

Development and Evaluation of Coconut Flakes

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Abstract

Cocos nucifera L. (Family Arecaceae) commonly known as coconut, is an important fruit crop in the tropical countries. The objective of this study was to develop coconut chips with different flavours from tall, dwarf and breed varieties of coconut and to evaluate organoleptically. Also nutrient analysis of three varieties of coconut was carried out followed by the shelf life study of coconut chips. Three varieties of coconut were selected namely tall, dwarf and breed. Plain, sweet and spicy coconut chips were prepared from these three varieties and it was compared with that of the standard namely conventional traditional variety of coconut. Traditional variety is most suitable for making plain coconut chips with white pepper flavour (PSV1) followed by dwarf, tall and breed varieties of coconut. Mean acceptability score of sweet coconut chips- osmotic dehydration method (S_wSV1) revealed that traditional variety was good followed by dwarf, tall and breed varieties of coconut. Sweet coconut chips prepared without osmotic dehydration method traditional variety was good followed by tall, dwarf and breed varieties of coconut. Traditional variety of coconut chips was good for making spicy coconut chips- white pepper flavour (SpSV₁) followed by breed, dwarf and tall varieties of coconut. Spicy coconut chips- chilli powder (SpMV₂), traditional variety of coconut chips was good followed by dwarf, breed and tall varieties of coconut.

Keyword: Coconut, coconut chips, proximate analysis, peroxide value

Introduction

Cocos nucifera L. (Family Arecaceae) commonly known as coconut, is an important fruit crop in the tropical countries. The coconut, *Cocos nucifera L.*, has been described as "the tree of life"¹ or the tree of plenty or the consols of the east^{2,3}. There are many varieties that describe for coconut trees, for example "talls", "dwarfs" or hybrids between

them. The tall coconuts are late flowering, more tolerant to harsh environmental conditions and produce larger nuts⁴. Dwarf coconuts grow to a height of about 10-15m and are autogamous, early flowering and generally produce a large number of small nuts with distinctive colour forms and they are mainly self pollinating⁴. The breeding of coconut palm is mainly based on selection of phenotypic

traits and artificial hybridization, involving varietal crosses between Tall and Dwarf forms⁵.

The fruit of the coconut is highly nutritious; rich in fibre, vitamins and minerals. It is classified as a 'functional food' because it provides many health benefits beyond its nutritional content⁶. In traditional medicine around the world coconut is used to treat a wide variety of health problems including the following: abscesses, asthma, baldness, bronchitis, bruises, burns, colds, constipation, cough, dropsy, dysentery, earache, fever, flu, gingivitis and gonorrhoea.

Coconut chips is a value added product of coconut kernel. Coconut chips can be used as a healthy snack and can be conceived as healthy and nutritious alternative to potato chips and it can also bring changes to the usual food products already accustomed by the consumers. In the present study tall, dwarf and breed varieties of coconut is selected for the development of coconut chips with different flavours and are evaluated organoleptically. Also nutrient analysis of three varieties of coconut was carried out followed by the shelf life study of coconut chips.

Therefore, the study has been designed with the following objectives:

- identify the coconut variety and develop value added coconut chips
- development of chips with different flavours
- comparison of different varieties of coconut chips with that of traditional variety
- evaluate the acceptability of the developed coconut chips
- analysis of the nutrients present in the tall, dwarf and breed varieties of coconut
- determination of shelf life

Materials and Methods

Selection of different varieties of coconut

The coconut for the study was collected from Kerala Agricultural University, Kasargod in Kerala. The tall, dwarf and breed are the three different varieties of coconut. In tall varieties there are different kinds, from which west coast tall have been selected for the study. In dwarf there are two varieties, chowghatorange dwarf (COD) and chowghat green varieties (CGD), from which chowghat green dwarf (CGD) and in breed varieties kerasee breed was selected for the study.

Development of coconut chips with different varieties of coconut in different flavours

Sweet coconut chips

Sweet coconut chips were prepared using tall, dwarf and breed varieties of coconut. To compare these varieties, traditional tall varieties of coconut were used for making sweet coconut chips and compared with the new varieties. In sweet coconut chips two variations were done. Variation I (S_wSV_1) is sweet coconut chips with osmotic dehydration. Variation II (S_wMV_2) is sweet coconut chips without osmotic dehydration.

