Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

**E-ISSN:** 2278-4136
**P-ISSN:** 2349-8234
JPP 2018; SP1: 3129-3134

**Tshering Tashi Lepcha**
Dept. of Horticulture, Sikkim University, 6th Mile, Tadong, Gangtok, Sikkim, India

**Sujata Upadhyay**
Dept. of Horticulture, Sikkim University, 6th Mile, Tadong, Gangtok, Sikkim, India

**S Manivannan**
Dept. of Horticulture, Sikkim University, 6th Mile, Tadong, Gangtok, Sikkim, India

**Karma Diki Bhutia**
Dept. of Horticulture, Sikkim University, 6th Mile, Tadong, Gangtok, Sikkim, India

**Laxuman Sharma**
Dept. of Horticulture, Sikkim University, 6th Mile, Tadong, Gangtok, Sikkim, India

**Venkata Ramana Muddarsu**
Dept. of Horticulture, Sikkim University, 6th Mile, Tadong, Gangtok, Sikkim, India

**Correspondence**
**Tshering Tashi Lepcha**
Dept. of Horticulture, Sikkim University, 6th Mile, Tadong, Gangtok, Sikkim, India

# Proximate and nutritional analysis of Culantro *(Eryngium foetidum)*

**Tshering Tashi Lepcha, Sujata Upadhyay, S Manivannan, Karma Diki Bhutia, Laxuman Sharma and Venkata Ramana Muddarsu**

**Abstract**
The aim of the present study was to reveal proximate and nutrient contents and multielement profile of culantro *(Eryngium foetidum)* and to compare nutrients with secondary data of coriander. Twelve samples were collected from different districts of Sikkim i.e. North, South, East and West. The values of crude protein, fat, crude fibre, ash, reducing sugar, ascorbic acid, moisture and minerals (In, Ba, Pb, Ag, Al, As, Be, Bi, Ca, Cd, Co, Cs, Cu, Fe, Ga, Li, Mg Mn, Na, Ni, Mo, Rb, Sr, Ti, U, V, Zn, Hg, Si, Xe, I and Ce were obtained. The results revealed that the samples had high concentration of moisture (83.33%), crude protein (2.63), fat (0.73%), crude fibre (31.50%) and ash (3.0%). The results revealed that concentration of ascorbic acid (32.33%) is less in culantro. It was found that T1 (Singik, North Sikkim), T4 (Yangang, South Sikkim), T6 (Namthang, South Sikkim) samples contained high amount of minerals (particularly Mn, Fe). The South and East district samples showed higher amount of nutrients as compared to other two district samples. The results reveal that culantro contains appreciable amount of nutrients. Culantro contains similar content of nutrients as coriander and may be recommended in its place for consumption.

**Keywords:** Culantro, spice, proximate constituents, nutrients, multielements

## 1. Introduction
India is traditionally known as the spice bowl of the world. According to the Bureau of Indian Standards, about 63 spices are widely grown in our country. Spices accounts an area of 3163(000'HA) its production is 5908 (000'MT) and the productivity is 1.9 (MT/HA).

Sikkim is located between 27° 04'46''and 28°07" 48" North latitude and between 88° 0"55" and 89°55''25" East longitude in the eastern Himalaya with geographical area of 7096 km$^2$ is surrounded almost on all sides by Steep Mountain walls except in South it is open by Teesta River and High Mountains of north are always covered under perpetual snow cover. The land use pattern of Sikkim is strongly influenced by the elevation climate and mountainous terrain especially in the field of agriculture and forestry. The cultivated land is approximately 11.13 % of the total geographical area (776.74km$^2$) and is confined to altitude less than 2000m. The soils of Sikkim are generally acidic pH ranging from 4.3 to 6.4 with mean value of 5.35. The soil texture is silty to clay loam with depth varying from a few inches to several feet. Organic matter content is high with a mean value of 2.74%. Horticulture is one of the major economic activities of the people of Sikkim. Large Cardamom, Ginger and Turmeric are the principal spice grown in the state.

