

PHARMACOLOGICAL IMPORTANCE OF SOME FRUIT BEARING TREES ON PRINCEFIELD UNIVERSITY COLLEGE, EMERALD CAMPUS, HO, GHANA.

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ABSTRACT

Fruit bearing trees are flowering plants which are mainly grown for their fruits which are consumed by humans and some animals. In recent times some are also grown for their aesthetic value, however there are many fruit bearing trees that have medicinal uses as well. On Princefield University College (PUC) Emerald campus (Ho, Volta region), many fruit bearing trees have been identified on the campus as having medicinal properties. This paper sought to identify some of the medicinal properties of the various parts of such trees on the campus. The paper reviewed the following plants which were identified; *Magnifera indica*, *Carica papaya* and *Elaeis guineensis*. It is hoped

that this review will lead scientists into identifying the pharmacological benefits of the various parts of these fruit bearing trees.

KEYWORDS: *Magnifera indica*, *Carica papaya* and *Elaeis guineensis*.

INTRODUCTION

Medicinal plants have been sources of a number of important compounds which have been discovered during the last century. Research conducted on medicinal plants have served the dual purposes of bringing up new therapeutic agents and providing useful leads for studies directed towards the synthesis of drugs on the basis of the chemical structures of the natural products. Modern pharmaceutical industries still rely to some extent on the bioactive principle, obtained from plants. For example, the antimalarial agent artemisinin obtained from the Chinese herb *Artemisia annua* has been an effective drug in the treatment of

malaria.^[1] These plants are also used in their natural forms to treat various diseases under the general term herbal medicine. Herbal medicine deals with plants and plant extracts in treating diseases. The number of patients seeking herbal therapy grows each and every day. Herbal medicines which are less expensive, more compatible with the human body and due to their minimal side effects, are in great demand in the developing world for primary health care.

It is therefore necessary that we have in-depth knowledge on the medicinal uses of the many plants that encompass us. This paper identified three fruit bearing trees on PUC with medicinal effects and presents a review on description, parts identified with their specific medicinal uses based on valid studies performed.

MAGNIFERA INDICA

Mangifera indica is an important medicinal plant in the Ayurvedic and indigenous medical systems for over 4000 years. Commonly referred to as mango, this plant belongs to genus *Mangifera* which consists of about 30 species of tropical fruiting trees in the flowering plant family Anacardiaceae. *M. indica* is a large evergreen tree that grows to a height of 10-45 m, dome shaped with dense foliage, typically heavy branched from a stout trunk. The leaves are spirally arranged on branches, linear-oblong, lanceolate-elliptical, pointed at both ends. The inflorescence occurs in panicles consisting of whitish-red or yellowish-green flowers. The fruit is a well-known large drupe containing a thick yellow pulp, single seed encased in a hard, compressed fibrous endocarp. It is native from tropical Asia and is now found naturalized in most tropical countries.^[2]



Figure 1: A mango tree showing its leaves and fruits.

Its parts are commonly used in folk medicine for a wide variety of remedies. In Ghana (West Africa) *M. indica* is usually commonly used as herbal preparations in the treatment of toothache, gastrointestinal disorders, dysentery, diarrhoea, gastrointestinal tract infections, respiratory and urinary tract infections, sore gums and sore throats.

The mango leaves are reddish or purplish when tender and new and grows into dark green colour and pale underside. Mangiferin, being a polyphenolic antioxidant and a glucosylxanthone, it has strong antioxidant, anti-lipid peroxidation, immunomodulation, cardiogenic, hypotensive, wound healing, antidegenerative and antidiabetic activities. Mangiferin is extracted from mango at high concentration from young leaves (172 gm/kg) and from old leaves (94 gm/kg).^[3]

PHARMACOLOGICAL PROPERTIES OF *M. INDICA*

Analgesic and anti-inflammatory effects of *Mangifera indica*

In a research done by Islam *et al.*, (2010), to test the analgesic and anti-inflammatory effect of ethanol extract of mango leaves, data obtained were compared with commercially available analgesic and anti-inflammatory drug, diclofenac sodium. The degree of inhibition of leaves extract was 55.8% compared to the effect of standard analgesic drug, diclofenac sodium (75.28%). On the other hand, though leaves extract had a lower effect, they did not show any significant side effects when compared with the diclofenac sodium.

