

**ICAR AD-HOC SCHEME ON  
NUTRIENT AND ANTINUTRIENT  
COMPOSITION OF ETHNIC PLANT FOODS  
CONSUMED BY THE TRIBES OF KERALA**

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**FINAL REPORT**

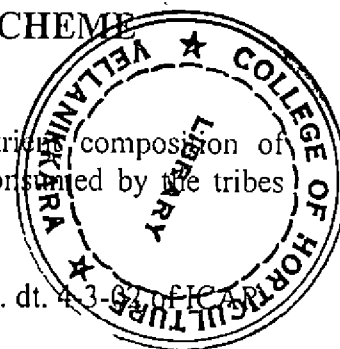
3-5-2002 to 2-5-2005



**DEPARTMENT OF HOME SCIENCE  
COLLEGE OF HORTICULTURE  
VELLANIKKARA  
THRISSUR-680 656**

## FINAL REPORT OF THE RESEARCH SCHEME

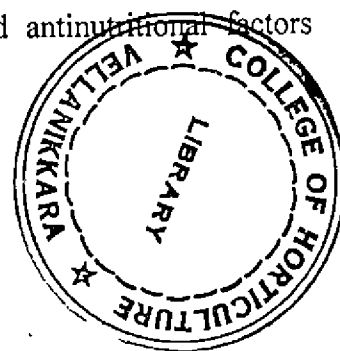
1. Project Title : Nutrient and antinutrient composition of ethnic plant foods consumed by the tribes of Kerala
2. Sanction order : No.13(19)/2000-H.Sc. dt. 4-3-2000
3. Date of start : 3-5-2002
4. Date of termination : 2-5-2005
5. Institution's name : College of Horticulture  
Kerala Agricultural University  
Place : Vellanikkara  
District : Thrissur  
State : Kerala  
  
Department/Division name : Home Science  
Actual location : College of Horticulture
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8. Objectives

- i) To study the dietary habits and food consumption pattern of the tribal families of Kerala.
- ii) To study the nutrient composition and antinutritional factors present in the ethnic plant foods consumed by the tribes of Kerala
- iii) To study the effect of cooking on the nutritional and antinutritional factors present in the ethnic foods

9. Duration of the scheme : Three years
10. Total cost of the scheme : Rs.18,56,040
- Contingencies : Rs. 3,60,000
- Pay of Research Associates : Rs. 7,19,800
- Pay of helper : Rs. 90,000



Name of post	Pay scale	No. of post	Total (Rs.)
Research Associate*	Rs.11500 + 540(HRA)	2	7,19,800
Helper	Rs.100 per day for 25 days in a month	1	90,000
Others	-	-	-
Total			8,09,800

\* - Amount sanctioned as per order No.13(19)2000-H.Sc. : Rs.6,62,400  
dt. 23-1-03 of ADG (H.Sc.)

Additional grant sanctioned as per order No: 13(19)  
2000-EPD dt.26-4-04 :Rs. 57,400

Total : Rs.7,19,800

**Details of Expenditure**

Year	Pay of officers	Pay of Estt. (Rs.)	Contingencies including TA (Rs.)	Total (Rs.)
2002-03	-	1,37,091	1,11,652	2,48,743
2003-04	-	2,33,975	1,16,064	3,50,039
2004-05	-	3,33,045	92,760	4,25,805
Grand total	-	7,04,111	3,20,476	10,24,587

Year	Recurring (including TA) (Rs.)	Non Recurring contingencies (Rs.)	10% institutional charge (Rs.)	Total (Rs.)
2002-03	2,48,743	5,72,624	24,874	8,46,241
2003-04	3,50,039	NIL	35,004	3,85,043
2004-05	4,25,805	NIL	42,581	4,68,386
Grand total	10,24,587	5,72,624	1,02,459	16,99,670

11. Total amount sanctioned : Rs.18,56,040

Total : Rs.17,44,800

10% Institutional charge : Rs.1,11,240

Grand total : Rs.18,56,040

12. Total amount spent : Rs.16,99,670

13. Results of practical / scientific value

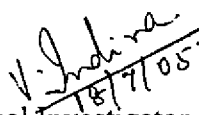
- 1) Most of the tribal families of Idukki, Palakkad and Wayanad districts were non-vegetarians.
- 2) The staple food of majority of tribal families was rice. They supplemented rice with millets and roots and tubers.
- 3) The diet was found to be monotonous and majority of the families followed two meals a day pattern.
- 4) All families used ordinary storage methods for storing foods and very few families preserved foods during their availability.
- 5) Special foods were not included in the diet of children, adolescents and elderly. However, few families made slight modification in the diet of pregnant and lactating women.
- 6) Most of the tribal families collected food items from forest during their availability and included in their diet.
- 7) Most of the leafy vegetables collected from tribal areas were rich in different micronutrients
- 8) Vegetables and roots and tubers were also found to contain various nutrients

- 9) Oxalate and nitrate contents were found to be low in leafy vegetables
- 10) Significant variation in most of the constituents was noticed in the foods both in the raw and cooked stages and between the raw and cooked stages
- 11) Wide diversity in the constituents was also observed for various foods collected from Idukki, Palakkad and Wayanad districts

14. Papers published : Nil

Signature:

Name : Dr.V.Indira  
Designation: Associate Professor

  
Principal Investigator  
18/7/05

Director of Research  
KAU

15. Comments of the Project Co-ordinator:

16. Remarks of the Council:

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## INTRODUCTION

Forests are precious endowment of nature to mankind bountifully bearing omnifarious resources of sustenance of humans, besides ensuring ecological security. Forests are the original habitat of tribal groups in India which are the repository of nutritious food that grow wild and are neither cultivated nor marketed. Tribals living as a part of nature exploited nature to meet their food demands and depended on these natural flora especially during the lean months. The problem of providing adequate nutrition is very important in the tribal areas as their dietary standards are low and the diet hardly provides the essential nutrients in correct proportion.

✓ Food based strategies to combat malnutrition prevalent among the population involves special consideration of identifying optimal food sources of nutrients and ensuring their availability. Though, the tribal communities of Kerala consume different plant and animal foods collected from the forest areas, no attempt has been made on the evaluation of quality attributes of these foods. To promote the conservation of food stuffs consumed by the tribal communities and to bring them under cultivation for their sustainable utilization the present investigation was carried out with the following objectives:

1. To study the food consumption pattern and dietary habits of the tribal communities.
2. To study the nutrient and antinutrient constituents present in the ethnic plant foods consumed by the tribal communities.
3. To study the effect of cooking on the constituents present in the ethnic foods.

## REVIEW OF LITERATURE

Investigations conducted among the Kurumbas (Mathur, 1977), Kadar (Chakrabarti, 1979), Uralies (Kattakayam, 1983) and tribes of Pottumavu hills (Prema, 1983) of Kerala indicated that they supplemented their staple food item with millets, roots and tubers, creepers, wild flesh of deer, jungle sheep and goat. Bhuinyas of Orissa (Ali, 1983), Savaras of Andhra Pradesh (Rao and Satyanarayana, 1987) and Maaring's and Thangkuls of Manipur (Rao *et al.*, 1991) also consumed edible roots, tubers, flowers, vegetables, mushrooms, fruits, tender shoots of bamboo, yam and wild orchids and tomatoes collected from the forest especially during the lean months. The dietary habits of Irula tribal community of Attappady hills of Kerala was assessed by Indira (1993) and indicated that their diet had no variety and the food and nutrient intake of children between the age group of 5 to 15 years were lower than the Recommended Dietary Allowances.

Rao (1996) conducted studies among the tribal groups spread over nine States and Union Territories and indicated that the tribals consumed wild roots and tubers, fruits, green leafy vegetables as well as meat of snakes, rats and birds collected from forest.

Food consumption pattern and dietary intake of Sugalis, the largest tribal population of Andhra Pradesh conducted by Reddy and Rao (2000) indicated gross inadequacy in the consumption of different food groups among the population. The intake of nutrients especially energy and proteins was also found to be lower than the Recommended Dietary Allowances.

Rajayalakshmi and Geervani (1987) evaluated the nutrient composition of foods consumed by the tribals of Vizianagaram District of Andhra Pradesh and reported a protein content of 6.8 to 11 per cent in cereals/millets. The authors also reported higher mineral content in these cereals/millets than the local varieties.

Leafy vegetables consumed by the Naga tribes of Nagaland and Manipur were found to be rich in proteins, calcium, magnesium, iron and zinc (NIN, 1988). The



study also indicated 29 per cent proteins and 33.5 per cent fat in the seeds of *Parkia roxburghi*, a legume consumed by these tribes. The unconventional plant foods consumed by Khasis of Meghalaya were found to be rich in energy and other nutrients (Easwaran and Goswani, 1989).

Chandrasekhar *et al.* (1990) reported 1.7 to 3.9 g proteins, 50-70 mg calcium, 99-175 mg vitamin C and 0.9 to 3.9 g of fibre per 100 g of leafy vegetables used in the weaning foods of the tribal groups of Attappady and Katchuvadi hills. The nutritive value of grains and tubers consumed by the Kota and Kadar tribes of Nilgiri and Anamalai hills were found to be rich in energy, iron and calcium (Chandrasekhar and Chitra, 1990).

Unconventional plant foods like greens, roots and tubers and bamboo seeds consumed by the Paliyar tribes of Tamil Nadu were found to be nutritionally recommendable by their mineral contents (Murugesan and Ananthalakshmi, 1991). Mohan and Janardhanan (1995) evaluated the nutritional and antinutritional constituents of wild under exploited tribal pulses and found that they are rich in proteins (16.1 to 22.8%), fat (8.8 to 12.7%) and carbohydrates (55.1 to 65.8%). Potassium was found to be the predominant mineral in these pulses and antinutritional factors like total free phenols, tannins and L-DOPA were also found in the pulses.

The unconventional leafy vegetables found in the forest and cultivable waste lands of Konkan region were found to be high in proteins, fat and carbohydrates (Shingade *et al.*, 1995).

Siddhuraju *et al.* (1995) analysed the nutrient and antinutrient composition of two under exploited pulses namely *Tamarindus indica* and *Cassia laevigata* and indicated that the seeds contained 13 and 20.8 per cent proteins, 5.3 and 7.1 per cent fat, 58.6 and 61.7 per cent carbohydrates respectively. Cassia was found to be rich in calcium, iron and zinc while *Tamarindus* was rich in potassium.

Siddhuraju and Becker (2001) studied the effect of various domestic processing methods on the antinutritional factors of white and black varieties of

*Mucuna pruriens* var. utilis, a tribal pulse and indicated that cooking or autoclaving of raw and presoaked seeds in water, tamarind extract, sodium bicarbonate and citric acid solutions significantly reduced the antinutritional factors compared to soaking or dry heat techniques.

The wild green leafy vegetables consumed by the tribes of North East India (Longvah, 2000) and Ladakh (Chaurasia *et al.*, 2000) were found to be nutritious as the cultivated leafy vegetables. Bharathi and Umamaheshwari (2001) revealed that the non-traditional leafy vegetables of Nellore and Prakasam Districts of Andhra Pradesh were good source of proteins, crude fibre,  $\beta$ -carotene and ascorbic acid and has lower fat content and a moderate amounts of oxalic acid. Sheela *et al.* (2002) evaluated various under utilized greens for various nutrients and found to contain iron (3.68 - 37.34 mg 100 g<sup>-1</sup>), calcium (73 - 400 mg 100 g<sup>-1</sup>) and vitamin C (55 - 175 mg 100 g<sup>-1</sup>). Muriugkar and Subhulakshmi (2003) evaluated 27 wild edible green leaves consumed by Khasi tribes of Meghalaya and were found to be rich in various nutrients.

Hyder (2004) evaluated ten green leafy vegetables consumed by the tribes of Wayanad district and indicated that they are rich in various micronutrients. Among the leaves analysed Valiyakadaladi was found to be the best with respect to higher nutrients and lower antinutritional factors.

## METHODOLOGY

### 1. Selection of the tribal communities to conduct the dietary survey

Among the fourteen districts of Kerala, three districts with the highest tribal population namely Idukki, Palakkad and Wayanad were selected for the study representing Southern, Central and Northern regions of the state respectively.

From the different tribal communities of these three districts, 14 tribal communities were identified for conducting the dietary survey. The major tribal communities selected to conduct the dietary survey included Hill Pulaya, Malayarayar, Mannan, Muthuvan, Palliyan and Urali of Idukki district, Irular, Kurumba and Muduga groups of Palakkad district and Adiyan, Kattunayakan, Kuruchchan, Kuruman, Paniyan and Urali groups of Wayanad district. A total number of 330 families were selected to conduct the dietary survey and the details of tribal communities and the number of families selected from each community from the three districts are given in Table 1. The families were selected from each community depending on the total families in each group and on the heterogeneity and homogeneity in the dietary practices in each group.

Table 1. Distribution of families selected for the dietary survey

Sl. No.	Tribal communities	Districts			Grand total
		Idukki	Palakkad	Wayanad	
1	Adiyan	-	-	5	5
2	Hill Pulaya	19	-	-	19
3	Irular	-	54	-	54
4	Kattunayakan	-	-	20	20
5	Kuruchchan	-	-	20	20
6	Kuruman	-	-	15	15
7	Kurumba	-	13	-	13
8	Malayarayar	23	-	-	23
9	Mannan	36	-	-	36
10	Muduga	-	13	-	13
11	Muthuvan	15	-	-	15
12	Palliyan	31	-	-	31
13	Paniyan	-	-	27	27
14	Urali	31	-	8	39
	Total	155	80	95	330

## **2. Dietary habits and food consumption pattern of the tribal families**

Dietary habits and food consumption pattern of the selected tribal families were conducted using a structured and pretested questionnaire with particular reference to the type of foods consumed, details on staple foods, details on the ethnic foods used, cooking devices, meal pattern, storage and preservation practices, foods included and avoided during special conditions and diseased conditions.

## **3. Collection and identification of ethnic food stuffs**

Ethnic plant foods consumed by the tribes of three districts were collected from the tribal areas with the help of tribal people residing in the respective regions. Most of these foods were identified with the help of a taxonomist.

## **4. Analysis of chemical constituents in the collected foods**

The food stuffs collected from the three districts were analysed for the following constituents using standard procedure as detailed below.

1. Moisture (AOAC, 1980)
2. Fat (AOAC, 1955)
3. Protein (AOAC, 1980)
4. Crude fibre (Chopra and Kanwar, 1978)
5. Starch (Sadasivam and Manickam, 1992)
6. Free amino acid (Sadasivam and Manickam, 1992)
7. Vitamin C (Sadasivam and Manickam, 1992)
8. Beta carotene (AOAC, 1970)
9. Calcium (Hesse, 1971)
10. Phosphorus (Jackson, 1973)
11. Iron (Raghuramulu *et al.*, 2003)
12. Sodium (Jackson, 1973)
13. Potassium (Jackson, 1973)
14. Magnesium (Hesse, 1971)
15. Copper (Perkin-Elmer, 1982)

16. Manganese (Perkin-Elmer, 1982)
17. Zinc (Perkin-Elmer, 1982)
18. Energy( Bomb Calorimeter)
19. Oxalate (Marderosian *et al.*, 1979)
20. Nitrate (Bharghava and Raghupati, 1993)
21. Tannin (Sadasivam and Manickam, 1992)

The food stuffs were analysed for the above constituents after cooking to find out the effect of cooking on the constituents. All the analysis were carried out in triplicate samples.

## RESULTS

### 1. Dietary habits and food consumption pattern of the tribal families

From the dietary survey it was found that all the tribal families of Wayanad district and majority of the families of Idukki and Palakkad districts consumed rice as their staple food item. Only 43.48 per cent of Malayarayar and 3.23 per cent of Urali families of Idukki district and 7.69 per cent of Kurumba families of Palakkad district consumed ragi or other millets as their staple food items.

Regarding the consumption of staple food items, it was seen that nearly 66 per cent of the families of Wayanad district consumed the staple food throughout the year. In Idukki and Palakkad districts this was found to be only 39.35 per cent and 10 per cent respectively. During lean months the staple food was substituted by other cereals, millets, roots and tubers and dried tapioca. Among the different tribal communities surveyed in three districts, all the Kuruman families of Wayanad district opined that they consumed the staple food item throughout the year. The details on the consumption of staple food items by the different tribal communities are furnished in Table 2.

From the dietary survey it was found that all families belonging to different tribal communities of three districts except one Irula family of Palakkad and two Urali families of Wayanad district were non-vegetarians. It was also seen that due to religious beliefs all the tribal communities avoided pork and beef in their diet. However, they included rabbit, deer, rat, yak and birds which they used to collect from the forest.

The details of the families who collected birds and animals from the forest areas are furnished in Table 3. Most of the families in the three districts did not go for hunting though it was a common practice among their forefathers. In Idukki district the per centage of families who used to hunt birds and animals were found to be only 0.65 per cent and 22.06 per cent respectively. In Palakkad and Wayanad districts this was 3.75 and 14.74 per cent (hunting birds) and 10 and 24.21 per cent (hunting animals) respectively. It was also observed that only male members of the families went occasionally for hunting and used to catch rabbit, deer and birds. Nearly 38.06

**Table 2. Details on the consumption of staple food items by the tribal communities**

<b>Tribal community</b>	<b>Consumed throughout the year</b>	<b>Substituted with other food items</b>	<b>Total</b>
<b>IDUKKI</b>			
Hill Pulaya	-	19 (100)	19 (100)
Malayarayar	20 (86.96)	3 (13.04)	23 (100)
Mannan	17 (47.22)	19 (52.78)	36 (100)
Muthuvan	-	15 (100)	15 (100)
Palliyar	6 (19.35)	25 (80.65)	31 (100)
Urali	18 (58.06)	13 (41.94)	31 (100)
<b>Total</b>	<b>61 (39.35)</b>	<b>94 (60.65)</b>	<b>155 (100)</b>
<b>PALAKKAD</b>			
Irular	4 (7.41)	50 (92.59)	54 (100)
Kurumba	2 (15.38)	11 (84.62)	13 (100)
Muduga	2 (14.38)	11 (84.62)	13 (100)
<b>Total</b>	<b>8 (10)</b>	<b>72 (90)</b>	<b>80 (100)</b>
<b>WAYANAD</b>			
Adiyan	1 (20)	4 (80)	5 (100)
Kattunayakan	4 (20)	16 (80)	20 (100)
Kurichchan	19 (95)	1 (5)	20 (100)
Kuruman	15 (100)	-	15 (100)
Paniyan	18 (66.67)	9 (33.33)	27 (100)
Urali	6 (75)	2 (25)	8 (100)
<b>Total</b>	<b>63 (66.32)</b>	<b>32 (33.68)</b>	<b>95 (100)</b>

Table 3. Details of tribal families who collected bird / animals

Tribal community	Hunt birds			Hunt animals			Catch fish		
	Yes	No	Total	Yes	No	Total	Yes	No	Total
<b>IDUKKI</b>									
Hill Pulaya	-	19	19	7	12	19	7	12	19
		(100)	(100)	(36.84)	(63.16)	(100)	(36.84)	(63.16)	(100)
Malayarayar	-	23	23	1	22	23	-	23	23
		(100)	(100)	(4.35)	(95.65)	(100)		(100)	(100)
Mannan	-	36	36	7	29	36	20	16	36
		(100)	(100)	(19.44)	(80.56)	(100)	(55.56)	(44.44)	(100)
Muthuvan	-	15	15	4	11	15	6	9	15
		(100)	(100)	(26.67)	(73.33)	(100)	(40)	(60)	(100)
Palliyan	-	31	31	6	25	31	20	11	31
		(100)	(100)	(19.35)	(80.65)	(100)	(64.52)	(35.48)	(100)
Uruli	1	30	31	3	28	31	6	25	31
	(3.23)	(96.77)	(100)	(9.68)	(90.32)	(100)	(19.35)	(80.65)	(100)
Total	1	154	155	28	127	155	59	96	155
	(0.65)	(99.35)	(100)	(22.06)	(81.94)		(38.06)	(61.94)	(100)
<b>PALAKKAD</b>									
Irular	1	53	54	4	50	54	16	38	54
	(1.85)	(98.15)	(100)	(7.41)	(29.59)	(100)	(29.63)	(70.37)	(100)
Kurumba	2	11	13	2	11	13	4	9	13
	(15.38)	(84.62)	(100)	(15.38)	(84.62)	(100)	(30.77)	(69.23)	(100)
Muduga	-	13	13	2	11	13	3	10	13
		(100)	(100)	(15.38)	(84.62)	(100)	(23.08)	(76.92)	(100)
Total	3	77	80	8	72	80	23	57	80
	(3.75)	(96.25)		(10)	(90)		(28.75)	(71.25)	
<b>WAYANAD</b>									
Adiyan	1	4	5	-	5	5	4	1	5
	(20)	(80)	(100)		(100)	(100)	(80)	(20)	(100)
Kattunayakan	1	19	20	4	16	20	8	12	20
	(5)	(95)	(100)	(20)	(80)	(100)	(40)	(60)	(100)
Kurichchan	2	18	20	6	14	20	10	10	20
	(10)	(90)	(100)	(30)	(70)	(100)	(50)	(50)	(100)
Kuruman	4	11	15	8	7	15	9	6	15
	(26.67)	(73.33)	(100)	(53.33)	(46.67)	(100)	(60)	(40)	(100)
Paniyan	5	22	27	4	23	27	19	8	27
	(12.52)	(81.48)	(100)	(14.81)	(85.19)	(100)	(70.37)	(29.63)	(100)
Uruli	1	7	8	1	7	8	2	6	8
	(12.5)	(87.5)	(100)	(12.5)	(87.5)	(100)	(25)	(75)	(100)
Total	14	81	95	23	72	95	52	43	95
	(14.74)	(85.26)		(24.21)	(75.79)		(54.74)	(45.26)	(100)



per cent, 28.75 per cent and 54.74 per cent of the families of Idukki, Palakkad and Wayanad districts used to catch fishes from the nearby ponds and included in their diet.

None of the tribal families in the three districts did any meal planning in advance and the daily meal pattern had no variety.

Among the total families surveyed in Idukki, Palakkad and Wayanad districts 49.68 per cent, 50 per cent and 50.53 per cent respectively cooked meals twice in a day while 33.55 per cent and 28.42 per cent of the families in Idukki and Wayanad districts respectively cooked meals thrice in a day. However, 50 per cent of the families in Palakkad district cooked meals only once daily. Among the different tribal communities 61.54 per cent of Kurumba families of Palakkad district cooked meals once in day while 87.10 per cent of Uralies of Idukki district used to cook meals three times in a day. In Wayanad district majority of Adiyar (60%), Kattunayakan (70%) and Urali (75%) families cooked meals twice in a day.

Regarding the consumption of food it was found that majority of the Malayarayar (91.3%), Urali (93.55%), Mannan (58.33%) families of Idukki district and Adiyar (80%), Kurichchan (90%) and all the Kuruman families of Wayanad district consumed meals thrice daily. About 69.23 per cent of Kurumba and 61.54 per cent of Muduga families of Palakkad district and majority of Kattunayakan (70%), Paniyan (62.96%) and Urali (75%) families of Wayanad district and Hill Pulaya (68.42%) and Palliyar (83.87%) families of Idukki district consumed meals twice in a day. About 25 per cent Kattunayakan and 12.5 per cent of Urali families of Wayanad district cooked and consumed meals only once in a day. The community-wise details on the frequency of cooking and consumption of meals is given in Table 4.

All the tribal communities of three districts used aluminium and earthen pots for cooking. Along with these, few families used steel and copper vessels for this purpose.

All the tribal families used ordinary storage methods for storing cereals, pulses and other foods.

Table 4. Details on the frequency of cooking and consumption of meals by the tribal communities

Tribal community	Frequency of cooking				Frequency of consumption			
	Number of families							
	Once	Twice	Thrice	Total	Once	Twice	Thrice	Total
<b>IDUKKI</b>								
Hill Pulaya	7 (36.84)	12 (63.16)	-	19 (100)	-	13 (68.42)	6 (31.58)	19 (100)
Malayarayar	3 (13.04)	12 (52.17)	8 (34.78)	23 (100)	-	2 (8.69)	21 (91.3)	23 (100)
Mannan	-	19 (52.77)	17 (47.23)	36 (100)	-	15 (41.06)	21 (58.33)	36 (100)
Muthuvan	8 (53.33)	7 (46.66)	-	15 (100)	-	9 (60)	6 (40)	15 (100)
Palliyan	8 (25.8)	23 (74.19)	-	31 (100)	-	26 (83.87)	5 (16.13)	31 (100)
Urali	-	4 (12.9)	27 (87.10)	31 (100)	-	2 (6.45)	29 (93.55)	31 (100)
Total	26 (16.77)	77 (49.68)	52 (33.55)	155 (100)	-	67 (43.23)	88 (56.77)	155
<b>PALAKKAD</b>								
Irular	26 (48.15)	28 (51.85)	-	54 (100)	-	24 (44.44)	30 (55.55)	54 (100)
Kurumba	8 (61.54)	5 (38.46)	-	13 (100)	-	9 (69.23)	4 (30.77)	13 (100)
Muduga	6 (46.15)	7 (53.85)	-	13 (100)	-	8 (61.54)	5 (38.46)	13 (100)
Total	40 (50)	40 (50)	-	80 (100)	-	41 (51.25)	39 (48.75)	80 (100)
<b>WAYANAD</b>								
Adiyan	2 (40)	3 (60)	-	5 (100)	-	1 (20)	4 (80)	5 (100)
Kattunayakan	5 (25)	14 (70)	1 (5)	20 (100)	5 (25)	14 (70)	1 (5)	20 (100)
Kurichchan	-	11 (55)	9 (45)	20 (100)	-	2 (10)	18 (90)	20 (100)
Kuruman	-	4 (26.66)	11 (73.33)	15 (100)	-	-	15 (100)	15 (100)
Paniyan	12 (44.4)	10 (37.04)	5 (18.52)	27 (100)	3 (11.11)	17 (62.96)	7 (25.93)	27 (100)
Urali	1 (12.5)	6 (75)	1 (12.5)	8 (100)	1 (12.5)	6 (75)	1 (12.5)	8 (100)
Total	20 (21.05)	48 (50.53)	27 (28.42)	95 (100)	9 (9.47)	40 (42.11)	46 (48.42)	95 (100)

Regarding the food preservation methods employed by the tribal communities, it was seen that about 70.32 per cent, 93.75 per cent and 70.53 per cent of the families of Idukki, Palakkad and Wayanad districts did not preserve any food at home. Rest of the families in the three districts preserved foods mainly by preparing pickles and by drying. Mango and Amla were most commonly preserved as pickles and tapioca, jack fruit, green chilly, bittergourd and meat were preserved by drying.

Details on the foods given during special conditions indicated that none of the tribal communities in the three districts included any special food item in the diet of school going children and adolescents. They gave normal adult diet to these groups. However, it was seen that 17.39 per cent of Malayarayar families of Idukki district and 13.33 per cent Kuruman families of Wayanad district included special foods in the diet of pre-school children and 8.69 per cent of Malayarayar families of Idukki district gave special food items to elderly. Only 17.39 per cent Malayarayar, 5.55 per cent Mannan and 9.68 per cent Palliyan families Idukki district and 5 per cent Kurichchan and 26.66 per cent Kuruman families of Wayanad district included special food items in the diet of pregnant women. During lactation also 21.74 per cent (Malayarayar), 13.89 per cent (Mannan), 9.68 per cent (Palliyan), 15 per cent (Kurichchan), 46.66 per cent (Kuruman), 7.41 per cent (Paniya) and 12.5 per cent (Urali of Wayanad) families of three districts included special food items like ragi, milk and more quantity of rice in the diet of pregnant and lactating women.

During diseases like measles, jaundice, common cold, sore throat, stomach pain and snake bite only 30.97 per cent, 5 per cent and 12.63 per cent of the tribal families of Idukki, Palakkad and Wayanad districts used various herbal preparations. It was also found that majority of the families in the three districts preferred allopathy medicines and went to the nearby Public Health Centre or hospitals for treating various diseases.

Details on the use of ethnic foods by the tribal communities indicated that 65.81 per cent, 80 per cent and 47.37 per cent of the families of Idukki, Palakkad and Wayanad districts used different ethnic plant food items in their diet occasionally. Most of the respondents indicated that they are not in the habit of using ethnic foods frequently due to the non availability of these foods in the forest and also due to the

reluctance of the younger generation to go to the forest to collect these food items. The community wise details on the use of ethnic plant foods by the tribal families are given in Table 5. All the Hill Pulaya families and majority of other tribal communities of Idukki and Palakkad districts used ethnic plant foods occasionally in their diet. However, in Wayanad district majority of Urali (87.5%) and Adiyani (60%) families collected ethnic plant foods and used these food items occasionally. Use of ethnic foods by other tribal communities of Wayanad district varied from 13.33 per cent among Kuruman families to 55 per cent in Kattunayakan families.

The list of various ethnic plant foods used by the tribal communities of Idukki, Palakkad and Wayanad districts are given in Table 6 A, B and C. Most of these foods were identified by the taxonomist and the details like local name of the food, family and scientific name are also furnished in Table 6. Plates 1 to 12 show the plant food stuffs used by the tribal communities of Idukki, Palakkad and Wayanad districts.

## **2. Chemical constituents present in the collected foods**

The constituents with respect to nutrients and antinutrients present in the leafy vegetables, vegetables, roots and tubers, fruits and cereals collected from the tribal areas of Idukki, Palakkad and Wayanad districts were estimated in the raw stage. The chemical constituents of most of the food stuffs were estimated after cooking also. Leafy vegetables were cooked by absorption method and other food stuffs were cooked by boiling. The constituents in the raw and cooked stages and between the raw and cooked stages were statistically analysed by Analysis of Variance to see the variation in the constituents present in different foods in the raw and cooked stages and between the raw and cooked stages. To find out the variation of constituents between the raw and cooked samples, the foods which were analysed in both stages only were taken. The analysis of certain constituents in some foods were not done due to the shortage of samples collected. The results of the chemical constituents present in the food stuffs collected from Idukki, Palakkad and Wayanad districts are given in this section.

Table 5. Details on the use of ethnic foods by the tribal communities

Tribal community	Number of families		
	Using ethnic foods	Not using ethnic foods	Total
<b>IDUKKI</b>			
Hill Pulaya	19 (100)	-	19 (100)
Malayarayar	14 (60.87)	9 (39.13)	23 (100)
Mannan	22 (61.11)	14 (38.89)	36 (100)
Muthuvan	12 (80.00)	3 (20.00)	15 (100)
Palliyan	24 (77.42)	7 (22.58)	31 (100)
Urali	11 (35.48)	20 (64.52)	31 (100)
<b>Total</b>	<b>102 (65.81)</b>	<b>53 (34.19)</b>	<b>155 (100)</b>
<b>PALAKKAD</b>			
Irular	46 (85.19)	8 (14.81)	54 (100)
Kurumba	9 (69.23)	4 (30.77)	13 (100)
Muduga	9 (69.23)	4 (30.77)	13 (100)
<b>Total</b>	<b>64 (80.00)</b>	<b>16 (20.00)</b>	<b>80 (100)</b>
<b>WAYANAD</b>			
Adiyan	3 (60.00)	2 (40.00)	5 (100)
Kattunayakan	11 (55.00)	9 (45.00)	20 (100)
Kurichchan	8 (40.00)	12 (60.00)	20 (100)
Kuruman	2 (13.33)	13 (86.66)	15 (100)
Paniyan	14 (51.85)	13 (48.15)	27 (100)
Urali	7 (87.50)	1 (12.50)	8 (100)
<b>Total</b>	<b>45 (47.37)</b>	<b>50 (52.63)</b>	<b>95 (100)</b>

Table 6. Ethnic foods used by the tribal communities

## A. IDUKKI DISTRICT

## A. 1. Leafy vegetables

Sl.No.	Name of foodstuff	Family	Scientific Name
1	Anacheviyancheera	**	**
2	Arakkeera	**	**
3	Avanakkucheera	Compositae	<i>Sonchus oleraceus</i> , Linn.
4	Chembila	Araceae	<i>Colocasia antiquorum</i> , Schoott
5	Cherucheera	**	**
6	Chumalacheera	Amaranthaceae	<i>Alternanthera amabilis</i>
7	Kadamankutticheera	Amaranthaceae	<i>Cyathula prostrate</i> , Blume.
8	Kadukcheera(a)	Amaranthaceae	<i>Alternanthera triandra</i> , Lamk.
9	Kadukcheera(b)	Capparidaceae	<i>Cleome monophylla</i> , Linn.
10	Kaipucheera	Amarantaceae	<i>Amaranthus paniculatus</i> , Linn.
11	Kallethamara	**	**
12	Kattukadukcheera	Capparidaceae	<i>Cleome viscosa</i> , Linn.
13	Kattumuringa	**	**
14	Keezharnelli (big)	Euphorbiaceae	<i>Phyllanthus lawii</i> , Grah.
15	Keezharnelli (small)	Euphorbiaceae	<i>Phyllanthus niruri</i> , Linn.
16	Kodappakeera	Amaranthaceae	<i>Alternanthera triandra</i> , Lamk..
17	Kozhikodalancheera	Vitaceae	<i>Parthenocissus neilgherriensis</i> , Planch.
18	Kuppacheera	Solanaceae	<i>Solanum nigrum</i> , Linn.
19	Manalancheera	Portulacaceae	<i>Portulaca oleraceae</i>
20	Mangacheera	Compositae	<i>Bidens humilis</i> , H.B.&K.
21	Mathipuli	Malvaceae	<i>Hibiscus sabdariffa</i> , L.
22	Mulakucheera	Solanaceae	<i>Capsicum frutescens</i> , Linn.
23	Mullancheera	Amaranthaceae	<i>Amaranthus spinosus</i> , Linn.
24	Mullucheera	Amaranthaceae	<i>Amaranthus spinosus</i> , Linn.
25	Nadancheera	Amaranthaceae	<i>Amaranthus paniculatus</i> , Linn..
26	Nayirunjikeera	Amaranthaceae	<i>Achyranthes aspera</i> , Linn.
27	Neeruvatti	**	**
28	Nerinjikeera	**	**
29	Ottakeera	Compositae	**
30	Palachettikeera	Acanthaceae	<i>Asystasia travancoria</i> , Bedd.
31	Palakeera	**	**
32	Perandakodi	Vitaceae	<i>Vitis quadrangularis</i> , Linn.
33	Potticheera	Solanaceae	<i>Solanum nigrum</i> , Linn.
34	Pulikeera	Malvaceae	<i>Hibiscus subdariffa</i> , Willd
35	Shingacheera	Leguminoceae	<i>Mymosa rubicaulis</i> , Lamk.
36	Sonakeera	Convolvulaceae	<i>Convolvulus rotlerianus</i> , Choisy.
37	Thakara	Leguminoceae	<i>Cassia alata</i> , Linn.
38	Thakkila	**	**
39	Thalamuzhakeera	Amaranthaceae	<i>Allmania nodiflora</i> , Roxb.

Sl.No.	Name of foodstuff	Family	Scientific Name
40	Thalu	Araceae	<i>Colocasia antiquorum</i> , Schott.
41	Thandankeera	Amaranthaceae	<i>Amaranthus hypochondriacus</i> , Lamk..
42	Tharikeera	**	**
43	Thazhuthama	Nyctaginaceae	<i>Boerhaavia diffusa</i> , Linn.
44	Thoppikeera	Amaranthaceae	<i>Amaranthus paniculatus</i> , Linn.
45	Thumbacheera	Amaranthaceae	<i>Aerva wightii</i> , Hook.
46	Valiyacheviyancheera	**	**
47	Vazhukkacheera	Portulacaceae	<i>Talinum cuneifolium</i> , willd
48	Vazhukkakeera	Chenopodiaceae	<i>Basella rubra</i>
49	Vellathazhuthama	Aizoaceae	<i>Trianthema portulacastrum</i> , Linn.
50	Velukkacheera	Chenopodiaceae	<i>Basella alba</i> , Linn.

### A. 2. Vegetables

Sl.No.	Name of foodstuff	Family	Scientific Name
1	Akidikka	Euphorbiaceae	<i>Euphorbia trigona</i>
2	Chembuthandu	Araceae	<i>Colocasia antiquorum</i> , Schoott.
3	Eenthinkaya	Palmaceaea	<i>Phonix fannifera</i> , Roxb.
4	Kaipuchunda	Solanaceae	<i>Solanum torvum</i> , Swartz.
5	Kallipoovu	Cactaceae	<i>Opuntia coccinellifera</i> , Mill.
6	Kattuchakka	**	**
7	Kattumanga	**	**
8	Kattupana	Musaceae	<i>Musa superba</i> , Roxb.
9	Kattuthakkali	Solanaceae	<i>Lycopersicum esculentum</i> , Mill.
10	Mullikka	Solanaceae	<i>Solanum melongena</i> , Linn.
11	Putharichunda	Solanaceae	<i>Solanum torvum</i> , Swartz.
12	Thaluthandu	**	**
13	Uriikka	Sterculaceae	<i>Kleinhofia hospita</i> , L.

### A. 3. Roots and tubers

Sl.No.	Name of foodstuff	Family	Scientific Name
1	Chanakoova	Zingiberaceae	<i>Curcuma pseudomontana</i>
2	Cheenchembu	Araceae	<i>Colocasia antiquorum</i>
3	Chena	**	**
4	Chonakizhangu	**	**
5	Kachil	**	**
6	Kannukarakizhangu	Portulacaceae	<i>Portulaca tuburosa</i> , Roxb.
7	Karichembu	**	**
8	Kattinchi	Zingiberaceae	<i>Zingiber casumunar</i> , Roxb.
9	Kattuchembu	**	**
10	Kattumanjal	Zingiberaceae	<i>Curcuma longa</i> , Linn.
11	Koova	Cannaceae	<i>Canna indica</i> , Linn.
12	Kuzhala	**	**

Sl.No.	Name of foodstuff	Family	Scientific Name
13	Manchakoova	**	**
14	Malayankizhangu	Dioscoreaceae	<i>Dioscorea pentaphylla</i> , Linn.
15	Nooran	Dioscoreaceae	<i>Dioscorea pentaphylla</i> , Linn.
16	Paracheenan	**	**
17	Thettam	**	**
18	Vellarikizhangu	Dioscoreaceae	<i>Dioscorea bulbifera</i> , Linn.
19	Venkizhangu	**	**
20	Vettukachil	**	**

#### A. 4. Fruits

Sl.No.	Name of foodstuff	Family	Scientific Name
1	Chitteenth	Palmaceae	<i>Phoenix farinifera</i> , Roxb.
2	Chumalakalli	Cactaceaea	**
3	Kalakaya	Apocynaceae	<i>Carissa paucinervia</i> , A.Dc.
4	Kallipazham	Cactaceae	<i>Opuntia coccinellifera</i> , Mill.
5	Kattumanga	**	**
6	Kattunaranga	Rutaceae	<i>Citrus acida</i>
7	Komulishamkaya	Rutaceae	<i>Citrus aurantium</i> , Linn.
8	Kurukuttapazham	Rutaceae	<i>Zanthoxylum rhetsa</i> , DC.
9	Mullapazham	Tiliaceae	<i>Grewia tiliaefolia</i> , Vahl.
10	Njaval (small)	Myrtaceae	<i>Syzigium myhendrae</i> , Gamble.
11	Njaval (big)	Myrtaceae	<i>Syzigium parnottianum</i> , Walp.
12	Pottipazham	Rutaceae	<i>Zanthoxylum dudrunga</i> , Wall.
13	Putharichunda	Solanaceae	<i>Solanum torvum</i> , Swartz
14	Unnapazham	Tiliaceae	<i>Grewia barberi</i> , Drumm.



