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Nutritional and Anti-Oxidant Potential of Commonly Growing Plant Foods from Southern India

C. Rajendran[#,*], S. Kirtana[@], V. Rashmi[#], Pooja Yadav[#], and K.R. Anilakumar[#]

[#]*DRDO-Defence Food Research Laboratory, Mysuru - 570 011, India*
[@]*Food Science Division, University of Melbourne, Melbourne, Australia*
[*]*E-mail: chellairajendran1@gmail.com*

ABSTRACT

Certain varieties of plants are abundantly available with rich in nutrients, but the complete sets of nutritional composition studies have not been carried out. Among them, the matured leaves of *Murrya keonigii;* seeds and leaves of *Moringa oleifera*, and fruit pulp of *Aegle marmelos* were chosen. The proximate analysed for above samples showed that the moisture varies from 2.4% -8.2%, crude proteins from 18.75%- 34.57 %, fat content from 5.6% -19.6%, ash content from 3.87%-15.6% and carbohydrate from 28.65% - 41.23%, respectively. Estimation of mineral contents revealed that the leaves and seeds of moringa had higher concentrations than others. Determination of total antioxidant (total flavonoid) was higher (63.550 µg (RU)/ml of samples) in matured curry leaves than others. Determination of *in vitro* antioxidant activity with FRAP revealed highest activity in curry leaves (174.5µg) to a least activity with seeds of moringa (45.725 µg), whereas the DPPH revealed highest activity for fruit pulp of bael (1680.6µg ascorbic acid) to the least in leaves of moringa (263.15 µg ascorbic acid equivalent/mg). The ABTS showed IC_{50} value of 210.52 ±0.5774 for curry leaf, 487.8 ±0.3347 and 205.36 moringa seeds and leaves and 513.24 IC_{50} µg for pulp of bael fruit. Quantitative analysis of water soluble vitamins such as thiamine (B1) varied from 2.172 -5.558 mg; riboflavin (B2) from 2.201 -11.354 mg; pyridoxine (B6) from 4.608 -194.001 mg; biotin (B7) from 36.864 -153.027 mg, respectively. Further, the vitamin C (ascorbic acid) varied from 6.733 -23.142 mg /100g of oven dried samples, respectively. Therefore, the above foods are well intended to be included in routine diet regime and may also be willing to utilise for food supplementation with other suitable diets to manage the conditions such as malnutrition and nutrient deficiencies.

Keywords: Plant foods; *Murraya koenigii; Moringa oleifera*; *Aegle marmelos*; Nutritional assay; Macro and micro nutrients and anti-oxidant assay

1. INTRODUCTION

Plants offer healthful diet and at the same time, they have potentials for supplementing various macro and micro nutrients to the consumer. The following plants such as *Murraya koenigii, Moringa oleifera* and *Aegle marmelos* are abundantly growing without much efforts. *M. koenigii* (Curry leaf) is a member of the Rutaceae family and it is one of the most commonly used spices in India[1]. It is native to India, Sri Lanka, Bangladesh and the Andaman Islands[2] and found almost everywhere in the Indian subcontinent excluding the higher levels of Himalayas and also widely cultivated. Traditional system of medicine in eastern Asia mentions about its usage. Also, it is being used as stimulant, anti-dysenteric and for the management of diabetes mellitus[3] and the whole plant is considered to be a tonic and stomachic[4].

Moringa oleifera (drumstick) is a most nutritious and widely cultivated species of the genus Moringa, with a variety of potential uses[5]. However, it is a fast growing, drought resistant tree that is native to the Sub Himalayan tracts of India, Pakistan, Bangladesh and Afghanistan[6] and is the most vital sources for poor people[7]. All parts of *M. oleifera* are useful in the traditional medicine.

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Aegle marmelos, generally called as bael, golden apple, Japanese bitter orange, stone apple, or wood apple etc. All parts of this tree have medicinal values and have been used in the indigenous medicine. The ripe fruits are aromatic, astringent, and laxative and it has considerable medicinal value. The unripe fruit is used to treat stomachic, anti-scorbutic, digestive, chronic diarrheoa and dysentery and also the ripe fruit is regarded as best of all laxatives. Biochemical compounds of leaves, fruits and seeds of bael have been used in diseases like diabetes, cardiovascular and anti-inflammatory condition[8].

