Uses of *Cucumis metuliferus:* A Review

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Abstract: The main constraint of people in the developing world to modern medicine is poverty. This has led individuals to ancient times where uses of plants as a cure for various ailments are cheaper and easy to assess. People in the developing countries or rural areas rely on traditional medicine for their primary health care, majority of which use plants or their active principles. Another world wide problem is increase resistance of pathogens to commercial drugs; this has also necessitated a search for new antimicrobial substances from other sources, including plants. The plant *Cucumis metuliferus* and other plants of the family Cucurbitaceae have been reported to have medicinal value; this review is aimed at revealing some of the diseases or ailments that are treated with the plant *Cucumis metuliferus*.
[Usman J.G., Sodipo, O.A., Kwaghe, A.V. and Sandabe, U.K. **Uses of *Cucumis metuliferus:* A Review.** *Cancer Biology* 2015;5(1):24-34]. (ISSN: 2150-1041). http://www.cancerbio.net. 3

Key words: poverty, traditional medicine, resistance, plants, *Cucumis metuliferus*

Introduction

Plants have been used for various purposes since prehistoric times (Lawrence and Bennett, 1995; Evans, 2009) and medicinal herbs are being increasingly studied by pharmacological researchers (Sinclair, 1998). Indian Ayurveda medicine used herbs as early as 1900 BC describing about 700 medicinal plants (Aggarwal *et al*., 2007). Herbal medicine was also important from early days in Europe. Dioscorides, who became popular with natural remedies about 60 AD, described over 600 plants and plant extracts (Carr, 1997). It was not until recently that more attention was drawn to these practices. According to the World Health Organization (WHO) more than 80% of the world's populations rely on traditional medicine for their primary healthcare, majority of which use plants or their active principles (Gupta *et al.,* 2005). All over the world people strongly believe in the use of plants for food, forage, herbal medicine, fire, shade and for spiritual purposes. For example, the Teripes people of Panama still rely heavily on healing powers of plants, due to the difficulty in getting modern medical care for their day-to-day problems, even though the western medicine has been present in the region since the seventies (Gupta *et al.,* 2005); Zulu medicinal plants are traded and used all over South Africa (Lin *et al*., 1999). Many plants are used in Africa for the treatment of different diseases of man and animals such as coccidiosis (Usman *et al*., 2011), diarrhoea (Sodipo *et al.,* 2005; Dawurung *et al*., 2011), tuberculosis (Ofukwu *et al.,* 2008), skin diseases (Harsha *et al*., 2003), hyperlipidemia (La Cour *et al*., 1995), salmonellosis (Geidam *et al*., 2007) fever (Devi *et al*., 2003), dysentery (Hernández *et al*., 2003), and others which are typical diseases of a tropical country (Silva and Fernandes Jr., 2010). Reports of various plants used in the treatment of diseases have been documented in Nigeria (Alawa *et al*., 2008; Sofowora, 2008), Togo (Beloin *et al*., 2005), South Africa (Rabe and van Staden, 1997; Lin *et al*., 1999), Uganda (Hamill *et al*., 2003), Kenya (Fabry *et al*., 1998; Matu and van Staden, 2003), Ethiopia (Gedif and Hahn, 2003), India (Harsha *et al*., 2003; Nandagopalan *et al*., 2011), Belize (Camporese *et al*., 2003), Turkey (Yeşilada *et al*., 1995), Columbia (Ritch-Krc *et al*., 1996), Panama (Gupta *et al*., 2005), Italy (Guarrera, *et al*., 2005), Mexico (Hernández *et al*., 2003), Australia (Semple *et al*., 1998). Increased attention on ethnoveterinary medicine (EVM) is justified because it is accessible, easy to prepare and administer at little or no cost at all (Jabbar *et al.,* 2005). These practices may be the only option in areas where conventional services are economically unavailable or cannot be effectively reached (Mathias and McCorkle, 2004). Many EVM practices do work and make sound

veterinary sense (Schillhorn van Veen, 1996). Herbal medicines are known to be broad spectrum and therefore may be a future answer to pathogen resistance to conventional drugs (Mwale *et al.,* 2005). These have necessitated a search for new antimicrobial substances from other sources including plants (Erdogrul, 2002).