## B. PALAKKAD DISTRICT

## B. 1. Leafy vegetables

Sl.No.	Local name	Family	Scientific Name
1	Chembila	Araceae	<i>Colocasia antiquorum</i> , Schoott
2	Chukkutticheera	Solanaceae	<i>Solanum nigrum</i> , Linn
3	Chunalacheera	Amaranthaceae	<i>Alternanthera amabilis</i>
4	Churuli	Filicinae	<i>Dryopteris</i> sp.
5	Elipinnakdag	Acanthaceae	<i>Strobilanthes humilis</i> , Gamble.
6	Gonikeera	Portulacaceae	<i>Portulaca oleracea</i>
7	Kainedag	**	**
8	Katukusoup	Cruciferae	<i>Brassica campestris</i>
9	Keera	**	**
10	Kovakeera	Cucurbitaceae	<i>Coccina indica</i> , W.&A.
11	Kuppakeera	Amaranthaceae	<i>Amaranthus viridis</i>
12	Mathanela	Cucurbitaceae	<i>Cucurbita maxima</i> , Duch.
13	Mulakucheera	Solanaceae	<i>Capsicum frutescens</i> , Linn.
14	Mullucheera	Amaranthaceae	<i>Amaranthus spinosus</i> , Linn.
15	Munnekeera	**	**
16	Palekeera	Apocynaceae	<i>Koposia fruticosa</i> , A.Dc.
17	Pampattikeera	Nyctaginaceae	<i>Boerhaavia verticillata</i> , Poir.
18	Pannedag	Lauraceae	<i>Litsea coriacea</i> , Hook.
19	Pattikeera	**	**
20	Payarila	Leguminoceae	<i>Peuraria hispida</i>
21	Perandika	Nyctaginaceae	<i>Boerhaavia verticillata</i> , Poir.
22	Ponnamkanni	Amaranthaceae	<i>Alternanthera triandra</i>
23	Sambarcheera	**	**
24	Sheengedag	Compositae	<i>Artemisia parviflora</i>
25	Swargacheera	Vitaceae	<i>Ampelocissus araneosa</i> , Planch.
26	Thakara	Leguminoceae	<i>Cassia tora</i> , Linn.
27	Thazhuthama	Nyctaginaceae	<i>Boerhavia diffusa</i> , Linn.
28	Theyyedeg	Amaranthaceae	<i>Celosia pulchella</i> , Moq.
29	Thondesoup	Compositae	<i>Bidens pilosa</i> , L.
30	Vashalacheera	Chenopodeaceae	<i>Basella rubra</i> , L.
31	Vela	**	**
32	Vellakeera	**	**
33	Vellathandancheera	**	**

## B. 2. Vegetables

Sl.No.	Local name	Family	Scientific Name
1	Chembuthandu	Araceae	<i>Colocasia antiquorum</i> , Schoott
2	Chundakka	**	**
3	Kattuthakkali	Solanaceaea	<i>Lycopersicum esculentum</i> , Mill.
4	Mulamkoombu	**	**
5	Narala	Vitaceae	<i>Vitis quadrangularis</i> , Linn.

**B. 3. Roots and tubers**

Sl.No.	Local name	Family	Scientific Name
1	Chembu	Araceae	<i>Colocasia antiquorum</i> , Schoott
2	Neeruvekka	Liliaceae	<i>Asparagus racemosus</i> , willd.
3	Nara	**	**
4	Nooran	Dioscoreaceae	<i>Dioscorea pentaphylla</i> , Linn.
5	Perukku	Dioscoreaceae	<i>Dioscorea esculenta</i> , Burk.
6	Vettilakodiyan	Dioscoreaceae	<i>Dioscorea alata</i> , Linn.

**B.4. Cereals**

Sl.No.	Local name
1	Chama
2	Cholam
3	Kambacholam
4	Makkacholam
5	Malanchama
6	Manjacholam
7	Porikeera seeds
8	Ragi
9	Thena
10	Varaku

## C. WAYANAD DISTRICT

## C. 1. Leafy Vegetables

Sl.No.	Local name	Family	Scientific Name
1	Ambasheppu	Compositae	<i>Bidens pilosa</i> , Linn
2	Appuppanthadi	Compositae	<i>Bidens humilis</i>
3	Chanacheera	Amaranthaceae	<i>Amaranthus viridis</i> , Linn
4	Churuli	Filicinae	<i>Dryopteris sp</i>
5	Cheera	Amaranthaceae	<i>Amaranthus paniculatus</i> , Linn
6	Cheriyakadaladi	Amaranthaceae	<i>Aerva lanata</i> , juss.
7	Chumannacheera	**	**
8	Chumalacheera	Amaranthaceae	<i>Alteranthera amabilis</i>
9	Kadukucheera	**	**
10	Kadumudunga	Solanaceae	<i>Solanum nigrum</i> , Linn.
11	Kaippayila	Cucurbitaceae	<i>Momordica subangulata</i> Bl.
12	Kallurukki	Scrophularaceae	<i>Scoparia dulcis</i>
13	Kannisoupe	Commelinaceae	<i>Commelina benghalensis</i> , Linn.
14	Karamanasheppu	Solanaceae	<i>Capsicum frutescens</i> , Linn.
15	Karimchembila	Araceae	<i>Colocasia antiquorum</i> , Schoott
16	Kattukadukucheera	Cruciferae	<i>Brassica juncea</i> , Hook.
17	Kattuthakkaliela	Solanaceae	<i>Lycopersicum esculentum</i> , Mill.
18	Kayacheera	Amaranthaceae	<i>Amaranthus viridis</i> , Linn
19	Kaycheera I	Chenopodiaceae	<i>Basilla rubra</i>
20	Kayyoonnam	Compositae	<i>Eclipta alba</i>
21	Kodakan	Umbelliferae	<i>Centella asiatica</i> , L.
22	Kozhuppa	Portulacaceae	<i>Portulaca oleracea</i> , Linn.
23	Kuppakeera	Amaranthaceae	<i>Amaranthus viridis</i> , L
24	Mattasheppu	Cucurbitaceae	<i>Cucurbita maxima</i> , Duch.
25	Minnamkanni	Amaranthaceae	<i>Allmania nodiflora</i> , R.br.
26	Mullukeera	Amaranthaceae	<i>Amaranthus spinosus</i> , L
27	Murukkila	Leguminoceae	<i>Erythrina stricta</i> , Roxb.
28	Neycheera	Amaranthaceae	<i>Amaranthus tricolor</i>
29	Palcheera	Amaranthaceae	<i>Amaranthus polygonoides</i> , L.
30	Payarila	Leguminoceae	<i>Peuraria hispida</i>
31	Ponnamkanni	Amaranthaceae	<i>Alteranthera triandra</i> , Lamk.
32	Pottipazhamela	Solanaceae	<i>Physalis peruviana</i> , Linn
33	Sambarcheera	Portulacaceae	<i>Talinum cuneifolium</i> , willd.
34	Thakara	Leguminoceae	<i>Cassia alata</i> , Linn.
35	Thalu	Araceae	<i>Colocasia antiquorum</i> , Schoott
36	Thumbacheera	Labiatae	<i>Leucas zeylanica</i> , R.Br.
37	Uruvulikkila	Cucurbitaceae	<i>Bynopsis laciniosa</i> , Naud.
38	Valiyakadaladi	Amaranthaceae	<i>Aerva wightii</i> , Hook.
39	Vashalacheera	Chenopodiaceae	<i>Basella rubra</i> , Linn.
40	Vayalchulli	**	**
41	Vayalchulli (valuthu)	**	**
42	Vayalkaduku	Cruciferae	<i>Brassica juncea</i> , Hook.
43	Vazhacheera	**	**
44	Vellachembila	**	**

## C. 2. Vegetable

Sl. No.	Local name	Family	Scientific Name
1	Karinthaluthandu	Araceae	<i>Colocasia antiquorum</i> , Schoott
2	Manithakkali	**	**
3	Mulamkoombu	**	**
4	Pindichakka	Combretaceae	<i>Terminalia catappa</i> , L.
5	Uruvulikka	Cucurbitaceae	<i>Bynopsis laciniosa</i> , Naud.
6	Vellathaluthandu		

## C. 3. Roots &amp; Tubers

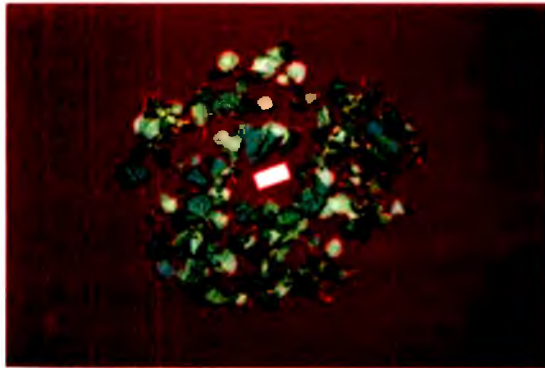
Sl.No.	Local name	Family	Scientific name
1	Benni	**	**
2	Nuran	Dioscoreaceae	<i>Dioscorea pentaphylla</i> , Linn.
3	Nara	**	**
4	Neendikizhangu	Dioscoreaceae	<i>Dioscorea esculanta</i> , Burk.
5	Kattuchena	**	**



**Avanakkucheera**



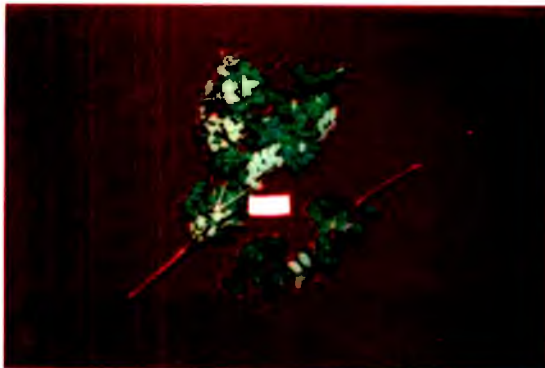
**Chumalacheera**



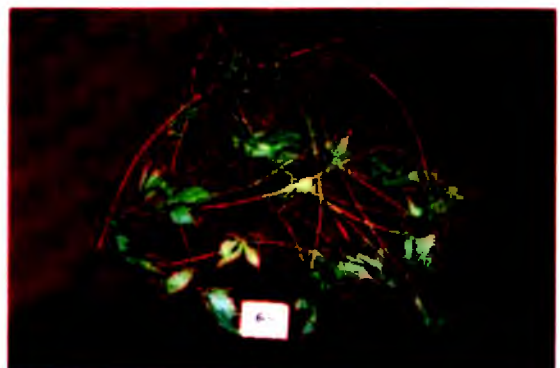
**Kadamankuttycheera**



**Kallethamara**



**Kattumuringa**



**Kozhikodalancheera**

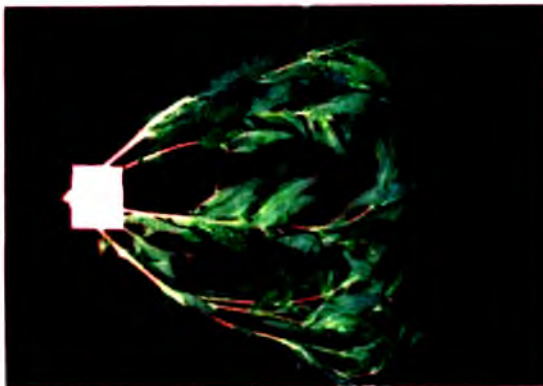
**Plate 1. Leafy vegetables consumed by the tribes of Idukki district**



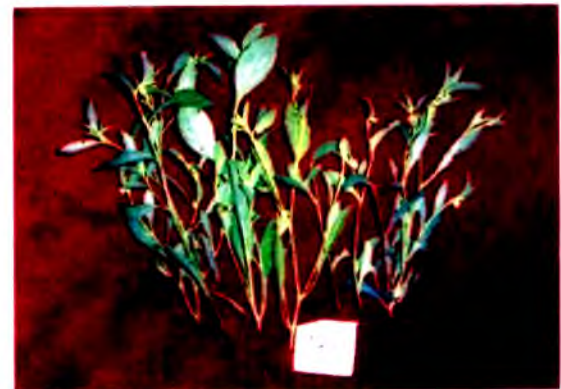
**Mangacheera**



**Palachettikeera**



**Sonakeera**



**Thalamuzhakeera**



**Vazhukkakeera**

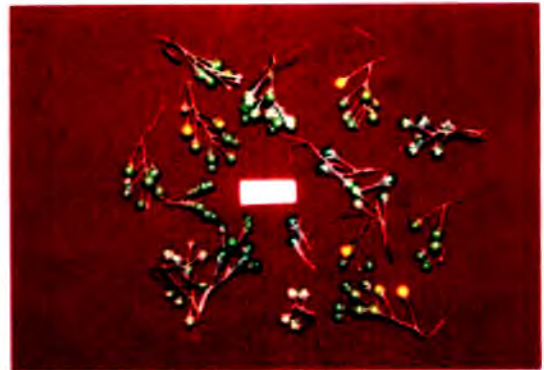


**Velukkacheera**

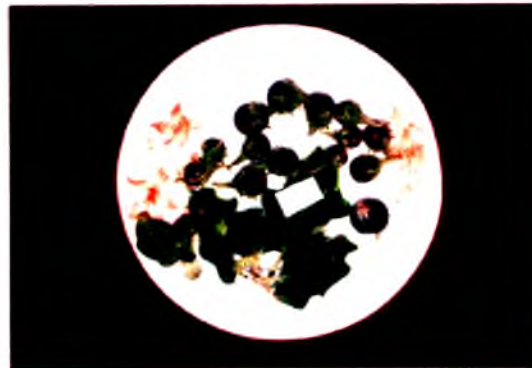
**Plate 2. Leafy vegetables consumed by the tribes of Idukki district**



**Akidikka**



**Kaippuchunda**



**Mullikka**

**Plate 3. Vegetables consumed by the tribes of Idukki district**



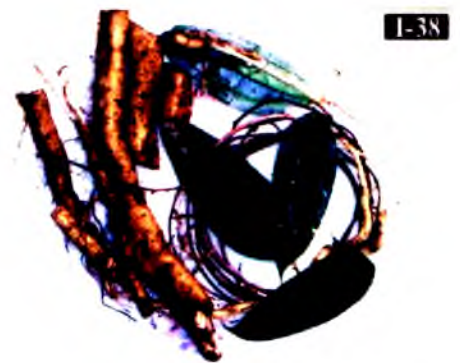
**Kuzhala**



**Nooran**



**Paracheenan**



**Vellarikizhangu**

I-38

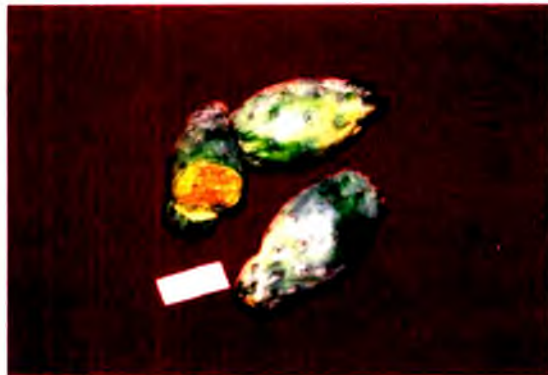
**Plate 4. Roots and tubers consumed by the tribes of Idukki district**



**Chumalakalli**



**Kalakaya**



**Kallipazham**



**Mullapazham**



**Njaval (Small)**



**Pottipazham**

**Plate 5. Fruits consumed by the tribes of Idukki district**





**Chembila**



**Chumalacheera**



**Churuli**



**Kovakeera**



**Katukusoup**



**Palekeera**

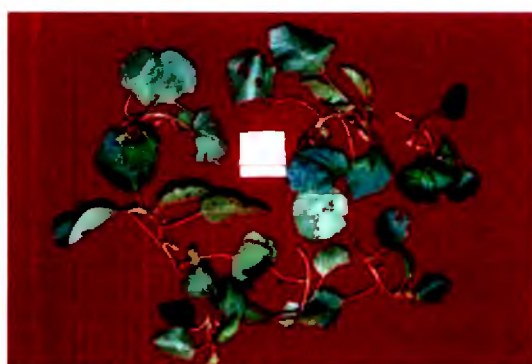
**Plate 6. Leafy vegetables consumed by the tribes of Palakkad district**



**Pannedag**



**Swargacheera**



**Theyyedag**



**Thondesoup**



**Vashalacheera**

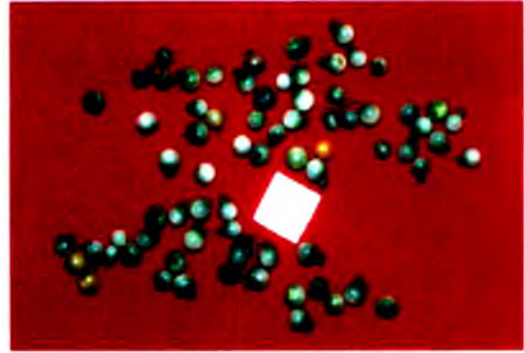


**Vela**

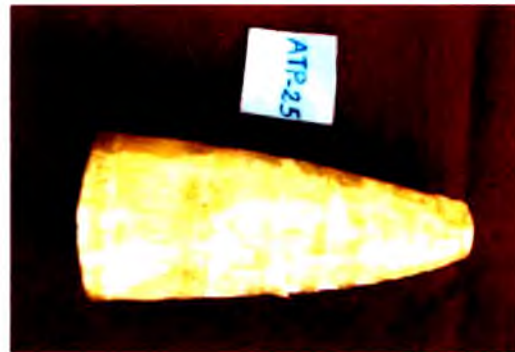
**Plate 7. Leafy vegetables consumed by the tribes of Palakkad district**



**Chundakka**



**Kattuthakkali**



**Mulamkoombu**

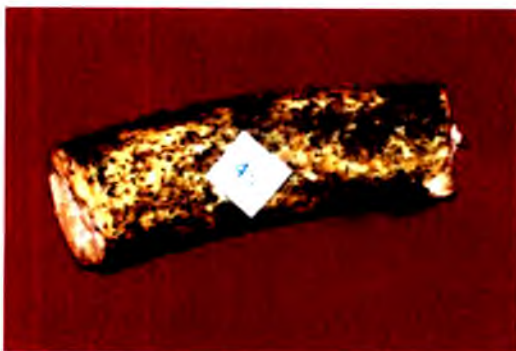
**Plate 8. Vegetables consumed by the tribes of Palakkad district**



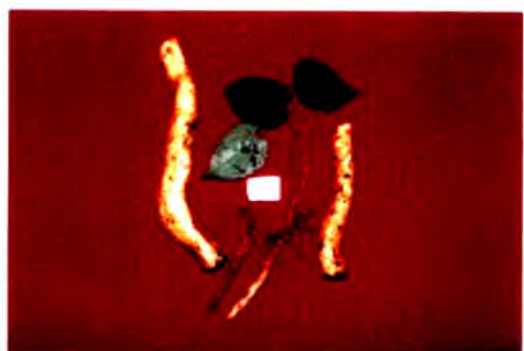
**Chembu**



**Neeruvekka**



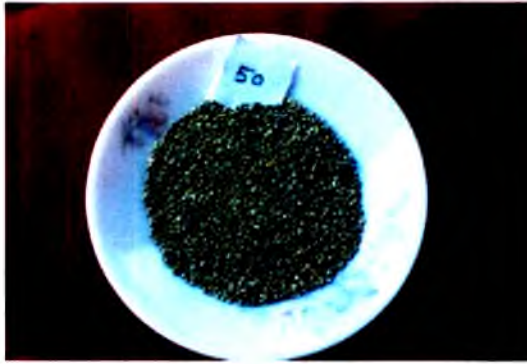
**Perukku**



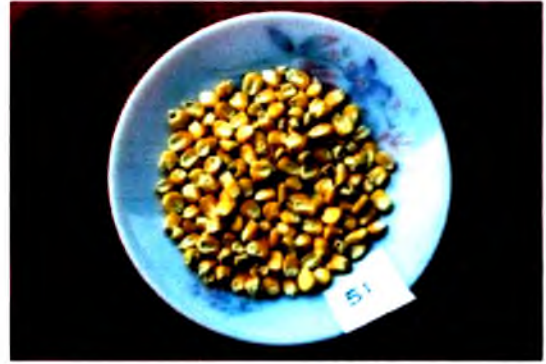
**Vettilakodiyan**

**Plate 9. Roots and tubers consumed by the tribes of Palakkad district**

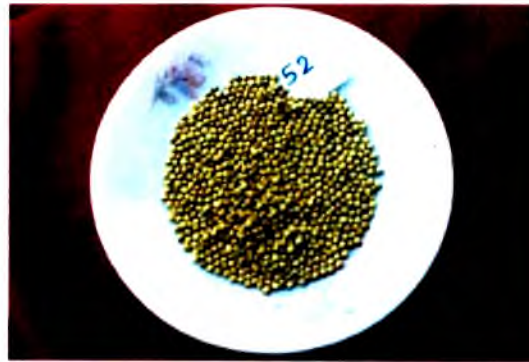




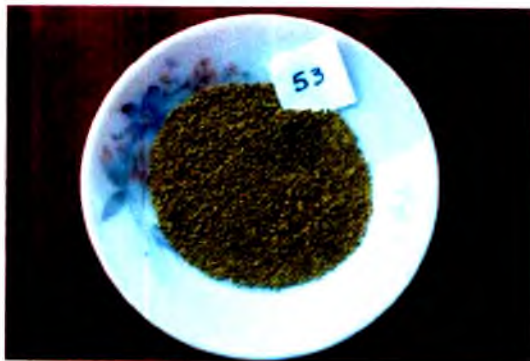
**Kambacholam**



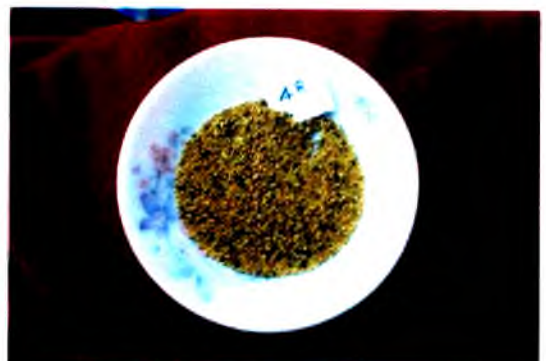
**Makkacholam**



**Manjacholam**



**Thena**

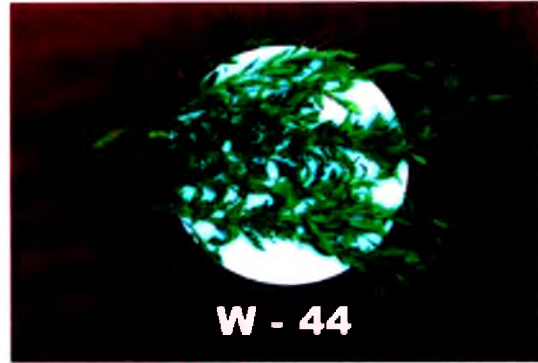


**Varaku**

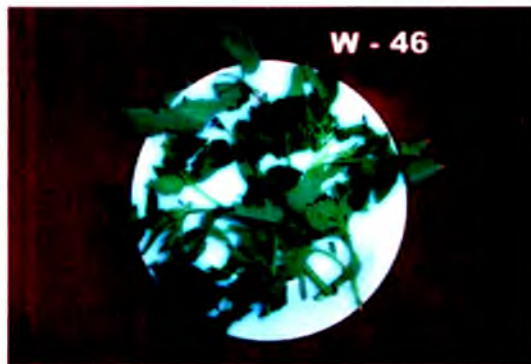
**Plate 10. Cereals consumed by the tribes of Palakkad district**



**Appuppanthadi**



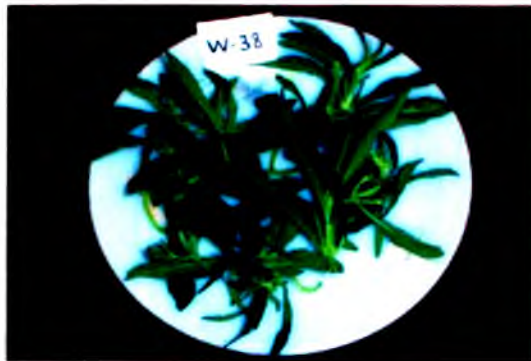
**Kalluruki**



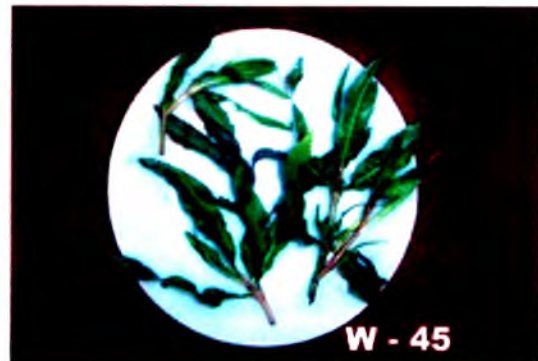
**Kattuthakkaliela**



**Kodakan**

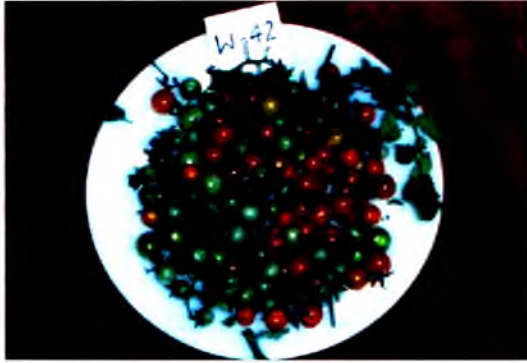


**Thumbacheera**



**Vayalchulli**

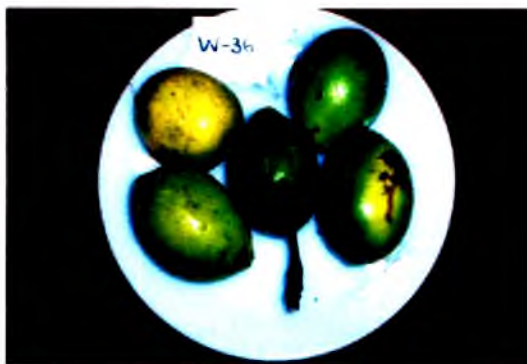
**Plate 11. Leafy vegetables consumed by the tribes of Wayanad district**



**Manithakkali**



**Mulamkoombu**



**Pindichakka**



**Uruvulikka**

**Plate 12. Vegetables consumed by the tribes of Wayanad district**

## I. IDUKKI

### I. A. Leafy vegetables

#### Moisture

The moisture content of the fresh leaves varied from 72.73 per cent in Shingacheera to 94.26 per cent in Thalu (Table 7). In the cooked leaves it varied from 74.26 per cent (Shingacheera) to 96 per cent (Tharikeera). The mean moisture content of the leaves was found to be 81.82 per cent in fresh leaves and 84.58 per cent in cooked leaves. The moisture contents of Kadukcheera (73.49%), Keezharnelli (small) (73.62%), Palakeera (73.97%) and Sonakeera (74.09%) were found to be on par with the lowest moisture content of 72.73 per cent observed in fresh Shingacheera. In the cooked leaves the moisture contents of Perandakodi (94.95%) and Kallethamara (95.15%) were found to be on par with the highest moisture content observed in Tharikeera. Significant variation in the moisture content of the leafy vegetables was observed within and between the fresh and cooked leaves.

#### Fat

The fat content of leafy vegetables varied from 0.19 (Vazhukkakeera) to 2.78 per cent (Thakara) in fresh leaves with significant variation in the fat content of the leaves (Table 7). In the cooked leaves the content varied from 0.09 (Manalancheera) to 1.53 per cent (Keezharnelli small) with significant variation in the fat content. Significant variation was also observed between the fresh and cooked leaves with respect to fat content. The fat content of cooked Thakara was found to be on par with the lowest content observed in Manalancheera. In the raw stage the leaves with the fat content in between 0.20 to 0.41 per cent was found to be on par with the lowest content noted in Vazhukkakeera.

#### Protein

Protein content of the leafy vegetables varied from 0.79 per cent to 7.33 per cent in the fresh state (Table 7). In the cooked leaves the protein content varied from 0.48 per cent to 6.08 per cent. The highest and lowest protein contents were observed in Thakara and Kallethamara respectively both in raw and cooked leaves. The protein



**Table 7. Mean nutritive value of leafy vegetables (raw and cooked) consumed by the tribal communities of Idukki District (per 100g FWB)**

Sl. No.	Name of foodstuff	Moisture (g)		Fat (g)		Protein (g)	
		Raw	Cooked	Raw	Cooked	Raw	Cooked
1	Anacheviyancheera	80.21	82.67	0.40	0.17	5.00	4.09
2	Arakkeera	80.04	82.58	-	-	6.66	-
3	Avanakkucheera	88.69	91.61	-	-	3.50	2.24
4	Chembila	86.96	88.66	0.34	0.14	3.87	3.16
5	Cherucheera	79.50	80.87	0.27	0.13	5.06	4.61
6	Chumalacheera	82.46	86.29	-	-	6.66	5.74
7	Kadamankutticheera	78.01	79.66	-	-	5.09	4.38
8	Kadukcheera (a)	73.49	76.66	-	-	6.57	4.56
9	Kadukcheera (b)	76.31	78.75	-	-	5.96	5.07
10	Kaipucheera	82.55	85.96	-	-	4.42	-
11	Kallethamara	93.04	95.15	0.33	0.21	0.79	0.48
12	Kattukadukcheera	74.56	77.31	-	-	6.43	-
13	Kattumuringa	76.19	78.3	1.36	0.65	6.32	5.14
14	Keezharnelli (big)	79.67	81.35	1.65	1.02	5.54	4.62
15	Keezharnelli (small)	73.62	76.92	1.86	1.53	5.76	4.52
16	Kodappakeera	83.59	85.45	-	-	4.52	4.12
17	Kozhikodalancheera	84.28	87.29	-	-	3.94	3.09
18	Kuppacheera	82.82	86.24	1.19	0.93	6.44	5.53
19	Manalancheera	91.30	93.64	0.26	0.09	1.71	1.24
20	Mangacheera	81.78	83.56	0.24	0.17	3.95	3.46
21	Mathipuli	78.38	80.24	1.02	0.66	5.26	3.09
22	Mulakucheera	87.53	89.92	0.41	0.21	3.48	2.64
23	Mullancheera	79.67	83.77	0.40	0.22	4.52	3.95
24	Nadancheera	82.31	84.78	-	-	4.12	-
25	Nayirunjikeera	76.42	83.62	0.70	0.34	4.56	3.14
26	Neeruvatti	80.27	83.48	0.55	0.39	4.77	3.95
27	Nerinjikeera	78.28	81.28	0.36	0.19	4.33	3.57
28	Ottakeera	84.93	87.16	-	-	5.59	4.31
29	Palachettikeera	82.46	86.91	-	-	5.02	3.91
30	Palakeera	73.97	76.62	-	-	5.01	-
31	Perandakodi	92.57	94.95	0.23	0.15	1.44	0.94
32	Potticheera	81.51	85.28	0.98	0.94	4.78	-
33	Pulikeera	77.74	80.82	-	-	4.86	3.81
34	Shingacheera	72.73	74.26	0.64	0.34	3.53	3.22
35	Sonakeera	74.09	77.63	-	-	4.14	4.07
36	Thakara	74.82	76.9	2.78	0.92	7.33	6.08
37	Thakkila	82.84	85.63	-	-	3.18	-

Contd.

Table 7. Continued

Sl. No.	Name of foodstuff	Moisture (g)		Fat (g)		Protein (g)	
		Raw	Cooked	Raw	Cooked	Raw	Cooked
38	Thalamuzhakeera	85.52	89.01	0.48	0.34	2.59	1.65
39	Thalu	94.26	94.67	-	-	1.97	-
40	Thandankeera	77.66	82.83	-	-	5.89	4.97
41	Tharikeera	93.23	96.00	0.32	0.09	1.43	0.8
42	Thazhuthama	87.13	89.67	-	-	4.04	2.87
43	Thoppikeera	81.82	83.45	-	-	4.87	3.68
44	Thumbacheera	76.33	78.85	-	-	5.72	4.51
45	Valiyacheviyancheera	76.23	78.65	-	-	6.42	-
46	Vazhukkacheera	91.91	92.43	-	-	1.09	0.99
47	Vazhukkakeera	92.55	94.73	0.19	0.13	2.42	1.53
48	Vellathazhuthama	92.07	94.03	0.21	0.20	2.09	1.50
49	Velukkacheera	91.65	94.04	-	-	1.36	1.07
	Means $\pm$ SE	81.82 $\pm$ 0.56	84.58 $\pm$ 0.42	0.718 $\pm$ 0.01	0.422 $\pm$ 0.001	4.22 $\pm$ 0.09	3.53 $\pm$ 0.12
	CD	1.579	1.184	0.263	0.003	0.254	0.342
	CD between raw & cooked	0.187		0.005		0.043	

FWB- Fresh Weight Basis

content of the leaves varied significantly in raw and cooked leaves and between the raw and cooked leaves. The mean protein content was found to be 4.22 per cent in raw leaves and 3.53 per cent in cooked leaves. None of the raw leaves had a similar protein content which was observed either in Thakara or Kallethamara. However, the protein content of Chumalacheera (5.74%) was found to be on par with the highest content observed in Thakara after cooking.

### Fibre

Fibre content of the leaves varied from 0.63 per cent (Velukkacheera) to 5.52 per cent Keezharnelli (small) with a mean fibre content of 1.80 per cent in the raw state (Table 8). Significant variation in the fibre content of the fresh leaves was also observed. The mean fibre content of cooked leaves was found to be 1.34 per cent with the highest content in Keezharnelli (small) (2.93%) and the lowest in Manalancheera (0.40%). Significant variation was observed in the fibre content of cooked leaves. Cooked Sonakeera with a fibre content of 2.86 per cent was the only leaf which was on par with the highest fibre content noted in cooked Keezharnelli - small. The fibre contents of Kallethamara (0.81%), Manalancheera (0.72%), Thalu (0.67%), Tharikeera (0.85%) and Vellathazhuthama (0.73%) were found to be similar to the lowest content of 0.63 per cent noted in Velukkacheera in the fresh state. In the cooked leaves the fibre contents of Perandakodi (0.51%), Tharikeera (0.44%) and Vellathazhuthama (0.42%) were also found to be similar to the content of 0.40 per cent noted in Manalancheera. Significant variation in the fibre content was observed between the raw and cooked leaves.

### Starch

Significant variation in the starch content of raw and cooked leaves and between the raw and cooked leaves was observed. The mean starch content of the leaves was found to be 0.68 g and 0.45 g per 100 g of raw and cooked leaves respectively (Table 8). The starch content of raw leaves varied from 0.061 g to 2.29 g and in the cooked leaves the content varied from 0.009 g to 1.7 g per 100 g. Highest starch content was noted in Nadancheera and in Kattukadukcheera in the raw and cooked leaves respectively, while the lowest content in both stages was found in

**Table 8. Mean nutritive value of leafy vegetables (raw and cooked) consumed by different tribal communities of Idukki District (per 100g FWB)**

Sl. No.	Name of foodstuff	Fibre (g)		Starch (g)		Free amino acid (mg)	
		Raw	Cooked	Raw	Cooked	Raw	Cooked
1	Anacheviyancheera	2.09	1.51	0.926	0.39	0.002	-
2	Arakeera	-	-	-	-	-	-
3	Avananakkucheera	1.22	0.98	0.723	0.474	0.005	0.003
4	Chembila	1.15	0.79	0.179	0.105	0.003	-
5	Cherucheera	1.59	1.39	1.40	0.586	0.007	0.005
6	Chumalacheera	1.54	0.94	0.705	0.337	0.004	0.002
7	Kadamankutticheera	2.12	1.72	0.518	0.227	0.022	0.015
8	Kadukcheera (a)	3.31	2.44	0.925	0.636	0.008	0.005
9	Kadukcheera (b)	1.98	1.97	1.11	0.851	0.005	0.002
10	Kaipucheera	1.27	0.84	0.786	0.541	0.019	-
11	Kallemthamara	0.81	0.6	0.386	0.148	0.004	0.002
12	Kattukadukcheera	2.39	2.09	2.17	1.70	0.012	0.008
13	Kattumuringa	1.51	1.36	1.10	0.758	0.074	0.064
14	Keezharnelli (big)	2.04	1.88	0.584	1.39	0.021	0.018
15	Keezharnelli (small)	5.52	2.93	0.832	0.448	0.008	0.005
16	Kodappakeera	2.1	1.86	0.710	0.428	0.008	-
17	Kozhikodalancheera	1.95	1.41	0.276	0.204	0.007	0.003
18	Kuppacheera	1.66	0.99	0.467	0.432	0.012	0.002
19	Manalancheera	0.72	0.40	0.077	0.03	0.002	0.002
20	Mangacheera	1.69	1.6	0.687	0.337	0.017	0.013
21	Mathipuli	1.63	1.28	0.942	0.582	0.006	0.004
22	Mulakucheera	1.06	0.73	0.277	0.170	0.011	-
23	Mullancheera	1.47	0.97	0.617	0.610	0.007	0.004
24	Nadancheera	1.89	1.44	2.29	1.47	-	-
25	Nayirunjikeera	1.39	0.76	1.01	0.805	0.01	0.006
26	Neeruvatti	2.19	1.61	0.413	0.354	0.017	-
27	Nerinjikeera	2.39	1.68	0.406	0.295	0.027	0.022
28	Ottakeera	1.44	1.43	0.301	0.252	0.005	0.002
29	Palachettikeera	2.4	1.18	0.986	0.423	0.005	0.003
30	Palakeera	-	-	0.368	-	-	-
31	Perandakodi	0.92	0.51	0.124	0.064	0.003	0.002
32	Potticheera	1.62	1.46	0.396	0.265	0.025	0.017
33	Pulikeera	2.66	2.07	0.501	0.297	0.013	0.008
34	Shingacheera	1.3	0.77	0.443	0.350	0.13	0.006
35	Sonakeera	4.49	2.86	0.631	0.477	0.005	0.002
36	Thakara	2.21	2.15	0.541	0.356	0.008	0.004
37	Thakkila	1.38	0.97	0.895	0.388	-	-
38	Thalamuzhakeera	2.22	1.21	1.07	0.632	0.008	0.004
39	Thalu	0.67	0.54	0.162	0.102	-	-
40	Thandankeera	2.2	1.38	0.998	0.230	0.008	0.003
41	Tharikeera	0.85	0.44	0.061	0.009	0.008	0.006
42	Thazhuthama	1.27	1.1	0.289	0.270	0.008	0.005
43	Thoppikeera	1.9	1.54	0.346	0.230	0.011	0.007
44	Thumbacheera	2.01	1.37	1.20	0.829	-	-

Contd.

