



TITOLO RELAZIONE:

Moringa oleifera: aspetti nutrizionali



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MILANO | 11-12 MAGGIO | 2017

All plant parts of *Moringa oleifera* are traditionally used for different purposes

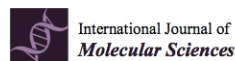
Int. J. Mol. Sci. **2015**, *16*, 12791–12835; doi:10.3390/ijms160612791

OPEN ACCESS
International Journal of
Molecular Sciences
ISSN 1422-0067
www.mdpi.com/journal/ijms

Review

Cultivation, Genetic, Ethnopharmacology, Phytochemistry and Pharmacology of *Moringa oleifera* Leaves: An Overview

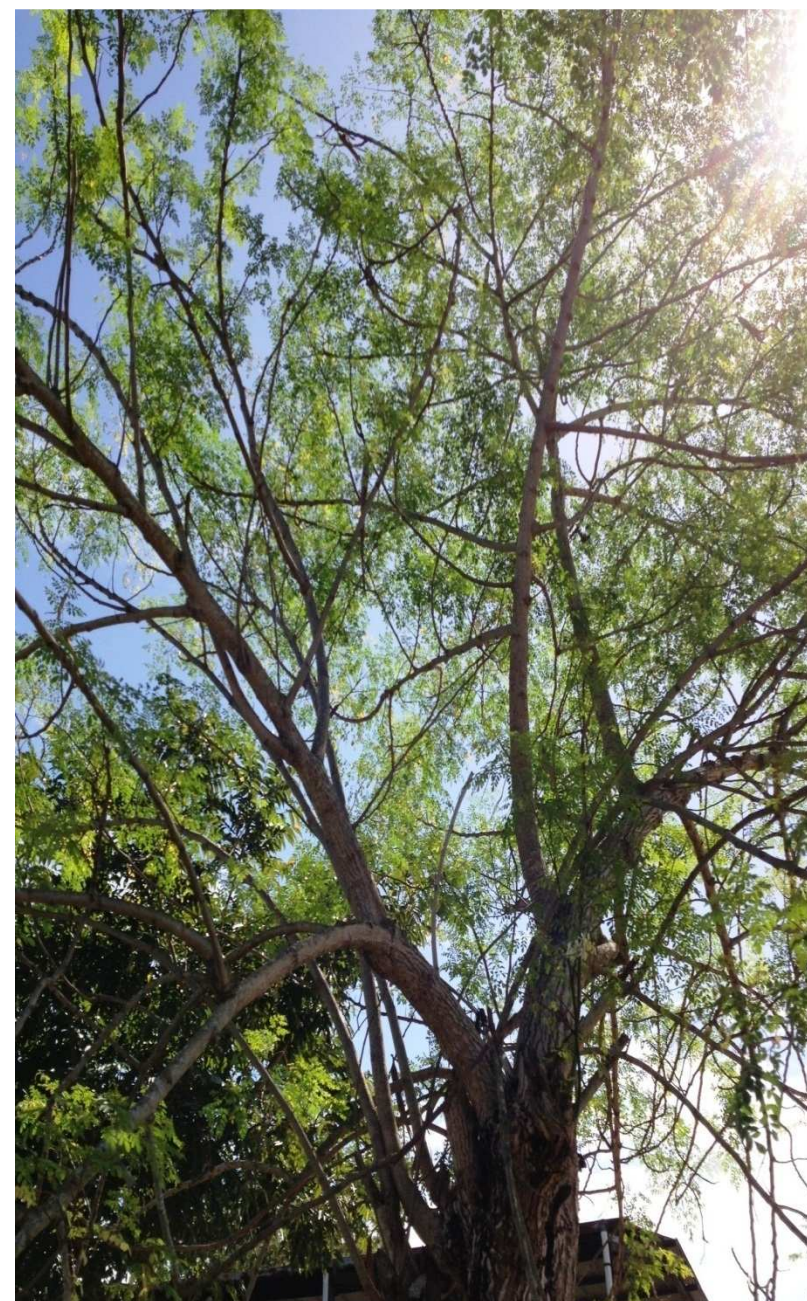
Alessandro Leone ^{1,2,*}, Alberto Spada ³, Alberto Battezzati ^{1,2}, Alberto Schiraldi ², Junior Aristil ³ and Simona Bertoli ^{1,2}



Review

Moringa oleifera Seeds and Oil: Characteristics and Uses for Human Health

Alessandro Leone ^{1,2,*}, Alberto Spada ³, Alberto Battezzati ^{1,2}, Alberto Schiraldi ², Junior Aristil ³ and Simona Bertoli ^{1,2}



Moringa Oleifera

Leaves are generally the most used

In particular, they are used in:

- ✓ Human nutrition
- ✓ Traditional medicine

are rich in

- ✓ Protein
- ✓ Mineral
- ✓ Vitamins
- ✓ Antioxidant compounds

These nutrients are often lacking among the populations of underdeveloped or developing countries.