Culantro (*Eryngium foetidum*) belongs to family Apiaceae and used as a spice as well as medicinal plant. It is a tropical perennial and annual herb and it is a native of Mexico and South America. Its common name is Mexican Coriander also called as long coriander. Culantro is a tap-rooted biennial herb with long evenly branched roots. The oblanceolate leaves arranged spirally around the short thick stem from a basal rosette and are as much as 30 cm long and 4 cm broad. The leaf margin is serrated each tooth of the margin contains a small yellow spine. The plant produces a well-branched cluster of flower heads in spikes forming the characteristic umbel inflorescence on a long stalk arising from the center of the leaf rosette. The calyx is green while the corolla is creamy white in color. The appearance of culantro and cilantro are different but the leaf aromas are similar, although culantro is more pungent. Because of this aroma similarity the leaves are used interchangeably in many food preparations and are the major reason for the misnaming of one herb for the other.

In India it is found mainly in the northeastern state of Sikkim (bhotay dhonia), Assam (man dhonia), Manipur (awa phadigom or sha maroi), Mizoram (asbahkhawr), Tripura (bilati dhonia), Nagaland (Burma dhania). It is used in the Andaman & Nicobar Island and in few

parts of Tamil Nadu, Kerala and Karnataka.

The local people of Sikkim use culantro as a condiment and use it as spice, chutney as well as for medicinal purposes. As a spice they use it as a seasoning of meats, vegetables, chutneys and soup. The common part of the plant consumed is leaves. As there were no earlier complete reports published on nutritional and proximate analysis of culantro and by looking at its importance for the people of Sikkim particularly farming community, the present study aimed to reveal proximate, nutrient contents and multielement profile of culantro *(Eryngium foetidum)* and to compare it with secondary data available for coriander.

## Materials and Methods

The present research work has been done in Culantro *(Eryngium foetidum)* which is traditionally consumed as herbal spice. The present work entitled " Proximate and Nutrient Analysis of Culantro *(Eryngium foetidum)"* was carried out during the year of 2015-2016 in the P.G Laboratory Department of Horticulture, Sikkim University, 6th mile, Tadong, Gangtok at an altitude of 1610 m and with latitude and longitude as N 2718.495' and E 8835.307'. Details of the materials and methodology employed during the course of investigation are described as follows:

### Glasswares and plasticwares

During the research work the glasswares (beakers, volumetric flasks, reagent bottles, pipettes, conical flasks, burettes of various capacities) used were of Borosils brand. Tarsons brand of plastic were used in the whole research work (plastic bottle, narrow mouth bottles, funnel, bottle top, liquid dispenser, wash bottle, droppers, measuring cylinder of various capacities). To avoid contamination all the glasswares were thoroughly washed with running tap water and rinsed with Tween-20 and then further three to four times washing with distilled water was done. Then the glasswares were allowed to dry in hot air oven at the temperature of $40^0$C for 30 minutes.

### Instruments used

The instrument used during the research work were ICP-MS and crude fibre extractor, oil extractor, muffle furnace, hot air oven, willey mill, exhaust fan, water bath, centrifuge and digital balance.

### Collection of sample

The fresh sample along roots were collected from four districts of Sikkim namely North, South, East and West during the month of November-December, 2015 and they were maintained in the polyhouse of Horticulture department, Sikkim University, Gangtok as a germplasm collection. The main objective of Culantro collection from different altitudes was to grow and maintain germplasm for future research in the department. From each district samples were collected from three different locations for the analysis of nutrients.

From North samples were collected from Singik, Naga village and Sangytam. In South region samples were collected from Yangang, Namthang and Bermiok. And from East collections were done from Ranka, Rumtek and Sang. Likewise from West samples were collected from Sombaria, Namchaybong and Lashithang. Twelve Samples were named as (T1, T2, T3) from North, (T4, T5 T6) from South, (T7, T8, T9) from East and (T10, T11, T12) from West. The collection site and their respective elevations have been mentioned on Table 1. All the samples were collected with correct location data by using GPS (Garmin). There after the sample leaves were stored in polythene bags at -20 $^0$C until analysis.