Therefore, the curry leaves, seeds and leaves of moringa and the unripe fruit of bael were collected from in and around Mysuru area for the present study to analyse their proximate, macro and micro minerals and vitamins, which have not been studied in this area.

2. MATERIALS AND METHODS

2.1 Collection of Samples

The fresh plant foods of *M. oleifera* (leaves and seeds), *M. koenigii* leaves, *A. marmelos* fruit were collected from in and around Mysuru District. The dried plant leaves and fruit pulp were pulverised to fine powder using a grinding machine, packed in a glass jar stored at 4 °C until use.

2.2 Sample Preparation and Extraction

The powdered plant foods were extracted using alcohol extraction method; One gram of powdered raw sample was dissolved in 10 ml of 70% alcohol and centrifuged at 3000 rpm for 20 minutes. The supernatant was collected and dried in water bath at 40 °C. The dried samples were again dissolved in the same alcohol solvent and collected in vials for the antioxidant studies.

2.3 Analysis of Proximate Composition

Moisture content was estimated by method developed by Pearson[9] & James[10]. Crude protein (N x 6.25) was quantified by protocol developed by Kjeldahl as described by Chang[11]. The recommended method of Association of Official Analytical Chemist[12] was used for the estimation of moisture analysis followed with ash content[13], crude lipid[14] and crude fibre[14]. The carbohydrates were calculated based on the individual composition difference as below.

Carbohydrate (%) =100-(% moisture+ ash + Fat + protein + crude fiber).

2.4 Estimation of mineral content

2.4.1 Estimation of Iron by Wong's Method

The presence of iron in the given sample was estimated by Wong's method[15]

2.4.2 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[16], which is made more specific in the presence of 8-quinolinol[17].

2.5 Quantification of Antioxidant

2.5.1 Quantification of Total Flavonoids

(i) Flavonoids

Total flavonoids were determined as per the method developed by Singleton and Rossi[18]. The concentration was measured using epicatechin as standard curve.

2.6 Determination of Antioxidant Activities

2.6.1 Ferric Reducing Antioxidant Power (FRAP) Assay

This test measures the ability of antioxidants to reduce ferric iron as per method used[19].

2.6.2 2,2'-diphenyl-1-picrylhydrazyl (DPPH) Radical Scavenging Assay

The scavenging activities of different extracts (the above samples) were analysed using DPPH radical scavenging assay[20].

2.6.3 ABTS (2, 22 -azinobis 3-ethylbenzthiazoline-sulphonic acid) Scavenging Activity

This test followed on the principle of increase in the absorbance of the reaction mixtures indicates the reducing power of the samples[21].

2.7 Analysis of Vitamins

High pressure liquid chromatography (HPLC) is one of the major methods of analysis of organic compounds. High partition efficiency is obtained by optimization of column parameters, particularly the particle size of the column packing.

2.8 Statistical analysis

Results obtained were reported as standard error mean (±SEM) of triplicate measurements using SPSS (version 17)[22].

3. RESULTS AND DISCUSSIONS

The plant foods such as leaves of *M. koenigii* (curry leaves), seeds and leaves of *M. oleifera* (Murangaka or moringa), pulp of *A. marmelos* were collected, dried under oven method, which were subjected to proximate for the appropriate quantification of proximate and macro, micro nutrients and antioxidant properties.

3.1 Determination of Proximate Contents

The result of the proximate analysis of different plant food samples are presented in Table 1. The total moisture content, crude fiber, ash content were 7.0, 6.2, 15.6%, carbohydrate is 41.23% and fat and protein content of oven dried curry leaves was found to be 8.3 and 18.75% respectively. Matured curry leaves had moderately good amount of carbohydrates. Similar findings were reported from Uttar Pradesh using the dehydrated[23] and sun dried curry leaves[24]. Zhang[25], *et al.* had reported regarding the proximate estimates were in partial agreement with our analysis except fat (5.1%), crude fiber (2.5%) and crude protein (11.8%) was comparatively lesser in freeze dried curry leaves. Udousoro and Ekanem (2013) had reported proximate value of leaves of *M. koenigii,* to have higher amount of moisture (80.75%), crude protein (25.38%) than the result of our study and lesser percentage of crude fiber (2.70%) and fat (1.85%), respectively [26]. Further, Uraku and Nwankwo (2015) had reported with lesser carbohydrate (1.29%), ash (3.60%), crude fiber (1.78%) and crude protein (3.60%)[27] and Igara[26], *et al.* reported to have lesser amount of protein (8.38%) in curry leaves.

