



SLICING OPEN THE NUTRITION STORY OF THIS

SUPER FUN SUPERFRUIT



MANGOS ARE KNOWN AS THE KING OF FRUITS. That's because this sunniest fruit in the produce aisle is the most commonly consumed fruit in the world. Native to India and Southeast Asia – where it has been cultivated for over 5,000 years – mangos are quickly becoming a favorite in American households.

The mango (*Mangifera indica* L.) is classified as a stone fruit or drupe that belongs to a family of flowering plants known as *Anacardiaceae*, which also includes cashews, pistachios and sumac.

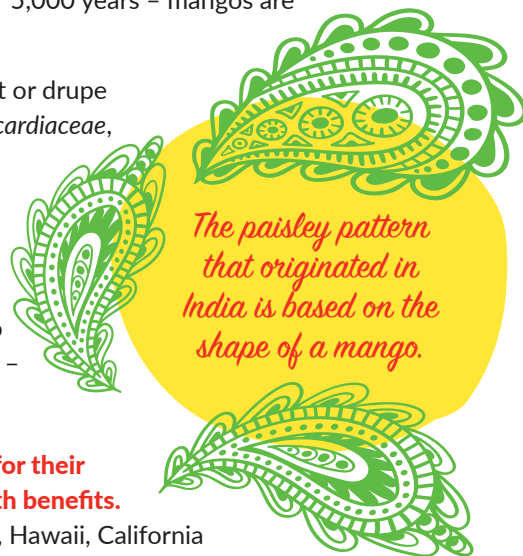
Historically, mangos have been revered as symbols of life, love and happiness.

Buddhist monks cultivated mangos, which were considered to be sacred. It is believed that Buddha himself meditated in the peaceful tranquility of lush mango groves. For centuries, every part of the mango – the pulp, peel, seed, leaves and bark – has been treasured for its health properties.

MANGO IS THE NATIONAL FRUIT OF INDIA, PAKISTAN AND THE PHILIPPINES.

Today, mangos have captivated America – praised for their unique sweet taste, versatility and impressive health benefits.

Fortunately, with six main varieties grown in Florida, Hawaii, California and various parts of the world, mangos are always in season. Whether enjoyed in a smoothie, piled high on pancakes or oatmeal, stuffed in a taco, added to a salad or grain bowl, stirred into a salsa or simply eaten whole with juice dripping down your chin, there are endless ways to soak up this tropical flavor all year round.



The paisley pattern that originated in India is based on the shape of a mango.

A SUPER FUN SUPERFRUIT

Mangos are full of health-promoting nutrients and bioactive compounds. Scientific research continues to unlock new reasons to bite into this luscious, sweet fruit.

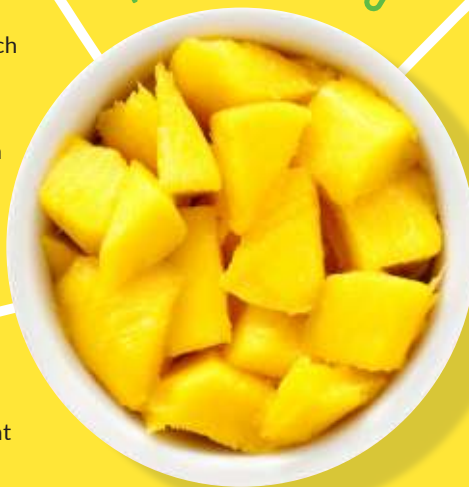
VITAMINS

- Excellent source of vitamin C, 50% DV, which plays an important role in immune function and skin health
- Good source of folate, 15% DV, which is vital for a healthy immune system
- 8% DV of vitamin A, which helps maintain healthy skin and eye health
- 8% DV of vitamin B6, which plays a critical role in metabolism, supports immune function and brain health

MINERALS

Good source of copper, 15% DV, which is essential for the development of collagen

*One serving of FRESH MANGO**



POLYPHENOLS

- Beta-carotene, lutein and other carotenoids account for the yellow color
- Anthocyanins contribute to the red in some varieties
- Other bioactive compounds include mangiferin, flavonoids (quercetin, catechin and epicatechin), gallotannins, gallic acid, and ellagic acid

DIETARY FIBER

2 grams or 7% DV of filling dietary fiber

NUTRITION RESEARCH

Studies have explored the potential impact of mangos on heart health, blood pressure, weight management, diabetes and gut health.