The use of plant resources mainly for herbal medicine, food, forage etc in Nigeria represents a long history of human interaction with the environment and their *in vitro* and *in vivo* properties to microbial pathogens have been widely reported (Hashish and Gomaa, 2003; Iwalokun *et al.,* 2004). These herbs have many potential clinical and therapeutic applications in the modern medical setting, as numerous studies have revealed that they contain bioactive components, which have resulted in a better understanding of their physiological, therapeutic and clinical actions (Merken *et al.,* 2001; Zheng and Wang, 2001). Antimicrobial agents can also be derived from herbs, and over 1000 plants exhibit antimicrobial effects (Nychas, 1995). The plant *Cucumis metuliferus* (Cucurbitaceae) is a monoecious annual herb with staminate flowers that grows wild (Wannang *et al.,* 2007). It flowers and fruits from July to September and the fruits ripen from October to December (Bates *et al.,* 1990), the unripe fruits are green while the ripe fruits are yellow to orange-red in colour (Burkill, 1985; Anon a, 2009). The common English names are: African horned cucumber, jelly melon and kiwano. In Nigeria it is locally called 'bùurar zaàki', 'nòònon-kuùraà', 'gautar kaji' (Burkill, 1985; Anon a, 2009; Wannang, 2011).

The Plant Description and Distribution

Cucumis metuliferus E. Mey. ex Naudin belongs to the family Cucurbitaceae. It is commonly referred to as African horned cucumber, jelly melon, Kiwano in English. In Nigeria it is called 'bùuràr zaàki', 'nòònòn-kuùraà' 'gautar kaji' by the Hausas (Burkill, 1985; Anon a, 2009; Wannang, 2011).

Cucumis metuliferus is an annual climbing or rarely trailing herb; vegetative parts are rough with spreading hairs. Stems are up to 3 m long, radiating from a woody rootstock. The leaves are broadly ovate-cordate in outline, up to 90 x 100 mm, unlobed or usually palmately 3–5-lobed, margins minutely toothed; leaf stalks (petioles) up to 100 mm long. Both male and female flowers appear on the same plant (monoecious). Male flowers are solitary or up to 4 in sessile or short-stalked groups, greenish to light yellow, the corolla is 5–10 mm long. Female flowers are solitary on 20–60 mm long stalks; the ovary is up to 20 mm long, pale green with numerous minute, dark green, fleshy spines, the corolla is yellow, 8–15 mm long. The fruit is ellipsoid-cylindrical, obscurely trigonous (triangular in shape), 60–150 mm long, 30–60 mm across when ripe, the scattered spines are rather stout, fleshy, 10 x 2–5 mm, broad-based, deep green-grey, ripening yellow to orange-red with obscure longitudinal stripes of small pale markings and rather softly fleshy. Seeds are ellipsoid, flattened, 6–9 mm long, numerous, embedded in a light green or emerald-green, jelly-like flesh (Burkill, 1985; Anon a, 2009).

Cucumis metuliferus grows naturally in tropical Africa south of the Sahara down to Senegal, Nigeria, Namibia, Botswana, South Africa and Swaziland. In Nigeria, it is found in Jos, Plateau State. In South Africa it is found in Limpopo, Mpumalanga and KwaZulu-Natal. It has also been recorded in Yemen and is occasionally cultivated in South Africa and elsewhere. This specie usually grows in shallow or deep, well-drained sand, mostly in alluvial soil on river banks, in river beds or flood plains; it is also recorded from clay or loam soil and rocky slopes. It climbs on trees, shrubs or grass in various vegetation types such as forest edges (often riverine), semi-evergreen forest, deciduous woodland (often with *Acacia*), savanna or grassland. The jelly melon also grows in disturbed areas and abandoned land (Burkill, 1985; Anon a, 2009).

Derivation of the Name

The genus name *Cucumis* is the Latin name for the cucumber which was already cultivated in Ancient Egypt. *Cucumis* is a genus of more than 32 species, indigenous mainly to Africa, also Asia, Australia and some islands in the Pacific. It includes two major commercial vegetable crops: *C. sativus* (cucumbers, from Asia) and *C. melo* (melons, from Africa and Australia, asia), and two minor ones: the West Indian gherkin *(C. anguria)* and the kiwano *(C. metuliferus)*. These last two species became cultivated crops outside their native Africa (Burkill, 1985; Anon a, 2009).

