ITBC BI8 Moleculaire fylogenie & Webtechnologie en textmining

General Assignment

Assignment for bioinformatics second years

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The health-giving benefits of bitter gourd (Momordica charantia) and yam (Dioscorea batatas).

Bitter gourd is a member of the family of cucurbitaceae and is grown and eaten in Africa, Asia and the Caribbean. In traditional herbal medicine, bitter gourd is used to treat diabetes, wounds, malaria, inflammation. Recently, bitter gourd has been shown to have a role in lowering blood glucose levels, cholesterol and fat mass. To date, these studies use the pulp of the whole fruit and little information is available regarding which parts of the fruit have the positive health benefits, or relate to how the fruit is prepared and eaten.

Yams are grown in Africa and comprise complex carbohydrates that allow for its place as a low glycaemic index food. Asian medicine has made use of yams as they contain allantoin which speeds up the healing process of wounds, but also act to stimulate appetite and have a link to hormonal patterns and thus affect osteoporosis and menopausal symptoms. Yams is also indicated to be of use in the treatment of diabetes.

As part of a large research consortium, we wish to investigate the science behind the health claims of bitter gourd, yam and other vegetables. A bioinformatics approach can be used to identify compounds of interest, and identify if those compounds exist in other fruits and in what ratios. The aim of this research is to identify the data from literature and analyse them to provide an inventory of knowledge. The research questions are:

1. To undertake a literature review to generate an inventory of the health-giving benefits of a) bitter gourd (Momordica charantia) and b) yam (Dioscorea batatas) in scientific literature. It will also be of interest to investigate the compounds within the fruits that have an effect. For example (not limited to!):

i. Saponins à inhibit acetylcholinesterase, affect permeability of cell membranes and affect food absorption (the latter can be tested with worm mutants, such as eat-2)

ii. Alkaloids à neurotoxic effect on acetylcholinesterase and is an antioxidant that reduces nitrates and thus affects development

iii. Flavonoids à affect larval growth and results in neurodegeneration

iv. Tanninsà affect cuticle development and uncouple oxidative phosphorylation

2. Identify other crops that have an anti-diabetic effect. What are the compounds that cause the plant to have such properties.

3. Visualise healthy vegetables and their overlapping compounds in such a way that is useful for a biologist to discover new relations between healthy vegetables and compounds.

Some basic information about bitter gourd

Research on Bitter gourd.docx

The bitter gourd is the edible part of the plant *Momordica Charantia*, which is a vine of the *Cucurbitaceae* family and is considered the most bitter among all fruits and vegetables.

The plant thrives in tropical and subtropical regions, including: South America, Southeast Asia, China parts of Africa and the Caribbean.

In many Asian countries, it is used as a part of traditional, herbal medicines to treat conditions like rheumatism, cough and flu.


Bitter melon comes in a variety of shapes and sizes. The cultivar common in China is 20-30 cm long, oblong with bluntly tapering ends and pale green in color, with a gently undulating, warty surface. The bitter melon more typical of India has a narrower shape with pointed ends, and a surface covered with jagged, triangular "teeth" and ridges. It is green to white in color. Between these two extremes are any number of intermediate forms. Some bear miniature fruit of only 6-10 cm in length, which may be served individually as stuffed vegetables. These miniature fruit are popular in Bangladesh, India, Pakistan, Nepal and other countries in South Asia. The sub-continent variety is most popular in Bangladesh and India.

Bitter gourd juice contains a train of important nutrients ranging from iron, magnesium and vitamin to potassium and vitamin C. An excellent source of dietary fiber, it also contains twice the calcium of spinach, beta-carotene of broccoli, and the potassium of a banana.

A quick tip to reduce the bitterness of the drink is to add some honey or jiggery to it or pair it with sweet fruits like apple or pears. You can even add lemon juice to lessen the harsh taste of bitter melon juice. A pinch of black pepper and ginger can also decrease the tartness.

Health benefits of Bitter Gourd:

- Helps in maintaining blood sugar levels; the bitter gourd contains at least 3 active substances with antidiabetic properties, including charantin, which has been confirmed to have a blood glucose-lowering effect, vicine and an insulin-like compound known as polypeptide-p. These substances either work individually or together to help reduce blood sugar levels.

It is also known that bitter melon contains a lectin that reduces blood glucose concentrations by acting on peripheral tissues and suppressing appetite – similar to the effects of insulin in the brain. This lectin is thought to be a major factor behind the hypoglycemic effect (takes place when an agent, such as a food, herb or medication, causes the insulin in the blood to quickly drop; can be very harmful to the body) that develops after eating bitter melon.