Table 8. Continued

Sl. No.	Name of foodstuff	Fibre (g)		Starch (g)		Free amino acid (mg)	
		Raw	Cooked	Raw	Cooked	Raw	Cooked
45	Valiyacheviyancheera	2.34	1.87	0.914	0.522	0.005	-
46	Vazhukkacheera	0.91	0.76	0.218	0.178	0.006	0.005
47	Vazhukkakeera	0.95	0.55	0.747	0.454	0.005	0.002
48	Vellathazhuthama	0.73	0.42	0.325	0.200	0.002	0.001
49	Velukkacheera	0.63	-	0.255	0.123	0.020	-
	Means $\pm$ SE	1.80 $\pm$ 0.59	1.34 $\pm$ 0.04	0.68 $\pm$ 0.04	0.45 $\pm$ 0.03	0.013 $\pm$ 0.001	0.008 $\pm$ 0.001
	CD	0.254	0.113	0.113	0.085	0.003	0.003
	CD between raw & cooked	0.027		0.013		0.00003	

FWB- Fresh Weight Basis

Tharikeera. The starch content of Kattukadukcheera in the fresh stage was found to be the only leaf which had a content on par with the content noted in Nadancheera. The starch contents of Manalancheera, Perandakodi and Thalu which varied from 0.077 to 0.162 per cent were found to be similar to the lowest content seen in Tharikeera in the raw state, while in the cooked leaves the starch contents of Perandakodi and Manalancheera were found to be on par with the content present in cooked Tharikeera.

#### **Free amino acid**

The mean free amino acid content of the leaves was found to be 0.013 mg and 0.008 mg per 100 g in fresh and cooked leaves respectively (Table 8). Significant variation in the free amino acid content was observed in the raw and cooked leaves and between the raw and cooked leaves. The free amino acid content of raw leaves varied from 0.002 mg to 0.074 mg 100 g<sup>-1</sup> and in the cooked leaves it varied from 0.001 mg to 0.064 mg per 100 g. The lowest content was noted in Anancheviancheera, Manalancheera and Vellathazhuthama in the raw leaves and the highest content was observed in Kattumuringa. In the cooked leaves highest and lowest contents were noted in Kattumuringa and Vellathazhuthama respectively. None of the leaves had a free amino acid content on par with the highest content observed in Kattumuringa in the raw and cooked stages respectively. The leaves with the free amino acid content in the range of 0.003 to 0.005 mg per 100 g in the fresh stage and 0.002 to 0.004 mg in the cooked stage were found to be on par with the lowest content of 0.002 mg and 0.001 mg per 100 g in the raw and cooked stages respectively.

#### **Vitamin C**

Vitamin C content of fresh leaves varied from 16.26 mg in Sonakeera to 248.66 mg per 100 g in Kuppacheera. After cooking the content varied from 6.04 mg in Sonakeera to 121.02 mg in Kuppacheera (Table 9). The mean vitamin C content was found to be 98.99 mg in fresh and 38.65 mg in cooked leaves with significant variation in the Vitamin C content of leaves before and after cooking. Significant variation between the raw and cooked leaves was also noticed. None of the leaves analysed were found to have a similar vitamin C content observed in Kuppacheera

Table 9. Mean nutritive value of leafy vegetables (raw and cooked) consumed by the tribal communities of Idukki District (per 100 g FWB)

Sl. No.	Name of foodstuff	Vitamin C (mg)		$\beta$ Carotene ( $\mu$ g)	
		Raw	Cooked	Raw	Cooked
1	Anacheviyancheera	154.62	46.25	645	473
2	Arakkeera	186.86	92.04	-	-
3	Avananakkucheera	41.19	14.52	1297	810
4	Chembila	41.04	14.42	803	620
5	Cherucheera	216.36	103.48	1676	1467
6	Chumalacheera	179.61	88.94	1538	1125
7	Kadammanakutticheera	105.63	38.98	1712	1071
8	Kadukcheera (a)	60.04	22.6	1462	721
9	Kadukcheera (b)	180.3	49.58	2637	1352
10	Kaipucheera	92.49	38.82	1350	842
11	Kallethamara	57.51	19.17	557	313
12	Kattukadukcheera	96.75	39.66	1170	710
13	Kattumuringa	130.87	49.92	1055	886
14	Keezharnelli (big)	129.17	56.52	1622	926
15	Keezharnelli (small)	118.83	30.12	1376	1048
16	Kodappakeera	41.41	13.96	1003	570
17	Kozhikodalancheera	107.03	48.91	947	620
18	Kuppacheera	248.66	121.02	2367	1786
19	Manalancheera	40.53	22.52	195	136
20	Mangacheera	81.62	31.73	1710	1493
21	Mathipuli	116.66	50.23	1512	1434
22	Mulakucheera	75.14	17.34	1248	962
23	Mullancheera	216.36	58.05	1570	1122
24	Nadancheera	113.87	52.52	1032	821
25	Nayirunjikeera	125.26	26.74	1798	363
26	Neeruvatti	51.39	16.97	1232	1117
27	Nerinjikeera	99.84	31.52	858	606
28	Ottakeera	33.95	13.06	1377	940
29	Palachettikeera	43.17	18.14	1159	766
30	Palakeera	195.91	84.18	749	-
31	Perandakodi	67.73	23.06	118	50
32	Potticheera	123.68	39.89	1763	1586
33	Pulikeera	56.39	26.89	682	567
34	Shingacheera	111.85	53.54	471	418
35	Sonakeera	16.26	6.04	1551	949
36	Thakara	154.8	68.11	2081	977
37	Thakkila	50.0	32.17	988	796
38	Thalamuzhakeera	42.02	15.27	850	622
39	Thalu	86.72	32.17	296	221

Contd.

Table 9. Continued

Sl. No.	Name of foodstuff	Vitamin C (mg)		$\beta$ Carotene ( $\mu$ g)	
		Raw	Cooked	Raw	Cooked
40	Thandankeera	79.52	32.65	1360	941
41	Tharikeera	42.84	27.08	517	297
42	Thazhuthama	41.45	18.46	694	438
43	Thoppikeera	37.69	19.17	1694	1358
44	Thumbacheera	97.37	47.71	947	736
45	Valiyacheviyancheera	77.73	15.42	1117	959
46	Vazhukkacheera	59.33	10.06	410	363
47	Vazhukkakeera	66.4	25.38	624	312
48	Vellathazhuthama	43.76	17.84	91	44
49	Velukkacheera	111.89	52.71	368	-
	Means $\pm$ SE	98.99 $\pm$ 4.63	38.65 $\pm$ 2.28	1181.57 $\pm$ 33.38	809.523 $\pm$ 30.61
	CD	13.06	6.43	94.13	86.32
	CD between raw & cooked	1.41		12.65	

FWB – Fresh Weight Basis



Table 9. Continued

Sl. No.	Name of foodstuff	Vitamin C (mg)		$\beta$ Carotene ( $\mu$ g)	
		Raw	Cooked	Raw	Cooked
40	Thandankeera	79.52	32.65	1360	941
41	Tharikeera	42.84	27.08	517	297
42	Thazhuthama	41.45	18.46	694	438
43	Thoppikeera	37.69	19.17	1694	1358
44	Thumbacheera	97.37	47.71	947	736
45	Valiyacheviyancheera	77.73	15.42	1117	959
46	Vazhukkacheera	59.33	10.06	410	363
47	Vazhukkakeera	66.4	25.38	624	312
48	Vellathazhuthama	43.76	17.84	91	44
49	Velukkacheera	111.89	52.71	368	-
	Means $\pm$ SE	98.99 $\pm$ 4.63	38.65 $\pm$ 2.28	1181.57 $\pm$ 33.38	809.523 $\pm$ 30.61
	CD	13.06	6.43	94.13	86.32
	CD between raw & cooked	1.41		12.65	

FWB - Fresh Weight Basis

either in fresh or cooked stages. The vitamin C content of cooked Vazhukkacheera was found to be similar to the lowest content noted in cooked Sonakeera.

### Beta carotene

The mean  $\beta$  carotene content of the leaves was found to be 1181.57  $\mu\text{g}$  (raw) and 809.52  $\mu\text{g}$  (cooked) per 100g with significant variation in the  $\beta$  carotene content of raw and cooked leaves and between the raw and cooked leaves (Table 9). The highest  $\beta$  carotene content was noted in Kadukcheera (b) in the fresh (2637  $\mu\text{g}$  100  $\text{g}^{-1}$ ) and in Kuppacheera in the cooked leaves (1786  $\mu\text{g}$  100  $\text{g}^{-1}$ ). The lowest  $\beta$  carotene content was noted in Vellathazhuthama in the raw (91  $\mu\text{g}$  100  $\text{g}^{-1}$ ) and cooked (44  $\mu\text{g}$  100  $\text{g}^{-1}$ ) leaves. None of the leaves had a similar  $\beta$  carotene content observed either in Kadukcheera or in Kuppacheera in the fresh and cooked stages respectively. However, the  $\beta$  carotene content of Perandakodi was the only leaf which had a  $\beta$  carotene content on par with the  $\beta$  carotene content noted in Vellathazhuthama both in raw and cooked stages.

### Calcium

Significant variation in the calcium content was noticed within fresh and cooked leaves and between the fresh and cooked leaves (Table 10). Highest calcium content of 0.923 per cent in the fresh and 0.789 per cent in the cooked leaves was noticed in Anacheviyancheera and the lowest content of 0.017 (raw) and 0.01 per cent (cooked) was observed in Manalancheera. The mean calcium content was found to be 0.317g in raw and 0.229 g 100  $\text{g}^{-1}$  in cooked leaves. The calcium contents of Avanakkucheera, Kallethamara, Kozhikodalancheera, Shingacheera, Thakkila, Tharিকেera and Vazhukkacheera were having almost similar content observed in Manalancheera in the fresh state. Cooked Avanakkucheera and Thakkila were also having a similar calcium contents which was observed in cooked Manalancheera .

### Phosphorus

Phosphorus content varied from 0.015 g to 0.158 g 100  $\text{g}^{-1}$  in the raw and from 0.009 g to 0.142 g 100  $\text{g}^{-1}$  in cooked leaves (Table 10). Highest and lowest phosphorus contents were observed in Shingacheera and Kallethamara respectively

Table 10. Mean nutritive value of leafy vegetables (raw and cooked) consumed by the tribal communities of Idukki District (per 100 g FWB)

Sl. No.	Name of foodstuff	Calcium (g)		Phosphorus (g)		Iron (mg)	
		Raw	Cooked	Raw	Cooked	Raw	Cooked
1	Anacheviyancheera	0.923	0.789	0.095	0.075	6.72	2.09
2	Arakkeera	-	-	-	-	8.99	6.48
3	Avananakkucheera	0.027	0.01	0.091	0.053	3.84	0.67
4	Chembila	0.234	0.181	0.094	0.08	0.755	0.455
5	Cherucheera	0.623	0.524	0.103	0.099	10.63	8.58
6	Chumalacheera	0.282	0.181	0.084	0.032	2.06	0.534
7	Kadamankutticheera	0.535	0.477	0.104	0.067	9.12	1.61
8	Kadukcheera (a)	0.355	0.236	0.153	0.128	27.61	17.14
9	Kadukcheera (b)	0.466	0.256	0.079	0.061	12.84	4.12
10	Kaipuchera	0.651	0.504	0.079	0.053	1.28	0.43
11	Kallethamara	0.07	0.044	0.015	0.009	18.3	9.41
12	Kattukadukucheera	-	-	-	-	-	-
13	Kattumuringa	0.227	0.07	0.071	0.068	13.65	10.46
14	Keezharnelli (big)	0.424	0.278	0.101	0.088	1.21	1.01
15	Keezharnelli (small)	0.484	0.391	0.157	0.112	4.8	2.21
16	Kodappakeera	0.282	0.216	0.059	0.039	13.09	0.448
17	Kozhikodalancheera	0.056	0.041	0.133	0.083	10	1.12
18	Kuppacheera	0.336	0.307	0.088	0.056	14.23	9.86
19	Manalancheera	0.017	0.01	0.062	0.041	0.969	0.27
20	Mangacheera	0.098	0.072	0.131	0.115	6.51	0.803
21	Mathipuli	0.343	0.191	0.049	0.038	16.99	13.65
22	Mulakucheera	0.253	0.188	0.03	0.019	3.52	1.14
23	Mullancheera	0.679	0.531	0.101	0.076	21.56	14.6
24	Nadancheera	-	-	-	-	-	-
25	Nayirunjikeera	0.288	0.216	0.072	0.042	6.98	1.12
26	Neeruvatti	0.411	0.194	0.065	0.048	23.28	12.1
27	Nerinjikeera	0.26	0.209	0.087	0.069	98.08	79.97
28	Ottakeera	0.076	0.048	0.036	0.028	1.75	0.927
29	Palachettikeera	0.182	0.107	0.104	0.081	10.78	4.53
30	Palakeera	-	-	-	-	-	-
31	Perandakodi	0.345	-	0.36	0.024	0.402	0.059
32	Potticheera	0.372	0.279	0.064	0.035	5.99	2.23
33	Pulikeera	0.215	0.195	0.075	0.051	15.5	4.09
34	Shingacheera	0.06	0.051	0.158	0.142	0.314	0.0
35	Sonakeera	0.442	0.368	0.093	0.078	23.6	16.95
36	Thakara	0.847	0.631	0.082	0.066	6.43	4.5
37	Thakkila	0.034	0.017	0.076	0.062	0.258	0.079
38	Thalamuzhakeera	0.452	0.169	0.037	0.036	1.0	0.528

Contd.

Table 10. Continued

Sl. No.	Name of foodstuff	Calcium (g)		Phosphorus (g)		Iron (mg)	
		Raw	Cooked	Raw	Cooked	Raw	Cooked
39	Thalu	-	-	-	-	-	-
40	Thandankeera	0.892	0.654	0.074	0.062	13.27	1.43
41	Tharikeera	0.07	0.047	0.029	0.015	3.12	0.93
42	Thazhuthama	0.204	0.165	0.071	0.049	20.45	2.45
43	Thoppikeera	0.34	0.287	0.079	0.068	3.34	2.49
44	Thumbacheera	0.351	0.256	0.096	0.08	24.65	14.87
45	Valiyacheviyancheera	0.434	-	0.049	0.038	-	-
46	Vazhukkacheera	0.055	0.039	0.027	0.02	1.01	0.452
47	Vazhukkakeera	0.172	0.047	0.031	0.017	6.38	6.2
48	Vellathazhuthama	0.169	0.119	0.028	0.018	0.956	0.23
49	Velukkacheera	0.094	-	0.029	0.019	0.103	-
	Means $\pm$ SE	0.317 $\pm$ 0.02	0.229 $\pm$ 0.01	0.087 $\pm$ 0.001	0.061 $\pm$ 0.001	11.16 $\pm$ 0.34	6.41 $\pm$ 1.36
	CD	0.057	0.028	0.003	0.003	0.969	3.875
	CD between raw & cooked	0.014		0.0008		0.399	

FWB- Fresh Weight Basis

both in raw and cooked stages. Significant variation in the phosphorus content was observed both in fresh and cooked leaves and between the fresh and cooked leaves. Kadukcheera (a) and Keezharnelli small were found to have similar phosphorus contents observed in Shingacheera in the raw stage. The mean phosphorus content was found to be  $0.087 \text{ g } 100 \text{ g}^{-1}$  in raw leaves and  $0.061 \text{ g } 100 \text{ g}^{-1}$  in cooked leaves.

### Iron

Among the leaves analysed for their iron content Nerinjikeera was found to be having the highest content in fresh (98.08 mg) and cooked (79.97 mg) leaves (Table 10). The lowest content was observed in Velukkacheera (0.103 mg) in fresh and Perandakodi (0.059 mg) in cooked. The mean iron content of the leaves was found to be 11.16 mg (raw) and 6.41 mg (cooked) with significant variation within raw and cooked leaves and between the raw and cooked leaves. None of the leaves had a similar iron content observed in Nerinjikeera either in the raw or cooked stages. However, the iron contents in the range of 0.314 to 1.01 mg observed in fresh leaves and 0.079 to 2.49 mg in cooked leaves were found to be on par with the lowest content observed in Vellukkacheera and Perandakodi respectively. Significant variation in the iron content of raw and cooked leaves and between raw and cooked leaves were also observed.

### Sodium

The sodium content of leafy vegetables varied from 2.27 mg to 383.6 mg and in cooked leaves the content varied from 1.48 mg to  $247.25 \text{ mg } 100 \text{ g}^{-1}$  (Table 11). The highest sodium content was observed in Kuppacheera and Keezharnelli (small) in raw and cooked leaves and the lowest was in Manalancheera in both stages. The mean sodium content of leaves was found to be 46.49 mg (raw) and 28.94 mg (cooked) with significant variation within raw and cooked leaves and between raw and cooked leaves. None of the leaves either in the raw or cooked stages were on par with the highest contents observed in Kuppacheera and Keezharnelli (small) respectively. Most of the leaves with a sodium content in between 2.43 to 15.02 mg in fresh stage and in the range of 1.8 to 20.97 mg in the cooked stages were found to be on par with the lowest sodium content found in Manalancheera.

### Potassium

Significant variation in the potassium content of leafy vegetables was observed within raw and cooked and between raw and cooked stages (Table 11). Highest potassium contents of 1473 mg and 794 mg 100 g<sup>-1</sup> were found in Anacheviyan cheera and Mullancheera in the fresh and cooked stages respectively with a mean content of 652.83 mg in raw and 445.58 mg in cooked leaves. The lowest potassium contents of 116 mg and 87 mg 100 g<sup>-1</sup> were noted in Thalu in raw and cooked stages. Significant variation in the potassium contents of fresh and cooked leaves and between fresh and cooked leaves were also found. The potassium contents of raw Thumbacheera and cooked Nayirunjikeera were found to be on par with the highest contents observed in Anacheviyancheera and Mullancheera respectively. The potassium contents of Kallethamara, Manalancheera, Mathipuli and Perandakodi in the raw and Kallethamara and Perandakodi in the cooked stages were on par with the lowest potassium contents noted in Thalu in the raw and cooked stages respectively.

### Magnesium

As revealed in Table 11 the magnesium content of the leaves varied from 0.088 mg to 0.745 mg in raw leaves and 0.041 mg to 0.612 mg 100 g<sup>-1</sup> in cooked leaves. Highest magnesium contents in both stages were found in Kadukcheera (a) and the lowest in Vellathazhuthama (raw) and Thakara (cooked). The mean magnesium content was found to be 0.306 mg in fresh leaves and 0.239 mg in cooked leaves with significant variation within raw and cooked leaves and between raw and cooked leaves. The magnesium content of Nerinjikeera (0.733 mg 100 g<sup>-1</sup>) was found to be having a similar content observed in raw Kadukcheera (a). The magnesium contents of Kallethamara, Vazhukkakeera and Velukkacheera were also found to be on par with the lowest magnesium content observed in Vellathazhuthama in raw stage. None of the leaves in cooked stage had a magnesium content on par with either the highest or lowest content observed in Kadukcheera (a) and Thakara respectively.

### Copper

The copper content of the fresh leafy vegetables varied from 0.045 mg to 0.458 mg with the mean copper content of 0.208 mg 100 g<sup>-1</sup> (Table 12). In the cooked

Table 11. Mean nutritive value of leafy vegetables (raw and cooked) consumed by the tribal communities of Idukki District (per 100 g FWB)

Sl No.	Name of foodstuff	Sodium (mg)		Potassium (mg)		Magnesium (mg)	
		Raw	Cooked	Raw	Cooked	Raw	Cooked
1	Anacheviyancheera	12.63	6.4	1473	-	0.164	0.109
2	Arakkeera	-	-	925	713	-	-
3	Avananakkucheera	73.45	47.73	684	473	0.201	0.15
4	Chembila	4.11	2.49	367	283	0.181	0.149
5	Cherucheera	24.88	18.72	864	415	0.291	0.259
6	Chumalacheera	7.09	6.26	774	580	0.347	0.265
7	Kadamankutticheera	7.58	6.87	814	686	0.37	0.315
8	Kadukcheera (a)	295	183.74	610	447	0.745	0.612
9	Kadukcheera (b)	27.91	9.16	826	551	0.372	0.311
10	Kaipuchera	7.18	5.18	1085	414	0.296	0.225
11	Kallethamara	2.94	1.96	168	118	0.114	0.076
12	Kattukadukucheera	-	-	-	-	-	-
13	Kattumuringa	21.69	17.44	458	371	0.458	0.388
14	Keezharnelli (big)	7.14	4.7	469	385	0.203	0.181
15	Keezharnelli (small)	312.55	247.25	572	414	0.473	0.404
16	Kodappakeera	8.04	6.87	689	613	0.284	0.254
17	Kozhikodalancheera	10.92	8.58	725	570	0.285	0.12
18	Kuppacheera	383.6	57.2	727	652	0.198	0.155
19	Manalancheera	2.27	1.48	268	208	0.177	0.125
20	Mangacheera	6.56	4.09	601	484	0.215	0.177
21	Mathipuli	19.95	6.7	239	197	0.521	0.357
22	Mulakucheera	5.2	4.0	509	370	0.131	0.081
23	Mullancheera	57.92	50.22	960	794	0.319	0.217
24	Nadancheera	-	-	-	-	-	-
25	Nayirunjikeera	10.14	9.8	870	772	0.156	0.06
26	Neeruvatti	15.02	11.22	351	256	0.175	0.125
27	Nerinjikeera	7.6	5.43	505	378	0.733	0.62
28	Ottakeera	11.48	9.22	570	429	0.233	0.192
29	Palachettikeera	132.6	108.08	901	472	0.315	0.258
30	Palakeera	-	-	-	-	-	-
31	Perandakodi	3.98	2.81	188	119	0.144	0.094
32	Potticheera	9.4	7.5	799	581	0.255	0.186
33	Pulikeera	30.53	19.2	305	182	0.359	0.229
34	Shingacheera	11.47	6.43	416	398	0.488	0.423
35	Sonakeera	21.44	20.97	969	833	0.484	0.436
36	Thakara	8.82	5.57	617	406	0.478	0.041
37	Thakkila	27.09	9.36	714	234	0.248	0.121
38	Thalamuzhakeera	5.22	3.74	504	300	0.217	0.216

Contd.

Table 11. Continued

SI No.	Name of foodstuff	Sodium (mg)		Potassium (mg)		Magnesium (mg)	
		Raw	Cooked	Raw	Cooked	Raw	Cooked
39	Thalu	-	-	116	87	-	-
40	Thandankeera	17.17	11.35	335	258	0.171	0.14
41	Tharikeera	3.2	1.8	595	188	0.144	0.058
42	Thazhuthama	5.04	3.12	471	364	0.177	0.143
43	Thoppikeera	9.41	7.97	996	635	0.281	0.253
44	Thumbacheera	14.7	10.29	1327	536	0.188	0.139
45	Valiyacheviyancheera	24.5	-	-	-	0.327	-
46	Vazhukkacheera	2.43	2.28	571	509	0.186	0.167
47	Vazhukkakeera	18.47	3.54	481	169	0.11	0.084
48	Vellathazhuthama	4.2	3.6	318	224	0.088	0.061
49	Velukkacheera	3.19	2.1	563	-	0.12	-
	Means $\pm$ SE	46.49 $\pm$ 4.51	28.94 $\pm$ 14.04	652.83 $\pm$ 56.8	445.58 $\pm$ 21.72	0.306 $\pm$ 0.01	0.239 $\pm$ 0.001
	CD	12.85	40.01	160.18	61.89	0.028	0.003
	CD between raw & cooked	4.21		16.34		0.0019	

FWB- Fresh Weight Basis



leaves the copper content varied from 0.029 mg to 0.341 mg with a mean content of 0.147 mg 100 g<sup>-1</sup>. The highest copper content was noted in Keezharnelli (small) and Neeruvatti and the lowest in Velukkacheera and Kaipucheera in the raw and cooked leaves, respectively. The variation observed in the copper content of the leaves was found to be statistically significant both in the raw and cooked leaves and between the raw and cooked leaves. The copper contents of Mangacheera and Valiyacheviyan cheera were found to be on par with the highest copper content observed in Keezharnelli (small) and the copper contents in the range of 0.058 to 0.105 mg present in different leaves were also found to be on par with the lowest content present in fresh Vellukkacheera. In the cooked leaves the copper content of Cherucheera, Chumalacheera and Mullancheera were also found to be on par with the highest content noticed in Neeruvatti. The copper contents in between 0.033 mg to 0.108 mg 100 g<sup>-1</sup> present in different leaves were similar to the lowest content seen in Kaipucheera.

### **Manganese**

Significant variation in the manganese content of fresh and cooked leaves was observed which varied from 0.15 mg (Perandakodi) to 50.27 mg (Kadukcheera - b) in raw leaves and from 0.05 mg (Perandakodi) to 6.7 mg (Mathipuli) in cooked leaves (Table 12). None of the leaves had a manganese content on par with the highest content observed in Kadukcheera and Mathipuli in the raw and cooked stages respectively. However, the manganese contents of various leaves in the range of 0.25 mg to 2.13 mg in fresh leaves and 0.18 mg to 1.3 mg in cooked leaves were found to be on par with the lowest contents observed in fresh and cooked Perandakodi respectively. The variation observed with respect to the manganese contents between the raw and cooked leaves were also found to be statistically significant. The mean manganese content of the leaves was found to be 4.17 mg (raw) and 1.87 mg (cooked).

### **Zinc**

The mean zinc content was found to be 0.81 mg 100 g<sup>-1</sup> in raw leaves and 0.49 mg 100 g<sup>-1</sup> in cooked leaves (Table 12). Significant variation in the zinc content was observed in raw and cooked leaves and between the raw and cooked leaves.

Table 12. Mean nutritive value of leafy vegetables (raw and cooked) consumed by the tribal communities of Idukki District (per 100 g FWB)

Sl No.	Name of foodstuff	Copper (mg)		Manganese (mg)		Zinc (mg)	
		Raw	Cooked	Raw	Cooked	Raw	Cooked
1	Anacheviyancheera	0.238	0.121	1.09	1.04	1.19	0.692
2	Arakkeera	0.14	0.123	-	-	-	-
3	Avananakkucheera	0.051	0.033	1.53	0.872	0.452	0.249
4	Chembila	0.356	0.102	4.18	0.262	1.18	0.904
5	Cherucheera	0.263	0.258	30.75	1.62	0.764	0.615
6	Chumalacheera	0.284	0.256	14.52	5.11	0.792	0.417
7	Kadamankutticheera	0.222	0.179	1.78	1.1	1.56	0.506
8	Kadukcheera (a)	0.132	0.092	5.1	3.98	0.116	0.039
9	Kadukcheera (b)	0.287	0.25	50.27	0.923	1.49	0.233
10	Kaipuchera	0.068	0.029	0.70	0.56	0.525	-
11	Kallethamara	0.087	0.049	1.68	1.17	0.49	0.294
12	Kattukadukucheera	-	-	-	-	-	-
13	Kattumuringa	0.220	0.122	2.17	0.763	1.01	0.218
14	Keezharnelli (big)	0.216	0.157	2.04	1.88	0.752	0.408
15	Keezharnelli (small)	0.458	0.161	2.13	1.84	1.5	0.532
16	Kodappakeera	0.148	0.13	0.984	0.584	1.48	1.17
17	Kozhikodalancheera	0.136	0.124	0.935	0.512	0.936	0.384
18	Kuppacheera	0.188	0.181	3.43	2.17	1.22	0.274
19	Manalancheera	0.066	0.039	0.609	0.32	0.479	0.32
20	Mangacheera	0.384	0.22	0.82	0.364	0.637	0.492
21	Mathipuli	0.247	0.197	10.85	6.7	0.256	0.217
22	Mulakucheera	0.145	0.10	0.868	0.6	0.124	0.1
23	Mullancheera	0.272	0.264	1.62	1.01	1.21	1.13
24	Nadancheera	-	-	-	-	-	-
25	Nayirunjikeera	0.343	0.152	8	2.87	0.338	0.232
26	Neeruvatti	0.371	0.341	1.95	1.9	0.585	0.165
27	Nerinjikeera	0.347	0.243	3.15	2.24	1.74	1.4
28	Ottakeera	0.227	0.132	0.832	0.755	0.512	0.453
29	Palachettikeera	0.276	0.151	1.14	0.855	0.462	0.328
30	Palakeera	-	-	-	-	-	-
31	Perandakodi	0.101	0.061	0.15	0.05	0.3	0.153
32	Potticheera	0.241	0.147	0.94	0.515	0.188	0.147
33	Pulikeera	0.279	0.173	14.54	12	0.444	0.384
34	Shingacheera	0.158	0.129	1.37	1.29	1.91	1.8
35	Sonakeera	0.26	0.186	3.77	2.65	1.82	1.4
36	Thakara	0.258	0.19	1.98	1.39	0.882	-
37	Thakkila	0.332	0.246	1.38	1.0	0.516	0.144
38	Thalamuzhakeera	0.098	0.057	1.96	1.32	0.58	0.44
39	Thalu	0.058	0.053	-	-	-	-
40	Thandankeera	0.261	0.184	1.78	1.55	0.446	0.344
41	Tharikeera	0.062	0.034	1.05	0.4	0.34	0.2
42	Thazhuthama	0.204	0.108	1.42	0.937	0.364	0.26
43	Thoppikeera	0.168	0.125	0.905	0.664	0.633	0.498

Contd.

Table 12. continued

Sl No.	Name of foodstuff	Copper (mg)		Manganese (mg)		Zinc (mg)	
		Raw	Cooked	Raw	Cooked	Raw	Cooked
44	Thumbacheera	0.325	0.131	1.66	1.26	0.474	0.21
45	Valiyacheviyancheera	0.376	0.214	3.39	2.46	0.702	0.428
46	Vazhukkacheera	0.105	0.076	1.34	0.95	0.324	0.23
47	Vazhukkakeera	0.174	0.042	0.851	0.624	0.156	0.111
48	Vellathazhuthama	0.09	0.06	0.25	0.18	0.083	0.06
49	Velukkacheera	0.045	-	0.336	-	0.928	0.168
	Means $\pm$ SE	0.208 $\pm$ 0.03	0.147 $\pm$ 0.03	4.17 $\pm$ 0.7	1.87 $\pm$ 0.52	0.81 $\pm$ 0.15	0.49 $\pm$ 0.07
	CD	0.085	0.085	1.98	1.48	0.427	0.199
	CD between raw & cooked	0.011		0.253		0.049	

FWB- Fresh Weight Basis

Shingacheera was found to be having the highest zinc content both before (1.91 mg 100 g<sup>-1</sup>) and after (1.8 mg 100 g<sup>-1</sup>) cooking. The lowest zinc content was in Vellathazhuthama (0.083 mg 100 g<sup>-1</sup>) in raw leaves and in Kadukcheera (a) (0.039 mg 100 g<sup>-1</sup>) in the cooked leaves. Among the raw leaves analysed for zinc contents Kadammankutticheera, Kadukcheera (b), Keezharnelli (small), Nerinjikeera and Sonakeera were found to be having a zinc content on par with the highest content observed in raw Shingacheera. None of the leaves had a similar zinc content which was observed in cooked Shingacheera. However, various leaves with a zinc content in the range of 0.116 to 0.49 mg 100 g<sup>-1</sup> in fresh and 0.06 to 0.233 mg 100 g<sup>-1</sup> in cooked stages were found to be on par with the lowest content observed in Vellathazhuthama and Kadukcheera in the raw and cooked leaves respectively.

## I. B. Vegetables

### Moisture

Among the thirteen vegetables collected from Idukki district, Akidikka was found to have the highest moisture content in the raw (95.35%) and cooked (96.04%) stages (Table 13). The lowest was in Putharichunda (61.61%) in the raw and Kaippuchunda (66.73%) in the cooked stages. Mean moisture content was found to be 88.36 per cent and 84.61 per cent in the raw and cooked stages respectively. Significant variation in the moisture content of vegetables was observed both in the raw and cooked and between the raw and cooked stages. The moisture contents of raw Thaluthandu and cooked Chembuthandu and Thaluthandu were found to be on par with the highest moisture contents observed in raw and cooked Akidikka respectively.

### Protein

The mean protein contents of raw and cooked vegetables were 2.8 g and 1.76 g respectively with significant variation in the protein contents of the raw and cooked vegetables and between the raw and cooked vegetables (Table 13). The protein content of raw vegetables varied from 0.79 per cent (Akidikka) to 5.76 per cent (Putharichunda) while in the cooked vegetables the content varied from 0.61 per cent (Chembuthandu) to 4.4 per cent (Kaippuchunda). None of the raw vegetables had a protein content similar to that observed in Putharichunda in the raw stage. In the

**Table 13. Mean nutritive value of vegetables (raw & cooked) consumed by the tribal communities of Idukki District (per 100 g FWB)**

Sl. No.	Name of foodstuff	Moisture (g)		Protein (g)	
		Raw	Cooked	Raw	Cooked
1	Akidikka	95.35	96.04	0.79	0.63
2	Chembuthandu	92.37	95.1	0.97	0.61
3	Eenthinkaya	76.06	78.18	5.51	-
4	Kaipuchunda	64.43	66.73	4.87	4.4
5	Kallipoovu	89.67	91.93	2.6	2.06
6	Kattuchakka	61.98	64.55	-	-
7	Kattumanga	78.29	76.52	1.04	0.98
8	Kattupana	84.8	-	1.49	-
9	Kattuthakkali	89.07	90.86	1.98	1.56
10	Mullikka	86.47	88.90	2.95	2.22
11	Putharichunda	61.61	86.4	5.76	2.71
12	Thaluthandu	94.26	95.49	0.86	0.65
13	Uriikka	70.39	-	4.82	-
	Means $\pm$ SE	88.36 $\pm$ 0.64	84.61 $\pm$ 0.38	2.80 $\pm$ 0.07	1.76 $\pm$ 0.02
	CD	1.95	1.18	0.215	0.064
	CD between raw & cooked	0.387		0.047	

FWB- Fresh Weight Basis

cooked vegetables, the protein content of Akidikka and Thaluthandu were found to be on par with the lowest content observed in Chembuthandu. The protein contents of raw Chembuthandu and Thaluthandu were on par with the lowest content noticed in raw Akidikka.

### **Fibre**

Putharichunda and Thaluthandu were having the highest and lowest fibre contents respectively both in raw and cooked stages with significant variation in the fibre contents of the raw and cooked vegetables and between the raw and cooked vegetables (Table 14). The mean fibre content was found to be 2.69 per cent in raw and 1.00 per cent in cooked vegetables. None of the vegetables had a similar fibre content on par with the highest or lowest values observed in Putharichunda or Thaluthandu in raw and cooked stages.

### **Starch**

Significant variation in the starch content of the vegetables was observed within and between the raw and cooked with a mean content of 0.80 per cent in raw and 0.4 per cent in cooked vegetables (Table 14). The starch contents of the raw vegetables varied from 0.13 g to 2.55 g 100 g<sup>-1</sup> and in cooked vegetables the content varied from 0.05 to 1.03 g 100 g<sup>-1</sup>. The highest starch contents were in Putharichunda and Kattumanga in the fresh and cooked stages respectively and the lowest was in Kallipoovu both in raw and cooked vegetables. None of the vegetables had a starch content on par with the highest contents found in Putharichunda or Kattumanga in raw and cooked stages while the starch contents of raw Chembuthandu, Kattuthakkali and Thaluthandu and cooked Chembuthandu were found to be almost similar to the lowest content found in raw and cooked Kallipoovu respectively.

### **Free amino acid**

Significant variation in the free amino acid content of the raw and cooked vegetables and between the raw and cooked vegetables was noticed with a mean free amino acid content of 0.013 mg in raw and 0.009 mg in cooked vegetables (Table 14). In the raw stage the free amino acid contents varied from 0.0002 mg in Akidikka to

**Table 14. Mean nutritive value of vegetables (raw & cooked) consumed by the tribal communities of Idukki District (per 100 g FWB)**

Sl. No.	Name of foodstuff	Fibre (g)		Starch (g)		Free amino acid (mg)	
		Raw	Cooked	Raw	Cooked	Raw	Cooked
1	Akidikka	0.58	0.21	1.32	0.419	0.0002	-
2	Chembuthandu	0.72	0.23	0.27	0.072	-	-
3	Eenthinkaya	2.4	1.15	1.07	0.463	-	-
4	Kaipuchunda	7.92	1.83	1.21	0.711	0.02	0.009
5	Kallipoovu	1.37	0.65	0.13	0.05	0.028	0.02
6	Kattuchakka	-	-	-	-	-	-
7	Kattumanga	1.94	1.11	1.27	1.03	0.005	0.005
8	Kattupana	1.44	-	0.548	-	0.003	-
9	Kattuthakkali	0.82	0.38	0.19	0.137	0.01	0.009
10	Mullikka	1.29	0.555	0.355	0.251	0.01	0.007
11	Putharichunda	10.88	3.81	2.55	0.749	0.041	0.013
12	Thaluthandu	0.28	0.09	0.164	0.114	0.002	0.002
13	Urikka	-	-	0.569	-	-	-
	<b>Means <math>\pm</math> SE</b>	<b>2.69<math>\pm</math> 0.04</b>	<b>1.00<math>\pm</math> 0.03</b>	<b>0.80<math>\pm</math> 0.06</b>	<b>0.4<math>\pm</math> 0.01</b>	<b>0.013<math>\pm</math> 0.001</b>	<b>0.009<math>\pm</math> 0.001</b>
	<b>CD</b>	<b>0.124</b>	<b>0.094</b>	<b>0.184</b>	<b>0.031</b>	<b>0.003</b>	<b>0.003</b>
	<b>CD between raw &amp; cooked</b>	<b>0.034</b>		<b>0.0076</b>		<b>0.0003</b>	

FWB- Fresh Weight Basis

0.041 mg in Putharichunda. The free amino acid contents of raw Kattupana and Thaluthandu were found to be on par with the lowest content observed in raw Akidikka. In the cooked vegetables the contents varied from 0.002 mg in Thaluthandu to 0.02 mg 100 g<sup>-1</sup> in Kallipoovu. The free amino acid content of Kattumanga was found to be on par with the content observed in Thaluthandu.

