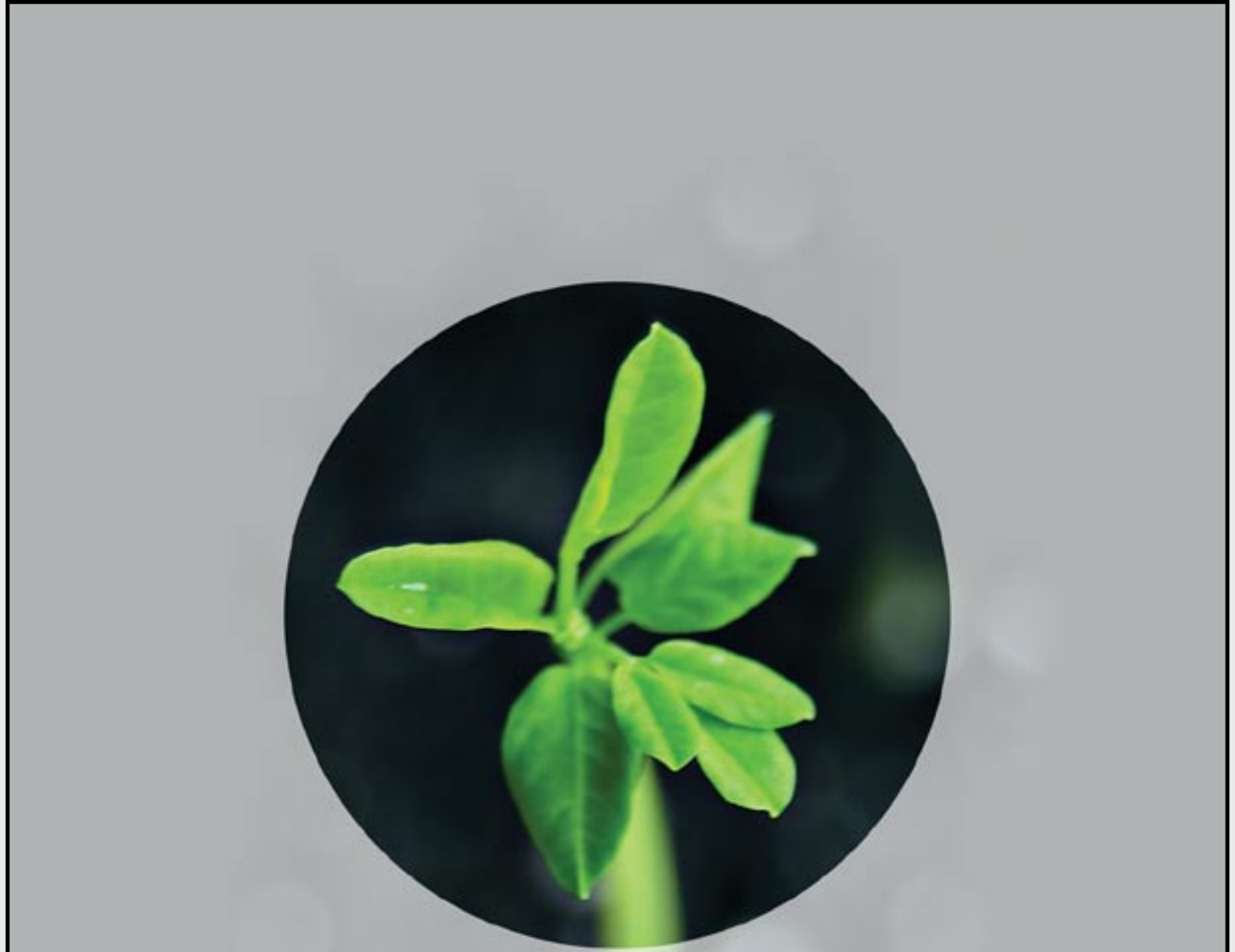
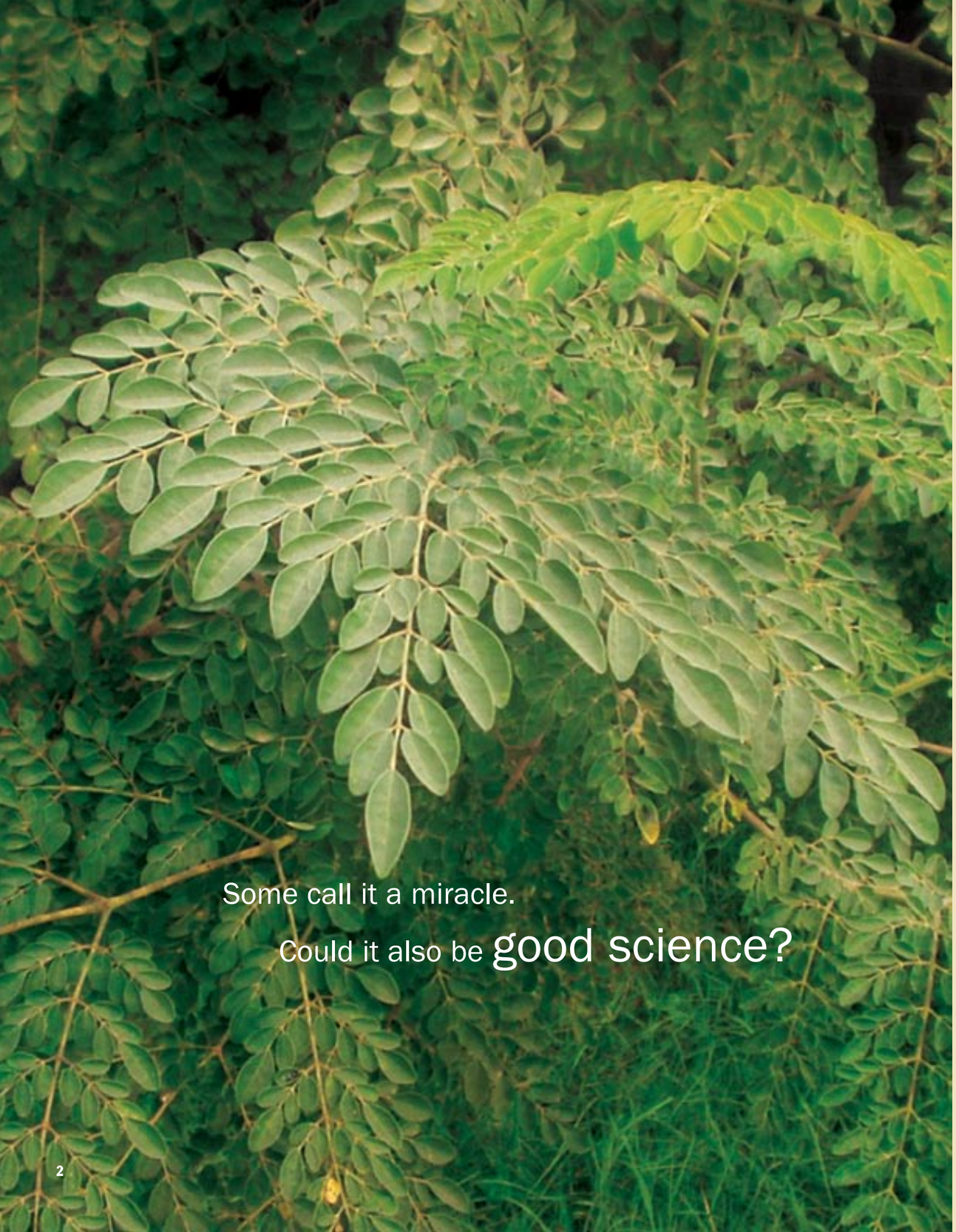

“The hardest thing to see is what is in front of your eyes.”
- Goethe



These leaves could

save millions of lives.



