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Macro-micronutrients and Antioxidant Potentials of Plants and Fungal-based Food from Tawang Area, Arunachal Pradesh, India

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ABSTRACT

Certain variety of plants such as vegetables, spices and seaweed are abundantly being grown in high altitude area of Tawang in Arunachal Pradesh, India. Therefore, four different vegetables, spices and seaweed were taken from that particular cold region viz., finger millet, nori seaweed, pepper corn, bean along with edible higher fungi, mushroom have been selected based on the higher consumption of people of Northeast India for the proximate analysis, mineral, antioxidant and its potentials and vitamin contents. The nutritional studies conducted on the plant foods and fungi, mushroom in Northeast is spares with very few reports are available. For this reason, this study was undertaken to determine the macro and micro nutrients and antioxidant potential of these plant foods. Common bean showed higher percentage of protein with 35.09 per cent and fat percentage of the finger millet is higher (9.20 %) as compared to other varieties from other regions (1-1.5 %). Higher crude fibre was assessed in mushroom with 47.77 per cent followed with pepper corn (38.42 %), bean with 30.98 per cent, and finger millet (5.14 %). Calcium was higher in finger millet with 225.0 mg per 100g whereas iron content was higher in mushroom with 652.0 mg followed with beans (543.0 mg), pepper corn (408.0 mg per 100 g). Higher amount of polyphenols observed in finger millet with 8.71 µg gallic acid equivalent (GAE)/mg and highest total flavonoids in pepper corn with 48.19 µg rutin (RU) equivalent per gram of dried extract. Likewise, highest FRAP in finger millet noticed with 72.0 µg of FeSO4 equivalent/mg and reducing power (ascorbic acid equivalent/mg) in mushroom (244.0) and pepper corn (242.0). All samples had higher metal chelating activity at IC_{50} between 86.65- 83.38. Similarly, higher amount of vit B_6 was noted in pepper corn with 197.0 mg while lowest in seaweed with 1.76 mg/100gm, respectively.

Keywords: Finger millet; Nori; Pepper corn; Common bean; Mushroom; Tawang area; Macro micro nutrients content; Antioxidant potentials.

1. INTRODUCTION

Finger millet (*Eleusine coracana,* Maruba dhan), one of the oldest crops in India is referred as “nrtta kondaka” (Indian Sanskrit literature) which means “dancing grain,” is also referred as “rajika” or “markataka”. Finger millet is a cereal grass grown for the purpose of its grain, comes under the family Poaceae, used for food or brewing. It’s a robust tillering grass and also grows in tufts. The leaves of the plant are dark green, linear and mostly smooth with some hair on the leaf edges. It has been domesticated at the beginning of the Iron age in Africa and was introduced into India 3000 year ago before into Southeast Asia. It’s a fast growing crop that reaches maturity within 3 months to 6 month. It is valuable because of the important amino acids, methionine, which are mostly missing in their diets of hundred millions of the poor who are living on starchy staples[1] and those suffering from diabetes and obesity[2].

Nori (*Eucheuma spp.*) is the edible seaweed species and is a plant like organisms, it’s a green algae (phylum Chlorophyta, classes Bryopsidophyceae, Chlorophyceae) that are living in a rock, walls, houses, and tree bark in damp places or other hard objects in coastal area including freshwater (river and lakes). It has many specialised tissues and growth forms. Seaweed is having higher amount of vitamins, minerals, and fiber and can be tasty. It’s very familiar in the USA and other countries and also an important ingredient of sushi, referred as “nori” or simply as seaweed. Also, it is being used as a wrap for sushi and *onigiri* and as a garnish in noodles and soups. Out of 20,000 species of algae around the world, 434 species of red, 194 species of brown and 216 species of green algae were reported in our country[3].

Peppercorn (*Zanthoxylum piperitum,* Sichuan pepper corns) is a deciduous aromatic spiny medium sized shrub or tree, belonging to family, Rutaceae (citrus and rue), which can grow to about 7 m in height and width. The leaves of this plant is having similarity to those of ash tree, which along with the spikiness gives rise to one of its common name “prickly ash”. The red berries of the pepper are around 5 mm in diameter and wrapped its flavor in it. The macerated fruits (“peppercorns” or “berries”) are generally called as “Japanese

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pepper" or *konazanshō*, is a standard spice for sprinkling on the broiled eel (*kabayaki unagi*) dish. It is also one out of seven main ingredients of the blended spice called *shichimi*, which also holds red chili peppers.

