david@zestos.co.nz

Independent Scientific review on *Garcinia mangostana* and its related product mangosteen

David Whyte 23rd April 2006

The background for this review is that the *Garcinia mangostana* a tropical fruit grown and used in South East Asia has now become available in New Zealand as a drinkable product marketed as Mangosteen. A distributor of this product has requested an independent evaluation of the scientific literature. This is an introductory review to the scientific literature on *Garcinia mangostana.*

The standard database for all things medical is PubMed run by the USA based National library of Medicine and the National Institute of Health. This database has over 4 800 biomedical journals and 12 million articles indexed back to the 1960's. What is does not cover is the more obscure journals that may be published at a local or national level.

Searching this data base for *Garcinia mangostana* only a small number of papers are produced, 39 relevant citations. To put this in perspective the highly studied herb St Johns Wort has over 1000 citations. The lesser-known herbs of Valerian and Dong Quai have 462 and 142 citations respectively. What is not surprising that the *G. mangostana* references virtually all occur in the last 15 years as the interest in botanicals has increased. Furthermore 22 of them (56%) have been published after the year 2000. This would indicate that the research is very new. Therefore not surprisingly then is that only 8 studies have involved humans and no clinical trials have been undertaken.

What is also interesting is that searching under the promoted product mangosteen yields 22 relevant hits. With the majority being same studies as found under scientific herbal name. This indicates a strong cross over between the studies being undertaken, and the availability of the promoted product. This should hardly be surprising as the more studied herbs either come from two groups. The first being traditional Western herbs for instance St Johns Wort. Or the second being Chinese herbs that made significant inroads into the Western culture from the 1960's onwards. Therefore as the *G. mangostana* comes from the South East Asia it would be unlikely to attract attention until it was promoted in the west and available as a product to investigate.

Therefore we can conclude from the introductory literature search that this product is new to the market, with scientific work being greatly accelerated by the easy access of the plant extract. An area of concern would be that due to the small number of human studies and the small length of time under investigation potential side affects may not have been discovered, characterized or outlined. This could be especially important with any drug interactions. It should be mentioned however that in general herbs have very low side affects, unlike conventional medications.

Looking at the specific studies we can determine the following:

Xathone's are present [9H-xanthen-9-ones or (dibenzo-γ-pirone)]
Currently there are 11 different broad categories of bioactive plant compounds. xanthones are one of these, and it is the term used to describe the molecules that have 13 carbon atoms in the following shape. All bioactive plant compound groups have many different types. This is because they are quite reactive and associate with unique side chains. That is additional atoms easily bind to these basic building blocks to produce many new and unique shapes.

Xanthone was first synthesized in 1939, with its first use being an insecticide. Interestingly enough even thought it is highly toxic to insects it currently is not banned in any country nor is it listed as a ground water contaminate, hazardous air pollutant, persistent organic pollutant. Nor does it seem to be no significant detrimental affect to the human user.

There currently is an explosion of xanthone discovery. Between 2000 to 2005[1] 515 new xanthones were reported with 278 from natural xanthones. These xanthones have been identified from 20 families of higher plants (122 species in 44 genera), fungi (19 species) and lichens (3 species).

It would appear a significant number of xanthones are present in *G. mangostana* in the plant with the current count being 19[2].

Antioxidant activity
Three papers look at the antioxidant activity of the *G. mangostana*. Not surprisingly the xanthones have anti oxidant activity. However all three studies were undertaken in vitro, that is in a dish on the lab bench. Therefore it cannot be generalized that the *G. mangostana* has antioxidant activity in the human body. That is absorption across the intestinally wall and into human cellular system cannot be inferred from this work. However as most plant bioactives impact the body, it would be highly likely that the *G. mangostana* would provide antioxidant activity in the body.

Anti cancer properties
As nearly all new substances are checked for anti cancer properties it is not surprising that *G. mangostana* has also been investigated. This work is normally highly specialized and complex. Due to the inherent nature of this type of research. It can be gathered from the research that the xanthones in *G. mangostana* inhibits human leukemia cells[3]. Causes cancer cells to die in some liver, lung and other gastric cancers[4]. In another study it

[1] Current Medicinal Chemistry Volume 12, Number 21, 2005 Naturally-Occurring Xanthones: Recent Developments L.M.M. Vieira and A. Kijjoa
[2] Cytotoxic prenylated xanthones from the young fruit of Garcinia mangostana. Chem Pharm Bull (Tokyo). 2006 Mar;54(3):
[3] J Nat Prod. 2003 Aug;66(8):1124-7.
[4] Planta Med. 2002 Nov;68(11):975-9.

inhibited breast cancer growth and induced cancer cell death[5]. However it must be remembered that all of these studies was again in vitro. That was on the bench in lab, therefore the cells had very high concentrations of *G. mangostana.* Therefore we cannot conclude that *G. mangostana* will stop or illuminate cancers in humans. However the one animal study undertaken with rats showed that *G. mangostana* in the rats diet was chemopreventive in the short term against colon cancer and suggested that longer exposure might result in suppression of tumor development.

COX Inhibition

The body takes the fat that is in the cell walls and makes it into hormones for use in the direct area. One of the omega 6 essential fatty acid found in red meat and eggs is arachidonic acid. The body uses this to create inflammatory prostaglandins, especially E2 also called PGE2.

A signal in vitro (benchtop) study[6] looked at how *G. mangostana* prevented a fat being turned into prostaglandin E2 (PGE2). This is called cyclooxygenase (COX) inhibitor. It would appear from the study that both COX pathways (1 and 2) are inhibited by *G. mangostana.*

Again from a scientific point of view it cannot be concluded that an in vitro study can be applied in vivo, that is in the body.

Anti bacterial properties

A significant number of the studies looked at the anti bacterial properties of the *G. mangostana*

Conclusion

We can conclude that there is scant research around *G. mangostana*. It would appear that the research that has been undertaken has occurred since the *G. mangostana* become available under the Mangosteen branded product. Bench top studies show that it has significant levels of xanthones, and these xanthones are

- Anti oxidants
- Have anti cancer properties
- COX Inhibition

[5] J Ethnopharmacol. 2004 Jan;90(1):161-6.
[6] Biochem Pharmacol. 2002 Jan 1;63(1):73-9.

david@zestos.co.nz

However it cannot be concluded that the *G. mangostana* will have these properties when taken internally by humans. Furthermore the dose rates to achieve the above mentioned properties have not been calculated. For example assuming that COX inhibition was achieved in vitro, the does to achieve this has not been calculated. However just because the work has not been undertaken, does not mean that the above positive properties will not occur when taken by humans. In summary at this stage this is a product that shows strong potential to be beneficial but will be a number of years before this is proved or otherwise by the scientific community as further studies are undertaken.