A potential life-saver

In a remote village of eastern India, I was approached by an old and dignified practitioner of traditional medicine. He had learned that Trees for Life was helping villagers plant fruit trees, and he had traveled more than a hundred miles to meet me. As we talked, he made an outrageous claim: "The leaves of the Moringa tree prevent 300 diseases."

His claim was based on real-life experience. Now science is confirming the idea. The more we study, the more it seems that the *Moringa oleifera* tree truly delivers wonders.

The leaves of this tree are worthy of special attention. Traditional medicine in several countries has used these leaves to cure a host of diseases. Clinical studies are suggesting that traditional medicine has been on the right track.

Nutritional analyses show that the leaves are very high in protein and contain all of the essential amino acids, including two amino acids that are especially important for children's diets. This is most uncommon in a plant food.

Moringa leaves are also packed with essential vitamins and minerals—especially vitamins A and C. Delivering such powerful nutrition, these leaves could prevent the scourge of malnutrition and related diseases.

To top it off, Moringa is a fast-growing, drought-resistant tree that grows even in marginal soils and with very little care.

Some call it a miracle. Could it also be good science?

Please spend a few minutes learning the story of Moringa. Then seriously consider joining hands with the worldwide community to explore how this remarkable tree could serve the people of your nation.

These humble leaves have the potential to deliver the nutrition needed to prevent and cure diseases and save populations.

Balbir S. Mathur
President

Trees for Life, 3006 W. St. Louis, Wichita, KS 67203-5129 USA
Ph: 316.945.6929 Fax: 316.945.0909 info@treesforlife.org www.treesforlife.org

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Tiny leaves.

Enormous benefits.

7 times the Vitamin C of Oranges

4 times the Vitamin A of Carrots

4 times the Calcium of Milk

3 times the Potassium of Bananas

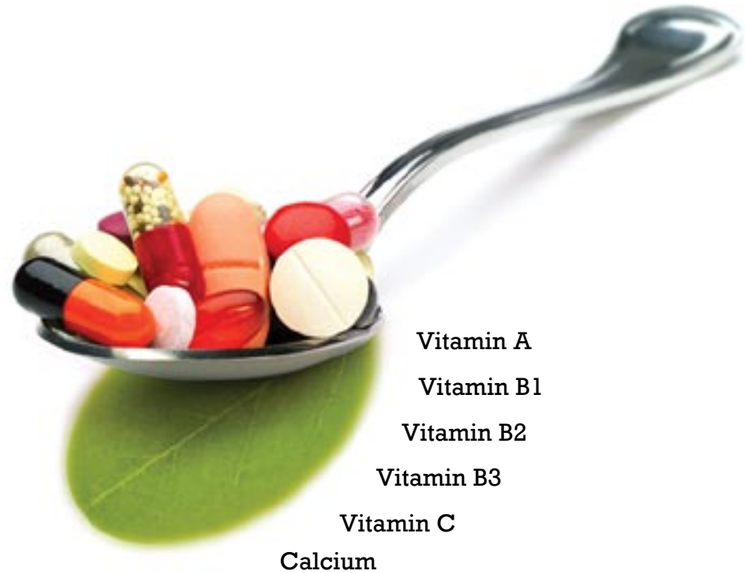
2 times the Protein of Yogurt

Gram-for-gram comparison of nutritional information[1]

It’s like growing

multi-vitamins

at your doorstep.



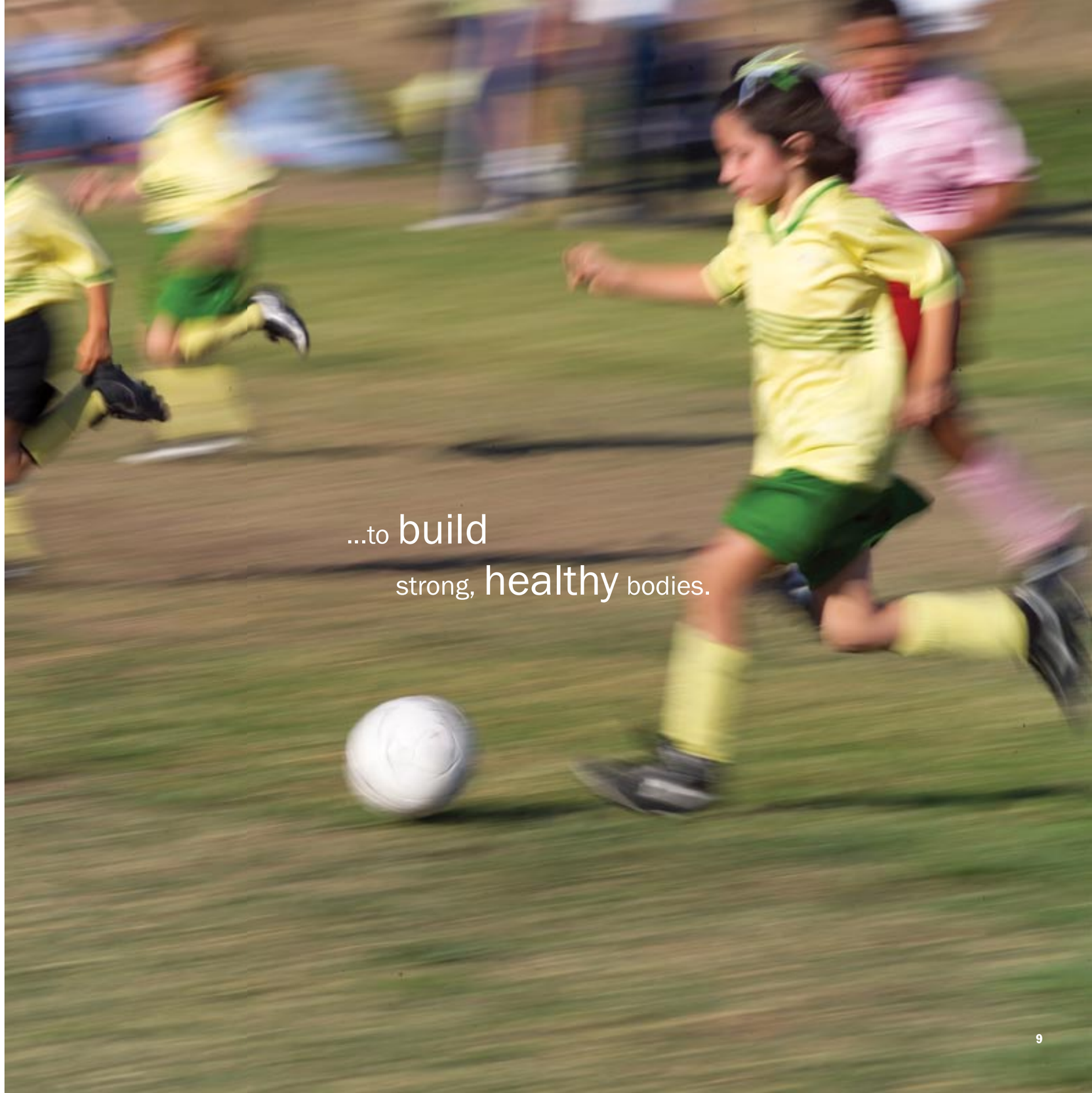
Vitamin A
Vitamin B1
Vitamin B2
Vitamin B3
Vitamin C
Calcium
Chromium
Copper
Iron
Magnesium
Manganese
Phosphorus
Potassium
Protein
Zinc

Rare for a plant source,

Moringa leaves contain

all the essential

amino acids (proteins)...