For variation I, the sugar syrup was prepared by adding 1kg of sugar to 1 litre of water and added 20ml of ginger extract and 20ml of lemon juice. To this syrup 50g of small coconut pieces were added and warmed at temperature of 50°C and maintained for 3 hours. Then coconut pieces were drained off the sugar syrup and was placed in a tray and kept it for drying.

In variation II the sugar syrup was first prepared by dissolving 300g of sugar in 700 ml of water. Mixed well and added 0.3% of citric acid. To the sugar syrup added 50g coconut pieces and kept for four days or until the sugar syrup reached 60°brix. When the brix comes to 60° the syrup was filtered and washed the coconut pieces with lukewarm water and drained the water completely and kept for sun drying. The procedure for preparing sweet coconut chips was followed for tall, dwarf, breed and traditional variety of coconut taking 50 g of coconut pieces and it was named as ($S_w TSV_1$) and ($S_w TMV_2$) for tall, $S_w DSV_1$ and $S_w DMV_2$ for dwarf, $S_w BSV_1$ and $S_w BMV_2$ for breed and $S_w TrSV_1$ and $S_w TrMV_2$ for traditional tall variety respectively.

Plain coconut chips

To prepare plain coconut chips two variations PSV_1 , PMV_2 were prepared. In variation I plain coconut chips were prepared using salt solution with white pepper. In variation II plain coconut chips was prepared with salt solution without using white pepper. For making plain coconut chips 8% of salt solution was prepared. For making 8% salt solution 80 g of salt was added in 1000 ml of water.

In variation I (PSV_1), 2 g of white pepper was mixed in 200 ml of the prepared salt solution and then added the small coconut pieces. It was kept for three days. After three days the salt solution containing coconut pieces were filtered and coconut pieces were sun dried. In variation II (PMV_2), 50 g of medium coconut pieces were added to 200 ml of the prepared salt solution and kept for three days. After three days the salt solution was filtered and sun dried the coconut pieces.

In tall, dwarf, breed and traditional variety 50 g of small and medium coconut pieces were taken. This procedure for preparing plain coconut chips was followed for tall, dwarf, breed and traditional variety of coconut taking 50 g of coconut pieces and named as $PTSV_1$ and $PTMV_2$ for tall, $PDSV_1$ and $PDMV_2$ for dwarf, $PBSV_1$ and $PBMV_2$ for breed and $PTrSV_1$ and $PTrMV_2$ for traditional tall variety respectively.

Spicy coconut chips

Spicy coconut chips were prepared by using tall, dwarf, breed and traditional tall varieties of coconut. In spicy two variations $SpSV_1$ and $SpMV_2$ were prepared. In variation I spicy coconut chips were prepared by using white pepper. In variation II spicy coconut chips were prepared with chilli powder.

In variation I ($SpSV_1$), 50 g of small coconut pieces were taken in all varieties. 8% of salt solution was prepared. Two grams of white pepper was mixed in 200 ml of the prepared salt solution and then added the small coconut pieces and kept it for three days. After three days the salt solution was

filtered and the coconut pieces were sun dried. After drying, the coconut pieces were placed in a bowl. Five grams of white pepper was weighed and mixed with 3 ml of water to make paste. This paste was transferred to the bowl containing dried coconut pieces. Mixed and marinated. Then it was shallow fried.

In variation II (SpMV₂), 50 g of medium coconut pieces were taken in all variety. Medium coconut pieces were added to 200 ml of prepared salt solution and kept for three days. The coconut pieces were kept for sun drying after the filtering of salt solution from the coconut pieces. The coconut pieces were placed in a bowl. Then 5 g of chilli powder was mixed with 3 ml of water. This paste was applied to coconut pieces. Then it was shallow fried.

In tall, dwarf, breed and traditional variety 50 g of small and medium coconut pieces were taken. This procedure for preparing spicy coconut chips was followed for tall, dwarf, breed and traditional variety of coconut taking 50 g of coconut pieces and named as S_pTSV₁ and S_pTMV₂ for tall, S_pDSV₁ and S_pDMV₂ for dwarf, S_pBSV₁ and S_pBMV₂ for breed and S_pTrSV₁ and S_pTrMV₂ for traditional tall variety respectively.

Organoleptic evaluation of coconut chips

The acceptability test was conducted for the prepared coconut chips by evaluating the different sensory attributes like appearance, colour, flavour, texture, taste and overall acceptability by thirty semi-trained members. Nine point hedonic scale were used to evaluate the coconut chips.

