Proximate Composition of the Flesh and the Peel of Sri Lankan Cassava Variety "MU-51"

Somendrika.M.A.D[1], Wickramasinghe.I[1], Wansapala.M.A.J[1], Peiris.S[2]
[1]*Department of Food Science and Technology, Faculty of Applied Sciences, University of Sri Jayewardenepura, Gangodawila, Nugegoda*
[2]*National Cleaner Production Centre, Sri Lanka*

***Abstract*- Cassava (Manihot esculenta) is a tropical perennial plant and starchy root of cassava is the majour source of carbohydrates for approximately 800 million people in developing regions of the tropics. Although cassava production has increased drastically in last decade in Sri Lanka still there are no significant studies have been conducted to analyse the proximate compositions of recommended cassava varieties in Sri Lanka. The purpose of the current study was to analyse the proximate in the flesh and peel of the Cassava variety "MU-51". The root peel had significantly high amount ($p<0.05$) of moisture (70.80±0.09), fat (0.42±0.06) and fibre(1.74±0.03) content than the flesh. The root flesh contain high amount of ash(1.26±0.04) and protein(1.13±0.19) than the peel even though the difference was not significant ($P>0.05$). There was significant negative correlation ship($p<0.05$) exist in between Moisture flesh versus carbohydrate flesh and moisture peel versus protein flesh, fat flesh versus protein flesh and significantly positive correlation ship ($p<0.05$) exist among moisture peel versus fat flesh.**

Index terms- Cassava, Proximate composition, Macro nutrients, MU 51 , Cassava peel, Cassava flesh

INTRODUCTION

Tropical peranial plant cassava which can grow on poor depleted soils is one of the most efficient crops in terms of carbohydrate production [1]. The roots of cassava enlarge to form starchy storage roots are the majour source of carbohydrates for approximately 800 million people in developing regions of the tropics [2-4]. Phelloderm(peel), paranchyma(the bulk) and central vascular core are the three distinctive areas of raw cassava root [5].

Cassava is an important economic crop of Sri Lanka having high demand in both local and export markets [6, 7]. The recent records have shown that, the estimated annual production of cassava in year 2014 is 302,767 Metric tons and the area of land under cultivation of cassava is 23,970 Hectares [8].

Although cassava production has increase drastically in last decade still the highest demand is for domestic purpose in raw form [6] and there are no significant studies have been conducted to analyse the proximate compositions of recommended cassava varieties in Sri Lanka.

The purpose of the current study was to analyse the proximate (moisture, ash, total fat, crude fibre, protein and carbohydrate) in the flesh and peel of the Cassava variety "MU-51". Such baseline information will be useful for increasing the food use and the industrial utilization of selected cassava variety.

MATERIALS AND METHODS

Sample collection

Six healthy plants in the same maturity stage of cassava variety "MU-51" was randomly selected from the experimental fields of Horticultural Crop Research and Development Institute (HORDI), Gannoruwa, Sri Lanka. The samples of roots at the age of twelve months from plantation were collected by harvesting without causing any damage to the roots.

Sample preparation

Harvested samples were immediately transported to the laboratory at the Department of Food Science and Technology, University of Sri Jayewardenepura with packing in labelled shallow, rigid, ventilated plastic crates. The samples were then cleaned by dry brushing, packed in to polyethylene bags and stored in refrigerated condition (Temperature 4oC to 0oC) until taken to analysis (Maximum duration 2 weeks).

Proximate composition analysis of samples

The samples stored in refrigerator were taken and the peel was removed carefully from the flesh. The peels were separately collected and upper epidermis of the peel was removed carefully. The rest of the peels and flesh of the tubers were ground using mortar and the pestle to decrease the particle size and taken in to analysis.

The proximate composition (moisture, ash, crude fibre,protein and total fat) of the six samples was determined using AOAC standard methods (1980) with three replicates [9]. The carbohydrate content was calculated by the difference of the entire proximate parameters. (Carbohydrate content= 100 – (moisture% + ash% + protein% + fat% + crude fibre %))

Statistical analysis

The data were subjected to normality test and paired t test at 95% confident level was used to indicate significant difference among proximate compositions of the peel and the flesh. Simple linear correlation coefficients were determined for proximate composition parameters. The relationship between significant proximate composition parameters of the peel and the flesh was predicted using a linear regression model[10].

RESULTS

Table 01; Proximate compositions in the root flesh and the root peel of Cassava variety "MU-51" wet basis

Variable	Flesh	Peel
Moisture	62.25± 0.38^a	70.80± 0.09^b
Ash	1.26± 0.04^a	1.22±0.03^a
Fat	0.29±0.04^a	0.42±0.06^b
Protein	1.13±0.19^a	0.97±0.01^a
Fibre	0.89±0.02^a	1.74±0.03^b
carbohydrate	34.19±0.32^a	24.85±0.12^b

Data are expressed as mean±SD; Means±SD followed by the same letter, within a row, are not significantly different (p>0.05).

