The Pharma Innovation Journal 2018; 7(10): 62-66

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.03
TPI 2018; 7(10): 62-66

www.thepharmajournal.com
Received: 26-08-2018
Accepted: 27-09-2018

Kalina S
Department of Food science and Technology, University of Sri Jayewardenepura, Nugegoda, Colombo, Sri Lanka

Navaratne SB
Department of Food science and Technology, University of Sri Jayewardenepura, Nugegoda, Colombo, Sri Lanka

Correspondence
Kalina S
Department of Food science and Technology, University of Sri Jayewardenepura, Nugegoda, Colombo, Sri Lanka

Developing an edible food product from tender coconut mesocarp and analyzing its sensory parameters

Kalina S and Navaratne SB

Abstract
Coconut (*Cocos nuciferus.* L) Is one of the perennial tree crop widely grown in many South East Asian countries. The parts of coconut such as epicarp, mesocarp and endocarp were considered inedible. The present study is aimed at developing a food product from mesocarp. For this, four types of edible snacks were produced from, tender young and king coconut mesocarps by providing a combination of optimum treatments such as blanching - solar drying and blanching - cooling with dehumidifying, and a sensory evaluation was done for snacks based on the parameters such as aroma, colour, taste, bitterness, sweetness, texture, mouth feeling and overall acceptability. The results of sensory evaluation reveals that, there is a significant difference in taste, bitterness, sweetness and overall acceptability of coconut mesocarp snacks developed, at 95% confidence level and among the snacks produced, King coconut blanched-solar dried mesocarp snack is more sensory appealing based on the average ranks of these significant sensory parameters. So, a consumer preferable edible food product could be produced from King Coconut blanched-solar dried mesocarp.

Keywords: King coconut, Young coconut, Mesocarp, Sensory parameters

1. Introduction
For a long time, consuming fruits and vegetables in high amounts was considered critical in safeguarding humans from many diseases, like cancer, diabetes, neurodegenerative diseases, and heart and brain vascular diseases. Presently, it is thought that the protective properties of these foods are derived from the low-molecular antioxidants present and these antioxidants protect the cells and their structures from oxidative damage [1]. In a previous study, it was proved that tender King and Young coconut mesocarps have high antioxidant activity [2]. Coconut is a palm having high importance in the food industry, but a considerable part of the biomass is considered as inedible. The parts such as epicarp, mesocarp and endocarp which represent about half of the weight of the fruit are inedible and they produce a large amount of coconut waste material. This is a problem especially in cities of the main producer countries [3]. This problem also exists after getting coconut water from tender coconut. Recently, a study showed that simple pretreatment condition with a high-solid load of biomass followed by saccharification and fermentation of un-detoxified coconut mesocarp hydrolysates to produce ethanol with high titer [4]. In this study it was intended to develop a food product from coconut mesocarp the part between skin and the kernel which is a waste, after getting coconut water from tender coconut. In the product development process, combined treatments of blanching and drying were to be provided to the mesocarp as optimum conditions in order to preserve nutritional and sensory value of the food product. Blanching is the process of heating vegetables to a temperature sufficient to destroy enzymes present in the tissue. It helps in terminating the enzyme action, setting the color, and shortening the drying and dehydration time. It is usually carried out in hot water or in steam. This technique was used by indigenous people to reduce or eliminate the bitterness and acidity of the vegetables [5]. Several studies have revealed that blanching improves the palatability and bioavailability of natural occurring antioxidants in vegetables [6, 7]. Additionally, blanching would bring about a number of changes in physical characteristics and chemical composition of vegetables [8, 9]. Also there are studies to prove that dried fruits are nutritionally equivalent to fresh fruits in smaller serving sizes. They have unique combination of taste/aroma, essential nutrients, fibre, and phytochemicals. Dried fruits play a major role in human health in providing great nourishment and health benefits. Considerable opportunities are there for dried fruit based functional food products, for innovation and expansion. Hence, more sophisticated human intervention studies are necessary to validate the

Health benefits of various dried fruits [10]. So this study was done with the objective of making tender coconut mesocarp edible by making a desirable product with the treatments like blanching and drying and also analyzing the sensory parameters of the product developed.