* 3/4 cup fresh mango pieces (124g), DV = Daily Value.
Source: U.S. Department of Agriculture, Nutrient Database for Standard Reference

A FEEL-GOOD TREAT

Mangos are so deliciously sweet that they feel like a treat, but they're extremely nutrient dense and can be a wholesome addition to your daily diet. In fact, an observational study that examined national food consumption data (NHANES) found that mango consumption was associated with better nutrient intakes and diet quality.¹ Adult mango eaters also weighed less, and children who ate mangos had lower sugar intakes compared to those who did not eat mangos. It may be that people who regularly eat mangos are making other smart lifestyle choices, but it's a good sign that enjoying a mango a day is a good idea!

Mangos not only contribute valuable nutrients, they're classified as a low glycemic food, which can be helpful for managing blood sugar levels, according to the American Diabetes Association.²

The bright yellow color of mangos is a clue that beta-carotene and other carotenoids are abundant in the pulpy flesh. These beneficial phytonutrients, along with other polyphenols, including mangiferin, quercetin, gallotannins and gallic acid, have been the focus of previous investigations of mangos.³⁻⁶

One review of existing studies on mangos concluded that the health benefits of isolated mango compounds and extracts from mango by-products have been well-documented, although more research is needed on the whole fruit.⁴

DIABETES AND OBESITY

Evidence supporting a potential role of mangos in diabetes and obesity prevention involve both animal studies⁷⁻¹⁰ and human trials.¹¹⁻¹³ Collectively, some of the human mango studies reported potential impact on maintaining normal blood glucose control, possibly through improvements in insulin action and glycogen synthesis.⁴ Other studies showed mixed results for different populations, suggesting that more research is needed.

A 12-week study of 20 obese adults, ages 20-50 years, found that regular consumption of mango helped maintain normal fasting blood glucose levels and did not negatively impact body weight, suggesting potential health benefits for individuals with metabolic disorders.¹¹

Animal and cell culture studies have explored effects on insulin resistance,¹⁴⁻¹⁵ glycogen metabolism and pancreatic beta-cell function.^{10, 16} In one animal study, rats fed freeze-dried mango experienced improved glucose tolerance and lipid profile and reduced body fat associated with a high-fat diet compared to the control group.¹⁴

The same research team fed rats freeze-dried mango and found improved glucose tolerance and lipid profiles without negative effects on bone health, which can be a risk with certain diabetes medications.⁸

Additional research with humans is needed to determine the benefits of mangos in diabetes control.

FRESH MANGO

Nutrition Facts

3/4 cup pieces

Serving size (124g)

Amount per serving

Calories 70

% Daily Value*

Total Fat 0g	0%
Saturated Fat 0g	0%
Trans Fat 0g	
Cholesterol 0mg	0%
Sodium 0mg	0%
Total Carbohydrate 19g	7%
Dietary Fiber 2g	7%
Total Sugars 17g	
Includes 0g Added Sugars	0%
Protein 1g	2%
Vitamin D 0mcg	0%
Calcium 14mg	2%
Iron 0.2mg	2%
Potassium 208mg	4%
Vitamin A 67mcg RAE	8%
Vitamin C 45mg	50%
Vitamin E 1.11mg	8%
Vitamin K 5.2mcg	4%
Niacin 0.828mg	6%
Vitamin B6 0.147mg	8%
Folate 53mcg	15%
Copper 0.137 mg	15%

*The % Daily Value (DV) tells you how much a nutrient in a serving of food contributes to a daily diet. 2,000 calories a day is used for general nutrition advice.



In a human trial of 12 lean and 9 obese adults, ages 18-65, the lean participants who consumed 400 grams of mango pulp each day for 6 weeks experienced lowered blood pressure. The obese participants experienced decreased inflammatory cytokines, which may have implications for obesity-related chronic diseases, the authors conclude.¹⁷ Additional research is needed with a larger sample size and longer duration. Long-term effects are not known.

An observation study found that mango eaters tend to weigh less than people who do not eat mangos,¹ which may be due to overall increased intake of fruits and vegetables or other lifestyle factors.

