed foods to fill our local supermarket shelves enabling self –sustainable approach and independence.

1.0 INTRODUCTION

Fiji has diverse seasonal agricultural crops which when in season provides over-supply and a glut of seasonal foods. This seasonality in most cases contribute to high spoilage and high wastage rates due to poor handling practices, poor or limited storage facilities and limited technology that impact the price of food. While it is encouraging to see Fiji promoting import substitution and export promotion of fresh local produce (Mudalliar n.d.), it is vitally important to add value to such seasonal and other crops not only to boost export promotion but more so to fill our local supermarket shelves in order to further enhance import substitution drive of processed foods.

In the world of business, food companies either seek new products through product development or find new users for old products to gain profit for continued growth and survival (Rudolph 1995). Product development is one of a few ways a company or food institution can follow for increased profitability by replacing old products that no longer sell well with a new and demanding products. Besides potential technological obstacles, legislative aspects and consumer demand driven products, developing new products requires talented, knowledgeable and skilled personnel, extensive research, suitable physical facilities, and resources to function properly (Costa and Jongen 2006). Such human and physical resources are expensive and that higher education institutions need to assist develop and train human resources in the area of relevance and usefulness to society and community especially in developing countries such as the Pacific region including Fiji.

In product development, consumer acceptance has been recognized as one of the key factors in negotiating market opportunities. It explores the main challenges of such product development focusing on the different factors determining the acceptance of food. In this research, development of vanilla bean paste for Spice of Fiji was conducted to add-value to their existing dried vanilla beans and ethanol extracts that is anticipated to provide a competitive edge and attract better and higher market and to boost export.

The major vanilla producing countries worldwide are Mexico, Madagascar, Tahiti and Indonesia while small quantities of vanilla are also produced and exported from the Pacific region (Lamprecht *et al.* 1994; Dignum *et al.* 2001; Waliszewski *et al.* 2006). However, world demand for natural vanilla beans currently outstrips supply; thus Pacific island countries are in a perfect position to seize this market opportunity.

The food industry is the principle user of vanilla products where these are used for flavouring dairy products, beverages, baked goods and confectionary or as a general flavour enhancer (Dignum *et al.* 2001; Frenkel *et al.* 2010; Anuradha *et al.* 2013). Vanillin is the compound which gives vanilla its characteristic flavour and aroma. It is estimated that 0.3-2.5g of vanillin is present per 100g of vanilla beans (Dignum *et al.* 2001; Frenkel *et al.* 2010; Anuradha *et al.* 2013) depending on the size, variety and quality of vanilla beans (Azeez 2008). Vanillin has been given the *Generally Recognised as Safe (GRAS)* status in the food and fragrance industry. Antioxidant and antimicrobial properties of vanillin have also been acknowledged (Burri *et al.* 1989; Cerrutti *et al.* 1997; Fitzgerald *et al.* 2003). Natural vanilla beans and extract is widely used in the kitchens of international hotels and resorts. Spices of Fiji is currently the only Fijian company that sells to local resorts as well as to the wider public through major local supermarkets such as Morris Hedstrom and Kudan Singh.

Spices of Fiji is an organic certified farm that grows and cultivates a number of spices including vanilla, cinnamon (*Cinnamomum* sp.), pepper (*Piper nigrum* L.), nutmeg (*Myristica* sp.), turmeric (*Curcuma longa* L.), ginger (*Zingiber officinale* Roscoe) and cardamom. Most of these spices are processed into dried forms, either whole or powdered. The only liquid form of spice developed by Spices of Fiji is their vanilla extract which is gaining some popularity but the company seeks to develop other niche products such as paste-based and expand its market in order to increase their current earnings. Its dried vanilla beans and vanilla bean extracts are also exported mainly to New Zealand, Australia and New Caledonia.

The aim of this project was to develop shelf stable vanilla pastes that are acceptable in the market using dried vanilla beans from cultivated vanilla plants of Spice of Fiji.

2.0 MATERIALS AND METHODS

The preparation of vanilla bean paste had a three-step process as indicated below.

2.1 *Preparation of 4-Strength Vanilla Bean Syrup*

A 4-strength water extracted vanilla syrup was achieved by soaking 250g dried cut pieces of vanilla beans with seeds into 1L of hot-boiled syrup, simmered and stirred for 5-10 min. This was stored in a closed sterilized jar and cured for 6-8 weeks.

