



NUTRITIONAL COMPOSITION OF TUBER CROPS GROWN IN KONKAN REGION

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Abstract: *The tuber crops grown in Konkan region of Maharashtra State were chemically analyzed for their nutritional composition in terms of moisture, protein, fat, ash, fiber, carbohydrates, energy, calcium, magnesium, micronutrients, starch, sugars and ascorbic acid by standard methods. The amounts of crude protein, crude fat, crude fiber and carbohydrates were high in the varieties Konkan Ashwini of sweet potato, Kelva of colocasia, Trivendrum and Panchanadi of arrow root and Sree Jaya and H-119 of cassava, respectively compared to the other varieties of tuber crops. H-119 variety of cassava was found to contain high amounts of calcium while Sree Jaya of cassava had maximum amounts of magnesium. The variety Vengurla of elephant foot yam revealed higher amounts of both iron and manganese. Both the varieties of colocasia viz. Kelva and Sree Pallavi were found to be rich in micronutrients. Cassava revealed to be a good source of starch.*

Key words: *Konkan, tubers, varieties, nutritional composition.*

Introduction

Tubers are modified plant structures that are enlarged to store nutrients. They are used by plants to survive the winter or dry months, to provide energy and nutrients for regrowth during the next growing season. Tuber crops are chief source of energy and fulfill the starch requirement in the absence of food grains. The varieties with better tuber quality, cooking quality and higher yield fetch higher price to the farmers, while the varieties with greater nutritive value enrich the diet and support better nutrition. The most striking aspect of tubers is that they supply cheap source of food and energy to the weaker sections of the society. Of the 50,000 edible plants grown in the world, only 15 comprising of these valuable tubers provide 90 per cent of the total world's food energy intake (Dutt, 2013). Tubers are also rich in several other nutrients including vitamins and minerals but deficient in fats.

The nutritional composition of the tubers is observed to be significantly affected by the genotypes and to a certain extent by the cultural practices, location, soil type and weather conditions. Hence, a study was undertaken with an objective to

evaluate the nutritional composition of the tuber crop varieties released by this university, for cultivation in Konkan region.

Material and Methods

The Central Experiment Station of Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth is located at Wakawali which is at a distance of 18 kms. towards East of Dapoli on Dapoli-Khed road. The eighteen varieties of nine tuber crops viz. Konkan Ashwini and Kamal Sundari of sweet potato, KKV-DB-1 and KKV-DB-11 of aerial yam, Konkan Kanchan and Sree Lata of lesser yam, Konkan Ghorkand and Sree Kartika of greater yam, Kelva and Sree Pallavi of colocasia, Sree Jaya and H-119 of cassava, Gajendra and Vengurla of elephant foot yam, Trivendrum and Panchanadi of arrow root, Konkan Haritparni and KKV-Xa-2 of xanthosoma grown during the *Kharif* season of the year 2013 were selected for the study. The tubers were washed under running tap water, rinsed with distilled water, cut into pieces, dried at 105⁰C. The oven dried samples were used for analysis of their nutritional composition by standard methods (AOAC, 1990) in the Department of Soil Science and Agril. Chemistry, Dr. Balasaheb

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Result and Discussion

The data regarding the proximate composition of the eighteen varieties of nine tuber crops is presented in Table 1. The moisture content of the eighteen varieties of nine tuber crops under study ranged from 57.55 (Sree Jaya) to 80.89 (Vengurla) per cent, with an average value of 69.06 per cent. Moisture is an important parameter for the storage of tubers. Low levels are more favorable and render relatively longer shelf life. The crude protein content of the eighteen varieties showed considerable variation. It ranged from 1.14 g per 100g (Konkan Kanchan of lesser yam) to 3.23 g per 100g (Konkan Ashwini of sweet potato) with an average value of 2.08 g per 100 g on dry weight basis, respectively. The variety Kelva of colocasia was found to have higher fat content (1.03 g/100g) compared to all other varieties while the variety KKV-DB-11 of aerial yam had lower fat content (0.18 g/100g). The values obtained for crude fat agree with the values reported by Lenka and Ndabikunze (2011) who found that elephant foot yam and colocasia contained 0.24 to 0.48 and 0.78 to 1.20 per cent crude fat, respectively. From the data, the crude fiber content in the varieties of tubers was found to range from 0.93 to 2.48 mg per 100g with a mean value of 1.38 mg per 100g. The values agree