These leaves come from the humble tree, *Moringa oleifera*.

Native to the Indian sub-continent, Moringa has spread around the world.
Some common names:

English: Drumstick tree, (Horse)radish tree, Mother's best friend, West Indian ben
Spanish: Ben, Árbol del ben, Morango, Moringa
French: Bèn ailé, Benzolive, Moringa

Africa

Benin: Patima, Ewé ilé
Burkina Faso: Argentiga
Cameroon: Paizlava, Djihiré
Chad: Kag n'dongue
Ethiopia: Aleko, Haleko
Ghana: Yevu-ti, Zingerindende
Kenya: Mronge
Malawi: Cham'mwanba
Mali: Névrédé
Niger: Zôgla gandi
Nigeria: Ewe ile, Bagaruwar maka
Senegal: Neverday, Sap-Sap
Somalia: Dangap
Sudan: Ruwag
Tanzania: Mlonge
Togo: Baganlua, Yovovoti
Zimbabwe: Mupulanga

Asia

Bangladesh: Sajina
Burma: Dandalonbin
Cambodia: Ben ailé
India: Sahjan, Murunga, Moonga
Indonesia: Kalor
Pakistan: Suhanjna
Philippines: Mulangai
Sri Lanka: Murunga
Taiwan: La Mu
Thailand: Marum
Vietnam: Chùm Ngây

South and Central America, Caribbean

Brazil: Cedro
Colombia: Angela
Costa Rica: Marango
Cuba: Palo Jeringa
Dominican Republic: Palo de aceiti
El Salvador: Teberinto
French Guiana: Saijhan
Guadeloupe: Moloko
Guatemala: Perlas
Haiti: Benzolive
Honduras: Maranga calalu
Nicaragua: Marango
Panama: Jacinto
Puerto Rico: Resada
Suriname: Kelor
Trinidad: Saijan

Oceania

Fiji: Sajina
Guam: Katdes
Palau: Malungkai

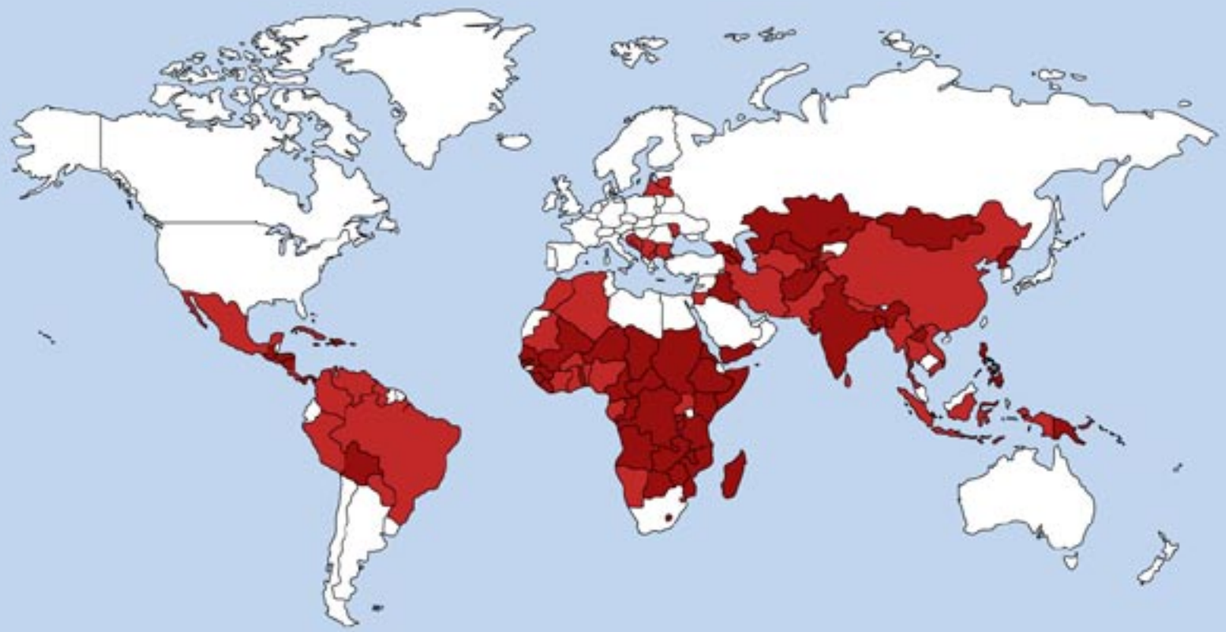
Additional names:
www.treesforlife.org/moringa/names

While *Moringa oleifera* is the most well-known species of Moringa, some names may refer to other species.

Nutritious Moringa

Countries where Moringa grows

Malnutrition



Countries with 20-35% of population malnourished[2]

Countries with 5-19% of population malnourished[2]

The Moringa tree grows...

...precisely where people need it most.

"Green leafy vegetables and fruits supply much needed essential micronutrients like beta-carotene [vitamin A], vitamin C, folic acid, and also calcium and potassium. Moringa leaves in particular are a rich, inexpensive source of micronutrients."

- Dr. C. Gopalan, President, Nutrition Foundation of India[3]

"Among the leafy vegetables, one stands out as particularly good, the horseradish [Moringa] tree. The leaves are one of the best plant foods that can be found."

- Dr. Frank W. Martin, in *Survival and Subsistence in the Tropics*[4]

"A major advantage to Moringa is the fact that it is a local resource. This contrasts with many of the ongoing programs designed to fight malnutrition which depend on imported products and outside support. ...Moringa is a very simple and readily available solution to the problem of malnutrition."

- Lowell J. Fuglie, in *The Miracle Tree* - Moringa oleifera: *Natural Nutrition for the Tropics*[5]

"Moringa shows great promise as a tool to help overcome some of the most severe problems in the developing world—malnutrition, deforestation, impure water and poverty. The tree does best in the dry regions where these problems are worst."

- Andrew Young, former Atlanta Mayor and United Nations Ambassador[6]

"Among the wide range of Green Leafy Vegetables, Moringa is the richest source of Beta-Carotene [vitamin A], apart from providing other important micronutrients."

- Dr. Kamala Krishnaswamy, former Director, Indian Council of Medical Research, Hyderabad[7]

"Although few people have ever heard of it today, Moringa could soon become one of the world's most valuable plants, at least in humanitarian terms."

- Noel Vietmeyer, US National Academy of Sciences, Washington D.C.[8]

THE NEED:

Moringa leaves have been used in the traditional medicine passed down for centuries in many cultures. Now they have also attracted interest in the modern scientific community. In the recent past, more than 750 studies, articles and other publications have included Moringa (see examples on page 30).*

However, most of the studies are either nutritional analyses or laboratory studies with animals. There are very few studies of the effects on human beings. Considering the potentially enormous benefits to humanity, the time has come for medically controlled studies with human subjects that document the bio-availability of nutrients in Moringa leaves and their effectiveness over a long period of time.

