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EVALUATION OF PROXIMATE PRINCIPLES OF DRIED LEAF POWDER OF *MORINGA OLEIFERA* LAM. FROM AJMER CITY, RAJASTHAN

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Moringa oleifera Lam.is a plant known for its nutrient content and medicinal values. The Miracle Plant, that is specially cultivated world over, has multifarious utility. The pharmaceutical and processed food industries are specially benefited by the usage of different elements of *Moringa oleifera* Lam, making significant impact in improving the nutraceutical, dietary and medicinal values of the supplements that are either derived or processed from leaves of the plant. When the composition of proximate principles of the dried *M. oleifera* Lam. leaves, obtained from four different areas of Ajmer, Rajasthan was compared, it gave a clear insight to the objective of the study initiated, showing that the leaves contained 7.51±0.82 gm of moisture (ranged from 6.37±0.01 to 8.22±0.01 gm) , 28.38±0.58 gm of protein (varied between 27.65±0.01 - 28.95±0.03) , 4.52±0.13 gm of fat (ranged from 4.36±0.00to 4.68±0.01gm) , crude fibre 9.54±0.25 gm (ranged from 9.26±0.02to 9.83±0.03 gm), 10.62±0.78 gm of ash (ranged from 9.87±0.00 to11.83±0.01gm), 48.77±1.29 gm of carbohydrate (ranged 46.89±0.78 to 49.84±0.13gm) and 351.39±4.65 kcal energy (ranged from 345.04±0.80 to 357.18±0.71 kcal)respectively. The study also threw a light to the fact which reveals that an appreciable amount of nutrients is existing in dried *M. oleifera* Lam leaves, supplementing for proteins and fibres, showcasing the nutritional importance of the natural product, enhancing the possibilities of betterment of health care system and general life style of each individual in the country, together with cost effectiveness, in particular. In an overview, it is evident in the analysis, that the therapeutic composition of the leaves of *M. oleifera* is an undeniably worth the efforts put in assessing the same.

Keywords: Nutraceuticals, Nutrients, *Moringa oleifera***,** Proximate principle, Therapeutic

Introduction

Right from the prehistoric era usage of plants have majorly featured in every aspect of the life advancement. The multipurpose utilization of plants and its various parts has grown a new dimension to the functional and behavioural pattern of the life styles.

Through the advancement of science and technology, different research orientation and scientific breakthrough, the magnitude of *Moringa Oleifera,* thewonder and miracle plant has come to the fore. Hailing from the family Moringace, the miracle plant is the best known specie of Genus Moringa having total thirteen different species. After its initiation from the sub-Himalayan tracts, that included Asia Minor, India, Pakistan, Africa and Arabia[1] the plant paced up its distribution in Philippines, Cambodia, North Central and South America and Caribbean Island[2]. The wide spread popularity of the tree due to its ample usefulness, has made its implantation possible in different parts of the world, and is known as Drumstick, Horse radish in quite a few places where as around the Neil valley, the plant is almost worshiped and known as Shagara-Al-Rauwaq that literally means a tree for purifying. The famed *M. oleifera* is also called Kelor and Sajana or Saijhina in many parts of India. [3,4]

Being considered to be one of the most useful trees of the world, the plant has invaded the medical and industrial organization with aplomb.[5] The leaves, flowers and fresh pods are appreciated for their edible quality of the highest order, and it happens to be the best known livestock feed[6]. The leaves of *M. oleifera,* rates very highwith it utility quotient, and is made into a nutrient dense powder after immaculate processing through the drying and grinding actions. The potentiality of the leaves is not restricted to the edible gratification but it also enjoys the admiration of scientists, technologists and pundits, who have truly valued and proven the nutritive completeness of the plant that is so apparent in nutritive maximization, enhancement in food security and both urban and rural development in particular.

No wonder, the remarkable nutritional elements of the plant has opened new vistas to therapeutic explorations, as being a natural organic health supplement, than the other similar varieties.[7] It has been observed that the plant contains higher content of vitamin A than carrots, more vitamin C than oranges, greater calcium than milk, better potassium than bananas, higher iron then spinach and considerably greater protein percentage than milk and eggs put together[4]. The rich deposition of antioxidants and bioactive components in the *M. oleifera,* mainly the Flavonids, phenolic acids, glucosinolates together with isothiocanates, tannins and saponins, has raised the bar of the scientist, researchers and industrial specialists alike.[8] It restricts the spreading of multifarious illness through its health promoting potentials that maintains balanced diet, together with the prevention of free radical damage.