2.2 *Preparation of Thickener*

Dried white-coloured *Eucheuma* seaweed sourced from Ono-i-Lau, Fiji was used. These were sorted, weighed, rinsed and washed in clean warm water for about 5-10 times until clean and whitish in colour prior to soaking for 8-10 hrs. These were again rinsed and washed for 5-10 times in warm water until all dark spots disappeared. Enough water was added to cover the seaweed and then boiled and simmered until all the seaweeds melted. Continuous stirring to avoid burning and sticking to the bottom of the pot was made. The hot melted *Eucheuma* was sieved into a storage container with a lid and left to cool and set like a gel. Once cooled, it was stored in the refrigerator ready for use.

2.3 *Formulation of Vanilla Bean Paste*

The 4-strength vanilla bean with seeds in syrup was mixed with 3-strength vanilla bean ethanol extract (obtained from Spices of Fiji) and the seaweed thickener was boiled with continuous stirring at low heat until all the seaweed thickener melted and dissolved. The hot mixture was then added with the 3-strength ethanol vanilla extract and blended in a hand-held barmix (Brand-StarModel) for 2 min, packed into sterilized jars and sealed.

2.4 *Sensory Evaluation*

Sensory profiling and descriptive tests were conducted by trained panelists that assessed 10 different vanilla bean paste formulation prototypes against key parameters. Consumer acceptance test was further conducted on the two finalists (SpiceFiji1 and SpiceFiji2) in order to select the most acceptable and the best product formulation.

2.5 *Sensory Profiling and Descriptive Tests*

A total of 10 vanilla bean paste prototypes were developed and modified over a period of four months. Various product modifications were conducted until the key sensory and quality parameter listed in Table 1 were achieved. These were made possible through a series of sensory profiling and descriptive tests which were conducted at the University of the South Pacific with eight staff who were selected from a pool of respondents who had higher than average sensory acuity, and greater ability to identify different tastes and aroma. They were trained as panellists in order to participate in the sensory profiling and descriptive evaluation of different vanilla bean paste prototypes. In-house chemical and microbial tests that guided the quality and safety standards of the product and shelf life stability tests were conducted simultaneously.

Table 1. Key sensory attribute for Vanilla bean paste

Sensory Attributes	**Characteristics**
Appearance	Speckled pepper
Colour	Bright/dark brown (bright brown is preferred – depends on raw materials received)
Texture/viscosity	Thin gel with increased viscosity
Aroma	Strong vanilla aroma
Flavour	Strong vanilla flavour with mild sweet and tangy taste

Apart from the sensory profiling, descriptive tests were also carried out on cakes baked with added vanilla bean paste from selected vanilla bean paste prototypes. This was conducted to identify and confirm the two vanilla bean paste product finalists. The cakes baked with added vanilla bean paste were prepared to achieve the following sensory attributes; strong vanilla aroma and flavour with lingering vanilla after taste. The concentration and amount of vanilla bean paste added into the cakes were recorded and compared.

2.6 *Consumer Preference Test of Vanilla Bean Paste*

Consumer preference tests were conducted on the two vanilla bean paste finalists to further assess the acceptability of the formulation and to select the best one. A total of 99 individuals participated in three separate sensory evaluation events that were conducted to assess consumer preference of the two vanilla bean paste finalists. The two finalists; SpiceFiji1 and SpiceFiji2 were compared to two popular commercially available vanilla bean pastes; Com1 and Com2 brands. All the vanilla bean paste samples were coded when presented to consumer panellists.

The first sensory evaluation was conducted at the Pacific Women in Business conference, the second sensory evaluation involved professional chef in

the major hotels and resorts of Viti Levu, Fiji and the third sensory evaluation involved randomly selected individuals from around Suva, Fiji.