with Jadhav (2001) who has reported that the sweet potato, aerial yam, lesser yam, greater yam, colocasia and cassava contained 0.99 to 1.14, 0.94 to 1.82, 1.48, 0.98 to 1.54, 0.96 to 2.98 and 0.78 to 1.12 g per 100g crude fiber, respectively. Ndabikunze *et al.* (2011) found the lesser yam and xanthosoma tubers contained 1.34 and 1.96 g per 100g crude fiber, respectively. Hsu *et al.* (2013) reported that the greater yam contained 1.24 to 1.41 per cent crude fiber. The highest ash content was observed in Kelva (1.67 g/100g) of colocasia while low values for ash were observed in Trivendrum (1.02 g/100g) of arrow root. It is observed from the above table that the tuber crops contained appreciable amount of mineral content. The carbohydrate content in the eighteen varieties of nine tuber crops was observed from 14.06 to 36.85 per cent with an average of 26.12 per cent. The carbohydrate content was found to be least (14.06 g per 100g) in the variety, Vengurla (Elephant foot yam) and high in the varieties, Sree Jaya (36.85 %) and H-119 (36.14 %) of cassava. Ndabikunze *et al.* (2011) found the tubers, lesser yam and xanthosoma contained 23.03 and 20.95 g per 100g carbohydrate on dry weight basis, respectively. Oluwole *et al.* (2004) reported that cassava tuber contained 32 to 35 per cent carbohydrate. The energy content represents the physiological fuel value.

Table 1: Proximate composition of tuber crops (per 100 g)

No	Tuber Crop/ Variety	Moisture (%)	Crude Protein g	Crude Fat g	Crude Fiber g	Ash g	Carbohydrates g	Energy Kcal
A)	Sweet Potato							
1.	K. Ashwini	68.17	3.23	0.67	0.93	1.25	25.75	121.95
2.	Kamal Sundari	67.73	2.70	0.73	1.07	1.38	26.39	122.93
B)	Aerial Yam							
1.	KKV-DB-1	75.13	1.46	0.38	1.17	1.46	20.4	90.86
2.	KKV-DB-11	69.77	2.20	0.18	1.08	1.23	25.54	112.58
C)	Lesser yam							
1.	Konkan Kanchan	70.49	1.14	0.48	1.29	1.38	25.22	109.76
2.	Sree Lata	69.30	1.75	0.36	1.43	1.15	26.01	114.28
D)	Greater Yam							
1.	K.Ghorkand	67.66	3.03	0.55	1.42	1.62	25.72	119.95
2.	Sree Kartika	68.05	2.33	0.29	1.39	1.08	26.86	119.37
E)	Colocasia							
1.	Kelva	70.08	2.86	1.03	1.03	1.67	32.24	149.67

2.	Sree Pallavi	68.42	2.37	0.91	1.44	1.25	25.61	120.11
F)	Cassava							
1.	Sree Jaya	57.55	2.23	0.53	1.58	1.26	36.85	161.09
2.	H-119	58.59	2.47	0.33	1.39	1.08	36.14	157.41
G)	Elephant Foot Yam							
1.	Gajendra	75.05	1.47	0.39	1.06	1.63	20.4	90.99
2.	Vengurla	80.89	2.07	0.32	1.18	1.48	14.06	67.40
H)	Arrow Root							
1.	Panchanadi	66.85	1.40	0.68	2.48	1.12	27.47	121.60
2.	Trivendrum	68.86	1.25	0.92	2.43	1.02	25.52	115.36
I)	Xanthosoma							
1	Konkan Haritparni	71.34	2.27	0.41	1.24	1.52	23.22	105.65
2.	KKV-Xa-2	69.19	1.28	0.33	1.27	1.07	26.86	115.53
	Mean	69.06	2.08	0.52	1.38	1.31	26.12	117.58