Thus to conclude the *M. oleifera* is a boon for humanity, through its enormous potential, that became conclusive in the study conducted at the ecological environment of Ajmer city, ascertaining the nutritive abundance of the plant leaves. Although the information about the proximate principles of dried *M.oleifera* leaves is available in the literature but no research is done on the *M.oleifera* indigenous to Ajmer city, Rajasthan. The objectives of the present research was to assess and compare the proximate principles of the dry leaf powder of *M.oleifera* from four different areas of Ajmer city and also to compare proximate principles of fresh and dry leaf powder of *M.oleifera* and to compare the proximate principles of dry *M.oleifera* leaves powder with the Recommended dietary allowances.

Methodology-

Sample collection, Preparation and Initiation of the study- The leaves were collected from East, West, North and South parts of Ajmer city, during months of April – June , and were meticulously sorted, thoroughly rinsed with clean water and dried in shade for 2-4 days on muslin cloth.After leaves being dried under aseptic conditions, the leaves were finely grind, sieved and kept in dry airtightcontainer.

Proximate Principle Analysis-The proximate analysis is a standard method which determine the values of macro nutrients in a food sample and also gives the idea of it's both quantitative and qualitative nutrient composition. The proximate components are moisture content, ash content, crude protein, crude fat, crude fibre, carbohydrate and caloric value. Determination for moisture, crude fibre and ash was carried out in accordance with Manual of Methods of Analysis of Foods "Cereal and Cereal Products" 2016[9] and rest of the nutrients i.e. crude protein (IS: 7219) [10] , fat (IS:4684)[11], carbohydrate (IS: 1656)[12] and energy (IS: 14433)[13] are analysed by the methods given by Bureau of Indian Standard.

All the nutrients were analysed in triplicate and the data obtained was statistically analysed using ANOVA.

Moisture content:5 g of the powder was placed in an already dried and weighed aluminum dish. The sample was dried in hot air oven for 2 hours at 105°C and then cooled in a desiccator. Then it was weighed to determine the dry weight and the percentage of moisture content.

Fat: The fat content was determined by directly extracting the sample with petroleum ether in Soxhlet extractor (Automatic SOCS Plus Solvent Extraction System). The residue in bottom of crucible after solvent removal represented the fat content of the sample.

Crude protein: The crude protein content of the samples was estimated by Micro-Kjeldahl method, in which 0.2gm of sample was digested with 10 ml of concentrated Sulphuric acid at the temperature of 420°C for approximately 100 minutes. The digested material was distilled after the addition of 40% NaOH. The digested sample was heated by passing steam and ammonia liberated due to addition of 40% NaOH was dissolved in boric acid. The boric acid consisting of ammonia is titrated against 0.1 N HCl. The percentages of nitrogen were converted to protein by multiplying it by 6.25.

Crude fibre: 2.5 grams of sample was taken in 250 ml conical flask and 200 ml of 1.25% Sulfuric acid solution was added. The sample was boiled for about 30 minutes, filtered and washed until traces of acid could not be detected using pH paper. The extract was transferred into 250 ml conical flask and 1.25% NaOH solution was added subsequently. The sample was boiled again for 30 minutes, and then the insoluble matter was transferred to a sintered crucible by means of boiling distilled water till it was acid free and was washed twice with Ethyl alcohol. The whole material was transferred into crucible and dried at 105°C until constant weight was achieved. After that the crucible was placed into muffle furnace at 550°C for 12 h and then removed for cooling in a desiccator, reweighed and the percentage of the crude fibre in the sample was calculated.

Ash: The preparation for ash analysis was the same as that for moisture content. 2 grams of sample was put into a crucible, the

weight was recorded and put it in muffle furnace at 550°C approx. until the ash has been obtained. It was cooled in a desiccator and weighed.

Total Carbohydrate:

Total carbohydrate (gm/100 gm) was determined by Difference method, after determining the percentage of moisture, total protein, fat and total ash, it was subtracted from 100.