### **Vitamin C**

The vitamin C content of the raw vegetables varied from 8.12 mg in Mullikka to 194.74 mg in Kattumanga, with a mean vitamin C content of 39.24 mg 100 g<sup>-1</sup> (Table 15). In the cooked vegetables the content varied from 4.15 mg in Chembuthandu to 71.34 mg in Kattumanga with a mean content of 15.50 mg 100 g<sup>-1</sup>. Significant variation in the vitamin C content was observed in raw and cooked vegetables and between the raw and cooked vegetables. None of the vegetables had a vitamin C content on par with that observed in raw and cooked Kattumanga. However, the vitamin C contents of raw Chembuthandu and cooked Eenthinkaya, Kaipuchunda and Mullikka were found to be on par with the lowest vitamin C content of cooked Chembuthandu.

### **Beta carotene**

The mean beta carotene contents of fresh and cooked vegetables were found to be 105.07 µg and 69.85 µg 100 g<sup>-1</sup> respectively with significant variation in the beta carotene content of raw and cooked vegetables (Table 15). The highest contents were found in Putharichunda (186.18 µg) and Kattumanga (152.61 µg) in the raw and cooked stages respectively while the lowest contents were in Thaluthandu (22.96 µg) in the raw state and Chembuthandu (13.69 µg) in the cooked state. Significant variation between the beta carotene content of raw and cooked vegetables was also noted. None of the vegetables had a β carotene content on par with the highest contents observed in raw Putharichunda and cooked Kattumanga. However, the β carotene contents of raw Kattupana and cooked Thaluthandu were on par with the lowest contents observed in raw Thaluthandu and cooked Chembuthandu respectively.



**Table 15. Mean nutritive value of vegetables (raw & cooked) consumed by the tribal communities of Idukki District (per 100 g FWB)**

Sl. No.	Name of foodstuff	Vitamin C (mg)		β Carotene (µg)	
		Raw	Cooked	Raw	Cooked
1	Akidikka	42.43	19.79	144.22	33.41
2	Chembuthandu	8.68	4.15	61.22	13.69
3	Eenthinkaya	11.11	4.72	38.12	-
4	Kaipuchunda	17.66	6.41	135.0	105.92
5	Kallipoovu	29.04	10.27	161.59	111.92
6	Kattuchakka	12.24	8.06	-	-
7	Kattumanga	194.74	71.34	163.01	152.61
8	Kattupana	21.26	-	23.71	-
9	Kattuthakkali	22.58	13.14	156.82	122.42
10	Mullikka	8.12	5.23	48.86	32.86
11	Putharichunda	13.96	11.94	186.18	41.61
12	Thaluthandu	-	-	22.96	14.11
13	Urikka	53.24	-	119.14	-
	Means ± SE	39.24±0.69	15.50±0.72	105.07±2.96	69.85±1.39
	CD	2.12	2.26	9.09	4.43
	CD between raw & cooked	0.615		1.46	

FWB - Fresh Weight Basis

### Calcium

The calcium content varied from 0.004 g to 0.316 g in raw vegetables and 0.00 g to 0.113 g in cooked vegetables (Table 16). The highest calcium content was noted in Putharichunda both in raw and cooked vegetables while the lowest content was in Kattuthakkali and Kattupana in the raw and cooked vegetables respectively. The mean calcium contents of raw and cooked vegetables were 0.125 g and 0.07 g 100 g<sup>-1</sup> respectively with significant variation within and between the raw and cooked vegetables.

### Phosphorus

The mean phosphorus content of vegetables was found to be 0.052 g and 0.016 g 100 g<sup>-1</sup> in the raw and cooked stages respectively (Table 16). The phosphorus contents of raw vegetables varied from 0.01 g to 0.157 g 100 g<sup>-1</sup> with the highest content in Eenthinkaya and the lowest in Kattumanga. In the cooked vegetables the highest content of 0.026 g 100 g<sup>-1</sup> was observed in Kattuthakkali and Mullikka and the lowest content of 0.008 g 100 g<sup>-1</sup> in Kallipoovu. The variation observed in the phosphorus content of vegetables was found to be statistically significant both in the raw and cooked stages and between the raw and cooked vegetables. The phosphorus content of raw Kallipoovu and cooked Kattumanga were found to be on par with the lowest content observed in raw Kattumanga and cooked Kallipoovu respectively.

### Iron

The iron content of raw vegetables varied from 0.083 mg (Kattumanga) to 1.48 mg (Urikka) 100 g<sup>-1</sup> with the mean content of 0.854 mg 100 g<sup>-1</sup> (Table 16). In the cooked vegetables the content varied from 0.00 mg (Kattumanga and Putharichunda) to 0.576 mg (Kaipuchunda) with a mean content 0.219 mg 100 g<sup>-1</sup>. Significant variation in the iron content of raw and cooked vegetables and between the raw and cooked vegetables were also observed. The iron contents of Akidikka, Kattuthakkali, Mullikka and Putharichunda were found to be on par with the lowest content observed in Kattumanga in the raw stage. In the cooked stage the iron contents of Mullikka and Akidikka were almost similar to the lowest content observed in Kattumanga and Putharichunda.

Table 16. Mean nutritive value of vegetables (raw & cooked) consumed by the tribal communities of Idukki District (per 100 g FWB)

Sl. No.	Name of foodstuff	Calcium (g)		Phosphorus (g)		Iron (mg)	
		Raw	Cooked	Raw	Cooked	Raw	Cooked
1	Akidikka	0.035	0.024	0.025	0.016	0.34	0.066
2	Chembuthandu	0.063	0.036	0.026	0.014	0.737	0.267
3	Eenthinkaya	-	-	0.157	-	3.23	-
4	Kaipuchunda	0.292	0.205	-	-	1.02	0.576
5	Kallipoovu	0.119	0.086	0.013	0.008	0.81	0.434
6	Kattuchakka	-	-	-	-	-	-
7	Kattumanga	0.073	0.065	0.01	0.009	0.083	0.00
8	Kattupana	0.082	0.00	0.098	-	1.02	-
9	Kattuthakkali	0.004	-	0.032	0.026	0.272	-
10	Mullikka	0.095	0.07	0.035	0.026	0.156	0.085
11	Putharichunda	0.316	0.113	-	-	0.336	0.00
12	Thaluthandu	0.042	0.028	0.018	0.014	0.768	0.326
13	Urikka	0.26	-	0.109	-	1.48	-
	Means $\pm$ SE	0.125 $\pm$ 0.001	0.07 $\pm$ 0.001	0.052 $\pm$ 0.001	0.016 $\pm$ 0.001	0.854 $\pm$ 0.1	0.219 $\pm$ 0.03
	CD	0.003	0.003	0.003	0.003	0.307	0.098
	CD between raw & cooked	0.0033		0.0012		0.051	

FWB - Fresh Weight Basis

### Sodium

The sodium content of raw vegetables varied from 2.16 mg to 16 mg and in the cooked vegetables it varied from 1.13 to 7.33 mg 100 g<sup>-1</sup> with significant variation in the sodium content of raw and cooked vegetables (Table 17). The highest sodium content was in Urikka (raw) and Kaippuchunda (cooked) and the lowest was in Kallipoovu both in raw and cooked stages. The mean sodium content of vegetables was found to be 5.55 mg (raw) 2.91 mg (cooked). The variation observed between the raw and cooked vegetables with respect to the sodium content was found to be statistically significant. None of the vegetables had a sodium content similar to that observed either in cooked Kaipuchunda or raw and cooked Kallipoovu. However, the raw vegetables with a sodium content in the range of 2.89 to 3.6 mg 100 g<sup>-1</sup> were found to be on par with the lowest content observed in raw Kallipoovu.

### Potassium

The mean potassium contents of the raw and cooked vegetables were found to be 437.33 mg and 344.99 mg 100 g<sup>-1</sup> (Table 17). The highest and lowest potassium contents were found in Urikka and Thaluthandu respectively both in raw and cooked stages. Significant variation in the potassium contents of the raw and cooked vegetables and between the raw and cooked vegetables were observed. Potassium content of raw and cooked Akidikka was found to be on par with the lowest contents observed in raw and cooked Thaluthandu.

### Magnesium

The magnesium content of raw vegetables varied from 0.008 mg to 0.291 mg 100 g<sup>-1</sup> with a mean content of 0.136 mg 100 g<sup>-1</sup> (Table 17). In the cooked vegetables the content varied from 0.005 mg to 0.078 mg 100 g<sup>-1</sup> with a mean content of 0.059 mg 100 g<sup>-1</sup>. The highest and lowest contents were found in Putharichunda and Akidikka respectively in the raw and cooked stages. Significant variation in the magnesium contents of the raw and cooked vegetables and between the raw and cooked vegetables were also observed. None of the vegetables had a magnesium content on par with the highest or lowest contents observed in Putharichunda or Akidikka.

Table 17. Mean nutritive value of vegetables (raw & cooked) consumed by the tribal communities of Idukki District (per 100g FWB)

Sl. No.	Name of foodstuff	Sodium (mg)		Potassium (mg)		Magnesium (mg)	
		Raw	Cooked	Raw	Cooked	Raw	Cooked
1	Akidikka	3.17	2.09	81	57	0.008	0.005
2	Chembuthandu	3.6	1.97	254	144	0.11	0.062
3	Eenthinkaya	3.6	1.97	870	794	-	-
4	Kaipuchunda	10.68	7.33	427	408	0.218	0.20
5	Kallipoovu	2.16	1.13	180	126	0.047	0.031
6	Kattuchakka	-	-	-	-	-	-
7	Kattumanga	3.02	2.8	308	303	0.047	0.045
8	Kattupana	2.89	-	665	-	0.272	-
9	Kattuthakkali	5.45	3.38	273	235	0.221	-
10	Mullikka	5.44	3.33	490	383	0.039	0.035
11	Putharichunda	7.32	2.74	472	154	0.291	0.078
12	Thaluthandu	3.31	2.39	59	37	0.018	0.016
13	Urikka	16.0	-	1169	1154	0.223	-
	Means $\pm$ SE	5.55 $\pm$ 0.66	2.91 $\pm$ 0.26	437.33 $\pm$ 30.9	344.99 $\pm$ 6.53	0.136 $\pm$ 0.001	0.059 $\pm$ 0.001
	CD	2.03	0.817	94.94	20.27	0.003	0.003
	CD between raw & cooked	0.492		20.21		0.004	

FWB- Fresh Weight Basis

### Copper

The copper content of the raw vegetables varied from 0.047 mg (Akidikka) to 0.385 mg (Putharichunda) with a mean content of 0.196 mg 100 g<sup>-1</sup> (Table 18). In the cooked vegetables the content varied from 0.027 mg (Akidikka) to 0.333 mg (Kaippuchunda) with a mean content of 0.143 mg 100 g<sup>-1</sup>. Significant variation in the copper contents of raw and cooked vegetables and between the raw and cooked vegetables were also observed. Thaluthandu (cooked) was the only vegetable which had a copper content almost similar to the lowest content found in cooked Akidikka.

### Manganese

Significant variation in the manganese content of the raw and cooked vegetables and between the raw and cooked vegetables was observed. The mean manganese content was found to be 0.296 mg (raw) and 0.147 mg (cooked) with the lowest content in Akidikka in raw (0.052 mg) and Chembuthandu (0 mg) in cooked stages (Table 18). The highest content was in Putharichunda (0.77 mg) in the raw and Kaippuchunda (0.333 mg) in the cooked vegetables. The manganese contents of Chembuthandu, Kallipoovu and Thaluthandu were found to be on par with the lowest content found in Akidikka in the raw state. In the cooked vegetables the manganese contents of Akidikka, Kallipoovu and Thaluthandu were also found to be on par with the content of cooked Chembuthandu.

### Zinc

The zinc content of the vegetables varied from 0 mg to 3.2 mg with a mean content 0.964 mg 100 g<sup>-1</sup> in the raw and from 0 to 2.33 mg with a mean content 0.625 mg 100 g<sup>-1</sup> in cooked vegetables (Table 18). The highest and lowest contents were observed in Kaipuchunda and Kattumanga respectively both in raw and cooked vegetables. The variation observed in the zinc contents of raw and cooked vegetables and between the raw and cooked vegetables were found to be statistically significant. The zinc content of raw Akidikka and Thaluthandu was found to be on par with the lowest content observed in Kattumanga in the raw state. The content of cooked Akidikka was also found to be on par with the lowest content noted in cooked Kattumanga.

Table 18. Mean nutritive value of vegetables (raw & cooked) consumed by the tribal communities of Idukki District (per 100g FWB)

Sl. No.	Name of foodstuff	Copper (mg)		Manganese (mg)		Zinc (mg)	
		Raw	Cooked	Raw	Cooked	Raw	Cooked
1	Akidikka	0.047	0.027	0.052	0.038	0.052	0.038
2	Chembuthandu	0.08	-	0.08	0.00	0.36	0.215
3	Eenthinkaya	0.24	0.219	-	-	1.8	1.64
4	Kaipuchunda	0.356	0.333	0.356	0.333	3.2	2.33
5	Kallipoovu	0.124	0.081	0.103	0.081	0.309	0.243
6	Kattuchakka	-	-	-	-	-	-
7	Kattumanga	0.233	0.196	0.233	0.216	0.00	0.00
8	Kattupana	0.152	-	0.228	-	1.3	-
9	Kattuthakkali	0.109	-	0.218	-	0.436	0.376
10	Mullikka	0.272	0.11	0.272	0.111	0.816	0.444
11	Putharichunda	0.385	0.137	0.77	0.205	2.5	0.822
12	Thaluthandu	0.058	0.046	0.058	0.046	0.203	0.138
13	Urikka	0.296	-	0.592	-	0.592	-
	Means $\pm$ SE	0.196 $\pm$ 0.001	0.143 $\pm$ 0.01	0.296 $\pm$ 0.02	0.147 $\pm$ 0.03	0.964 $\pm$ 0.07	0.625 $\pm$ 0.04
	CD	0.003	0.033	0.062	0.1	0.215	0.126
	CD between raw & cooked	0.005		0.02		0.053	

FWB- Fresh Weight Basis

## **I. C. Roots and tubers**

### **Moisture**

As revealed in Table 19 the moisture content of roots and tubers consumed by the tribal communities of Idukki district varied from 51.76 per cent to 89.34 per cent in raw and from 52.75 per cent to 90.79 per cent in cooked stages. Highest and lowest moisture contents were found in Kannukarakizhangu and Cheenichembu in both stages. Significant variation in the moisture content of roots and tubers was observed in raw and cooked stages with a mean content of 76.05 per cent (raw) and 78.27 per cent (cooked). The variation observed in the moisture content of roots and tubers before and after cooking was also found to be statistically significant. The moisture content of Kuzhala was found to be on par with the highest content found in Kannukarakizhangu both in raw and cooked stages.

### **Protein**

Significant variation in the protein content of roots and tubers was observed within and between raw and cooked samples (Table 19). The mean protein content was found to be 2.61 per cent in raw and 2.03 per cent in cooked. The protein content of the roots and tubers varied from 0.6 to 5.43 per cent (raw) and 0.47 to 3.85 per cent in cooked. The lowest content in both stages was noticed in Chonakizhangu and the highest in Manchakoova. The protein content of raw and cooked Kannukarakizhangu was found to be on par with the lowest content present in raw and cooked Chonakizhangu.

### **Fibre**

The fibre content of raw roots and tubers varied from 0.43 per cent to 2.28 per cent with a mean content of 1.13 per cent and in cooked the content varied from 0.22 per cent to 1.34 per cent with a mean content of 0.62 per cent (Table 20). Significant variation in the fibre contents of raw and cooked and between the raw and cooked samples were observed. The lowest fibre contents were found in Kannukarakizhangu in raw and Chonakizhangu in cooked and the highest in Kachil and Manchakoova in raw and cooked stages respectively. Roots and tubers namely Cheenichembu, Chonakizhangu and Thettam in the raw stage with a fibre content of



**Table 19. Mean nutritive value of roots & tubers (Raw & Cooked) consumed by the tribal communities of Idukki District (per 100g FWB)**

Sl. No.	Name of foodstuff	Moisture (g)		Protein (g)	
		Raw	Cooked	Raw	Cooked
1	Chanakoova	74.27	76.46	2.66	2.24
2	Cheenichembu	51.76	52.75	3.28	2.96
3	Chena	74.44	77.1	2.38	1.78
4	Chonakizhangu	87.1	88.98	0.6	0.47
5	Kachil	60.41	63.52	3.83	2.89
6	Kannukarakizhangu	89.34	90.79	0.75	0.58
7	Karichembu	58.81	59.35	3.84	3.29
8	Kattuchembu	65.97	67.2	1.12	1.06
9	Koova	65.72	67.83	4.29	2.69
10	Kuzhala	88.91	90.48	1.72	1.13
11	Manchakoova	57.93	68.38	5.43	3.85
12	Malayankizhangu	77.53	79.03	2.37	2.05
13	Nooran	83.39	85.82	2.84	2.27
14	Paracheenan	81.06	84.09	1.33	1.18
15	Thettam	81.89	85.28	2.37	1.69
16	Vellarikizhangu	82.67	85.92	2.8	1.94
17	Venkizhangu	77.52	79.24	2.09	1.72
18	Vettukachil	71.57	72.4	3.23	2.7
	Means $\pm$ SE	76.04 $\pm$ 0.61	78.27 $\pm$ 0.26	2.61 $\pm$ 0.09	2.03 $\pm$ 0.04
	CD	1.78	0.763	0.267	0.118
	CD between raw & cooked	0.298		0.049	

FWB- Fresh Weight Basis

0.49 to 0.60 per cent were found to be on par with Kannukarakizhangu with respect to the lowest fibre content. In the cooked stage, the fibre content of Koova was similar to that observed in Manchakoova (highest) and the content in Vellarikizhangu was on par with the lowest content found in Chonakizhangu.

### **Starch**

The starch content of raw roots and tubers varied from 1.05 per cent in Chonakizhangu to 14.74 per cent in Vellarikizhangu with a mean content of 4.97 per cent (Table 20). In cooked samples the content varied from 0.78 per cent Kuzhala to 11.98 per cent in Kannukarakizhangu with a mean content of 3.72 per cent. Significant variation within and between the raw and cooked samples was observed. The starch content of raw Kannukarakizhangu (14.72%) was found to be on par with the highest content seen in raw Vellarikizhangu and the starch content of raw Kuzhala was similar to the lowest starch content of Chonakizhangu. In the cooked samples the starch content of Chonakizhangu, Manchakoova and Vettukachil were found to be on par with the lowest content of Kuzhala.

### **Free amino acid**

The mean free amino acid content of roots and tubers was found to be 0.005 mg 100 g<sup>-1</sup> in raw as well as cooked (Table 20). The content in the individual roots and tubers varied from 0.001 to 0.02 mg 100 g<sup>-1</sup> in raw and 0.001 to 0.016 mg 100 g<sup>-1</sup> in cooked. The highest free amino acid contents in raw and cooked samples were found in Koova and the lowest in Cheenichembu and Kannukarakizhangu in raw and Chonakizhangu, Kattuchembu, and Paracheenam in cooked samples. Significant variation in the raw and cooked and between the raw and cooked roots and tubers was noticed with respect to free amino acid content. None of the samples had a free amino acid content on par with the highest content observed in Koova in the raw and cooked stages.

### **Vitamin C**

Manachakoova and Nooran had the highest vitamin C content both in raw and cooked stages (Table 21). The mean vitamin C content was found to be 23.59 mg

Table 20. Mean nutritive value of roots & tubers (raw & cooked) consumed by the tribal communities of Idukki District (per 100g FWB)

Sl. No.	Name of foodstuff	Fibre (g)		Starch (g)		Free amino acid (mg)	
		Raw	Cooked	Raw	Cooked	Raw	Cooked
1	Chanakoova	-	-	7.04	4.8	-	-
2	Cheenichembu	0.6	0.47	2.61	-	0.001	-
3	Chena	1.77	0.52	3.87	3.42	0.003	0.002
4	Chonakizhangu	0.45	0.22	1.05	0.856	0.002	0.001
5	Kachil	2.28	0.822	3.06	1.92	0.004	0.004
6	Kannukarakizhangu	0.43	-	14.72	11.98	0.001	-
7	Karichembu	0.62	0.41	2.94	2.48	0.004	0.003
8	Kattuchembu	1.96	0.49	4.28	3.5	0.002	0.001
9	Koova	1.81	1.29	-	-	0.02	0.016
10	Kuzhala	0.68	0.45	1.11	0.78	0.003	0.003
11	Manchakoova	1.89	1.34	2.03	0.807	0.008	0.005
12	Malayankizhangu	0.74	0.42	4.36	3.27	0.005	0.0048
13	Nooran	0.74	0.43	5.33	4.12	-	-
14	Paracheenan	1.86	0.83	1.55	3.04	0.002	0.001
15	Thettam	0.49	0.36	7.73	5.33	0.01	0.01
16	Vellarikizhangu	0.79	0.28	14.74	9.96	0.005	-
17	Venkizhangu	1.64	1.14	9.37	4.84	0.005	-
18	Vettukachil	0.92	0.69	1.53	0.802	0.004	0.003
	Means $\pm$ SE	1.13 $\pm$ 0.06	0.62 $\pm$ 0.03	4.97 $\pm$ 0.06	3.72 $\pm$ 0.06	0.005 $\pm$ 0.001	0.005 $\pm$ 0.001
	CD	0.178	0.089	0.178	0.179	0.003	0.003
	CD between raw & cooked	0.034		0.044		0.0003	

FWB- Fresh Weight Basis

Table 21. Mean nutritive value of roots & tubers (raw & cooked) consumed by the tribal communities of Idukki District (per 100g FWB)

Sl. No.	Name of foodstuff	Vitamin C (mg)		β Carotene (µg)	
		Raw	Cooked	Raw	Cooked
1	Chanakoova	5.67	2.76	5.6	4.73
2	Cheenichembu	11.7	5.85	2.01	-
3	Chena	17.25	8.81	10.16	8.55
4	Chonakizhangu	6.62	3.1	13.97	11.34
5	Kachil	9.37	4.81	11.26	9.41
6	Kannukarakizhangu	11.87	8.26	2.65	2.13
7	Karichembu	10.54	5.29	4.18	2.77
8	Kattuchembu	7.96	3.98	5.29	4.37
9	Koova	5.9	2.68	47.06	43.16
10	Kuzhala	8.71	4.31	6.93	4.57
11	Manchakoova	225.84	159.64	1501.94	623.45
12	Malayankizhangu	17.92	11.55	10.43	9.7
13	Nooran	4.96	2.46	44.71	32.1
14	Paracheenan	12.4	5.97	12.74	5.61
15	Thettam	13.73	3.04	48.49	33.09
16	Vellarikizhangu	14.65	6.96	8.83	2.39
17	Venkizhangu	12.51	6.73	14.33	6.98
18	Vettukachil	14.8	11.1	7.06	5.85
	Means ± SE	23.56±0.09	14.29±0.1	97.65±1.66	47.66±0.65
	CD	0.266	0.296	4.92	1.93
	CD between raw & cooked	0.056		0.903	

FWB- Fresh Weight Basis

(raw) and 14.29 mg (cooked) with significant variation within and between the raw and cooked roots and tubers. The vitamin C contents of cooked Chanakoova and Koova were found to be on par with the lowest content observed in cooked Noonan.

### Beta Carotene

The  $\beta$  carotene content of raw roots and tubers varied from 2.33  $\mu\text{g}$  (Cheenichembu) to 1501.94  $\mu\text{g}$  (Manchakoova) with significant variation in the samples (Table 21). In the cooked samples the content varied from 2.13  $\mu\text{g}$  to 623.45  $\mu\text{g}$  in Kannukarakizhangu and Manchakoova respectively with significant variation in the  $\beta$  carotene content. The mean  $\beta$  carotene content of the raw and cooked samples was found to be 97.65  $\mu\text{g}$  and 47.66  $\mu\text{g}$  100  $\text{g}^{-1}$  respectively. The variation observed in the  $\beta$  carotene contents between the raw and cooked samples were also found to be significant. None of the samples had a content similar to that observed in Manchakoova which was the highest (raw and cooked).

### Calcium

The highest calcium contents in roots and tubers were found in Kattuchembu with 0.259 g in raw and 0.105 g 100  $\text{g}^{-1}$  in cooked (Table 22). The lowest content of 0.018 g and 0.017 g 100  $\text{g}^{-1}$  was in Malayankizhangu in raw and cooked samples respectively. The mean calcium content was 0.069 g (raw) and 0.041 g (cooked) with significant variation within and between raw and cooked roots and tubers. The calcium contents within the range of 0.027 to 0.041 g 100  $\text{g}^{-1}$  observed in Koova, Manchakoova, Thettam and Venkizhangu were found to be on par with the lowest content found in Malayankizhangu in the raw stage.

### Phosphorus

Significant variation in the phosphorus content of raw and cooked roots and tubers was observed with a mean content of 0.05 g in raw and 0.037 g 100  $\text{g}^{-1}$  in cooked samples (Table 22). The lowest phosphorus content was found in Manchakoova in both raw (0.01%) and cooked samples (0.002%) and the highest was in Karichembu in raw (0.108%) and Chanakoova (0.074%) in the cooked samples.

Table 22. Mean nutritive value of roots & tubers (raw & cooked) consumed by the tribal communities of Idukki District (per 100g FWB)

Sl. No.	Name of foodstuff	Calcium (g)		Phosphorus(g)		Iron(mg)	
		Raw	Cooked	Raw	Cooked	Raw	Cooked
1	Chanakoova	0.067	0.047	0.085	0.076	0.396	0.18
2	Cheenichembu	0.058	0.028	0.043	0.036	3.51	-
3	Chena	0.117	0.042	0.055	0.044	0.975	0.5
4	Chonakizhangu	0.055	0.04	0.024	0.018	0.965	0.401
5	Kachil	0.079	0.058	0.082	0.041	11.12	6.58
6	Kannukarakizhangu	0.054	0.042	0.027	0.023	0.534	0.212
7	Karichembu	0.09	0.032	0.108	0.074	2.45	2.03
8	Kattuchembu	0.259	0.105	0.044	0.027	2.22	1.26
9	Koova	0.041	0.033	0.072	0.063	0.917	0.124
10	Kuzhala	0.05	0.038	0.032	0.025	0.753	0.474
11	Manchakoova	0.034	0.025	0.01	0.002	1.21	0.804
12	Malayankizhangu	0.018	0.017	0.053	0.042	0.69	0.24
13	Nooran	0.056	0.043	0.038	0.03	0.634	0.055
14	Paracheenan	0.083	0.057	0.033	0.026	1.27	0.146
15	Thettam	0.032	0.023	0.035	0.02	1.29	0.442
16	Vellarikizhangu	0.077	0.048	0.056	0.044	0.878	0.537
17	Venkizhangu	0.027	0.023	0.05	0.046	0.083	0.00
18	Vettukachil	0.051	0.033	0.059	0.028	0.872	0.212
	Means $\pm$ SE	0.069 $\pm$ 0.01	0.041 $\pm$ 0.001	0.05 $\pm$ 0.001	0.037 $\pm$ 0.01	1.71 $\pm$ 0.16	0.84 $\pm$ 0.05
	CD	0.029	0.003	0.003	0.003	0.474	0.149
	CD between raw & cooked	0.005		0.002		0.086	

FWB- Fresh Weight Basis

### Iron

Kachil had the highest iron content of 11.12 mg and 6.58 mg 100 g<sup>-1</sup> in raw and cooked samples respectively. The lowest content in the raw (0.083 mg 100g<sup>-1</sup>) and cooked samples (0 mg) was observed in Venkizhangu. The variation observed in the raw and cooked and between the raw and cooked samples was found to be statistically significant with a mean iron content of 1.71 mg (raw) and 0.84 mg (cooked). None of the roots and tubers had an iron content similar to the highest content observed in Kachil both in raw and cooked stages (Table 22).

### Sodium

The sodium content of roots and tubers varied from 6.64 mg to 29.88 mg in raw samples and 4.58 mg to 28.38 mg in cooked samples (Table 23). Highest sodium content was in Cheenichembu both in raw and cooked and the lowest in Kannukarakizhangu (raw) and Venkizhangu (cooked). The mean sodium content was found to be 13.48 mg and 11.16 mg in raw and cooked samples respectively with significant variation within and between raw and cooked roots and tubers. None of the samples had a sodium content on par with the highest or lowest contents observed in raw as well as cooked samples.

### Potassium

Mean potassium contents of raw and cooked samples were 496.72 mg and 416.09 mg 100 g<sup>-1</sup> with significant variation in the content of raw and cooked samples (Table 23). The potassium content varied from 179 mg to 863 mg 100 g<sup>-1</sup> in raw and 157 mg to 780 mg 100 g<sup>-1</sup> in cooked samples. Raw Manchakoova was found to have the highest potassium content and in cooked samples it was in Cheenichembu. The lowest content was observed in Kuzhala both in raw and cooked samples. The potassium contents of Cheenichembu, Karichembu and Vellarikizhangu were found to be on par with the highest content observed in raw Manchakoova.

### Magnesium

Significant variation in the magnesium content of raw and cooked roots and tubers was observed with a mean content of 0.157 mg and 0.006 mg 100 g<sup>-1</sup> in raw

**Table 23. Mean nutritive value of roots & tubers (raw & cooked) consumed by the tribal communities of Idukki District (per 100g FWB)**

Sl. No.	Name of foodstuff	Sodium (mg)		Potassium (mg)		Magnesium (mg)	
		Raw	Cooked	Raw	Cooked	Raw	Cooked
1	Chanakoova	13.88	10.77	533	462	0.068	0.056
2	Cheenichembu	29.88	28.38	819	780	0.093	-
3	Chena	9.92	8.32	274	243	0.365	0.078
4	Chonakizhangu	10.84	9.24	229	182	0.067	0.049
5	Kachil	19.06	16.79	675	602	0.556	0.123
6	Kannukarakizhangu	6.64	5.52	203	168	0.032	0.006
7	Karichembu	16.48	16.24	814	497	0.158	0.146
8	Kattuchembu	18.7	13.12	663	549	0.163	0.071
9	Koova	18.58	17.39	550	515	0.194	0.159
10	Kuzhala	18.53	15.68	179	157	0.099	0.082
11	Manchakoova	9.26	5.67	863	630	0.232	0.09
12	Malayankizhangu	9.45	8.4	518	473	0.086	0.065
13	Nooran	10.4	8.52	272	217	0.081	0.058
14	Paracheenan	11.78	7.85	259	256	0.128	0.075
15	Thettam	11.04	8.64	344	266	0.076	0.052
16	Vellarikizhangu	9.16	6.72	827	630	0.097	0.069
17	Venkizhangu	9.49	4.58	452	447	0.114	0.087
18	Vettukachil	9.66	9.14	447	416	0.213	0.201
	<b>Means ± SE</b>	<b>13.484± 0.35</b>	<b>11.16± 0.18</b>	<b>496.72± 61.48</b>	<b>416.09± 40.43</b>	<b>0.157± 0.001</b>	<b>0.006± 0.001</b>
	<b>CD</b>	<b>1.037</b>	<b>0.533</b>	<b>182.13</b>	<b>119.77</b>	<b>0.003</b>	<b>0.003</b>
	<b>CD between raw &amp; cooked</b>	<b>0.188</b>		<b>34.95</b>		<b>0.00003</b>	

FWB- Fresh Weight Basis



and cooked samples respectively (Table 23). The contents in raw and cooked samples were found to be in the range of 0.032 to 0.556 mg and 0.006 to 0.201 mg 100 g<sup>-1</sup> respectively. The lowest content in both stages was found to be in Kannukarakizhangu and the highest in Kachil (raw) and Vettukachil (cooked). None of the samples had a magnesium content similar to that observed either in samples with highest or lowest contents in both stages.

### Copper

The copper content of the samples varied from 0.107 mg to 0.717 mg 100 g<sup>-1</sup> in raw and 0.003 mg to 0.52 mg 100 g<sup>-1</sup> in cooked samples with a mean content of 0.339 mg (raw) and 0.233 mg (cooked) per 100 g (Table 24). The highest content was in Karichembu both in raw and cooked samples and the lowest was in Kannukarakizhangu (raw) and Manchakoova (cooked). None of the samples had a copper content which was on par with the highest or lowest contents observed in raw and cooked samples and the variation observed in the copper content of raw and cooked samples was found to be statistically significant.

### Manganese

The mean manganese content of raw and cooked roots and tubers was found to be 0.882 mg and 0.313 mg 100 g<sup>-1</sup> respectively (Table 24). The content in the raw samples varied from 0.107 mg to 0.84 mg 100 g<sup>-1</sup> and in cooked samples it varied from 0.092 to 0.693 mg 100 g<sup>-1</sup>. The highest contents in raw and cooked samples were found in Manchakoova and Chena respectively and the lowest in Kannukarakizhangu in both raw and cooked samples. The manganese contents of Chena and Karichembu were found to be on par with the highest content observed in raw Manchakoova.

### Zinc

The zinc content of raw roots and tubers varied from 0.107 mg to 0.528 mg 100 g<sup>-1</sup> and cooked samples it varied from 0.092 mg to 0.462 mg 100 g<sup>-1</sup> (Table 24). The highest contents in raw and cooked samples were in Vellarikizhangu and Chena respectively and the lowest in Kannukarakizhangu in both stages. Significant variation in the zinc contents of raw and cooked and between the raw and cooked roots and

**Table 24. Mean nutritive value of roots & tubers (raw & cooked) consumed by the tribal communities of Idukki District (per 100g FWB)**

Sl. No.	Name of foodstuff	Copper (mg)		Manganese (mg)		Zinc (mg)	
		Raw	Cooked	Raw	Cooked	Raw	Cooked
1	Chanakoova	0.257	0.234	0.257	0.234	0.257	0.234
2	Cheenichembu	0.511	-	0.48	-	0.482	-
3	Chena	0.277	0.261	0.783	0.693	0.522	0.462
4	Chonakizhangu	0.26	0.198	0.258	0.165	0.258	0.11
5	Kachil	0.655	0.402	0.596	0.365	0.397	0.365
6	Kannukarakizhangu	0.107	0.092	0.107	0.092	0.107	0.092
7	Karichembu	0.717	0.52	0.824	0.406	0.412	0.4
8	Kattuchembu	0.286	0.226	0.656	0.34	0.34	0.00
9	Koova	0.344	0.322	0.688	0.644	0.344	0.322
10	Kuzhala	0.2	0.146	0.109	0.095	0.327	0.285
11	Manchakoova	0.262	0.003	0.84	0.315	0.842	0.00
12	Mlayankizhangu	0.27	0.21	0.45	0.42	0.225	0.21
13	Nooran	0.165	0.142	0.33	0.284	0.165	0.142
14	Paracheenan	0.283	0.16	0.19	0.157	0.19	0.157
15	Thettam	0.27	0.144	0.362	0.144	0.362	0.288
16	Vellarikizhangu	0.509	0.331	0.352	0.28	0.528	0.28
17	Venkizhangu	0.226	0.208	0.452	0.416	0.452	0.208
18	Vettukachil	0.496	0.364	0.57	0.277	0.284	0.277
	Means $\pm$ SE	0.339 $\pm$ 0.001	0.233 $\pm$ 0.01	0.882 $\pm$ 0.05	0.313 $\pm$ 0.01	0.361 $\pm$ 0.001	0.225 $\pm$ 0.001
	CD	0.003	0.030	0.148	0.03	0.003	0.003
	CD between raw & cooked	0.007		0.025		0.00003	

FWB- Fresh Weight Basis

tubers were also observed with a mean content of 0.361 mg in raw and 0.225 mg 100 g<sup>-1</sup> in cooked samples.

#### **I. D. Fruits**

The nutritive value of fruits is given in Table 25a and 25b.

##### **Moisture**

The moisture content of fruits varied from 51.41 g in Chitteenth to 90.24 g in Chumalakalli with a mean content of 78.40 g 100 g<sup>-1</sup>. Significant variation was observed in the moisture content of fruits and the moisture contents of Kattunaranga and Komulishamkaya were found to be similar to the highest content observed in Chumalakkali.

##### **Protein**

The highest (2.76%) and the lowest (0.40%) protein contents were found in Mullapazham and Kallipazham respectively with significant variation in the protein content of fruits. The mean protein content was found to be 1.21 per cent.

##### **Fibre**

The fibre contents of fruits varied from 0.49 per cent in Kattunaranga to 11.48 per cent in Mullapazham with significant variation in the fibre content of fruits. The mean fibre content was found to be 2.37 per cent.

##### **Starch**

Starch content of fruits was found to be low with a variation of 0.34 per cent in Kalakaya to 4.96 per cent in Kattumanga. The variation observed in the starch content of fruits was found to be statistically significant with a mean content of 1.25 per cent.

##### **Free amino acid**

The free amino acid contents of fruits varied from 0.001 mg in Putharichunda to 0.041 mg in Kattumanga with a mean content of 0.009 mg 100 g<sup>-1</sup>. Significant variation was observed in the free amino acid content of fruits. The free

Table 25a. Mean nutritive value of fruits (raw) consumed by the tribal communities of Idukki District (per 100 g FWB)

Sl. No.	Name of foodstuff	Moisture (g)	Protein (g)	Fibre (g)	Starch (g)	Free amino acid (mg)	Vitamin C (mg)	β Carotene (μg)
1	Chitteenth	51.41	1.38	5.09	2.38	0.012	63.79	62.12
2	Chumalakalli	90.24	0.618	1.36	0.62	0.003	27.35	44.61
3	Kalakaya	87.19	0.76	1.54	0.34	0.003	14.07	20.55
4	Kallipazham	86.56	0.40	1.82	1.06	0.002	15.54	35.48
5	Kattumanga	78.54	1.00	0.97	4.96	0.041	57.09	22.22
6	Kattunaranga	89.21	0.59	0.49	0.35	0.017	44.64	42.35
7	Komulishamkaya	89.43	0.71	0.83	0.37	0.008	40.87	102.21
8	Kurukuttapazham	86.71	1.65	0.74	0.53	-	45.38	85.94
9	Mullapazham	53.91	2.76	11.48	1.31	0.008	6.97	169.4
10	Njaval (small)	69.74	1.73	0.82	0.12	0.004	58.33	28.38
11	Njaval (big)	70.29	1.78	2.09	1.78	0.002	57.77	25.55
12	Pottipazham	82.82	0.83	0.87	0.4	0.009	32.67	52.17
13	Putharichunda	81.64	1.27	2.73	2.58	0.001	75.51	84.5
14	Unnapazham	77.06	1.41	-	0.68	-	14.75	91.56
	Means ± SE	78.40± 0.66	1.21± 0.02	2.37± 0.03	1.25± 0.51	0.009± 0.001	37.24± 1.15	61.93± 1.3
	CD	1.98	0.06	0.091	1.54	0.003	3.46	3.93

FWB- Fresh Weight Basis

amino acid contents of fruits namely Chumalakalli, Kalakaya, Kallipazham, Njaval (small & big) were found to be on par with the lowest amino acid content observed in Putharichunda.