**Table 1:** Collection of Culantro *(Eryngium foetidum)* from various places and various elevations

| Treatment no. | Sample | Name of place | Altitude | Latitude | Longitude |
|---|---|---|---|---|---|
| North | T1<br>T2<br>T3 | Singik<br>Naga village<br>Sangytam | 1445 m<br>1273 m<br>1132 m | N27°28.32'<br>N27°25.31'<br>N27°15.86' | E088°22.32'<br>E088°18.33'<br>E088°28.17' |
| East | T4<br>T5<br>T6 | Yangang<br>Bermiok<br>Namthang | 2230 m<br>1815 m<br>1812 m | N27°17.43'<br>N27°16.72'<br>N27°1574 | E088°26.10'<br>E088°26.10'<br>E088°26.18' |
| West | T7<br>T8<br>T9 | Ranka<br>Khamdong<br>Sang | 1437 m<br>1132 m<br>1555 m | N27°25.17'<br>N27°16.86'<br>N27°17.28' | E088°<br>E088°2817'<br>E088°27.12' |
| South | T10<br>T11<br>T12 | Sombaria<br>Namchaybong<br>Lashithang | 18.34 m<br>1735 m<br>1545 m | N27°18.34'<br>N27°25.47'<br>N27°17.32, | E088°26.17'<br>E088°28.17'<br>E088°26.12' |

### Sample preparation

The leaves of Culantro (*Eryngium foetidum*) were separated from roots and the sample leaves were washed with running tap water and then further washed with distilled water. The samples were spread under blotting paper to remove the excess moisture after that the sample were put in a paper bag and kept in hot air oven at 60 $^0$C for 3-4 days until it dried. And then the dried sample was ground with the help of Willey Mill grinder to make into a fine powder. The fine powder was put into a plastic container and kept at room temperature until it was used and then further analyzed. And some fresh samples were used for analysis and some sample were maintained under refrigerator (-20 $^0$C).

### Experimental materials

Culantro (*Eryngium foetidum*) leaves were used as

experimental materials for present study. It was collected from farmers field from various districts of Sikkim. The collected plant material was placed in a polyethylene bag to prevent loss of moisture during transportation to the laboratory.

**Experimental methods**

The present study of Culantro (*Eryngium foetidum*) was conducted in the P.G. laboratory, Department of Horticulture, Sikkim University, 6th mile Tadong, Gangtok. The dietary nutrients were analyzed by following methods as mentioned below:

**Moisture estimation**

Moisture content in the leaves was estimated by the gravimetric method (AOAC, 2000). The following formula was used for calculation:-

$$\text{Moisture (\%)} = \frac{W_1 - W_2}{W_1} \times 100$$

Where: $W_1$ = weight (g) of sample before drying
$W_2$ = weight (g) of sample after drying

**Estimation of crude fat**

Crude fats were determined by solvent extraction method (AOAC 2000) by using instrument Socsplus-SCS 06 DLS, PELICAN. The following formula was used for calculation:-

Weight of fat = $W_1$-$W_2$

$$\text{Fat\%} = \frac{W_1 - W_2}{W_1} \times 100$$

**Estimation of crude fibre**

Crude fibre was estimated by the method described by the (AOAC, 2000) by using fibre estimation system, model no. Fibra plus FES 04 AS DLS, PELICAN. The extracted fibre samples were expressed as percentage and calculated by using the following formula:-.

$$\text{Crude fibre (\%)} = \frac{\text{Digested sample } (W_1) - \text{Ashed sample } (W_2)}{\text{Weight of sample}} \times 100$$

**Ash estimation**

Ash % was estimated by incinerating the sample at 600 for 3 hours (SMBA 2004). The calculation was done with the following formula:-

$$\text{Ash (\%)} = \frac{\text{Weight of ash}}{\text{Weight of sample}} \times 100$$

**Estimation of vitamin C**

Ascorbic acid was determined as described in the Handbook of Analysis and Quality control for fruits and vegetables products (2012).

Dye factor was determined by the formula:-

$$\text{Dye factor} = \frac{0.5}{\text{Titer}}$$

The calculation of ascorbic acid determination was done with the following formula:-

$$\text{mg of ascorbic acid/ 100g/ml} = \frac{\text{titre} \times \text{dye factor} \times \text{vol.made up} \times 100}{\text{aliquot of extract} \times \text{wt or vol of Sample taken for estimation taken for estimation}}$$

**Determination of crude protein and reducing sugar**

Determination of crude protein was done by Lowry's method. Estimation of reducing sugar by Lane and Eynon methods Standardization of the Fehling's solution was done.