The specie name *metuliferus* refers to the sharp spines on the fruit, from the Latin word, *metula,* meaning a small pyramid, and *ferus,* meaning bearing. The Cucurbitaceae family consists of about 120 genera and 735 species that are cosmopolitan in mostly tropical and subtropical countries. Many species are cultivated and are of economic importance as food plants such as pumpkin, watermelon and also cucumber and melon as listed above. Members of this family are annual or perennial herbs or shrubs (Burkill, 1985; Anon a, 2009).

Ecology

Cucumis metuliferus grows at an altitude of 210 m to as high as 1800 m above sea level. Based on the information on specimen labels in the National

Herbarium, the flowering time is from about January to May, while the fruiting time is from about February to July. Birds eat the juicy ripe fruits. Hollowed-out shells are often found on the ground; rodents, primates and small antelopes (e.g. steenbok) nibble on the fruit. Jelly melons lack the layer of firm flesh found in cultivated cucumbers, thus containing proportionately more moisture; therefore providing a useful source of water for humans and animals in arid areas (Burkill, 1985; Anon a, 2009).

Various Species of *Cucumis*

Cucumis is a genus of vines in the gourd family, Cucurbitaceae. It includes many important food plants, such as cucumber, muskmelon, and kiwano melon. *Cucumis sativus*, or the cucumber, and *Cucumis melo*, or muskmelon, are both widely cultivated. The muskmelon, or true melon, has many varieties, including cantaloupe and honeydew (Burkill, 1985; Anon a, 2009).

C. sativus, the cucumber, originated in India, and is now cultivated throughout the world. Many different varieties have also been developed. The cylindrical fruit, mix in cuisine as a vegetable, is eaten when green. The fruit becomes yellow when it is ripe, but the mature fruit is considered too sour and bitter. Cucumber is usually eaten raw or pickled, and certain varieties are intended for food or medicinal use (Anon a, 2009).

C. melo, the melon or muskmelon, is native to Persia and the surrounding areas, and like *C. sativus*, is now widely cultivated. Varieties of *C. melo* can be divided into smooth skinned and netted melons. In addition to their fruit, melons may be grown for their scent, seeds and oil, or their skin, which can be dried and used as a substitute for leather. *C. melo* varieties vary greatly in both colour and flavour (Anon a, 2009).

An interesting *Cucumis* species is *C. metuliferus*, the kiwano or horned melon. Native to Africa, *C. metuliferus* is also grown in Australia, New Zealand, Chile, and California. The fruit is bright orange when ripe and covered in sharp spikes, with a bright green, gelatinous flesh. Its taste has been compared to a combination of cucumber and banana. It is often eaten raw, as a snack, but may also be used in cooking (Burkill, 1985; Anon a, 2009).

C. anguria, or the West Indian gherkin, is another *Cucumis* species with a spiked fruit. It is native to Africa, but popular in Brazil, where it is used in a meat stew. The flavour of *C. anguria* is similar to that of the cucumber (Anon a, 2009).

C. humifructus, Southern African specie, is commonly called Aardvark cucumber or Aardvark pumpkin, because it is the only fruit eaten by the Aardvark. It is also the only *Cucumis* species with a fruit that grows underground. Another southern African species with a spiked fruit, *C. myriocarpus* or paddy melon, has become a weed in California and Australia. Unlike many *Cucumis* species, *C. myriocarpus* is toxic. It can kill livestock and has historically been used by humans as an emetic, to induce vomiting. (Burkill, 1985; Foster, 2003; Anon a, 2009).

The nutritional value of raw horned melon (*Cucumis metuliferus*) is shown in table 1.

Table 1: Nutritional value per 100g of a raw horned melon (*Cucumis metuliferus*).