### **Vitamin C**

Putharichunda and Kattuchakka were found to have the highest (75.51 mg) and lowest (3.86 mg) vitamin C contents with a mean content of 37.24 mg per 100 g. Significant variation in the vitamin C content of the fruits was also observed. None of the fruits had a vitamin C content on par with the highest content observed in Putharichunda. However, the vitamin C content of Mullapazham was found to be on par with the lowest content noted in Kattuchakka.

### **Beta carotene**

The beta carotene content of fruits varied from 20.55  $\mu\text{g}$  in Kalakaya to 169.4  $\mu\text{g}$  in Mullapazham. The variation in the beta carotene content of fruits was found to be statistically significant with a mean content of 61.93  $\mu\text{g}$  100  $\text{g}^{-1}$ . The beta carotene content of Kattumanga was on par with the lowest content observed in Kalakaya.

### **Calcium**

The mean calcium content was found to be 0.117 g 100  $\text{g}^{-1}$  with a variation of 0.024 g in Njaval (big) to 0.32 g 100  $\text{g}^{-1}$  in Chumalakalli. The variation in the calcium content of fruits was found to be statistically significant. The calcium contents of Kattumanga, Kattunaranga, Kurukuttapazham, Njaval (small) were found to be on par with the lowest content present in Njaval (big).

### **Phosphorus**

The phosphorus content of fruits varied from 0.01 g to 0.11 g 100  $\text{g}^{-1}$ . The highest and lowest phosphorus contents were found in Chitteenth and Kattumanga respectively. The mean phosphorus content was found to be 0.034 g 100  $\text{g}^{-1}$ . The phosphorus content of all other fruits was found to be on par with the lowest content observed in Kattumanga.

### Iron

The mean iron content of fruits was found to be 0.898 mg 100 g<sup>-1</sup> with a variation of 0.04 mg in Komulishamkaya to 2.52 mg in Njaval (small). The iron contents of Chittenth and Njaval (big) were found to be on par with the highest iron content of Njaval (small).

### Sodium

The sodium content of fruits varied from 0.018 mg to 8.26 mg 100 g<sup>-1</sup> with the highest and lowest contents in Mullapazham and Kattumanga respectively. The mean sodium content was found to be 3.80 mg 100 g<sup>-1</sup> with significant variation in the sodium content of fruits. The sodium content of Njaval (big) was found to be on par with the lowest content present in Kattumanga.

### Potassium

The potassium content was found to be in the range of 107 mg (Kurukuttapazham) to 964 mg (Mullapazham) with a mean content of 406.17 mg 100 g<sup>-1</sup>. None of the fruits had a potassium content on par with the highest or lowest contents observed in Mullapazham or Kurukuttapazham.

### Magnesium

The variation observed in the magnesium content of fruits was found to be statistically significant with a mean content of 0.269 mg 100 g<sup>-1</sup>. The highest content was in Mullapazham (0.996 mg) and the lowest (0.084 mg) in Kattumanga.

### Copper

The copper content of fruits varied from 0.06 mg in Kurukuttapazham to 0.388 mg in Chitteenth. The mean copper content was found to be 0.191 mg 100 g<sup>-1</sup> with significant variation in the copper content of fruits. The copper content of Njaval (small) was on par with the highest content observed in Chitteenth. The copper contents of Chumalakalli, Kalakaya, Kallipazham, Kattunaranga, Pottipazham were found to be on par with the lowest content observed in Kurukuttapazham.

### **Manganese**

The mean manganese content was found to be  $0.467 \text{ mg } 100 \text{ g}^{-1}$  with the highest (1.21 mg) and lowest (0.106 mg) contents in Chitteenth and Komulishamkaya respectively. The manganese content of Kallipazham was found to be on par with the highest manganese content of Chitteenth. The manganese content observed in Chumalakalli, Kalakaya, Kattunaranga, Kurukuttapazham, Njaval (small), Pottipazham and Putharichunda were found to be on par with the lowest content noticed in Komulishamkaya.

### **Zinc**

Significant variation was observed in the zinc content of fruits with a range in between 0 mg to  $0.552 \text{ mg per } 100 \text{ g}^{-1}$ . The mean zinc content was found to be  $0.202 \text{ mg } 100 \text{ g}^{-1}$ . None of the fruits had a similar zinc content which was observed in Putharichunda which had the highest. The zinc content of Njaval (big and small) was also found to be 0.

Table 25b. Mean Nutritive Value of Fruits (Raw) consumed by the tribal communities of Idukki District (per 100 g FWB)

Sl. No.	Name of foodstuff	Calcium (g)	Phosphorus (g)	Iron (mg)	Sodium (mg)	Potassium (mg)	Magnesium (mg)	Copper (mg)	Manganese (mg)	Zinc (mg)
1	Chitteenth	0.097	0.11	1.67	4.61	715	0.163	0.388	1.21	0.00
2	Chumalakalli	0.32	0.013	0.205	4.07	318	0.138	0.096	0.334	0.097
3	Kalakaya	0.21	0.02	0.098	5.64	266	0.276	0.14	0.256	0.256
4	Kallipazham	0.194	0.029	0.536	1.93	362	0.102	0.142	1.13	0.266
5	Kattumanga	0.043	0.01	0.911	0.018	306	0.084	0.229	0.43	0.215
6	Kattunaranga	0.039	0.018	0.062	4.86	462	0.176	0.077	0.108	0.216
7	Komulishamkaya	0.055	0.017	0.04	4.24	151	0.275	0.197	0.106	0.212
8	Kurukuttapazham	0.041	0.015	0.72	3.88	107	-	0.06	0.268	0.134
9	Mullapazham	0.253	0.066	1.15	8.26	964	0.996	0.153	0.92	0.459
10	Njaval (small)	0.036	0.041	2.52	2.68	335	-	0.336	0.298	0.00
11	Njaval (big)	0.024	0.035	1.95	0.024	262	0.191	0.284	0.448	0.00
12	Pottipazham	0.06	0.028	0.735	1.74	335	0.113	0.14	0.348	0.174
13	Putharichunda	0.147	0.038		5.89	396	0.336	-	0.184	0.552
14	Unnapazham	0.122	0.033	1.08	5.37	708	0.381	0.242	0.488	0.244
	Means $\pm$ SE	0.117 $\pm$ 0.01	0.034 $\pm$ 0.02	0.898 $\pm$ 0.41	3.801 $\pm$ 0.22	406.17 $\pm$ 10.32	0.269 $\pm$ 0.001	0.191 $\pm$ 0.03	0.467 $\pm$ 0.08	0.202 $\pm$ 0.001
	CD	0.03	0.06	1.25	0.665	31.21	0.003	0.091	0.242	0.003

FWB- Fresh Weight Basis



## II. PALAKKAD DISTRICT

### II. A. Leafy vegetables

#### Moisture

The moisture content of the leafy vegetables consumed by the tribal communities of Palakkad District varied from 72 per cent in Palakeera to 92.24 per cent in Gonikeera (Table 26). In the cooked leaves the moisture content varied from 74.26 per cent in Sheengedag to 92.83 per cent in Sambarcheera. The mean moisture content was found to be 81.82 g and 84.11 g 100 g<sup>-1</sup> in raw and cooked leaves respectively. Significant variation in the moisture content was observed both in raw and cooked leaves and between the raw and cooked leaves. Among the raw leaves the moisture content of Sheengedag (72.73%) was found to have a content on par with the lowest content observed in Palekeera. Among the cooked leaves the moisture content of Gonikeera was found to be almost similar to the highest content observed in Sambarcheera. Cooked Palekeera was also found to have a moisture content on par with that observed in cooked Sheengedag (lowest).

#### Fat

The fat content of raw leaves varied from 0.05 to 1.51 per cent with a mean content of 0.58 per cent (Table 26). In cooked leaves, the content varied from 0.08 to 1 per cent with a mean content of 0.37 per cent. Highest fat content in raw and cooked leaves was observed in Palekeera and the lowest in Pampattikeera (raw) and Sheengedag and Elipinnakdag (cooked). Significant variation was observed in the fat content of raw and cooked leaves and between the raw and cooked leaves.

#### Protein

Significant variation in the protein content of the leafy vegetables was observed within fresh and cooked and between the raw and cooked leaves (Table 26). Highest protein content was found to be in Palekeera both in raw (6.58%) and cooked (6%) leaves. The lowest content was observed in Swargacheera (1.68%) in the raw stage and in Sambarcheera (1.58%) in the cooked stage. The decrease in the protein

Table 26. Mean nutritive value of leafy vegetables (raw & cooked) consumed by the tribal communities of Palakkad District (per 100 g FWB)

Sl. No.	Name of foodstuff	Moisture (g)		Fat (g)		Protein (g)	
		Raw	Cooked	Raw	Cooked	Raw	Cooked
1	Chembila	86.50	89.64	0.68	0.34	2.61	1.93
2	Chukkutticheera	82.62	83.08	1.12	0.93	3.47	3.26
3	Chumalacheera	80.33	82.93	1.03	0.65	3.47	2.58
4	Churuli	81.57	80.90	0.69	0.45	3.63	3.62
5	Elipinnakdag	74.49	76.89	0.16	0.08	3.43	3.00
6	Gonikeera	92.24	90.54	0.49	0.28	2.26	1.70
7	Kainedag	87.61	90.19	0.33	0.13	1.71	-
8	Katukusoup	86.30	89.42	0.48	-	3.40	2.60
9	Keera(a)	76.25	79.92	0.56	-	5.84	4.52
10	Keer(b)	78.49	81.48	0.79	0.37	4.96	4.06
11	Kovakeera	81.67	83.21	0.95	0.49	3.65	3.31
12	Kuppakeera	78.92	83.43	1.07	0.42	5.94	4.58
13	Mathanela	82.88	85.54	0.63	0.44	4.42	3.62
14	Mulakucheera	78.74	80.38	0.46	0.43	3.74	3.21
15	Mullucheera	79.25	81.83	1.03	0.42	4.16	3.49
16	Munnekeera	76.95	78.50	0.54	0.42	4.91	4.10
17	Palekeera	72.00	74.79	1.51	1.00	6.58	6.00
18	Pamattikeera	86.40	88.87	0.05	-	2.68	2.15
19	Pannedag	82.84	83.15	0.75	0.39	3.11	2.91
20	Pattikeera	78.52	81.06	-	-	5.69	4.78
21	Payarila	83.86	86.57	-	-	3.91	-
22	Perandika	82.45	84.92	-	-	3.8	-
23	Ponnamkanni	87.80	89.91	0.30	0.28	2.09	1.62
24	Sambarcheera	90.13	92.83	0.23	0.20	2.23	1.58
25	Sheengedag	72.73	74.26	0.09	0.08	5.42	-
26	Swargacheera	87.70	89.92	-	-	1.68	-
27	Thakara	75.72	78.47	0.56	0.29	5.78	-
28	Thazhuthama	83.15	87.74	-	-	2.50	-
29	Theyyedeg	80.63	83.13	0.23	0.19	4.66	3.70
30	Thondesoup	76.38	78.94	0.42	0.24	5.78	4.96
31	Vashalacheera	87.34	89.63	0.63	0.24	2.64	1.95
32	Vela	82.97	85.32	-	-	2.92	-
33	Vellakeera	83.94	86.07	0.53	0.23	4.17	3.30
34	Vellathandan cheera	81.66	86.14	0.33	-	3.15	-
	Mean $\pm$ SE	81.82 $\pm$ 0.49	84.11 $\pm$ 0.82	0.58 $\pm$ 0.01	0.37 $\pm$ 0.001	3.83 $\pm$ 0.08	3.30 $\pm$ 0.06
	CD	1.39	2.34	0.029	0.003	0.228	0.174
	CD between raw & cooked	0.315		0.003		0.042	

FWB - Fresh Weight Basis

content after cooking was found to be statistically significant. The mean protein content of raw and cooked leaves was found to be 3.83 per cent and 3.30 per cent respectively. Among the raw leaves the protein content of Kainedag (1.71%) was found to be similar to the lowest content in Swargacheera. In the cooked leaves the protein contents of Gonikeera (1.7%) and Ponnankanni (1.62%) were found to be on par with the lowest content of Sambarcheera. None of the leaves was having almost similar highest values which was observed in Palekeera both in raw and cooked stages.

### **Fibre**

The fibre content of the leafy vegetables varied from 0.70 to 3.18 per cent in the raw leaves and from 0.30 to 2.8 per cent in the cooked leaves (Table 27). Munnekeera was found to be having the highest fibre content both in raw and cooked stages. Lowest fibre content was noticed in Keera (b) among the raw and Swargacheera among the cooked leaves. Significant variation in the fibre content was observed within raw and cooked leaves and between raw and cooked leaves. The mean fibre content was found to be 1.38 g (raw) and 1.08 g (cooked) per 100 g. The fibre content of cooked Palekeera was found to be on par with the highest content observed in Munnekeera in the cooked stage. The fibre contents of Gonikeera, Katukusoup and Vellathandancheera were found to be on par with the lowest content observed in Keera (b) in the raw state and in the cooked leaves the contents in Keera (b) and Vashalacheera were found to have almost similar values which was observed in cooked Swargacheera.

### **Starch**

As revealed in Table 27, the starch content of the fresh leafy vegetable varied from 0.05 per cent in Vela to 3.62 per cent in Keera (b). In the cooked leaves the starch content varied from 0.066 per cent in Vellakeera to 0.605 per cent in Chumalacheera. The mean starch content of the raw and cooked leaves was found to be 0.504 per cent and 0.234 per cent respectively. Statistically, the variation observed in the starch content of the leaves was found to be significant both in the fresh and

Table 27. Mean nutritive value of leafy vegetables (raw & cooked) consumed by the tribal communities of Palakkad District (per 100g FWB)

Sl. No.	Name of foodstuff	Fibre (g)		Starch (g)		Free amino acid (mg)	
		Raw	Cooked	Raw	Cooked	Raw	Cooked
1	Chembila	1.12	0.99	0.279	0.130	0.034	0.025
2	Chukkutticheera	1.00	0.93	0.690	0.458	0.031	0.027
3	Chumalacheera	1.18	1.07	0.642	0.605	0.001	0.001
4	Churuli	1.53	0.84	0.210	0.178	0.005	0.002
5	Elipinnakdag	1.60	1.22	0.345	0.296	0.004	0.002
6	Gonikeera	0.79	0.71	0.232	0.133	0.002	0.001
7	Kainedag	1.33	0.91	0.808	0.455	0.002	-
8	Katukusoup	0.73	0.71	0.447	0.109	0.045	0.033
9	Keera(a)	1.19	0.80	0.301	0.175	0.005	0.003
10	Keera(b)	0.70	0.37	3.62	-	0.003	0.001
11	Kovakeera	1.15	0.92	0.206	0.194	0.003	0.002
12	Kuppakeera	2.80	0.83	0.602	0.100	0.029	0.017
13	Mathanela	1.76	1.67	0.261	0.085	0.002	0.001
14	Mulakucheera	1.92	1.42	0.848	0.557	0.018	0.014
15	Mullucheera	1.09	0.89	0.544	0.424	0.004	0.002
16	Munnekeera	3.18	2.80	0.385	0.316	0.015	0.011
17	Palekeera	2.44	2.40	0.174	0.104	0.004	0.002
18	Pampattikeera	0.85	0.59	0.236	0.209	0.003	0.002
19	Pannedag	1.20	1.06	1.41	0.135	0.003	0.002
20	Pattikeera	1.40	0.91	0.277	0.184	0.004	0.002
21	Payarila	1.37	0.98	0.401	0.309	0.012	0.009
22	Perandika	-	-	0.290	0.138	-	-
23	Ponnamkanni	1.72	1.24	0.476	0.256	0.003	0.002
24	Sambarcheera	1.12	0.65	0.409	0.175	0.009	0.0002
25	Sheengedag	1.64	1.16	0.454	0.250	0.130	0.113
26	Swargacheera	0.80	0.30	0.462	-	0.003	-
27	Thakara	1.46	0.97	0.393	0.175	0.008	0.007
28	Thazhuthama	1.48	0.86	0.316	0.121	0.004	-
29	Theyyedeg	1.46	1.44	0.255	0.236	0.005	0.002
30	Thondesoup	2.30	1.69	0.792	0.344	0.001	0.0001
31	Vashalacheera	0.94	0.39	0.141	0.115	0.011	0.006
32	Vela	1.19	0.89	0.05	-	0.004	-
33	Vellakeera	0.89	0.97	0.07	0.066	0.011	0.005
34	Vellathandancheera	0.75	-	0.083	-	0.002	-
	Mean $\pm$ SE	1.38 $\pm$ 0.03	1.08 $\pm$ 0.03	0.504 $\pm$ 0.01	0.234 $\pm$ 0.01	0.010 $\pm$ 0.00	0.01 $\pm$ 0.00
	CD	0.086	0.086	0.028	0.029	0.003	0.003
	CD between raw & cooked	0.015		0.004		0.0003	

FWB - Fresh Weight Basis

cooked leaves and between the raw and cooked leaves. The starch contents of raw Vellakeera and cooked Mathanela were found to be on par with the lowest contents observed in Vela (raw) and Vellakeera (cooked).

#### **Free amino acid**

The mean free amino acid content was found to be 0.010 mg and 0.01 mg in the raw and cooked leaves respectively (Table 27). The free amino acid content of the fresh and cooked leaves varied from 0.001 to 0.13 mg and 0.0001 to 0.113 mg per 100 g. The highest and lowest contents in both stages were found in Sheengedag and Thondesoup respectively. The lowest content of 0.001 mg 100 g was also found in Chumalacheera in the raw stage. None of the leaves had a free amino acid content on par with the highest content found in raw and cooked Swargacheera. However, the leaves with a free amino acid content upto 0.004 mg in the raw and 0.003 mg in the cooked stages were found to be having almost similar lowest free amino acid content observed in Chumalacheera and Thondesoup in raw and cooked stages. The variation observed in the free amino acid content of the leaves was found to be statistically significant both in the raw and cooked leaves and between the raw and cooked leaves.

#### **Vitamin C**

The vitamin C content of the leafy vegetables varied from 21.67 mg in Thazhuthama to 213.66 mg in Palekeera per 100 g of fresh leaves (Table 28). A significant reduction in the vitamin C content of the leafy vegetables was observed after cooking in which the content varied from 10.25 mg to 83.17 mg per 100g. Highest and lowest vitamin C contents were found in Katukusoup and Ponnankanni leaves respectively after cooking. The vitamin C content of the leaves varied significantly both within raw and cooked leaves and between the raw and cooked leaves. The mean vitamin C content of the raw leaves was found to be 95.52 mg while in the cooked leaves, it was 40.57 mg per 100 g. A loss of 50 to 90 per cent in the vitamin C content of the leaves was observed after cooking. None of the leaves had a vitamin C content on par with the content observed in Palekeera or Katukusoup, which had the highest vitamin C content in raw and cooked stages respectively. However, the

**Table 28. Mean nutritive value of leafy vegetables (raw & cooked) consumed by the tribal communities of Palakkad District (per 100 g FWB)**

Sl. No.	Name of foodstuff	Vitamin C (mg)		β Carotene (μg)	
		Raw	Cooked	Raw	Cooked
1	Chembila	38.91	18.20	888	361
2	Chukkutticheera	83.76	28.50	2441	1091
3	Chumalacheera	42.16	22.72	3964	2496
4	Churuli	64.01	50.20	1370	856
5	Elipinnakdag	145.61	58.61	1884	1647
6	Gonikeera	39.56	16.06	439	426
7	Kainedag	94.97	38.34	525	345
8	Katukusoup	189.74	83.17	939	632
9	Keera(a)	176.30	74.55	1744	1367
10	Keera(b)	147.16	66.68	2075	-
11	Kovakeera	66.87	20.97	2111	1263
12	Kuppakeera	36.40	12.87	2191	1502
13	Mathanela	87.13	34.81	1051	500
14	Mulakucheera	67.95	18.84	3047	1946
15	Mullucheera	110.04	52.92	1927	1270
16	Munnekeera	89.52	38.33	1751	823
17	Palekeera	213.66	75.53	1828	1395
18	Pampattikeera	49.03	23.74	1647	1283
19	Pannedag	47.29	18.98	1023	990
20	Pattikeera	139.00	65.43	1552	1254
21	Payarila	34.82	16.74	591	473
22	Perandika	50.08	20.41	1402	1037
23	Ponnamkanni	39.38	10.25	783	379
24	Sambarcheera	133.86	46.83	464	444
25	Sheengedag	118.73	52.66	453	387
26	Swargacheera	152.36	71.63	521	-
27	Thakara	156.44	52.49	2027	1531
28	Thazhuthama	21.67	12.15	576	406
29	Theyyedeg	43.30	24.66	839	673
30	Thondesoup	98.59	35.33	2296	2017
31	Vashalacheera	137.52	65.11	1509	441
32	Vela	68.63	27.71	780	-
33	Vellakeera	108.40	52.26	1193	749
34	Vellathandancheera	155.10	71.64	978	-
	Mean ±SE	95.52±6.3	40.57±2.03	1435.33±10.65	999.15±8.96
	CD	17.95	5.78	30.35	25.8
	CD between raw & cooked	2.18		5.13	

FWB - Fresh Weight Basis

contents in Chembila, Gonikeera, Kuppakeera, Payarila and Ponnankanni in the raw state and Thazhuthama and Kuppakeera in the cooked state were found to be on par with the lowest Vitamin C content of Thazhuthama (raw) and Ponnankanni (cooked) respectively.

### **Beta carotene**

The beta carotene content of the fresh leaves varied from 439  $\mu\text{g}$  in Gonikeera to 3964  $\mu\text{g}$  in Chumalacheera (Table 28). Significant reduction in the beta carotene content of the leaves was noticed after cooking which varied from 345  $\mu\text{g}$  in Kainedag to 2496  $\mu\text{g}$  in Chumalacheera. The mean beta carotene content of the leaves in the raw stage was found to be 1435  $\mu\text{g}$ , and after cooking, it was 999  $\mu\text{g}$  per 100 g. Significant variation in the beta carotene content of the leaves was observed within raw as well as cooked and between the raw and cooked leaves. None of the leaves had a beta carotene content on par with the highest content observed in Chumalacheera.

### **Calcium**

The calcium content of the leaves varied from 0.055 to 0.619 per cent in fresh leaves and from 0.023 to 0.554 per cent in cooked leaves (Table 29). The highest calcium content was observed in Elipinnakdag and Kovakeera in the raw and cooked stages respectively while the lowest content was observed in Sheengedag and Mathanela respectively. The mean calcium content was found to be 0.298 (raw) and 0.200 g per 100 g (cooked). Significant variation in the calcium content of the leaves was noticed both in raw and cooked and between raw and cooked leaves. Churuli with a calcium content of 0.06 g per 100 g in the fresh stage was the only leaf which had a calcium content on par with the lowest content observed in Sheengedag. In the cooked leaves also Sheengedag (0.036%), Thakara (0.046%) and Churuli (0.046%) had almost similar lowest calcium content that was observed in Mathanela. Kovakeera had an almost similar highest content which was observed in Elipinnakdag.

### **Phosphorus**

The mean phosphorus contents of fresh and cooked leaves were found to be 0.087 and 0.062 per cent respectively (Table 29). Highest phosphorus content was

Table 29. Mean nutritive value of leafy vegetables (raw & cooked) consumed by the tribal communities of Palakkad District (per 100 g FWB)

Sl. No.	Name of foodstuff	Calcium (g)		Phosphorus (g)		Iron (mg)	
		Raw	Cooked	Raw	Cooked	Raw	Cooked
1	Chembila	0.108	0.075	0.047	0.034	22.24	17.05
2	Chukkutticheera	0.285	0.155	0.112	0.043	38.94	12.36
3	Chumalacheera	0.394	0.332	0.086	0.017	24.46	16.87
4	Churuli	0.060	0.046	0.151	0.129	4.60	4.44
5	Elipinnakdag	0.619	0.296	0.156	0.139	5.98	4.35
6	Gonikeera	0.140	0.105	0.053	0.032	15.81	7.075
7	Kainedag	0.179	0.124	0.048	0.035	17.66	14.90
8	Katukusoup	0.281	0.178	0.080	0.046	20.32	6.37
9	Keera(a)	0.253	-	0.139	-	10.14	-
10	Keera(b)	0.572	0.478	0.102	0.081	16.92	14.17
11	Kovakeera	0.590	0.554	0.127	0.114	3.76	2.81
12	Kuppakeera	0.101	0.080	0.148	0.033	40.01	30.46
13	Mathanela	0.209	0.023	0.065	0.053	8.04	6.35
14	Mulakucheera	0.290	0.255	0.063	0.052	37.74	31.41
15	Mullucheera	0.418	0.357	0.135	0.115	3.93	2.48
16	Munnekeera	0.146	0.138	0.118	0.103	1.46	0.496
17	Palekeera	0.575	0.504	0.084	0.076	3.43	2.47
18	Pampattikeera	0.169	0.158	0.046	0.036	5.46	4.24
19	Pannedag	0.210	0.203	0.101	0.055	6.44	5.84
20	Pattikeera	0.327	0.269	0.070	0.058	8.50	6.97
21	Payarila	0.142	0.107	0.020	0.016	1.24	0.799
22	Perandika	-	-	-	-	-	-
23	Ponnamkanni	0.099	0.071	0.038	0.031	14.51	11.75
24	Sambarcheera	0.131	0.086	0.036	0.022	11.17	6.88
25	Sheengedag	0.055	0.036	0.190	0.165	5.19	3.07
26	Swargacheera						
27	Thakara	0.549	0.046	0.100	0.083	1.59	0.909
28	Thazhuthama	0.466	-	0.090	-	22.32	-
29	Theyyedeg	0.559	0.477	0.068	0.058	58.68	31.95
30	Thondesoup	0.406	0.338	0.050	0.041	8.71	6.93
31	Vashalacheera	0.214	0.079	0.047	0.034	11.32	1.26
32	Vela	0.459	-	0.102	-	0.065	-
33	Vellakeera	0.277	0.228	0.083	0.069	31.18	26.36
34	Vellathandancheera	0.232	-	0.038		4.72	-
	Mean $\pm$ SE	0.298 $\pm$ 0.01	0.200 $\pm$ 0.01	0.087 $\pm$ 0.00	0.062 $\pm$ 0.00	14.58 $\pm$ 0.67	10.03 $\pm$ 0. 19
	CD	0.029	0.029	0.003	0.003	1.93	0.548
	CD between raw & cooked	0.006		0.0006		0.21	

FWB - Fresh Weight Basis



noticed in Sheengedag in both raw (0.19%) and cooked (0.165%) stages while the lowest was observed in Payarila in fresh (0.02%) and cooked (0.016%) leaves. Significant variation in the phosphorus content of the leaves was observed before and after cooking and also between the fresh and cooked leaves. Chumalacheera with a phosphorus content of 0.017 per cent after cooking was found to be having almost similar values which was observed in cooked Payarila. None of the leaves had a phosphorus content on par with the highest content observed in Sheengedag both in raw and cooked stages.

### Iron

Significant variation in the iron content of the fresh and cooked leaves was observed which varied from 0.065mg to 58.68 mg in raw leaves and from 0.496 to 31.95 mg in cooked leaves (Table 29). Theyyedag was found to be having the highest content both before and after cooking while the lowest content was in Vela and Munnekeera respectively in the raw and cooked stages. The iron contents of Munnekeera, Payarila and Thakara were found to be on par with the lowest iron content observed in Vela in the raw stage, while, after cooking Mulakucheera was found to be the only leaf with almost similar highest iron content noticed in Theyyedag. Cooked Payarila, Thakara and Vashalacheera were found to be having almost similar iron contents observed in cooked Munnekeera. Significant variation in the iron content was noticed within and between the raw and cooked leaves. The mean iron content was found to be 14.58 mg and 10.03 mg per 100 g in fresh and cooked leaves respectively.

### Sodium

The mean sodium content of the leaves was found to be 11.73 mg (raw) and 8.36 mg (cooked) per 100 g (Table 30). Significant variation in the sodium content was observed in the raw and cooked leaves and between the raw and cooked leaves. Ponnankanni was found to be having the lowest sodium content both before (3.15 mg 100 g<sup>-1</sup>) and after (2.42 mg 100 g<sup>-1</sup>) cooking while highest sodium content was in Mullucheera (32.6 mg 100 g<sup>-1</sup>) before cooking and Keera (b) (23.68 mg 100 g<sup>-1</sup>) after cooking. Among the raw leaves analyzed for the sodium contents,

Pampattikeera and Payarila were found to be having a sodium content on par with the lowest content observed in Ponnankanni. In the cooked stage the sodium contents of Mullucheera and Thakara were found to be on par with the highest content in Keera (b) and Kovakeera, Palekeera, Pampattikeera, Pannedag, Payarila, Sambarcheera, Thondesoup and Vashalacheera in the cooked stage had similar lowest sodium content which was observed in cooked Ponnankanni.

### Potassium

Potassium content of the leafy vegetables varied from 307 to 996 mg 100 g<sup>-1</sup> in the raw leaves and from 280 mg to 794 mg 100 g<sup>-1</sup> in the cooked leaves (Table 30). Mean potassium content was found to be 647.80 mg (raw) and 516.70 mg (cooked) per 100 g of the leaves. Highest and lowest contents were found in Sheengedag and Vellathandancheera respectively before cooking and Chukkutticheera and Gonikeera after cooking. Significant variation in the potassium content was observed both in fresh and cooked leaves and between fresh and cooked leaves. The potassium contents of Chembila, Kovakeera and Vashalacheera were found to be on par with the lowest content seen in Vellathandancheera while Kuppakeera and Keera (a) with a potassium content of 955 mg and 952 mg 100 mg<sup>-1</sup> respectively were found to be on par with the highest potassium content observed in Sheengedag. The potassium contents of cooked Chembila, Kovakeera, Thakara and Vashalacheera were found to be on par with the lowest content observed in cooked Gonikeera (lowest) and the potassium content of cooked Kuppakeera was found to be almost similar to the highest content observed in cooked Chukkuttikcheera.

### Magnesium

The magnesium content of fresh leaves varied from 0.055 mg to 2.77 mg 100 g<sup>-1</sup> with the highest and lowest values in Chembila and Payarila respectively (Table 30). After cooking, the contents varied from 0.034 mg in Elipinnakdag to 0.405 mg in Kuppakeera. The mean magnesium content was found to be 0.356 and 0.172 mg per 100 g of raw and cooked leaves respectively. Significant variation in the magnesium content was noticed in the raw and cooked leaves and between raw and cooked leaves. Raw Elipinnakdag and Sambarcheera were found to have a magnesium

Table 30. Mean nutritive value of leafy vegetables (raw & cooked) consumed by the tribal communities of Palakkad District (per 100 g FWB)

Sl. No.	Name of foodstuff	Sodium (mg)		Potassium (mg)		Magnesium (mg)	
		Raw	Cooked	Raw	Cooked	Raw	Cooked
1	Chembila	7.02	5.20	405	302	2.77	0.103
2	Chukkutticheera	10.79	7.43	862	794	0.156	0.145
3	Chumalacheera	9.85	6.67	798	487	0.260	0.222
4	Churuli	10.85	10.13	731	528	0.110	0.100
5	Elipinnakdag	10.20	6.93	740	670	0.061	0.034
6	Gonikeera	12.81	8.55	531	280	0.142	0.112
7	Kainedag	11.29	8.82	577	451	0.101	0.059
8	Katukusoup	11.44	7.53	692	466	0.329	0.046
9	Keera(a)	13.81		952		0.387	
10	Keera(b)	27.52	23.68	828	703	0.438	0.361
11	Kovakeera	13.18	4.87	339	302	0.285	0.248
12	Kuppakeera	10.55	7.30	955	739	0.521	0.405
13	Mathanela	10.26	5.95	778	609	0.209	0.145
14	Mulakucheera	19.60	15.49	687	627	0.230	0.198
15	Mullucheera	32.60	22.39	721	564	0.316	0.275
16	Munnekeera	8.085	6.99	491	452	0.288	0.188
17	Palekeera	4.88	4.29	711	668	0.376	0.336
18	Pampattikeera	3.81	2.66	517	416	0.197	0.077
19	Pannedag	5.16	3.89	706	602	0.275	0.274
20	Pattikeera	11.18	9.45	677	586	0.134	0.124
21	Payarila	3.22	2.68	564	469	0.055	0.042
22	Perandika	-	-	-	-	-	-
23	Ponnamkanni	3.15	2.42	572	389	0.130	0.089
24	Sambarcheera	5.15	2.88	683	446	0.077	0.073
25	Sheengedag	6.55	6.19	996	645	0.191	0.164
26	Swargacheera						
27	Thakara	28.19	21.93	522	355	0.310	0.257
28	Thazhuthama	9.46	-	600	-	0.105	-
29	Theyyedeg	10.48	7.94	582	423	0.360	0.126
30	Thondesoup	4.96	3.59	555	496	0.270	0.197
31	Vashalacheera	15.82	3.33	372	346	0.226	0.085
32	Vela	15.50	-	502	-	0.131	-
33	Vellakeera	18.03	15.01	777	549	1.780	0.340
34	Vellathandancheera	9.96	-	307	-	0.136	-
	Mean $\pm$ SE	11.73 $\pm$ 0.38	8.36 $\pm$ 0.89	647.80 $\pm$ 40.3	516.70 $\pm$ 29.81	0.356 $\pm$ 0.01	0.172 $\pm$ 0.02
	CD	1.09	2.57	116.03	85.99	0.029	0.058
	CD between raw & cooked	0.356		19.21		0.0082	

FWB - Fresh Weight Basis

content on par with the lowest content seen in Payarila. Seven leaves namely Vashalacheera, Ponnankanni, Kainedag, Katukusoup, Pampattikeera, Payarila and Sambarcheera with a magnesium content in the range of 0.042 to 0.089 mg 100 g<sup>-1</sup> in the cooked stage were found to be on par with the lowest magnesium content noticed in cooked Elipinnakdag, while, in the cooked stage Keera (b) was the only leaf having a magnesium content on par with that seen in Kuppakeera which had the highest magnesium content among the cooked leaves.

### **Copper**

The copper content of the fresh leafy vegetables varied from 0.008 to 2.56 mg 100 g<sup>-1</sup> with Vellathandancheera and Chumalacheera having the lowest and highest contents respectively (Table 31). In the cooked leaves, the content varied from 0.07 mg in Ponnankanni to 0.462 mg per 100 g in Elipinnakdag. The mean copper contents of raw and cooked leaves were found to be 0.347 mg and 0.212 mg 100 g<sup>-1</sup> respectively. Significant variation in the copper content of fresh and cooked leaves and between the fresh and cooked leaves was also observed. None of the leaves had a copper content on par with the highest content observed either in Chumalacheera or in Elipinnakdag in the fresh and cooked stages. However, Swargacheera, Sambarcheera, Ponnankanni, Vashalacheera, Vela and Thazhuthama were found to have lower copper contents similar to that present in Vellathandancheera in the raw stage and Sambarcheera, Pampattikeera, Gonikeera and Vashalacheera had copper contents almost similar to that of Ponnankanni in the cooked stage.

### **Manganese**

Significant variation in the manganese content of the leaves was noticed within fresh and cooked leaves and between the fresh and cooked leaves (Table 31). Highest manganese content of 4.48 mg and 4.01 mg 100 g<sup>-1</sup> was observed in Thondesoup in fresh as well as in cooked stages, while Kovakeera had the lowest manganese content of 0.84 mg (raw) and 0.37 mg (cooked) per 100 g of leaves. In cooked leaves the manganese contents of Munnekeera, Kuppakeera, Pampattikeera, Pattikeera and Theyyadag were found to be on par with the lowest content observed in Kovakeera.

Table 31. Mean nutritive value of leafy vegetables (raw & cooked) consumed by the tribal communities of Palakkad District (per 100 g FWB)

Sl. No.	Name of foodstuff	Copper (mg)		Manganese (mg)		Zinc (mg)	
		Raw	Cooked	Raw	Cooked	Raw	Cooked
1	Chembila	0.270	0.156	3.17	2.45	0.81	0.520
2	Chukkutticheera	0.250	0.169	1.39	1.01	0.69	0.592
3	Chumalacheera	2.560	0.171	3.15	1.37	1.28	0.684
4	Churuli	0.570	0.374	1.53	1.22	1.40	1.340
5	Elipinnakdag	0.510	0.462	1.85	1.41	0.64	0.578
6	Gonikeera	0.244	0.095	1.41	1.05	0.73	0.617
7	Kainedag	0.248	-	2.61	2.06	0.74	0.490
8	Katukusoup	0.266	0.159	1.26	1.01	0.79	0.424
9	Keera(a)	0.238	0.201	3.57	3.02	1.67	1.410
10	Keera(b)	0.430	0.354	4.09	3.52	1.94	1.480
11	Kovakeera	0.183	0.168	0.84	0.37	0.46	0.336
12	Kuppakeera	0.528	0.332	2.01	0.66	1.27	0.830
13	Mathanela	0.362	0.342	1.88	1.59	1.19	1.020
14	Mulakucheera	0.213	0.186	2.13	1.47	1.07	0.785
15	Mullucheera	0.455	0.209	3.35	1.64	2.09	1.180
16	Munnekeera	0.347	0.215	1.72	0.46	1.00	0.693
17	Palekeera	0.504	0.230	2.17	1.77	1.63	1.510
18	Pampattikeera	0.276	0.111	1.29	0.61	0.75	0.555
19	Pannedag	0.344	0.338	3.98	2.67	1.06	1.010
20	Pattikeera	0.215	0.189	1.32	0.75	0.86	0.756
21	Payarila	0.241	0.134	2.74	2.28	0.48	0.268
22	Perandika	-	-	-	-	-	-
23	Ponnamkanni	0.103	0.070	1.88	1.57	0.61	0.505
24	Sambarcheera	0.099	0.072	2.38	1.12	0.64	0.576
25	Sheengedag	0.410	0.258	1.94	1.82	1.91	1.55
26	Swargacheera	0.123	-	-	-	0.86	-
27	Thakara	0.486	0.215	2.54	2.05	1.58	1.300
28	Thazhuthama	0.068	-	2.20	1.60	1.18	-
29	Theyyedeg	0.194	0.169	2.53	0.42	1.16	0.676
30	Thondesoup	0.236	0.167	4.48	4.01	1.30	0.844
31	Vashalacheera	0.134	0.104	1.41	0.94	0.80	0.520
32	Vela	0.032	-	2.38	2.06	0.43	-
33	Vellakeera	0.322	0.278	1.53	1.37	0.97	0.903
34	Vellathandancheera	0.008	-	2.46	1.04	-	-
	Mean $\pm$ SE	0.347 $\pm$ 0.06	0.212 $\pm$ 0.02	2.229 $\pm$ 0.13	1.533 $\pm$ 0.18	1.06 $\pm$ 0.07	0.828 $\pm$ 0.06
	CD	0.173	0.058	0.374	0.518	0.202	0.173
	CD between raw & cooked	0.0008		0.076		0.032	

FWB - Fresh Weight Basis

## Zinc

The zinc content of fresh leaves varied from 0.43 to 2.09 mg per 100 g in Vela and Mullucheera respectively with a mean zinc content of 1.06 mg per 100 g (Table 31). After cooking, the content varied from 0.268 mg in Payarila to 1.55 mg in Sheengedag with a mean content of 0.828 mg 100 g<sup>-1</sup>. Significant variation in the zinc content of the leaves was also observed within and between the fresh and cooked leaves. The zinc contents of Keera (b) and Sheengedag in the raw stage were found to be on par with the highest zinc content present in raw Mullucheera. The zinc contents of three leaves namely Kovakeera, Ponnankanni and Payarila which varied from 0.46 to 0.61 mg 100 g<sup>-1</sup> were found to be on par with the lowest zinc content present in Vela in the raw stage. In the cooked leaves the highest zinc content present in Sheengedag was found to be on par with the zinc content of cooked Keera (a & b) and Palekeera and the contents in Katukusoup and Kovakeera were found to be on par with the lowest content observed in Payarila.