Nutrient analysis of tall, dwarf and breed varieties of coconut

The nutrient content of tall, dwarf and breed varieties was carried out by biochemical analysis. Carbohydrate, protein, fat, fibre, calcium and nitrogen were determined in order to analyze the nutrient content of different varieties of coconut.

Shelf life study of developed chips

Microbial analysis was carried out to find the shelf life of coconut chips. Peroxide value method was selected to study the microbial load in coconut chips. The microbial analysis was carried out in a period of 30 days at room temperature.

Statistical analysis

The data obtained for sensory attributes of the developed recipes with three variations was analyzed statistically and interpreted. The data was consolidated and tabulated in which mean, standard deviation and ANOVA were computed.

Results and Discussion

Table I presents the mean acceptability of plain coconut chips with pepper flavour.

The coconut chips prepared from traditional variety scored the highest scores of 7.90±0.30 for appearance followed by dwarf, tall and breed variety with scores of 7.73±0.44, 7.70±0.46 and 7.46±0.50 respectively. The colour of traditional variety of coconut chips scored highest score of 8.53±0.50 followed by dwarf, tall and breeds with scores of 8.26±0.44, 8.16±0.37 and 7.86±0.34

TABLE I
Mean Acceptability Score of Plain Coconut Chips with Pepper Flavour (PSV₁)

Variations	Appearance	Colour	Flavour	Texture	Taste	Overall acceptability
Standard/ Traditional variety (PTrSV ₁)	7.90 ± 0.30	8.53 ± 0.50	7.86 ± 0.34	8.43 ± 0.50	8.43 ± 0.50	8.03 ± 0.31
Tall variety(PTSV ₁)	7.70 ± 0.46	8.16 ± 0.37	8.26 ± 0.44	7.66 ± 0.47	8.03 ± 0.18	7.76 ± 0.43
Dwarf variety(PDSV ₁)	7.73 ± 0.44	8.26 ± 0.44	7.66 ± 0.47	8.53 ± 0.50	8.03 ± 0.85	7.83 ± 0.37
Breed variety(PBSV ₁)	7.46 ± 0.50	7.86 ± 0.34	7.73 ± 0.58	7.56 ± 0.67	7.73 ± 0.52	7.56 ± 0.50
ANOVA	.003	.000	.000	.000	.000	.000

respectively. The flavour of traditional coconut chips scored the highest score of 7.86±0.34 followed by breed, dwarf and tall with scores of 7.73±0.58, 7.66±0.47 and 8.26±0.44 respectively. The texture of the dwarf variety had the highest score of 8.53±0.50 followed by traditional, tall and breed with scores of 8.43±0.50, 7.66±0.47, and 7.56±0.67 respectively. Traditional variety of coconut chips scored the highest scores of 8.43±0.50 for taste and the least scores of 7.73±0.52 obtained for breed variety. The overall acceptability of the traditional coconut chips had the highest score of 8.03±0.31 followed by

dwarf, tall and breed with scores of 7.83±0.37, 7.76±0.43 and 7.56±0.50 respectively.

From Table I, it is observed that the p value is less than 0.05. Hence, the null hypothesis is rejected at 5% level of significance. (i.e.) there is significant difference between the ranks of the various types of plain coconut chips with white pepper flavor in appearance, color, flavor, texture, taste and overall acceptability.

Table II and Figure 1 presents the mean acceptability score of plain coconut chips. The

TABLE II
Mean Acceptability Score of Plain Coconut Chips (PMV₂)

Variations	Appearance	Colour	Flavour	Texture	Taste	Overall acceptability
Standard/ Traditional variety (PTrMV ₂)	8.00	8.43 ± 0.50	7.00	6.96 ± 0.66	6.90 ± 0.30	7.00
Tall variety(PTMV ₂)	7.33 ± 0.47	8.13 ± 0.34	6.63 ± 0.49	6.93 ± 0.25	6.53 ± 0.50	6.56 ± 0.56
Dwarf variety(PDMV ₂)	7.20 ± 0.40	8.33 ± 0.47	6.70 ± 0.46	6.60 ± 0.49	5.50 ± 0.50	6.33 ± 0.47
Breed variety(PBMV ₂)	7.30 ± 0.59	8.23 ± 0.43	6.73 ± 0.44	6.46 ± 0.50	5.80 ± 0.84	6.16 ± 0.37
ANOVA	.000	.060	.004	.000	.000	.000