As the Moringa tree has spread from the Indian sub-continent throughout the tropical and sub-tropical world, it has adapted itself to local conditions, resulting in many variations. Thus, localized studies are needed to test the leaves' nutritional content and effects in different areas.

*Complete list of studies and publications available at: www.moringanews.org/biblio_en.html

HOW YOU CAN HELP:

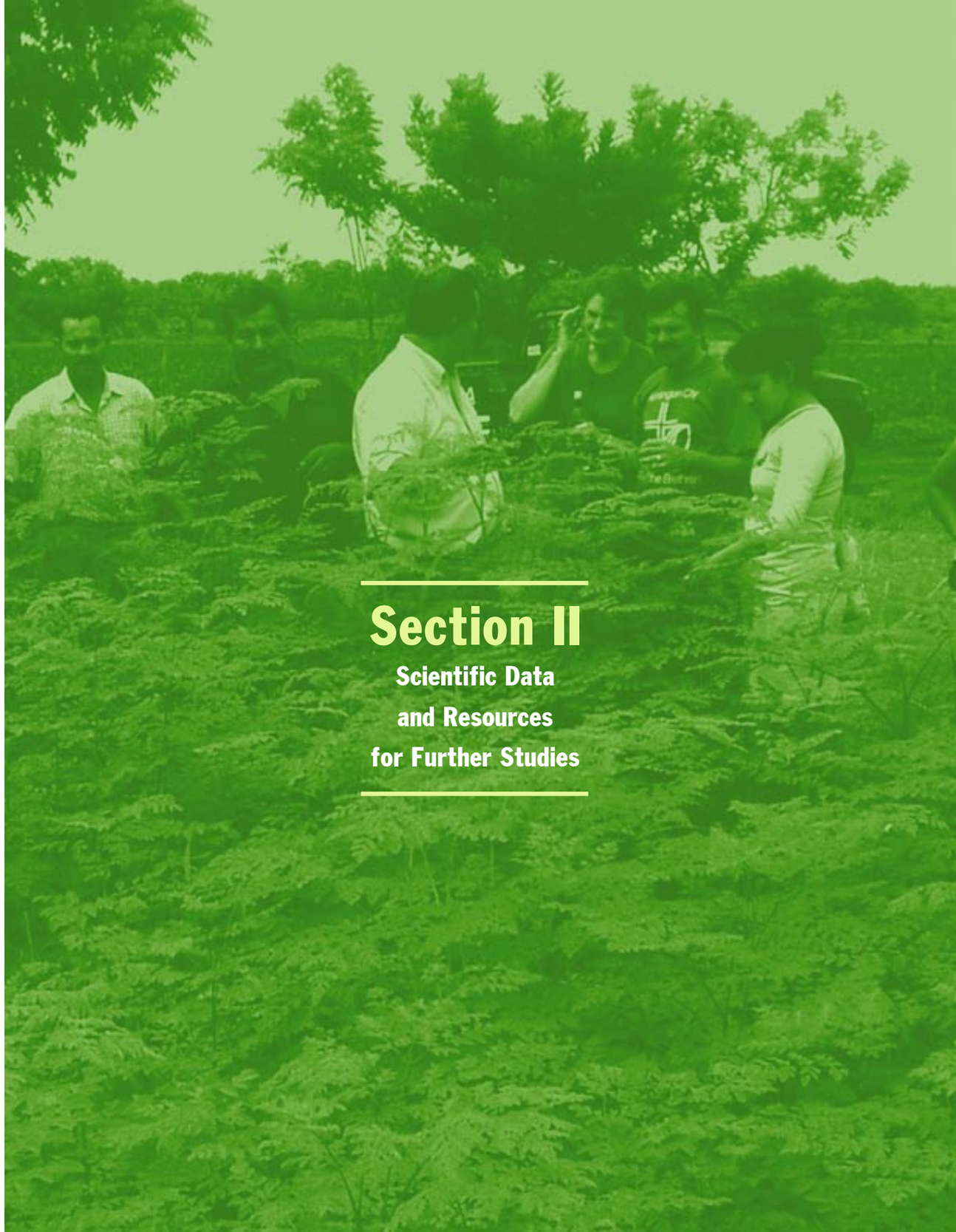
If studies show that the nutrients in Moringa leaves are sufficiently bio-available or that the medicinal benefits even come close to traditional claims, we would have a powerful tool to combat global malnutrition. It would be a tool provided by nature at practically no cost and at the very doorsteps of the people who need it most.

For this to happen, additional scientific studies are needed—locally as well as globally. (See page 29 for examples of studies needed.)

The knowledge gained from such studies could lead to a simple, economical and highly effective solution to a very grave problem.

Please share this information with people who can help conduct scientific studies to determine the effects of Moringa leaves on malnutrition and related diseases.

Your action may save millions of lives.



Section II

Scientific Data and Resources for Further Studies

The first part of this book dealt with the potential of Moringa leaves. The following section is for those who may be interested in further studies. This section provides additional background information on the Moringa tree, the scientific studies that have already been conducted and the types of studies that need to be conducted.

The following pages present merely a representative sampling of current knowledge on Moringa. However, an effort has been made to provide enough information to get you started.

For those who wish to proceed further, links are provided to the worldwide community waiting to join hands with you.

History of Moringa

Moringa oleifera is the best known of the thirteen species of the genus Moringacae. Moringa was highly valued in the ancient world. The Romans, Greeks and Egyptians extracted edible oil from the seeds and used it for perfume and skin lotion.

In the 19th century, plantations of Moringa in the West Indies exported the oil to Europe for perfumes and lubricants for machinery. People in the Indian sub-continent have long used Moringa pods for food. The edible leaves are eaten throughout West Africa and in parts of Asia.[5]

Identification

Species: *Moringa oleifera*

Family: Moringaceae

Range: Native to the Indian sub-continent, and naturalized in tropical and sub-tropical areas around the world[9]

Characteristics: Deciduous tree or shrub, fast-growing, drought-resistant, average height of 12 meters at maturity[5]

Varieties

Twelve other Moringa species are known as well:[5]

M. arborea
M. borziana
M. concanensis
M. drouhardii
M. hildebrandtii
M. longituba
M. ovalifolia
M. peregrina
M. pygmaea
M. rivae
M. ruspoliana
M. stenopetala

All parts are useful

Every part of the Moringa tree is said to have beneficial properties that can serve humanity. People in societies around the world have made use of these properties. While the focus of this book is on the leaves, other parts of the tree are also worthy of further study.

Leaves:
Nutrition
Medicine

Pods:
Nutrition
Medicine

Flowers:
Medicine

Seeds:
Water purification
Medicine
Cooking oil
Cosmetics
Lubricant

Bark:
Medicine

Gum:
Medicine

Roots:
Medicine

Sources: 1, 5, 9, 10

Nutritional Value of Moringa Leaves

Nutritional analyses indicate that Moringa leaves contain a wealth of essential, disease-preventing nutrients. They even contain all of the essential amino acids, which is unusual for a plant source. Since the dried leaves are concentrated, they contain higher amounts of many of these nutrients, except vitamin C.

Nutritional contents of vegetable matter can vary depending on varieties, seasons, climate, and soil conditions. Thus, different analyses produce different figures. For example, some studies show potassium content of Moringa leaves as lower and iron content as higher than what is shown here.

