Evaluation of cashew (*Anacardium occidentale* L.) varieties for immature kernel characters

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Abstract

Cashew varieties are categorised as early season, mid season and late season varieties. Harvesting of late season varieties coincides with rainy season, and the quality of matured nuts is very poor. This study was conducted to analyse various characteristics of immature cashew kernels so that the loss of matured nuts can be overcome by utilizing them before they reach maturity. Six varieties of cashew, namely, Madakkathara-2, Sulabha, Dhana, Priyanka, Poornima and Kanaka were studied for the immature kernel characteristics, which were collected from Cashew Research Station, Madakkathara. The physical characteristics studied were shelling percentage, kernel weight, kernel size, shell weight, testa weight, colour, external appearance and shape of kernel. The estimated range of biochemical composition of immature cashew kernels was 0.19-0.23% tannins, 4.88-9.63% carbohydrates, 5.08-9.08% fat, and 7.29-12.45% protein, which varied with varieties.The immature cashew kernels were observed as potential raw materials for preparing value-added products.

Keywords: Biochemical characteristics, Cashew varieties, Physical characteristics.

Introduction

Cashew, an important horticultural crop of India, has great socioeconomic significance in our country. It is native of Brazil and the Lower Amazon. Cashew was introduced to the Americas, the West Indies, Madagascar, India, and Malaysia, where it became a valuable crop (Frankel, 1991). The demand for raw and processed cashew nuts is bright in internal and export markets. According to the annual report of the Cashew Export Promotion Council of India (CEPC, 2019), India continued to be the largest producer of cashew nuts in the year 2017-2018, and Maharashtra contributed the maximum (33%), followed by Andhra Pradesh (14%), Kerala (11%) and Karnataka (11%). At present, cashew kernels are consumed directly or used for various food preparations.Raw cashews contain 5% water, 30% carbohydrates, 44% fat and 18% protein. In a 100 gram reference quantity, raw cashews provide 553 Calories, 67% of the Daily Value (DV) in total fats, 36% DV of protein, 13% DV of dietary fiber and 11% DV of carbohydrates (USDA, 2015). The research efforts bestowed till now are concentrated mostly on mature kernels and immature kernels gained little attention. In our state, sprouted cashew nuts are eaten raw and as cooked. Substantial quantities of cashew nuts are produced during the rainy season in Kerala, especially in the late season flowering types, which are inferior in quality and are being wasted. Late season flowering is mostly noticed in Wayanad and Idukki districts – hilly regions or high-range regions of Kerala. Nut quality is affected mainly by the infestation of pests and diseases. It is estimated that more than 50% of the crop is lost annually due to pests and diseases in cashew (Haribabu et al.,1983). If the immature nuts can be economically utilized, the loss during

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the rainy season can be reduced to a great extent. The immature nuts are harvested in tender form when the shells are not hardened and are green in colour. The shell is soft and can be cut with a knife, and the kernel can be extracted. The kernels are used in various ways like serving as a snack, relished as salads by combining them with mango, and preparation of sweets such as *tikka* and cashew cake (Anandkumar et al., 2011). In this context, the present study envisaged the evaluation of cashew varieties for their immature kernel characters.

Materials and Methods

Six varieties of cashew belonging to late and mid-season categories were collected from Cashew Research Station, Madakkathara, Thrissur. The selected varieties were Madakkathara-2, Sulabha, Dhana, Priyanka, Poornima and Kanaka.The inflorescences of selected cashew varieties were tagged on the day of anthesis, and the nuts were harvested after 55 days. These tender nuts were used to study the physical and biochemical characteristics. Physical parameters included shelling percentage, kernel weight, kernel size, shell weight, testa weight and colour, external appearance and shape of kernel. Biochemical analysis of kernels was done to estimate tannin, carbohydrate, fat, protein, and total sugar content. There were four replications for studying each character and the data was analysed statistically by Completely Randomised Design.