$$\text{Fehling factor} = \frac{\text{Titre} \times 2.5}{\text{(g of invert sugar) } 1000}$$

The percentage reducing sugar was determined with the following formula:

$$\text{\% reducing sugar} = \frac{\text{Fehling's Factor} \times \text{Dilution} \times 100}{\text{Titre} \times \text{Weight or volume of the sample}}$$

**Multi element through ICP-MS**

The open air digestion system was used for sample digestion as per the following steps:

Nitric acid ($HNO_3$) 9 ml and 4ml of perchloric acid was measured and mixed properly. The 0.5g of ground sample was weighed and placed in 100ml conical flask. Di-acid mixture (10 ml) to the ground sample was added. Then it was placed in hot plate. Yellow fumes developed when it firstly started.

When it fully digested it started producing white fumes and it was colourless. After digestion sample were transferred into 50ml volumetric flask when the temperature of the sample was reduced and distilled water was added. Then volume was made to 50ml.Thereafter the liquid colourless sample was transferred into narrow mouth bottle before the minerals were determined in ICP-MS. ICP-MS (Inductively Coupled Plasma Mass Spectrophotometer) Parkin Elmer Nex ION 300X was used for nutrient estimation. Digested samples were analyzed for the ionic constitution using multi elements standards solution 1, 3 and 5 solution containing analysis were used as a standards such as Ag, Al, B, Ba, Be, Bi, Ca, Cd, Co, Cr, Cs, Cu, Fe, Ga, Se, Ln, K, Li, Mg, Mn,Mo,Na, Nb, N, Ti, Pb,Rb, Ge, Se, Si, Tn, U,V,W,Zn, and Zr.

**Statistical Analysis**

The treatment was subjected to ANOVA using Completely Randomized Design (CRD). The number of treatments was twelve. Collected from four districts of twelve places with different altitudes and the total number of replications were three. The statistical analysis was carried out using HTPR software. The data was noted for estimation of moisture, crude fat, crude fibre, ash, crude protein, reducing sugar, vitamin-C and multi-elements. The arcsine transformation was applied to binomial data expressed on decimal fractions or percentage (%).

**Results and Discussion**

The results obtained in the present study are being given under sub-heads along with discussions supported by tables, figures and plates.

**Estimation of Moisture in Culantro (*Eryngium foetidum)* (%)**

It is evident from the data presented in Table 2 that all the

samples of Culantro (*Eryngium foetidum)* collected from different places of Sikkim varied significantly with respect to moisture content. The mean value for this parameter exhibited in a ranged from T1 (60.23%) to T4 (83.33%). The highest percentage of moisture contents (83.33%) in Culantro (*E. foetidum)* was found in T4 (Yangang) followed by T8 (Khamdong) (83.00%), T6 (Namthang) (82.00%), T9 (Sang) (77.33%), T5 (Bermiok) (75.66%), T7 (Ranka) (74.06%) and T3 (Sangytam) (73.66%) which were found to be significantly at par at 5% level of significance. However the lowest percentage of moisture content was found in T1 (Singik) (60.23) followed by T11 (Namchabong) (61.66) and it was statistically lower than other samples at 5% level of significance.

The present study was found similar to the findings of Ganesan *et al*. (2015), Nadeem *et al*. (2013), Khan *et al.* (2006). The moisture content was found to be nearly similar due to environmental factor, geographical location of the plant, season of sowing, harvesting time, storage and handling conditions.

**Estimation of Crude protein in Culantro (*Eryngium foetidum)***

The Table 2 gives the value of crude protein content in different samples of culantro which ranged from T9 (1.27%) to T7 (2.63%). The highest percentage of crude protein was found in T7 (Ranka) (2.63%) which was found to be highly significant at 5% level of significance. Likewise the lowest percentage of crude protein was found in T9 (Sang) (1.27%).