Common beans (*Phaseolus vulgaris*) is a major grain legume consumed widely in the globe and is an herbaceous annual plant grown worldwide for its edible dry seed (known as "beans"). It has come under the family Fabaceae, is a highly polymorphic warm seasonal one, which is grown as a pulse. Its leaf is occasionally used as a vegetable and straw as feed[4-5].

Button mushrooms (*Agaricus bisporus*) are belonged to class Basidiomycetes and Family Agaricaceae as higher fungi, which are used as food[6] and medicinal purposes since long time. This is a white button mushroom. It has got a higher nutritional value with higher amount of protein (up to 44.93 %) with micronutrients and minerals, fibers, trace elements with lesser calories and almost with little amount of cholesterol[7-8]. 14,000 numbers of known mushroom species have been reported, of which 2,000 are safe, with 650 have medicinal properties[9-10]. Reports on the antioxidant profile of pickled mushrooms of North East India are available[11]. Nutraceutical and medicinal mushrooms have been used in dietary supplement formulations in India as food, medicine, minerals[12-13].

Therefore, the present study has been designed to aim to analyse the macro and micro nutrient composition and antioxidants potential of the selected vegetables, grains, spice and higher fungi, mushroom, which have been collected from Tawang region, Arunachal Pradesh, India. The data generated on these plant foods and mushroom could be useful for the development of nutrient and antioxidant rich foods that could be used for the consumption widely.

2. MATERIALS AND METHODS

The freshly harvested samples of finger millet, nori seaweed, pepper corn, common bean and mushrooms were collected approximately to about 2 kg in weight and all these samples were collected between April to September 2016 from Tawang, Arunachal Pradesh, North Eastern India. It was brought to DFRL, Mysore by air after tightly packed. Analysis of all the samples were done on wet weight (DW) basis except mushrooms, which were dried at room temperature. The altitude of Tawang is at 2669 m (8757 ft) and situated at approximately latitude of 27° 45' N and longitude of 90° 15' E at the northwest extremity of Southern part of Tibet.

2.1 Analysis of proximate composition

Moisture content was derived as per the protocol established by James[14,]. Crude protein (N x 6.25) was estimated by kjedahl method as described by Chang[15]. The recommended method of association of Official Analytical Chemist[16] was used for the estimation of moisture analysis followed with ash content[17], crude lipid[18] and crude fibre[18]. The carbohydrates were calculated based on the individual composition difference as below. Total carbohydrate (%) = 100-(% moisture+ ash + Fat + protein + crude fiber)[18].

2.1.1 Estimation of Reducing Sugar and Total Sugar by Fehling's Solution

Sugars present in the carbohydrate act as a reducing agent, which cause the Fehling-A solution containing copper to a red insoluble copper (I) oxide (Ferguson, 1996)[19]. The reducing sugars are determined using the following formula,

Reducing sugars (%) =

$$\frac{\text{mg of invert sugar x Dilution}}{\text{Titre x Weight of sample (g) x 1000}} x100$$

2.1.2 Determination of Total Reducing Sugars

50 ml was pipetted out from the clarified, de-leaded filtrate to a 100 ml volumetric flask. Added 5 ml of concentrated hydrochloric acid and allowed to position at RT for 24 hours. Then it was neutralised with concentrated sodium hydroxide solution followed by 0.1N sodium hydroxide. The volume was adjusted to and transferred to 50 ml burette and completed the titration on Fehling's solution as per the procedure for the estimation of reducing sugars (Benedict, 1907)[20].

Non-reducing sugars (%)

$$= \{TotalSugar(\%) - \mathrm{Re}\,ducingsugar(\%)\} x0.095$$

2.2 Estimation of Mineral Content

2.2.1 Estimation of Iron by Wong's Method

The presence of iron in the given sample was estimated by Wong's method[21].