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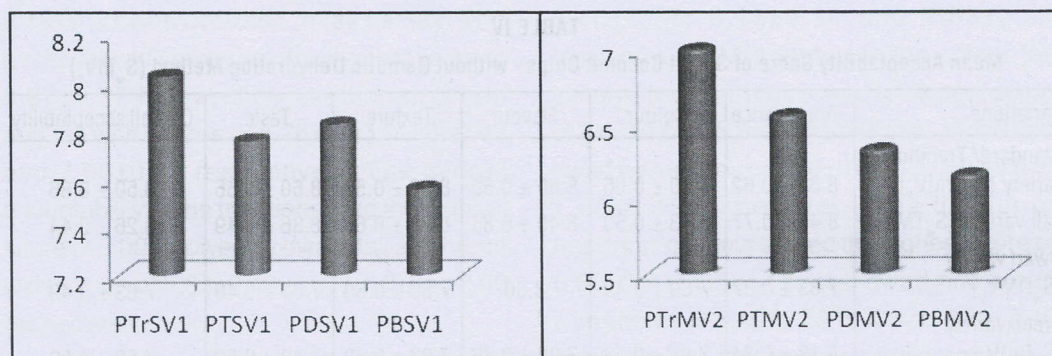


Figure 1

Overall acceptability of plain coconut chips-variation I and variation II

plain coconut chips prepared from traditional variety scored the highest scores of 8.00 for appearance followed by tall, breed and dwarf variety with scores of 7.33 ± 0.47 , 7.30 ± 0.59 and 7.20 ± 0.40 respectively. The colour of traditional coconut chips scored highest score of 8.43 ± 0.50 followed by dwarf, breeds and tall with scores of 8.33 ± 0.47 , 8.23 ± 0.43 and 8.13 ± 0.34 respectively. The flavour of traditional coconut chips scored the highest score of 7.00 followed by breed, dwarf and tall with scores of and 6.73 ± 0.44 , 6.70 ± 0.46 and

6.63 ± 0.49 respectively. The texture of the traditional had the highest score of 6.96 ± 0.66 followed by tall, dwarf and breed with scores of 6.93 ± 0.25 , 6.60 ± 0.49 and 6.46 ± 0.50 respectively. The taste of the traditional had the highest score of 6.90 ± 0.30 followed by tall, breed and dwarf with scores of 6.53 ± 0.50 , 5.80 ± 0.84 and 5.50 ± 0.50 respectively. The overall acceptability of the traditional variety had the highest score of 7.00 followed by tall, dwarf and breed with scores of 6.56 ± 0.56 , 6.33 ± 0.47 and 6.16 ± 0.37 respectively.

TABLE III

Mean Acceptability Score of Sweet Coconut Chips-Osmotic Dehydration Method (S_w SV1)

Variations	Appearance	Colour	Flavour	Texture	Taste	Overall acceptability
Standard/ Traditional variety (S_w T_rSV ₁)	8.76 ± 0.43	8.80 ± 0.40	8.66 ± 0.47	8.76 ± 0.43	8.76 ± 0.43	9.00
Tall variety (S_w T _{SV1})	8.46 ± 0.50	8.10 ± 0.30	7.60 ± 0.49	8.16 ± 0.53	7.66 ± 0.47	7.63 ± 0.49
Dwarf variety (S_w DSV ₁)	8.76 ± 0.43	8.93 ± 0.25	8.66 ± 0.47	8.46 ± 0.50	8.83 ± 0.37	8.63 ± 0.49
Breed variety (S_w BSV ₁)	7.63 ± 0.49	7.63 ± 0.49	8.13 ± 0.73	8.46 ± 0.62	7.86 ± 0.62	7.00
ANOVA	.000	.000	.000	.000	.000	.000

TABLE IV
Mean Acceptability Score of Sweet Coconut Chips - without Osmotic Dehydration Method (S_wMV_2)