As all the observations of proximate analysis in the flesh and the peel were normally distributed (P >0.05) the paired t test was performed. Table 1 shows the proximate compositions of the flesh and the peel of "MU-51" variety.

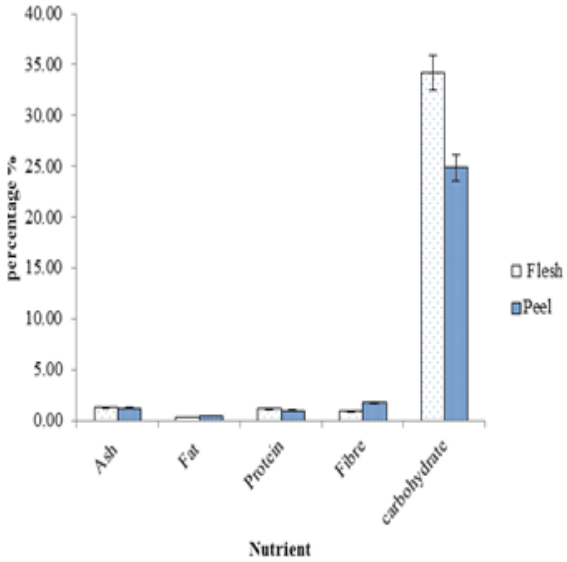

Fig 01; Proximate compositions in the root flesh and the root peel of Cassava variety "Kirikawadi" wet basis

The root peel had significantly high amount (p<0.05) of moisture, fat and fibre content than the flesh.

The root flesh contain high amount of ash and protein than the peel even though the difference was not significant (P>0.05).

Correlation coefficient of the proximate composition of flesh and the peel was illustrated in Table 2.

There was strong negative correlations exist between carbohydrate content of the flesh and moisture content of the root flesh. Fat content of the flesh showed a strong negative correlation with the protein content of the flesh and a strong positive correlation with moisture content of the root peel. A highly significant negative correlation was exist between the protein content of the flesh and the moisture content of the peel.

DISCUSSION

The moisture content of "MU51" cassava variety flesh and peel were 62.25± 0.38% and 70.80±0.09% respectively. The values were compared to the observations of Sri Lankan cassava variety "Kirikawadi" (flesh 61.07-67.44% and peel 71.96-73.3%) [7] and the study of wheatley and cuzel(1993) on four cassava cultivars which was 65 to 74%[11].

	Moisture Flesh	Moisture peel	Ash Flesh	Ash peel	Fat flesh	fat peel	Protein flesh	Protein peel	Fibre flesh	Fibre peel	Carbohydrate flesh	Carbohydrate Peel
Moisture Flesh	1.000											
Moisture peel	0.706	1.000										
Ash Flesh	0.307	0.757	1.000									
Ash peel	-0.662	-0.370	-0.216	1.000								
Fat flesh	0.768	**0.912**	0.691	-0.292	1.000							
fat peel	-0.320	-0.129	-0.515	0.274	-0.329	1.000						
Protein flesh	-0.635	**-0.984**	-0.795	0.396	**-0.894**	0.123	1.000					
Protein peel	0.444	-0.270	-0.656	-0.210	-0.085	-0.027	0.378	1.000				
Fibre flesh	0.055	0.639	0.393	-0.209	0.438	0.286	-0.745	-0.737	1.000			
Fibre peel	0.300	0.178	-0.309	0.232	0.392	0.361	-0.147	0.417	0.005	1.000		
Carbohydrate Flesh	**-0.966**	-0.508	-0.137	0.634	-0.628	0.399	0.420	-0.632	0.197	-0.288	1.000	
Carbohydrate Peel	-0.358	-0.650	-0.139	-0.141	-0.585	-0.549	0.616	0.064	-0.517	-0.698	0.186	1.000

Table 03; Regression analysis of proximate composition contents in cassava peels and flesh

The ash content (04-1.7%), protein content (0.3-3.5%), fat content (0.03-0.5%), fibre content (1.5%) and carbohydrate content (25.3-35.7%) of the cassava flesh described by the study of Mantagnec et

Relationship	Regression equation	R-Sq
Moisture peel(MP) verses fat flesh(FF)	MP=70.21+2.017 FF	83.2%
Moisture peel(MP) verses Protein flesh(PF)	MP= 71.33-0.4714 PF	96.8%
Moisture flesh(MF) verses carbohydrate flesh(CF)	MF=102.3-1.171 CF	93.2%
Fat flesh(FF) verses protein flesh(PF)	FF=0.5113-0.1936 PF	79.8%

al.,(2009) talied with the proximate composition observations of the current study on cassava variety "MU-51"(table 01)[12].