## II. B. Vegetables

### Moisture

Highest and lowest moisture contents were present in Narala and Chundakka both raw and cooked stages (Table 32). The mean moisture content was found to be 89.29 per cent (raw) and 91.41 per cent (cooked) which varied from 84.36 to 93.22 per cent in raw and from 86.9 to 95.74 per cent in cooked. Significant variation was also observed within and between the raw and cooked vegetables with respect to moisture content.

### Protein

The protein content of the raw vegetables varied from 1.26 g to 2.27 g 100 g<sup>-1</sup> and in cooked vegetables from 0.73 g to 1.78 g 100 g<sup>-1</sup> (Table 32). The mean protein content was found to be 1.82 g (raw) and 1.32 g (cooked). The highest protein content in both stages was found in Chembuthandu and lowest in Narala. The variation observed in the protein content of the vegetables in and between raw and cooked stages was found to be statistically significant.

Table 32. Mean nutritive value of vegetables (raw and cooked) consumed by the tribal communities of Palakkad District (per 100 g FWB)

Sl. No.	Name of foodstuff	Moisture (g)		Protein (g)		Fibre (g)		Starch(g)		Free amino acid (mg)	
		Raw	Cooked	Raw	Cooked	Raw	Cooked	Raw	Cooked	Raw	Cooked
1	Chembuthandu	88.57	91.19	2.27	1.78	1.52	1.35	0.259	0.205	0.029	0.01
2	Chundakka	84.36	86.90	2.02	1.60	4.72	3.57	0.314	0.218	0.011	-
3	Kattuthakkali	89.63	92.25	1.72	1.14	0.86	0.53	0.361	0.220	0.096	-
4	Mulamkoombu	91.55	90.96	-	-	-	-	0.664	0.497	0.145	-
5	Narala	93.22	95.74	1.26	0.73	1.31	0.73	0.557	0.375	0.013	-
	Mean $\pm$ SE	89.29 $\pm$ 0.35	91.41 $\pm$ 0.12	1.82 $\pm$ 0.03	1.32 $\pm$ 0.01	2.1 $\pm$ 0.03	1.55 $\pm$ 0.03	0.431 $\pm$ 0.01	0.303 $\pm$ 0.001	0.058 $\pm$ 0.001	
	CD	1.21	0.414	0.117	0.039	0.117	0.117	0.036	0.004	0.004	
	CD between raw & cooked	0.329		0.04		0.044		0.014		0.004	

FWB- Fresh Weight Basis

### **Fibre**

The highest and lowest fibre contents were found in Chundakka and Kattuthakkali respectively in both raw and cooked stages with significant variation within and between the raw and cooked vegetables (Table 32). The fibre content varied from 0.86 percent to 4.72 per cent in raw and 0.53 per cent to 3.57 percent per cent in cooked vegetables with a mean fibre content of 2.1 per cent and 1.55 percent respectively.

### **Starch**

The starch content of raw and cooked vegetables varied from 0.259 to 0.664 per cent and from 0.205 to 0.497 per cent with Chembuthandu and Mulamkoombu having the lowest and highest contents (Table 32). The mean starch content was found to be 0.431 per cent and 0.303 per cent with significant variation within and between the raw and cooked vegetables.

### **Free amino acid**

Significant variation was observed in the free amino acid content of raw vegetables with a mean content of 0.058 mg per 100 g (Table 32). The highest (0.145%) and lowest (0.011%) contents were found in Mulamkoombu and Chundakka respectively. The free amino acid content of raw Narala was on par with the lowest content observed in raw Chundakka.

### **Vitamin C**

The mean vitamin C content of vegetables was found to be 30.61 mg 100 g<sup>-1</sup> with significant variation in the vitamin C content of raw vegetables (Table 33). The content in raw vegetables varied from 11.81 mg in Chembuthandu to 67.73 mg in Narala with significant variation in the vitamin C content. The vitamin C contents of cooked Narala and Kattuthakkali were found to be 23.06 mg and 10.62 mg 100 g<sup>-1</sup>.

### **Beta carotene**

Highest and lowest beta carotene were observed in Chembuthandu and Kattuthakkali respectively in raw and cooked vegetables (Table 33). The content



**Table 33. Mean nutritive value of vegetable consumed by the tribal communities of Palakkad District**

Sl No.	Name of foodstuff	Vitamin C (mg)		$\beta$ Carotene ( $\mu$ g)	
		Raw	Cooked	Raw	Cooked
1	Chembuthandu	11.81	-	490.6	365.23
2	Chundakka	34.86	-	75.31	61.55
4	Kattuthakkali	17.36	10.62	66.68	40.02
3	Mulamkoombu	21.31	-	67.82	58.4
5	Narala	67.73	23.06	106.9	60.62
	Mean $\pm$ SE	30.61 $\pm$ .64	16.84 $\pm$ 2.39	161.46 $\pm$ 1.5	117.16 $\pm$ 1.32
	CD	2.13	10.72	5.44	4.79
	CD between raw & cooked leaves	3.541		1.99	

varied from 66.68  $\mu\text{g}$  to 490.6  $\mu\text{g}$  in raw and 40.02  $\mu\text{g}$  to 365.23  $\mu\text{g}$  in cooked vegetables. The mean beta carotene content was found to be 161.46  $\mu\text{g}$  in raw and 117.16  $\mu\text{g}$  in cooked vegetables. The beta carotene content of raw Mulamkoombu was found to be on par with the beta carotene content of Kattuthakkali.

### Calcium

The calcium content of raw and cooked vegetables varied from 0.004 g to 0.27 g and 0.003 g to 0.163 g per 100 g (Table 34). The highest and lowest calcium contents were found in Narala and Kattuthakkali respectively both in raw and cooked vegetables. The mean calcium content of the vegetables was found to be 0.105 g (raw) and 0.069 g (cooked) with significant variation within and between raw and cooked vegetables.

### Phosphorus

The highest phosphorus contents of 0.052 g and 0.028 g in raw and cooked vegetables were found in Chembuthandu and Kattuthakkali respectively (Table 34). The lowest content 0.003 g 100 g<sup>-1</sup> was found in raw and cooked Chundakka. Mean phosphorus content was 0.025 g in raw and 0.011 g in cooked vegetables with significant variation within and between the raw and cooked vegetables. However, the phosphorus contents of raw Mulamkoombu and cooked Chembuthandu and Mulamkoombu were found to be on par with the lowest contents observed in raw and cooked Chundakka.

### Iron

The iron content of raw vegetables varied from 0 mg to 8.58 mg and in cooked vegetables from 0 to 3.73 mg per 100 g with significant variation in and between the iron content of raw and cooked vegetables (Table 34). The highest content was observed in raw Chembuthandu and cooked Kattuthakkali and lowest in raw and cooked Narala. The mean iron content was found to be 3.01 mg and 1.03 mg 100 g<sup>-1</sup> respectively in raw and cooked vegetables.

Table 34. Mean nutritive value of vegetables consumed (raw and cooked) by the tribal communities of Palakkad District (per 100 g FWB)

Sl. No.	Name of foodstuff	Calcium (g)		Phosphorus (g)		Iron (mg)		Sodium (mg)		Potassium (mg)		Magnesium (mg)	
		Raw	Cooked	Raw	Cooked	Raw	Cooked	Raw	Cooked	Raw	Cooked	Raw	Cooked
1	Chembuthandu	0.082	0.053	0.052	0.005	8.58	0.61	6.84	4.52	376	317	0.10	0.049
2	Chundakka	0.123	0.094	0.003	0.003	0.69	0.45	10.92	8.91	507	400	0.03	0.024
3	Kattuthakkali	0.004	0.003	0.041	0.028	5.29	3.73	8.09	5.70	380	263	0.76	0.061
4	Mulamkoombu	0.045	0.032	0.007	0.005	0.47	0.36	2.70	1.78	66	-	0.03	0.026
5	Narala	0.27	0.163	0.024	0.015	0.00	0.00	2.86	1.81	197	116	0.082	0.049
	Mean $\pm$ SE	0.105 $\pm$ 0.001	0.069 $\pm$ 0.001	0.025 $\pm$ 0.001	0.011 $\pm$ 0.001	3.01 $\pm$ 0.04	1.03 $\pm$ 0.03	6.29 $\pm$ 0.25	4.54 $\pm$ 0.08	305.16 $\pm$ 3.49	273.7 $\pm$ 3.49	0.2 $\pm$ 0.001	0.042 $\pm$ 0.001
	CD	0.004	0.004	0.004	0.004	0.145	0.109	0.906	0.29	12.65	12.72	0.004	0.004
	CD between raw & cooked	0.002		0.0006		0.047		0.264		5.84		0.0047	

FWB- Fresh Weight Basis

### Sodium

The sodium content of raw vegetables varied from 2.7 mg to 10.92 mg  $100\text{ g}^{-1}$  with Chundakka having the highest and Mulamkombu having the lowest (Table 34). Mean sodium content of raw vegetables was found to be 6.29 mg. In the cooked vegetables also highest and lowest contents were found in Chundakka (8.91 mg) and Mulamkoombu (1.78 mg) respectively with a mean content of 4.54 mg  $100\text{ g}^{-1}$ . Significant variation in the sodium contents of raw and cooked and between the raw and cooked vegetables were also observed. The sodium content of raw and cooked Narala was found to be on par with the lowest content present in raw and cooked Mulamkoombu.

### Potassium

Highest potassium content of 507 mg and 400 mg per 100 g of vegetables was noted in raw and cooked Chundakka respectively (Table 34). The lowest content in raw and cooked vegetables was in Mulamkoombu (66 mg  $100\text{ g}^{-1}$ ) and in Narala (116 mg  $100\text{ g}^{-1}$ ) respectively. The mean potassium content in raw and cooked vegetables was found to be 305.16 mg and 273.7 mg  $100\text{ g}^{-1}$  with significant variation within and between the sodium content of raw and cooked vegetables.

### Magnesium

Mean magnesium content of raw and cooked vegetables was 0.2 mg and 0.042 mg per 100 g with insignificant variation within and between the raw and cooked (Table 34). The content varied from 0.03 mg to 0.76 mg per 100 g in raw and 0.024 mg to 0.061 mg per 100 g in cooked vegetables. Highest content was observed in Kattuthakkali in raw and cooked vegetables. The lowest content in raw vegetables was in Chundakka and Mulamkoombu and in cooked vegetables in Chundakka. The magnesium content of cooked Mulamkoombu was found to be on par with the lowest content observed in cooked Chundakka.

### Copper

Copper content of raw vegetables varied from 0.068 mg in Narala to 0.188 mg in Mulamkoombu. In cooked, the content varied from 0.01 mg in

Kattuthakkali to 0.162 mg in Mulamkoombu. The mean content was found to be 0.13 mg (raw) and 0.088 mg (cooked) with significant variation in the copper content of raw and cooked and between the raw and cooked vegetables (Table 35).

### **Manganese**

Highest and lowest manganese contents were found in Kattuthakkali and Chembuthandu in raw and cooked vegetables (Table 35). The content varied from 0.078 mg to 0.572 mg in raw and 0.192 mg to 0.415 mg  $100\text{ g}^{-1}$  in cooked vegetables. The mean manganese content was found to be 0.327 mg in raw and 0.292 mg in cooked vegetables. The variation observed in the manganese content of raw and cooked and between the raw and cooked vegetables was found to be statistically insignificant. The manganese content of raw and cooked Mulamkoombu was found to be on par with the highest manganese content observed in Kattuthakkali and the content in raw and cooked Chundakka was on par with the lowest content noted in Chembuthandu.

### **Zinc**

Zinc content of the vegetables varied from 0.272 mg to 0.798 mg  $100\text{ g}$  in raw stage and 0.129 mg to 0.405 mg  $100\text{ g}^{-1}$  in cooked stage with a mean content of 0.483 mg and 0.288 mg  $100\text{ g}^{-1}$  in raw and cooked vegetables respectively (Table 35). Highest zinc content in raw and cooked stages was noted in Chembuthandu and Mulamkoombu respectively and the lowest in Narala in both stages. Significant variation in the zinc content of raw and cooked vegetables and between the raw and cooked vegetables was also observed.

## **II. C. Roots and tubers**

### **Moisture**

The moisture content of roots and tubers collected from Palakkad District varied from 71.85 per cent (Nooran) to 96.83 (Vettilakodiyan) in raw and from 73.83 per cent (Chembu) to 98.49 per cent (Vettilakodiyan). The moisture content varied significantly within and between raw and cooked roots and tubers and the mean moisture content was found to be 80.96 per cent (raw) and 82.8 per cent (cooked). The

**Table 35. Mean nutritive value of vegetables (raw and cooked) consumed by the tribal communities of Palakkad District (per 100 g FWB)**

Sl. No.	Name of foodstuff	Copper (mg)		Manganese (mg)		Zinc (mg)	
		Raw	Cooked	Raw	Cooked	Raw	Cooked
1	Chembuthandu	0.114	0.096	0.078	0.192	0.798	0.288
2	Chundakka	0.156	0.131	0.234	0.196	0.468	0.393
4	Kattuthakkali	0.125	0.010	0.572	0.415	0.312	0.225
3	Mulamkoombu	0.188	0.162	0.423	0.365	0.564	0.405
5	Narala	0.068	0.043	-	-	0.272	0.129
	Mean $\pm$ SE	0.13 $\pm$ 0.001	0.088 $\pm$ 0.001	0.327 $\pm$ 0.05	0.292 $\pm$ 0.04	0.483 $\pm$ 0.001	0.288 $\pm$ 0.001
	CD	0.004	0.004	0.196	0.157	0.004	0.004
	CD between raw & cooked	0.00003		0.077		0.00003	

FWB- Fresh Weight Basis

moisture contents of cooked Nooran and Perukku were found to be on par with the lowest content observed in cooked Chembu (Table 36).

### **Protein**

The mean protein content of raw and cooked roots and tubers was found to be 1.82 per cent and 1.32 per cent respectively with significant variation in and between the protein content of raw and cooked roots and tubers (Table 36). The protein content varied from 0.25 g to 2.59 g 100 g<sup>-1</sup> in raw and 0.11 g to 2.39 g 100 g<sup>-1</sup> in cooked roots and tubers. The highest and lowest contents were observed respectively in Chembu and Vettilakodiyam in both raw and cooked roots and tubers.

### **Fibre**

Highest and lowest fibre contents were observed in Perukku and Vettilakodiyam respectively in raw and cooked roots and tubers (Table 36). The highest fibre content in raw and cooked stages were found to be 1.4 g and 1.24 g 100 g<sup>-1</sup> and the lowest were 0.09 g and 0.04 g 100 g<sup>-1</sup> respectively. The mean fibre content was 0.70 g (raw) and 0.47 g (cooked). The variation observed in the fibre content of raw and cooked and between the raw and cooked roots and tubers were statistically significantly.

### **Starch**

The starch content varied from 1.01 g to 6.99 g 100 g<sup>-1</sup> in raw and 0.69 g to 3.16 g 100 g<sup>-1</sup> in cooked with a mean content of 2.71 g and 1.79 g 100 g<sup>-1</sup> in raw and cooked roots and tubers (Table 36). Highest starch contents in both stages were found in Nara and the lowest in Vettilakodiyam (raw) and Neeruvekka (cooked). The starch content varied significantly in and between the raw and cooked roots and tubers.

### **Free amino acid**

The free amino acid content of most of the roots and tubers was found to be 0 except in Neeruvekka in which it had a free amino acid content of 0.002 mg (raw) and 0.001 mg in cooked roots and tubers (Table 36).

Table 36. Mean nutritive value of roots & tubers (raw & cooked) consumed by the tribal communities of Palakkad District (per 100 g FWB)

Sl. No.	Name of foodstuff	Moisture (g)		Protein (g)		Fibre (g)		Starch(g)		Free amino acid (mg)	
		Raw	Cooked	Raw	Cooked	Raw	Cooked	Raw	Cooked	Raw	Cooked
1	Chembu	72.88	73.83	2.59	2.385	0.34	0.26	1.65	1.57	0.000	0.000
2	Neeruvekka	91.65	92.99	0.975	0.755	0.69	0.49	1.11	0.69	0.002	0.001
3	Nara	80.46	83.34	1.955	1.625	0.98	-	6.99	3.16	0.000	0.000
4	Nooran	71.85	74.12	1.915	1.75	0.71	0.33	2.96	2.09	0.000	0.000
5	Perukku	72.11	74.01	2.075	1.82	1.40	1.24	2.55	1.44	0.000	0.000
6	Vettilakodiyam	96.83	98.49	0.245	0.106	0.09	0.04	1.01	-	0.000	0.000
	Mean $\pm$ SE	80.96 $\pm$ 0.02	82.8 $\pm$ 0.10	1.82 $\pm$ 0.03	1.32 $\pm$ 0.03	0.70 $\pm$ 0.03	0.47 $\pm$ 0.04	2.71 $\pm$ 0.002	1.79 $\pm$ 0.03	0.0001 $\pm$ 0.001	0.0001 $\pm$ 0.001
	CD	0.242	0.345	0.069	0.104	0.104	0.145	0.069	0.109	0.003	0.003
	CD between raw & cooked	0.109		3.54		0.052		0.036		0.00003	

FWB- Fresh Weight Basis



### Vitamin C

The mean vitamin C content of raw and cooked roots and tubers was found to be 14.19 mg and 4.66 mg 100 g<sup>-1</sup> respectively with a significant variation in and between the vitamin C content of raw and cooked roots and tubers (Table 37). The content varied from 4.79 to 26.67 mg 100 g<sup>-1</sup> in raw and 2.17 mg to 7.58 mg 100 g<sup>-1</sup> in cooked. The highest content in both stages was found in Nooran and the lowest in Perukku (raw) and Nara (cooked). The vitamin C contents of raw Vettilakodiyam and Nara were found to be on par with the highest and lowest vitamin C contents observed in Nooran and Perukku respectively. In cooked, the vitamin C contents of Chembu and Perukku were on par with the lowest content observed in Nara.

### Beta carotene

The beta carotene content of roots and tubers varied from 2.34 µg to 39.93 µg 100 g<sup>-1</sup> in raw and 2.19 µg to 15.51 µg 100 g<sup>-1</sup> in cooked with a mean content of 16.72 µg (raw) and 6.92 µg (cooked) (Table 37). Highest beta carotene was noted in Perukku (raw) and Nara (cooked) and lowest in Vettilakodiyam (raw) and Chembu (cooked). None of the roots and tubers had a similar highest beta carotene content observed in raw Perukku and cooked Nara. However, the beta carotene content of raw Chembu and cooked Nooran were on par with the lowest beta carotene content observed in raw Vettilakodiyam and cooked Chembu respectively.

### Calcium

The calcium content of roots and tubers varied from 0.003 g to 0.12 g in raw and 0 g to 0.039 g per 100 g in cooked (Table 38). Highest content was found in Nara in both raw and cooked roots and tubers. The lowest was in Vettilakodiyam (raw) and Nooran (cooked). The mean calcium content of raw and cooked roots and tubers was 0.037 g and 0.015 g 100 g<sup>-1</sup> with significant variation within and between the raw and cooked roots and tubers.

### Phosphorus

The mean phosphorus content of roots and tubers was 0.035 g in raw and 0.021 g in cooked with significant variation in the phosphorus content of raw and

**Table 37. Mean nutritive value of roots & tubers (raw & cooked) consumed by the tribal communities of Palakkad District (Per 100 g FWB)**

Sl. No.	Name of foodstuff	Vitamin C (mg)		β Carotene (μg)	
		Raw	Cooked	Raw	Cooked
1	Chembu	-	-	2.79	2.19
2	Neeruvekka	8.55	3.23	4.16	3.74
3	Nara	6.10	2.17	25.55	15.51
4	Nooran	26.67	7.58	25.64	2.33
5	Perukku	4.79	2.81	39.93	10.86
6	Vettilakodiyam	24.83	7.54	2.34	-
	Mean ±SE	14.19±1	4.66±0.72	16.72±0.3	6.92±0.06
	CD	3.63	2.61	1.04	0.218
	CD between raw & cooked	1.22		0.337	

FWB- Fresh Weight Basis

cooked samples (Table 38). The content in raw samples varied from 0.006 g in Neeruvekka to 0.061 g in Perukku in the raw samples and 0.005 g in Neeruvekka and Nara to 0.046 g 100 g<sup>-1</sup> in Perukku.

### **Iron**

Iron content of roots and tubers varied from 0 to 11.86 mg 100 g<sup>-1</sup> in raw with the highest content in Nara and the lowest in Neeruvekka (Table 38). In the cooked samples also along with Neeruvekka, Perukku had no iron content and the highest content of 6.54 mg 100 g<sup>-1</sup> was found in Chembu. Significant variation was noted in and between the iron content of raw and cooked roots and tubers with a mean content of 4.19 mg in raw and 2.31 mg 100 g<sup>-1</sup> in cooked samples.

### **Sodium**

Highest sodium content of 17.48 mg in raw and 6.71 mg per 100 g in cooked samples was observed in Nooran and the lowest content of 0.665 mg in raw and 0.285 mg in cooked samples was found in Vettilakodiyam (Table 38). Mean sodium content in raw and cooked samples was found to be 7.57 mg and 4.63 mg 100 g<sup>-1</sup> with significant variation in and between the raw and cooked roots and tubers.

### **Potassium**

Potassium content varied from 70 mg to 793 mg in raw and 19 mg to 701 mg 100 g<sup>-1</sup> in cooked roots and tubers (Table 38). Highest and lowest contents were noted in Chembu and Vettilakodiyam in both raw and cooked samples. Mean potassium content was found to be 330.48 mg in raw and 255.89 mg 100 g<sup>-1</sup> in cooked samples with significant variation within and between the raw and cooked roots and tubers.

### **Magnesium**

Mean magnesium content of 0.12 mg in raw and 0.071 mg in cooked roots and tubers was observed (Table 38). The content varied from 0.02 mg to 0.19 mg in raw and 0.007 mg to 0.124 mg in cooked. Highest and lowest contents in both raw and cooked roots and tubers were observed in Nooran and Vettilakodiyam respectively.

Table 38. Mean nutritive value of roots & tubers (raw & cooked) consumed by the tribal communities of Palakkad District (per 100 g FWB)

Sl. No.	Name of foodstuff	Calcium (g)		Phosphorus (g)		Iron (mg)		Sodium (mg)		Potassium (mg)		Magnesium (mg)	
		Raw	Cooked	Raw	Cooked	Raw	Cooked	Raw	Cooked	Raw	Cooked	Raw	Cooked
1	Chembu	0.022	0.021	0.038	0.036	7.36	6.54	5.42	5.24	793	701	0.13	0.116
2	Neeruvekka	0.038	0.03	0.006	0.005	0.00	0.00	4.03	3.70	155	114	0.07	0.050
3	Nara	0.12	0.039	0.033	0.005	11.86	1.38	11.70	6.68	278	217	0.15	0.022
4	Nooran	0.045	0.00	0.046	0.019	5.25	3.62	17.48	6.71	310	187	0.19	0.124
5	Perukku	0.033	0.016	0.061	0.046	0.43	0.00	6.14	5.18	377	298	0.17	0.110
6	Vettilakodiyan	0.003	0.001	0.028	0.013	0.245	-	0.665	0.285	70	19	0.02	0.007
	Mean $\pm$ SE	0.037 $\pm$ 0.001	0.015 $\pm$ 0.001	0.035 $\pm$ 0.001	0.021 $\pm$ 0.001	4.19 $\pm$ 0.09	2.31 $\pm$ 0.15	7.57 $\pm$ 0.23	4.63 $\pm$ 0.21	330.48 $\pm$ 3.15	255.89 $\pm$ 9.78	0.12 $\pm$ 0.001	0.071 $\pm$ 0.001
	CD	0.003	0.003	0.003	0.003	0.311	0.544	0.794	0.725	11.42	33.74	0.003	0.003
	CD between raw & cooked	0.0006		0.0006		0.183		0.278		10.48		0.0043	

FWB- Fresh Weight Basis

Significant variation was observed in the magnesium content of raw and cooked and between the raw and cooked roots and tubers.

### **Copper**

The mean copper content of roots and tubers was found to be 0.298 mg in raw and 0.174 mg in cooked samples (Table 39). The highest copper content was observed in raw Chembu (0.524 mg) and cooked Perukku (0.279 mg). The lowest content in both raw (0.032 mg) and cooked (0.011 mg) stages was found in Vettilakodiyan. Significant variation in the copper content of raw and cooked and between the raw and cooked roots and tubers was also observed.

### **Manganese**

The manganese content varied from 0.128 mg to 1.08 mg in raw and 0.06 mg to 0.774 mg in cooked roots and tubers (Table 39). Highest manganese content was found in Nara (raw) and Nooran (cooked) and the lowest in both raw and cooked stages was in Vettilakodiyan. Mean manganese contents in raw and cooked stages were found to be 0.698 mg and 0.505 mg respectively. The manganese contents of Chembu, Perukku and Nooran in the raw state were found to be on par with the highest content noted in raw Nara. The contents in raw and cooked Neeruvekka were also on par with the lowest content observed in raw and cooked Vettilakodiyan. In the cooked roots and tubers also the manganese contents of Chembu, Nara and Perukku were found to be on par with the highest content observed in cooked Nooran.

### **Zinc**

The variation in the zinc content of roots and tubers in the raw state was found to be statistically insignificant (Table 39). However, the zinc content of cooked roots and tubers and between the raw and cooked stages were found to be statistically significant. The zinc content varied from 0.064 mg to 0.977 mg in raw and 0.015 mg to 0.262 mg in cooked samples. The highest content was noted in Perukku (raw) and Chembu (cooked) and the lowest in Vettilakodiyan in both stages. The mean zinc content was found to be 0.436 mg and 0.197 mg in raw and cooked roots and tubers respectively.

Table 39. Mean nutritive value of roots & tubers (raw & cooked) consumed by the tribal communities of Palakkad District (Per 100 g FWB)

Sl. No.	Name of foodstuff	Copper (mg)		Manganese (mg)		Zinc (mg)	
		Raw	Cooked	Raw	Cooked	Raw	Cooked
1	Chembu	0.524	0.271	0.813	0.707	0.542	0.262
2	Neeruvekka	0.042	0.035	0.420	0.350	0.168	0.140
3	Nara	0.390	0.167	1.080	0.501	0.585	0.250
4	Nooran	0.282	0.258	0.850	0.774	0.282	0.258
5	Perukku	0.518	0.279	0.900	0.558	0.977	0.259
6	Vettilakodiyam	0.032	0.011	0.128	0.060	0.064	0.015
	Mean $\pm$ SE	0.298 $\pm$ 0.001	0.174 $\pm$ 0.001	0.698 $\pm$ 0.13	0.505 $\pm$ 0.11	0.436 $\pm$ 0.17	0.197 $\pm$ 0.03
	CD	0.003	0.003	0.449	0.38	0.587	0.104
	CD between raw & cooked	0.00003		0.149		0.155	

## II. D. Cereals

The nutritive value of Cereals is given in Table 40 and 41.

### Moisture

The moisture content of cereals varied from 3.14 per cent (Manjacholam) to 11.48 per cent (Chama) with a mean content of 7.12 per cent. Significant variation in the moisture content of cereals was observed. The moisture content of Makkacholam was found to be almost similar to the moisture content of Manjacholam.

### Protein

The protein content of cereals varied from 7.35 per cent in Cholam to 14.23 per cent in Malanchama with a mean content of 11.30 per cent. The protein content of Chama (13.89%) was found to be on par with the highest protein content observed in Malanchama.

### Fibre

The mean fibre content of cereals was found to be 2.26 per cent with a variation in between 0.95 per cent in Kambacholam and Malanchama to 8.47 per cent in Porikeera seeds. The variation observed in the fibre content of cereals was statistically insignificant and the fibre content of Manjacholam was found to be on par with the lowest content seen in Kambacholam and Malanchma.

### Starch

Highest (63.46%) and lowest (20.75%) starch contents were found in Chama and Makkacholam with a mean content of 47.05 per cent. Significant variation was observed in the starch content of cereals with a mean content of 47.05 per cent.

### Free amino acid

The free amino acid content of cereals varied from 0.005 mg to 0.018 mg 100 g<sup>-1</sup> with Porikeera seeds having the highest and Ragi the lowest. Mean free amino acid was found to be 0.012 mg 100 g<sup>-1</sup>. The variation in the free amino acid content of cereals was found to be statistically insignificant. The free amino acid content of Malanchama was found to be on par with the lowest content observed in Ragi.

Table 40. Mean nutritive value of cereals consumed by the tribal communities of Palakkad District (per 100 g FWB)

Sl No.	Name of foodstuff	Moisture (g)	Protein (g)	Fibre (g)	Starch (g)	Free amino acid (mg)	β Carotene (μg)	Energy (K cal)
1	Chama	11.48	13.89	1.55	63.46	0.012	7.43	320
2	Cholam	8.15	7.35	1.38	28.82	0.011	15.49	132
3	Kamba cholam	5.00	8.29	0.95	56.22	0.014	4.32	325
4	Makka cholam	3.99	13.17	1.44	20.75	0.013	38.64	146
5	Malanchama	5.06	14.23	0.95	57.91	0.007	16.93	312
6	Manja cholam	3.14	9.45	0.97	49.78	0.013	41.66	290
7	Porikeera seeds	8.40	11.97	8.47	49.43	0.018	4.87	283
8	Ragi	9.90	11.49	3.72	54.75	0.005	9.44	313
9	Thena	9.94	11.91	1.80	37.91	0.012	7.57	255
10	Varaku	5.83	11.22	1.41	59.48	0.011	4.63	317
	Mean ±SE	7.12 ±0.37	11.30 ±0.5	2.26±0.1	47.052±0.1	0.012±0.001	15.09 ±0.23	269±1.00
	CD	1.16	0.346	0.314	0.314	0.003	0.723	3.15

FWB - Fresh Weight Basis



### **Beta carotene**

The beta carotene content of cereals varied from 4.32  $\mu\text{g}$  in Kambacholam to 41.66  $\mu\text{g}$  in Manjacholam with a mean content of 15.10  $\mu\text{g}$  100  $\text{g}^{-1}$ . Significant variation was also observed in the beta carotene content of cereals. The content in Porikeera seeds and Varaku were found to be on par with the lowest beta carotene content of Kambacholam.

### **Energy**

The energy content of cereals varied from 132 Kcal to 325 Kcal 100  $\text{g}^{-1}$ . The lowest content was noted in Cholam and the highest in Kambacholam. The variation observed in the energy content of cereals was statistically significant.

### **Calcium**

The calcium content of cereals varied from 0.125 g in Chama to 0.414 g in Ragi with a mean content of 0.218 g 100  $\text{g}^{-1}$ . Significant variation in the calcium content of cereals was observed. The calcium content of Makkacholam was found to be on par with the lowest content observed in Chama.

### **Phosphorus**

The phosphorus content varied from 0.15 g to 0.561 g 100  $\text{g}^{-1}$  with Porikeera seeds having the highest and Cholam having the lowest contents. Significant variation was observed in the phosphorus content of cereals with a mean content of 0.241 g 100  $\text{g}^{-1}$ . The phosphorus content of Makkacholam was found to be on par with the lowest content present in Cholam.

### **Iron**

Mean iron content of cereals was found to be 31.31 mg 100  $\text{g}^{-1}$  with significant variation in the iron content of cereals. Highest and lowest contents were observed in Manjacholam (43.15 mg 100  $\text{g}^{-1}$ ) and Malanchama (14.53 mg 100  $\text{g}^{-1}$ ) respectively.

### **Sodium**

The sodium content of cereals varied from 3.77 mg to 22.73 mg with Kambacholam having the highest and Varaku the lowest. Mean sodium content was

found to be 13.19 mg 100 g<sup>-1</sup> with insignificant variation in the sodium content of cereals.

#### **Potassium**

Highest potassium content (320.6 mg 100 g<sup>-1</sup>) was observed in Porikeera seeds and the lowest (84.96 mg 100 g<sup>-1</sup>) in Chama. Mean content was found to be 163.33 mg 100 g<sup>-1</sup> with insignificant variation in the potassium content of cereals. The potassium content of Ragi (315.35 mg 100 g<sup>-1</sup>) was found to be on par with the highest value observed in Porikeera seeds and the potassium content of Varaku (88.55 mg 100 g<sup>-1</sup>) was on par with the lowest content observed in Chama.

#### **Magnesium**

Highest and lowest magnesium contents were found in Makkacholam (0.829 mg) and Malanchama (0.468 mg) respectively with a mean content of 0.607 mg 100 g<sup>-1</sup>. Significant variation in the magnesium content of cereals was also observed.

#### **Copper**

The copper content varied from 0.184 mg (Cholam) to 0.916 mg (Porikeera seeds) per 100 g with a mean content of 0.514 mg per 100 g. The variation observed in the copper content of cereals was found to be statistically significant.

#### **Manganese**

The manganese contents of almost all cereals analysed were found to be low except ragi which had the highest content of 16.67 mg 100 g<sup>-1</sup>. In all other cereals the content varied from 1.9 mg to 5.04 mg per 100 g. Mean manganese content was found to be 4.82 mg per 100 g.

#### **Zinc**

Significant variation in the zinc content of cereals was observed with a mean content of 2.78 mg 100 g<sup>-1</sup>. The content varied from 0.92 mg to 7.54 mg 100 g<sup>-1</sup> with Varaku having the highest and Cholam the lowest zinc contents.

Table 41. Mean nutritive value of cereals consumed by the tribal communities of Palakkad District (per 100 g FWB)

Sl No.	Name	Calcium (g)	Phosphorus (g)	Iron (mg)	Sodium (mg)	Potassium (mg)	Magnesium (mg)	Copper (mg)	Zinc (mg)	Manganese (mg)
1	Chama	0.125	0.264	30.24	12.39	84.96	0.595	0.620	2.67	3.54
2	Cholam	0.220	0.150	38.07	11.02	128.52	0.518	0.184	0.92	4.13
3	Kamba cholam	0.208	0.167	33.70	22.73	163.83	0.546	0.474	1.89	3.79
4	Makka cholam	0.134	0.152	36.11	16.32	137.20	0.829	0.288	0.96	2.40
5	Malanchama	0.209	0.247	14.53	15.20	126.35	0.468	0.380	2.85	1.90
6	Manja cholam	0.214	0.257	43.15	11.63	157.95	0.535	0.581	1.94	3.36
7	Porikeera seeds	-	0.561	26.01	10.99	320.60	0.747	0.916	2.75	5.04
8	Ragi	0.414	0.191	35.28	15.32	315.35	0.581	0.360	2.70	16.67
9	Thena	0.216	0.255	23.35	12.61	109.93	0.595	0.586	3.60	3.60
10	Varaku	0.226	0.157	32.69	3.77	88.55	0.656	0.754	7.54	3.77
	Mean $\pm$ SE	0.218 $\pm$ 0.02	0.241 $\pm$ 0.001	31.31 $\pm$ 1.16	13.19 $\pm$ 1.07	163.33 $\pm$ 18.61	0.607 $\pm$ 0.02	0.514 $\pm$ 0.01	2.782 $\pm$ 0.001	4.82 $\pm$ 1.08
	CD	0.064	0.003	3.64	2.89	7.73	0.031	0.031	0.003	3.39
	CD between raw & cooked	0.047	0.002	0.872	0.714	2.42	0.011	0.012	0.051	0.848

FWB - Fresh Weight Basis

### III. WAYANAD DISTRICT

#### III. A. Leafy vegetables

##### Moisture

The moisture content of raw leafy vegetables varied from 73.7 per cent in Cheriya kadaladi to 93.61 per cent in Kaycheera I with a mean moisture content of 84.98 per cent (Table 42). In the cooked leaves the content varied from 76.02 per cent (Cheriya kadaladi) to 93.15 per cent in Kozhuppa. The variations observed in the moisture content of raw and cooked leaves and between the raw and cooked leaves were found to be statistically significant. The moisture contents of cooked Chumannacheera, Sambarcheera and Vayalkaduku were found to be on par with the highest moisture content of cooked Kozhuppa.

##### Fat

The fat content of the raw leaves varied from 0.13 to 1.22 per cent with a mean content of 0.52 per cent (Table 42). The highest and lowest fat contents in raw leaves were found in Kallurukki and Mullukeera respectively. In the cooked leaves the highest and lowest fat contents were found in Karimchembila (0.63%) and Vashalacheera (0.03%) respectively. Significant variation was observed within and between the raw and cooked leafy vegetables with respect to fat content.

##### Protein

Highest protein content of 6.49 per cent and 5.64 per cent was observed in Cheriya kadaladi both in raw and cooked samples respectively (Table 42). The lowest was in Kayacheera I (1.28%) in raw leaves and Vayalkaduku (0.86%) in cooked leaves. The mean protein content of the leaves was found to be 3.17 per cent (raw) and 2.54 per cent (cooked). The variation observed in the protein content of raw and cooked leaves and between the raw and cooked leaves was found to be statistically significant. Raw Vayalkaduku was the only leaf which had a protein content on par with the lowest content observed in Kaycheera I.