A cell culture study observed that mango peel (which is not typically eaten) inhibited the process of adipogenesis, which involves the production of mature fat cells.¹⁸ This hypothesis-testing study was exploratory. It is not known if the compounds in mango peel will play a role in regulating adipogenesis in humans. Similarly, mango polyphenols (gallotannin derivatives) were observed to have potential anti-obesogenic effects in mature fat cells.¹⁹ These cellular studies provide a hypothesis only and human clinical studies are needed to determine what the effect would be on humans.



GUT HEALTH

The research on mangos and gut health is still emerging, although early evidence indicates that mangos may have beneficial effects. Research conducted at Texas A & M University found that mangos were more effective in relieving constipation and reducing intestinal inflammation than comparable amounts of fiber.²⁰ In the four-week study, 36 men and women with chronic constipation were randomly divided into two groups: the mango group ate about 300 grams of mango a day (equivalent to about 2 cups or 1 mango), while the fiber group consumed a comparable amount of fiber powder, 1 teaspoon of psyllium fiber supplement (5 grams of dietary fiber). Mango consumption was found to be more effective in reducing the symptoms of constipation and increasing short-chain fatty acid levels, which indicate improvement of intestinal microbial composition. The mango group also experienced a reduction in certain biomarkers of inflammation, a benefit over fiber consumption.

A variety of cell culture and animal studies have explored the potential impact of mango consumption on the microbiome and intestinal inflammation. These findings are preliminary and only pertain to rats. Consequently, no conclusions can be drawn regarding effects in humans and more human investigations are needed.

Rats given a mango beverage experienced a reduction of certain biomarkers of inflammation in a model of colitis.^{21, 22} The study was conducted over a short period and had a small sample size. Longer-term and larger human investigations would be needed to determine the effect in humans. In another animal study, rats that consumed mango experienced a reduction of the loss of beneficial gut bacteria caused by a high-fat diet. Mango consumption also supported the production of short-chain fatty acids, suggesting greater microbial fermentation.²³ The analysis was only conducted with a high-fat diet. The outcomes for other types of diets are not known.

In a human clinical pilot trial of 32 participants, lean and obese adults (ages 18-50) were given 400 grams of mango pulp every day

Research on mangos has explored constipation and intestinal microbial composition.

for 6 weeks.²⁴ Only the lean participants experienced a significant increase in the production of gallotannin metabolites and a slight, non-significant increase in fecal short-chain fatty acids. SCFA are metabolites resulting from bacterial fermentation in the digestive tract that may play a role in gut health. It is unknown if the observed changes would be long lasting; additional research is needed.

Human clinical trials using whole mangos are currently underway to explore the potential impact of mango consumption on gut health.

HEART HEALTH

Emerging research suggests polyphenol-rich mangos may play a role in helping to maintain heart health.^{4, 5} In a human clinical trial of 97 adults in China, the overweight participants with hyperlipidemia who consumed mangiferin supplementation (150 mg/day) for 12 weeks experienced decreased serum levels of triglycerides and free fatty acids, and increased HDL or “good” cholesterol levels.²⁵ Other lifestyle patterns may have contributed to this outcome and it is unknown what the effects would be in a U.S. population.

In an observational study, adult mango consumption was found to be associated with lower levels of C-reactive protein, a risk factor for heart disease.¹ Another analysis of food consumption surveys using NHANES data did not find a relationship between fruit and vegetable intake and C-reactive protein levels. Findings on produce are mixed, more research is needed.

Emerging research suggests polyphenol-rich mangos may play a role in helping to maintain heart health.

Animal studies have also explored the role of mangiferin, the major polyphenol compound in mangos, in supporting normal cholesterol levels.²⁶ Ongoing research based on mango extracts

suggests that mango polyphenol compounds may interfere with multiple biological processes critical to the development of metabolic syndrome and heart disease.²⁷ It is not yet known if similar effects would be observed with whole fruit consumption, which may also be an area for further investigation.

These studies were primarily animal and cellular studies, so the findings are preliminary. No conclusions can be drawn regarding effects in humans, and more human investigations are needed.

Additional human clinical trials are currently underway to further explore the impact of mango consumption on blood pressure.



CANCER

Culture cell and animal studies have explored the connection between the compounds in mango and cancer risk.²⁸ The studies on mangiferin and gallotannins derived from mango have involved breast, colon and renal cancer cell lines.^{6, 28-31}

Researchers at Texas A & M found that mango polyphenols, specifically pyrogallol derived from gallotannins, helped suppress breast cancer cells in vitro at physiological concentrations.²⁹

As with all animal and cellular research, these studies are helpful for forming hypotheses for future investigations with humans. At this time, however, there are no potential benefits to humans and additional human clinical trials are needed to confirm these findings.