2. Materials and Methodology

2.1 Developing a product from the coconut mesocarp

For the product development process, tender young coconut and king coconuts at good quality were taken. Then the mesocarp that was separated from the coconut were cut into pieces of regular sizes (Length= 3cm, Width=1cm, and Thickness=0.7cm approximately). Then the best combinations of treatments, which could preserve the nutritional and sensory qualities of mesocarp, were given to the cut mesocarp pieces. The treatments given were blanched-solar drying where mesocarp pieces were blanched with 0.5% citric acid at 95^{o}C for 6 minutes and then dried in a solar dryer at 70-75^{o}C for 2 days, and the blanched- cooled with dehumidifying where cut mesocarp pieces were blanched in similar way and then dried in a refrigerant humidifier at 4^{o}C for 2 days. Then these mesocarp pieces were coated with white refined sugar, by heating sugar with little water and then adding the mesocarp pieces in to the syrup and allowing them to cool. There were four types of mesocarp snacks produced from two varieties of coconut by giving two treatments each.

2.2 Sensory analysis

Organoleptic acceptability of coconut mesocarp snacks was evaluated by conducting a sensory analysis.

The samples of four coconut mesocarp snacks were coded with random digits as follows.

Young coconut- blanched -solar dried mesocarp snacks - 245

Young coconut- blanched- cooled with dehumidified mesocarp snacks - 681

King coconut- blanched -solar dried mesocarp snacks - 937

King coconut -blanched -cooled with dehumidified mesocarp snacks - 502

The sensory test was done by using an untrained panel at the Food analysis Laboratory of Department of Food Science and Technology, University of Sri Jayewardenepura with 34 respondents. Each respondent was provided with an evaluation form (ANNEXURE I) and were asked to rate the coconut mesocarp snacks samples based on the taste, aroma, colour, bitterness, sweetness, texture, mouth feeling and overall acceptability by using a 5 point hedonic scale, where the scales 5,4,3,2,1 indicates Extremely like, Like, Neither like nor dislike, Dislike and Extremely dislike, respectively.

2.3 Data analysis

The collected data was finally analyzed by using MINITAB®17 software. For the graphical representation of the data Microsoft Office Excel 2010 was used. Kruskal-Wallis non parametric analysis was used for data analysis of the sensory evaluation to determine any significant difference in selected parameters between selected samples at 95% confidence level. Then the mean separation values were calculated by using the equation in ANNEXURE I. The difference between the average rank values of the samples and the calculated mean separation value was compared pairwise between the samples for each sensory parameter to determine significant differences. A radar chart is also used to clearly illustrate the average rank of parameters.

3. Results and Discussion

The average rank values obtained for each of the sensory parameters such as aroma, colour, taste, bitterness, sweetness, texture, mouth feeling and over all acceptability from Kruskal-wallis test are given in table 3.1 as shown below.

Table 3.1: Average rank values of sensory attributes of the four mesocarp snacks.

sample	Aroma	colour	taste	bitterness	sweetness	texture	mouth feeling	over all acceptability
King coconut blanched solar dried mesocarp snack	67.3^{a}	77.4^{a,b}	97.8^{a}	94.7^{a}	95.2^{a}	79.6^{a}	82.0^{a}	87.6^{a}
Young coconut blanched solar dried mesocarp snack	60.8^{a}	85.2^{b}	58.4^{b}	52.9^{b}	61.8^{b}	73.6^{a}	59.8^{a}	54.9^{b}
King coconut blanched cooling with dehumidified mesocarp snacks.	76.1^{a}	58.9^{a}	65.5^{b}	68.4^{b}	67.3^{b}	64.0^{a}	67.3^{a}	71.2^{a,b}
Young coconut blanched cooling with dehumidified mesocarp snacks.	69.9^{a}	52.5^{a}	52.3^{a,b}	58.0^{a,b}	49.7^{a,b}	56.7^{a}	65.0^{a}	60.3^{a,b}
P- values at 5% level of significance	0.448	0.001	0.000	0.000	0.000	0.065	0.096	0.002

Data presented as average rank values of sensory attributes. A, b letters in same column are significantly different at P<0.05 level.