In the case of moringa in our study, the moringa seeds to have protein content (35.67%) more or less similar when compared to the moringa leaves (32.13%) whereas the ash content in seed was 3.87% as compared to 6.8% in leaves. The fat content was found to be higher in moringa seeds (13.5%)

Table 1. The proximate analysis of commonly growing plant foods collected from Mysuru area, Southern India

Proximate	Curry leaf	Moringa seed	Moringa leaves	Wood apple
Total moisture	7.0±0.013	7.8±0.006	8.2±0.006	2.4±0.006
Crude fibre	6.2±0.006	9.2±0.006	5.32±0.006	7.0±0.003
Ash content	15.6±0.006	3.87±0.009	6.8±0.006	5.5±0.001
Carbohydrates	41.23±0.006	28.65±0.058	38.21±0.006	38.7±0.006
Fat	8.3±0.006	13.5±0.003	5.6±0.006	19.6±0.006
Protein	18.75±0.006	34.57±0.000	32.14±0.058	24.8±0.000
Acid insoluble ash	1.20	1.260	1.80	0.80

Values are the mean with triplicate and expressed as standard error mean (SEM)

than the leaves (5.6%) and the seeds had lower carbohydrate content (28.65%) as compared to the leaves (32.13%). The crude fiber too was higher (9.2%) as compared to the leaves (5.6%). This is almost in agreement with the research published by Ajantha[29], *et al.* from leaves for moringa and results reported from leaves of *M. oleifera* to have higher amount of crude fiber (22.90%) and fat (16.07%) and lesser amount of carbohydrate (7.4% only)[30], which were in partial agreement with our study. Similar results were found in moringa leaves[25] and very lesser amount of protein (5.7 g) from *M. oleifera* matured leaves[31]. But Aja[32], *et al.* reported higher amount of fiber (35.0%) and fat (20.0%) from the leaves of Moringa with very meagre amount of crude protein (1.40% only), which was totally opposite to our findings. The differences in the amount of carbohydrate might be due to the extraction method of other compositions.

Proximate analysis of wood apple fruit pulp showed to have protein content of 24.8%. The moisture content of the oven dried sample was found to be 2.4%, lower the moisture content helps to better shelf life of the sample. The fat content was found to be as high as 19.6%. The crude fibre and the carbohydrate content were determined to be 7% and 38.7% respectively. This was sharply in disagreement with the authors who had reported to have moisture as 61.6%, crude protein as 4.7%, crude fat as 0.5%, crude fiber 6.5 % and ash 2.7 from the pulp of bael[33,34].

3.2 Determination of Mineral Contents

Our study revealed that the matured curry leaves were found to have 18.16 mg per 100 gm of iron and 190.73mg per 100 gm of calcium (Table 2). This was not in agreement with the earlier authors who reported that fresh curry leaves revealed to have 0.93 mg of iron and 830 mg of calcium whereas the dehydrated samples showed 12 mg of iron and 2040 mg of calcium [27] and 0.90 mg of iron and 825 mg/100g of calcium in their unpublished paper[35]. Zhang[25], *et al.* had revealed similar findings that curry leaves showed i.e., 0.05 mg/g of iron and 20.89 mg/g of calcium on dry weight basis. Whereas Uraku and Nwankwo[27] had revealed that the curry leaves to have 9.44 mg/100g of iron and 3.77 mg / 100 g of calcium. Igara[28], *et al*. revealed only calcium of 19.75mg/100g from matured curry leaves, which was in agreement with our results.