Energy

The IS: 14433 method was used to calculate the calorie content of the sample , the total kcal contentofthe food was based upon the values of 4 kcal/gm of carbohydrates, 4 kcal/gm ofproteinsand 9 kcal/gm offat. [13]

Results and Discussion:

The results of the present study revealed the of mean values of proximate principles of dried leaf powder of *M. oleifera* Lam. (DLPMOL) from four different samples (Table 1) . Comparison of result revealed that the mean moisture content was7.51±0.82 gm with the range of 6.31±0.01 to 8.22±0.01 gm. The highest (8.22±0.01 gm) moisture content was found in Sample 3 and lowest (6.31±0.01 gm) in Sample 1. When the moisture content of all four samples was compared the difference in result was statistically significant (p 0.05).

The protein content was generally high (28.38±0.58 gm) and varied between 27.65±0.01 to 28.95±0.03 gm. The highest content was in Sample 1 (28.95±0.03 gm) followed by sample 2 (28.74±0.02 gm), sample 4 (28.20± 0.15 gm) and sample 3 (27.65±0.01 gm) respectively. The difference in protein content of the four samples was statistically significant (p 0.05).

he fat content of the four samples of DLPMOL was in range of 4.36±0.00 gm to 4.68±0.01 gm with the mean value of 4.52±0.13 gm. The fat content was again highest in sample 1 (4.68±0.01 gm) and lowest in sample 3 (4.36±0.00 gm). There was statistically significant difference in the fat content of the four samples of the DLPMOL (p 0.05).

The fibre content of the four samples was 9.54±0.25 gm in the range of 9.26±0.02 to 9.83±0.03 gm. Maximum fibre content was obtained in sample 2 (9.83±0.03 gm) and minimum in the sample 4 (9.26±0.02 gm). The difference in the fibre content of four samples was statistically significant at p 0.05.

The ash content in the four samples was in the range of 9.87±0.00 to 11.83±0.01 gm with the average value of 10.62±0.78 gm. The highest ash content was found in sample 1 (11.83±0.01 gm) followed by sample 3 (10.65±0.00 gm) sample 2 (10.16±0.01 gm) and sample 4 (9.87±0.00 gm). The ash content of the four samples was statistically significant (p 0.05).

The calculated mean value of carbohydrate of the four samples was 48.77 ±1.29 gm, in the range of 46.89±0.78 gm to 49.84±0.13 gm. Maximum carbohydrate was found in the sample 4 (49.84±0.13 gm) and lowest in the sample 1 (46.89±0.78 gm) and the difference in the carbohydrate of four samples was also significant (p 0.05).

The energy value calculated for the four samples was in the range of 345.04±0.08 to 357.18±0.71 kcal with the mean value of 351.39±4.65 kcal. The maximum energy content was in the sample 1 (357.18±0.71 kcal) and lowest in the sample 3 (345.04±0.08 kcal). The difference in the energy content was significant (p 0.05).

When compared (Table 2 and Figure 1) with the proximate nutritive values of fresh drumstick leaves as per Indian Food Composition Table 2017[14] (Moisture

75.65±1.49, Protein 6.41± 0.35g, Fat 1.64± 0.12g, Fibre 8.21± 0.19g, Ash 2.46± 0.18g, Carbohydrate 5.62± 1.44g and Energy 67.46 kcal) it is clear that after dehydration, leaves sample became a concentrated source of all nutrients. The moisture content was reduced from 75.65±1.49 to7.51±0.82 gm i.e. 90.07 per cent less from the fresh leaves. The moisture content in DLPMOL is in the range mentioned by FSS Regulations 2011[15]. The low moisture content is good for long storage life. The protein content is increased considerably in DLPMOL it is 342.74 per cent higher than the fresh leaves, because of high protein content dry leaves of *M.oleifera* can be used as protein supplements. Though the fat content was also increased (from1.64±0.12g to 4.52±0.13 gm) after drying but it was observed in further researches done on fatty acid profile of dried *M.oleifera* leaves that Moringa leaves contains more dietary polyunsaturated fatty acid than saturated fatty acid[16,17]. A higher PUFA and lower amount of SFA is recommended in diet as it is beneficial in prevention of diseases hence good for health. The crude fibre content of dried leaf powder (9.54±0.25 gm) is 16.19 per cent higher than the fresh leaves (8.21±0.19 gm), so these leaves are good source of dietary fibre and can help in maintain glucose and cholesterol levels. The ash content in dried leaf powder is increased from 2.46±0.18gm to10.62±0.78 i.e. 331.70 per cent higher than the ash content of the fresh leaves. The high ash content is an indication of higher mineral content of the food item. The calculated carbohydrate content of dried Moringa leaf powder (48.77±1.29gm) is 767 per cent more than the fresh leaves (5.62±1.44gm). Carbohydrates are the main source of energy to carry out daily routine activities and to spare protein. The caloric content of dreid *M.oleifera* leaf powder is 420.30 per cent more than the fresh leaves. The dried *M.oleifera* leaf powder can contribute in the energy requirements of the body with its great caloric value.

