



REVIEW ARTICLE

Role of pH in the Development of T2DM and Hepatocarcinoma and Possible Therapy of Botanicals in the Management of T2DM and Hepatocarcinoma

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Manuscript Details

Manuscript Submitted : 20/03/2025
Manuscript Revised : 23/04/2025
Manuscript Accepted : 28/04/2025
Manuscript Published : 15/05/2025

Available On

<https://plantaescientia.com/ojs>

Cite This Article As

Bhattacharya Sarthak, Wasgare Navsin, Pansari Misbah, Salunkhe Siddhi & Biramane Santosh (2025). Role of pH in the Development of T2DM and Hepatocarcinoma and Possible Therapy of Botanicals in the Management of T2DM and Hepatocarcinoma *Pla. Sci.* 2025; Vol. 08 Iss. 3:34-41

DOI-

<https://doi.org/10.32439/ps.v8i3.34-41>

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ABSTRACT

Traditional Indian Medicines (TIM) like Traditional Chinese Medicines (TCM) plays a pivotal role in the management of Type 2 diabetes (T2DM) and neoplastic disorders especially Hepatocarcinoma. Diabetes mellitus, disorder of carbohydrate metabolism is pigeonholed by impaired ability of the body to generate or respond to insulin and thereby uphold proper levels of sugar (glucose) in the blood. So many molecular, sub-molecular, tissues micro-environment studies are conducted to know the origin of T2DM and Cancer but till date no study directly reflects the relation between T2DM and Hepatocarcinoma. It is evident that particularly Hepatocellular carcinoma and T2DM are life threatening and pH plays a significant role in the development of these two diseases. pH of the blood of a healthy individual is 7.4 whereas, in T2DM cases pH is 7.35 and for neoplastic disorders between (7.1-7.3) based on the stages of cancer. It is palpable that pH modulation if done then both can be managed at the grass root level from the body. T2DM is responsible for fatty livers, increase in SGOT, SGPT levels, non-alcoholic fatty liver disease. On longer period of time NAFLD turns into liver damage/ cirrhosis of liver/ liver cancer (Hepatocellular carcinoma). Synthetic drugs have many side effects causing some serious medical problems during a period of treatment. Therefore, traditional medicines have been used for a long time and play a key role as alternative medicines. Traditional medicine performed a good clinical practice and is showing a bright future in the therapy of T2DM and Hepatocarcinoma.

Keywords: TIM, TCM, T2DM, Hepatocarcinoma, Indian Botanicals, SGOT and SGPT levels

INTRODUCTION

Type 2 Diabetes Mellitus (T2DM) and cancer represent two of the most prevalent and devastating chronic diseases globally, posing significant public health challenges. The rising incidence and associated morbidity and mortality underscore the urgent need for effective preventive and therapeutic strategies. While conventional medical treatments have made substantial advancements, they often come with limitations, including adverse side effects, high costs, and sometimes inadequate efficacy for long-term disease management. This has led to a renewed interest in complementary and alternative medicine, particularly the use of medicinal herbs, which have been integral to traditional healing systems for millennia. This review aims to provide a comprehensive overview of the current scientific evidence supporting the therapeutic potential of various herbs in the prevention and management of both T2DM and cancer. By critically evaluating a wide range of studies, this review will consolidate the current understanding of how different herbal compounds exert their effects in regulating glucose metabolism and inhibiting cancer progression.

Highlight mechanistic insights: It will delve into the diverse pharmacological mechanisms through which these herbs operate, including their antioxidant, anti-inflammatory, immunomodulatory, anti-proliferative, and pro-apoptotic properties, among others with aspect to the pH.

Identify promising herbal candidates: The review pinpoint specific herbs that have demonstrated significant efficacy in in vitro, in vivo, and human studies for either T2DM or cancer, or both. Justify further research: Ultimately, this review will underscore the immense untapped potential of herbal medicine as a valuable adjunct or alternative therapeutic approach for T2DM and cancer, thereby providing a rationale for continued scientific inquiry and the development of novel, nature-derived interventions. (Greenwood & Wood, 1994)

REVIEW OF LITERATURE

Herbal medicine plays a crucial role in global healthcare due to its long history of use, cultural acceptance, and perceived fewer side effects compared to conventional drugs. For Type 2 Diabetes Mellitus (T2DM), a chronic metabolic disorder, herbal remedies offer promising avenues for research and therapeutic development. Many traditional herbs contain bioactive compounds that can help manage blood glucose levels through various mechanisms, including enhancing insulin sensitivity, stimulating insulin secretion, inhibiting carbohydrate digestion, and possessing

antioxidant and anti-inflammatory properties. Examples include *Moringa oleifera*, *Gymnema sylvestre*, *Momordica charantia* (bitter melon), and *Trigonella foenum-graecum* (fenugreek). (Guercio et. al. 2016)