Variations	Appearance	Colour	Flavour	Texture	Taste	Overall acceptability
Standard/ Traditional variety (S_wTrMV_2)	8.53 ± 0.62	8.20 ± 0.66	8.50 ± 0.50	8.46 ± 0.57	8.60 ± 0.56	8.50 ± 0.86
Tall variety (S_wTMV_2)	8.46 ± 0.77	8.43 ± 0.50	8.40 ± 0.85	8.33 ± 0.66	8.36 ± 0.49	8.26 ± 0.44
Dwarf variety (S_wDMV_2)	7.83 ± 0.37	7.60 ± 0.49	8.00	7.50 ± 0.50	7.63 ± 0.49	7.63 ± 0.49
Breed variety (S_wBMV_2)	8.13 ± 0.34	7.96 ± 0.18	7.30 ± 0.46	7.23 ± 0.43	7.43 ± 0.50	7.53 ± 0.50
ANOVA	.000	.000	.000	.000	.000	.000

From the Table II it is observed that the p value is less than 0.05 for appearance, color, flavor, taste, texture and overall acceptability. Hence, the null hypothesis is rejected at 5% level of significance. (i.e.) there is significant difference between the ranks of the various types of plain coconut chips (Figure 1).

Table III presents the mean acceptability score of sweet coconut chips- osmotic dehydration method.

The traditional and dwarf variety of coconut chips scored the highest and same scores of 8.76±0.43 for appearance followed

by tall and breed variety with scores of 8.46±0.50 and 7.63±0.49 respectively. The colour of dwarf variety of coconut chips scored highest score of 8.93±0.25 followed by traditional, tall and breed with scores of 8.80±0.40, 8.10±0.30 and 7.63±0.49 respectively. The flavour of traditional and dwarf variety of coconut chips scored the highest and same score of 8.66±0.47 followed by breed and tall with scores of 8.13±0.73 and 7.60±0.49 respectively. The texture of the traditional had the highest score of 8.76±0.43. Dwarf and breed variety obtained the same scores of 8.46±0.50 and the least score of

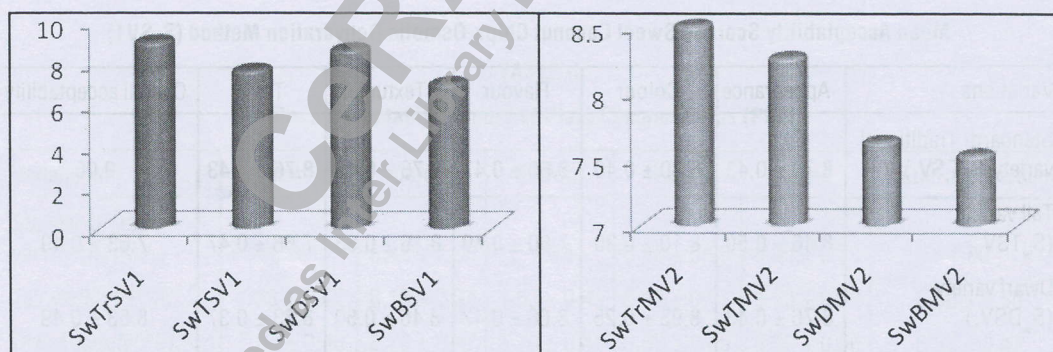


Figure 2

Overall acceptability of sweet coconut chips- variation I and variation II

8.16±0.53 was obtained in tall variety. The taste of dwarf variety had the highest score of 8.83±0.37 followed by traditional, breed and tall with scores of 8.76±0.43, 7.86±0.62 and 7.66±0.47 respectively. The overall acceptability of the traditional had the highest score of 9.00 followed by dwarf, tall and breed with scores of 8.63±0.49, 7.63±0.49 and 7.00 respectively.

From Table III, it is observed that the p value is less than 0.05 for appearance, colour, flavor, texture, taste and overall acceptability. Hence, the null hypothesis is rejected at 5% level of significance. (i.e.) there is significant difference between the ranks of the various types of sweet coconut chips.

Table IV and Figure 2 presents the mean acceptability score of sweet coconut chips – without osmotic dehydration method.