The comparison of mean proximate principles of dried leaf powder of *M. oleifera* with the Recommended Dietary Allowances (RDA) ICMR 2010 is shown in Table 3. It is observed from the comparison that 100 gm of dried leaf powder of *M. oleifera* provides 47.3 per cent of RDA for protein, 18.08 per cent of RDA for fat, 20.56 per cent of RDA of fibre 3.23 per cent of RDA for carbohydrate and 15.14 per cent of RDA for energy. And 1 gm of dried leaf powder of *M.oleifera* can provide 0.47 per cent, 0.18 per cent, 0.2 per cent, 0.03 per cent and 0.15 per cent of RDA for protein, fat, fibre, carbohydrate and energy respectively.

These results obtained in this study are in agreement with the values reported in the studies done on byMayo *et. al.* 2011 and Joshi *et. al.* 2010 [17,18] but with little variation. These slight differences in proximate composition were because of wide range of reasons, such as cultivated regions, growing conditions, nature of soil, seasonal changes, genetically different cultivars, age of tree, maturity of leaves, storage conditions and due to the period of analysis[19, 20].

The data derived from the study showed that the whole dried leave powder of *M.oleifera* Lam contain good amount of all macro nutrients with noteworthy content of crude protein (28.38±0.58 gm) and crude fibre (9.54±0.25 gm). This indicates that, the dried leave powder of *M.oleifera* Lam can be used in daily diet to improve nutrition and health of the individual.

Conclusion

The study conclude that dried *M. oleifera* leaves powders are excellent source of

nutrients and has potential to be used in various food products as supplement and for food fortification to improve their nutritive value. Proximate composition of *M. oleifera*leaves significantly varies with the source of sample. Drying the leaves assist to concentrate the nutrients, facilitate conservation and consumption so that it can be used during the time when it's not available or can be transported to the areas where it is not cultivated.