A 9 point hedonic scale was used to assess the sensory attributes of appearance, colour, aroma, flavour, texture and aftertaste. The hedonic scale (1 to 9) indicated how much respondents liked or disliked each sensory attribute for each of the four samples as shown below., 1-like extremely, 2-like very much, 3-like moderately, 4-like slightly, 5-neither like nor dislike, 6-dislike slightly, 7-dislike moderately, 8-dislike very much, 9-dislike extremely. Furthermore, after each attribute was assessed, respondents were also asked to rank the four vanilla bean pastes from 1 to 4 in which 1 ranked the highest while 4 ranked the lowest. Data on sensory evaluation were analysed by non-parametric statistical tests; both Kruskal-Walis (KW) and Mann-Whitney (MW) using PSAW Statistics 18 (SPSS Hong Kong).

3.0 RESULTS AND DISCUSSIONS

At global level, the demand for vanilla beans outstrips the supply by the major producing countries of Mexico, Madagascar, Tahiti and Indonesia for vanilla beans. This may mean that there is a window of opportunity by the Pacific island region to demonstrate their interest and competitiveness to join the major vanilla producing countries in the effort to fulfil the world demand. This vanilla bean paste project was developed in collaboration with the Spice of Fiji and Secretariat of the Pacific Community - "Pacific Horticultural and Agricultural Market Access" programme of Secretariat of the Pacific Community (SPC-PHAMA).

Vanilla products are well known for its wider applications including food industries mainly as flavouring agents in dairy products, beverages, baked goods and confectionary or as a general flavour enhancer (Dignum *et al.* 2001; Frenkel *et al.* 2010; Anuradha *et al.* 2013). Vanillin, the compound that gives vanilla its characteristic flavour and aroma has also been recognized to have antioxidant and antimicrobial properties (Burri *et al.*, 1989; Cerrutti *et al.*, 1997; Fitzgerald *et al.*, 2003).

3.1 *Processing of Vanilla Bean Paste*

Vanilla bean paste was developed in this project due to increasing popularity of its unique flavour and appearance characteristics compared to vanilla extract, which is generally clear and free from seeds. The paste's viscose colloidal form on the other hand has more advantages in cooking applications when straight liquid is undesirable especially when sugar in the form of syrup in the paste provided stronger bonds with vanillin that help reduce dissipation during cooking.

A total of six control points (CPs) and four critical control points (CCPs) were developed and used in the manual processing of vanilla bean paste (Fig. 1). The six CPs were part of the pre-requisite programme aimed at compliance of good hygienic practices (GHPs) that helped in the avoidance, prevention and elimination of contamination and/or cross contamination while the four CCPs that were identified with their associated critical limits were carefully monitored together with their corrective actions. However, note that the preparation of a full HACCP plan was beyond the scope of this project.

It is important to note that paste-based products required the use of a thickener that provided the right viscosity of the product. Therefore, in this case *Eucheuma* seaweed was used as the thickening agent due to its high levels of carrageenan (25-40%). It is also rich in retinol and minerals which added more value to the whole paste product. *Eucheuma* seaweed is widely cultivated in Fiji and been exported abroad without local application. The utilization of locally cultivated plants that contain natural thickener was explored to ensure a sustainable supply of organically grown thickeners of food grade quality, which are likely to be cheaper, and have the added benefit of creating a market opportunity for local producers.

3.2 *Sensory Evaluation*

Sensory evaluation usually gives a realistic opinion about the liking or acceptability by consumers of a particular flavour, aroma, appearance or texture of a food product and thus was conducted to evaluate the acceptability of the newly developed vanilla bean paste (Herbert and Sidel 1992; Carpenter *et al.* 2000). Consumer testing provided information on consumer preferences and views on the various vanilla bean paste prototypes that enabled the investigators understood the choices that consumers made in relation to selecting the best formulation from a group of similar prototypes.

The tests also enabled the investigators to design or modify the product, its appearance, taste, flavour, odour and aroma in the hope of maximising its market success, which helped in the identification of the best formulation.

The three sensory evaluation events conducted on the vanilla bean pastes were the Pacific Women in

Business conference participants, the professional chefs of major hotels and resorts of Viti Levu and the randomly selected individuals from around Suva.

by Kruskal-Wallis test (Table 2).