The coconut chips prepared from traditional variety scored the highest score of 8.53±0.62 for appearance followed by tall, breed, and dwarf variety with scores of

8.46±0.77, 8.13±0.34 and 7.83±0.37 respectively. With regard to the colour tall variety of coconut chips scored highest score of 8.43±0.50 followed by traditional, breed and dwarf with scores of 8.20±0.66, 7.96±0.18 and 7.60±0.49 respectively. The flavour of traditional coconut scored the highest score of 8.50±0.50 followed by tall, dwarf and breed with scores of 8.40±0.85, 8.00 and 7.30±0.46 respectively. The texture of the traditional coconut variety had the highest score of 8.46±0.57 followed by tall, dwarf and breed with scores of 8.33±0.66, 7.50±0.50 and 7.23±0.43 respectively. The taste of traditional scored the highest score of 8.60±0.56 followed by tall, dwarf and breeds with scores of 8.36±0.49, 7.63±0.49 and 7.43±0.50 respectively. The overall acceptability of the traditional variety had the highest score of 8.50±0.86 followed by tall, dwarf and breed with scores of 8.26±0.44, 7.63±0.49 and 7.43±0.50 respectively.

From Table V it is observed that the p value is less than 0.05. Hence, the null

TABLE V
Mean Acceptability Score of Spicy Coconut Chips- White Pepper Flavour (SpSV₁)

Variations	Appearance	Colour	Flavour	Texture	Taste	Overall acceptability
Standard/ Traditional variety (S _p TrSV ₁)	7.90 ± 0.75	8.00	8.36 ± 0.49	7.66 ± 0.47	8.16 ± 0.37	8.20 ± 0.48
Tall variety (S _p TSV ₁)	7.40 ± 0.49	7.26 ± 0.44	7.40 ± 0.49	7.43 ± 0.50	8.00	7.00 ± 0.45
Dwarf variety (S _p DSV ₁)	7.63 ± 0.61	7.43 ± 0.50	7.86 ± 0.50	7.40 ± 0.67	7.13 ± 0.34	7.43 ± 0.50
Breed variety (S _p BSV ₁)	7.73 ± 0.58	7.50 ± 0.50	8.00	7.50±0.93	8.33 ± 0.47	8.00
ANOVA	.020	.000	.000	.002	.000	.000

hypothesis is rejected at 5% level of significance. (i.e.) there is significant difference between the ranks of the various types of sweet coconut chips in appearance, colour, flavor, texture, taste and overall acceptability.

Table V presents the mean acceptability score of spicy coconut chips- white pepper flavour.

The traditional variety of coconut chips scored the highest scores of 7.90 ± 0.75 for appearance followed by breed, dwarf and tall with scores of 7.73 ± 0.58 , 7.63 ± 0.61 and 7.40 ± 0.49 respectively. The colour of the chips of traditional variety had a highest score of 8.00 followed by breed, dwarf and tall with scores of 7.50 ± 0.50 , 7.43 ± 0.50 and 7.26 ± 0.44 respectively. The flavour of traditional variety scored the highest score of 8.36 ± 0.49 followed by breed, dwarf and tall with scores of 8.00, 7.86 ± 0.50 and 7.40 ± 0.49 respectively. With regard to texture also the traditional variety only had the highest score of 7.66 ± 0.47 followed by breed, tall and dwarf with

scores of 7.50 ± 0.93 , 7.43 ± 0.50 and 7.40 ± 0.67 respectively. The taste of breed variety of coconut scored the highest score of 8.33 ± 0.47 followed by traditional, tall and dwarf with scores of 8.16 ± 0.37 , 8.00 and 7.13 ± 0.34 respectively. The overall acceptability of the chips prepared out of traditional variety coconut had the highest score of 8.20 ± 0.48 followed by breed, dwarf and tall with scores of 8.00, 7.43 ± 0.50 and 7.00 ± 0.45 respectively.

From Table V it is observed that the p value is less than 0.05. Hence, the null hypothesis is rejected at 5% level of significance. (i.e.) there is significant difference between the ranks of the various types of spicy coconut chips in appearance, colour, flavor, texture, taste and overall acceptability.

The overall acceptability of the chips prepared from traditional variety coconut had the highest score of 8.33 ± 0.47 followed by dwarf, breed and tall with scores of 8.23 ± 0.43 , 7.33 ± 0.60 and 7.20 ± 0.61 respectively.