Our study showed that the moringa leaves contained 22.5 mg/100 g of iron and 416 mg of calcium per 100 g of sample whereas the seeds of moringa contained 8.23 mg/100g of iron and 520 mg of calcium per 100 g of sample (Table 2). This was not in agreement with the author reported from leaves of moringa to have 28.5 mg of iron and 1.60 mg of calcium/100 g of leaves[29]. Also, authors have revealed that the seeds of moringa to have 2.18 ppm of iron and 67.01 ppm of calcium whereas the leaves had 4.11 ppm of iron and 141.42 ppm of calcium/100g dry weight[30]. The USDA data base revealed that a cup of seeds of moringa to have 4.00 mg of iron and 185mg of calcium. The authors from outside the country revealed that the mature leaves of moringa revealed 9.2 mg / 100 g of iron and 638 mg / 100 g of calcium[31] which was similar to our study. Similar results were obtained by Zhang[25], *et al.* from moringa leaves to have 0.073 mg/g of iron and 25.60 mg/g of calcium on dry weight basis. The analysis for calcium was 14.75 mg (1.475×10^2 mg/l) in seed sample whereas the concentration in the leaves were 11.51 mg / 100 g (1.151×10^2 mg/l)[32]. Okiki[36], *et al.* revealed 0.58 mg of iron and 82.50 mg/100g of calcium in leaves. A higher amount of calcium and iron was observed in *M. peregrina* morphotype i.e., 764.8 mg /100 g and 1164.8 mg /100 g, respectively[37].

Wood apple contains 19 mg of iron per 100 gms of sample and 41 mg of calcium per 100 gms of sample (Table 2). Our results are not in agreement with the results obtained that 1.824mg (18.24 ppm) of iron and 9.49 mg /100 g (94.9ppm) of calcium in fruit pulp powder of *A. marmelos*[38]. The iron and calcium content were moderate in wood apple, which was not in agreement with the authors reported from other part of India, where one author reported to have 0.55 mg / 100 g of iron and 78 mg / 100 g of calcium[34]. Some others reported to have 8.0 mg /100 g of iron[37] and some other reported 61.0 mg / kg of calcium in bael fruit[39].

3.3 Estimation of Total Flavonoids (Antioxidants)

Our study revealed that the total flavonoid content from matured curry leaves had 63.550 mg, leaves of moringa had 53.835mg, seeds of moringa had 2.424 mg and the pulp of wood apple had 0.6325 mg rutin equivalent per gram of sample (Table 3). This was not in agreement with the earlier authors who had reported lesser amount of flavonoids among different types of *M.koenigii* L[40]. Igara[28], *et al.* had revealed higher quantity (600.25 mg / 100 g) of total flavonoids in dried curry leaves. This was not in agreement with the following results based on various organic solvent based extract (curry leaves) to have 12.83 -16.6 mg CatE/g of sample[41] and also of various extracts (water =4.53± 0.01%; hydro-alcohol=19.92 ±0.05%; methanol=6.96±0.01%) of *M. koenigii*[42].

Sravanthi & Rao[43] had showed that the leaves of moringa had higher amount of flavonoids 232 mg/g dry wt. Likewise, the amount of total flavonoids among the aqueous and ethanol extract of dried leaves of *M.oleifera*, the ethanol based extract revealed the maximum amount of total flavonoids (6.20 g isoquercetin equivalents/100 g extract)[44]. Our result was in close agreement with this findings revealed that leaves of *M.oleifera* for total flavonoids of 61.618 mg/gm of dry

Table 2. Showing the mineral content of commonly growing plant foods collected from Mysuru area, Southern India

Minerals	Curry leaf	Moringa seed	Moringa leaves	Wood apple
Calcium	190.73±0.577	323.82±0.577	416.8±0.006	41.0±0.577
Iron	18.16±0.006	8.23±0.577	22.5±0.577	10.34±0.577

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

Table 3. Estimation of the antioxidant, total flavonoids (µg (RU)/ml) from commonly growing plant foods collected from Mysore area, Southern India

Flavonoids	Curry leaf	Moringa seed	Moringa leaves	Wood apple
Total flavonoids, µg (RU)/ml	63.550±0.004	2.424±0.002	53.835±0.001	0.6325±0.001

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

weight basis/sample [25] whereas the other authors revealed highest amount of total flavonoids in leaves of moringa i.e., 846.67mg/100g[36]. The other authors revealed that *M.oleifera* methanolic (7.3 -254.3) and ethanolic leaf (69.7 – 342.5) extract revealed significant amount of total flavonoids than the aqueous extract (27.0-87.2 mg QUER E/g)[45]. Sulaiman Mohammed and Fazilah Abd Manan (2015) revealed the total flavonoid content from the seeds of moringa was 2.900 ± 0.0002 (mg Quercetin equivalents /g dry matter)[46] which was very similar to our results.