Results and Discussion

The highest shelling percentage was observed for the variety Madakkathara-2 (17.88%), and the least was for Priyanka (14.83%), as given in Table 1a.The immaturity of nuts might have resulted in a lesser shelling percentage than mature nuts. Sobhana and Mathew (2014) reported the shelling percentage (kernel recovery) of immature cashew nuts as 32.7% for Madakkathara-1, 22% for Vridhachalam-3, 20.7% for Priyanka, 18.3% for Dhana, 18% for Poornima and 17% for Damodhar. The immature kernel weight recorded for the varieties ranged from 2.173g (Kanaka) to 2.759g (Poornima). Poornima having the highest kernel weight, even though there was no significant difference. Jayaprakash Naik (2009) reported the kernel weight for mature nuts of different varieties *viz*., 1.88g for Madakathara-2, 2.88g for Sulabha, 2.44g for Dhana, 2.87g for Priyanka, 2.6g for Poornima and 2.08g for Kanaka. This implies that the kernel weight does not change much after 55 days of anthesis till the nut reaches complete maturity. Among the six varieties,

Table 1a. Physical characteristics of immature cashew kernels of different cashew varieties

Varieties	Shelling percentage (%)	Kernel weight (g)	Kernel size		Weight of shell (g)	Weight of testa (g)
			Length (cm)	Width (cm)		
Madakkathara-2	17.88	2.18	2.58	1.09	8.83	0.75
Sulabha	16.21	2.49	2.84	1.19	11.47	0.87
Dhana	15.68	2.23	2.42	0.96	11.18	0.52
Priyanka	14.83	2.64	3.21	1.23	13.24	1.66
Poornima	16.08	2.76	3.08	1.06	12.81	1.045
Kanaka	16.13	2.17	2.38	0.84	10.39	0.65
CD value (0.05)	NS	NS	0.179	0.113	2.102	0.486

Table 1b. Physical characteristics of immature kernel of different cashew varieties

Varieties	Colour of the kernel	External appearance	Kernel shape
Madakkathara-2	Yellowish white	Glossy with few wrinkles	Oblong
Sulabha	Yellowish white	Glossy with few wrinkles	Oblong-ellipsoid
Dhana	Pale yellow	Glossy and smooth	Oblong-ellipsoid
Priyanka	Greenish white	Less glossy with wrinkles	Kidney
Poornima	Yellowish white	Glossy with few wrinkles	Oblong-ellipsoid
Kanaka	Yellowish white	Glossy with few wrinkles	Oblong-ellipsoid

Priyanka was found superior in kernel size, both length wise (3.20 cm) and widthwise (1.23 cm). Arogba (1999) reported the dimensions of matured cashew kernel as 2.5 ± 0.3 cm length wise and 0.9 ± 0.2 cm width wise. According to Pushpalatha (2009), the nut length, width, and thickness increased up to 40 days after fertilisation and declined later. These reports indicate that the immature kernels have larger dimensions than the matured ones, and that might be the reason for getting higher dimensions for the immature kernel under study. The weight of shell and testa were evaluated for the six varieties, and the variety Priyanka was found superior in both the characters, with 13.24g shell weight and 1.66g testa weight. Colour of the immature cashew kernel was observed as pale yellow for Dhana, greenish white for Priyanka, and yellowish white for Madakkathara-2, Sulabha, Poornima, and Kanaka (Table 1b). Arogba (1999) reported pale yellow colour for cashew nut kernels while studying its comparison with kolanut (*Cola nitida*). The immature kernels of the cashew varieties Madakkathara-2, Sulabha, Poornima and Kanaka were glossy along with few wrinkles on external appearance, unlike Dhana, which had glossy and smooth kernels, and Priyanka, with wrinkles and less glossy kernels.The shape of the immature kernels varied with varieties. The immature kernels were oblong-ellipsoid for Sulabha, Dhana, Poornima and Kanaka; oblong for Madakkathara-2, and kidney shaped for Priyanka. Arogba (1999) reported the shape of cashew kernel as crescent shape.