It was found from Table 2 that Ca content varied between 13.99 and 49.44 mg per 100 g with a mean value of 30.51 mg per 100 g in the eighteen varieties of nine tuber crops under study. The variety Sree Jaya (49.44 mg/100g) of cassava recorded highest calcium content. The variety Panchanadi (13.99 mg/100g) of arrow root recorded the lowest calcium content. The magnesium content of the

varieties analysed is given in Table 2. It was observed that the magnesium content of eighteen varieties of nine tuber crops ranged from 15.23 to 63.62 mg per 100g with a mean value of 31.16 mg per 100 g. The maximum content of magnesium was seen in Sree Jaya (63.62 mg/100g) of cassava while the lowest magnesium content was recorded in Trivendrum (15.23 mg/100g) of arrow root.

Table 2: Secondary nutrient content of tuber crops

No.	Tuber Crop/Variety	Calcium (mg/100g)	Magnesium (mg/100g)
A)	Sweet Potato		
1.	Konkan Ashwini	42.70	37.2
2.	Kamal Sundari	40.63	36.00
B)	Aerial Yam		
1.	KKV-DB-1	19.36	29.2
2.	KKV-DB-11	18.70	22.4
C)	Lesser yam		
1.	Konkan Kanchan	32.33	24.13
2.	Sree Lata	29.22	22.94
D)	Greater Yam		
1.	Konkan Ghorkand	14.21	24.8
2.	Sree Kartika	16.88	23.2
E)	Colocasia		
1.	Kelva	37.77	22.4
2.	Sree Pallavi	39.77	31.6
F)	Cassava		
1.	Sree Jaya	49.44	63.62
2.	H-119	47.59	59.21
G)	Elephant Foot Yam		
1.	Gajendra	46.22	38.41
2.	Vengurla	44.83	36.00
H)	Arrow Root		
1.	Panchanadi	13.99	22.88
2.	Trivendrum	14.10	15.23
I)	Xanthosoma		
1.	Konkan Haritparni	21.55	26.19
2.	KKV-Xa-2	20.00	25.63
	Mean	30.51	31.16

Table 3 revealed that the iron content in various varieties of tubers It varied from 0.49 to 1.98 mg per 100 g on dry weight basis with a mean value

of 1.17 mg per 100g. The highest iron content was observed in Vengurla (1.98 mg/100g) of elephant foot yam KKV-DB-1 (0.66 mg/100g) of aerial yam

had lower iron content. The lowest manganese content was observed in RM-1 (0.15 mg/100g) of yam bean. Bhandari *et al.* (2003) evaluated four yam species and found that the tubers contained 0.14 to 0.35 mg manganese per 100g on dry weight basis. Ndabikunze *et al.* (2011) reported that lesser yam and xanthosoma tubers contained 3.68 and 1.95 mg manganese per 100g on dry weight basis, respectively. The results are in agreement with that of Bhandari *et al.* (2003) who found that the yam tubers contained 0.22 to 0.53 mg zinc per 100g on dry

weight basis. The copper content in the different varieties of the nine tuber crops varied from 0.18 to 0.92 mg with a mean value of 0.50 mg per 100 g. The variety Vengurla (0.92 mg/100g) of elephant foot yam recorded the highest amount of copper while Kelva (0.18 mg/100 g) of colocasia was lower value. The results are on par with those reported by Ndabikunze *et al.* (2011) for lesser yam (0.19 mg /100g) and xanthosoma (0.63 mg /100g) on dry weight basis.