In January 2011, the results of a 4-week clinical trial were published in the *Journal of Ethnopharmacology*, which showed that a 2,000 mg daily dose of bitter melon significantly reduced blood glucose levels among patience with type 2 diabetes, although the hypoglycemic effect was less than a 1,000 mg/day dose of metformin (is the first-line medication for the treatment of type 2 diabetes).

- Lowers bad cholesterol levels; Bangalore-based Nutritionist, Dr. Anju Sood, says, “bitter gourd juice is anti inflammatory and also helps in lowering bad cholesterol levels in the body. Thereby, it significantly reduces the risk of heart attack and stroke”. It also maintains the blood pressure of the body as it is rich in potassium, which absorbs excessive sodium in the body. It is rich in iron and folic acid which are known to decrease the risk of a stroke and keep your heart healthy.
- For glowing skin and lustrous hair; Dr. Simran Saini from Fortis Hospital in New Delhi suggests that bitter gourd juice has powerful anti-oxidants along with vitamin A and C which prevent premature skin ageing and diminishes wrinkles. Futhermore, it reduces acne, aids in treating eczema and psoriasis (common skin condition that speeds up the life cycle of skin cells), as well as protects the skin from the harmful UV rays.

The nutrients vitamin A, vitamin C, Biotin and Zinc impart shine and lustre to your locks. Applying bitter gourd juice regularly to you scalp can decrease hair loss and greying of hair, treat split-ends and rough hair, shrug off dandruff, and combat itchiness.

- Cures hangovers and cleanses the liver; sipping some bitter gourd juice wipes out alcoholic intoxication settled in your liver. The juice cleanses your bowel as well as heals many liver problems. Published in the International Journal of Vitamin and Nutrition, a study concluded that a compound called Momordica Charantia provides protection against liver failure by strengthening anti-oxidant activity of the enzymes in the liver. It also booststs the functioning of your bladder.
- Helps in weight loss; bitter gourd is low in calories, fat and carbohydrates. It keeps you full for longer. In a 2010 issue of a report published in the Journal BMC Complementary and Alternative Medicine, it was disclosed that extracts of bitter gourd helped in the dislocation of human fat cells and also hindered the formation and growth of new fat cells. It was futher concluded that bitter gourd can be viewed as a natural agent for treating obesity.
- Boost your immune system; bitter gourd fights viruses and bacteria and strengthens your immunity. It prevents allergies and indigestion. The antioxidants work as powerful defense mechanisms against illness and also help fight free-radical damage that can cause various types of cancer. In 2010, a study was published in the Pharmaceutical research Journal which stated that bitter-melon hast anti-carcinogen and anti-tumor properties. It reduced the risk of prostate, breast and cervical cancer.
- Great for you eyes; Dr. Anshul Jai Bharat says that it helps in preventing vision-related problems such as cataract since it has compounds like beta-carotene and vitamin A which are healthy for you eyes and strengthens eyesight.
- Is good for the stomach and bowel-related ailments such as gastro-intestinal infection, intestinal worms, ulcerative colitis, constipation etc.

As with everything moderation is required. Excess consumption of bitter gourd juice may cause abdominal pain and diarrhea. Pregnant women should also avoid taking too much bitter gourd or its juice as it may stimulate the uterus and lead to preterm labour. 30 ml bitter gourd juice extract is recommended on a daily basis.

"Research shows that it is good for lowering blood sugar levels and fighting viruses, and a study at the University of Colorado Cancer Center showed that bitter melon juice kills cancer cells.'

Side effects:

- Can stimulate miscarriage; bitter gourds are notorious for causing emmenagogue (increase of menstrual flow) and abortifacient effects.

Bitter gourd can also trigger contractions. And for lactating women, it is best to avoid bitter gourd. This is because though there isn't any scientific backing which says bitter gourds are bad for lactating women, its adverse effects on pregnant women might have similar effects on lactating women.