Nutrients	Nutritional value
Carbohydrates	7.56 g
Fat	1.26 g
Protein	1.78 g
Water	88.97 g
Vit. A equiv.	7 µg (1%)
-beta carotene	88 µg (1%)
Thiamine (vit B_1)	0.025 mg (2%)
Riboflavin (vit B_2)	0.015 mg (1%)
Niacin (vitB_3)	0.565 mg (4%)
Pantothenic acid (B_5)	0.183 mg (4%)
Vitamin B_6	0.063 mg (5%)
Folate (vit B_9)	3 µg (1%)
Vitamin C	5.3 mg (6%)
Calcium	13 mg (1%)
Iron	1.13 mg (9%)
Magnesium	40 mg (11%)
Manganese	0.039 mg (2%)
Phosphorus	37 mg (5%)
Potassium	123 mg (3%)
Sodium	2 mg (0%)
Zinc	0.48 mg (5%)

Percentages are relative to US recommendations for adult.
Source: USDA Nutrient Database In: Anon b, 2013.

Uses of Other Plants within the Family Cucurbitaceae

The plants of the family Cucurbitaceae play an important role in health care for the treatment of various ailments. Some plants of the family Cucurbitaceae have shown anti-diabetic activity, these are *Cocinia indica* (ivy gourd), *Momordica cymbalaria* (kaarali-kanda), *Momordica dioica* (small bitter gourd), *Cucumis trigonus* (indravaaruni) and *Luffa tuberose* (wild luffa) (Sharma and Arya, 2011). *Bryonia alba* L. is for rheumatic pain (Yeşilada *et al*., 1995), *Luffa operculata* Cogn. for sinusitis, *Corallocarpus epigaeus* is used for wounds, obesity, skin disease, tumours, cough and bronchitis

(Nandagopalan *et al*., 2011). *Coccinia grandis* (Linn.) J. O. Voight is used for eye diseases, *Lablab purpureus* is for inflammation, colic and urinary retention (Nandagopalan *et al*., 2011). *Sechium edule* (Jacq) SW. is used as a diuretic, local anaesthetic and for hypertension (Burkill, 1985; Rivera and obón, 1995). *Citrullus vulgaris* Schrad. is for weakness, *Citrullus colocynthis* (Linn.) Schrad. (Colocynth bitter apple) the sap of unripe green fruit is used for treating scorpion stings (Hutt and Houghton, 1998), tumours, leucoderma, ulcers, asthma, bronchitis, jaundice, elephantiasis, tubercular glands of the neck and splenomegaly (Nandagopalan *et al*., 2011). Juice of fresh squeezed leaves of *Zehneria scabra* Sond. is used to treat diarrhoea, headache and fever (Gedif and Hahn, 2003). A decoction of the plant *Ruthalicia longipes* (Hook. F) C. Jeffrey is used in Ivory Coast to relieve stomach-ache, scrotal elephantiasis and jaundice (Burkill, 1985). *Ruthalicia eglandulosa* (Hook. F) C. Jeffrey has a medico-magical application in Liberia to treat shortness of breath (Burkill, 1985).

Lagenaria siceraria (Molina) Standl. is for cough, bronchitis, asthma, fever, inflammations, leprosy, skin diseases, decaying teeth, flatulence and baldness (Nandagopalan *et al*., 2011). The pulp is used in Asian medicine as a diuretic, antiemetic, antidote against certain poisons and to soothe cough (Burkill, 1985). In India the seed is taken orally or the seed-oil is applied externally for treating headaches, the leaves are used as a purgative. In Nigeria and India the leaf decoction is given for jaundice while in Congo, a dressing of crushed leaves and palm oil is applied for urticaria caused by caterpillars in Congo (Burkill, 1985). *Lagenaria breviflora* (Benth.) Roberty is used as a cathartic, vermifuge and treating headache in Nigeria, and as a purgative in Tanganyika (Tanzania) [Burkill, 1985]. In Ivory Coast the sap of *Lagenaria guineensis* (G. Don) C. Jeffrey is used as acollyrium (eyewash) for opthalmias (Burkill, 1985). The leaves and expressed sap of *Luffa acutangula* Roxb. (Angular sponge loofah, Ridge gourd), are applied to sores in West Africa. In Senegal, the poultice is put on to cutaneous eruptions and on to guinea-worm sores to kill worm. The leaves are used in India as a poultice for piles, leprosy and splenitis and leaf-sap for granular conjunctivitis in children eye-wash. Leaf decoction has been used for uraemia, amenorrhoea and treating itch. The roots are used in India and Asian Russia as purgative. The entire plant and seed are insecticidal (Burkill, 1985). The plant has also been reported to have anti-diabetic activity (Sharma and Arya, 2011). The entire seeds of *Luffa cylindrica* (Linn.) M.J. Roem. have emetic, cathartics and anthelmintic effects (Burkill, 1985). The leaves promote wound healing in Gabon, in Congo it is used to maturate abscesses and to kill filarial. In South Africa the leaf-infusion is taken by the Zulu tribe for stomach-ache. In Tanganyika leaf sap is added to a root decoction to prevent abortion. A root preparation in Gabon is used for the treatment of cancer of the nose (Burkill, 1985). *Kedrostis foetidissima* is for anaemia (Saravanan and Manokaran, 2012). *Telfairia occidentalis* is commonly eaten in Nigeria and has been shown to increase haematological parameters, the leaves are used as a haematinic (Dina *et al*., 2000; Ifeanyi *et al*., 2014).