The information used in this book for fresh Moringa leaves comes from Gopalan, et al., based mostly on analysis done at the National Institute of Nutrition in Hyderabad, India.[1] Information on dried Moringa leaves comes from Fuglie, based mostly on analysis sponsored by Church World Service and the Department of Engineering at the University of Leicester and performed by Campden & Chorleywood Food Research Association in Gloucestershire, UK.[5]

Vitamin A is obtained from vegetables in the form of its precursor, carotene. The intestines only absorb a fraction of the carotene in foods. Thus, there are differing views on how to calculate the amount of carotene that is absorbed and converted to vitamin A. For vitamin A content, Gopalan et al. and Fuglie simply give the figures for carotene or beta-carotene. The most commonly accepted conversion factor of carotene to vitamin A (retinol) is 6:1.

Amino Acid Content of Moringa Leaves*

All values are per 100 grams of edible portion.

	Fresh Leaves[1]	Dried Leaves[5]
Arginine	406.6 mg	1,325 mg
Histidine	149.8 mg	613 mg
Isoleucine	299.6 mg	825 mg
Leucine	492.2 mg	1,950 mg
Lysine	342.4 mg	1,325 mg
Methionine	117.7 mg	350 mg
Phenylalinine	310.3 mg	1,388 mg
Threonine	117.7 mg	1,188 mg
Tryptophan	107 mg	425 mg
Valine	374.5 mg	1,063 mg

*While Gopalan, et al. expressed amino acid content per g N (nitrogen), these figures have been converted to mg per 100g leaves for clarity.

Vitamin and Mineral Content of Moringa Leaves

All values are per 100 grams of edible portion.

	Fresh Leaves[1]	Dried Leaves[5]
Carotene (Vit. A)*	6.78 mg	18.9 mg
Thiamin (B1)	0.06 mg	2.64 mg
Riboflavin (B2)	0.05 mg	20.5 mg
Niacin (B3)	0.8 mg	8.2 mg
Vitamin C	220 mg	17.3 mg
Calcium	440 mg	2,003 mg
Calories	92 cal	205 cal
Carbohydrates	12.5 g	38.2 g
Copper	0.07 mg	0.57 mg
Fat	1.70 g	2.3 g
Fiber	0.90 g	19.2 g
Iron	0.85 mg	28.2 mg
Magnesium	42 mg	368 mg
Phosphorus	70 mg	204 mg
Potassium	259 mg	1,324 mg
Protein	6.70 g	27.1g
Zinc	0.16 mg	3.29 mg

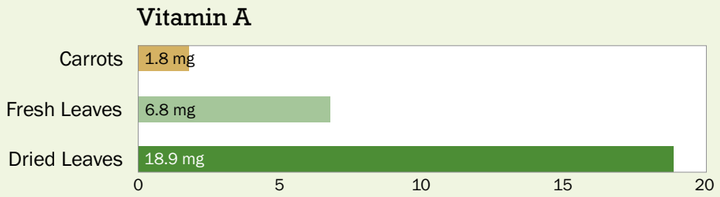
*Figures shown for vitamin A are carotene content for fresh leaves and beta-carotene content for dried leaves.[1, 5]

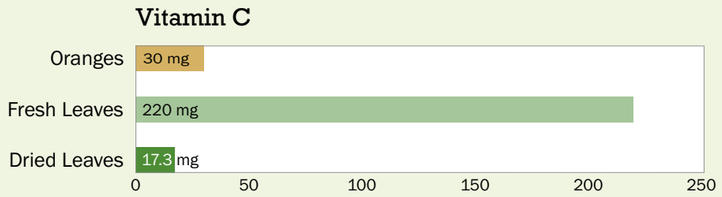
Moringa Leaves Compared to Common foods

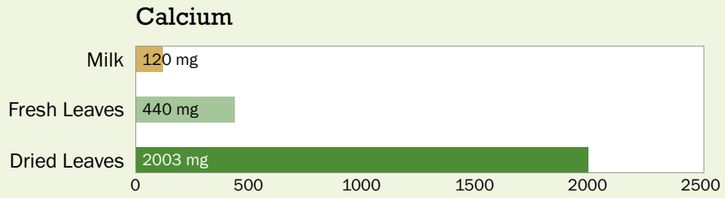
The following graphs show a comparison of the nutritional content of fresh Moringa leaves and dried Moringa leaves compared to common foods, gram for gram.

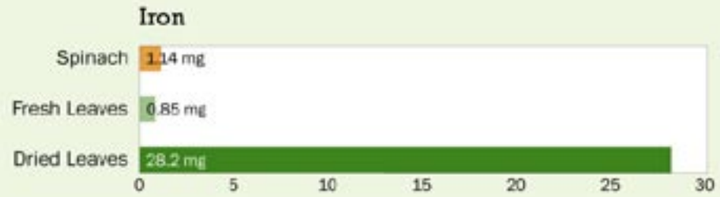
Again, nutritional contents of these common foods can also vary depending on varieties, seasons, location, climate, and soil conditions. For example, some studies show higher iron content for spinach and higher potassium content for bananas. The data for fresh Moringa leaves and common foods come from Gopalan, et al.[1] Data for dried Moringa leaves come from Fuglie.[5]

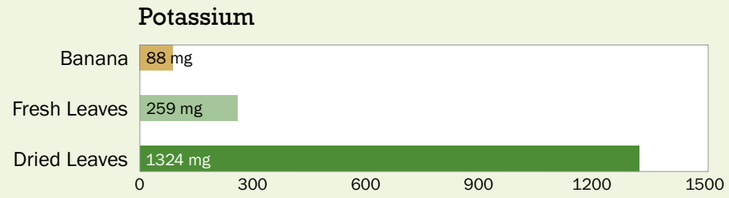
All values are per 100 grams of edible portion.

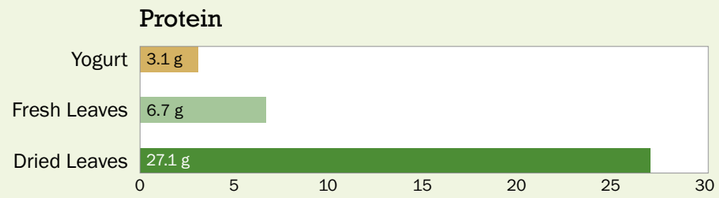












Fresh Leaves

Gram for gram, fresh leaves contain about:

- **4** times the Vitamin A of Carrots
- **7** times the Vitamin C of Oranges
- **4** times the Calcium of Milk
- **3** times the Potassium of Bananas
- **¾** the Iron of Spinach
- **2** times the Protein of Yogurt

Dried Leaves

Gram for gram, dried leaves contain about:

- **10** times the Vitamin A of Carrots
- **½** the Vitamin C of Oranges
- **17** times the Calcium of Milk
- **15** times the Potassium of Bananas
- **25** times the Iron of Spinach
- **9** times the Protein of Yogurt

Case Study: Moringa Leaf Powder Treating Malnutrition

In 1997-98, Alternative Action for African Development (AGADA) and Church World Service tested the ability of Moringa leaf powder to prevent or cure malnutrition in pregnant or breast-feeding women and their children in southwestern Senegal.[5, 19] Malnutrition was a major problem in this area, with more than 600 malnourished infants treated every year. During the test, doctors, nurses, and midwives were trained in preparing and using Moringa leaf powder for treating malnutrition. Village women were also trained in the preparation and use of Moringa leaf powder in foods.