In the context of cancer, a leading cause of mortality worldwide, herbal medicine has been a significant source of novel anticancer agents. Numerous herbs and their isolated compounds demonstrate remarkable cytotoxic, antiproliferative, pro-apoptotic, anti-angiogenic, and anti-metastatic activities against various cancer cell lines and in vivo models. They often target multiple signaling pathways involved in cancer progression, offering a multi-targeted approach that conventional drugs may lack. Furthermore, some herbal compounds can enhance the efficacy of chemotherapy and radiotherapy while mitigating their adverse effects. Noteworthy examples include *Curcuma longa* (turmeric/curcumin), *Camellia sinensis* (green tea/EGCG), *Withania somnifera* (ashwagandha), and *Catharanthus roseus* (Vinca alkaloids) mentioned by Graser, E. R. (1940).

Reviewing the scientific evidence for these herbs in T2DM and cancer is essential to validate their traditional uses, identify active principles, elucidate mechanisms of action, assess safety and efficacy, and pave the way for the development of new, effective, and accessible therapeutic agents. This research can significantly contribute to integrative medicine and global health initiatives.

OVERVIEW OF T2DM

T2DM is a chronic disorder of carbohydrate, fat and protein metabolism characterized by increased fasting and post prandial blood sugar levels. Diabetes mellitus is a complex metabolic disorder resulting from either insulin insufficiency or insulin dysfunction.

Type I diabetes (Insulin dependent)

Type 1 diabetes, in earlier times referred to as insulin-dependent diabetes mellitus (IDDM) or juvenile-onset diabetes, usually witnesses in childhood. Type 2 diabetes in earlier times referred to as non-insulin-dependent diabetes mellitus (NIDDM) or adult-onset diabetes, usually occurs after age 40 and becomes more familiar with escalating age. Type 1 diabetes mellitus accounts for about 5 to 10 percent of cases of diabetes. Most cases of type 1 diabetes develop in children or adolescents, but about 20 percent of new patients are adults. The frequency of type 1 diabetes varies widely in different countries, from less than 1 case per 100,000 people per year in China and parts of South America to more than 20 cases per 100,000 people per year in places such as Canada, Finland, Norway, Sweden, and the United Kingdom. Most patients present with

symptoms of hyperglycaemia, but some patients present with diabetic ketoacidosis. Mentioned by Sona et al. 2018)

Type II diabetes (Insulin independent)

T2DM is accounting for about 90 percent of all cases. The frequency of type 2 diabetes varies to a great extent within and between countries and is increasing throughout the world. Most patients with type 2 diabetes are adults, frequently older adults, but it can also happen in children and adolescents. Genetically T2DM is highly associated. Twins are much more likely to both develop T2DM than to both develop type 1 diabetes, and 7 to 14 percent of people whose mother or father has T2DM will also develop T2DM; this approximation increases to 45 percent if both parents are affected. Numerous patients with T2DM are asymptomatic, and they are frequently diagnosed with T2DM when schedule measurements reveal high blood glucose concentrations. In some patients the incidence of one or more symptoms associated with the enduring complications of diabetes leads to a diagnosis of T2DM. (Goossens et. al. 2015)

Other patients have the symptoms of hyperglycemia that have been present for many months show the sudden onset of symptoms in the form of severe hyperglycemia and vascular collapse. T2DM is sturdily associated with fatness and is a result of insulin resistance and insulin deficiency. Insulin resistance is a very common characteristic of T2DM in patients who are obese, and thus patients often have higher serum insulin concentrations. However, some obese persons are unable to produce sufficient amounts of insulin, and thus increase blood glucose concentrations resulting in hyperglycemia for them. People with T2DM can manage blood glucose levels through diet, exercise and life style changes. T2DM correlations with Hepatocarcinoma or hepatocellular carcinoma: T2DM is linked to a high risk of developing Hepatocarcinoma or hepatocellular carcinoma. Possible causes for the development of Hepatocarcinoma or hepatocellular carcinoma from T2DM: There are several factors which include the following: Shared risk factors that is diabetes: cancer share risk factor like aging, obesity, diet and physical inactivity, Hyperglycemia: high blood sugar level can damage DNA which can lead to cancer.