Moringa Oleifera

Malnutrition



Moringa



Moringa leaves have been proposed *to add to food preparations as integrators of the diet.*

Moringa Oleifera Leaves from different countries

Yogoua



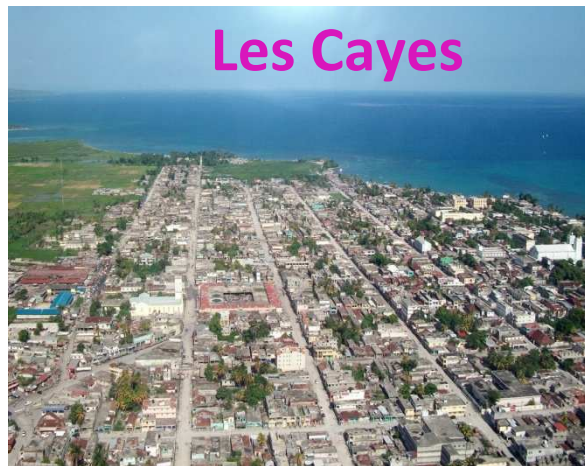
Country: Cameroon

Department: Mayo-Danay

Altitude: 356 m s.l.m.

Population: 67,400

Climate: pre-Saharan, with heavy rains between May and October and dry during the rest of the year, with temperatures up to 43 °C



Les Cayes

Country: Algeria

Province: Tindouf, (Hammada)

Altitude: 400-500 m s.l.m.

Population: 300,000

Climate: in the summer temp max 50 °C with sandstorms and temp min -5 °C overnight



Refugee camps Saharawi



Country: Haiti

Department: South

Altitude: 0 m s.l.m.

Population: 137,952

Climate: tropical, average temperatures range between 28-30 °C warm months and 23 °C cold months



Chirundu, Zambia

Moringa Leaves

Table 1: Nutritional characterization of *Moringa oleifera* dried leaves from Chad, Sahrawi refugee camps (Southwestern Algeria) and Haiti.

		CHAD		SAHRAWI CAMPS ^a		HAITI	
		Mean	Sd	Mean	sd	Mean	sd
Proximate analysis							
Moisture	g/100g	7.3	0.5	6.0	0.2	8.8	0.1
Proteins	g/100g	29.2	0.3	26.3	0.1	19.0	0.0
Lipids	g/100g	6.2	0.2	4.5	0.2	6.4	0.1
Total fibre	g/100g	30.8	0.8	29.9	0.4	34.3	1.7
Insoluble fibre	g/100g	22.2	0.6	26.2	0.3	27.4	1.3
Soluble fibre	g/100g	8.6	0.2	3.7	0.1	6.9	0.4
Glucose	g/100g	2.2	0.2	1.9	0.2	4.2	0.1
Fructose	g/100g	0.4	0.1	0.5	0.0	4.4	0.3
Sucrose	g/100g	2.3	0.1	7.5	0.0	1.6	0.1
Ashes	g/100g	10.0	0.1	12.6	0.0	8.8	0.0
Sodium	mg/100g	285.3	0.3	743.3	2.8	239.4	4.7
Calcium	mg/100g	1705.5	21.8	2542.5	66.6	1960.6	49.1
Iron	mg/100g	15.8	0.6	38.3	1.7	10.9	0.7
Zinc	mg/100g	2.3	0.0	2.9	0.0	2.0	0.1
Magnesium	mg/100g	521.6	5.4	460.2	7.4	486.5	21.1

ZAMBIA

30.9	0.5
6.3	0.0
31.3	0.6
27.3	0.6
4.0	0.3
6.0	0.2
4.1	0.0
8.2	0.0
1468.1	8.0
24.5	0.8

[Nutritional Characterization and Phenolic Profiling of *Moringa oleifera* Leaves Grown in Chad, Sahrawi Refugee Camps, and Haiti.](#)

Leone A, Fiorillo G, Criscuoli F, Ravasenghi S, Santagostini L, Fico G, Spadafranca A, Battezzati A, Schiraldi A, Pozzi F, di Lello S, Filippini S, Bertoli S.

Int J Mol Sci. 2015 Aug 12;16(8):18923-37. doi: 10.3390/ijms160818923.