As compared with coriander, the results of the present study are similar as reported by Ganesan *et al.* (2015) in which protein content was found to be 3.3%. Sharangi and Guha (2013) reported that the protein present in coriander was 3.3%. Nadeem *et al.* (2013) also reported the protein content in coriander of Pakistan was 3.3%. According to findings of Khan *et al.* (2006) higher values were reported that the protein content as 18.34% in the Parachinar, Kurran Pakistan this might be due to because of geographical location, different species etc. The crude protein was found to be similar with coriander as per observations by Ganesan *et al* (2015); Sharangi and Guha (2013) and Nadeem *et al.* (2013) due to nature of the plant and environment, soil type, fertilizer application, drying methods, storage and handling condition. It showed that the study conducted by Khan *et al.* (2006) somewhat higher content of protein was recorded in coriander as compared with culantro due to impact of environmental condition, different species, soil type, orchard location and different methods used for the protein estimation.

**Estimation of reducing sugar in Culantro (*Eryngium foetidum)* (%)**

The data presented in Table 2 clearly showed that reducing sugar content in different treatments ranged from T10 (2.66%) to T11 (8.26%). The maximum percentage was observed in T11 (Namchaybong) (8.26%) and the minimum percentage was found in T10 (2.66%) at 5% level of significance.

As compared with coriander the result of the present study were found similar with the findings of Ganesan *et al* (2015) and Nadeem *et al.* (2013) that the reducing sugar content was 6.5% derived from coriander. The findings of Khan *et al.* (2006) that the reducing sugar content in *Coriandrum sativum* was 49.81%, 56.179%, 44.576% and 49.649% respectively was found to be in higher concentration as compared with culantro in present study.

**Estimation of Vitamin C in Culantro (*Eryngium foetidum)* (mg/100g)**

The Table 2 shows clearly identified Vitamin content in different treatments ranging from T2 (18.33 mg/g) to T8 (32.33mg/g). The maximum value was found in T8 (32.33 mg/g) at 5% level of significance. The lowest Vitamin C was found in T2 (18.33 mg/g) followed by T10 (20.50mg/g), T1 (22.00 mg/g), T4 (22.33 mg/g), T9 (22.67 mg/g) and T9 (22.67 mg/g) which was found to be significantly at par at 5% level of significance. However, in the present study the ascorbic acid content in culantro (*Eryngium foetidum)* varied from T2 (18.33 mg/g) to T8 (32.33mg/g) which was found to have lower Vitamin C content as compared to *Coriandrum sativum* given by Nadeem *et al.* (2013) who reported that Vitamin C content in coriander to be 135mg/100g. The Vitamin C was found to be lower due to different geographical location, environmental factor, harvesting time, different species, season, farming and drying method, storage and handling condition.

**Estimation of Crude fat in Culantro (*Eryngium foetidum)* (%)**

It is evident from Table 3 that the crude fat content in different treatments ranged from T9 (1.27%) to T7 (2.63%). The highest percentage of crude fat in Culantro (*Eryngium foetidum)* was found in T8 (0.73%) followed by T7 (0.56%) which was found to be significantly at par at 5% level of significance. It was also observed that T6 and T12 were significantly at par at 5% level of significance. The lowest percentage of crude fat was found in T1 (0.23%) and it was statistically lower than other treatments at 5% level of significance. According to the Sharangi and Guha (2013), the crude fat content in coriander was 0.6%. In the present study of Culantro (*Eryngium foetidum)* it was found that the fat content was lower as compared with coriander as reported by Sharangi and Guha (2013). It should be influenced by various factors like different climatic conditions, species, harvesting period, storage and handling conditions, instruments used, season and geographical origin.

**Estimation of Crude fibre in Culantro (*Eryngium foetidum)* (%)**

It is evident from Table 3 that crude fibre content in different treatments ranged from T2 (16.83%) to T9 (31.50%). The maximum percentage of crude fibre content in Culantro (*Eryngium foetidum)* was observed in T9 (31.50) at 5% level of significance. The lowest percentage of crude fibre content was derived in T2 (16.83%) which was followed by T6 (18.13%) which was found to be statistically at par at 5% level of significance. In present study the results showed that crude fibre content was found to be highest in T9 (31.50%) in Culantro (*Eryngium foetidum)* so that the recent findings show that the crude fibre content in Culantro was higher as compared with coriander as reported by Khan *et al.* (2006). Hence, coriander (*Coriandrum sativum)* was found to have lower fibre content as compared with Culantro (*Eryngium foetidum)* as per findings of Khan *et al.* (2006). Culantro is a shade loving plant. Fibre content might be higher than coriander due to different geographical region, climatic condition, drying method, instruments used, and harvesting time and storage conditions.