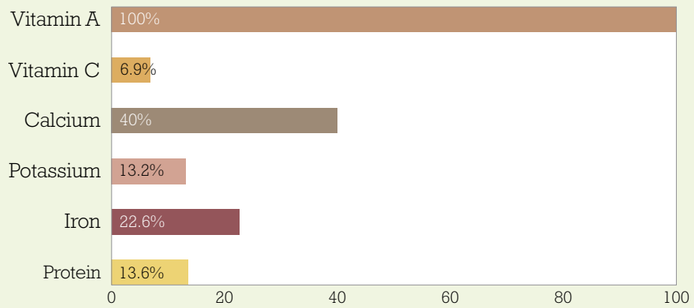
This test found the following effects to be common among subjects taking Moringa leaf powder:

- **Children maintained or increased their weight and improved overall health.**
- **Pregnant women recovered from anemia and had babies with higher birth weights.**
- **Breast-feeding women increased their production of milk.**

The following graphs show RDA values of major nutrients in dosages suggested by this test:

For a Child Aged 1- 3 Years

RDA% per tbsp. (8g) Moringa Leaf Powder[5]

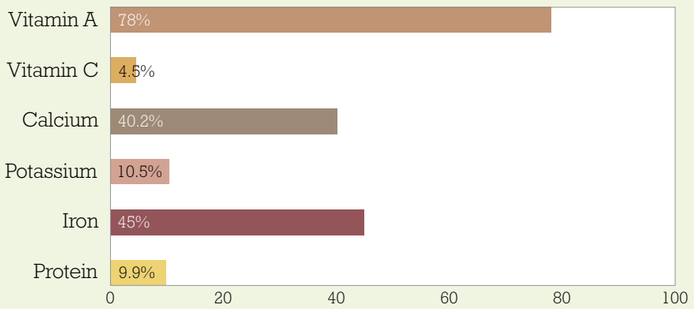


Suggested Dosage:
Children: 1 to 3 tablespoons a day, depending on nutritional needs

1 tbsp. provides 100% RDA of Vitamin A.

For Breast-Feeding Women

RDA% per 3 tbsp. (24g) Moringa Leaf Powder[5]



Suggested Dosage:
Pregnant or nursing women: 2 to 3 tablespoons a day, depending on hemoglobin levels

3 tbsp. provides 78% RDA of Vitamin A.

Absorption of nutrients may vary depending on individual diets and health conditions. Moringa leaves, with their high iron and protein content, are not appropriate for initial treatment of the severely malnourished.

Claims of Traditional Medicine

For centuries, people in many countries have used Moringa leaves as traditional medicine for common ailments. Clinical studies have begun to suggest that at least some of these claims are valid. With such great medicinal value being suggested by traditional medicine, further clinical testing is very much needed at this time. If studies conclude that even some of the claims are correct, these leaves could become an invaluable resource for people in areas where other forms of treatment are scarce.

Guatemala	skin infections, sores
India	anemia, anxiety, asthma, blackheads, blood impurities, bronchitis, catarrh, chest congestion, cholera, conjunctivitis, cough, diarrhea, eye and ear infections, fever, glandular swelling, headaches, abnormal blood pressure, hysteria, pain in joints, pimples, psoriasis, respiratory disorders, scurvy, semen deficiency, sore throat, sprain, tuberculosis
Malaysia	intestinal worms
Nicaragua	headache, skin infections, sores
Philippines	anemia, glandular swelling, lactation
Puerto Rico	intestinal worms
Senegal	diabetes, pregnancy, skin infections, sores
Venezuela	intestinal worms
Other countries	colitis, diarrhea, dropsy, dysentery, gonorrhea, jaundice, malaria, stomach ulcers, tumor, urinary disorders, wounds

Sources: 5, 11, 12, 13, 14, 15, 16, 17, 18

We hope this booklet has given you a meaningful introduction to Moringa leaves and their immense potential to impact human life.

Today billions of people on our planet suffer from malnutrition. Their pain and suffering cannot even be imagined. It is a chronic and urgent problem that will not go away easily. To address this problem we will need every tool possible at our command, and perhaps Moringa can play a role.

If you can assist in initiating further studies, this booklet gives you a starting point. Some examples of the studies needed have been provided, but the list is not exhaustive.

While the need is for local studies, ultimately they will add to the collective knowledge that can serve our world. Every action, even the smallest one, will help complete the picture.

If we can be of further service, please contact us: moringa@treesforlife.org

Examples of studies needed

Moringa leaves are worthy of further study from many angles. Possible subjects include their use as animal fodder, farming practices, discovery of unknown varieties and potential uses not yet considered. However, this book brings attention to the need for study of one narrow, but vitally important, aspect: human malnutrition.

Study of this subject will require:

1. Further analyses of the nutritional properties of Moringa leaves.

2. Scientific examinations of the claims of Moringa leaves' ability to fight diseases.

A few examples of such studies are listed below.

Nutritional studies:

1. Nutritional composition of Moringa leaves in different locations, various growing conditions, etc.
2. Recommended preparations and amounts for use as a nutritional supplement

Clinical studies with human subjects to investigate:

1. Nutrient bio-availability
2. Potential toxic effects (bio-toxicity)
3. Positive effects on the immune system in fighting diseases, such as:
   - Malnutrition
   - HIV/AIDS
   - Sexually transmitted infections
   - Tuberculosis
4. Effects claimed by traditional medicine in regard to diseases, such as:
   - Hypertension
   - Diabetes
   - High blood pressure
5. Antioxidant properties in fighting diseases, such as:
   - Heart disease
   - Cancer
   - Alzheimer's disease

Identification of Moringa varieties:

1. Resistant to caterpillars and other pests
2. Possessing the greatest bio-available nutritional content

Share your studies:

Those interested in conducting such studies, please contact us at: **moringa@treesforlife.org**
For more resources, connect with the International Moringa Network at: www.moringanews.org
To post documents on the International Moringa Network site, email Armelle de Saint Sauveur at: asauveur@wanadoo.fr

Moringa Studies

Following are some examples of the scientific studies on Moringa leaves that have been conducted in recent years. For a complete list of studies, articles and other publications, see: www.moringanews.org/biblio_en.html

Nutrition

Barminas, J.T.; Charles, Milam; Emmanuel, D. "Mineral composition of non-conventional leafy vegetables." *Plant Foods for Human Nutrition* 53.1 (1998): 29-36.

Ching, L.S.; Mohamed, S. "Alpha-tocopherol content in 62 edible tropical plants." *Journal of Agricultural and Food Chemistry* 49.6 (2001 Jun): 3101-5.

Freiberger, C.E.; Vanderjagt, D.J.; Pastuszyn, A., and others. "Nutrient content of the edible leaves of seven wild plants from Niger." *Plant Foods for Human Nutrition* 53.1 (1998): 57-69.

Geervani, P.; Devi, A. "Influence of protein and fat on the utilisation of carotene from drumstick *(Moringa oleifera)* leaves." *The Indian Journal of Medical Research* 74.0 (1981 Oct): 548-53.

Girija, V.; Sharada, D.; Pushpamma, P. "Bioavailability of thiamine, riboflavin and niacin from commonly consumed green leafy vegetables in the rural areas of Andhra Pradesh in India." *International Journal for Vitamin and Nutrition Research* 52.1 (1982): 9-13.

Hosken, Fran. P., ed. "Stopping Malnutrition in the Tropics with the Moringa Tree." *Women's International Network News* 26.2 (2000): 47-48.