Antiulcer effects of *Mangifera indica*

Due to the reported side effects of available antiulcer drugs, focus was shifted to research more into herbal treatments used in ayurvedic practices especially mango leaves. At the end of the study Neelapu *et al.*, (2012) reported that “Mangiferin, a naturally occurring glucosyl xanthone of *Mangifera indica* affords gastroprotection against gastric injury most possibly through the antisecretory and antioxidant mechanisms of action which is consistent in the present study of *Mangifera indica* extracts which were able to prevent formation of ulcers. The antiulcer activity is probably due to the presence of bioactive compounds like flavonoids, saponin and tannins.” Further studies are required to confirm the exact mechanism underlying the ulcer healing and protecting property of the extract and to identify the chemical constituents responsible for it.

Antibiotic and antioxidant activity of *Magnifera indica*

In relation to the indigenous use of the bark, leaves and seeds as antibacterials and antioxidants, several studies attest to the potency and efficacy of such uses. El-Mahmood (2009) in a separate investigation stated that the aqueous stem bark extract of *M. indica* is active against both Gram positive and negative bacteria tested. The antibacterial effect of this plant extract could be attributed to the presence of some bioactive compounds like mangiferin and some phytochemical compounds like the flavonoids and resins. The extract was found to be active against *Salmonella typhi*, *Shigella*, *Proteus vulgaris*, *Staphylococcus aureus*, *Pseudomonas aeruginosa* and *Escherichia coli* but *Streptococcus faecalis* was resistant.^[6] This implies that extracts of *Magnifera indica* can be used to treat illnesses caused by such pathogens. *M. indica* are potential source of natural antioxidants, phytochemicals and antibacterial that can be used for the development of novel drugs and may represent new source of antimicrobials with stable, biologically active components that can establish a scientific base for further use in modern medicines.^[7]

Antifungal properties of *Magnifera indica*

Candida spp. is the most frequent agent of fungal infections of diabetic foot ulcers^[8] while studies carried out by Odds (1993), observed resistance of this fungal species to orally administered azole derivatives. The phytochemical analysis of methanolic extract of amchur (dried pulp of unripe mango) reveals the presence of tannins and terpenoids which have very good antifungal effects against *candida spp.* and other species.^[10] The leaves extract of *Magnifera indica* also showed antifungal activity against three fungal species *Aspergillus ustus*, *Aspergillus niger* and *Aspergillus ochraceus*.^[4] This would be an interesting topic for further study and possibly reducing fungal infections.

Antihyperglycemic activity of *Magnifera indica*

The mango leaves are very useful for treating diabetes. The tender leaves of the mango tree contain tannins called anthocyanidins, which helps to treat early diabetes.^[11] The leaves are dried and powdered or used as an infusion to treat the same. It also helps to treat angiopathy diabetes and diabetic retinopathy. Mango tea leaves are very good for this purpose. It also helps treat Hyperglycemia. The leaves contain a compound called taraxerol-3-beta, and ethyl acetate extract which synergize with insulin to activate GLUT4 and stimulate the synthesis of glycogen.^[11] Treatment with *Magnifera indica* extract showed signs of recovery as comparable with the standard drug glibenclamide.^[11]

Effects of *M. indica* on pregnancy

Since most drugs have effects and are thus contraindicated in pregnancy, studies were done on *Magnifera indica* leaf extracts. These results revealed that oral administration of aqueous *Magnifera indica* leaf extracts reduced weight gain, disrupted oestrous cycling, reduced serum follicle stimulating hormone (FSH) while increasing estradiol level in non-pregnant female Sprague-Dawley rats. It also reduced maternal weight and litter birth weight. However, it has no significant effect on duration of pregnancy.^[12]

CARICA PAPAYA

Pawpaw is one of the trees found on Princefield campus with a lot of health benefits. The scientific name for pawpaw is *Carica papaya*. *Carica Papaya* may be grown in well protected areas at sea level. The global production of *C.papaya* in 2004 was 6.75 million.^[13] *C. papaya* contains a lot of active ingredients that are obtained from the leaves, fruit, seeds and all parts of the tree that is used to treat various ailment as well as provide nutritional components essential for the growth and repair of worn out tissues in the human body. The unripe fruit is used among the Yoruba tribe of Nigeria for the treatment of various human and veterinary diseases including malaria, hypertension, diabetes mellitus, hypercholesterolemia, jaundice and intestinal helminthiasis.^[14]



Figure 2: A papaw fruit with its seeds (A); A papaw tree with fruits, branches and leaves (B) and A papaw leaf (C).