Hyperinsulinemia: high insulin level can contribute to cancer Inflammation: obesity which often accompanied T2DM can lead to inflammation that promote tumour growth, Medication and cancer risk; Some medications for diabetes like metformin may also reduce the risk of Cancer metformin lowers blood sugar (glucose) and stimulates DNA repair. Substantial evidence suggests that people with T2DM have high risk of developing

Hepatocarcinoma or hepatocellular carcinoma noted by Barone et al. 2019.

Stages of Hepatocarcinoma or hepatocellular carcinoma: Stages show that in early stage a cancerous environment tends to be slightly acidic.

- 0- Cancer cells found in the earliest form
- 1- Early stage: A small tumour that hasn't spread (pH 6.5-6.9)
- 2- Localized: Cancer that has grown more deeply into nearby tissues (pH 6.7-7.1)
- 3- Regional spread: Cancer that has spread to lymph node or nearby tissue
- 4- Distant spread: Cancer that has spread to distant parts of the body

Stages of Hepatocarcinoma or hepatocellular carcinoma

The healthy liver- The liver is your body's largest internal organ, weighing between 3 to 5 pounds. Your liver is located on the right side of your upper body below the lungs, taking up most of this space in your ribcage. The gallbladder, which stores bile made in the liver, is found tucked under your liver. The liver is made up of two separate sections or lobes: the largest right lobe and the smallest left lobe. The liver produces bile, which is a yellow-green acidic liquid that helps carry away waste and breakdown fat in the small intestine during digestion and produces protein for blood plasma. Blood plasma is a fluid which transports blood components (red and white blood cells and platelets), nutrients, hormones, protein and waste products, and also produces cholesterol and special proteins to help carry fats through the body. Moreover, it converts unused glucose into glycogen for storage.

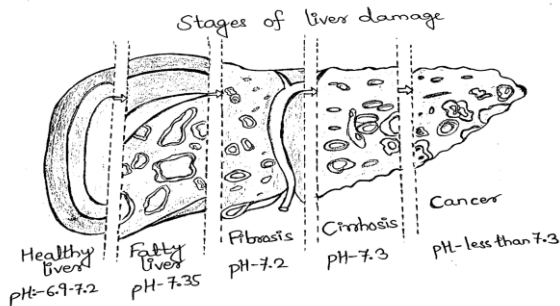
Fibrosis- When liver disease erupts, the liver enters into a very treacherous cycle with persistent inflammation or hepatitis sending nonstop signals to repair cells to continue depositing collagen. The extra collagen stiffens around the tissue like it is supposed to be in the healthy liver. Instant signals are being released to stop the inflammation and get rid of the extra collagen. During continuation of inflammation and deposition of more collagen leads to more stiffening of collagen.

Cirrhosis- Cirrhosis is the condition of the liver when the liver is severely damaged. Cirrhosis is caused by many forms of liver diseases. Cirrhosis is often categorized as either compensated or decompensated. Cirrhosis doesn't necessarily show the symptoms of disease. The case may be mild or non-existence. Someone with decompensated cirrhosis will feel sick as the liver is struggling to function.

Liver cancer (Hepatocarcinoma or hepatocellular carcinoma): Liver cancer is a cancer that begins in the cell

of the liver. of cancer may be formed in the liver but the most common type of a liver cancer is hepatocellular carcinoma or HCC which begins in the main liver cell (hepatocytes). Liver cancer is one of the leading causes of cancer related to death worldwide over the last 3 years. Rates of liver cancer have tripled in United State and many other countries. (Dubas & Ingrassia, 2013)

Figure No. 1



SGOT and SGPT levels

Liver cell contains the enzyme serum glutamate pyruvate transmitters (SGPT or ALT) and serum glutemic oxalate transmitters (SGPT or AST) the bloodstream presence acts as biomarker for liver damage. SGOT and SGPT are released into the bloodstream in response to inflammation or damaged to the liver cell. Keeping an eye on the level acids in assessing the degree of inflammation on liver damage several tissues such as liver, brain pancreas, heart, kidney, lungs and skeletal muscle contain SGOT. In case of any of this tissue damaged the blood will be exposed to SGOT in contrast the liver is the primary location of SGPT while elevate SGPT levels are always cause of Cancer they don't always indicate a major issue high SGPT level can be a sign of a mile to sever liver injury. SGPT & SGOT Test Normal Range: SGPT: 4 to 36 U/L SGOT: 8 to 33 U/L

Cancer pH level

Key point about cancer pH levels is that cancer cells tend to create a more acidic environment around themselves (lower extracellular pH) compared to healthy cells, while maintaining a slightly alkaline internal pH within the cancer cell itself, which can contribute to tumor growth and invasion; this phenomenon is often attributed to the high metabolic rate of cancer cells leading to increased lactic acid production.