- Drug interactions; bitter gourd can come in the way of drugs. Combining bitter gourds with standard drugs can reduce blood sugar levels steeply. This might possibly lead to dangerously low blood sugar levels. Hence diabetic patients who are under medication should consult their doctors before consuming bitter gourds.
- Can cause irregular heart rhythm; in 2010, a study published 'The Annals of Saudi Medicine' revealed something new. A 22 year old male without any heart rhythm irregularities developed related symptoms when he drank half a cup of bitter gourd juice before the admission. When the heart rhythm gets irregular, it leads to the pooling of the blood in one side of the heart. This can result in the platelets forming clots in the pool, thereby causing stroke or heart attack.
- Bitter gourds for your children?; it has been reported that red arils (covering on the seeds) might be toxic to children. They might cause vomiting and diarrhea.
- Hypoglycaemic coma; a condition of coma which is caused due to excessive doses of injected insulin. This might lead to severe decrease in blood sugar levels. There are case report which suggest the onset of hypoglycaemic coma and start of atrial fibrillation (abnormal heart rhythm) with the intake of bitter gourds.
- Might affect the liver; intake of bitter gourds for extended periods of time to control diabetes might actually induce liver inflammation.

Bitter gourds don't directly damage the liver. Long term use of bitter gourds can elevate liver enzymes and result in a condition called atherosclerosis (hardening of the arteries)

Moderate consumption of bitter gourd is not going to be harmful!

Cooking with bitter gourd

An important point to keep in mind while cooking with the veggie is to ensure that one tones down the bitter flavor.

- Include a bit of jaggery at the final stage of cooking;
- Teaming it with other vegetables like onions, potatoes or tomatoes;
- Scrape the veggie properly;
- Remove all the seeds, especially the big ones;
- Wash properly, cut the marinate with salt and leave aside for at least half an hour;
- Squeeze the juice out;
- Wash properly ensuring the removal of excess salt;
- You can also boil cut pieces in a solution of water and lemon;
- Soaking the veggie in tamarind juice for at least half an hour before cooking can also help.

Unless you get a small, young bitter melon (recommended), avoid eating the thick, waxy skin. Instead, peel the fruit to get the flesh beneath.

There are lots of ways of using bitter melon – it can be steamed or pan-fried like zucchini, and some cooks leave it whole and hollow it out to stuff, like a squash. Its bitterness makes it a perfect match for chilies and fat. It can also be used in soups.

Dissecting the bitter melon à split it in half, dig the seeds out with a spoon and slice into half moons. It's best to toss the bitter melon in some salt and let it sit for 30 to 45 minutes to help draw out some of the bitterness and excess liquid.

Recipes:

- Bitter melon with onions and indian spices à karela and onion Subzi
- Thai style à stir fried bitter melon with eggs
- Vietnamese à stuffed bitter melon soup
- Okinawan style à Goya Chanpuru / stir-Fried bitter melon

Bitter melon is generally consumed cooked in the green or early yellowing stage. The young shoots and leaves of the bitter melon may also be eaten as greens.

In Chinese cuisine, bitter melon is valued for its bitter flavor, typically in stir-fried (often with pork and douchi), soups, dim sum, and herbal teas (Gohyah tea). It has also been used in place of hops as the bittering ingredient in some beers in China and Okinawa.

Bitter melon is very popular throughout India. In North Indian cuisine, it is often served with yoghurt on the side to offset the bitterness, used in curry such as *sabzi* or stuffed spices and then cooked in oil.

In South Indian cuisine, it is used in the dishes *thoran/thuvaran* (mixed with grated coconut), *mezhukkupuratti* (stir fried with spices), *theeyal* (cooked with roasted coconut) and *pachadi* (which is considered a medicinal food for diabetics).

Other popular recipes include preparations with curry, deep fried with peanuts or other ground nuts, and *Pachi Pulusu*, a soup with fried onions and other spices.

In Kannada and Tamil, a special preparation called *pagarkai pitla*, a kind of sour *koottu*, variety is very popular. Also popular is *kattu pagarkkai*, a curry that involves stuffing with onions, cooked lentil and grated coconut mix, tied with thread and fried in oil.

In the Konkan region of Maharashtra, salt is added to finely chopped bitter gourd, and then it is squeezed, removing its bitter juice to some extent. After frying this with different spices, the less bitter and crispy preparation is served with grated coconut

It is widely used in Goan cuisine.

In Northern India and Nepal, its prepared as a fresh pickle. For this, the vegetable is cut into cubes or slices, and sautéed with oil and a sprinkle of water. When it is softened and reduced, it is crushed in a mortar with a few cloves of garlic, salt and a red or green pepper. It is also eaten sautéed to golden-brown, stuffed, or as a curry on its own or with potatoes.