PHARMACOLOGICAL IMPORTANCE OF *C. PAPAYA*

Antiproliferative effect of *C. papaya*

Pawpaw extract contains (among other active ingredients) acetogenins which modulate the production of ATP (adenosine triphosphate) in mitochondria of cancer cells. This reduces the

growth of blood vessels that nourish cancer cells. It also inhibits the growth of multiple drug resistance cells.^[16] No other alternative or conventional cancer treatment (except treatments from trees similar to pawpaw) has shown any effectiveness against multiple drug resistance cells.^[16]

Most tumours contain a small percentage, approximately 2%, of multiple drug-resistant cells.^[16] Chemotherapy is not effective against these cells. After the first round of chemotherapy, if the chemotherapy is effective, all of the cells that are not multiple drug resistant do not show up in scans. Since this accounts for the vast majority of the tumour mass, the tumour will appear to be effectively gone. However, the multiple drug resistance cells remain and start to multiply. Eventually, a new tumour is formed that is entirely multiple drug resistant. The next time chemotherapy is used, none of the cells will disappear because they are all multiple drug resistant cells. Pawpaw and graviola are the only cancer treatments that have shown effectiveness against multiple drug resistance cells.^[16]

One of the effects of pawpaw is to reduce the ATP levels in each cell of our body. Our cells have an electrical potential that effects how the cell processes energy producing substances mostly blood sugar and oxygen from our blood supply. By reducing this voltage level from 70-110 mv to something in the 50 mv region, normal cells can still function.^[16] However, cancer and viral cells cannot process energy at this low voltage level and start to starve. The process of starving is a slower process than being poisoned which is why pawpaw works slower than chemotherapy. When pawpaw does not work, it is usually because it is not absorbed sufficiently into the cells of the body to cause this voltage reduction.^[16]

Nephroprotective effect of *C. papaya*

Consuming the seeds help minimize the possibility of renal failure and works effectively in alleviating kidney poisoning case. A study carried out by Olagunju *et al.* (2009) on nephroprotective activities of aqueous seed extracts of *Carica papaya* confirmed the rationale for the folkloric use of the aqueous seed extract of *Carica papaya* in the treatment of poison-related renal disorders.

In addition to the highlighted pharmacological activities of *C. papaya*, a number of other medicinal importance have been observed over the years.

A research conducted on 70 dengue fever patients, using *C. papaya* leaf and juice from the seed revealed an increase in white blood cells counts. Platelets levels were also normalized, thus restoring clotting.^[18]

The nutrients inside *C. papaya* seed can help the body and skin to rejuvenate better as some of the nutrients from the body is not easily self-regenerated. Seeds are rich in various amino acids such as glycine and leucine that are good for the skin.^[18]

The leaves of *C. papaya* contain chemical compounds of karpain, substances which kill microorganisms that interfere with digestion.^[18]

Taking small amount of *Carica papaya* seed effectively helps the body to detoxify and liberates it from any toxic substance that poses threat to the body.^[17]

With respect to the reproductive health, methanolic extracts from the seeds of pawpaw when consumed by men can lower sperm production therefore serving as birth control.^[19]

ELAEIS GUINEENSIS

Oil palm (*Elaeis guineensis*) is a tropical tree crop which is mainly grown for its industrial production of vegetative oil. It is a typical estate crop, grown and harvested over large uniform areas. Oil palm tree has an erect trunk reaching a height of 3.5 to 10.5 meters. Leaves are numerous, 3 to 4.5 meters long. Petioles are broad, armed on the sides with spinescent, reduced leaves. Leaflets are numerous, linear-lanceolate, nearly 1 meter long, 2 to 4 centimeters wide. Male inflorescence is dense, having numerous, cylindrical spikes which are 6 to 12 centimetres long and about 1 centimetre in diameter; the rachises excurrent as a stout awn. Female inflorescence is dense, branched, 20 to 30 centimetres long, the flowers densely disposed. It bears its fruits in large dense masses. The origin of oil palm points to Africa, in particular to West Africa which then spread across the world as dated back to the middle of 19th century. Palm yields two kinds of oil: the palm oil and palm-kernel oil.