##### Fibre

The fibre content of the leafy vegetables varied from 0.55 per cent to 3.1 per cent with the highest in Chanacheera and lowest in Kaycheera I and Vashalacheera

Table 42. Mean nutritive value of leafy vegetables (raw & cooked) consumed by the different tribal communities of Wayanad district (per 100 g FWB)

Sl. No.	Name of foodstuff	Moisture (g)		Fat (g)		Protein (g)	
		Raw	Cooked	Raw	Cooked	Raw	Cooked
1	Ambasheppu	85.36	88.24	0.55	0.48	3.61	2.82
2	Appuppanthadi	85.76	84.45	0.37	-	1.66	1.57
3	Chanacheera	86.79	89.86	0.62	0.17	3.31	2.48
4	Churuli	88.33	87.65	0.36	0.29	3.55	2.74
5	Cheera	86.84	89.06	-	-	2.73	2.01
6	Cheriyakadaladi	73.70	76.02	0.56	0.53	6.49	5.64
7	Chumannacheera	89.01	91.46	0.15	0.14	1.76	1.41
8	Chumalacheera	83.80	86.05	0.54	-	4.09	3.5
9	Kadukucheera	84.31	87.44	0.69	-	-	-
10	Kadumudunga	81.04	84.29	0.83	0.30	4.34	3.13
11	Kaipayila	81.14	83.82	0.56	0.32	2.62	2.58
12	Kallurukki	87.38	89.85	1.22	0.45	2.5	1.88
13	Kannisoupe	82.87	86.72	-	-	4.54	3.35
14	Karamanasheppu	78.37	83.54	0.72	-	5.34	3.64
15	Karimchembila	85.98	87.5	0.75	0.63	2.77	2.37
16	Kattuthakkaliela	87.92	91.01	1.13	0.27	2.37	1.69
17	Kayacheera	83.29	86.42	0.23	-	3.32	2.67
18	Kaycheera I	93.61		0.33	-	1.28	-
19	Kayyoonnam	83.15	87.45	0.39	-	3.18	2.27
20	Kodakan	86.27	85.72	0.29	0.23	3.17	3.04
21	Kozhuppa	90.44	93.15	0.19	0.07	1.92	1.31
22	Kuppakeera	81.02	84.03	0.44	0.43	4.24	3.32
23	Mattasheppu	85.0	87.26	0.55	0.34	2.89	2.34
24	Minnamkanni	88.48	91.35	0.58	-	2.91	2.12
25	Mullukeera	80.36	82.37	0.13	-	3.96	3.42
26	Murukkila	85.36	88.9	0.43	0.32	3.77	2.74
27	Neycheera	87.14	89.72	0.26	0.17	2.6	2.0
28	Palcheera	86.27	88.8	0.23	-	3.0	-
29	Payarila	88.72	85.28	0.49	0.37	1.57	1.34
30	Ponnankanni	81.69	85.76	0.73	0.57	4.65	3.47
31	Pottipazhamela	77.71	-	0.59	-	3.01	-
32	Sambarcheera	90.04	93.11	0.29	0.28	1.91	1.31
33	Thakara	77.87	83.55	0.92	0.49	5.28	3.79
34	Thalu	86.18	89.64	0.32	0.17	2.67	2.01
35	Thumbacheera	83.39	86.05	0.55	0.51	2.68	2.31
36	Uruvulikkila	87.56	90.96	0.70	0.31	2.78	2.0
37	Valiyakadaladi	77.88	80.46	0.07	-	5.56	4.84
38	Vashalacheera	87.68	90.54	0.58	0.03	2.51	1.75
39	Vayalchulli	84.2	91.15	0.36	0.12	4.05	2.11

Contd.

Table 42. continued

Sl. No.	Name of foodstuff	Moisture (g)		Fat (g)		Protein (g)	
		Raw	Cooked	Raw	Cooked	Raw	Cooked
40	Vayalchulli (valuthu)	86.08	84.05	0.52	0.21	2.19	1.93
41	Vayalkaduku	89.9	92.72	0.41	0.09	1.32	0.86
42	Vazhalacheera	85.69	-	-	-	2.05	-
43	Vellachembila	90.26	89.8	-	-	-	-
	Means $\pm$ SE	84.98 $\pm$ 0.93	87.39 $\pm$ 0.61	0.52 $\pm$ 0.001	0.31 $\pm$ 0.001	3.17 $\pm$ 0.07	2.54 $\pm$ 0.05
	CD	2.65	1.74	0.003	0.003	0.199	0.142
	CD between raw & cooked	0.354		0.0008		0.03	

FWB-Fresh Weight Basis

(Table 43). In the cooked state the content varied from 0.24 per cent to 2.16 per cent with the highest fibre content in Cheriyakadaladi and the lowest in Vashalacheera. The fibre content of raw and cooked leaves and between the raw and cooked leaves varied significantly with a mean fibre content of 1.58 per cent in raw and 1.05 per cent in cooked leaves. Vayalchulli with a fibre content of 0.36 per cent was found to be on par with the lowest fibre content of Vashalacheera in the cooked stage.

### **Starch**

The mean starch content of leaves was found to be 0.383 per cent (raw) and 0.182 per cent (cooked) (Table 43). The starch content of raw leaves varied from 0 to 2.22 per cent and in cooked leaves it varied from 0 to 0.713 per cent. The highest starch content in raw and cooked leaves was found to be in Thakara and Cheriyakadaladi respectively and the lowest was in Kayacheera I and Neycheera in both stages. Significant variation in the starch content of raw and cooked leaves and between the raw and cooked leaves was also observed.

### **Free amino acid**

Free amino acid content of raw leaves varied from 0.001 (Cheera) to 0.031 (Payarila) per cent with a mean content of 0.007 per cent (Table 43). The leaves with free amino acid contents in the range of 0.002 to 0.004 mg 100 g<sup>-1</sup> were found to be on par with the lowest content observed in Cheera. None of the raw leaves had a similar free amino acid content observed in Payarila which was the highest. In cooked leaves also the contents varied from 0.001 mg to 0.026 mg 100 g<sup>-1</sup>. The lowest content was observed in Ambasheppu, Cheriyakadaladi, Chumalacheera, Kodakan, Kozhuppa, Mattasheppu, Valiyakadaladi and Vayalkaduku. Highest free amino acid content was observed in cooked Payarila. Here also the leaves with free amino acid contents in between 0.002 to 0.004 mg 100 g<sup>-1</sup> were found to be on par with the lowest content of 0.001 mg 100 g<sup>-1</sup> observed in different leaves.

### **Vitamin C**

The vitamin C content of the leaves varied from 32.03 mg in Churuli to 222.22 mg in Chumalacheera with a mean content of 80.70 mg 100 g<sup>-1</sup> (Table 44). In

Table 43. Mean nutritive value of leafy vegetables (raw & cooked) consumed by the different tribal communities of Wayanad District (per 100g FWB)

Sl. No.	Name of foodstuff	Fibre (g)		Starch (g)		Free amino acid (mg)	
		Raw	Cooked	Raw	Cooked	Raw	Cooked
1	Ambasheppu	1.5	0.97	0.6	0.263	0.003	0.001
2	Appuppanthadi	1.47	1.44	0.281	0.144	0.005	0.003
3	Chanacheera	3.1	0.68	0.434	0.222	0.01	0.004
4	Churuli	1.99	1.48	0.301	0.14	0.004	0.002
5	Cheera	1.29	0.76	0.265	0.19	0.001	
6	Cheriyakadaladi	2.89	2.16	0.758	0.713	0.002	0.001
7	Chumannacheera	1.05	0.74	0.235	0.171	0.015	0.009
8	Chumalacheera	1.94	1.4	0.468	0.389	0.002	0.001
9	Kadukucheera	-	-	-	-	0.017	-
10	Kadumudunga	1.63	1.22	0.248	0.00	0.006	0.003
11	Kaipayila	1.37	1.13	0.31	0.176	0.008	0.005
12	Kallurukki	2.15	1.58	0.404	0.241	0.016	0.011
13	Kannisoupe	1.37	1.29	0.162	0.091	0.009	0.006
14	Karamanasheppu	1.62	1.02	0.606	0.177	0.019	0.011
15	Karimchembila	2.28	1.72	0.641	0.055	0.005	0.003
16	Kattuthakkaliela	1.33	1.04	0.023	0.006	0.027	0.018
17	Kayacheera	1.48	0.68	0.321	0.245	0.002	
18	Kaycheera 1	0.55	-	0.00	0.00	0.005	-
19	Kayyoonnam	1.77	0.88	0.149	0.095	0.01	-
20	Kodakan	1.4	1.27	0.122	0.084	0.005	0.001
21	Kozhuppa	0.96	0.57	0.328	0.244	0.002	0.001
22	Kuppakeera	2.04	1.04	0.482	0.045	0.003	0.002
23	Mattasheppu	1.75	1.27	0.345	0.047	0.002	0.001
24	Minnamkanni	1.38	0.69	0.134	0.098	0.003	
25	Mullukeera	1.47	0.62	0.552	0.481	0.003	
26	Murukkila	1.89	1.58	0.272	0.189	0.011	0.009
27	Neycheera	0.84	0.77	0.00	0.00	0.008	0.004
28	Palcheera	1.75	0.83	0.119	-	0.012	-
29	Payarila	1.14	0.96	1.71	0.187	0.031	0.026
30	Ponnamkanni	2.53	1.64	0.542	0.392	0.009	0.005
31	Pottipazhamela	1.23	-	0.312	-	0.008	-
32	Sambarcheera	1.21	0.45	0.19	0.12	0.007	0.002
33	Thakara	1.76	1.07	2.22	0.247	0.008	0.004
34	Thalu	1.09	1.08	0.453	0.248	0.005	0.004

Contd.



Table 43. continued

Sl. No.	Name of foodstuff	Fibre (g)		Starch (g)		Free aminoacid (mg)	
		Raw	Cooked	Raw	Cooked	Raw	Cooked
35	Thumbacheera	1.42	1.33	0.331	0.187	0.005	0.002
36	Uruvulikkila	1.33	1.01	0.073	0.041	0.008	0.004
37	Valiyakadaladi	2.38	1.66	0.639	0.599	0.002	0.001
38	Vashalacheera	0.55	0.24	0.106	0.069	0.004	0.002
39	Vayalchulli	1.19	0.36	0.179	0.091	0.003	0.002
40	Vayalchulli (valuthu)	2.28	1.25	0.123	0.122	0.005	0.005
41	Vayalkaduku	0.97	0.61	0.138	0.127	0.002	0.001
42	Vazhalacheera	1.29	-	-	-	-	-
43	Vellachembila	1.97	0.77	0.188	0.166	0.005	-
	Means $\pm$ SE	1.58 $\pm$ 0.03	1.05 $\pm$ 0.05	0.383 $\pm$ 0.01	0.182 $\pm$ 0.02	0.007 $\pm$ 0.001	0.005 $\pm$ 0.001
	CD	0.085	0.142	0.028	0.057	0.003	0.003
	CD between raw & cooked	3.27		0.007		0.00003	

FWB-Fresh Weight Basis

cooked leaves the content varied from 6.61 mg to 79.45 mg with the lowest and highest contents in Neycheera and Thakara respectively. The mean vitamin C content of cooked leaves was found to be 30.69 mg. The variation in the vitamin C contents of raw and cooked leaves and between the raw and cooked leaves were found to be statistically significant. Among the cooked leaves the vitamin C content of Kadumudunga and Kallurukki were found to be almost similar to the highest vitamin C content observed in Thakara. The vitamin C content of cooked Churuli was also found to be on par with the Vitamin C content of cooked Neycheera.

### **Beta carotene**

The beta carotene content of raw leaves varied from 341  $\mu\text{g}$  to 2135  $\mu\text{g}$  and in cooked leaves the content varied from 85  $\mu\text{g}$  to 1949  $\mu\text{g}$  100  $\text{g}^{-1}$  (Table 44). Highest beta carotene was seen in Mullukeera (raw) and Cheriyaadaladi (cooked) and the lowest in both stages was in Kozhuppa. The mean content was found to be 1158  $\mu\text{g}$  (raw) and 876  $\mu\text{g}$  (cooked). Significant variation was noticed in the beta carotene content of raw and cooked leaves and between the raw and cooked leaves. Raw Kadumudunga and Pottipazham leaves were found to have beta carotene contents similar to that in Mullukeera. Cooked Mullukeera also had a similar beta carotene content observed in cooked Cheriyaadaladi.

### **Calcium**

Significant variation in the calcium content of raw and cooked leaves and between the raw and cooked leaves was observed (Table 45). The mean calcium content was found to be 0.32 g 100  $\text{g}^{-1}$  in raw and 0.214 g 100  $\text{g}^{-1}$  in cooked leaves. The calcium content of raw leaves varied from 0.067 g (Pottipazham leaf) to 1.40 g 100  $\text{g}^{-1}$  in Cheriyaadaladi. In cooked leaves the calcium content was in the range of 0.038 g to 0.95 g 100  $\text{g}^{-1}$  with Churuli and Cheriyaadaladi having the lowest and highest contents respectively. The calcium contents of Churuli, Karimchembila, Kozhuppa and Thalu were found to be almost similar to the content observed in Pottipazham leaf which was the lowest in the raw state. In cooked leaves calcium contents of Kozhuppa and Sambarcheera were on par with the highest content

Table 44. Mean nutritive value of leafy vegetables (raw & cooked) consumed by the different tribal communities of Wayanad District (per 100 g FWB)

Sl. No.	Name of foodstuff	Vitamin C (mg)		β Carotene (µg)	
		Raw	Cooked	Raw	Cooked
1	Ambasheppu	38.01	12	1226	1069
2	Appuppanthadi	46.13	15.08	747	658
3	Chanacheera	37.42	14.37	1325	519
4	Churuli	32.03	7.28	833	599
5	Cheera	-	-	383	-
6	Cheriyakadaladi	59.55	31.0	1989	1949
7	Chumannacheera	40.35	14.19	548	531
8	Chumalacheera	222.22	-	1520	1271
9	Kadukucheera	171.01	-	1465	-
10	Kadumudunga	141.56	79.0	2061	1564
11	Kaipayila	54.86	33.64	1684	1683
12	Kallurukki	183.51	76.63	1318	1057
13	Kannisoupe	125	25.01	639	489
14	Karamanasheppu	97.14	45.2	1276	940
15	Karimchembila	27.79	10.12	908	798
16	Kattuthakkaliela	54.75	18.51	1091	795
17	Kayacheera	78.03	23.47	884	723
18	Kaycheera 1	60.5	27.28	786	-
19	Kayyoonnam	45.54	17.53	684	413
20	Kodakan	56.28	19.08	613	383
21	Kozhuppa	36.83	16.35	341	85
22	Kuppakeera	50.66	17.75	1281	1050
23	Mattasheppu	86.47	38.9	917	770
24	Minnamkanni	101.25	45.89	615	463
25	Mullukeera	105.42	44.69	2135	1933
26	Murukkila	66.84	28.06	990	611
27	Neycheera	25.35	6.61	1006	687
28	Palcheera	63.42	28.55	830	-
29	Payarila	68.15	26.59	1394	1046
30	Ponnamkanni	48.99	20.03	1079	546
31	Pottipazhamela	98.45	-	2107	-
32	Sambarcheera	175.57	71.92	733	467
33	Thakara	151.79	79.45	1822	1375
34	Thalu	66.12	13.12	972	533
35	Thumbacheera	34.16	21.32	1341	749

Contd.

Table 44. continued

Sl. No.	Name of foodstuff	Vitamin C (mg)		β Carotene (µg)	
		Raw	Cooked	Raw	Cooked
36	Uruvulikkila	190.27	91.7	2037	1292
37	Valiyakadaladi	34.56	17.99	1800	1744
38	Vashalacheera	161.6	46.66	1177	889
39	Vayalchulli	43.15	19.06	1573	805
40	Vayalchulli (valuthu)	44.9	17.08	1457	706
41	Vayalkaduku	43.77	17.55	359	348
42	Vazhalacheera	46.99	-	1010	-
43	Vellachembila	-	-	-	-
	Means± SE	80.70±2.88	30.69±1.34	1158±26.14	876±0.23
	CD	8.21	3.82	74.49	23.45
	CD between raw & cooked	1.05		4.006	

FWB-Fresh Weight Basis

observed in Cheriyaadaladi. The calcium content of raw Kaippiyila was also found to be on par with the highest content observed in Cheriyaadaladi.

### Phosphorus

The phosphorus content of raw leaves ranged from 0.003 to 0.136 g and in cooked leaves from 0.016 g to 0.122 g 100 g<sup>-1</sup> (Table 45). The highest phosphorus content in raw and cooked leaves was found to be in Mattasheppu and the lowest in Kaycheera I (raw) and Vayalchulli (cooked). The variation observed in the phosphorus content of raw leaves was found to be statistically insignificant, while, in the cooked leaves the variation was found to be statistically significant. The mean phosphorous content of the leaves was found to be 0.062 g (raw) and 0.047 g 100 g<sup>-1</sup> (cooked).

### Iron

The iron content of the raw and cooked leaves varied from 0 mg to 68.23 mg and 0 mg to 62.47 mg 100 g<sup>-1</sup> (Table 45). The highest iron content in the raw and cooked leaves was observed in Kuppakeera and Cheriyaadaladi respectively and the lowest in raw Kaycheera I and Mattasheppu and in cooked leaves in Mattasheppu, Payarila, Thalu and Thumbacheera. The variation observed within and between the raw and cooked leaves with respect to the iron content was found to be statistically significant. None of the leaves were found to have an iron content on par with that observed in Kuppakeera and Cheriyaadaladi which had the highest contents in the raw and cooked stages.

### Sodium

Highest sodium content in raw (108.75 mg 100 g<sup>-1</sup>) and cooked (107.25 mg 100 g<sup>-1</sup>) leafy vegetables was present in Kodakan and lowest was in Thalu (2.56 mg 100 g<sup>-1</sup>) in raw and Karimchembila (1.26 mg 100 g<sup>-1</sup>) in cooked (Table 46). Mean sodium content of 10.82 mg 100 g<sup>-1</sup> and 8.04 mg 100 g<sup>-1</sup> were observed in raw and cooked leaves. Significant variation in the raw and cooked leaves and between the raw and cooked leaves was also observed with respect to sodium content. The leaves with sodium contents of 2.79 mg to 3.79 mg 100 g<sup>-1</sup> in raw and 1.63 mg to 3.81 mg 100 g<sup>-1</sup>

Table 45. Mean nutritive value of leafy vegetables (raw & cooked) consumed by the different tribal communities of Wayanad District (per 100 g FWB)

Sl. No.	Name of foodstuff	Calcium (g)		Phosphorus (g)		Iron (mg)	
		Raw	Cooked	Raw	Cooked	Raw	Cooked
1	Ambasheppu	0.142	0.125	0.069	0.054	21.96	9.64
2	Appuppanthadi	0.157	0.137	0.073	0.071	11.48	8.44
3	Chanacheera	0.243	0.168	0.075	0.042	12.59	6.11
4	Churuli	0.112	0.038	0.049	0.036	1.8	0.392
5	Cheera	0.278	-	0.047	0.035	7.57	3.58
6	Cheriyakadaladi	1.40	0.95	0.073	0.055	62.6	62.47
7	Chumannacheera	0.168	0.102	0.028	0.019	2.41	1.29
8	Chumalacheera	0.252	0.177	0.049	0.036	15.42	3.14
9	Kadukucheera	0.286	-	0.044	-	63.97	-
10	Kadumudunga	0.346	0.234	0.08	0.076	4.76	1.49
11	Kaipayila	1.36	0.396	0.056	0.047	5.2	1.37
12	Kallurukki	0.126	0.088	0.019	0.018	2.54	0.996
13	Kannisoupe	0.20	0.134	0.105	0.073	42.56	21.29
14	Karamanasheppu	0.233	0.163	0.117	0.055	7.88	4.63
15	Karimchembila	0.096	0.075	0.064	0.038	3.82	1.0
16	Kattuthakkaliela	0.169	0.115	0.047	0.027	18.12	13.08
17	Kayacheera	0.584	0.438	0.084	0.066	31.79	3.68
18	Kaycheera 1	0.156	-	0.003	-	0.00	-
19	Kayyoonnam	0.146	0.101	0.073	0.055	57.15	31.85
20	Kodakan	0.217	0.116	0.058	0.054	13.63	12.54
21	Kozhuppa	0.075	0.052	0.04	0.028	11.88	7.96
22	Kuppakeera	0.475	0.224	0.112	0.091	68.23	55.77
23	Mattasheppu	0.399	0.28	0.136	0.122	0.00	0.00
24	Minnamkanni	0.221	0.166	0.045	0.033	3.6	2.06
25	Mullukeera	0.698	0.598	0.084	0.075	15.43	13.41
26	Murukkila	0.159	0.103	0.065	0.053	12.86	8.96
27	Neycheera	0.359	0.266	0.059	0.047	27.76	20.94
28	Palcheera	0.203	-	0.118	-	25.77	-
29	Payarila	0.15	0.14	0.037	0.036	0.259	0
30	Ponnamkanni	0.199	0.086	0.084	0.02	14.71	7.96
31	Pottipazhamela	0.067	-	0.044	-	9.89	-
32	Sambarcheera	0.198	0.065	0.029	0.021	1.36	-
33	Thakara	0.72	0.441	0.083	0.053	6.66	0.436
34	Thalu	0.11	0.102	0.03	0.017	0.565	0.00
35	Thumbacheera	0.17	0.134	0.059	0.049	3.54	0

Contd.

Table 45. continued

Sl. No.	Name of foodstuff	Calcium (g)		Phosphorus (g)		Iron (mg)	
		Raw	Cooked	Raw	Cooked	Raw	Cooked
36	Uruvulikkila	0.226	0.126	0.088	0.053	2.86	1.06
37	Valiyakadaladi	0.433	0.148	0.073	0.062	22.59	18.12
38	Vashalacheera	0.259	0.188	0.039	0.026	2.55	1.46
39	Vayalchulli	0.34	0.164	0.028	0.016	27.05	14.61
40	Vayalchulli (valuthu)	0.643	0.62	0.044	0.038	27.75	26.35
41	Vayalkaduku	0.347	0.239	0.048	0.033	19.56	12.05
42	Vazhalacheera	-	-	0.036	-	-	-
43	Vellachembila	-	-	-	-	-	-
	Means± SE	0.32± 0.02	0.214± 0.01	0.062± 0.03	0.047± 0.001	16.884± 1.36	10.504± 0.22
	CD	0.057	0.028	0.085	0.003	3.88	0.627
	CD between raw & cooked	0.007		0.012		0.489	

FWB Fresh Weight Basis

in cooked were found to be on par with the lowest contents observed in Thalu and Karimchembila in the raw and cooked states respectively.

### Potassium

The potassium content of raw leafy vegetables varied from 253 mg to 1104 mg  $100\text{ g}^{-1}$  in Vayalchulli and Ponnankanni (Table 46) respectively. In cooked leaves the content varied from 140 mg in Kozhuppa to 965 mg  $100\text{ g}^{-1}$  in Valiyakadaladi. Mean potassium contents of raw and cooked leaves were 536 mg and 401 mg  $100\text{ g}^{-1}$ . The variations observed within and between the raw and cooked leaves were found to be statistically significant. The potassium contents of raw Kannisoupe and Valiyakadaladi were found to be on par with the highest content noted in Ponnankanni and the raw leaves with potassium contents in the range of 266 and 415 mg  $100\text{ g}^{-1}$  were on par with the lowest content observed in raw Vayalchulli. The cooked Sambarcheera and Vayalchulli also had a similar potassium content which was present in cooked Kozhuppa.

### Magnesium

Among the leaves analysed for their magnesium content Pottipazham leaves had a higher content in the raw state and Karamanasheppu in the cooked state (Table 46). Lowest magnesium content was noted in raw Vayalkaduku (0.063 mg) and cooked Mattasheppu (0.006 mg) with significant variation in the magnesium content of raw and cooked leaves and between the raw and cooked leaves. Mean magnesium content was 0.237 mg (raw) and 0.168 mg (cooked) per 100 g of leaves. The magnesium contents of Churuli, Kadumudunga, Karimchembila, Kodakan and Payarila were found to be on par with the lowest content noted in raw Vayalkaduku.

### Copper

The copper content of raw leaves varied from 0.097 mg (Karimchembila) to 0.669 mg  $100\text{ g}^{-1}$  (Pottipazham leaf) with a mean content of 0.268 mg  $100\text{ g}^{-1}$  (Table 47). In the cooked leaves the content varied from 0.069 mg in Sambarcheera to 0.327 mg  $100\text{ g}^{-1}$  in Karamanasheppu with a mean content of 0.173 mg  $100\text{ g}^{-1}$ . Significant variation in the copper contents of raw and cooked leaves and between the raw and



**Table 46. Mean nutritive value of leafy vegetables (raw & cooked) consumed by the different tribal communities of Wayanad District (per 100 g FWB)**

Sl. No.	Name of foodstuff	Sodium (mg)		Pottassium (mg)		Magnesium (mg)	
		Raw	Cooked	Raw	Cooked	Raw	Cooked
1	Ambasheppu	11.31	4.78	557	445	0.111	0.091
2	Appuppanthadi	5.62	5.04	507	469	0.144	0.113
3	Chanacheera	10.29	6.77	538	407	0.468	0.359
4	Churuli	16	3.53	686	548	0.087	0.075
5	Cheera	5.28	3.27	525	395	0.243	-
6	Cheriyakadaladi	14.2	12.48	704	516	0.29	0.189
7	Chumannacheera	5.94	2.55	495	387	0.253	0.205
8	Chumalacheera	4.11	2.31	802	631	0.101	0.055
9	Kadukucheera	8.11	-	652	-	0.42	-
10	Kadumudunga	12.29	6.08	787	623	0.08	0.077
11	Kaippayila	8.79	7.13	496	360	0.561	0.121
12	Kallurukki	4.41	1.63	271	204	0.251	0.196
13	Kannisoupe	14.74	10.32	1088	486	-	-
14	Karamanasheppu	8.64	3.26	767	636	0.109	0.481
15	Karimchembila	3.13	1.26	266	244	0.079	0.277
16	Kattuthakkaliela	10.53	6.39	357	245	0.204	0.151
17	Kayacheera	14.15	-	595	479	0.159	0.147
18	Kaycheera I	3.02	-	391	-	0.187	-
19	Kayyoonnam	4.9	3.28	621	583	0.282	0.2
20	Kodakan	<b>108.75</b>	<b>107.25</b>	415	413	0.089	0.086
21	Kozhuppa	10.37	6.9	333	140	0.253	0.182
22	Kupakeera	17.29	10.88	774	560	0.374	0.333
23	Mattasheppu	2.79	2.55	603	340	0.136	0.006
24	Minnamkanni	2.88	1.83	566	424	0.183	0.156
25	Mullukeera	9.61	8.45	588	528	0.266	0.234
26	Murukkila	4.83	2.46	447	321	0.123	0.092
27	Neycheera	15.87	12.47	513	409	0.348	0.291
28	Palcheera	12.06	-	339	-	0.364	-
29	Payarila	4.65	4.26	345	274	0.074	0.052
30	Ponnamkanni	18.4	4.79	1104	569	0.236	0.038
31	Pottipazhamela	3.79	-	273	-	0.674	-
32	Sambarcheera	3.3	2.0	296	181	0.142	0.141
33	Thakara	5.97	3.81	820	259	0.156	0.093
34	Thalu	2.56	2.29	378	270	0.206	0.101
35	Thumbacheera	6.31	4.48	374	224	0.189	0.155

Contd.

Table 46. continued

Sl. No.	Name of foodstuff	Sodium (mg)		Pottassium (mg)		Magnesium (mg)	
		Raw	Cooked	Raw	Cooked	Raw	Cooked
36	Uruvulikkila	3.47	2.16	574	398	0.205	0.162
37	Valiyakadaladi	3.76	3.12	983	965	0.29	0.180
38	Vashalacheera	13.68	13.65	508	352	0.332	0.255
39	Vayalchulli	7.74	3.39	253	158	0.497	0.215
40	Vayalchulli (valuthu)	8.8	6.81	296	241	0.33	0.324
41	Vayalkaduku	9.39	5.9	332	216	0.063	0.044
42	Vazhalacheera	12.87	-	350	-	-	-
43	Vellachembila	-	-	-	-	0.145	-
	Means± SE	10.82± 0.53	8.04± 0.96	536± 59.83	401± 19.46	0.237± 0.01	0.168± 0.01
	CD	1.51	2.74	170.49	55.45	0.028	0.029
	CD between raw & cooked	0.371		22.22		0.0025	

FWB-Fresh Weight Basis

cooked leaves were also noticed. In the cooked leaves, the copper contents of Chumalacheera, Kadumudunga, Ponnankanni and Valiyakadaladi were found to be on par with the highest content observed in Karamanasheppu.

### **Manganese**

Significant variation in the manganese content of the raw and cooked leaves and between the raw and cooked leaves was observed (Table 47). The mean manganese content of the leaves was found to be 4.34 mg (raw) and 2.74 mg (cooked) per 100 g. The manganese content of raw leaves varied from 0.06 mg to 23.87 mg 100 g<sup>-1</sup> in Kaycheera I and Valiyakadaladi respectively. In the cooked leaves the content varied from 0.24 mg to 9.87 mg 100 g<sup>-1</sup> in Kuppakeera and Chumalacheera respectively. The manganese content of Valiyakadaladi was found to be on par with the highest manganese content observed in Chumalacheera.

### **Zinc**

The mean zinc content of raw and cooked leaves was 0.943 mg and 0.643 mg respectively with significant variation in the zinc content of raw and cooked leaves and between the raw and cooked leaves (Table 47). The zinc content of raw leaves varied from 0.063 mg (Kaycheera I) to 2.35 mg (Mullukeera). In the cooked leaves the highest content was found in Kodakan (2.0 mg) and lowest content in Thalu (0.104 mg). The zinc content of raw Kodakan was found to be almost similar to the highest content seen in Mullukeera and the zinc contents of Kadukucheera, Thalu, Uruvulikka leaves, Vayalchulli and Vazhacheera were on par with the lowest content seen in raw Kayacheera I.

## **III b. Vegetables**

### **Moisture**

Moisture content of vegetables consumed by the tribes of Wayanad district varied from 81.78 per cent to 93.41 per cent (raw) and 82.89 per cent to 93.82 per cent (cooked) (Table 48). The highest and lowest contents in both stages were found in Vellathaluthandu and Pindichakka respectively. Significant variation in the moisture contents of raw and cooked and between the raw and cooked vegetables were also

Table 47. Mean nutritive value of leafy vegetables (raw & cooked) consumed by the different tribal communities of Wayanad District (per 100 g FWB)

Sl. No.	Name of foodstuff	Copper (mg)		Manganese (mg)		Zinc (mg)	
		Raw	Cooked	Raw	Cooked	Raw	Cooked
1	Ambasheppu	0.435	0.247	2.76	1.42	1.74	0.649
2	Appuppanthadi	0.35	0.156	1.54	1.48	1.26	1.09
3	Chanacheera	0.188	0.157	2.22	1.45	1.06	0.707
4	Churuli	0.312	0.253	0.79	0.63	0.936	0.252
5	Cheera	0.27	0.109	8.51	4.53	1.22	0.872
6	Cheriyakadaladi	0.395	0.24	2.24	0.96	1.97	0.92
7	Chumannacheera	0.22	0.085	7.26	3.96	0.555	0.495
8	Chumalacheera	0.324	0.297	11.26	9.87	1.3	0.91
9	Kadukucheera	0.318	-	1.59	-	0.239	-
10	Kadumudunga	0.304	0.288	2.74	2.5	1.64	1.06
11	Kaipayila	0.281	0.162	2.81	1.78	1.68	1.05
12	Kallurukki	0.126	0.102	2.65	2.34	0.693	0.663
13	Kannisoupe	0.389	0.252	7.91	6.23	0.516	0.402
14	Karamanasheppu	0.516	0.327	2.37	1.08	1.3	0.815
15	Karimchembila	0.097	0.125	5.88	0.42	1.26	0.5
16	Kattuthakkaliela	0.121	0.09	2.42	1.71	0.484	0.45
17	Kayacheera	0.164	-	8.69	6.33	0.82	0.54
18	Kaycheera I	0.126	-	0.06	-	0.063	-
19	Kayyoonnam	0.313	0.126	8.74	4.73	0.845	0.252
20	Kodakan	0.145	0.129	3.34	0.57	2.03	2.0
21	Kozhuppa	0.24	0.138	1.73	1.04	0.768	0.449
22	Kuppakeera	0.38	0.16	3.8	0.24	1.33	0.16
23	Mattasheppu	0.311	0.224	2.16	0.75	1.34	1.02
24	Minnamkanni	0.23	0.174	2.08	1.31	0.805	0.479
25	Mullukeera	0.196	-	4.61	3.61	2.35	1.52
26	Murukkila	0.339	0.232	1.18	0.99	0.568	0.428
27	Neycheera	0.129	0.103	4.07	2.84	0.515	0.129
28	Palcheera	0.137	-	1.85	-	0.617	-
29	Payarila	0.226	0.147	0.74	0.39	0.588	0.339
30	Ponnamkanni	0.344	0.297	9.57	6.8	0.512	0.644
31	Pottipazhamela	0.669	-	3.68	-	1.34	-
32	Sambarcheera	0.146	0.069	2.43	1.66	0.53	0.344
33	Thakara	0.426	0.227	2.67	0.97	1.4	0.405
34	Thalu	0.187	0.104	7.87	5.46	0.163	0.104
35	Thumbacheera	0.332	0.14	1.92	0.28	0.664	0.42

Contd.

Table 47. continued

Sl. No.	Name of foodstuff	Copper (mg)		Manganese (mg)		Zinc (mg)	
		Raw	Cooked	Raw	Cooked	Raw	Cooked
36	Uruvulikkila	0.18	0.124	1.18	0.77	0.372	0.225
37	Valiyakadaladi	0.442	0.292	23.87	9.85	1.37	1.35
38	Vashalacheera	0.246	0.095	2.28	1.43	1.05	0.57
39	Vayalchulli	0.141	0.089	9.01	5.16	0.158	0.4
40	Vayalchulli (valuthu)	0.278	0.16	8.69	3.12	0.834	0.64
41	Vayalkaduku	0.153	0.072	1.12	0.79	0.612	0.504
42	Vazhalacheera	0.215	-	-	-	0.143	-
43	Vellachembila	0.254	-	-	-	-	-
	Means± SE	0.268± 0.04	0.173± 0.02	4.34± 0.6	2.74± 0.3	0.943± 0.11	0.643± 0.16
	CD	0.114	0.057	1.71	0.855	0.313	0.456
	CD between raw & cooked	0.015		0.229		0.065	

FWB-Fresh Weight Basis

observed with a mean moisture content of 89.03 percent in raw and 90.29 per cent in cooked. The moisture contents of Karimthaluthandu in raw and cooked stages and Mulamkoombu in cooked stage were found to be on par with the highest content observed in Vellathaluthandu.

### **Protein**

Lowest protein content was observed in Mulamkoombu in both raw (0.67%) and cooked (0.45%) vegetables (Table 48). Highest was in raw Manithakkali (2.52%) and cooked Vellathaluthandu (1.16%). Mean protein content was found to be 1.35 per cent in raw and 0.93 per cent in cooked with significant variation in the protein content of raw and cooked vegetables and between the raw and cooked vegetables. The protein content of cooked Uruvulikka was found to be on par with the highest content seen in Vellathaluthandu.

### **Fibre**

The fibre content of vegetables varied from 0.55 to 3.05 per cent in raw and 0.3 to 1.73 per cent in cooked (Table 48). Highest and lowest protein contents were found in Uruvulikka and Vellathaluthandu respectively in raw and cooked stages. Significant variation in the fibre contents of raw and cooked and between the raw and cooked vegetables were noted. The fibre content of cooked Pindi chakka was found to be on par with the highest content observed in cooked Uruvulikka.

### **Starch**

The lowest starch contents of 0.053 per cent and 0.011 per cent were observed in raw and cooked Vellathaluthandu and the highest in raw Mulamkoombu (0.595%) and cooked Pindichakka (0.212%) (Table 48). The mean starch contents of raw and cooked vegetables were 0.276 per cent and 0.108 per cent respectively. Statistically, the variation observed in the starch content of raw and cooked vegetables and between the raw and cooked vegetables was significant.

### **Free amino acid**

The free amino acid content of raw vegetables varied from 0.011 mg to 0.06 mg (Table 48). In cooked vegetables, the content varied from 0.001 mg to

Table 48. Mean nutritive value of vegetables (raw & cooked) consumed by the different tribal communities of Wayanad District (per 100 gFWB)

Sl. No.	Name of foodstuff	Moisture (g)		Protein (g)		Fibre (g)		Starch(g)		Free amino acid	
		Raw	Cooked	Raw	Cooked	Raw	Cooked	Raw	Cooked	Raw	Cooked
1	Karinthaluthandu	93.21	93.2	0.926	0.849	1.29	1.01	0.196	0.101	0.06	0.005
2	Manithakkali	88.48	90.07	2.52	-	0.92	0.5	0.383	-	0.011	-
3	Mulamkoombu	89.68	92.64	0.673	0.449	1.01	0.629	0.595	0.125	0.03	0.021
4	Pindichakka	81.78	82.89	1.29	1.07	2.11	1.71	0.339	0.212	0.04	0.005
5	Uruvulikka	87.58	89.17	1.36	1.14	3.05	1.73	0.136	0.107	0.022	0.001
6	Vellathaluthandu	93.41	93.82	1.33	1.16	0.55	0.3	0.053	0.011	0.033	0.002
	Mean $\pm$ SE	89.03 $\pm$ 0.24	90.29 $\pm$ 0.48	1.35 $\pm$ 0.02	0.933 $\pm$ 0.02	1.487 $\pm$ 0.03	0.979 $\pm$ 0.02	0.276 $\pm$ 0.001	0.108 $\pm$ 0.001	0.034 $\pm$ 0.001	0.007 $\pm$ 0.001
	CD	0.828	1.66	0.069	0.073	0.104	0.069	0.003	0.004	0.004	0.004
	CD between raw & cooked	0.477		0.024		0.034		0.0044		0.0041	

FWB- Fresh Weight Basis

0.021 mg per 100 g. The highest and lowest contents were in Karimthaluthandu and Manithakkali in the raw stage and Mulamkoombu and Uruvulikka in cooked stage, respectively. Mean free amino acid content was 0.034 mg and 0.007 mg in raw and cooked vegetables with significant variation in the free amino acid content of raw and cooked and between the raw and cooked vegetables.