Table 3: Micronutrient status of tuber crops

Sr. No.	Variety/Crop	Iron (Fe)	Manganese (Mn)	Zinc (Zn)	Copper (Cu)
		mg /100g			
A)	Sweet Potato				
1.	Konkan Ashwini	0.83	0.47	0.52	0.74
2.	Kamal Sundari	0.96	0.42	0.68	0.87
B)	Aerial Yam				
1.	KKV-DB-1	0.66	0.18	0.34	0.21
2.	KKV-DB-11	0.87	0.22	0.42	0.28
C)	Lesser yam				
1.	Konkan Kanchan	0.79	0.30	0.38	0.19
2.	Sree Lata	0.86	0.39	0.49	0.23
D)	Greater Yam				
1.	K.Ghorkand	0.71	0.47	0.38	0.58
2.	Sree Kartika	0.98	0.36	0.37	0.59
E)	Colocasia				
1.	Kelva	1.57	0.38	2.45	0.18
2.	Sree Pallavi	1.93	0.58	2.43	0.22
F)	Cassava				
1.	Sree Jaya	0.84	0.36	0.49	0.23
2.	H-119	0.81	0.40	0.46	0.37
G)	Elephant Foot Yam				
1.	Gajendra	1.56	0.57	1.38	0.83
2.	Vengurla	1.98	0.65	1.96	0.92
H)	Arrow Root				
1.	Panchanadi	1.22	0.48	0.65	0.73
2.	Trivendrum	1.49	0.46	0.71	0.85
I)	Xanthosoma				
1.	Konkan Haritparni	1.87	0.45	1.18	0.49
2.	KKV-Xa-2	1.15	0.54	0.92	0.58
	Mean	1.17	0.42	0.90	0.50

The Carbohydrate profile of the eighteen varieties of nine tuber crops is presented in Table 4. The highest starch content was observed in Sree Jaya (29.45 %) of cassava. The lowest starch content was observed in Gajendra (11.87 %) of elephant foot yam. The reducing sugar content of eighteen varieties of nine tuber crops varied between 0.12 and 2.83 per cent with a mean value of 0.78 per cent. The maximum amount of reducing sugar was present in Sree Jaya (2.83 %) of cassava while lowest in 0.12 per

cent in Sree Lata of lesser yam. No reducing sugar was found in arrow root tubers. The non-reducing sugar content in the eighteen varieties of tubers under study ranged from 0.65 to 21.15 with a mean value of 4.26 per cent. The sweetness is mainly due to sucrose, the only non-reducing sugar, which is an important factor contributing to taste and flavor. The total sugar content in H-119 of cassava was highest i.e. 23.93 per cent on fresh weight basis, than all the other varieties . Anon *et al.* (2011) studied the Ivorian

taro (*Colocasia esculenta* cv. yatan) and reported that the colocasia tubers had 5.84 per cent total sugar, on dry weight basis. These results are on par with the present study. Shedge *et al.*, (2011) found that the total sugar

was in the range of 5.60 (IB 90-11-1) to 6.42 per cent (IB 700) with a mean value of 6.06 per cent in sweet potato, while in the present study, the figures for sweet potato are in the range of 9.46 to 10.25 per cent.

Table 4: Carbohydrate profile of tuber crops (%)

No.	Crop / Variety	Starch	Reducing Sugar	Non-Reducing Sugar	Total Sugar
A)	Sweet Potato				
1.	K. Ashwini	16.82	1.76	8.06	10.25
2.	Kamal Sundari	19.13	1.71	7.36	9.46
B)	Aerial Yam				
1.	KKV-DB-1	17.92	0.27	0.68	0.99
2.	KKV-DB-11	19.68	0.29	0.65	0.98
C)	Lesser yam				
1.	Konkan Kanchan	21.23	0.26	0.72	1.02
2.	Sree Lata	22.84	0.12	0.81	0.98
D)	Greater Yam				
1.	K.Ghorkand	22.13	0.48	3.00	3.64
2.	Sree Kartika	19.89	0.46	2.29	2.88
E)	Colocasia				
1.	Kelva	12.63	0.57	3.69	4.46
2.	Sree Pallavi	13.94	0.56	3.37	4.11
F)	Cassava				
1.	Sree Jaya	29.45	2.83	17.04	20.77
2.	H-119	27.13	1.66	21.15	23.93
G)	Elephant Foot Yam				
1.	Gajendra	11.87	0.33	0.90	1.28
2.	Vengurla	12.93	0.27	0.67	0.98
H)	Arrow Root				
1.	Panchanadi	18.12	-	2.03	2.14
2.	Trivendrum	16.69	-	2.20	2.32
I)	Xanthosoma				
1.	Konkan Haritparni	15.64	0.28	1.18	1.53
2.	KKV-Xa-2	17.21	0.67	1.03	1.75
	Mean	18.62	0.78	4.26	5.19