TABLE VI
Mean Acceptability Score of Spicy Coconut Chips- Chilli Powder (S_pMV_2)

Variations	Appearance	Colour	Flavour	Texture	Taste	Overall acceptability
Standard/ Traditional variety (S_pTrMV_2)	8.03 ± 0.55	7.86 ± 0.34	8.36 ± 0.49	8.06 ± 0.58	8.76 ± 0.43	8.33 ± 0.47
Tall variety (S_pTMV_2)	7.56 ± 0.50	7.60 ± 0.56	7.66 ± 0.47	7.33 ± 0.75	7.03 ± 0.85	7.20 ± 0.61
Dwarf variety (S_pDMV_2)	7.80 ± 0.40	7.73 ± 0.63	8.13 ± 0.81	7.70 ± 0.53	8.26 ± 0.44	8.23 ± 0.43
Breed variety (S_pBMV_2)	7.60 ± 0.62	7.66 ± 0.80	7.63 ± 0.80	7.53 ± 0.86	7.56 ± 0.89	7.33 ± 0.60
ANOVA	.003	.376	.000	.001	.000	.000

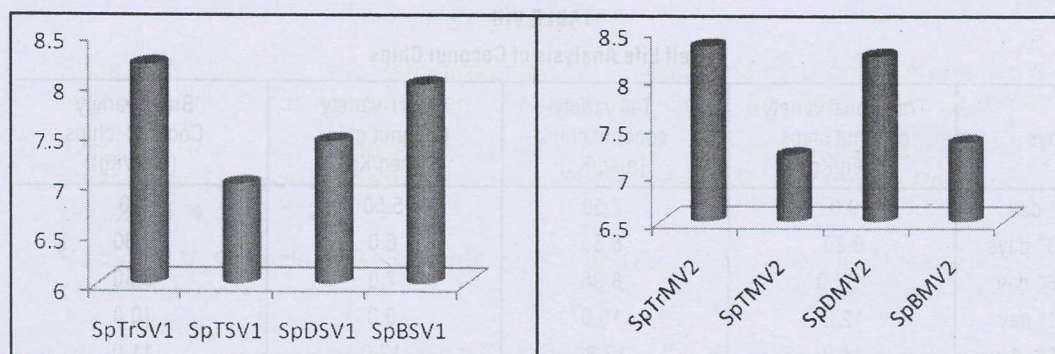


Figure 3

Overall acceptability of spicy coconut chips- variation I and variation II

From the Table VI it is observed that the p value is less than 0.05. Hence, the null hypothesis is rejected at 5% level of significance. (*i.e.*) there is significant difference between the ranks of the various types of spicy coconut chips in appearance, colour, flavor, texture, taste and overall acceptability.

Table VI and Figure 3 presents the mean acceptability scores of spicy coconut chips with chilli powder taste and flavour.

The coconut chips prepared from traditional coconut variety scored the highest scores of 8.03 ± 0.55 for appearance followed by dwarf, breed and tall variety with scores of 7.80 ± 0.40 , 7.60 ± 0.62 and 7.56 ± 0.50

respectively. The colour of traditional variety scored highest with 7.86 ± 0.34 followed by dwarf, breed and tall with scores of 7.73 ± 0.63 , 7.66 ± 0.80 and 7.60 ± 0.56 respectively. The flavour of traditional variety had the highest score of 8.36 ± 0.49 followed by dwarf, tall and breed with scores of 8.13 ± 0.81 , 7.66 ± 0.47 and 7.63 ± 0.80 respectively. The texture of the traditional variety had the highest score of 8.06 ± 0.58 followed by dwarf, breed and tall with scores of 7.70 ± 0.53 , 7.53 ± 0.86 and 7.33 ± 0.75 respectively. The taste of traditional scored the highest score of 8.76 ± 0.43 followed by dwarf, breed and tall with scores of 8.26 ± 0.44 , 7.56 ± 0.89 and 7.03 ± 0.85 respectively. With regard to the overall acceptability, the chips

TABLE VII

Nutrient Content of 100g of Tall, Dwarf and Breed Varieties of Coconut

Coconut varieties	Moisture (%)	Crude fibre (g)	Total carbohydrate (g)	Protein (g)	Fat (g)	Calcium (mg)
Tall variety	37.3 ± 2.5	13.3 ± 1	29.50 ± 3.27	6.25 ± 0	11.00 ± 1.00	25.00 ± 4.35
Dwarf variety	42.00 ± 1	12.00	18.66 ± 3.32	17.8 ± 1	7.66 ± 0.57	14.00 ± 2.00
Breed variety	44.00 ± 3.6	10.00 ± 2	28.66 ± 1.15	6.25 ± 0	16.00 ± 1.00	18.00 ± 2.00