As shown in the table 3.1 the p-values of the sensory parameters at 5% level of significance show that, there is a significant difference in the sensory attributes like color, taste, bitterness, sweetness and overall acceptability among the four samples and there is no significant difference in aroma, texture and mouth feeling among four samples of mesocarp snacks developed. When considering the significantly different sensory attributes, for color young coconut blanched solar dried mesocarp had highest average rank, so more appealing to respondents and the un-blanched -cooled with dehumidified young coconut mesocarp had lowest average rank. When the average ranks are compared pairwise, there is significant difference of colour only in young coconut blanched-solar dried mesocarp snack from king coconut blanched-cooled with dehumidified mesocarp and from young coconut blanched-cooled with dehumidified mesocarp snacks.

For taste, the king coconut blanched-solar dried mesocarp snacks had highest average rank.so it had more appealing taste and the young coconut blanched cooled with dehumidified mesocarp had lowest average rank being less appealing in taste. According to the pair wise comparison of taste among the four samples, there was a significant difference of king coconut blanched-solar dried sample from king coconut blanched-cooled with dehumidified sample and also from young coconut blanched solar dried sample. For bitterness, the king coconut blanched solar dried mesocarp snacks had highest average rank. So the extent of bitterness in king coconut is more appealing to respondents. The young coconut blanched-solar dried mesocarp had the lowest average rank, higher bitterness. According to the pair wise comparison of bitterness among the four samples, there is significant difference of king coconut blanched-solar dried sample from king coconut blanched-cooled with dehumidified sample and also from young coconut blanched-solar dried sample. For sweetness, the king coconut blanched-solar dried mesocarp snacks had highest average rank.so it had more

appealing sweetness and the young coconut blanched-cooled with dehumidified mesocarp had lowest average rank being less appealing in sweetness. According to the pair wise comparison of sweetness among the four samples, there is significant difference of king coconut blanched-solar dried sample from king coconut blanched -cooled with dehumidified sample and also from young coconut blanched-solar dried sample. For over all acceptability, the king coconut blanched solar dried mesocarp snacks had highest average rank. So the extent of overall acceptability in king coconut is more appealing to respondents. The young coconut blanched-solar dried mesocarp had the lowest higher overall acceptability. According to the pair wise comparison of overall acceptability of the four samples of mesocarp snacks, there is a significant difference of only king coconut blanched-solar dried mesocarp snacks from that of young coconut blanched-solar dried mesocarp snacks. To further validate the results of sensory evaluation, sensory profiles of the four products developed from four treatments were drawn in a chart and which is given in figure 3.1 as shown below.