SKIN HEALTH

Few studies have been published on mangos and skin health, yet the data looks promising and additional research is warranted.

After all, mangos contain multiple nutrients that are linked to skin health, including vitamin A, vitamin C and copper. Vitamin A (retinol) is hydrophilic, or water loving, which helps draw water to the surface of the skin. The nutrient may help improve the texture, moisture and elasticity of skin. Vitamin C (ascorbic acid) has antioxidant properties and plays an essential role in collagen synthesis and protects against ultraviolet (UV)-induced skin damage. Copper is an essential mineral that plays a key role in the synthesis and stabilization of skin proteins.

Researchers in Korea studied hairless mice to explore the impact of mango intake on UV-induced skin aging.³² They found that mango extract was associated with the increase in skin thickness, wrinkle formation, and collagen fiber loss in hairless mice. Degradation of collagen is considered a major contributor to wrinkle formation and skin appearance. It is not known if mango extract alone was the cause.

Additional human studies investigating mangos and skin health are underway. One study is exploring the impact of mango consumption on facial wrinkles in postmenopausal women.

VITAMIN C

VITAMIN A

COPPER



EAT IT RIPE

Six major varieties of mangos are available at different times of the year, and each has a slightly different color.

So do not use color as a guide to determine if a mango is ripe. Pick it up instead and give it a squeeze. A ripe mango gives a bit when pressed. Mangos will continue to ripen at room temperature, becoming sweeter and softer over several days.



To speed up ripening, place mangos in a paper bag. Once ripe, mangos should be moved to the refrigerator, which will slow down the ripening process. Whole, ripe mangos may be stored for up to five days in the refrigerator. Mangos can be peeled, cubed and placed in an airtight container in the refrigerator for several days, or in the freezer for up to six months.



HONEY / ATAULFO



FRANCIS



HADEN



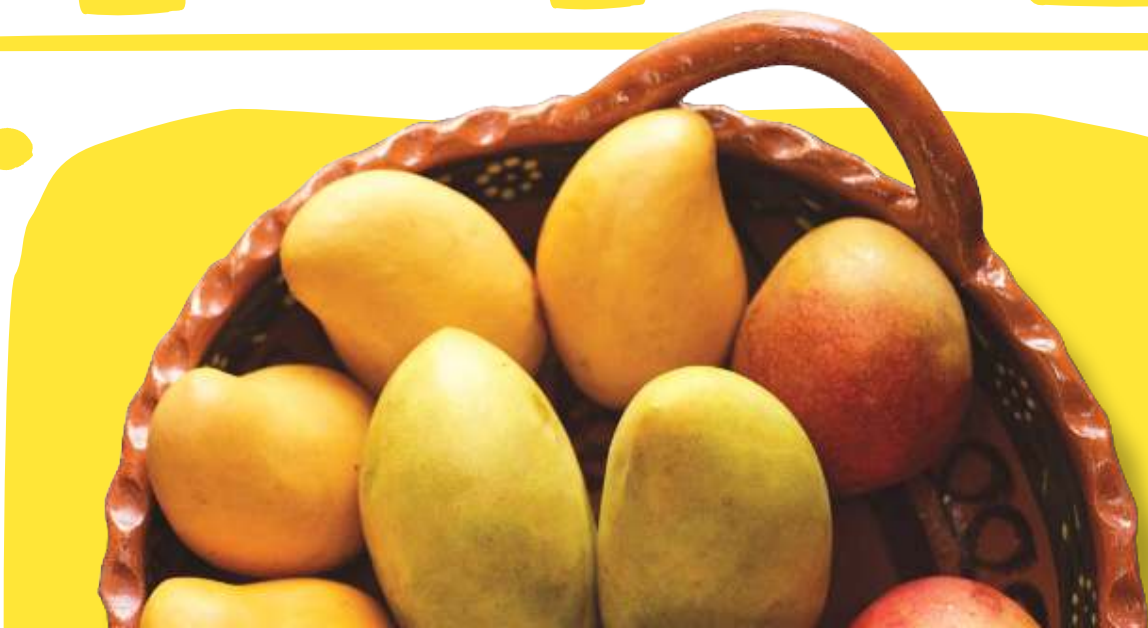
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TOMMY ATKINS





HOW TO CUT

It's easy to cut a mango. Just make sure you use a clean knife and cutting board, and always wash the mango before cutting.