In the case of bael fruit pulp, the earlier authors had revealed higher quantity of flavonoids i.e., 129.00±07.00 (aqueous) and 166.33±09.60 (alcoholic) mg/g, respectively[47] but few other authors also revealed similar results but were not quantified[38,39].

3.4 Determination of Antioxidant activity

3.4.1 Ferric Reducing Antioxidant Power assay

The results of the present study showed that curry leaf revealed 174.5 µg of $FeSO_4$ equivalent/mg (Table 4). The other authors had also reported varying results with curry leaf fractions. Some other authors had showed higher FRAP activity, the reducing power in the curry leaf extracts was in the range from 644.25 (Kelantan) and 563.42 µm of Fe (II)/g (Johor). The FRAP values for all stages of curry leaf extracts were significantly lower than set by the standard antioxidants such as BHT and vitamin C (715.1 and 1232.24 µmol Fe (II)/g, respectively)[48].

The moringa leaf contained to have 83.4 µg of $FeSO_4$ equivalent/mg and moringa seeds had 45.725 µg of $FeSO_4$ equivalent/mg (Table 4). Likewise, the aqueous and ethanol extract of dried leaves of *M.oleifera* also exhibited the highest FRP value (51.50 mmol FeSO4 equivalents/100g extract) [44]. The other authors showed FRAP value for the leaf of moringa was 510 mg/g dry wt of antioxidant content[43].

In our study, pulp of bael fruit was found to contain 49.275 µg of $FeSO_4$ equivalent/mg (Table 4). Comparable results were achieved for wood apple with FRAP assay showed to reduce Fe^{3+} to Fe^{2+} was 47.55±0.40 µM of TE/g of dry weight of sample[49].

3.4.2 DPPH Radical Scavenging Assay

Our study showed that the matured curry leaves revealed 228.18 µg ascorbic acid equivalent/mg of sample in DPPH scavenging activity (Table 4). The leaf extract of *M. koengii* revealed 1.60 and 0.63 mg DPPH/mg extract with known antioxidant, BHT with EC_{50} as 0.62 and 2.32 for anti-radical power [25].

Our study showed that the matured moringa seeds and leaves revealed 1470.5 and 263.15 µg of ascorbic acid equivalent/mg of sample (Table 4). But few authors reported a lesser scavenging activity with the leaves of moringa in DPPH assay, which showed 0.63 mg/g dry wt[43]. Further, anti-radical power of ethanolic leaf extracts of *M. oleifera* showed 0.84 and 1.19 mg DPPH/mg[25]. Likewise, the aqueous and ethanol extract of dried leaves of *M.oleifera* also exhibited high DPPH scavenging activity (EC_{50} 62.94 µg/mL) [44]. Similarly, result revealed that *M.oleifera* methanolic leaf extract showed significant radical scavenging activity. Also, a study provided that *M. oleifera* leaves possess antioxidant in that Trolox was used as standard with IC_{50} 5.89 µg/mL in DPPH assay. The methanolic extract of *M.oleifera* showed highest scavenging activity in DPPH assay[50].

Our study revealed that the bael fruit pulp showed 1680.6 µg ascorbic acid equivalent/mg of sample in DPPH scavenging activity (Table 4), which was very high as compared to the previously reported. Both aqueous and alcoholic extracts of *A.marmelos* fruit rind produced similar result to DPPH scavenging power (44.36±2.09% & 40.12±5.36% respectively) at 100µg/ml concentration with 92.648±30.68µg/ml of IC_{50} for aqueous extract & 106.15 ±25.33µg/ml of IC_{50} value for alcoholic extract and 63.99 ±25.24µg/ml for ascorbic acid[47]. The free radical scavenging activity determined by DPPH for wood apple was 78.99 µM of TE/g of dry weight of sample[49].