Moringa Leaves

Vitamins content in *Moringa oleifera* leaves



Bioactive compound	Form	Value found in literature	Value express as dry weight	Drying method	Extractive method	Analytical method	Country	Ref
Vitamins								
Vitamin A	fresh	11300 IU	45200 IU		N/A	N/A	India	14
	fresh	23000 IU	92000 IU ^a		N/A	N/A	Brazil	46
Vitamin B1 – Thiamine	fresh	0.06 mg/100g	0.24 mg/100g		N/A	N/A	India	14
	fresh	0.21 mg/100g	0.84 mg/100g		N/A	N/A	N/A	49
	fresh	0.6 mg/100g	2.58 mg/100g		N/A	Microbiological method	India	61
	dried	2.64 mg/100g	2.85 mg/100g	N/A	N/A	N/A	N/A	49
Vitamin B2 – Riboflavin	fresh	0.05 mg/100g	0.20 mg/100g		N/A	N/A	India	14
	fresh	0.05 mg/100g	0.20 mg/100g		N/A	N/A	N/A	49
	fresh	0.17 mg/100g	0.726 mg/100g		N/A	Microbiological method	India	61
	dried	20.5 mg/100g	22.16 mg/100g	N/A	N/A	N/A	N/A	49
Vitamin B3 – Niacin	fresh	0.8 mg/100g	3.20 mg/100g		N/A	N/A	India	14
	fresh	0.8 mg/100g	3.20 mg/100g		N/A	N/A	N/A	49
	fresh	0.82 mg/100	3.5 mg/100g		N/A	Microbiological method	India	61
	dried	8.2 mg/100g	8.86 mg/100g	N/A	N/A	N/A	N/A	49
Vitamin C - Ascorbic acid	fresh	220 mg/100g	880 mg/100g		N/A	N/A	India	14
	dried	17.3 mg/100g	18.7 mg/100g	N/A	N/A	N/A	N/A	49
	dried	92 mg/100g 140 mg/100g 56 mg/100g	92 mg/100g 140 mg/100g 56 mg/100g	Sun-drying for 4 days Shadow-drying for 6 days Oven-drying at 60°C for 1 h	N/A	AOAC 2004	India	52
	dried	38.8 mg/100g ^b	38.8 mg/100g ^b	Air-drying	Metaphosphoric acid	Indophenol titration	Pakistan	56
	Freeze-dried	271 mg/100g	271 mg/100g	Freeze-drying	Deionized water	Colorimetric method	Florida, USA	54
	Freeze-dried	920 mg/100g 840 mg/100g 680 mg/100g	920 mg/100g 840 mg/100g 680 mg/100g	Freeze-drying	6% metaphosphoric acid	Titration against 2,6-dichlorophenolindophenol	Nicaragua India Niger	57
	fresh	9.0 mg/100g	16.21 mg/100g		N-hexane + ethyl acetate + BHT	Reverse-phase HPLC	Malaysia	58
Vitamin E – Tocopherol	dried	113 mg/100g	122.16 mg/100g	N/A	N/A	N/A	N/A	49
	dried	74.45 mg/100g	74.45 mg/100g	Drying at 60°C for 8 h	Microscale saponification and extraction with n-hexane	HPLC	Mexico	60
	dried	77.0 mg/100g	85.08 mg/100g	Air-dried under shade	N/A	HPLC Fluorescence	South Africa	51