The seeds and flowers of *Cucurbita pepo* Linn. have been used as a an anthelmintic, taenicide, as well as for treating ear ache and anaemia. The seed if eaten by poultry, ostrich and cattle in South Africa causes craziness and symptoms of paralysis. In Congo, the seed lightly torrefied and crushed in water when given to a woman in labour helps to promote delivery. The flowers are used cosmetically in Iran to improve complexion and medically for alleviating chest problems. The poultice of the fruit-pulp is used for minor burns, boils and inflamed swellings or applied as a cooling compress for headache and neuralgia. It has been recorded for use on tumours of the eye, liver and corns on the feet (Burkill, 1985). The seed of *Cucurbita maxima* Duch. in Nigeria and India, is considered as a tonic, taenicide and a dry a diuretic. In Senegal, the sap from the roots is used for treating otitis (Burkill, 1985) and Amorim *et al*. (1991) also showed that *Cucurbita maxima* has antimalarial activity. *Cucurbita moschata* for burns, scalds, inflammations, abscesses, boils, migraine and neuralgia (Nandagopalan *et al*., 2011). The fruit of *Cucurbita ficifolia* Bouché is used as a diuretic and an analeptic (Rivera and obón, 1995). *Mukia maderaspatana* (Linn.) M.J. Roem. is used for burning sensation, flatulence, colic, ulcers, cough, asthma, neuralgia, nostalgia, odontalgia (toothache), vertigo and anaemia (Nandagopalan *et al*., 2011; Saravanan and Manokaran, 2012). Decoction of young shoots and leaves is used in Nigeria as aperients especially in children. The fruit in Senegal is used as a vermifuge and the root is chewed in Nigeria for relieve of facial neuralgia and toothache (Burkill, 1985).

Momordica balsamina Linn. (Balsam apple) the whole plant is used as a bitter stomachic, emetic and a purgative. The Fula of Senegal used it as a vermifuge, the Yoruba from Nigeria used the juice expressed from the leaves for expelling roundworm (Ascaris) and threadworm in children. A macerate of the whole plant to which salt has been added is used in Senegal as a galactogogue and to increase milk yield of cows (Burkill, 1985). The fruit mixed with olive or almond oil is used for piles in U.S.A; for festers, inflammations, swellings, yaws, burns, intermittent fever, burning sensation of sole, nyctalopia (night