**Estimation of Ash in Culantro (*Eryngium foetidum)* (%)**

The Table 3 shows clearly identified ash content in different treatments which ranged from T10 (1.1) to T5 (3.0). The

highest percentage of ash content in Culantro (*Eryngium foetidum)* was found in treatment T5 (3.0%). However treatments T4 (1.2%), T12 (1.06%), T6 (1.06), T8 (1.26%), T1 (1.30), T7 (1.33), and T (1.36) were found to be at par to T1 at 5% level of significance. The lowest ash content was found in T10 (1.1%) at 5% level of significance.

However the ash content varied from 1.1% to 3.3% in present study. Culantro (*Eryngium foetidum)* was found to have lower ash content as compared to coriander as reported by Ganesan *et al.* (2015) and Nadeem *et al*. (2013). The ash content was found to be lower due to harvesting time, drying methods, season, environmental factors, storage and handling conditions.

**Determination of ionic contents in Culantro (*Eryngium foetidum)* (mg/100g)**

The result of the analysis of elements concentration present in Culantro (*Eryngium foetidum)* including Indium (In), Barium (Ba), Laed (Pb), Silver (Ag), Aluminium ( Al), Arsenic ( As), Beryllium (Be), Bismuth (Bi), Calcium (Ca), Cadmium (Cd), Cobalt (Co), Caesium (Cs), Copper) (Cu), Iron (Fe), Gallium (Ga), Magnesium (Mg), Manganese (Mn), Sodium (Na), Nickel (Ni), Molybdenum (Mo), Rubidium (Rb),Strontium (Sr), Titanium (Ti), Uranium (U), Vanadium (V), Zinc (Zn), Mercury (Hg), Silicon (Si), Xenon (Xe), Iodine (I), and Cerium (Ce). The minerals present in different samples of Culantro (*Eryngium foetidum)* were found to be statistically different from each other.T1 (Singik), T4 (Yangang) and T6 (Namthang) were found to have higher concentrations than all other samples. However, as mentioned in Fig.1 the PCA revealed that T1, T4 and T6 could be grouped in to one category (group1) based on the abundance of Si, V, U, Be, I, Mn, Fe, Xe, Sr and Al. In this group higher concentration of V, U, Be, I, Mn, Fe, Xe, and Sr were found in T1, followed by Si and Al was significantly higher in T4 and T6. It was found that in T6 the lowest content of Si, V, U, Be, I, Mn, Fe, Xe, and Sr followed by T4 is lower than T1 (Singik) and the maximum content of Al was found in T6 (Namthang).

In group (2) from the obtained analytical data it was found that T3 (Sangytam), T5 (Bermiok), and T10 (Sombria) were having moderate amount of ionic contents among rest of the germplasm. While T3, T5 and T10 had maximum content of Zn, Cs, Mg, Ba, Cu, Rb, Cd, Cs,Pb, Ag, Na and Cu. The maximum amount of Zn, Cs, Ba, Rb, Cd, Cs, Ag and Na was observed in T5 followed by T3, T0 had higher amount Pb and Cs then T5.

The least concentration of Zn, Cs, Ba,, Rb, Cd, Cs, and Pb, was observed in T10.Mg was observed to be lowest in T3 and Cu content lowest in T5 (Bermiok). In group (3) it was found that T2 (Naga village), T7 (Ranka), T9 (Sang) and T12 (Lashithang) in this germplasm minerals concentration was slightly moderate as compared with other germplasm it can be influenced by many factors like environmental factor, soil type, harvesting time and storage conditions. Minerals present in this treatments are Mo, in and Bi. In T2 content higher amount of in and Bi and T12 present larger concentration of Mo was present. The minimum concentration of in and Bi was found in T7 followed by T2 were least concentration of Mo was observed.

In group (4) consisting of T11 (Namchaybong) was completely different from rest of the samples as all the ionic contents were least in this treatment except Li and Ni were present. This might be due to varying climatic conditions, soil type, geographical origin, storage and handling conditions.

Further as compared to culantro (*Eryngium foetidum)* with coriander *(Coriandrum sativum)* Khan *et al*.(2006), Bhat *et al*. (2014) and Khattak (2013) reported that the ionic elements in coriander content are slightly higher than Culantro which might be due to influence by environment, soil type, species, storage and handling condition and geographical origin.

