Mangosteen – Traditional and Modern Uses

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Introduction – Traditional Use
Mangosteen (Garcinia mangostana) is a tropical fruit has been used as a traditional indigenous medicine across Southeast Asia (Thailand, Malaysia, Taiwan, Philippines, Indonesia, and Sri Lanka) for treatment of a wide range of ailments including fighting infections, healing wounds, and treating diarrhea and related gastrointestinal complaints. Mangosteen is known to contain a wide range of naturally-occurring polysaccharide and xanthone compounds within the fruit, leaves, heartwood, and especially the pericarp (rind/peel/hull) with widespread biological activities, including anti-inflammatory (Bennett 1989; Chomnawang 2005), antioxidant (Chiang 2003; Jung 2006), anti-proliferative (Ji 2006; Pedraza-Chaverri 2008), immunostimulatory (Matsumoto 2003), and antibacterial/antiviral effects in a number of experiments (Chanarat 1997; Pedraza-Chaverri 2008).

The pleasant taste (sweet and slightly acidic) and medicinal qualities of the reddish-purple mangosteen fruit has led to its common name as “Queen of Fruits” (Jung 2006). The demonstration of widespread biological effects of mangosteen-derived compounds, and especially of the family of bioactive xanthones (polyphenolic compounds, of which more than 1,000 have been described in nature, 18 isolated from mangosteen fruit, and 60 from the pericarp), suggest a scientific basis for the historical medicinal use of mangosteen preparations in Southeast Asian traditional medicine systems, including Ayurvedic medicine (Pedraza-Chaverri 2008). More “modern” health benefits of mangosteen preparations have been described in cases of arthritis (Pierce 2003), cancer (Ho, 2002), wounds (Mahabusarakam 1986; Wan 1973), inflammation (Saralamp 1996), ulcers (Harbone 1999), eczema (Morton 1987), acne (Chomnawang 2005), allergies (Nakatani 2002), and abdominal pain (Moongkarndi 2004), among many others (Pedraza-Chaverri 2008).

Scientific Evidence
Extensive laboratory and human clinical research has suggested a strong link between the mechanisms by which oxidative stress leads to chronic inflammation, which in turn may mediate a wide array of chronic diseases of “aging” including cancer, obesity, diabetes, and diseases of the cardiovascular, pulmonary, and neurological systems (Reuter 2010). Oxidative stress is known to activate numerous inflammatory pathways and transcription factors, including those for growth factors, cytokines, and cell cycle regulatory molecules, which may lead to transformation of a normal cell to a tumor cell (Reuter 2010). Reducing inflammation in overweight and obese individuals may be valuable in preventing the progression to metabolic syndrome with associated risks for heart disease and diabetes (Udani 2009).
Inflammatory conditions are typically multifactorial in their etiology. In obesity, for example, central adipose tissue is known to produce inflammatory cytokines including CRP and IL-6, which further influence insulin activity and glucose homeostasis (Rexrode 2003). Systemic chronic inflammation has emerged as a significant and specific predictor of cardiovascular disease, risk for myocardial infarction, and development of metabolic syndrome. Therefore the ability to reduce inflammation with mangosteen/xanthones may be an important and valuable preventive measure against the development of diabetes (Pradhan 2001 & 2003), heart disease (Pepys 2006; Ridker 2003; Tuomisto 2006; Willerson 2004), arthritis (Bradley 1992; Nicklas 2004; Reimold 2003), and inflammatory diseases of the lungs (Cazzola 2005; Martin 2002), digestive tract (Setoyama 2003), and skin (Breuer 2006; Groves 2004).

The pharmacological options for treating inflammation are numerous, including steroids and non-steroidal anti-inflammatory drugs (NSAIDs, such as aspirin, ibuprofen, and naproxen) – but their long-term use is associated with a range of potential adverse side effects including reduced resistance to infection and gastrointestinal bleeding (Caradoc-Davies 1984). As natural anti-inflammatory agents, mangosteen-derived xanthones, particularly alpha- and gamma-mangostins, are supported by a large body of scientific literature for their effects in various inflammatory pathways, including:

- Inhibition of both IgE-mediated histamine release and prostaglandin E2 synthesis from arachidonic acid as well as COX-2 activity in rat cancer cell lines (Chairungsrikerd 1996; Nakatani 2002a and 2002b).