The ascorbic acid content of the eighteen varieties of nine tuber crops under the study is presented in Table 5. The ascorbic acid content ranged from 2.33 to 25.66 mg per 100g with a mean value of 11.44 mg per 100 g, on fresh weight basis. The variety H-119 (25.66 mg/100g) of cassava recorded highest ascorbic acid content while the variety, Trivendrum (2.33 mg/100g) recorded the lowest ascorbic acid

content among all the tubers. The values observed in the present study agreed with the values reported by Jadhav (2001) who have reported that the sweet potato, aerial yam, lesser yam, greater yam, colocasia and cassava contained 23.81 to 24.40, 9.23 to 13.98, 7.61, 4.85 to 7.42, 3.91 to 6.64 and 30.46 to 33.63 mg ascorbic acid per 100g of edible portion, respectively.

Table 5: Ascorbic acid content of tuber crops

No.	Variety/Crop	Ascorbic acid (mg/100g)
A)	Sweet Potato	
1.	Konkan Ashwini	21.53
2.	Kamal Sundari	25.33
B)	Aerial Yam	
1.	KKV-DB-1	10.1
2.	KKV-DB-11	16.4
C)	Lesser yam	
1.	Konkan Kanchan	4.20
2.	Sree Lata	6.24

D)	Greater Yam	
1.	Konkan Ghorkand	4.48
2.	Sree Kartika	6.24
E)	Colocasia	
1.	Kelva	4.53
2.	Sree Pallavi	3.38
F)	Cassava	
1.	Sree Jaya	24.50
2.	H-119	25.66
G)	Elephant Foot Yam	
1.	Gajendra	16.84
2.	Vengurla	23.33
H)	Arrow Root	
1.	Panchanadi	2.45
2.	Trivendrum	2.33
I)	Xanthosoma	
1.	Konkan Haritparni	4.88
2.	KKV-Xa-2	3.61
	Mean	11.44

Conclusions:

The eighteen varieties of nine tuber crops viz. Konkan Ashwini and Kamal Sundari of sweet potato, KKV-DB-1 and KKV-DB-11 of aerial yam, Konkan Kanchan and Sree Lata of lesser yam, Konkan Ghorkand and Sree Kartika of greater yam, Kelva and Sree Pallavi of colocasia, Sree Jaya and H-119 of cassava, Gajendra and Vengurla of elephant foot yam, Trivendrum and Panchanadi of arrow root, Konkan Haritparni and KKV-Xa-2 of xanthosoma grown during the *Kharif* season of the year 2013, showed varying nutrient composition. Konkan Ashwini of

sweet potato, Kelva of colocasia, Trivendrum and Panchanadi of arrow root and Sree Jaya and H-119 of cassava were found to contain high amounts of crude protein, crude fat, crude fiber and carbohydrates, respectively. H-119 and Sree Jaya variety of cassava contained high amounts of calcium and magnesium, respectively. The varieties, Vengurla of elephant foot yam and Sree Pallavi of colocasia were found to be both good sources of iron and manganese. Both the varieties of colocasia viz. Kelva and Sree Pallavi were found to be good sources of micronutrients. Cassava revealed to be a good source of Starch.

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