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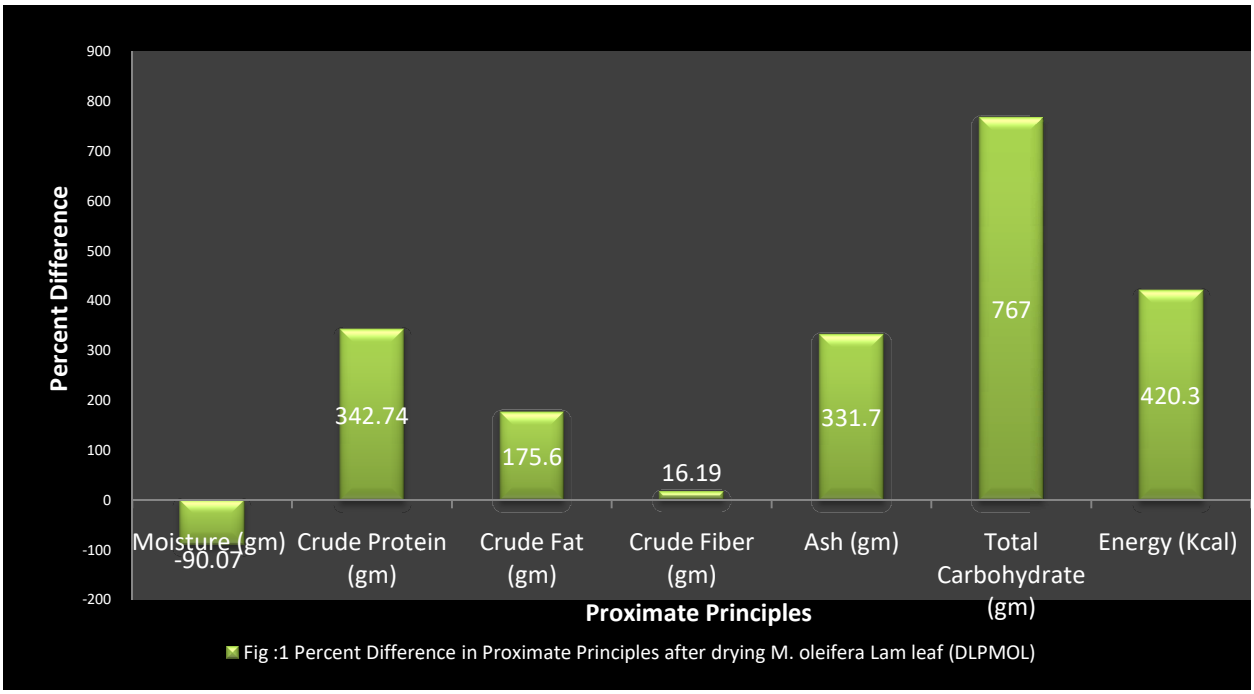
Parameters (values per 100gm)	**DLPMOL Sample 1**	**DLPMOL Sample 2**	**DLPMOL Sample 3**	**DLPMOL Sample 4**	**Range**	**Mean ± SD**	**SE**
Crude Protein (gm)	28.95±0.03	28.74±0.02	27.65±0.01	28.20±0.15	27.65±0.01-28.95±0.03	28.38±0.58*	.03569
Crude Fat (gm)	4.68±0.01	4.58±0.01	4.36±0.005	4.47±0.005	4.36±0.00-4.68±0.01	4.52±0.13*	.15270
Crude Fibre (gm)	9.41±0.01	9.83±0.03	9.68±0.02	9.26±0.02	9.26±0.02-9.83±0.03	9.54±0.25*	.06735
Ash (gm)	11.83±0.01	10.16±0.01	10.65±0.00	9.87±0.00	9.87±0.00-11.83±0.01	10.62±0.78*	.22548
Total Carbohydrate (gm)	46.89±0.78	49.08±0.63	49.26±0.10	49.84±0.13	46.89±0.78-49.84±0.13	48.77±1.29*	.34862
Energy (Kcal)	357.18±0.71	352.30±0.07	345.04±0.80	349.96±0.79	345.04±0.80-357.18±0.71	351.39±4.65*	1.22743

*The mean difference is ssignificant at 0.05 level

Table : 1 Comparison of mean values of Proximate Principles of dried leaf powder of *M. oleifera* Lam (DLPMOL)

Parameters (values per 100gm)	**Mean Proximate Principles values obtained in dried leaf of *M. oleifera*in present study (Mean ± SD)**	**Proximate Principles values in fresh leaf of *M. oleifera* as per IFCT 2017 (Mean ± SD)**	**Difference in Mean Values (Dried-Fresh)**	**Per cent difference in Proximate Principle after drying of *M. oleifera* leaf**
Moisture (gm)	7.51±0.82	75.65± 1.49	-68.14	-90.07
Crude Protein (gm)	28.38±0.58	6.41± 0.35	+21.97	+342.74
Crude Fat (gm)	4.52±0.13	1.64± 0.12	+2.88	+175.60
Crude Fibre (gm)	9.54±0.25	8.21± 0.19	+1.33	+16.19
Ash (gm)	10.62±0.78	2.46± 0.18	+8.16	+331.70
Total Carbohydrate (gm)	48.77±1.29	5.62± 1.44	+43.15	+767
Energy (Kcal)	351.39±4.65	67.46	+283.54	+420.30

Table: 2 Comparison of Proximate Principles in fresh and dried leaf of *M. oleifera* Lam (DLPMOL)



Nutrients	**Recommended Dietary Allowances (ICMR 2010)**	**Proximate Principles values obtained in DLPMOL (Mean ± SD) (values per 100gm)**	**Percent of RDA provided by 100 gm DLPMOL**	**Percent of RDA provided by 1gm DLPMOL**
Crude Protein (gm)	60	28.38±0.58	47.3	0.47
Crude Fat (gm)	25	4.52±0.13	18.08	0.18
Crude Fibre (gm)*	46.4	9.54±0.25	20.56	0.2
Total Carbohydrate (gm)	1508	48.77±1.29	3.23	0.03
Energy (Kcal)	2320	351.39±4.65	15.14	0.15

Table: 3 Proximate Nutrients provided by 100 gm dried leaf of *M. oleifera*in comparison with RDA(ICMR 2010)