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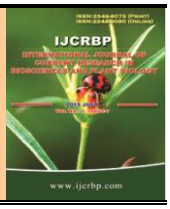

Review Article

Medicinal Utility of Egusi Melon (*Citrullus colocynthis* L.)

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A b s t r a c t

The recent trend of moving away from synthetic or chemical-based treatments, towards more nature-based remedies has not at all been condemned, with efficacy, safety, relative availability and affordability taking sides with the later. The seed of Egusi melon (*Citrullus colocynthis* L.), an annual herbaceous, monoecious plant which is grown mostly in tropical regions is up to 28% protein and 35% fats, with about 72% by weight unsaturated fatty acids, and 57.4% of it being polyunsaturated fatty acids (PUFA). PUFAs being essential fatty acids must be provided in the diet and egusi melon serves as a rich source. Preventive or therapeutic strategies to control hypercholesterolemia have focused on the manipulation of the amount and nature of dietary fat intake. Previous study has revealed that egusi melon oil contains nutritionally good amounts of linoleic acid and other essential fatty acids which have protective effect against coronary heart disease and that a possible mechanism is its inhibitory activity against lecithin: cholesterol acyltransferase activity, resulting in less amounts of cholesteryl ester produced. Its possible role as an anti-cancer, anti-benign prostate hyperplasia and anti-dermatitis food plant, as well as its much striking hypocholesterolemic effect is discussed.

K e y w o r d s

Citrullus colocynthis
Egusi melon
Heart disease
Hypocholesterolemic
Polyunsaturated fatty acid

Introduction

Commonly known as the colocynth, bitter apple, bitter cucumber, egusi, or vine of Sodom, Egusi Melon – *Citrullus Colocynthis* L., also referred to as *Citrullus lanatus* Thumb., *Curcurbita citrullus* L. or *Colocynthis citrullus* L., as documented by Quattrocchi (2000) in the *CRC World Dictionary of Plant Names A-C* belongs to the Cucurbitaceae family, a large plant family which consists of nearly 120 genera and 825 species (Milind and Kulwat, 2011). This plant family is known for its great genetic diversity and widespread adaptation which includes tropical and subtropical regions, arid deserts and temperate locations.

Curcubits are known for their high protein and oil content. Seeds of cucurbits are sources of oils and protein with about 50% oil and up to 35% protein (Achu, 2005). Specifically for these reasons they are cultivated and consumed world over. Only recently is it being discovered that this is *medicinal food*! Previous studies have shown that most "melons" have therapeutic and

nutritional value and these have been well documented. The edible family member, *Momordica charantia*, called bitter melon or bitter gourd in English, is a tropical and subtropical vine of the family Cucurbitaceae, widely grown in Asia, Africa, and the Caribbean for its edible fruit. This has been reported to have quite a number of medicinal uses ranging from antiviral, antidiabetic, antiulcerogenic, antioxidant and hepatoprotective (Semiz and Sen, 2007) to antihelmintic (Beloin et al., 2005), antimalarial (Waako et al., 2005), anticancer (Kohno et al., 2004; Kobori et al., 2008) to cardioprotective properties (Gadang et al., 2011).

Also, *Cucumis melo* (musk melon or cantaloupe) has been shown to possess useful medicinal properties which include anti-oxidant, free-radical scavenging, anti-platelet, anti-ulcer, anti-microbial, anti-cancer, anti-diabetic, anti-helmintic, anti-fertility, analgesic and anti-inflammatory (Milind and Kulwant, 2011). All through this write-up, "egusi" (*Citrullus colocynthis* L.) has been referred to as "egusi" or "egusi melon" for proper identification and consistency with the literature.

This review is in response to the obvious need for better healthcare, specifically from natural sources. The reasons behind this recent trend of moving away from synthetic treatments, to more naturally oriented remedies range from cardinal points like cost, availability and toxicity or safety, to idoesyncracies and policies.

A traditional food plant in Africa, this little-known vegetable, we agree with NCR (2006), has potential to improve nutrition, boost food security, foster rural development and support sustainable landcare. Now being added to the credits of egusi is a seemingly unprecedented medicinal potential, somewhat like a silver lining in the dark clouds of stroke, high blood pressure, heart failure, coronary heart disease, cancer, etc.