As compared with coriander moisture, crude protein, crude fat, fibre and ash in Culantro were found to be nearly similar. The ascorbic acid was found lower than coriander as compared to Culantro (Table 4).

The present study revealed that multi elements present in culantro were lower as compared to coriander. Highest nutrients present in Culantro *(Eryngium foetidum)* were found in T8 (Khamdong) followed by T4 were collected from (Yangang), T7 (Ranka), T5 from (Bermiok) and T9 (Sang). In this study it was observed the samples collected from East and South districts showed higher content of dietary nutrients whereas in ionic concentration the maximum content of minerals was observed in T1 (Singik), T4 (Yangang) and T5 (Bermiok).

As per the present findings it may be concluded that culantro *(Eryngium foetidum)* is similar to coriander in nearly all the nutrients and minerals. Culantro *(Eryngium foetidum)* may be recommended in place of coriander for daily consumption or dietary supplement. The production of culantro in the state of Sikkim needs to be strengthened

**Table 2:** Estimation of Moisture, Crude protein, Reducing Sugar and Vitamin C in Culantro (*Eryngium foetidum)*.

| Treatment | Moisture% | Crude protein% | Reducing sugar% | Vitamin C mg/100g |
|---|---|---|---|---|
| T1 | 60.23(50.90) | 2.17(8.63) | 3.06 | 22.00 |
| T2 | 65.33(53.93) | 1.63(7.34) | 3.46 | 18.33 |
| T3 | 73.66(59.12) | 1.60(7.27) | 5.43 | 26.67 |
| T4 | 88.33(65.92) | 1.70(30.82) | 5.23 | 22.33 |
| T5 | 75.66(60.44) | 2.23(8.59) | 4.80 | 27.50 |
| T6 | 82.00(64.92) | 2.30(8.72) | 3.73 | 27.00 |
| T7 | 74.00(62.68) | 2.63(7.67) | 4.56 | 25.67 |
| T8 | 83.00(61.62) | 1.60(7.26) | 4.56 | 32.33 |
| T9 | 77.33(61.57) | 1.27(6.46) | 3.40 | 22.67 |
| T10 | 67.66(55.35) | 2.33(8.78) | 2.66 | 20.50 |
| T11 | 61.66(51.74) | 2.30(8.72) | 8.26 | 29.33 |
| T12 | 83.00(65.67) | 1.80(7.71) | 7.24 | 29.33 |
| G.M. | 73.908 | 1.963 | 4.702 | 25.305 |
| SEm | 0.855 | 0.408 | 0.509 | 2.369 |
| CD at 5% | 2.496 | 0.119 | 0.148 | 6.916 |

*(Figures in parentheses show arcsine transformed values)

**Table 3**: Estimation of Crude Fat, Crude Fibre and Ash in Culantro (*Eryngium foetidum)* on dry weight basis

| Treatment no. | Crude fat% | Crude fibre% | Ash% |
|---|---|---|---|
| T1 | 0.23 (2.75) | 20.66(27.04) | 1.30 (6.53) |
| T2 | 0.53( 4.17) | 25.33(30.21) | 1.46 (6.96) |
| T3 | 0.43 (3.74) | 21.16(27.39) | 1.26 (6.45) |
| T4 | 0.46(3.91) | 22.66(28.42) | 1.16 (6.19) |
| T5 | 0.43(3.77) | 25.33(30.22) | 3.0 (9.95) |
| T6 | 0.33(3.27) | 18.13(25.20) | 1.06 (6.02) |
| T7 | 0.56(4.30) | 28.83(29.22) | 1.33 (6.62) |
| T8 | 0.73(4.81) | 22.66(28.43) | 1.26 (4.79) |
| T9 | 0.43(3.74) | 31.50(34.14) | 1.36 (6.70) |
| T10 | 0.53(4.17) | 22.73(28.47) | 1.1 (6.19) |
| T11 | 0.50(4.04) | 25.16(30.10) | 1.2 (6.44) |
| T12 | 0.36(3.46) | 16.83(24.21) | 1.06 (6.02) |
| G.M | 0.464 | 23.002 | 1.394 |
| SE(m) | 0.594 | 0.516 | 0.096 |
| CD at 5% | 0.173 | 1.504 | 0.283 |