Acidic tumour microenvironment: The extracellular pH around a tumor is usually lower (more acidic) than the surrounding healthy tissue due to the accumulation of waste products like lactic acid from rapid cancer cell metabolism.

Slightly alkaline intracellular pH: Despite the acidic extracellular environment, cancer cells typically maintain a slightly alkaline internal pH, which is thought to be necessary for their proliferation and survival.

pH regulation mechanisms: Cancer cells possess mechanisms to regulate their pH, including ion transporters that help pump out protons (hydrogen ions) to maintain their internal pH.

Implications for treatment: Understanding tumor pH could lead to the development of therapeutic strategies that target the acidic tumor microenvironment, potentially enhancing the efficacy of cancer treatments. (Cignarelli A, Genchi VA, Caruso I, Natalicchio A, Perrini S, Laviola L, et al.)

Diabetes pH levels

In severe cases of diabetes, particularly when experiencing diabetic ketoacidosis (DKA), a person's blood pH will be lower than normal (below 7.3), indicating acidosis due to a buildup of ketones in the blood, which is a serious complication requiring immediate medical attention; a normal blood pH is typically between 7.35 and 7.45.

Details about diabetes and pH level

Acidosis in DKA: When someone with diabetes develops DKA, their blood pH drops below 7.3, signifying acidosis, often accompanied by high blood glucose levels and ketone presence in the blood and urine.

Monitoring pH in diabetes management: Healthcare providers closely monitor a diabetic patient's blood pH level, especially if they suspect DKA, to assess the severity of acidosis and guide treatment.

Treatment for acidosis: Treating DKA involves administering insulin to lower blood sugar, fluids to rehydrate, and sometimes electrolytes to correct imbalances, aiming to raise the blood pH back to normal.

Mild vs. Severe DKA: The severity of DKA is often categorized based on the blood pH level, with a lower pH indicating a more severe case. (Huxley et al. 2015)

Role of botanicals in the management of T2DM and Hepatocarcinoma

In the last few years there has been an exponential growth in the field of herbal medicines and these drugs are gaining popularity both in developing and developed countries because of their natural origin and less side effects. Many traditional medicines in use are derived from medicinal plants, minerals and organic matter. A number of medicinal plants, traditionally used for over 1000 years are present in

herbal preparation of Traditional Indian medicine. In Indian systems of medicine most practitioners formulate and dispense their own recipes. The World Health Organization (WHO) has listed 21,000 plants, which are used for medicinal purposes around the world. Among these 2500 species are in India, out of which 150 species are used commercially on a large scale. India is the largest producer of medicinal herbs and is called as botanical garden of the world. The current review focuses on herbal drug preparations and plants used in the treatment of diabetes mellitus and cancer with aspect to the pH. (Kalibbala & Mpagi, 2012).

Traditional Indian herbs in modification of pH in T2DM and cancer

Indian Herbal drugs and plants used in the treatment of diabetes and cancer especially in India. Diabetes and cancer are an important human ailment afflicting many from various walks of life in different countries. In India it is proving to be a major health problem, especially in the urban areas. Though there are various approaches to reduce the ill effects of diabetes and cancer with aspect to its pH and its secondary complications, herbal formulations are preferred due to lesser side effects and low cost. A list of medicinal plants with proven antidiabetic and anticancer and related beneficial effects and of herbal drugs used in treatment of diabetes and cancer is compiled. Traditional Indian botanicals are commonly used in the traditional treatment of T2DM and Hepatocarcinoma (Guercio, Valentina; Turati, Federica; La Vecchia, Carlo; Galeone, Carlotta; Tavani, Alessandra (2016)

Curcuma longa

Turmeric or *Curcuma longa* is a flowering plant in the ginger family Zingiberaceae. It is a perennial, rhizomatous, herbaceous plant native to the Indian subcontinent and Southeast Asia that requires temperatures between 20 and 30 °C (68 and 86 °F) and high annual rainfall to thrive. Plants are gathered each year for their rhizomes, some for propagation in the following season and some for consumption. The rhizomes are used fresh or boiled in water and dried, after which they are ground into a deep orange-yellow powder commonly used as a coloring and flavoring agent in many Asian cuisines, especially for curries, as well as for the dyeing characteristics imparted by the principal turmeric constituent, curcumin.