2.2.2 Estimation of Calcium by Colorimetric Method

The presence of calcium for the selected samples were estimated by colorimetric method in which the calcium forms a colour complex (purple) with the o-cresolphthalein dye[22], which is made more specific in the presence of 8-quinolinol[23]. It was calorimetrically measured at 565 nm.

2.3 Antioxidant Analysis

2.3.1 Quantification of Total Polyphenols and Flavonoids

- Polyphenols : The principle involves that phenols react with phosphomolybdic acid of Folin-Ciocalteau's reagent in alkaline solution to produce a coloured complex, the intensity of which is directly proportional to the concentration of phenols.
- Flavonoids : Total flavonoids were determined as per the method developed by Singleton and Rossi[24]. The concentration was measured using epicatechin as standard curve.

2.3.2 Determination of Antioxidant Activities

2.3.2.1 Assay of DPPH (2, 2'-diphenyl-1-picrylhydrazyl) Radical Scavenging Activity

The scavenging activities of different extracts were determined by using DPPH assay[25] and the per cent radical scavenging activity of the plants and a mushroom extracts was calculated using the formula.

$$\% \text{ RSA} = \frac{\text{Abs control-Abs sample}}{\text{Abs control}} x100$$

2.3.2.2 Ferric Reducing Antioxidant Power Method

This assay measures the ability of antioxidants to reduce ferric iron as per the method of Benzie and Strain[26].

2.3.2.3 Reducing Power Method

This protocol is based on the principle of increase in the absorbance of the reaction mixtures that indicate the reducing power of the samples[27-28].

2.3.2.4 Metal Chelating Activity

Ferrozine can quantitatively chelate with Fe^{2+} and form a red colored complex and estimated as per the prescribed method[29].

2.4 Analysis of Water-Soluble Vitamins

The chromatographic analysis was carried out using Agilent Technologies Model 1260, USA, equipped with an auto injector, photo diode array (PDA) detector and chem station software as per the instruction given by the manufacturer with minor modifications. The water-soluble vitamins separation was achieved using RP C-18 column (250 mm x 4.5 mm and 0.5 µm particle size) and the mobile phase used with gradient composition of 0.1 per cent triflouro acetic acid (TFA) in water and 0.1 per cent TFA in acetonitrite at different time interval at 1.0 ml/min flow at 268 nm. The extraction of the samples was done individually by weighing 10 gm of each sample and subjected for digestion with extraction solution made by the combination of acetonitrile and glacial acetic acid in dilution with double distilled water at 40^0C for 45 mins. After extraction, the samples were centrifuged at 5000 rpm for 15mins at room temperature with Beckman Coulter-Avanti J-26SXP centrifuge. The samples were finally filtered through 0.22 µm PTFE membrane filters. The filtered samples were injected (20 µl) to HPLC for separation.

2.5 Statistical Analysis

Results obtained were reported as standard error mean (±SEM) of triplicate measurements using SPSS[30] (version 17).

3. RESULTS AND DISCUSSION

3.1 Proximate Composition

The proximate estimates of carbohydrates, protein, fat, total moisture, ash, crude fibre and acid insoluble ash content wet weight basis except mushrooms were processed after drying at room temperature are reported in Table 1. The moisture content and protein content of finger millet is 10.94 per cent and 7.44 per cent, which was closely equal to the finger millets grown in Shimla with 12 per cent and 7.30 per cent respectively[31]. The ash content of the finger millet (6.05 ±0.006 g/100gm) from the Tawang region is slightly high as compared to Shimla variety[31]. The moisture content is less so as to help to the longer storage of foods. The carbohydrates of the finger millet is 61.16 per cent, it is good source carbohydrates[32]. The fibre content is low that is only 5.14 per cent and the fat content of the finger millet from Tawang region is comparatively high to about 9.2 per cent as compared to millet samples from other regions, which was 1 to 1.5 per cent only[34]. This could be due to the regional specificity. Also, numbers of factors can affect the nutritional content including agronomics, harvest time, storage and preparation technique, and cultivar type etc., The fat is a universally store form of energy in living organisms. They are major structural elements of biological membranes as phospholipids and sterols.