Description

Egusi seeds are small and flat. They grow in gourds which are mainly cultivated for their seeds as the flesh is neither sweet nor edible. One end of the seed is rounded while the other is tapered. Egusi melon is an annual herbaceous, monoecous plant which is creeping but non-climbing. Pollination is by insects and egusi melon fruits which are indehiscent smooth berries, often large and seedy, are ready for harvest 3-4 months after planting (Ng, 1993).

After harvest, the gourds are left to ferment; the fermented flesh is then washed off the seeds. The seeds are then dried and the light brown husks removed by hand or mechanically. When ready to be used in food recipes, the white/cream seeds (shown in Fig. 1) are ground into powder (Fig. 2) and used as soup thickener.

Fig. 1: Egusi melon seeds (Image courtesy: All Nigeria Recipe, 2012).

Fig. 2: Egusi melon powder (Image courtesy: All Nigeria Recipe, 2012).

Egusi seeds are in a class of their own and should never be mistaken for pumpkin or watermelon seeds. In particular the name "egusi" may refer to either or both plants (or more generically to other cucurbits) in their capacity as seed crops, or to a soup made from these seeds and popular in West Africa.

Botanical description

Kingdom	: Plantae
Division	: Magnoliophyta
Class	: Magnoliopsida
Order	: Cucurbitales
Family	: Cucurbitaceae
Genus	: *Citrullus*
Species	: *C. colocynthis*

Habitat

The food plant *Citrullus colocynthis* (shown in Fig. 3) could be rightly described as a desert plant of the Cucurbitaceae, naturally adapted to arid environments although Ng (1993) reported that they thrive in temperate locations in addition to tropical, subtropical and arid deserts.

Fig. 3: Egusi melon - *Citrullus colocynthis* (Picture courtesy: H. Zell, 2012)

Season

Egusi seeds are available all year round. This is because it is dried after harvest; in this state, it can be stored for a very long time. Cultivation is at the beginning of the rainy season, in the months of April through June, either on ridges or on flat ground in holes about 75-90 cm apart. It is harvested at the onset of the dry season, in the months of October through December.

Disease treatment and prevention

Heart disease

Heart disease is becoming more and more unpopular as it seems to have become a very frequent headline, of course, to the unquantifiable pain of families, health practitioners, caregivers and sufferers. Zaykoski (2011) reports in his review *Benefits of Unsaturated Fats & Protein in a Diet* that the American Heart Association estimates that more than 81 million people had at least one form of heart disease as of 2006. These diseases include stroke, high blood pressure, heart failure and coronary heart disease, and one type of unsaturated fat may reduce the risk of coronary artery disease and lead to lower blood pressure levels.

Yes, the body needs cholesterol for tasks such as maintaining the walls of cells. But too much of the "bad" type increases the risk of heart attacks and strokes. Usually people with high blood cholesterol levels are usually given drugs in order to block cholesterol production as well as lower the level of the type of cholesterol that furs up the arteries by forming fatty plaques. Too much of the "bad" type increases the risk of heart attacks and strokes. Consequently, development of methods for lowering Low Density Lipoprotein or LDL cholesterol levels is becoming, as it seems, a major focus of medical research.

A person's cholesterol levels can be affected by a variety of factors. They include diet, overweight, lack of exercise, age and gender, heredity and certain medications and diseases like diabetes. Although diet play a role in diseases of the heart and the blood vessels, but eating fatty foods does not necessarily mean that someone will develop plaques. The types of fats consumed also seem to be important; fats which add to bad cholesterol tend to contribute to atherogenesis because the plaques often contain cholesterol.

Now a worldwide epidemic is hypercholesterolemia, with its prevalence continuing to increase at a rapid rate in various populations and across all age groups (Beaglehole et al., 1988) poses a major public health challenge since it is a well recognized independent predictor of premature mortality (Stamler et al., 1986). According to Hetzel et al. (1989), changes in dietary and lifestyle habits, such as rapidly changing diets, increased availability of high fat foods and reduced physical activity of people in both developed and developing countries have been implicated for the dramatic increase in the occurrence of hypercholesterolemia over the past several decades.