blindness), diabetes, asthma, cough (Burkill, 1985). The fruit has emetic and cathartics effects. The seed soaked in water and then inserted in the neck of the womb is a method of producing abortion practiced by the Mbula tribe of Northern Nigeria. The root is aphrodisiac (Burkill, 1985). The methanolic extract of *Momordica balsamina* is used for the treatment of diabetes in streptozocin induced rats (Sharma and Arya, 2011). *Momordica charantia* Linn. (Balsam pear, Bitter melon) is used for the treatment of diabetes (Sharma and Arya, 2011), it is used as a laxative, for the treatment of fever, stomach-ache, as a taenifuge and anthelmintic in West Africa (Burkill, 1985). The fruits are used as purgative and vermifuge in Senegal. In Ghana and Nigeria the leaves are steeped in water for treating diarrhoea and dysentery (Burkill, 1985). A plaster of pulverized plant is used in Nigeria for the treatment of malignant ulcers, cancer of the breast, scabies and other skin problems. (Burkill, 1985; Beloin *et al*., 2005), the plant has been used as an insecticide in Haiti. The leaves are used in Senegal for painful menstruation, roots for syphilis and rheumatism (Burkill, 1985). It has also been used as abortificient, for birth control, and to help relief pain after childbirth (Beloin *et al*., 2005). Bitter melon also has activity against gastrointestinal diseases and extracts have shown activity *in vitro* against the nematode worm *Caenorhabditis elegans*.(Beloin *et al*., 2005). Two compounds extracted from bitter melon, α-eleostearic acid (from seeds) and 15,16-dihydroxy-α-eleostearic acid (from the fruit) have been found to induce apoptosis of leukemia cells *in vitro* (Kobori *et al*., 2008). Diets containing 0.01% bitter melon oil (0.006% as α-eleostearic acid) were found to prevent azoxymethane-induced colon carcinogenesis in rats (Kohno *et al*., 2004). The extract from bitter melon, commonly eaten and known as *karela* in India have been reported to kill breast cancer cells and prevents them from multiplying (Ray *et al*., 2010). Tea from its leaves is used for the treatment of malaria Colombia. Bitter melons are boiled and stir-fried with garlic and onions, this dish are served to prevent malaria (Waako *et al*., 2005). In Togo, the plant is traditionally used against viral diseases such as chickenpox and measles. Tests with leaf extracts have shown *in vitro* activity against the Herpes simplex Type 1 virus, apparently due to unidentified compounds other than the momordicins (Beloin *et al*., 2005). Laboratory tests suggest compounds in bitter melon might be effective for treating HIV infection (Jiratchariyakul et *al*., 2001). Lolitkar and Rao (1962) extracted from the plant (Bitter melon) a substance, called charantin, which had hypoglycaemic effect on normal and diabetic rabbits. Other compounds in bitter melon have been found to activate the AMPK, the protein that regulates glucose uptake ; a process which is impaired in diabetics (Min-Jia *et al*., 2008). Bitter melon has been found to increase insulin sensitivity (Sridhar *et al*., 2008).

Cucumis sativus Linn. is for fever, insomnia, bronchitis, jaundice, haemorrhages, anthelmintic and general debility (Nandagopalan *et al*., 2011). In India it is used for sore throat and as a diuretic. The juice is said to banish fish-moth and woodlice, peel left on the floor at night when eaten by cockroaches will kill them after 3-4 nights (Burkill, 1985). Bellucio *et al*. (2008) also showed that *Cucumis sativus* extract has anti-oxidant activity by not changing the radiolabelling (Technetium-99m) of red blood cells and plasma proteins *in vitro* in rats. *Cucumis trigonus* is used for various ailments such as anthelmintic, liver tonic, cardio tonic, appetizer, expectorant, for treatment of jaundice, leprosy, diabetes, cough, anaemia, constipation and it is intellect-promoting (Balakrishnan and Kokilavani, 2012). The taproot of *Cucumis figarei* Naud. when dried and finely pulverized is used in northern Nigeria like snuff for the relieve of toothache (Burkill, 1985). *Cucumis prophetarum* Linn. in Mauritania is used for milk production, in Ethiopia the fruit is used as an abortifacient in women and to hasten expulsion of placenta in cows. In northern Nigeria the fresh fruit with an end cut off is applied thimble-like as a dressing for an inflamed finger. It is used as a vermifuge with the addition of sodium carbonate (Na_2CO_3) for horses by the Hausas. It can be used as an emetic and in small doses with honey as a stomachic for children (Burkill, 1985). *Cucumis melo* Linn. Plant extracts have been shown to inhibit fungal activity, the root has been found to contain emetic principle (Burkill, 1985).