Once you master how to cut around the long, flat seed in the center of the fruit, enjoying mangos is super simple.

1



With the stem on top, cut down slightly off center to the tip end.

2



Repeat on the other side, cutting as close to the seed as possible.

3



Cut the flesh in a grid-like pattern without going through the skin.

4



Use a large spoon to detach the flesh from the skin and scoop out the cubes. That's it, enjoy!

REFERENCES

- O'Neil CE, Nicklas TA, Fulgoni VL. Mangoes are associated with better nutrient intake, diet quality, and levels of some cardiovascular risk factors: National Health and Nutrition Examination Survey. *Journal of Nutrition and Food Sciences*. 2013;3:185.
- American Diabetes Association. Glycemic Index and Diabetes. <http://www.diabetes.org/food-and-fitness/food/what-can-i-eat/understanding-carbohydrates/glycemic-index-and-diabetes.html> (Accessed January 4, 2019)
- Barnes RC, Krennek KA, Meibohm B, Mertens-Talcott SU, Talcott ST. Urinary metabolites from mango (*Mangifera indica* L. cv. Keitt) galloyl derivatives and in vitro hydrolysis of gallotannins in physiological conditions. *Molecular Nutrition and Food Research*. 2016;60:542-550.
- Burton-Freeman BM, Sandhu AK, Edirisinghe I. Mangos and their bioactive components: adding variety to the fruit plate of health. *Food and Function*. 2017;13:32.
- Masibo M, He Q. Major mango polyphenols and their potential significance to human health. *Comprehensive Reviews in Food Science and Food Safety*. 2008;7:309-319.
- Nunez Selles AJ, Villa DG, Rastrelli L. Mango polyphenols and its protective effects on diseases associated to oxidative stress. *Current Pharmaceutical Biotechnology*. 2015;16:272-280.
- Gomes Natal DI, de Castro Moreira ME, Soares Miliao M, et al. Ubá mango juices intake decreases adiposity and inflammation in high-fat diet-induced obese Wistar rats. *Nutrition*. 2017; 32:1011-1018.
- Lucas EA, Brown A, Li W, et al. Mango modulates blood glucose similar to rosiglitazone without compromising bone parameters in mice fed high fat diet. *Journal of Pharmacy and Nutrition Sciences*. 2012;2:115-126.
- Saleh S, El-Maraghy N, Reda E, et al. Modulation of diabetes and dyslipidemia in diabetic insulin-resistant rats by mangiferin: role of adiponectin and TNF-alpha. *Academia Brasileria de Ciencias*. 2014;84:1935-1948.
- Perpétuo, G, Salgado, J. Effect of mango (*Mangifera indica* L.) ingestion on blood glucose levels of normal and diabetic rats. *Plant Foods for Human Nutrition*. 2003;58:1-12.
- Evans SF, Meister M, Mahmood M, et al. Mango supplementation improves blood glucose in obese individuals. *Nutrition and Metabolic Insights*. 2014;7:77-84.
- Fatema K, Ali L, Rahman MH, et al. Serum glucose and insulin response to mango and papaya in type 2 diabetic subjects. *Nutrition Research*. 2003;23:9-14.
- Guevarra MT, Panlasigui LN. Blood glucose responses of diabetes mellitus type II patients to some local fruits. *Asia Pacific Journal of Clinical Nutrition*. 2000;9:303-308.
- Lucas EA, Li W, Peterson SK, et al. Mango modulates body fat and plasma glucose and lipids in mice fed a high-fat diet. *British Journal of Nutrition*. 2011;106:1495-1505.
- Mohan CG, Viswanatha GL, Savinay G, et al. Penta-O-galloyl-beta-D-glucose, a bioactivity guided isolated compound from *Mangifera indica* inhibits 11beta-HSD-1 and ameliorates high fat diet-induced diabetes in C57BL/6 mice. *Phytomedicine*. 2013;20:417-426.
- Wang HL, Li CY, Zhang Y, et al. Mangiferin facilitates islet regeneration and beta-cell proliferation through upregulation of cell cycle and beta-cell regeneration regulators. *International Journal of Molecular Science*. 2014;15:9016-9035.