Lockett, Cassius; Calvert, Christopher; Grivetti, Louis. "Energy and micronutrient composition of dietary and medicinal wild plants consumed during drought. Study of rural Fulani, Northeastern Nigeria." *International Journal of Food Sciences and Nutrition* 51.3 (2000): 195-208.

Makkar, H.P.S.; Becker, K. "Nutrients and antiquality factors in different morphological parts of the *Moringa oleifera* tree." *The Journal of Agricultural Science* 128.3 (1997): 311-322.

Nambiar, V.S.; Bhadalkar, K.; Daxini, M. "Drumstick leaves as source of vitamin A in ICDS-SFP." *Indian Journal of Pediatrics* 70.5 (2003 May): 383-7.

Nambiar, V.S.; Daxini, M.; Bhadalkar, K. "Nutritional and Sensory Evaluation of Dried Drum-stick Leaf *(Moringa oleifera)* Recipes." *Indian Food Packer* 57. Part 6 (2003): 156-161.

Nambiar, Vanisha S.; Seshadri, Subadra. "Bioavailability trials of beta-carotene from fresh and dehydrated drumstick leaves *(Moringa oleifera)* in a rat model." *Plant Foods for Human Nutrition* 56.1 (2001): 83-95.

Pankaja, N.; Prakash, J. "Availability of calcium from kilkeerai *(Amaranthus tricolor)* and drumstick *(Moringa oleifera)* greens in weanling rats." *Die Nahrung* 38.2 (1994): 199-203.

Sena, L.P.; VanderJagt, D.J.; Rivera, C., and others. "Analysis of nutritional components of eight famine foods of the Republic of Niger." *Plant Foods for Human Nutrition* 52.1 (1998): 17-30.

Seshadri, S.; Nambiar, V.S. "Kanjero *(Digera arvensis)* and Drumstick Leaves *(Moringa oleifera)*: Nutrient Profile and Potential for Human Consumption." *World Review of Nutrition and Dietetics* 91.0 (2003): 41-59.

Siddhuraju, P.; Becker, K. "Antioxidant Properties of Various Solvent Extracts of Total Phenolic Constituents from Three Different Agroclimatic Origins of Drumstick Tree *(Moringa oleifera* Lam.) Leaves." *Journal of Agricultural and Food Chemistry* 51.8 (2003): 2144-2155.

Sreenivasan, Jyotsna. "The Drumstick Tree: A Natural Multi-vitamin." *E* 11.3 (May/Jun 2000): 17-18.

Subadra, Seshadri; Monica, Jain; Dhabhai, D. "Retention and Storage Stability of Beta-carotene in Dehydrated Drumstick Leaves *(Moringa Oleifera)*." *International Journal of Food Sciences and Nutrition* 48.6 (1997): 373-380.

Medicine

Abuye, C.; Omwega, A.M.; Imungi, J.K. "Familial tendency and dietary association of goitre in Gamo-Gofa, Ethiopia." *The East African Medical Journal* 76.8 (1999 Aug): 447-51.

Abuye, C.; Urga, K.; Knapp, H., and others. "A compositional study of *Moringa stenopetala* leaves." *The East African Medical Journal* 80.5 (2003): 247-252.

Caceres, A.; Saravia, A.; Rizzo, S.; Zabala, L.; De Leon, E.; Nave, F. "Pharmacologic properties of *Moringa oleifera*. 2: Screening for antispasmodic, antiinflammatory and diuretic activity." *Journal of Ethnopharmacology* 36.3 (1992 Jun): 233-7.

Caceres, A.; Cabrera, O.; Morales, O., and others. "Pharmacological properties of *Moringa oleifera*. 1: Preliminary screening for antimicrobial activity." *Journal of Ethnopharmacology* 33.3 (July 1991): 213-6.

Dangi, S.Y.; Jolly, C.I.; Narayanan, S. "Antihypertensive Activity of the Total Alkaloids from the Leaves of *Moringa oleifera*." *Pharmaceutical Biology* 40.2 (2002): 144-148.

Faizi, S.; Siddiqui, B.S.; Saleem, R., and others. "Fully acetylated carbamate and hypotensive thiocarbamate glycosides from *Moringa oleifera*." *Phytochemistry* 38.4 (1995): 957.

Faizi, S.; Siddiqui, B.N.; Saleem, R., and others. "Isolation and Structure Elucidation of New Nitrile and Mustard Oil Glycosides from *Moringa oleifera* and Their Effect on Blood Pressure." *Journal of Natural Products* 57.9 (1994): 1256-61.

Ghasi, S.; Nwobodo, E.; Ofili, J.O. "Hypocholesterolemic effects of crude extract of leaf of *Moringa oleifera* Lam in high-fat diet fed wistar rats." *Journal of Ethnopharmacology* 69.1 (2000): 21-26.

Mekonnen, Y. "Effects of Ethanol Extract of *Moringa stenopetala* Leaves on Guinea-pig and Mouse Smooth Muscle." *Phytotherapy Research* 13.5 (1999): 442-444.

Mekonnen, Y.; Yardley, V.; Rock, P., and others. "In Vitro Antitrypanosomal Activity of *Moringa stenopetala* Leaves and Roots." *Phytotherapy Research* 13.6 (1999): 538-9.

Mekonnen, Yalemtsehay; Drager, Birgit. "Glucosinolates in *Moringa stenopetala*." *Planta Medica* 69.4 (2003): 380-382.

Morton, Julia F. "The Horseradish Tree, *Moringa pterygosperma* (Moringaceae) – A Boon to Arid Lands?" *Economic Botany* 45.3 (1991): 318-333.

References

Murakami, Akira; Kitazono, Yumi; Jiwajinda, Suratwadee; Koshimizu, Koichi; Ohigashi, Hajime. "Niaziminin, a Thiocarbamate from the Leaves of *Moringa oleifera*, Holds a Strict Structural Requirement for Inhibition of Tumor-Promotor-Induced Epstein-Barr Virus Activation." *Planta Medica* 64.4 (1998): 319-323.

Nath, D.; Sethi, N.; Singh, R.K.; Jain, A.K. "Commonly used Indian abortifacient plants with special reference to their teratologic effects in rats." *Journal of Ethnopharmacology* 36.2 (1992 Apr): 147-54.

Pal, S.K.; Mukherjee, P.K.; Saha, B.P. "Studies on the Antiulcer Activity of *Moringa oleifera* Leaf Extract on Gastric Ulcer Models in Rats." *Phytotherapy Research: PTR* 9.6 (1995): 463.

Pal, S.K.; Mukherjee, P.K.; Saha, K., and others. "Studies on Some Psychopharmacological Actions of *Moringa oleifera* Lam. (Moringaceae) Leaf Extract." *Phytotherapy Research: PTR* 10.5 (1996): 402.

Pari, L.; Kumar, N.A. "Hepatoprotective Activity of *Moringa oleifera* on Antitubercular Drug-Induced Liver Damage in Rats." *Journal of Medicinal Food* 5.3 (2002): 171-177.

Rao, A.V.; Devi, P.U.; Kamath, R. "In vivo radioprotective effect of *Moringa oleifera* leaves." *Indian Journal of Experimental Biology* 39.9 (2001 Sep): 858-63.

Tahiliani, Pankaj; Kar, Anand. "Role of *Moringa oleifera* leaf extract in the regulation of thyroid hormone status in adult male and female rats." *Pharmacological Research: the Official Journal of the Italian Pharmacological Society.* 41.3 (2000): 319-23.