*(Figures in parentheses show arcsine transformed values)

**Table 4:** Comparison of various nutrient contents present in culantro and coriander

| Sl. No. | Parameters | Culantro | Coriander |
|---|---|---|---|
| 1 | Moisture (%) | 83.33 | 87.9 |
| 2 | Crude protein (%) | 2.63 | 3.3 |
| 3 | Reducing sugar (%) | 8.26 | 6.5 |
| 4 | Ascorbic acid (mg/100g) | 32.33 | 135 |
| 5 | Fat (%) | 0.73 | 4.78 |
| 6 | Fibre (%) | 31.50 | 10.40 |
| 7 | Ash (%) | 3.0 | 1.7 |

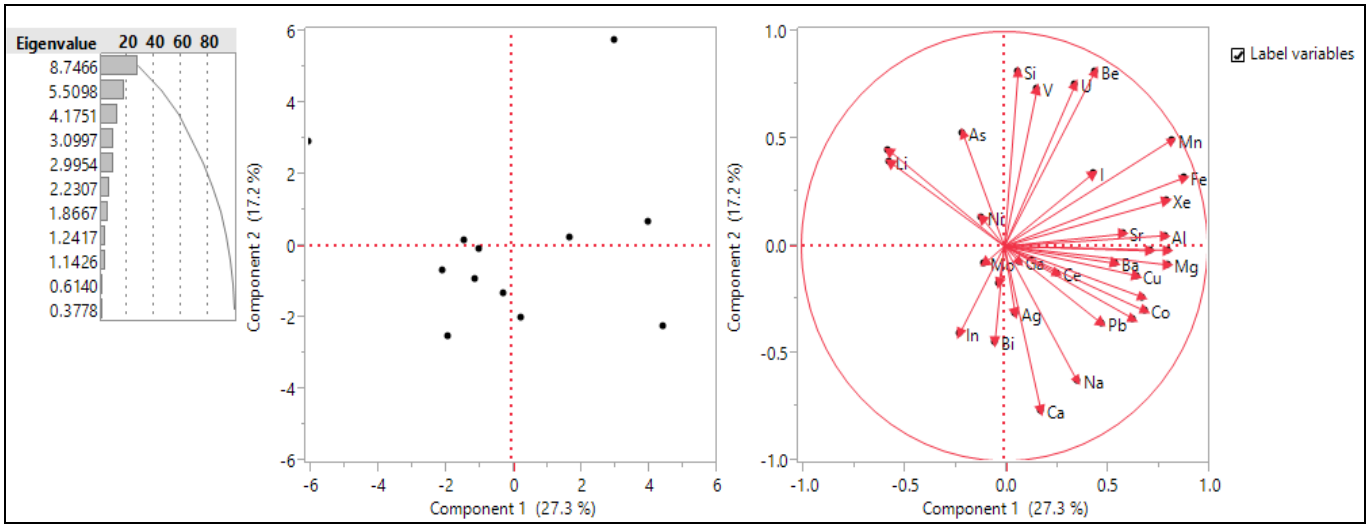


**Fig 1:** PC analysis showing similarity in nutrient contents of culantro collected from various places of Sikkim

## References


1. Ganesan P, Phaiphan AY, Murugan Y, Baharin BS. Comparative study of bioactive compounds in curry and coriander leaves an update. Journal of Chemical and Pharmaceutical Research. 2013; 5(11):590-594.
2. Khan SA, Ahmad I, Mohajir MS. Evaluation of mineral contents of some medicinal plants. Pakistan Journal Pharmceautical Science. 2006; 19(2):141-148.
3. Khattak MI. Determination of trace elements in some medicinal plants in Balochistan. Science. International Lahore). 2013; 25(3):599-602.
4. Nadeem M, Anjum FM, Khan MI, Tehseen S, El-Ghorab A, Sultan JI. Nutritional and Medicinal aspects of coriander (*Coriandrum sativum* L.): A review, British Food Journal. 2013; 115(5):743:755
5. Sharangi AB, Guha S. Wonders of leafy spices: Medicinal properties ensuring human health. Sci. Int. 2013; 1:312-317.