The Nori seaweed of Tawang region is reported to have high protein content (31.12 %) compared to other region, the ash and moisture content of the nori seaweed is 8.85 per cent and 6.71 per cent, respectively. The fat content of the seaweed is 9.98 per cent, which is high. Dhargalkar[33] reported that the protein content of the nori is comparatively high i.e. 28 per cent and the carbohydrates was 45 per cent whereas nori from Tawang region contained lower carbohydrate as compared to other regions.

The moisture and ash content of the pepper corn of Tawang region is 12.06 per cent and 4.28 per cent, respectively. The protein content of the pepper corn is 17.4 per cent. The fibre and fat content is 38.42 per cent and 12.98 per cent, respectively. Daily intake of fibre diet helps softening stool and lowering plasma cholesterol in the body and also plays significant physiological role in maintaining the intestinal distension for a natural peristaltic movement of intestinal tract[34]. Though the fibre content benefits in reducing the plasma cholesterol, the high fibre content may cause intestinal irritation and decrease the nutritional bioavailability[34].

The common bean of Tawang sample showed high amount of protein and fibre content i.e. 35 per cent and 30.98 per cent, respectively. The moisture and ash content of the bean is 6.75 per cent and 2.78 per cent.

Table 1. The proximate composition of foods on wet weight basis from Tawang area, Arunachal Pradesh, India

g/100g	Finger millet	Nori seaweed	Sichuan pepper corn	Common bean	Mushroom*
Carbohydrates	61.16±0.006	35.50±0.058	14.86±0.006	12.12±0.006	17.72±0.009
Protein	7.44±0.006	31.12±0.000	17.40±0.058	35.09±0.000	19.43±0.006
Fat	9.27±0.006	9.98±0.003	12.98±0.006	12.26±0.006	3.2±0.058
Total moisture	10.94±0.013	6.71±0.006	12.06±0.006	6.75±0.006	7.7±0.058
Ash content	6.05±0.006	8.85±0.009	4.28±0.006	2.78±0.001	4.18±0.006
Crude fibre	5.14±0.006	7.83±0.006	38.42±0.006	30.98±0.003	47.77±0.006

Standard error mean (SEM) ± indicated with three replicates of experiments

*Dry weight basis

Table 2. Calcium and iron contents of foods on wet weight basis from Tawang area, Arunachal Pradesh, India

mg/100g	Finger millet	Nori seaweed	Sichuan pepper corn	Common bean	Mushroom*
Calcium	225.0±0.577	132.0±0.577	18.43±0.006	68.0±0.577	19.61±0.006
Iron	33.13±0.006	125.0±0.577	408.0±0.577	543.0±0.577	652.0±0.577

Standard error mean (SEM) ± indicated with three replicates of experiments
*Dry weight basis.

Table 3. Water soluble vitamin contents of foods on wet weight basis from Tawang area, Arunachal Pradesh, India

mg/100g	Finger millet	Nori seaweed	Sichuan pepper corn	Common bean	Mushroom*
Vitamin B_1	-	0.84±0.009	57.0±0.577	Trace	Trace
Vitamin B_2	9.76 ±0.006	0.78±0.006	32.0±0.577	Trace	Trace
Vitamin B_3	34.0±0.577	0.28±0.006	62.0±0.577	Trace	Trace
Vitamin B_6	12.70±0.058	1.76±0.006	197.0±0.577	9.61±0.006	13.61±0.006
Vitamin B_9	34.5±0.058	0.55±0.006	30.0±0.577	39.64±0.006	70.17±0.006
Vitamin C	-	-	-	-	-

Standard error mean (SEM) ± indicated with three replicates of experiments
*Dry weight basis

Whereas the common bean belonged to Thailand contained 20 per cent protein, 56 per cent carbohydrates, and 11 per cent moisture content[35]. Therefore, the Tawang sample contained good amount of protein (35 %).

The mushroom from the Tawang region had higher amount of fibre and protein content i.e., 47.77 per cent and 19.43 per cent, respectively. The moisture and ash content of mushroom is 7.7 per cent and 4.18 per cent. The analysis of moisture was done further due to its nature of high water holding capacity. The fat content of the mushroom is low to 3.2 per cent. The other author reported from other variety of mushroom to have protein content between 15 per cent to 20 per cent[36].

3.2 Mineral Contents

The samples after converting to ash were analysed for calcium and iron content. The iron and calcium contents of the samples were estimated from standard curves.