In Sri Lanka, its an ingredient in many different curry dishes (Bitter gourd Curry and Bitter gourd Sambol) which are served mainly with rice in a main meal. Sometimes large grated coconut pieces are added, which is more common in rural areas. Bitter gourd juice is also sometimes served there.

In Pakistan and Bangladesh, bitter melon is often cooked with onions, red chili powder, turmeric powder, salt, coriander powder, and a pinch of cumin seeds. Another dish in Pakistan calls for whole, unpeeled bitter melon to be boiled and then stuffed with cooked minced beef, served with either hot *tandoori* bread, *naan*, *chappati*, or with *khichri* (a mixture of lentils and rice).

In Indonesian cuisine, its prepared in various dishes, such as *gado-gado*, and also stir fried, cooked in coconut milk, or steamed. It is also cooked with pork and chile.

In Vietnamese cuisine, raw bitter melon slices are eaten with dried meat floss, and bitter melon soup with shrimp are popular dishes. Bitter melons stuffed with ground pork are served as a popular summer soup in the south. It is also used as the main ingredient of “stewed bitter melon”.

In Thai cuisine, bitter melon is prepared stuffed with minced pork and garlic, in a clear broth. It is also served sliced, stir fried with garlic and fish sauce until just tender.

In the cuisine of the Philippines, bitter melon may be stir-fried with ground beef and oyster sauce, or with eggs and diced tomato. The dish *pinakbet*, popular in the Ilocos region of Luzon, consists mainly of bitter melons, eggplant, okra, string beans, tomatoes, lima beans, and other various regional vegetables all stewed together with a little *bagoong*-based stock.

In Trinidad and Tobago, bitter melons are usually sautéed with onion, garlic and scotch bonnet pepper until almost crisp.

https://www.youtube.com/watch?v=arFp4mnZPrg bitter melon smoothie.

https://www.youtube.com/watch?v=v3tNht4L8gk bitter melon tea.

Bitter melon juice can be taken as a plain shot, or mix it into a juice or smoothie with mango, pomegranate, or another strongly-flavored fruit to help it go down a bit more easily.

Traditional medicinal uses:

They have been in use for a very long time in Hindu medicine or Ayurveda (is a system of medicine with historical roots in the Indian subcontinent). Bitter melon has been used in various Asian and African herbal medicine systems for a long time. In Turkey, it has been used as a folk remedy for a variety of ailments, particularly stomach complaints. In traditional medicine of India, different parts of the plant are used as claimed treatments for diabetes, and as a stomachic, laxative, antibilious, emetic (vomiting) anthelmintic agent (expel parasitic worms), for the treatment of cough, respiratory diseases, skin diseases, wounds, ulcer (break in a bodily membrane that impedes the organ of which that membrane is part from continuing its normal functions), gout (form of inflammatory arthritis) and rheumatism.

Bitter gourd has a number of purported uses including cancer prevention, treatment of diabetes, fever, HIV and AIDS, and infections. While it has shown some potential clinical activity in laboratory experiments "further studies are required to recommend its use".

For fever reduction and relief of menstrual problems, there is no scientific research to back these claims. For cancer prevention, HIV and AIDS, and treatment of infections, there is preliminary laboratory research, but no clinical studies in humans showing a benefit. In 2017, the University of Peradeniya researchers revealed that bitter gourd seeds can be potentially used to destroy cancer cells and they were successfully administered to patients in Kandy General Hospital Cancer Unit.

With regard to the use of bitter gourd for diabetes, several animal studies and small-scale human studies have demonstrated a hypoglycemic effect of concentrated bitter melon extracts. In addition, a 2014 review shows evidence that bitter gourd, when consumed in raw or juice form, can be efficacious in lowering blood glucose levels. However , multiple review have found that bitter gourd does not significantly decrease fasting blood glucose levels or A1c (indicators of blood glucose control) when taken in capsule or tablet form. Bitter gourd may be beneficial in diabetes; however, the effects seem to depend on how it is consumed. More studies need to be performed in order to verify this effect. The Memorial Sloan Kettering Cancer Center concludes that bitter melon "cannot be recommended as a replacements therapy for insulin or hypoglycemic drugs".

Reported side effects include diarrhea, abdominal pain, fever, hypoglycemia, urinary incontinence, and chest pain. Symptoms are generally mild, do not require treatments, and resolve with rest.

A University of Colorado Cancer study published this week in the journal *Carcinogenesis* shows that bitter melon juice restricts the ability of pancreatic cells to metabolize glucose, thus cutting the cells' energy source and eventually killing them.

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