The estimated tannin content was very low in immature cashew kernels and did not vary much to the varieties studied. The tannin content of the varieties was 0.19% for Sulabha and Kanaka, 0.21% for Madakkathara-2, 0.21% for Dhana, 0.22 for Priyanka and 0.23% for Poornima, Poornima having the highest value (Table 2).This conforms with the finding of Sobhana and Mathew (2014), wherein tannin was reported as 0.22% for Dhana, 0.24% for Priyanka and 0.26% for Poornima.The carbohydrate content of the varieties under study did not vary much with respect to the varieties since it was found to be statistically non-significant (Figure 6). The carbohydrate content estimated was 9.63% for Kanaka, 9.3% for Priyanka, 7.35% for Poornima, 6.65% for Sulabha, 5.92% for Madakkathara-2 and 4.88% for Dhana. Carbohydrate content of immature cashew kernels was not reported in earlier works; however, there are many reports on the carbohydrate content of mature kernels. According to Nair (2009), the carbohydrate content ofmature cashew kernel was recorded as 25 percent. In another study by Ogunsina (2013), the carbohydrate content reported for mature cashew kernel was 24.19 pe rcent. The average fat content ranged between 5.08% - 9.08% among the varieties. The variety Poornima was superior (9.08%), followed by Kanaka (8.16%) among the six varieties.As in the case of carbohydrates, fat content also might increase with the advancement of maturity, and cashew nut is regarded as one of the nuts rich in fat, especially monounsaturated and polyunsaturated fatty acids. Akinhanmi et al. (2008) and Nair (2009) reported the fat content in matured cashew kernels as 49.1% and 47%, respectively, whereas Ogunsina (2013) reported the crude fat content as 42.19 percent in matured cashew kernels. Thus, it is evident that the fat content of cashew kernel

Table 2. Biochemical characteristics of immature cashew kernels of different cashew varieties

Varieties	Tannins (%)	Carbohydrates (%)	Fat (%)	Protein (%)	Sugar (%)
Madakkathara-2	0.21	5.92	6.05	8.89	-
Sulabha	0.19	6.65	7.82	7.60	-
Dhana	0.21	4.88	5.08	7.29	-
Priyanka	0.22	9.30	7.27	12.45	-
Poornima	0.23	7.35	9.08	10.26	-
Kanaka	0.19	9.63	8.16	7.36	-
CD value (0.05)	0.024	NS	1.447	2.545	-

increased with maturity and development, and immature kernel contain very little fat, as observed from the present study.The average protein content varied significantly with varieties. The highest protein content was estimated for the variety Priyanka (12.46%) and the least protein content was estimated for Dhana (7.29%), which was on par with Sulabha (7.60%) and Kanaka (7.36%). Venkatachalam and Sathe (2006) reported the protein content of cashew kernel as 18.81 ± 0.06%, whereas it was 21%, as reported by Nair (2009). According to Ogunsina (2013), the protein content of matured cashew kernel was 21.32%. The protein content of immature kernel was found to be lesser than that of the mature kernel. However, compared to other biochemical parameters like carbohydrate and fat, the difference of protein content of immature and mature kernels was less.

Sugar content could not be detected in the immature kernels of any of the varieties. According to Venkatachalam and Sathe (2006), the sugar content of matured cashew kernel was estimated as 3.96 ± 0.08g per 100g kernel. Griffin and Dean (2017) reported the sugar content of raw cashew kernels as 6.0 ± 0.26%. Thus, it is clear that the sugar content in the matured kernels is very low compared to carbohydrates, fat, and protein. This might be the reason for not getting detectable sugar quantity in the kernel's immature stage.

From this study, it could be concluded that the immature cashew kernel harvested at 55 days of maturity has good quality characteristics, which makes it suitable for consumption and also for using it as a potential raw material and further value addition.

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