However, it is interesting to note that no significant

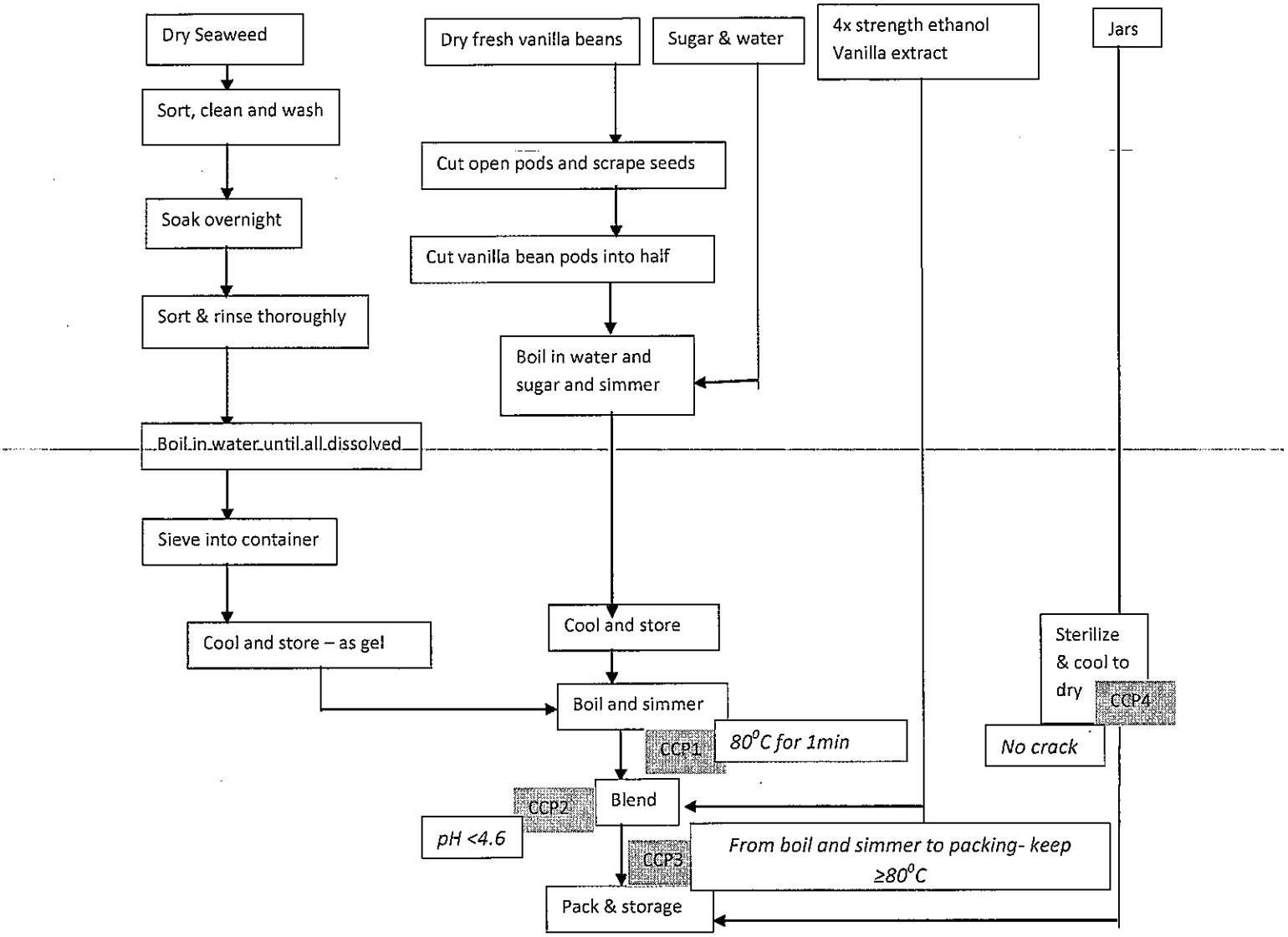

Figure 1. Process flow chart of the manual processing of Vanilla bean paste

3.3 *Pacific Women in Business Conference Participants*

The first sensory evaluation took place in November 2012 at the Tanoa International Hotel, Nadi, Fiji during the Pacific Women in Business Conference where 19 women volunteered to participate in the sensory evaluation. Results revealed that SpiceFiji1 ranked first overall, followed by SpiceFiji2, Com1 as third while Com2 brand was ranked the last (fourth) (Table 2). The data revealed a highly significant difference ($P < 0.01$) on the overall ranking between the four vanilla bean pastes. Other sensory attributes also showed significant difference between the four vanilla bean pastes; i.e. appearance ($P < 0.01$), colour ($P < 0.05$), aroma ($P = 0.058$), flavour ($P < 0.01$), texture ($P < 0.01$) and aftertaste ($P < 0.01$) difference ($p=0.571$) was observed in the overall ranking between SpiceFiji1 and the Com1 brand by these Pacific women, which may illustrate that the newly developed vanilla bean paste formulation (SpiceFiji1) is comparable to the Com1 brand. This is indeed a positive feedback as Com1 brand is a popular product and widely stocked in most Pacific island supermarkets including Fiji. With regards to specific attributes of Com1 and SpiceFiji1 pastes, no significant difference was observed between all of the tested attributes as follows; appearance ($P = 0.570$), colour ($P = 0.463$), aroma ($P = 0.952$), flavour ($P = 0.153$), texture ($P = 0.601$) and aftertaste ($P = 0.172$). This indicates that SpiceFiji1 is of the same consumer acceptance as the widely liked Com1 vanilla paste.

Table 2. Vanilla bean pastes sensory evaluation of 19 participants at the Pacific Women in Business Conference.

Sensory Attributes	Com2	SpiceFiji2	SpiceFiji1	Com1	KW* pvalue	MM**pvalue (SP1-Com1)	MM**pvalue (SP1-Com2)
Appearance	4.7±1.7	2.8±1.3	3.1±1.9	3.2±1.3	0.003	0.570	0.009