Table 2 shows the details of the iron and calcium contents analysed among the five different plant food samples. The finger millet of Tawang region contained 33.13 mg of iron and 225 mg of calcium out of 100 g, respectively, which is not in agreement with the earlier reports[36]. They reported that the finger millet sample had 350 mg of calcium and 3.9 mg of iron. It is interesting to note that the finger millet of Tawang region contained high amount of iron.

The nori seaweed contained 125 mg of iron and 132 mg of calcium from Tawang region sample, which is close to the earlier report indicating that the calcium and iron content of seaweed is 140 mg and 13 mg per 100 g, respectively[37]. The Sichuan pepper corn contains 408 mg of iron and 18.43 mg of calcium, which are higher as compared to the pepper corn from other part of world (27.3 mg of calcium and 1.8 mg of iron)[38].

The common bean contained 543 mg of iron and 68 mg of calcium, which is low as compared to the report published[35], in which the common bean contained higher amount of calcium and lesser amount of iron (905 mg and 63 mg per 100 g). The mushroom contained 652 mg of iron and 19.61 mg of calcium, which are highest as compared to the previous report by Chye[36], et. al. (31.1 mg and 1.5 mg per 100 g respectively).

3.3 Water Soluble Vitamins

The results of the water-soluble vitamins were carried out by high pressure liquid chromatography (HPLC) for plants and a mushroom samples (i.e. finger millet, nori seaweed, Sichuan pepper corn, common bean and mushroom) are as presented in Table 3. Identification of the nutrients was carried out by comparing their retention time to those of standard. The vitamin content of finger millet from Tawang region is 9.76 mg, 34 mg, 12.70 mg, and 34.5 mg of vitamin B_2, vitamin B_3, vitamin B_6 and vitamin B_9 per 100g of sample. The Tawang sample had higher content of vitamin Bs and this disagreed with the author reported from finger millet from Southern India[32], which had only niacin (B_3) - 1.1 mg, thiamine (B_1) - 0.43 and riboflavin (B_2) are 0.19 mg.

The nori seaweed from Tawang sample had lesser amount of vitamin Bs as compared to the one reported by Kanazawa[39], *et al.*, who reported that nori contained vitamin B_1-12.9 mg, vitamin B_2 -38.2 mg, Vitamin B_3-11 mg, vitamin B_6-1mg and vitamin C-112 mg in 100 gm. Nori from Tawang had no traces of vitamin C as compared to the other variety described which had 112 mg of Vitamin C[39].

The Sichuan pepper corn from Tawang sample had

Table 4. The total polyphenols and total flavonoids contents of foods on wet weight basis from Tawang area, Arunachal Pradesh, India

	Finger millet	Nori seaweed	Sichuan pepper corn	Common bean	Mushroom*
Total polyphenols (µg (GAE)/mg)	8.71±0.010	0.21±0.001	1.34±0.004	0.36±0.001	0.17±0.001
Total flavonoids (µg (RU)/ml)	21.96±0.004	9.60±0.002	48.19±0.001	5.25±0.001	4.59±0.001

Standard error mean (SEM) ± indicated with three replicates of experiments,*Dry weight basis

Table 5. The antioxidant activities of foods on wet weight basis from Tawang area, Arunachal Pradesh, India

	Finger millet	Nori seaweed	Sichuan pepper corn	Common bean	Mushroom*
FRAP µg of FeSO4 equivalent /mg	72.0±0.577	28.0 ±0.577	42.0±0.577	35.0± 0.577	32.0±0.577
Reducing power assay of ascorbic acid equivalent/ mg of sample extract	220.0± 0.577	204.0± 0.577	242.0±0.577	194.0±0.577	244.0± 0.577
Metal chelating activity EDTA as stand IC_{50} value expressed as µg	83.53± 0.012	84.35± 0.019	83.38± 0.078	86.65±0.009	85.60±0.058
DPPH radical scavenging activity µg of ascorbic acid equivalent/mg of sample	34.21±0.006	23.19± 0.015	21.73±0.178	24.14±0.009	20.85± 0.009

Standard error mean (SEM) ± indicated with three replicates of experiments,*Dry weight basis

higher amount of vitamin Bs as compared to the other samples analysed, which contained Vitamin B_1 -57.0 mg, vitamin B_2 – 32.0 mg, vitamin B_3 -62.0 mg, vitamin B_6-197 mg, vitamin B_9-30.0 mg whereas the vitamin C was absent. This could be due to that the plants growing with organic fertilizers most often contain a higher amount of vitamin B as compared with plants grown with inorganic fertilizers and further organic manures of diverse sources or sewage sludges introduce additional vitamins into the soil which in turn leads to increased vitamins in the plants[40].