Figure 3: Oil palm tree (*Elaeis guineensis*).

PHARMACOLOGICAL IMPORTANCE OF *ELAEIS GUINEENSIS*

Antioxidant properties of *Elaeis guineensis*

Antioxidants are molecules that prevent the oxidation of other molecules. Oxidation is a chemical reaction that can lead to production of free radicals that undergo chain reaction that may damage cells in the body. Red palm oil gets its characteristic dark red colour, which comes from carotenes such as alpha-carotene, beta-carotene and lycopene. Crude palm oil is considered to be the richest natural source of carotenoids (about 15 times more than in carrots).^[20]

The human body uses carotenoids as Vitamin A. Carotenoids also enhance immune function by a variety of mechanisms and can improve cardiovascular health. Carotenoids also play an important potential role by acting as biological antioxidants, thus protecting cells and tissues from the damaging effect of free radicals. These natural antioxidants act as buffers against free radicals and are believed to play a protective role in cellular ageing, atherosclerosis, cancer, arthritis and Alzheimer's disease.^[21]

In fact, no other vegetable oil has as much Vitamin E as compared to palm oil.^[22] Natural vitamin E exists in eight different forms or isomers, four tocopherols and four tocotrienols. Natural palm oil contains alpha, beta, gamma, and delta-tocopherols and alpha, beta, gamma, and delta-tocotrienols. Tocotrienols in Vitamin E have been found to have antioxidant and anti-cancer activities. Tocotrienols by its action on liver enzymes lowers blood cholesterol levels without reduction in good cholesterol (High Density Lipoprotein or HDL). A study by

a group of researchers in China comparing palm, soybean, peanut oils and lard showed that palm oil actually increased the level of good cholesterol and reduced the levels of bad cholesterol in the blood.^[23] Its antioxidant properties bring many benefits to the human body, such as preventing skin aging, preventing fat oxidation, and reducing blood pressure among others. Red palm oil antioxidant like tocotrienols and carotenes are added to foods and cosmetics due to their purported health benefits.^[24] Human studies have shown that palm tocotrienols have the ability to reverse blockage of the carotid artery and platelet aggregation (the clumping together of cells) thereby reducing the risk of stroke, arteriosclerosis, and ischaemic heart diseases.^[21]

Antiproliferative activity of *E. guineensis*

Gamma- and delta-tocotrienols derived from palm oil exhibit a strong activity against tumour promotion by inhibiting Epstein- Barr virus. The delta and gamma fractions of tocotrienols can inhibit certain types of cancer, including both the oestrogen- positive and oestrogen-negative breast cancer cells.^[21] Not only can the palm tocotrienols prevent the growth of these unwanted cells, but they can also do this in the presence as well as in the absence of oestradiol, thereby protecting against both hormone-related and other kinds of breast cancer.^[21] It is interesting to note that tocotrienols can inhibit or even kill normal cells, but only in extremely high amounts just as most any beneficial substance can be detrimental in excessive quantity. Malignant cells, on the other hand, are very sensitive to tocotrienols. In fact, the more cancerous the cell, the more susceptible it is to the destructive effects of tocotrienol, so very little is required to accomplish its favourable role of cancer cell annihilation.^[26]

CONCLUSION

Industrialization has led to the increase in chronic degenerative diseases with high cost in treatment. Mankind has been continuously using plants for the treatment of various ailments since the ancient period. According to WHO, about 80% of the world's population relies on traditional medicine for their primary health care.^[27] The biologically active constituents in these fruit bearing trees are vital for health and maintenance and also help in preventing chronic degenerative diseases of the body. All parts of these plant species possess medicinal activities which are helpful in curing many human diseases. Allopathic drugs have brought revolution throughout the world; however the plant based drugs have their own significance due to their little or no side effects.

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