Colour	4.3±1.7	3.0±1.3	2.9±2.2	3.0±1.4	0.024	0.463	0.015
Aroma	4.6±1.8	3.2±1.1	3.4±1.8	3.3±1.5	0.058	0.952	0.063
Flavour	4.6±1.7	2.8±1.3	2.6±1.8	3.1±1.5	0.000	0.153	0.000
Texture	4.7±1.8	3.1±1.3	2.7±1.2	3.1±1.8	0.001	0.601	0.000
Aftertaste	5.0±1.9	3.2±1.5	2.7±1.3	3.5±1.8	0.002	0.172	0.001
Overall Ranking[a]	3.4±1.0	2.2±0.8	2.1±1.0	2.3±1.2	0.001	0.571	0.001

* KW – Kruskal Walis test, **MM – Mann-Witney U test, [a]Overall ranking was the ranking of the four pastes from 1-4. SP1-SpiceFiji1, SP2-SpiceFiji2

Further results showed that when SpiceFiji1 was compared with Com2, a highly significant difference ($P < 0.001$) was observed in the overall ranking as well as on most other attributes as follows; appearance ($P < 0.01$), colour ($P < 0.05$), flavour ($P < 0.001$), texture ($P < 0.001$) and aftertaste ($P < 0.01$). This data means that SpiceFiji1 vanilla bean paste is highly superior to Com2 in all aspects of sensory attributes except for aroma with no significant difference ($P = 0.063$). The data revealed that SpiceFiji1 is superior to Com2.

Because this sensory evaluation represented women from various Pacific island countries including Solomon Islands, Samoa, Tonga, Kiribati, Fiji and Papua New Guinea, the data gathered provided the level of acceptability of the vanilla bean paste at regional level that may gauge the market potential of vanilla bean paste in other Pacific island countries thus the importance of this sensory evaluation event.

3.4 *Hotels and Resorts' Chefs as participants*

The second sensory evaluation test was conducted by professional chefs in selected hotels and resorts in Fiji. Results showed that the chefs rated both of the newly developed *Spices of Fiji* vanilla bean pastes; SpiceFiji2 (2.0±0.7) and SpiceFiji1 (2.1±1.2) superior over Com1 (2.8 ±1.1) and Com2 (3.3±1.2) pastes as shown in Table 3. Furthermore, no significant difference ($p=0.197$) was observed in the overall ranking between SpiceFiji1 and Com1 which reveals that both products are similar to chefs (Table 3).