- The major xanthone in mangosteen, alpha-mangostin, has shown antiplasmodal activity (Mahabusarakam 2006) and anti-larval activity (Ee 2006) in vitro.

- Various extracts of mangosteen (water, ethanol, ethyl acetate, methanol) have demonstrated antioxidant and neuroprotective activity in cell culture (Weecharangsan 2006).

- Antioxidant activity of mangosteen-derived xanthones has been demonstrated in direct free radical scavenging (Yoshikawa 1994), decreasing the oxidation of human low density lipoproteins (LDL) induced by peroxyl radical (Williams 1995), and prevention of alpha-tocopherol consumption during LDL oxidation (Mahabusarakam 2000). Such antioxidant effects have also been linked to neuroprotective activity (Weecharangsan 2006).

- Mangostin has shown antibacterial effects (in vitro) against staphylococcus aureus (Sakagami 2005; Voravuthikunchai 2005), Enterococci (Sakagami 2005), and Mycobacterium tuberculosis (Suksamrarn 2003) as well as a range of antibiotic-resistant strains of bacteria including methicillin-resistant S. Aureus (MRSA) and vancomycin resistant Enterococci (VRE) (Linuma 1996; Sakagami 2005).
• Chemopreventive effects of mangosteen extract have been demonstrated against rat colon carcinogenesis (Nabandith 2004) and against various human cell cultures of hepatic, lung, and gastric carcinomas (Ho 2002).

• In cell culture, alpha-mangostin induces apoptosis in a variety of human cancer cell lines (Matsumoto 2004a and 2004b; Moongkarndi 2004a), possibly due to antioxidant and/or anti-inflammatory activities (Moongkarndi 2004b).

• Direct anti-inflammatory activities of xanthones have been shown in rats challenged with the carrageenan-induced paw edema (Shankaranarayan 1979), and in cell cultures where both alpha- and gamma-mangostins inhibit histamine release (Chairungsrilerd 1996).

• Interestingly, a mouthwash containing mangosteen extract was found to reduce levels of volatile sulfur compounds associated with bad breath (Rassemeemasmaung 2007) and topical application of mangosteen xanthones has been shown to reduce acne (Chomnawang 2005; Saralamp 1996) and eczema (Morton 1987).

A recent human feeding trial evaluated the effects of a proprietary mangosteen (fruit plus pericarp) juice blend (Xango, Xango LLC) on markers of inflammation (highly-sensitive C-reactive protein, hs-CRP levels). The study was an 8 week randomized, double-blind, placebo-controlled design of 40 subjects that showed a significant change from baseline values (reduced CRP) in the subjects consuming mangosteen juice (Xango) compared to placebo (Udani 2009).

Conclusions
This brief overview of the traditional use and scientific evidence for mangosteen and mangosteen-derived xanthones demonstrates a long history of use of the fruit in traditional medicine systems around the world, as well as a detailed and extensive profile of the phytochemical constituents and pharmacological effects of the bioactive xanthone components that are richly and widely distributed in the mangosteen fruit and pericarp. The emerging clinical data suggests that whole mangosteen fruit preparations (fruit plus pericarp) containing a family of xanthone compounds may have important and considerable clinical potential in treating inflammation and a range of inflammatory conditions in human subjects. As such, the mangosteen is one of the few natural therapeutics from ancient traditional medicine systems that has stood the scrutiny of modern scientific evaluation. Further research should help elucidate and extend the health benefits of mangosteen to a wider population.

References


19. Gopalakrishnan C, Shankaranarayanan D, Kameswaran L, Nazimudeen SK. Effect of mangostin, a xanthone from


34. Mahabusarakam W, Kuaha K, Wilairat P, Taylor WC. Prenylated xanthones as potential
62. Reimold AM: New indications for treatment of chronic inflammation