TABLE VIII
Shelf Life Analysis of Coconut Chips

Days	Traditional variety coconut chips (meq/Kg)	Tall variety coconut chips (meq/Kg)	Dwarf variety Coconut chips (meq/Kg)	Breed variety Coconut chips (meq/Kg)
5 th day	9.0	7.50	5.50	7.0
10 th days	9.80	8.50	6.0	7.80
16 th day	10.50	8.98	7.0	8.50
21 st day	12.0	10.0	9.0	10.0
26 th day	14.0	12.80	12.0	11.0
31 st day	18.0	15.0	14.0	13.0

prepared from traditional variety coconut had the highest score of 8.33 ± 0.47 followed by dwarf, breed and tall with scores of 8.23 ± 0.43 , 7.33 ± 0.60 and 7.20 ± 0.61 respectively.

From the Table VII it is observed that the p value is less than 0.05. Hence, the null hypothesis is rejected at 5% level of significance. (i.e.) there is significant difference between the ranks of the various types of spicy coconut chips in appearance, colour, flavor, texture, taste and overall acceptability.

At the end of 31st day the peroxide values were 18.0, 15.0, 14.0 and 13.0 for traditional, tall, dwarf and breed respectively. The initial peroxide value of traditional coconut chips was high as compared to that of tall, dwarf and breed variety of coconut chips. The PV obtained for tradition coconut chips showed that 18.0 meq/kg which is classified at high oxidation state. The PV obtained for tall, dwarf and breed coconut chips were 15.0, 14.0 and 13.0 which are classified as high

oxidation state but less than that of the peroxide value obtained in the traditional coconut chips. From the peroxide value analysis coconut chips had good shelf life of more than 30 days.

Conclusion

Coconut chips is another value added product and it adds variety to the diet. Coconut chips are really great anytime snack for kids and adults of all ages. Chips improve the shelf life of coconut so that it can be stored for a long time and consumed as a healthy snack for children and adults. For making plain coconut chips with white pepper flavour, dwarf variety was good and without adding white pepper tall variety was good. Dwarf variety was good for making sweet coconut chips with osmotic dehydration process and tall variety was good for making sweet coconut chips without osmotic dehydration. In spicy coconut chips with white pepper flavour breed variety was good and in chilli powder flavour, dwarf variety was good.

REFERENCES

1. Rana, M.N., Das, A.K. and Ashaduzzaman, M. Physical and mechanical properties of coconut palm (*Cocos nucifera*) stem. *Bangladesh J. Sci. Indus. Res.*, 2015, **50**, 39-46.
2. Tyagi, N., Hooda, V., Hooda, A. and Malkani, S. Evaluation of anti-diabetic potential of ethanolic and aqueous extract of *cocos nucifera* endocarp. *World J. Pharm. Pharmaceu. Sci.*, 2015, **4**, 1112-1120.
3. Rasam. D.V., Gokhale, N.B., Sawardekar, S.V. and Patil, D.M. Molecular characterisation of coconut (*Cocos nucifera* L.) Varieties using ISSR and SSR markers. *The J. Horticul. Sci. Biotechnol.*, 2016, 1-6.
4. Kamaral, L.C.J., Perera, S.A.C.N., Perera, K.L.N.S. and Dassanayaka, P.N. Sri Lanka Yellow Semi Tall; A new addition to the coconut (*Cocos nucifera* L.) classification in Sri Lanka Cocos. 2016, **22**, 49-55.
5. Oyoo, M.E., Najya, M., Githiri, S.M., Ojwang, P.O., Muniu, F.K., Masha, E. and Owuoch, J.O. In-situ morphological characterization of coconut in the coastal lowlands of Kenya. *Afr. J. Plant Sci.*, 2015, **9**, 65-74.
6. Rajesh, M.K., Rijith, J., Rahman, S., Preethi, P., Rachana, K.E., Sajini, K.K. and Karun. A. Estimation of out-crossing rates in populations of West Coast Tall cultivar of coconut using microsatellite markers. *J. Plantat. Crops*, 2014, **42**, 277-228.
7. OBIDOA, Onyechi; JOSHUA, Parker Elijah and EZE, Nkechi J. Phytochemical analyses of *Cocos nucifera* L. *Arch. Pharm. Sci. Res.*, 2009, **1**, 87-96.