Uses of *Cucumis metuliferus*

Culinary Uses

The fruits occur in two forms - the bitter and non-bitter forms, which occur mostly in the wild state. The bitter form contains cucurbitacins (triterpenoids), which is a highly toxic compound (Teuscher and Lindequist, 1994). The non-bitter form has been found to be less toxic and has also been widely cultivated (Enslin *et al.,* 1954; Andeweg and De Bruyn, 1959). The taste of the non-bitter forms has been described as flavourless or rather bland pineapple-banana-like, may even be sweet or sour. According to Roodt (1998), in the Okavango (Southern Africa), the fruit is rather bitter and is seldom consumed by humans except in times of food scarcity, when it is eaten raw or cooked. The Khoisans roast the fruit and then strain the flesh. The leaves are cooked as spinach or mixed with maize meal (Arnold *et al.,* 1985). In the Kalahari area of South Africa, game animals eat the bitter fruit and in

time of scarcity, are fed to cattle and are even eaten by the bushman (Burkill, 1985). Edible cultivars are cultivated in northern SierraLeone and the fruit is a common item in the market under the name, English tomato (Burkill, 1985; Anon a, 2009).

Haematological Effects

The fruit of *C. metuliferus* was shown to increase the values of blood parameters: packed cell volume, haemoglobin, red blood cell and white blood cell counts (Usman, 2014).

Analgesic Effects

The jelly melon contains saponins, a substance which is often toxic, but which has many medicinal properties. The saponins are oily glycosides that foam freely when shaken with water (Burkill, 1985). Roodt (1998) reports that in the Okavango area, the Shona tribe (Zimbabwe) uses a decoction of the root for relief of pain after childbirth. It is also alleged that the boiled root is very good for gonorrhoea treatment (Burkill, 1985; Anon a, 2009).

Antiviral Uses

Wannang *et al*. 2010 showed that the isolated alkaloids from *C. metuliferus* at a dose of 600 mg/kg of the extract reduced the clinical signs seen in Newcastle disease and reversed the haemorrhagic lesions associated with the disease. Alkaloids have been documented to have antiviral and antileukemic activities (Moore and Pizza, 1992).

Antimicrobial Effects

The fruit of *C. metuliferus* has been shown to have antibacterial activity against *Salmonella gallinarum in vitro* (Usman *et al.*, 2014a).

Gastrointestinal Effects

The pulp extract of *C. metuliferus* was shown to have anti-ulcer property (Wannang *et al*., 2009). This was also seen in the isolated alkaloids from the fruit pulp of the plant, with a dose dependant gastric mucosal protection in mice (Omale *et al*., 2011).

Reproductive Effects

Administration of 500 mg/kg and 1000 mg/kg of the fruit extract of *C. metuliferus* showed absence of damages on the sertolli/leydig cells after 28 days continuous oral administration. However, 500 mg/kg of the fruit extract produced an increase in total sperm count and viable sperms, while the 1000 mg/kg decreased (but not significantly) both the viable and total sperm counts. The presence of immature sperm was seen at 1000 mg/kg which could have led to the decrease sperm count (Wannang *et al*., 2008).

Anti-Diabetic Effects

Glycosides extracted from the fruit pulp of *C. metuliferus* possess a dose dependant antihyperglycemic activity against alloxan-induced diabetes mellitus in rats (Jimam *et al*., 2010; Gotep, 2011).

Anti-Protozoan Activity

The antitrypanosomal efficacy of different doses of *Cucumis metuliferus* pulp extract was also investigated in rabbits. Parasitaemia fluctuated and was kept low in all the treated groups, with significant increase in both packed cell volume (PCV) and body weight. It also gave a survival period of 47 days beyond 28 days for the untreated control group, with alleviation of hepatomegaly and splenomegaly (Abubakar *et al*., 2011).

Behavioural Activity

The fruit of *C. metuliferus* alters the behavioural activities of chicks. Wannang (2011), showed that the fruit at the dose of 1000 mg/kg produced a significant ($P<0.05$) dose and time dependent increase in pecking at self while pecking on food showed a significant increase in activity with 500 mg/kg at 60 and 150 minutes, similarly pecking at non-food was significantly increased at 90-150 minutes with 500 and 1500 mg/kg. The Escape episodes for chicks revealed a dose and time dependent change in activity from 500 mg/kg to 1500 mg/kg. There was significant alteration in behavioural activity in 2-day old chicks at 1000 and 1500 mg/kg with 500 mg/kg of the extract demonstrating a very low effect on escape episodes.