### **Vitamin C**

Pindichakka had an higher vitamin C content of 582.38 mg and 204.44 mg per 100 g in raw and cooked stages. Lowest was in Mulamkoombu in raw (7.75 mg) and cooked (2.25 mg). Significant variations in the vitamin C content in and between the raw and cooked vegetables were observed. None of the vegetables analysed had a vitamin C content almost similar to that observed in raw and cooked Pindichakk (Table 49).

### **Beta carotene**

Mulamkoombu had the highest beta carotene content of 119.54  $\mu\text{g}$  among the raw and 57.82  $\mu\text{g}$  among the cooked vegetables. The lowest content was in Pindichakka both in raw (17.11  $\mu\text{g}$ ) and cooked (15.55  $\mu\text{g}$ ) (Table 49). Significant variation in the beta carotene contents of raw and cooked vegetables and between the raw and cooked vegetables were noticed. The beta carotene contents of Uruvulikka and Vellathaluthandu were found to be on par with the highest and lowest contents observed in Mulamkoombu and Pindichakka respectively in the cooked stage.

### **Calcium**

The mean calcium content of raw and cooked vegetables was 0.056 per cent and 0.035 per cent respectively with significant variation in the calcium content among the vegetables (Table 50). The highest calcium content was in Uruvulikka in raw (0.12%) and cooked (0.1%) vegetables and the lowest was in raw Vellathaluthandu (0.023%) and cooked Karimthaluthandu (0.015%). The calcium content of cooked Vellathaluthandu was found to be on par with the lowest content noticed in cooked Karimthaluthandu.



Table 49. Mean nutritive value of vegetables (raw & cooked) consumed by the different tribal communities of Wayanad District (per 100 g FWB)

Sl. No.	Name of foodstuff	Vitamin C (mg)		$\beta$ Carotene ( $\mu$ g)	
		Raw	Cooked	Raw	Cooked
1	Karinthaluthandu	11.21	5.00	54.18	18.71
2	Manithakkali	42.04	21.71	57	-
3	Mulamkoombu	7.75	2.25	119.54	57.82
4	Pindi chakka	582.38	204.44	17.11	15.55
5	Uruvulikka	89.94	32.02	79.63	57.55
6	Vellathaluthandu	9.62	3.32	35.05	16.81
Mean $\pm$ SE		123.82 $\pm$ 2.03	44.79 $\pm$ 2.47	60.412 $\pm$ 0.32	33.285 $\pm$ 0.39
CD		7.00	8.52	1.104	1.41
CD between raw and cooked		2.83		0.483	

FWB-Fresh Weight Basis

### Phosphorus

The phosphorus content of raw vegetables varied from 0.018 g to 0.067 g and in cooked vegetables from 0.017 g to 0.028 g 100 g<sup>-1</sup> (Table 50). Highest phosphorus content was seen in Mulamkoombu in the raw state and Mulambooku and Karimthaluthandu in the cooked stages. The lowest was in Vellathaluthandu in both raw and cooked vegetables. The phosphorus contents of cooked Pindichakka and Uruvulikka were found to be almost similar to the highest content observed in Mulamkoombu and Karimthaluthandu.

### Iron

Highest iron contents in the both raw (16.37 mg) and cooked (2.93 mg) stages were found in Mulambooku and the lowest in raw vegetables was in Manithakkali (0.042 mg) and in cooked vegetables in Karimthaluthandu (0.181 mg). The variations observed in the raw and cooked vegetables and between the raw and cooked vegetables were found to be statistically significant (Table 50).

### Sodium

Highest sodium content was observed in Vellathaluthandu in raw (3.9 mg) and cooked (3.42 mg) vegetables with significant variation in the sodium content of raw and cooked vegetables (Table 50). Lowest sodium was in Karimthaluthandu both in raw (1.36 mg) and cooked (1.24 mg) vegetables. None of the vegetables analysed had a sodium content similar to that observed in Vellathaluthandu which was the highest.

### Potassium

The potassium content of raw vegetables varied from 71.5 mg to 484.1 mg and in cooked vegetables the content varied from 60.48 mg to 367.65 mg 100 g<sup>-1</sup> (Table 50). Highest content in raw and cooked vegetables was in Mulamkoombu and Pindichakka respectively and the lowest was in Vellathaluthandu both in raw and cooked stages. The potassium content of raw Karimthaluthandu was found to be on par with the lowest content observed in raw Vellathaluthandu.

Table 50. Mean nutritive value of vegetables (raw & cooked) consumed by the tribal communities of Wayanad District (per 100 g FWB)

Sl. No.	Name of foodstuff	Calcium (g)		Phosphorus (g)		Iron (mg)		Sodium (mg)		Potassium (mg)		Magnesium (mg)	
		Raw	Cooked	Raw	Cooked	Raw	Cooked	Raw	Cooked	Raw	Cooked	Raw	Cooked
1	Karinthaluthandu	0.027	0.015	0.032	0.028	0.474	0.181	1.36	1.24	102	92.63	0.105	0.1
2	Manithakkali	0.051	-	0.033	-	0.042	-	-	-	322	-	0.213	-
3	Mulamkoombu	0.041	0.021	0.067	0.028	16.37	2.93	1.55	1.48	484.1	329.3	0.185	0.129
4	Pindi chakka	0.075	0.021	0.028	0.025	0.00	0.00	2.74	2.59	425.43	367.65	0.334	0.238
5	Uruvulikka	0.12	0.1	0.032	0.027	0.703	0.477	1.95	1.73	292.8	221.4	0.184	0.181
6	Vellathaluthandu	0.023	0.019	0.018	0.017	0.774	0.453	3.9	3.42	71.50	60.48	0.083	0.075
	Mean $\pm$ SE	0.056 $\pm$ 0.001	0.035 $\pm$ 0.001	0.035 $\pm$ 0.001	0.025 $\pm$ 0.001	3.127 $\pm$ 0.13	0.808 $\pm$ 0.03	33.27 $\pm$ 0.12	2.02 $\pm$ 0.09	282.971 $\pm$ 9.21	214.29 $\pm$ 5.33	0.184 $\pm$ 0.001	0.145 $\pm$ 0.001
	CD	0.003	0.004	0.003	0.004	0.449	0.109	0.414	0.326	31.78	19.32	0.004	0.004
	CD between raw & cooked	0.0018		0.0006		0.135		0.164		11.33		0.0015	

FWB- Fresh Weight Basis

### Magnesium

The highest and lowest magnesium contents in raw and cooked stages were found in Pindichakka and Vellathaluthandu respectively. The magnesium content varied from 0.083 to 0.334 mg 100 g<sup>-1</sup> in raw and 0.075 to 0.238 mg 100 g<sup>-1</sup> in cooked. Statistically, significant variation in the magnesium content was observed both in raw and cooked and between the raw and cooked vegetables (Table 51).

### Copper

Highest and lowest copper contents were observed in pindichakka and Vellathaluthandu respectively both in raw and cooked vegetables (Table 51). The content in raw vegetables varied from 0.091 mg to 0.187 mg 100 g<sup>-1</sup> and in cooked vegetables from 0.059 mg to 0.257 mg 100 g<sup>-1</sup>. The mean copper content was found to be 0.135 mg in raw and 0.114 mg in cooked vegetables. The variation observed in the copper content of cooked vegetables was found to be statistically insignificant. The copper content of raw Mulamkoombu was found to be on par with the highest content observed in raw Pindichakka.

### Manganese

The highest manganese content was observed in Pindichakka both in raw (12.06 mg) and cooked (10.26 mg) vegetables (Table 51). The lowest content was in Manithakkali (0.23 mg) and Uruvulikka (0.378 mg) respectively among the raw and cooked vegetables. The manganese contents of raw Uruvulikka and cooked Mulamkoombu were found to be on par with the lowest content observed in raw Manithakkali and cooked Uruvulikka respectively. The variation observed in the manganese contents of raw and cooked and between the raw and cooked vegetables were found to be statistically significant.

### Zinc

The mean zinc contents of raw and cooked vegetables were 0.607 mg and 0.415 mg 100 g<sup>-1</sup> with significant variation in the zinc content within and between the raw and cooked vegetables (Table 51). The zinc content varied from 0.204 mg to 1.03 mg 100 g<sup>-1</sup> in raw vegetables with the highest and lowest contents in Mulamkoombu

**Table 51. Mean nutritive value of vegetables (raw & cooked) consumed by the different tribal communities of Wayanad District (per 100 g FWB)**

Sl. No.	Name of foodstuff	Copper (mg)		Manganese (mg)		Zinc (mg)	
		Raw	Cooked	Raw	Cooked	Raw	Cooked
1	Karinthaluthandu	0.102	0.065	2.99	2.57	0.204	0.162
2	Manithakkali	0.115	-	0.23	-	0.575	-
3	Mulamkoombu	0.186	0.079	1.39	0.48	1.03	0.518
4	Pindichakka	0.187	0.257	12.06	10.26	0.655	0.342
5	Uruvulikka	0.122	0.108	0.488	0.38	0.854	0.756
6	Vellathaluthandu	0.091	0.059	2.243	1.92	0.325	0.295
	Mean±SE	0.135± 0.01	0.114± 0.04	3.23± 0.15	3.12± 0.12	0.607± 0.06	0.415± 0.04
	CD	0.035	0.145	0.518	0.435	0.207	0.145
	CD between raw and cooked	0.041		0.201		0.071	

FWB-Fresh Weight Basis .

and Karimthaluthandu respectively. In the cooked vegetables the content varied from 0.162 mg in Karimthaluthandu and 0.756 mg in Uruvulikka. The zinc content of raw and cooked vegetables and between the raw and cooked vegetables also varied significantly.

### Antinutritional factors present in the foods

#### I. Idukki

##### A. Leafy Vegetables

##### Oxalate

The oxalate content of leafy vegetables collected from Idukki District varied from 0.04 g in Arakeera and 1.16 g in Kozhikodalancheera in raw stage with a mean oxalate content of 0.362 g 100 g<sup>-1</sup> of leaves (Table 52). In the cooked leaves the content varied from 0.01 g (Vazhukkakeera) to 0.78 g (Kadukucheera - a) 100 g<sup>-1</sup> with the mean content of 0.234 g 100 g<sup>-1</sup> of leaves. Significant variation in the oxalate content was found within raw and cooked leaves and between raw and cooked leaves. The oxalate content of Kattumuringa was found to be on par with the highest content observed in Kozhikodalancheera in the raw stage and the oxalate content of Vellukka cheera was on par with that observed in Arakeera. None of the leaves in the cooked stage were found to be having a similar oxalate content observed either in Kadukcheera or Vazhukkakeera.

##### Nitrate

The mean nitrate content was found to be 0.013g in raw leaves and 0.01g per 100 g in the cooked leaves. In the raw and cooked leaves the nitrate content varied from 0.002 to 0.037 g 100 g<sup>-1</sup> and 0.002 to 0.026 g 100 g<sup>-1</sup> with significant variation between the leaves (Table 52). The variation observed between the raw and cooked leaves was also found to be statistically significant. Chumalacheera with a nitrate content of 0.035 g 100 g<sup>-1</sup> was the only leaf on par with the highest nitrate content observed in Mullancheera. The nitrate contents of the leaves in between 0.003 to 0.005 g were found to be on par with the lowest nitrate content observed in

**Table 52. Anti-nutritional factors present in the leafy vegetables (raw and cooked) consumed by the tribal communities of Idukki District (per 100 g FWB)**

Sl No.	Name of foodstuff	Oxalate (g)		Nitrate (g)	
		Raw	Cooked	Raw	Cooked
1	Anacheviyancheera	0.33	0.19	0.016	-
2	Arakkeera	0.04	-	0.016	0.007
3	Avanakkucheera	0.25	0.09	0.008	0.002
4	Chembila	0.12	0.07	0.003	0.002
5	Cherucheera	0.55	0.4	0.035	0.03
6	Chumalacheera	0.28	0.21	0.018	0.014
7	Kadammankutticheera	0.39	0.29	0.018	0.016
8	Kadukcheera (a)	0.96	0.78	0.024	0.02
9	Kadukcheera (b)	0.46	0.36	0.02	0.019
10	Kaipucheera	0.18	0.11	0.011	0.006
11	Kallemthamara	0.12	0.07	0.003	0.001
12	Kattukadukcheera	0.54	0.39	0.028	0.022
13	Kattumuringa	1.15	0.69	0.019	0.013
14	Keezharnelli (big)	0.42	0.2	0.012	0.01
15	Keezharnelli (small)	0.48	0.4	0.021	0.017
16	Kodappakeera	0.11	0.05	0.008	0.007
17	Kozhikodalancheera	1.16	0.7	0.01	0.007
18	Kuppacheera	0.66	0.24	0.018	0.008
19	Manalancheera	0.27	0.14	0.005	0.002
20	Mangacheera	0.43	0.34	0.015	0.012
21	Mathipuli	0.46	0.2	0.014	0.013
22	Mulakuheera	0.26	0.14	0.004	0.003
23	Mullancheera	0.44	0.34	0.037	0.026
24	Nadancheera	0.21	0.08	0.008	-
25	Nayirunjikeera	0.39	0.25	0.027	0.014
26	Neeruvatti	0.47	0.36	0.008	0.005
27	Nerinjikeera	0.15	0.06	0.017	0.012
28	Ottakeera	0.34	0.19	0.018	0.012
29	Palachettikeera	0.25	0.13	0.021	0.007
30	Palakeera	0.2	0.08	0.015	-
31	Perandakodi	0.18	0.1	0.004	0.002
32	Potticheera	0.46	0.31	0.02	0.016
33	Pulikeera	0.27	0.14	0.007	0.003
34	Shingacheera	0.7	0.52	0.017	0.013
35	Sonakeera	0.48	0.31	0.02	0.013
36	Thakara	0.85	0.73	0.021	0.015
37	Thakkila	-	-	-	-
38	Thalamuzhakeera	0.26	0.19	0.01	0.007

Contd.

Table 52. continued

SI No.	Name of foodstuff	Oxalate (g)		Nitrate (g)	
		Raw	Cooked	Raw	Cooked
39	Thalu	-	-	0.003	0.004
40	Thandankeera	0.39	0.23	0.017	0.011
41	Tharikeera	0.21	0.11	0.005	0.003
42	Thazhuthama	0.21	0.12	0.006	0.003
43	Thoppikeera	0.39	0.25	0.016	0.012
44	Thumbacheera	0.15	0.03	0.008	0.008
45	Valiyacheviyancheera	0.2	0.12	0.007	0.009
46	Vazhukkacheera	0.11	0.09	0.004	0.003
47	Vazhukkakeera	0.07	0.01	0.006	0.003
48	Vellathazhuthama	0.09	0.05	0.005	0.003
49	Velukkacheera	0.05	0.02	0.002	-
	Means $\pm$ SE	0.362 $\pm$ 0.01	0.234 $\pm$ 0.001	0.013 $\pm$ 0.001	0.01 $\pm$ 0.001
	CD	0.028	0.003	0.003	0.003
	CD between raw & cooked	0.012		0.0002	

FWB- Fresh Weight Basis



Vellukkacheera. In the cooked stage none of the leaves were found to be having a similar nitrate content of 0.026 g found in Mullancheera which was the highest. The lowest nitrate content in cooked stage was found in Avanakkucheera, Chembila, Manalancheera and Perandakodi and the leaves with a content in between 0.003 to 0.005 were also found to be on par with the lowest nitrate content observed in the above four leaves.

## **B. Fruits**

### **Tannin**

Highest tannin content of 1.05 mg 100 g<sup>-1</sup> was found in Chitteenth and the lowest content of 0.117 g 100 g<sup>-1</sup> was in Chumalakalli. The mean tannin content was found to be 0.404 g 100 g<sup>-1</sup> with significant variation in the tannin content of fruits. None of the fruits had a tannin content on par with that found either in Chitteenth or Chumalakalli (Table 53).

## **II. Palakkad**

### **A. Leafy Vegetables**

#### **Oxalate**

Among the leaves analysed, Vellathandancheera and Chukkutticheera with oxalate contents of 0.036 and 1.33 g per 100 g were having the lowest and highest contents in the raw stage (Table 54). In the cooked leaves, the content varied from 0.021 g in Sambarcheera to 0.858 g in Sheengedag. The mean oxalate content was found to be 0.395 g in the raw leaves and 0.244 g in the cooked leaves. Significant variation in the oxalate content was also noticed in raw and cooked and between the raw and cooked leaves. Pampattikeera was the only leaf, which was found to have an oxalate content on par with the lowest content noticed in Vellathandancheera. None of the other leaves had an oxalate content on par with the highest content observed in Chukkutticheera and Sheengedag in the raw and cooked stages.

#### **Nitrate**

Among the leaves, Thazhuthama and Kainedag had the highest nitrate content of 0.081g 100 g<sup>-1</sup> and 0.077g 100 g<sup>-1</sup> in the fresh and cooked stages

**Table 53. Tannin content of fruits (raw) consumed by the tribal communities of Idukki District (per 100g FWB)**

Sl. No.	Name of foodstuff	Tannin (mg)
1	Chitteenth	1.05
2	Chumalakalli	0.117
3	Kalakaya	0.294
4	Kallipazham	0.337
5	Kattumanga	0.386
6	Kattunaranga	-
7	Komulishamkaya	0.311
8	Kurukuttapazham	0.43
9	Mullapazham	0.56
10	Njaval (small)	0.616
11	Njaval (big)	0.379
12	Pottipazham	0.316
13	Putharichunda	0.196
14	Unnapazham	0.275
	<b>Means ± SE</b>	<b>0.404±0.01</b>
	<b>CD</b>	<b>0.03</b>

**Table 54. Antinutritional factors present in the leafy vegetables (raw & cooked) consumed by the tribal communities of Palakkad District (per 100 g FWB)**

Sl. No.	Name of foodstuff	Oxalate (g)		Nitrate (g)	
		Raw	Cooked	Raw	Cooked
1	Chembila	0.431	0.357	0.021	0.005
2	Chukkutticheera	1.330	0.231	0.015	0.012
3	Chumalacheera	0.319	0.218	0.008	0.006
4	Churuli	0.512	0.436	0.009	0.007
5	Elipinnakdag	0.233	0.150	0.017	0.010
6	Gonikeera	0.654	0.508	0.014	0.011
7	Kainedag	0.242	0.148	0.012	0.077
8	Katukusoup	0.708	0.280	0.006	0.005
9	Keera(a)	0.37	0.281	0.009	0.007
10	Keera(b)	0.079	0.050	0.008	0.005
11	Kovakeera	0.294	0.220	0.005	0.003
12	Kuppakeera	0.529	0.361	0.045	0.012
13	Mathanela	0.171	0.144	0.011	0.004
14	Mulakuheera	0.376	0.310	0.006	0.004
15	Mulluheera	0.254	0.212	0.015	0.009
16	Munnekeera	0.770	0.516	0.010	0.008
17	Palekeera	0.381	0.344	0.076	0.008
18	Pampattikeera	0.059	0.057	0.008	0.005
19	Pannedag	0.347	0.315	0.025	0.009
20	Pattikeera	0.196	0.143	0.007	0.006
21	Payarila	0.256	0.198	0.009	0.007
22	Perandika	-	-	-	-
23	Ponnamkanni	0.166	0.121	0.009	0.002
24	Sambarcheera	0.082	0.021	0.005	0.003
25	Sheengedag	1.020	0.858	0.030	0.019
26	Swargacheera	0.950	-	0.005	-
27	Thakara	0.200	0.129	0.012	0.007
28	Thazhuthama	0.368	0.211	0.081	0.018
29	Theyyedeg	0.115	0.100	0.005	0.004
30	Thondesoup	0.192	0.128	0.014	0.010
31	Vashalacheera	0.374	0.152	0.007	0.005
32	Vela	0.674	-	0.014	-
33	Vellakeera	0.358	0.128	0.013	0.012
34	Vellathandancheera	0.036	-	0.005	-
	Mean ±SE	0.395±0.01	0.244±0.00	0.014±0.01	0.007±0.00
	CD	0.029	0.003	0.029	0.003
	CD between raw & cooked	0.004		0.004	

FWB - Fresh Weight Basis

respectively (Table 54). The lowest nitrate content of  $0.005\text{g } 100\text{ g}^{-1}$  was seen in Kovakeera, Sambarcheera, Swargacheera, Theyyadag and Vallathandan cheera in the raw stage and Ponnankanni ( $0.002\text{g } 100\text{ g}^{-1}$ ) in the cooked stage. The mean nitrate content was found to be  $0.014\text{g}$  and  $0.007\text{g } 100\text{ g}^{-1}$  in the fresh and cooked stages. Palekeera was the only leaf which had a nitrate content almost similar to that found in Thazhuthama which was the highest in the fresh stage.

### III. Wayanad

#### A. Leafy vegetables

##### Oxalate

Among the raw and cooked leaves analysed for the antinutritional factors lowest oxalate content was noted in Kozhuppa in raw (0.037%) and in cooked (0.014%) (Table 55). Highest content was in raw Karamanasheppu (0.664%) and cooked Thakara (0.525%). Among the raw leaves, the oxalate content of Kadumudunga and Vayalchulli (big) were found to be on par with the highest content noted in raw Karamanasheppu. None of the raw leaves had a similar oxalate content seen in Kozhuppa which was the lowest. None of the cooked leaves also had an oxalate content on par with the highest content of cooked Thakara. The variation observed in the oxalate content of the raw and cooked leaves and between the raw and cooked leaves was found to be statistically significant.

##### Nitrate

Mean nitrate content of the leaves was found to be 0.01 percent and 0.007 percent respectively with a variation of 0.002 percent to 0.022 percent in raw leaves and 0.001 percent to 0.015 percent in cooked leaves (Table 55). In raw and cooked leaves lowest nitrate contents were noted in Cheera and Payarila respectively and highest was in Valiyakadaladi in both raw and cooked leaves. The variation noted in the nitrate content of raw and cooked leaves and between the raw and cooked leaves were found to be statistically significant. The nitrate contents observed within the range of 0.003 to 0.005 mg in raw leaves and from 0.002 to 0.004 mg in cooked leaves were found to be on par with the lowest nitrate contents seen in Cheera (raw) and

Table 55. Mean nutritive value of leafy vegetables (raw & cooked) consumed by the different tribal communities of Wayanad District (per 100g FWB)

Sl. No.	Name of foodstuff	Oxalate (g)		Nitrate (g)	
		Raw	Cooked	Raw	Cooked
1	Ambasheppu	0.237	0.232	0.02	0.015
2	Appuppanthadi	0.546	0.186	0.01	0.009
3	Chanacheera	0.122	-	0.015	0.006
4	Churuli	0.217	0.125	0.018	0.012
5	Cheera	0.091	-	0.002	-
6	Cheriyakadaladi	-	-	0.017	-
7	Chumannacheera	0.125	0.09	0.003	0.002
8	Chumalacheera	0.51	0.368	0.017	0.011
9	Kadukucheera	-	-	0.009	-
10	Kadumudunga	0.637	0.253	0.017	0.009
11	Kaipayila	0.224	-	0.009	0.008
12	Kallurukki	-	-	0.01	0.007
13	Kannisoupe	0.186	0.139	0.013	0.007
14	Karamanasheppu	0.664	0.26	0.003	0.001
15	Karimchembila	0.53	0.208	0.009	0.005
16	Kattuthakkaliela	0.208	0.127	0.007	0.005
17	Kayacheera	0.103	-	0.013	-
18	Kaycheera I	0.09	-	0.004	-
19	Kayyoonnam	0.362	0.252	0.012	0.008
20	Kodakan	0.408	0.351	0.013	0.012
21	Kozhuppa	0.037	0.014	0.008	0.004
22	Kuppakeera	0.099	0.046	0.018	0.013
23	Mattasheppu	0.347	0.268	0.016	0.01
24	Minnamkanni	0.092	0.038	0.004	0.003
25	Mullukeera	-	-	0.004	-
26	Murukkila	0.399	0.245	0.016	0.009
27	Neycheera	0.22	0.16	0.004	0.003
28	Palcheera	0.442	-	0.011	-
29	Payarila	0.129	-	0.004	0.001
30	Ponnamkanni	0.213	0.1	0.01	0.005
31	Pottipazhamela	0.268	-	0.015	-
32	Sambarcheera	-	-	0.004	0.002
33	Thakara	0.598	0.525	0.013	0.005
34	Thalu	0.337	0.238	0.011	0.007
35	Thumbacheera	0.222	0.116	0.005	0.003
36	Uruvulikkila	0.108	0.07	0.004	0.002
37	Valiyakadaladi	0.18	0.124	0.022	0.015

Contd.

Table 55. continued

Sl. No.	Name of foodstuff	Oxalate (g)		Nitrate (g)	
		Raw	Cooked	Raw	Cooked
38	Vashalacheera	0.162	0.1	0.006	0.005
39	Vayalchulli	0.155	0.077	0.014	0.008
40	Vayalchulli (valuthu)	0.636	0.053	0.009	0.008
41	Vayalkaduku	0.129	0.086	0.004	0.002
42	Vazhalacheera	-	-	-	-
43	Vellachembila	-	-	-	-
	<b>Means± SE</b>	<b>0.266±0.01</b>	<b>0.189±0.001</b>	<b>0.01±0.001</b>	<b>0.007±0.001</b>
	<b>CD</b>	<b>0.028</b>	<b>0.003</b>	<b>0.003</b>	<b>0.003</b>
	<b>CD between raw &amp; cooked</b>	<b>0.0036</b>		<b>0.0006</b>	

FWB-Fresh Weight Basis

Payarila (cooked). The nitrate contents of cooked Churuli, Kodakan and Kuppacheera were found to be on par with the highest content observed in Valiyakadaladi.

### **3) Diversity of constituents present in the tribal foods collected from Idukki, Palakkad and Wayanad districts**

To find out the diversity of constituents present in the food stuffs collected from Idukki, Palakkad and Wayanad districts of Kerala, Shannon's Diversity Index (H) suggested by Magurran (1988) was computed and the results are given in Tables 56, 57 and 58.

Among the leafy vegetables analysed for different chemical constituents highest diversity (Table 56) for moisture, protein, starch, vitamin C, beta carotene, calcium, iron, sodium, potassium, manganese, zinc, oxalates and nitrates was found in the leaves collected from Idukki district. Lowest diversity for most of the constituents was for the leaves collected from Palakkad district.

In the case of vegetables also highest diversity for all the constituents was observed for the vegetables collected from Idukki district (Table 57).

Wide variation in the constituents of roots and tubers collected from Palakkad and Idukki districts was also observed. Except vitamin C, highest diversity for all other constituents was noticed in the roots and tubers collected from Idukki district.

The highest diversity observed for most of the chemical constituents present in the plant foods collected from Idukki district may be due to the relatively higher attitude and undulating terrain which indirectly contributes for a better habitat. Another reason may be the large number and diverse leaves which were collected from Idukki district than from Palakkad and Wayanad districts.

**Table 56. Diversity of chemical constituents of leafy vegetables collected from three districts**

Nutrient	Wayanad	Idukki	Palakkad
Moisture	3.78307	3.98621	3.55364
Protein	3.64528	3.91187	3.49774
Fibre	3.67757	3.65947	3.45013
Starch	3.31598	3.75156	3.15227
Free amino acid	3.43862	3.18401	2.67683
Vitamin C	3.54728	3.91695	3.40583
$\beta$ Carotene	3.6192	3.82798	3.41114
Calcium	3.4200	3.78609	3.32834
Phosphorus	3.62805	2.94394	3.38765
Iron	3.20259	3.66504	3.11536
Sodium	3.26397	3.62086	3.34008
Potassium	3.66048	3.74029	3.4611
Magnesium	3.55257	3.2898	2.92588
Copper	3.66697	2.7859	3.13006
Manganese	3.34375	3.81039	3.40793
Zinc	3.56212	3.72773	3.41306
Oxalate	3.37811	3.68941	3.26921
Nitrate	3.56771	3.75258	2.99905

**Table 57. Diversity of chemical constituents of vegetables collected from three districts**

Nutrient	Wayanad	Idukki	Palakkad
Moisture	1.79078	2.37193	1.60887
Protein	1.70685	1.98581	1.36406
Fibre	1.63975	1.83738	1.15617
Starch	1.49043	2.15112	1.54704
Free amino acid	1.68109	1.72768	1.20330
Vitamin C	0.78271	1.65311	1.22014
$\beta$ Carotene	1.64374	2.08304	1.2937
Calcium	1.6296	2.056	0.93737
Phosphorus	1.70419	1.93179	1.47777
Iron	0.4691	2.11038	1.45757
Sodium	1.53277	2.2821	0.8546
Potassium	1.62533	2.23308	1.55897
Magnesium	1.69545	2.06162	0.89437
Copper	1.75233	2.32788	1.53412
Manganese	1.14922	2.0977	1.41676
Zinc	1.65415	1.98441	1.20573



**Table 58. Diversity of chemical constituents of roots and tubers collected from two districts**

<b>Nutrient</b>	<b>Palakkad</b>	<b>Idukki</b>
Moisture	1.78436	3.07972
Protein	1.6458	2.77283
Fibre	0.90478	2.74143
Starch	1.55126	2.59147
Free amino acid	-	2.06473
Vitamin C	1.38322	0.76792
$\beta$ Carotene	1.38262	2.68503
Calcium	1.64245	2.77983
Phosphorus	1.6559	2.32195
Iron	1.15582	2.81328
Sodium	1.29438	2.77921
Potassium	1.56497	2.64597
Magnesium	1.75019	2.78204
Copper	1.50216	1.96409
Manganese	1.65858	2.79099

## SUMMARY

- 1) Most of the tribal families of Idukki, Palakkad and Wayanad districts were non-vegetarians.
- 2) The staple food of majority of tribal families was rice. They supplemented rice with millets and roots and tubers.
- 3) The diet was found to be monotonous and majority of the families followed two meals a day pattern.
- 4) All families used ordinary storage methods for storing foods and very few families preserved foods during their availability.
- 5) Special foods were not included in the diet of children, adolescents and elderly. However, few families made slight modification in the diet of pregnant and lactating women.
- 6) Most of the tribal families collected food items from forest during their availability and included in their diet.
- 7) Most of the leafy vegetables collected from tribal areas were rich in different micronutrients
- 8) Vegetables and roots and tubers were also found to contain various nutrients
- 9) Oxalate and nitrate contents were found to be low in leafy vegetables
- 10) Significant variation in most of the constituents was noticed in the foods both in the raw and cooked stages and between the raw and cooked stages
- 11) Wide diversity in the constituents was also observed for various foods collected from Idukki, Palakkad and Wayanad districts

## CONCLUSION

The present investigation gave valuable information on the dietary habits of different tribal communities residing in Idukki, Palakkad and Wayanad districts of Kerala. The different ethnic plant foods consumed by the tribal communities of these districts were also identified. Leafy vegetables, vegetables, roots and tubers, fruits and cereals consumed by the tribal communities were evaluated for macro and micronutrients and certain antinutritional factors. Most of these foods were found to be rich in different macro and micronutrients and low in antinutritional factors.

## FUTURE LINE OF ACTION

Since, most of the foods analysed were rich in nutrients especially micronutrients, attempts should be taken to conserve these foods and to bring them under cultivation for their sustainable utilization. Future research should focus to develop value added products using these foods. Moreover, the foods can be subjected to genetic improvement to further enhance the nutritional qualities. Efforts should be taken to identify the ethnic foods used by the other tribal groups of Kerala and other states and to evaluate their quality attributes.

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## REFERENCES

- Ali, A. 1983. Diet pattern and nutritional status of the Hill Bhuinyas - A primitive tribe of Orissa *Child Nutrition in Tribal Areas*. A report on the workshop on Child Nutrition in Tribal Areas, June 21-24, Jabalpur, pp.100-126
- AOAC. 1955. *Official Methods of Analysis*. 8<sup>th</sup> ed. Association of Official Analytical Chemists, Washington, D.C.
- AOAC. 1970. *Official Methods of Analysis*. 11<sup>th</sup> ed. Association of Official Analytical Chemists, Washington, D.C.
- AOAC. 1980. *Official Methods of Analysis*. 13<sup>th</sup> ed. Association of Official Analytical Chemists, Washington, D.C.
- Bharathi, R. and Umamaheshwari, K. 2001. Proximate composition of non traditional leafy vegetables in Nellore and Prakasam Districts of Andhra Pradesh. *J. Fd Sci. Technol.* 38: 534-536
- Bharghava, B.S. and Raghupathi, H.B. 1993. Analysis of plant materials for macro and micro nutrients. *Methods of Analysis of Soil, Plants, Waters and Fertilizers* (ed. Tandon, H.L.S.). Fertilizer Development and Consultation Organisation, New Delhi, p.82
- Chakrabarti, S.B. 1979. Economic transmutations in a food gathering ecology - a note on the Kadar of Kerala. *J. Indian anthropol. Soc.* 14: 33-40
- Chandrasekhar, U. and Chitra, G. 1990. Diet profiles and nutritive value of selected foods eaten by the Kota and Kadar tribes. *Indian J. Nutr. Dietet.* 27: 101-107
- Chandrasekhar, U., Vasanthamani, G. and Thomas, A.K. 1990. Infant feeding and weaning practices among Irulas of Attapady Hills and Lambas of Katchuvadi Hills. *Indian J. Nutr. Dietet.* 27: 175-180
- Chaurasia, O.P., Singh, N. and Singh, B. 2000. Potential wild leafy vegetables from Ladakh. *Indian Hort.* 45: 4-5
- Chopra, S.L. and Kanwar, J.S. 1978. *Analytical Agricultural Chemistry*. Kalyani Publishers, Ludhiana, p.110
- Easwaran, P.P. and Goswami, B. 1989. Nutritive value of selected 15 unconventional plant foods consumed by Khasis of Meghalaya. *Indian J. Nutr. Dietet.* 26: 62-67
- Hesse, P.R. 1971. *A Textbook on Soil Chemical Analysis*. John Mary Publishers Ltd., London, p.528

- Hyder, N. 2004. Quality evaluation of selected leafy vegetables consumed by the tribes of Wayanad District. M.Sc.(Home Science) thesis, Kerala Agricultural University, Thrissur. p.81
- Indira, V. 1993. Nutritional status and dietary habits of Irulas of Attappady. Ph.D. (FS&N) thesis, Kerala Agricultural University, Trichur, p.388
- Jackson, M.L. 1973. *Soil Chemical Analysis*. Prentice Hall of India Pvt. Ltd., New Delhi, p.498
- Kattakayam, J. 1983. Social structure and change among the tribals. A study among the Uralies of Idukki district in Kerala, D.K. Publications, Delhi
- Longvah, T. 2000. Nutritive value of North-East Indian Plant Foods. *Nutr. News* 21: 1-6
- Magurran, A.1988. *Ecological Diversity and its Measurement*. Princeton University Press, Princeton. 461p.
- Marderosian, A.D., Beutler, J. and Pfendner, W. 1979. Nitrate and oxalate content of vegetable amaranth. *Amaranth Proceedings*. pp.31-40
- Mathur, P.R.G. 1977. Tribal situation in Kerala. Historical Society, Trivandrum.
- Mohan, V.R. and Janardhanan, K. 1995. Chemical determination of nutritional and antinutritional properties of tribal pulses. *J. Fd Sci. Technol.* 32: 465-469
- Murugesan, T.P. and Ananthalakshmi, A. 1991. Dietary practices of the Paliyar tribal group and the nutrient content of unconventional foods consumed. *Indian J. Nutr. Dietet.* 28: 297-301
- Murugkar, D.A. and Subhulakshmi, G. 2003. Macronutrient and micronutrient profiles of unconventional green leaves consumed by Khasis of Meghalaya. XXXV Annual Meeting. *Scientific programmes and abstracts*, 12-13 December, National Institute of Nutrition, Hyderabad, p.27
- NIN, 1988. Nutritive value of tribal (Nagaland) foods. *Annual Report*. 1987-88. National Institute of Nutrition, Hyderabad, p.198
- Perkin-Elmer, 1982. *Analytical Methods for Atomic Absorption Spectrophotometry*, Perkin-Elmer Corporation, USA, pp.1-14
- Prema, L. 1983. Changing the dietary habits of a tribal population through the introduction of new food crops. *Child Nutrition in Tribal Areas*. A report on the workshop on Child Nutrition in Tribal Areas, June 21-24, Jabalpur, pp.180-183

- Raghuramulu, N., Nair, K.M. and Kalyanasundaram, S. 2003. *A Manual of Laboratory Techniques*. National Institute of Nutrition, Hyderabad, p.183
- Rajyalakshmi, P. and Geervani, P. 1987. Nutrient composition of foods consumed by the tribals of Vizianagaram District, Andhra Pradesh. *Proc. Nutr. Soc. India*. National Institute of Nutrition, Hyderabad, 33: 143
- Rao, D.H. 1996. Nutritional profile of Indian tribes. *Nutrition News*: 17: 1-6
- Rao, D.H., Brahmam, G.N.V., Rao, K.M., Longvah, T. and Rao, N.P. 1991. Diet and nutritional status of tribal groups of Manipur. *Nutrition News* 12: 1-6
- Rao, D.H. and Satyanarayana, K. 1987. Nutritional status of certain tribal groups of Andhra Pradesh. *Proc. Nutr. Soc. India*. National Institute of Nutrition, Hyderabad 33: 70-75
- Reddy, P.P.Y.B. and Rao, A.P. 2000. Dietary habits, food consumption and nutrient intake among the Sugali, a tribal population of Andhra Pradesh, India. *Asia Pacific J. Clinical Nutr.* 9: 12-17
- Sadasivam, S. and Manikam, A. 1992. *Biochemical Methods for Agricultural Sciences*. Wiley Eastern Ltd., New Delhi and Tamil Nadu Agricultural University, Coimbatore, p.256
- Sheela, K., Nath, K.G., Vijayalakshmi, D., Yankanchi, G.M. and Patil, R.B. 2002. Utilization of underutilized greens for value addition. International conference on vegetables, Nov. 11-14, 2002, Bangalore. p.379
- Shingade, M.Y., Chavan, K.N. and Gupta, D.N. 1995. Proximate composition of unconventional leafy vegetables from the Konkan region of Maharashtra. *J. Fd Sci. Technol.* 32: 429-431
- Siddhuraju, P. and Becker, K. 2001. Effect of various domestic processing methods on antinutrients and *in vitro* protein and starch digestibility of two indigenous varieties of Indian tribal pulse, *Mucuna pruriens* var. utilis. *J. agrl. Fd Chem.* 49: 3058-3067
- Siddhuraju, P., Vijayakumari, K. and Janardhanan, K. 1995. Nutritional and antinutritional properties of the underexploited legumes *Cassia laevigata* willd. and *Tamarindus indica*, L. *J. Fd Composition and Analysis*. 8: 351-362