With regards to specific attributes, SpiceFiji1 appears to be the most preferred in terms of appearance, colour, flavour, texture and aftertaste, while SpiceFiji2 has the most preferred aroma. No significant difference was observed between the two newly developed vanilla bean pastes. However, when SpiceFiji1 was compared with Com1, significant differences were observed in appearance ($P < 0.05$) and aftertaste ($P < 0.05$) but no significant difference was observed in colour ($P = 0.158$), aroma ($P = 0.564$), flavour ($P = 0.191$ and texture ($P = 0.089$) revealing a similar taste likeness for all these attributes.

* KW – Kruskal Walis test, **MM – Mann-Witney U test, [a]Overall ranking was the ranking of the four pastes from 1-4. SP1-SpiceFiji1, SP2-SpiceFiji2.

Chefs also scored SpiceFiji1 vanilla paste highly superior in all sensory attributes; appearance, colour, aroma, flavour, texture and aftertaste when compared to the Com2 brand. This means that the newly developed products are comparable

Table 3. Vanilla bean pastes sensory evaluation by 10 Chefs in resorts and hotels on Viti Levu

Sensory Attributes	Com2	SpiceFiji2	SpiceFiji1	Com1	KW* pvalue	MM**pvalue (SP1-Com1)	MM**pvalue (SP1-Com2)
Appearance	5.0±2.2	2.5±0.5	2.0±1.2	3.4±1.5	0.005	0.048	0.004
Colour	4.6±1.8	2.4±1.0	2.2±1.5	3.3±1.9	0.013	0.158	0.008
Aroma	5.1±2.1	2.7±0.7	2.9±1.7	3.3±1.5	0.039	0.564	0.032
Flavour	4.9±2.2	3.0±1.2	2.8±2.4	3.6±1.8	0.041	0.191	0.020
Texture	5.0±1.8	3.1±1.6	2.3±1.3	3.8±2.0	0.009	0.089	0.002
Aftertaste	5.2±2.0	2.9±1.4	2.1±1.1	4.0±2.0	0.004	0.030	0.002
Overall Ranking[a]	3.3±1.2	2.0±0.7	2.1±1.2	2.8±1.1	0.039	0.197	0.043

Table 4. Vanilla bean pastes sensory evaluation by 70 randomly selected individuals around Suva City.

Sensory Attributes	Com2	SpiceFiji2	SpiceFiji1	Com1	K W * pvalue	MM**pvalue (SP1-Com1)	MM**pvalue (SP1-Com2)
Appearance	4.7±1.4	2.9±0.9	3.2±1.3	3.4±1.1	0.000	0.213	0.000
Colour	4.8±1.3	3.5±0.9	2.9±1.5	3.4±1.1	0.000	0.006	0.000
Aroma	4.8±1.3	3.2±0.9	3.4±1.5	3.2±0.9	0.000	0.234	0.000
Flavour	4.6±1.1	2.9±1.0	2.6±1.2	3.5±1.2	0.000	0.000	0.000
Texture	5.0±1.3	2.6±0.9	2.0±0.8	3.8±1.5	0.000	0.000	0.000
Aftertaste	4.9±1.3	3.0±1.1	2.7±1.1	3.5±1.3	0.000	0.000	0.000
Overall Ranking[a]	3.4±0.9	2.2±0.9	2.2±1.1	2.2±1.0	0.000	0.510	0.000

Table 5. Vanilla bean pastes sensory evaluation by 99 participants

Sensory Attributes	Com2	SpiceFiji2	SpiceFiji1	Com1	KW* pvalue	MM**pvalue (SP1-Com1)	MM** pvalue (SP1-Com2)
Appearance	4.7±1.5	2.9±1	3.1±1.5	3.4±1.1	0.000	0.035	0.000
Colour	4.8±1.3	3.3±1.1	2.9±1.6	3.3±1.2	0.000	0.009	0.000
Aroma	4.7±1.4	3.2±1.0	3.4±1.5	3.2±1.0	0.000	0.340	0.000
Flavour	4.6±1.2	2.9±1.0	2.6±1.4	3.4±1.2	0.000	0.000	0.000
Texture	4.9±1.4	2.6±1.0	2.2±0.9	3.6±1.5	0.000	0.000	0.000
Aftertaste	4.9±1.4	3.0±1.2	2.7±1.1	3.5±1.4	0.000	0.000	0.000
Overall[a] Ranking	3.4±0.9	2.2±0.9	2.1±1.0	2.3±1.0	0.000	0.030	0.000

to these Com1 and Com2 commercially available products. Given the fact that most of these chefs have had international work experience, the high ranking of the newly developed vanilla bean paste may mean the product is of international standing.