3.4.3 ABTS (2, 22 -azinobis 3-ethylbenzthiazoline-sulphonic acid) Scavenging effect

In our study, ABTS scavenging activity test, the IC_{50} value obtained for curry leaf extract was 210.52 ±0.5774 (Table 4). Other authors showed that the IC_{50} values showed differences (81.6, 118.4 and 21.4 µg/mL) among three type of *M. koenigii* L. Among the tested plant samples, methanolic extract of *M. koenigii* gamthi showed the most effective radical scavenging activity (IC_{50}=21.4 µg/mL) [40].

In our study, ABTS scavenging activity test, the IC_{50} value obtained for moringa seeds and leaves were 487.8 ±0.3347 and 205.36 (Table 4). Similarly, the leaf extracts of *M.oleifera* Lam. showed the highest ABTS activity (5.0 ±0.3 %) [43]. Also, another study revealed that *M. oleifera* leaves had antioxidant activity, which showed 3.06 µg/mL and the methanolic extract showed scavenging activity with IC_{50} value of 11.73 µg/mL in ABTS assay[50].

In our Study, ABTS scavenging activity test, the IC_{50} value obtained for pulp of bael fruit was 513.24 IC_{50} µg (Table 4). Similar results were obtained with ABTS radical scavenging activity by both aqueous and ethanolic extracts of *A.marmelos* fruit rind with 94.36% and 95.12% inhibition at 100 µg/ml concentrations[47]. Another authors observed that wood apple had 20.02 TE/g of dry weight of sample[49].

3.5 Determination of Water Soluble Vitamins

The quantification of water soluble vitamins was determined by high pressure liquid chromatography (HPLC)

Table 4. Showing antioxidant activity of commonly growing plant foods collected from Mysuru area, Southern India

Antioxidant activity	Curry leaf	Moringa seed	Moringa leaves	Wood apple
FRAP µg of FeSO4 equivalent /mg	174.5±0.577	45.725 ±0.577	83.4±0.577	49.275±0.577
DPPH scavenging activity µg of ascorbic acid equivalent/mg of sample	228.18±0.006	1470.5± 0.015	263.15±0.178	1680.6±0.009
ABTS Scavenging effect IC_{50} µg	210.52±0.577	487.8±0.334	205.36±0.379	513.24±0.573

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

Table 5. Showing the water soluble vitamin analysis of commonly growing plant foods collected from Mysuru area, Southern India

Vitamins	Curry leaf	Moringa seed	Moringa leaves	Wood apple
Vitamin B1 (mg/100g)	5.55±0.289	ND	8.83±0.295	2.17±0.057
Vit B2 (mg/100g)	11.35±0.197	ND	2.201±0.102	ND
Vit B3 (mg/100g)	4.60±0.157	194.001±0.080	27.96± 0.071	ND
Vit B6 (mg/100g)	154.72±0.272	153.02±0.325	147.43±0.256	36.86±0.167
Vit B9 (mg/100g)	120.084±0.125	ND	ND	ND
Vit C (mg/100g)	18.737±0.254	22.147±0.110	6.73±0.078	23.14±0.238

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

method and the results were presented in Table 5. Identification of the nutrients was carried out by comparing their retention time to the standard. The retention times observed for the standard vitamins were 8.705 min for thiamine, 16.189 min for riboflavin, 11.276 min for pyridoxine, 15.048 min for biotin, 4.531 min for folic acid and 6.471 min for vitamin C, respectively.

In our study, the curry leaves contained 5.558 mg of thiamine, 11.354 mg of riboflavin, 4.608 mg of pyridoxine, 154.729 mg of biotin, 120.084 mg of folic acid and 18.737 mg of vitamin C per 100 g of leaves. This was not in agreement with different studies conducted in different places and country[25,27,28,36].