Chemistry

Bennett, R.N.; Mellon, F.A.; Foidl, N., and others. "Profiling Glucosinolates and Phenolics in Vegetative and Reproductive Tissues of the Multi-Purpose Trees *Moringa oleifera* L. (Horseradish Tree) and *Moringa stenopetala* L." *Journal of Agricultural and Food Chemistry* 51.12 (2003): 3546-3553.

Leuck, Michael; Kunz, Horst. "Regular papers - Synthesis of active principles from the leaves of *Moringa oleifera* using S-pent-4-enyl thioglycosides." *Carbohydrate Research* 312.1-2 (1998): 33-44.

Ruby, J.; Nathan, P.T.; Balasingh, J., and others. "Chemical Composition of Fruits and Leaves Eaten by Short-Nosed Fruit Bat, *Cynopterus sphinx*." *Journal of Chemical Ecology* 26.12 (2000): 2825-2841.

Van Droogenbroeck, B.; Kyndt, T.; Maertens, I.; Romeijn-Peeters, E.; Scheldeman, X.; Romero-Motochi, J.P.; Van Damme, P.; Goetghebeur, P.; Gheysen, G. "Phylogenetic Analysis of the Highland Papayas (Vasconcellea) and Allied Genera (Caricaceae) Using PCR-RFLP." *Theoretical and Applied Genetics* 108.8 (2004 May Epub 2004 Jan 30): 1473-86.

General

Saint Sauveur (de), A., et al., eds. Development Potential for Moringa Products. International Workshop, Dar es Salaam, Tanzania, 29 Oct. - 2 Nov. 2001. CIRAD/PROPAGE/SILVA, coll. Colloques, CD Rom. 17 Jan. 2004 <www.moringanews.org/seminaire_en.html>.

1. Gopalan, C., B.V. Rama Sastri, and S.C. Balasubramanian. *Nutritive value of Indian foods.* Hyderabad, India: (National Institute of Nutrition), 1971 (revised and updated by B.S. Narasinga Rao, Y.G. Deosthale, and K.C. Pant, 1989).
2. United Nations World Food Programme. *Interactive Hunger Map.* 2004. December 2004. <www.wfp.org/country_brief/ hunger_map/map/ hungermap_popup/map_popup.html>.
3. Gopalan, C., President of the Nutrition Foundation of India. Email to Trees for Life. 9 July 2002.
4. Martin, Franklin W. and Ruth M. Ruberté. *Survival and Subsistence in the Tropics.* Mayaguez: Puerto Rico Antillian Press, 1978. [in Price, Martin L. "The Moringa Tree." Educational Concerns for Hunger Organization (ECHO) Technical Note. 1985 (revised 2000). May 2002. <www.echotech.org/technical/technotes/moringabiomasa.pdf>.
5. Fuglie, Lowell J., ed. *The Miracle Tree:* Moringa oleifera: *Natural Nutrition for the Tropics.* Training Manual. 2001. Church World Service, Dakar, Senegal. <www.moringatrees.org/moringa/miracletree.html>, May 2002.
6. Church World Service. "Hope during drought: CWS presents Andrew Young with 20 Moringa Trees." June 2000. May 2002. <www.churchworldservice.org/moringa/moringatoyoung.html>.
7. Krishnaswamy, Kamala, Director of the National Institute of Nutrition, Hyderabad, India. Email to Trees for Life. 14 Aug. 2002.
8. Fletcher, Rob. ed. "*Moringa oleifera* (the kelor tree)." *The Australian New Crops Newsletter.* Issue 9, Jan. 1998. May 2002. <www.newcrops.uq.edu.au/newslett/ncnl9192.htm>.
9. Price, Martin L. "The Moringa Tree." Educational Concerns for Hunger Organization (ECHO) *Technical Note.* 1985 (revised 2000). May 2002. <www.echotech.org/technical/technotes/moringabiomasa.pdf>.
10. Saint Sauveur (de), Armelle. "Moringa exploitation in the world: State of knowledge and challenges." Development Potential for Moringa Products. International Workshop, Dar es Salaam, Tanzania, 29 Oct. - 2 Nov. 2001.
11. Morton, Julia F. "The Horseradish Tree, *Moringa pterygosperma* (Moringaceae)—A Boon to Arid Lands?" *Economic Botany.* 45 (3), (1991): 318-333.
12. IndianGyan: The Source for Alternative Medicines and Holistic Health. Home Remedies for Common Ailments. May 2002. <www.indiangyan.com/books/healthbooks/remedies/cataract.shtml>.
13. Bakhru, H.K. *Foods That heal: The Natural Way to Good Health.* South Asia Books, 1995.
14. New Crop Resource Online Program (NewCROP). "*Moringa Oleifera* Lam." 7 Jan.1998. Purdue U. Jan. 2005. <www.hort.purdue.edu/ newcrop/duke_energy/Moringa_oleifera.html>.
15. Sairam, T.V. *Home remedies, Vol II: A Handbook of Herbal Cures for Commons Ailments.* New Delhi, India: Penguin, 1999.
16. M.S. Swaminathan Research Foundation. *Moringa oleifera* Lam, Moringaceae. May 2002. <www.mssrf.org./fris9809/fris1157.html>.
17. Participatory Development Resource Centre for Africa (PDRCA) Page. United Nations Volunteers. Aug. 2000. <www.unv.org/projects/pdrca/pdrca22.htm>.
18. Home Truths Page. Morepen Laboratories. March 2002. <www.morepen.com/morepen/newsletter/hometruths.htm>.
19. Sambou Diatta, B. "Supplementation for pregnant and breast-feeding women with *Moringa oleifera* powder." Development Potential for Moringa Products. International Workshop, Dar es Salaam, Tanzania, 29 Oct. - 2 Nov. 2001.

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For a list of people and organizations working with Moringa, see: www.treesforlife.org/moringa/book

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Balbir Mathur
President

Thanks for this opportunity

The creation of this book reminds me of the music I heard as a child in India. It always had the same age-old structure, but no two experiences were alike. The lead musician would improvise, playfully challenging his or her accompanists to keep up. The accompanists would rise to the occasion, radiating joy in the dance of creativity. We, the audience, did not just *hear* the music; we *experienced* the process of creation.

One of our team members, who left a lucrative job in New York City to share her skills in art direction, had a similar experience in the production of this book. She said it was like a banquet where every guest contributed his or her most prized recipes. And the guests at this banquet were many.

Trees for Life is a movement powered by volunteers. Bringing various talents, they join hands to give of themselves—as one would present a tender flower to the beloved. It would be impossible to mention all those who dedicated thousands of hours to this effort—and it is not necessary. This book is their gift to the world.

They express with me their gratitude for this great opportunity to serve.

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There once was a village chief named Ramasu.
He was known for his wisdom, but he was getting old.

One day a young, ambitious man appeared before him. "Ramasu, I challenge you to a public contest," he said. "I will ask you one question. If you cannot answer correctly, I will become the new chief."

On the contest day, the whole village showed up filled with anticipation. The young challenger stepped forward. "In my hands is a bird. Is it dead or alive?"

The crowd grew silent, knowing the implication. If Ramasu said "Alive," the young man would crush the little bird. If he said "Dead," he would let the bird fly. Either way, Ramasu was trapped.

Ramasu thought for a moment, and then gently replied, "The life of the bird is in your hands."

Like the living bird in the parable, the life-saving promise of the Moringa tree is in your hands.

Please act with wisdom.

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