- Fang C, Kim H, Barnes RC, et al. Obesity-associated diseases biomarkers are differently modulated in lean and obese individuals and inversely correlated to plasma polyphenolic metabolites after 6 weeks of mango (*Mangifera indica* L.) consumption. *Molecular Nutrition and Food Research*. 2018;62:1800129.
- Taing MW, Pierson JT, Hoang VLT, et al. Mango fruit peel and flesh extracts affect adipogenesis in 3T3-L1 cells. *Food and Function*. 2012;3:828-836.
- Fang C, Kim H, Noratto G, et al. Gallotannin derivatives from mango (*Mangifera indica* L.) suppress adipogenesis and increase thermogenesis in 3T3-L1 adipocytes in part through the AMPK pathway. *Journal of Functional Foods*. 2018;46:101-109.
- Venancio V, Kim H, Sirven MA, Tekwe CD, Honvoh G, Talcott ST, Mertens-Talcott SU. Mango (*Mangifera indica* L.) polyphenols ameliorate functional constipation symptoms in humans beyond equivalent amount of fiber. *Molecular Nutrition and Food Research*. 2018;62:1701034.
- Kim H, Banerjee N, Barnes RC, et al. Mango polyphenolics reduce inflammation in intestinal colitis - involvement of the miR-126/PI3K/AKT/mTOR axis in vitro and in vivo. *Molecular Carcinogenesis*. 2016; 56:197-207.
- Kim H, Banerjee N, Ivanov I, et al. Comparison of anti-inflammatory mechanisms of mango (*Mangifera indica* L.) and pomegranate (*Punica Granatum* L.) in a preclinical model of colitis. *Molecular Nutrition and Food Research*. 2016;60:1912-23.
- Ojo B, El-Rassi GD, Payton ME, et al. Mango supplementation modulates gut microbial dysbiosis and short-chain fatty acid production independent of body weight reduction in C57BL/6 mice fed a high-fat diet. *Journal of Nutrition*. 2016;146:1483-91.
- Barnes RC, Kim H, Fang C, et al. Body mass index as a determinant of systemic exposures to gallotannin metabolites during six-week consumption of mango (*Mangifera indica* L.) and modulation of intestinal microbiota in lean and obese individuals. *Molecular Nutrition and Food Research*. 2019;63(2).
- Na L, Zhang Q, Jiang S, et al. Mangiferin supplementation improves serum lipid profiles in overweight patients with hyperlipidemia: a double-blind randomized controlled trial. *Scientific Reports*. 2015;5:10344.
- Gururaja GM, Mundkinajeddu D, Kumar AS, et al. Evaluation of cholesterol-lowering activity of standardized extract of *Mangifera indica* in albino Wistar rats. *Pharmacognosy Research*. 2017;9:21-26.
- Fomenko EV, Chi Y. Mangiferin modulation of metabolism and metabolic syndrome. *Biofactors*. 2016;42:492-503.
- Noratto GD, Bertoldi MC, Krennek K, et al. Anticarcinogenic effects of polyphenolics from mango (*Mangifera indica*) varieties. *Journal of Agricultural and Food Chemistry*. 2010;58:4104-4112.
- Nemec MJ, Kim H, Marcianti AB, et al. Pyrogallol, an absorbable microbial gallotannins-metabolite and mango polyphenols (*Mangifera indica* L.) suppress breast cancer ductal carcinoma in situ proliferation in vitro. *Food and Function*. 2016;11:33.
- Nemec MJ, Kim H, Marcianti AB, et al. Polyphenolics from mango (*Mangifera indica* L.) suppress breast cancer ductal carcinoma in situ proliferation through activation of AMPK pathway and suppression of mTOR in athymic nude mice. *Journal of Nutritional Biochemistry*. 2017;41:12-19.
- Banerjee N, Kim H, Krennek K, et al. Mango polyphenolics suppressed tumor growth in breast cancer xenografts in mice: role of the P13K/AKT pathway and associated microRNAs. *Nutrition Research*. 2015; 744-751.
- Song JH, Bae EY, Choi G, et al. Protective effect of mango (*Mangifera indica* L.) against UVB-induced skin aging in hairless mice. *Photodermatology, Photoimmunology and Photomedicine*. 2013;29:84-89.



National Mango Board
3101 Maguire Blvd, Suite 111
Orlando, FL 32803

Connect with us



@Mangoboard



@Mango_board

info@mango.org