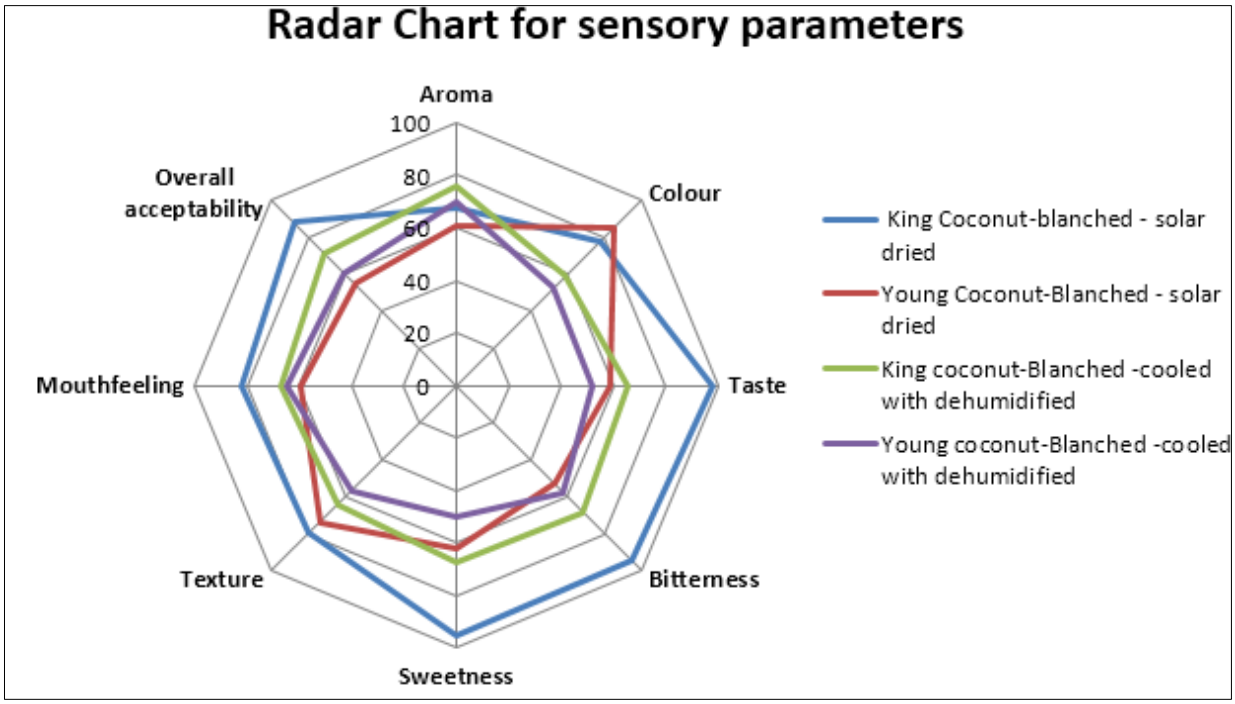

Fig 3.1: Graphical illustrations of sensory parameters.

According the figure 3.1, the most preferred sample of coconut mesocarp snack is the blanched –solar dried king coconut mesocarp snack and the least preferred coconut mesocarp snack is blanched-cooled with dehumidified young coconut mesocarp snack.

4. Conclusion

The final product of coconut mesocarp snack was made successfully by incorporating suitable treatments. The results of sensory evaluation revealed that, at 5% level of significance, there is a significant difference in the sensory attributes like color, taste, bitterness, sweetness and overall acceptability among the four samples and there is no significant difference in aroma, texture and mouth feeling among four samples of mesocarp snacks developed and the King coconut blanched-solar dried mesocarp had highest average rank in significant parameters of taste, bitterness, sweetness and overall acceptability. In colour only Young coconut solar dried mesocarp had highest average rank. Hence, King coconut blanched –solar dried mesocarp snack is the most preferred. Finally it is feasible to develop an edible food product from tender mesocarp with desirable sensory parameters.

References

1. Harasym J, Oledzki R. Effect of fruit and vegetable antioxidants on total antioxidant capacity of blood plasma. Nutrition. 2014; 30(5):511-517.
2. Kalina S, Navaratne SB. Evaluation of antioxidant activity and texture profile of tender-young and king coconut (Cocos nucifera) mesocarp. Journal of pharmacognosy and phytochemistry. 2018; 7(3):2945-2949.
3. Esmeraldo MA, Gomes AC, Freitas JEB, Fechine PBA, Sombra ASB, Corradini E. *et al*. Dwarf-green coconut fibers: a versatile natural renewable raw bioresource. Treatment, morphology, and physicochemical properties. Bio Resources. 2010; 5:2478-2501.
4. Soares Jimmy, Demeke, Mekonnen, Foulquie-Moreno, Maria, Van de Velde, Miet Verplaetse, Alex & Fernandes, A & Thevelein, Johan & Machado Bueno Fernandes, Patricia. Green coconut mesocarp pretreated by an alkaline process as raw material for bioethanol production. Bioresource Technology, 2016, 10. 1016/j.biortech.2016.05.105.
5. Akindahunsi AA, Oboh G. Effect of some post-harvest treatments on the bioavailability of zinc from some selected tropical vegetables. *La Rivista Italiana Delle* Sostanze Grasse. 1999; 76:285-287.
6. Granado F, Olmedilla B, Blanco I, mRojas-Hidalgo E. Carotenoid composition in raw and cooked Spanish vegetables. Journal of Agricultural and Food Chemistry. 1992; 40:2135-2140.
7. Hart DJ, Scott KJ. Development and evaluation of an HPLC method for the analysis of carotenoids in foods, and the measurement of the carotenoid content of

vegetables and fruits commonly consumed in the UK. Food Chemistry. 1995; 54:101-111.
8. Turkmen N, Sari Velioglu YS. The effect of cooking methods on total phenolics and antioxidant activity of selected green vegetables. Food Chemistry. 2005; 93:713-718.
9. Vina SZ, Olivera DF, Marani CM, Ferreyra RM, Mugridge A, Chaves AR, *et al*. Quality of Brussels sprouts (Brassica oleracea L. gemmifera DC) as affected by blanching method. Journal of Food Engineering. 2007; 80:218-225.
10. Chang Sui Kiat, Alasalvar Cesarettin, Shahidi, Fereidoon. Review of dried fruits: Phytochemicals, antioxidant efficacies, and health benefits. Journal of Functional Foods. 2016; 21:113-132. 10.1016/j.jff.2015.11.034.