Oguntola (2010) has reported that preventive or therapeutic strategies to control hypercholesterolemia have focused on the manipulation of the amount and nature of dietary fat intakes. Although diet plays a role in diseases of the heart and the blood vessels, but eating fatty foods does not necessarily mean that someone will develop plaques. The types of fats consumed also seem to be important; fats which add to *bad cholesterol* tend to contribute to atherogenesis because the plaques often contain cholesterol. In practice, the approach of reducing dietary cholesterol suffers from two limitations. The first is that cholesterol is present in all animal fats and many people are unwilling to sacrifice their preferred diet. The second is that the liver and other tissues synthesize cholesterol *de novo* if the dietary supply is inadequate (Oguntola, 2010).

Attention has shifted, in recent years, towards the role of nutritional supplement in the management of hypercholesterolemia. In a work by Oluba et al. (2008) reported that the oil from the seeds of egusi melon was used in diet formulation and fed (as a supplement to cholesterol-based diet) to rats for a period of 6 weeks to determine its effect on serum lipids and some selected serum enzymes used to aid diagnosis of cardiovascular disease. In addition, the fatty acid composition of the extracted oil was determined. The control rats were fed a diet containing 5% cholesterol without egusi melon oil while the experimental rats received a diet containing 5% cholesterol with 5% egusi melon oil. Serum cholesterol in the total, free and esterified forms were determined weekly. Egusi melon oil with a rich content of polyunsaturated fatty acid was found to produce a significant reduction ($p<0.05$) in serum total, free and esterified cholesterol and triglyceride concentrations. They also reported similar corresponding significant reduction ($p<0.05$) in serum activities of the enzymes studied, which included lactate dehydrogenase, aspartate aminotransferase and alanine aminotransferase, in the egusi melon oil-fed rats. In addition, feeding egusi melon oil (5% in the diet) to rats reduced severe atherosclerosis in the aorta and was found, from histopathological examination, to reduce foam cell formation and inhibit smooth muscle cell migration in the blood vessel of rats.

In studying the etiology of hypercholesterolemia-related metabolic disturbances such as atherosclerosis, cholesterol feeding has often been used to elevate serum cholesterol concentration. In a previous study by Oluba et al. (2011) using animal models, it was observed that egusi melon oil has the ability to improve serum and liver lipid profiles and offer protection against resultant lipid peroxides from consumption of high fat diet, thereby conferring an improved antioxidant status.

Ojieh et al. (2010), in another animal studies reported that egusi melon was found to show inhibitory activity against lecithin: cholesterol acyltransferase (LCAT) activity, resulting in less amount of cholesteryl ester produced and could be beneficial in reducing the incident rate of atherosclerosis. Egusi melon oil has been reported to contain nutritionally good amount of linoleic acid and other essential fatty acids which have been documented to have protective effect against coronary heart disease (Baylin et al., 2003; Wijendran and Hayes, 2004). It is quite evident from the study of Ojieh et al. (2010) that regulation of the activity of LCAT, especially by nutritional methods, could be a new target for therapy to prevent atherosclerosis.

Delvin (2006), in addition, reported clinical studies which shown that linoleic acid from plant and vegetable oils primarily decrease serum cholesterol levels, with modest effects on serum triacyglycerol. This lends credence to the hypocholesterolemic effect of egusi melon. This author suggested that at least four dietary components have an effect on serum cholesterol which is a risk factor for heart disease: polyunsaturated fatty acids (PUFAs), saturated fatty acids (SFA), fibre and cholesterol itself. He also put forward that a more significant reduction in cholesterol and triacylglycerol levels can be obtained by increasing the ratio of PUFA/SFA in the diet. Essential polyunsaturated fatty acids can be classified as either omega-6 or omega-3. The chief dietary source of omega-6 is linoleic acid which is the most abundant oil fraction in egusi melon oil (Oguntola, 2010; Oluba et al., 2011; Oluba et al., 2008; Bankole et al., 2005 and Schafferman et al., 1998).