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Moringa Leaves

Polyphenols content in *Moringa oleifera* leaves



Bioactive compound	Leaves	Value found in literature	Value express as dry weight	Drying method	Extractive method	Analytical method	Country	Ref	
Polyphenols									
	dried	2609.0 mg GAE/100g 3337.2 mg GAE/100g 2320.8 mg GAE/100g	2814.5 mg GAE/100g 3550.2 mg GAE/100g 2544.7 mg GAE/100g	Sun-drying	80% MeOH	Folin-Ciocalteau	Chad Sahrawi Haiti	53 *	
	dried	4581 mg GAE/100g ^a 3602 mg GAE/100g ^b	4581 mg GAE/100g ^a 3602 mg GAE/100g ^b	Shade-drying	Water Soxhlet extraction for 18-20 h	Folin-Ciocalteau	India	62	
	dried	3290 mg GAE/100g	3290 mg GAE/100g	N/A	50% MeOH	Folin-Ciocalteau	India	63	
	dried	2090 mg GAE/100g	2090 mg GAE/100g	N/A	50% MeOH, 100% MeOH and water	Folin-Ciocalteau	India	64	
	dried	10504 mg GAE/100g	10504 mg GAE/100g	N/A	Water at 80°C for 2 h	Folin-Ciocalteau	India	65	
	dried	10616 mg GAE/100g ^c	10616 mg GAE/100g ^c	Air-drying	80% MeOH	Folin-Ciocalteau	Pakistan	56	
	dried	9610 mgGAE/100g 17900 mgGAE/100g 8940 mg/GAE/100g 12600 mgGAE/100g	9610 mgGAE/100g 17900 mgGAE/100g 8940 mg/GAE/100g 12600 mgGAE/100g	Air-drying	100% MeOH 80% MeOH 100% EtOH 80% EtOH	Extraction by shaker	Folin-Ciocalteau	Pakistan	66
	dried	16600 mgGAE/100g 21100 mgGAE/100g 12200 mg/GAE/100g 17200 mgGAE/100g	16600 mgGAE/100g 21100 mgGAE/100g 12200 mg/GAE/100g 17200 mgGAE/100g	Air-drying	100% MeOH 80% MeOH 100% EtOH 80% EtOH				
	dried	2070 mg TAE/100g	2070 mg TAE/100g	Air-drying	Acetone/Water (7:3)	Folin-Ciocalteau	India	67	
	dried	1600 mgTEA/100g ^d 3400 mgTEA/100g ^e	1600 mgTEA/100g ^d 3400 mgTEA/100g ^e	Air-drying	80% EtOH	Folin-Ciocalteau	Nicaragua	68	
	dried	5350 mgCAE/100g 2930 mgCAE/100g 3710mgCAE/100g 3280 mgCAE/100g 4550 mgCAE/100g 4460 mgCAE/100g	5350 mgCAE/100g 2930 mgCAE/100g 3710mgCAE/100g 3280 mgCAE/100g 4550 mgCAE/100g 4460 mgCAE/100g	Oven-drying at 60° C for 24 h	Maceration with 70% EtOH Maceration with 50% EtOH Percolation with 70% EtOH Percolation with 50% EtOH Soxhlet extraction with 70% EtOH Soxhlet extraction with 50% EtOH	Folin-Ciocalteau	Thailand	95	
	Freeze-dried	1535.6 mgGAE/100g	1535.6 mgGAE/100g	Freeze-drying	80% EtOH	Folin-Ciocalteau	Florida, USA	54	

Acceptability



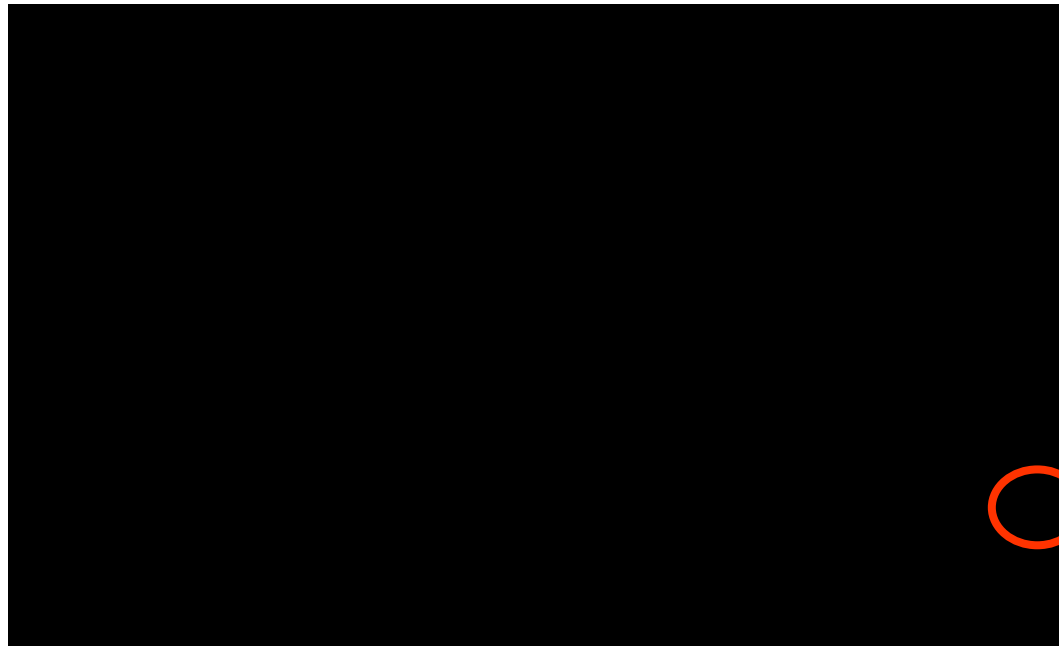
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Acceptability