The crude fibre content, fat content and ash contents of MU-51 cassava variety was comparable with the study of Eleazu and Eleazu,. (2012) (crude fibre 1.54-2.72%, fat 0.23-3.06% and Ash 0.92-3.70%) on six new elite yellow and white cassava varieties [13].

According to the results of paired t test ($p<0.05$) there was a significant high amount of moisture, fat and fibre in the peel of cassava "MU-51" variety than in the flesh. Those observations are comparable with the results of Mantagnec et al.,(2009) Somendrika et al., (2017) and Somendrika et al., (2016) [7, 12, 14]. Even though the "Mu-51" cassava variety peel contain low amount of protein in the peel than in the flesh there was no significant difference($p>0.05$) exist between the flesh and peel protein content(figure 01).

According to the regression analysis There was significant negative correlationship($p<0.05$) exist in between Moisture flesh versus carbohydrate flesh and moisture peel versus protein flesh, and in between fat flesh versus protein flesh. There was a significant possitive correlationship ($p<0.05$) exist among moisture peel versus fat flesh(table 02).

CONCLUSION

The root peel had significantly high amount ($p<0.05$) of moisture, fat and fibre content than the flesh. The root flesh contain high amount of ash and protein than the peel even though the difference was not significant ($P>0.05$). There was significant negative correlationship($p<0.05$) exist in between Moisture flesh versus carbohydrate flesh and moisture peel versus protein flesh, fat flesh versus protein flesh and significantly possitive correlationship ($p<0.05$) exist among moisture peel versus fat flesh.

ACKNOWLEDGEMENT

This research was financially supported by the University grant of University of Sri Jayewardenepura, Sri Lanka and it is highly appreciated.

REFERENCES

[1] Wang, L., et al., Efficient production of L-lactic acid from cassava powder by Lactobacillus rhamnosus. Bioresour Technol, 2010. 101(20): p. 7895-901.

[2] Liu, J., et al., Cassava genetic transformation and its application in breeding. J Integr Plant Biol, 2011. 53(7): p. 552-69.
[3] Somendrika, M.A.D., et al., Material flow analysis of Cassava crocket manufacturing process from raw cassava (Mannihotesculenta) roots. INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH IN TECHNOLOGY, 2016. 2(9): p. 32-35.
[4] Rajapaksha, K.D.S.C.N., M.A.D. Somendrika, and I. Wickramasinghe, Nutritional and toxicological composition analysis of selected cassava processed products. Potravinarstvo, 2017. 11(1).
[5] Pérez, J.C., et al., Genetic variability of root peel thickness and its influence in extractable starch from cassava (Manihot esculenta Crantz) roots. Plant Breeding, 2011. 130(6): p. 688-693.
[6] Wijesinghe, W.A.J.P. and K.H. Sarananda, Utilization of Cassava Through Freezing. 2008.
[7] Somendrika, M.A.D., et al., Nutritional composition of cassava cultivar "CARI-555". Pakistan Journal of Nutrition 2017. 16(4): p. 216-220.
[8] Statistics, D.o.C.a., NATIONAL ACCOUNTS OF SRI LANKA 2014. 2015.
[9] AOAC, Official Method of Analysis of the Association of Official Analytical Chemist. Washington DC, USA. 1980.
[10] Mead, R., R. Curnow, and A. Hasted, Statistical methods in agriculturel and Experimental Biology Chapman and Hall. New York, NY, 1983.
[11] Wheatley, C. and G. Chuzel, Cassava: the nature of the tuber and use as a raw material. Encyclopedia of Food Science, Food Technology and Nutrition. Academic Press, San Diego, CA, USA. p, 1993: p. 734-743.
[12] Julie A. Montagnac, C.R.D. and a.S.A. Tanumihardjo, Processing Techniques to Reduce Toxicity and Antinutrients of Cassava for Use as a Staple Food. COMPREHENSIVE REVIEWS IN FOOD SCIENCE AND FOOD SAFETY, 2009. 8: p. 17-27.
[13] Eleazu, C.O. and K.C. Eleazu, Determination of the Proximate composition, total carotenoid, reducing sugars and residual cyanide levels of flours of 6 new yellow and white cassava (Manihot esculenta Crantz) varieties. American Journal of Food Technology, 2012. 7(10): p. 642-649.
[14] Somendrika, M., et al., Analyzing Proximate Composition of Macro Nutrients of Sri Lankan Cassava Variety" Kirikawadi". Pakistan Journal of Nutrition, 2016. 15(3): p. 283.