Anti-Cancer

Cancer may now be confidently referred to as a much dreaded disease, and as an important cause of death, taking centre stage in the need for cures, especially research into complementary and alternative medicines as opposed to synthetic options or chemotherapy. Conjugated fatty acids (CFA) have received increased interest because of their beneficial effects on human health, including the potential to prevent cancer development. Many plant seed oils have been reported to contain conjugated trienoic fatty acids in the form of conjugated linolenic acids (CLN) (Chisholm and Hopkins, 1967; Liu et al., 1997). Tanaka et al. (2011) screened CLN from different plant seed oils to determine their cancer chemopreventive ability, including *Momordica charantia* L. (bitter melon), a family member of egusi melon's. They reported that in a short-term animal study, that dietary feeding with bitter gourd (*Momordica charantia*) seed oil for 5 weeks at three dose levels (0.01, 0.1, and 1%) caused a significant reduction in the frequency of colonic aberrant crypt foci (ACF), which are putative precursor lesions for colorectal cancer (CRC) in rats initiated with a colonic carcinogen, azoxymethane. A significant reduction in the multiplicity of ACF was found in rats fed the diet containing 0.01% bitter gourd oil, in which 0.006% CLN (9c,11t,13t-18:3) was present. Oluba et al. (2008) reported a 0.46% w/w of linolenic acid present in egusi melon oil. This may suggest why it is used in some parts of eastern Nigeria as remedy for benign prostate hyperplasia and prostate cancer. As a matter of emphasis, safety of CLN in humans needs to be confirmed if CLN is to be used as a

nutraceutical, as the exact biological effects CLN on the pathophysiological systems must be established, for example, in respect to its oxidative stability (Basch et al., 2003; Tsuzuki et al., 2004; Balakumar et al., 2007).

In fact, Ejike and Ezeanyika (2011) have documented successful inhibition of hormonally-induced benign prostate hyperplasia (BPH) in Wistar rats by the seeds of another member of the Curcubitaceae family, the fluted pumpkin (*Telfairia occidentalis* Hook f.). BPH, a tumor, involves hyperplasia of prostatic stromal and epithelial cells, resulting in the formation of large, fairly discrete nodules in the periurethral region of the prostate. Adenomatous prostatic growth is believed to begin at approximately age 30 years, with an estimated 50% of men have histologic evidence of BPH by age 50 years and 75% by age 80 years. In 40-50% of these patients, BPH becomes clinically significant (Rubenstein and McVary, 2008). *Curcubita pepo*, another pumpkin has been reported to be useful in inhibiting certain processes that result in aberrant growth of prostatic cells (Carbin et al., 1990; Gossell-Williams, 2006). It therefore may not be extraordinary that Egusi melon, which is of the same family as the plants above, is being used in the prevention, treatment and management of prostate pathologies and other cancers. This may be due to possible similarities in phytochemistry and maybe, nutritional composition.

Dermatitis

The skin is a very important part of the body and by surface area may be taken as the largest. Of course, its usefulness cannot be overemphasized but to clear any possible doubts, hypothermia is one fetal consequence of losing skin (thinning out or from burns). That on the big side, the skin being *comfortable* is sure a much desired quality as we will all *wear* our skins for as long as we live! Skin dryness and itchiness, in particular, are very serious problems in atopic dermatitis, which often lead to additional complications, such as opportunistic infections. In addition to other aspects of health, dietary fatty acids have been suggested to influence symptoms of atopic dermatitis (Horrobin, 2000; Proksch et al., 2003). Seed oils which are rich in essential fatty acids (EFAs), i.e. linoleic acid (18:2n6) and alpha-linolenic acid (18:3n3), and particularly seed oils that contain gamma-linolenic acid (GLA, 18:3n6), have been studied in patients with atopic dermatitis (Callaway et al., 2005), with varying degrees of success, and more recently in regard to immune response. Although there has not been a reported work on Egusi melon oil and dermatitis, it is only logical to say that Egusi melon oil, which is a rich source of EFAs, could be useful in preventing or alleviating symptoms of dermatitis.

Conclusion

A food plant mostly consumed not for its nutritive or medicinal value but as a complementary dish to starch food, egusi melon is finding a spot on the stage of modern nutraceutical research. These findings indicate that egusi melon is healthy, highly nutritive and has important medicinal properties. It holds a great potential as an anti-cancer and anti-benign prostate hyperplasia food plant and can enrich the body with essential oils and prevent the body from scaly dermatitis. Egusi melon also provides a rich source of unsaturated fatty acids, important among which is linoleic acid with hypocholesterolemic effect, implying a cardioprotective property.

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