The common bean contains only Vit B_2 (riboflavin) and vitamin (folic acid) i.e. 9.61 mg and 39.64 mg. This disagreed with Romero Arenas[40 41] et. al. They reported that the number of vitamins in common bean to be riboflavin-0.17 mg and niacin -1.8 mg per 100 gm.

The mushroom also has only vitamin B_6 and vitamin B_9 i.e.13.61 mg and 70.17 mg. In Italian region mushroom contains vitamin B_1-0.15 mg, vitamin B_2-0.50 mg, vitamin B_3-3.80 mg, and vitamin B_6-1.50 mg per 100 gm of mushroom[5]. Compared to this, the Tawang region mushroom contains much amount of vitamin B_9. Vitamin C has not been detected from any of the above plant and fungal food samples. The reason for the non-availability could be due to the lesser amount in all the samples and might have lost due to the heat treatment while processing for HPLC due to the of heat sensitive nature of vitamin C. Further, the composition of vitamin C in fruits, vegetables, spices and others could be influenced by various factors such as genotypic differences, preharvest climatic conditions and cultural practices, maturity and harvesting methods, and postharvest handling procedures. The higher the intensity of light during the growing season, the greater is vitamin C content in plant tissues. Nitrogen fertilizers at high rates tend to decrease the vitamin C content in many fruits and vegetables. Temperature management after harvest is the most important factor to maintain vitamin C content of fruits and vegetables. However some chilling sensitive crops show more losses in vitamin C at lower temperature[42].

3.4 Quantification of total polyphenols and flavonoids

3.4.1 Total polyphenols

The Tawang samples were having less polyphenolic content compared to the samples from other region (Table 4). In those plant food samples, finger millet contain high amount of polyphenolic content (8.71 µg of gallic acid equivalent/ mg), which is less than as the reported value (36.96 mg of GAE/100g)[31]. The mushroom samples showed the least content of polyphenols with 0.17 µg of GAE/mg as compared to other studies which revealed 8.85 mg GAE/g[38]. One of the most important antioxidant components of plants are polyphenolic compounds, which are widely investigated in many medicinal plants, spices and vegetables[43-44] .

3.4.2 Total Flavonoids

The total flavonoid content of the samples from Tawang area such as finger millet (21.96 µg rutin equivalent/mg), Nori seaweed (9.60 µg of rutin equivalent/mg), Sichuan pepper corn (48 µg of rutin equivalent/mg), common bean (5.20 µg of rutin equivalent/mg) and the mushroom (4.50 µg of rutin equivalent in mg/g) are as provided in Table 4.

3.5 Determination of Antioxidant Activity

3.5.1 FRAP Assay

The value of the FRAP assay is being expressed as ascorbic acid equivalent antioxidant capacity (AEAC). The results of the study indicated that the finger millet of the Tawang region sample contained 72 µg of $FeSO_4$ equivalent/mg. The Nori seaweed contains 28 µg, of Sichuan pepper contains 42 µg, the common bean contains 35 µg and mushroom contains 32 µg of $FeSO_4$ equivalent/mg (Table 5, Fig. 1).

3.5.2 Reducing Power Assay

The reducing power assay has been used as one of the indicators of antioxidant capacity of certain spices or herbs used for medicinal purpose[45]. The mushroom sample exhibited a high reducing activity with total ascorbic acid equivalent content of 244 µg of ascorbic acid equivalent/ mg whereas the other samples of finger millet, Nori seaweed, Common bean and Sichuan pepper corn had the reducing power activities, 220 µg, 204 µg, 242 µg and 194 µg of ascorbic acid equivalent/ mg, respectively. Among all, the Sichuan pepper corns had lower reducing power activity (Table 5, Fig. 1).