In the case of moringa leaves, our study showed to have 8.835 mg of thiamine, 2.201 mg of riboflavin, 27.968 mg of pyridoxine, 147.435 mg of biotin and 6.733 mg of vit C per 100 grams of dried sample. One of the studies was in agreement with our result except the riboflavin, which was observed higher (20.5 mg/100 g) in moringa leaves[29]. A higher value of vit C was observed in the leaves of *M.oleifera* with 2.7 mg/g dry weight basis[25]. In the case of *M.peregrina,* comparatively a higher amount of vit C in leaves (83 mg / 100 g) and seeds (14 mg/100 g) were noticed[38]. Whereas the moringa seeds in our study revealed to have 194.001 mg of pyridoxine, 153.027 mg of biotin and 22.147 mg of vit C per 100 g of sample. The seed of *M.peregrina* showed 14 mg/100 g of vit C/100 g of sample[38].

Our study revealed that the fruit pulp of bael contained 2.172 mg of thiamine, 36.864 mg of pyridoxine and 36.864 mg of biotin and 23.142 mg of vit C per 100 grams of dried sample. A similar result was observed for vit C (22.5 mg / 100 g)[34] which was higher as compared to seed (2.80 mg) and pericarp (8.00 mg / 100 g). But at the same time, a higher amount of vit C (57.09 mg/100 g) was observed in fruit of bael[51] and 49.09%[39].

4. CONCLUSIONS

The samples collected from in and around Mysuru area, Southern India are being cultivated widely and used for routine consumption. These samples were analysed for their proximate estimate, antioxidant, mineral such as calcium and iron and water soluble vitamins present in them and of their antioxidant activity *in vitro.* The studied plants had moderate to higher amount of antioxidants and vitamin B and C. This data might be useful for the development of nutrient rich foods or food supplementation with other suitable diets for solving malnutrition and nutrient based deficiencies in both human and animals.

Conflict of Interest

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

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CONTRIBUTORS

Dr C. Rajendran obtained his MVSc (ANGRAU), PhD from Indian Veterinary Research Institute (IVRI), Bareilly, Uttar Pradesh in the field of Parasitology. He is currently working as Scientist E in Freeze Dried and Animal Product Technology Division, DRDO-Defence Food Research Laboratory (DFRL), Mysuru. He is involved in the development and evaluation of functional foods and nutraceuticals to support anti-sea sickness and *in vivo* toxicological analysis in experimental animals. Also, in the development of ready to cook (RTC) fish soup cube by freeze drying and compressed bar technology.
Contributed to the concept and design of experiments, analysis of data and writing of this manuscript.

Ms S. Kirtana, obtained her BTech in Chemical Engineering from the University of SRM, Kattankulathur, Chennai. Currently doing her MS in Food Science in University of Melbourne, Australia. She is working on various aspects of food chemistry.
Contributed to the performance of experiments.

Mrs V. Rashmi obtained her BSc, in Chemistry & PG diploma in Food analysis and quality Assurance, with specialization in food analysis and quality assurance, presently is working as Project Assistant in Food Quality Assurance Division (FQA), Defence Food Research Laboratory, Defence Research and Development Organisation, Mysore. She is involved in the analysis of food samples for proximate composition which includes major and micronutrient analysis, antioxidant activities etc., by using various analytical techniques.
Contributed to the analysis of data.

Ms. Pooja Yadav, obtained her BSc in Chemistry from Jiwaji University, Gwalior, presently is working in Biochemistry, Nutrition and Toxicology Division (BNT), Defence Food Research Laboratory, Defence Research and Development Organisation, Mysore. She is working on the development and evaluation of functional foods and nutraceutical to support anti-sea sickness and actively involved in the development of phytonutrient & micronutrient enriched Nutraceutical.
Contributed to the analysis of samples.

Dr K.R. Anilakumar, MSc, PhD in Food Science with specialisation in Nutritional Biochemistry, presently working as Sc 'F' and heading the Food Quality Assurance Division, and also part of Biochemistry, Nutrition and Toxicology Division, Defence Food Research Laboratory, Defence Research and Development Organisation, Mysore. He is involved in the development and evaluation of functional foods and nutraceuticals to support anti-sea sickness, hepatoprotective, neuro-protective, anti-ulcer, anti-fatigue, anti-anxiety and anti-depression properties in experimental animals.
Contributed to the concept and design of experiments, administrative processing for the manuscript.