3.5 *Randomly selected adults participants*

The third sensory evaluation test was a random taste testing of 70 adults around Suva. Results revealed that SpiceFiji1, SpiceFiji2 and the Com1 brand are all of similar ranking while the Com2 brand was ranked the least liked (Table 4). Data analysis showed a highly significant difference ($P > 0.001$) on the overall ranking between the four pastes as do all of the other sensory attributes (Table 4).

It is interesting to note that when SpiceFiji1 was compared with Com1 vanilla paste both products were significantly different in colour ($P < 0.01$), flavour ($P < 0.001$), texture ($P < 0.001$), and aftertaste ($P < 0.001$), with SpiceFiji1 superior over Com1. However, both products did not differ in appearance ($P = 0.213$) and aroma ($P = 0.234$).

Moreover, when SpiceFiji1 was compared with Com2, significant differences ($P < 0.001$) were observed in all the sensory attributes. This confirms the superior, and most preferred product in all aspects of sensory attributes is SpiceFiji1.

* KW – Kruskal Walis test, **MM – Mann-Witney U test, [a]Overall ranking was the ranking of the four pastes from 1-4. SP1-SpiceFiji1, SP2-SpiceFiji2

3.6 *Overall preference of all participants*

Results revealed that the overall liking of the products from the most to the least preferred were as follows; SpiceFiji1 (2.1±1.0), followed by SpiceFiji2 (2.2±0.8), Com1 (2.3±1.2) and Com2 brand (3.4±0.9) (Table 5). The differences observed between the four vanilla bean pastes on each of the sensory attributes; appearance, colour, aroma, flavour, texture and aftertaste showed a highly significant difference ($P < 0.001$ sing Kruskal Wallis test.

Non-parametric statistical tests; *KW – Kruskal Walis test, **MM – Mann-Witney U test, [a]Overall ranking was the ranking of the four pastes from 1-4. SP1-SpiceFiji1, SP2-SpiceFiji2

Furthermore, when SpiceFiji1 and Com1 were compared using Mann-Witney U test (Table 5), the five sensory attributes, i.e. colour ($P < 0.01$), flavour ($P < 0.001$), texture ($P < 0.001$) and aftertaste ($P < 0.001$) were highly significant revealing SpiceFiji1 as superior. Aroma was the only sensory attribute that showed no significant difference between SpiceFiji1 and Com1 which may be interpreted as similarity in aroma. Similarly, when SpiceFiji1 was compared with Com2, all the sensory attributes showed highly

significant difference ($P < 0.001$) revealing superiority of SpiceFiji1 over Com2.

3.7 Selection of Vanilla Paste Final Formulation

Based on the overall results of the sensory evaluation events discussed above, SpiceFiji1 vanilla bean paste appeared to be the best overall preferred sample even when compared to two other commercially available brands, thus was selected as the best formulated product. The product was scaled up in production and further tested for shelf life prediction.

4.0 CONCLUSION

Developing value-added food products from seasonal crops of the Pacific region needs to be encouraged and supported if self-sufficiency, sustainability and independence are to be achieved. This will generate interest in the enhancement of import substitution not only for fresh produce but also for locally processed food commodities that could fill the local supermarket shelves. Strengthening collaboration with government, private sectors and academic institutions in the realization of their roles in producing skilled and knowledge workers that will be able to transform raw food materials into shelf stable new food products through food science engineering and technology are critical in enabling the environment of being relevant and useful especially in the enhancement of food security, trade and self-sufficiency. Product development or value-addition has been identified as one of major gaps that need to be bridged. Too often, higher education conduct research that do not directly benefit and impact the lives of the society surrounding them especially in developing countries, hence the importance of this project.

ACKNOWLEDGEMENT

The authors wish to take this opportunity to thank Minoru Ishigakisan, JICA volunteer for his technical assistance in the processing of the products as well as the microbial analyses; Ms Jagruti Chauhan for her assistance in the processing; and finally the financial support by the "Pacific Horticulture and Agricultural Market Access" programme of Secretariat of the Pacific Community (SPC-PHAMA).

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