Annexure I- Ballet sheet for sensory evaluation

Sensory evaluation score card for sensory attributes

You have been provided with 04 samples of coconut mesocarp snacks. Please test them and indicate how much you like or dislike the samples for each attribute by selecting the corresponding numerical value for your preferences from following scale.

Please note that higher score come for the most preferred product.

Extremely like	Like	Neither like or Dislike	Dislike	Extremely dislike
5	4	3	2	1

sample / Tested parameters	937	245	502	681
Aroma				
Colour				
Taste				
Bitterness				
Sweetness				
Texture				
Mouth feeling				
Over all Acceptability				

Comments & suggestions

.....

.....

.....

Name ..... Signature ..... Date .....

ANNEXURE II – Sensory data analysis

According to λ^2 table at 0.05 of significant levels for degree of freedom 3 values gives $H_{table} = 5.99$

Sensory Attribute	H_{STAT}	H_{TABLE}
Aroma	2.92	7.815
Colour	16.66	7.815
Taste	28.65	7.815
Bitterness	24.44	7.815
Sweetness	26.50	7.815
Texture	7.24	7.815
Mouth feeling	6.35	7.815
Overall Acceptability	22.63	7.815

When $H_{stat} > H_{table}$, there is a significant difference between samples. Here, for the parameters such as Colour, Taste, Bitterness, Sweetness and over allacceptability there is a significant difference among the samples.

Mean separation

Mean separation = $Z^*_{\propto}\sqrt{\frac{N\,(N+1)}{12}\,(\frac{1}{n_1}+\frac{1}{n_2})}$

n_1, n_2 - number of respondents =34
N - Total number of responses =136
K -number of treatments =4

$$\propto^* = \frac{\propto}{k\,(k-1)}$$

α = Significant level = 0.05

$$\propto^* = \frac{0.05}{4\,(4-1)}$$

α* = 0.0042
1 – 0.0042 = 0.9958
Z value according to the Z-table ($Z^*_{\propto}$) = 2.64

Mean separation = $Z^*_{\propto}\sqrt{\frac{N\,(N+1)}{12}\,(\frac{1}{n_1}+\frac{1}{n_2})}$

Mean separation = $2.64\sqrt{\frac{136(136+1)}{12}\,(\frac{1}{34}+\frac{1}{34})}$ = 25.23

Mean separation = 25.23
Paired wise comparison between samples Colour

	Average rank values	Average rank differences			
Sample		245	502	681	937
245	85.2				
502	58.9	26.3			
681	52.5	32.7	6.4		
937	77.4	7.8	18.5		

If the average rank difference > mean separation value (25.23), there is a significant difference between two samples.

Taste

	Average rank values	Average rank differences			
Sample		245	502	681	937
245	58.4				
502	65.5	7.1			
681	52.3	6.1	13.2		
937	97.8	39.4	32.3		

If the average rank difference > mean separation value (25.23), there is a significant difference between two samples.

Bitterness

	Average rank values	Average rank differences			
Sample		245	502	681	937
245	52.9				
502	68.4	15.5			
681	58.0	5.1	10.4		
937	94.7	41.8	26.3		

If the average rank difference > mean separation value (25.23), there is a significant difference between two samples.

Sweetness

	Average rank values	Average rank differences			
Sample		**245**	**502**	**681**	**937**
245	61.8				
502	67.3	5.5			
681	65.0	3.2	2.3		
937	95.2	33.4	27.9		

If the average rank difference > mean separation value (25.23), there is a significant difference between two samples.

Overall Acceptability

	Average rank values	Average rank differences			
Sample		245	502	681	937
245	54.9				
502	71.2	16.3			
681	60.3	5.4	10.3		
937	87.6	32.7	16.4		

If the average rank difference > mean separation value (25.23), there is a significant difference