Health Benefits of *Cucumis metuliferus* Fruits

C. metuliferus is a member of the cucumber family which is related to the melon, zucchini and cucumber. A native of the southern areas of Africa, it has since been cultivated in New Zealand and Australia and renamed the kiwano, and is now grown in other countries as well. The health benefits of the kiwano are in the nutrients it contains. These nutrients are made up of good levels of vitamin C, iron and potassium. It also has some amounts of phosphorus, magnesium, zinc, calcium, copper and sodium. The level of zinc in *C. metuliferus* is 1.1184 mg/ 223g (Anon c, 2014) could have effect on fertility as was reported by Wannang *et al.* (2008) to increase sperm count and sperm motility. The seeds contain linoleic and oleic acids. Linoleic acid is an omega fatty acid which is required for human health while oleic acid is thought to help with the lowering of blood pressure (Anon c, 2014; Anon d, 2014). There are two antioxidants which have been identified in the melon seeds, γ-tocopherol and α- tocopherol. Both are organic types of vitamin E which have many health

benefits to the body cells and organs, such as the red blood cells, skin, muscles, nerves and heart. Vitamin E works in the body by helping to neutralize the damage from free radicals which can cause cancer and cardiovascular disease. It has been suggested that Vitamin E may be helpful in reducing the risk of Parkinson's and Alzheimer's disease. Other health benefits of *C. metuliferus* are in the beta carotene and vitamin A contained in the pulp. Beta carotene is of importance to the immune system in helping to strengthen it. Vitamin A is good for the eyes and is important for night vision and it is important for healthy skin. Diets that are rich in beta carotene, lutein and lycoprene are said to help slow aging and may also protect and repair DNA (Anon c, 2014; Anon d, 2014). The World Health Organization is hoping that *C. metuliferus* can become a staple crop for sub-Saharan Africa and help alleviate malnutrition in the developing world (Anon d, 2014; Anon e, 2014). Karaye *et al*. (2012) showed the various amino acids, fatty acids and volatile compounds that are present in *C. metuliferus* which could be a source of alleviating malnutrition as well as be useful components of pharmaceutical and chemical industries.

Phytochemical Constituents of *Cucumis metuliferus*

The plant *C. metuliferus* has several groups of secondary metabolites which account for its use as food or in the treatment of various ailments. The phytochemicals present in the fruit of *C. metuliferus* revealed the presence of useful secondary metabolites such as alkaloids, carbohydrates, cardiac glycosides, flavonoids, saponins, tannins, steroids and terpenoids (Jimam *et al*., 2011; Gotep, 2011; Usman *et al*., 2014b).

Toxicity of *C. metuliferus*

Only the bitter fruits of *C. metuliferus* are toxic. They contain cucurbitans (titerpenoids) which are highly toxic compounds (Teuscher and Lindequist, 1994). Although the LD_{50} of the plant in rats is shown to be above 5000mg/kg (Wannang *et al*., 2008) it was shown that 1000 mg/kg of the extracts showed some levels of toxicity on the liver and kidney tissues of albino rats after 28 days of continuous daily oral administration (Jiman *et al*., 2011) with a dose dependant (500 mg/kg and 1000 mg/kg) increase in the level of blood urea nitrogen (BUN), aspartate aminotransferase (AST), alanine aminotransferase (ALT), alkaline phosphatase (ALP) and total protein (Wannang *et al*., 2007). These enzymes might have increased due to liver and kidney damage. However, there was no necrosis in the spleen and pancreas. The 500mg/kg of the extract showed no necrosis of the liver, kidney, spleen and pancreas (Jiman *et al*., 2011), even though there was an a dose dependant (500 mg/kg and 1000mg/kg) increase in the level of blood urea nitrogen (BUN), aspartate aminotransferase (AST), alanine aminotransferase (ALT), alkaline phosphatase (ALP) and total protein (Wannang *et al*., 2007).

Conclusion

In conclusion, this review paper has shown the various medicinal uses of the Cucurbitaceae plant family. The various phytochemicals extracted from the plants have shown antiviral, antifungal, antimicrobial, antitumour, antidiabetic, antimalarial, diuretic and analgesic effects. Commonly treated ailments are helminthosis, cough, bronchitis, asthma, diarrhoea, dysentery, skin diseases, headaches, jaundice, increased milk production, fever, ulcers, boils and in chicken diseases. Further studies need to be carried out on *Cucumis metuliferus* to isolate the active principles responsible for certain activity.

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