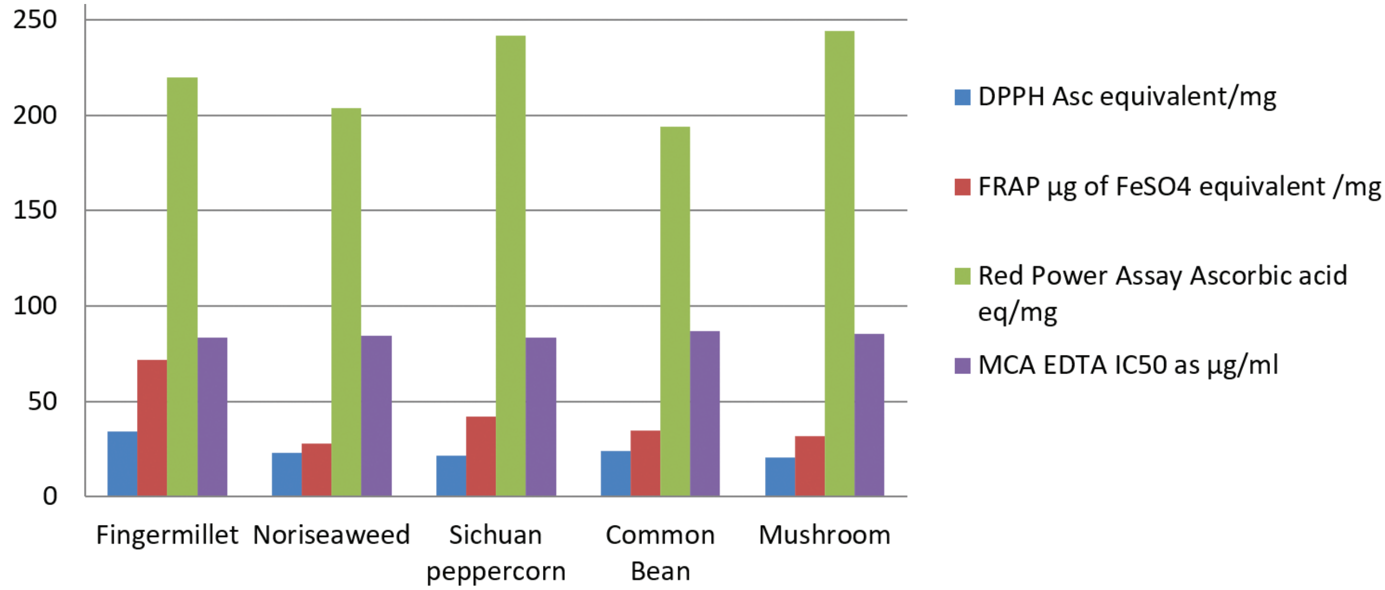

Figure 1. Showing various methods of antioxidant activities with aqueous extracts prepared from samples collected from Tawang, NE India.

3.5.3 Metal Chelating Activity

The results pertaining to metal chelating activity are presented in Table 5, Fig 1. EDTA was used as standard in this assay. The IC_{50} value of standard was found to be 82.33. The finger millet contained IC_{50} value of 83.53 followed by Nori seaweed, and Sichuan pepper corn. The common bean had IC_{50} value of 86.66 whereas the mushroom had IC_{50} value of 85.60. Among all, mushroom had low chelating capacity and pepper corn have better chelating capacity.

3.5.4 DPPH

The DPPH radical scavenging activity of plant food samples extracts are presented. Ascorbic acid was used as standard in this assay. The IC_{50} value of standard was 29.12 µg/ml of ascorbic acid equivalent/mg. The results of the study indicated that the finger millet of the Tawang sample had 34.21 µg/ml ascorbic acid equivalents per mg of sample followed by Nori seaweed, Sichuan pepper, common bean and mushroom (Table 5).

4. CONCLUSIONS

The samples collected from Tawang were totally different from each other and abundantly growing and used for routine consumption in that particular area. Many of them had good amount of B vitamins and antioxidant potential as compared to other samples analysed from different parts of the country and world. This data might be useful for the development of nutrient rich foods to be used for the NE region of India.

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CONFLICT OF INTEREST

The authors declare that this paper content has no conflict of interest.

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