Phytoconstituents: Turmeric powder is about 60–70% carbohydrates, 6–13% water, 6–8% protein, 5–10% fat, 3–7% dietary minerals, 3–7% essential oils, 2–7% dietary fiber, and 1–6% curcuminoids. The golden yellow color of turmeric is due to curcumin. Phytochemical components of

turmeric include diarylheptanoids, a class including numerous curcuminoids, such as curcumin, demethoxycurcumin, and bisdemethoxycurcumin. Curcumin constitutes up to 3.14% of assayed commercial samples of turmeric powder (the average was 1.51%); curry powder contains much less (an average of 0.29%). Some 34 essential oils are present in turmeric, among which turmerone, germacrone, atlantone, and zingiberene are major constituents.

Trigonella foenumgraecum

Fenugreek, scientifically known as *Trigonella foenum-graecum*, is an annual herb in the Fabaceae family, used as a spice, herb, and traditional medicine, with potential benefits for blood sugar control, cholesterol levels, and more.

Family: Fabaceae (also known as the legume family). Origin: Native to the Eastern Mediterranean region and the Indian subcontinent. Cultivation: Grown worldwide, including India, Canada, Russia, Pakistan, and other regions. Other names: Fenugreek is also known as methi, Greek hayseed, halba, and bird's foot.

Description: An annual, erect, smooth, herbaceous legume plant. Flowers: Produces triangular yellow flowers. Pods: Straight or sickle-like pods containing 10-20 seeds. Seeds: 6-8 mm long, oblong or square, green-olive or brownish in color, with a very strong and spicy odor.

Ocimum tenuiflorum

Ocimum tenuiflorum, commonly known as holy basil, tulasi or tulsi (from Sanskrit), is an aromatic perennial plant in the family Lamiaceae. It is widely cultivated throughout the Southeast Asian tropics. It is native to tropical and subtropical regions of Asia, Australia and the western Pacific. This plant has escaped from cultivation and has naturalized in many tropical regions of the Americas. It is an agricultural and environmental weed. Tulasi is cultivated for religious and traditional medicine purposes, and also for its essential oil. It is widely used as an herbal tea, commonly used in Ayurveda. It has a place within the Vaishnava tradition of Hinduism, in which devotees perform worship involving the plant or its leaves

Phytoconstituents: The plant and its oil contain diverse phytochemicals, including tannins, flavonoids, eugenol, caryophyllenes, carvacrol, linalool, camphor, and cinnamyl acetate, among others. One study reported that the plant contains an eponymous family of 10 neolignan compounds called tulsinol A-J.

Specific aroma compounds in the essential oil are camphor (32%), eucalyptol (19%), α -bisabolene (17%), eugenol

(14%), germacrene (11%) and β -bisabolene (11%). In addition, more than 60 different aroma compounds were found through gas chromatography– mass spectrometry analysis of holy basil. However, other studies have stated tulsi essential oil consists mostly of eugenol (70%) β -elemene (11%), β -caryophyllene (8%), and germacrene (2%), with the balance being made up of various trace compounds, mostly terpenes. (Sundaram, R. Shanmuga; Ramanathan, M; Rajesh, R; Satheesh, B; Saravanan, D (2012).

Cinnamomum verum

Cinnamomum verum (syn. *Cinnamomum zeylanicum*, also called true cinnamon tree or Ceylon cinnamon tree) is a small evergreen tree belonging to the family Lauraceae, native to Sri Lanka. The inner bark of the tree is historically regarded as the spice cinnamon, though this term was later generalized to include *C. cassia* as well. Cinnamon is the name for several species of trees and the commercial spice products that some of them produce. All are members of the genus *Cinnamomum* in the family Lauraceae. Only a few *Cinnamomum* species are grown commercially for spice. *Cinnamomum verum* (alternatively *C. zeylanicum*), known as "Ceylon cinnamon" after its origins in Sri Lanka (formerly Ceylon), is considered to be "true cinnamon", but most cinnamon in international commerce is derived from four other species, usually and more correctly referred to as "cassia": *C. burmanni* (Indonesian cinnamon or Padang cassia), *C. cassia* (Chinese cinnamon or Chinese cassia), *C. loureirii* (Saigon cinnamon or Vietnamese cassia), and the less common *C. citriodorum* (Malabar cinnamon). (Aleccia, Jonel, 2024).

Moringa oleifera

Moringa oleifera is a short-lived, fast-growing, drought-resistant tree of the family Moringaceae, native to northern India and used extensively in South and Southeast Asia. Common names include moringa, drumstick tree (from the long, slender, triangular seed-pods), horseradish tree (from the taste of the roots, which resembles horseradish), or malunggay (as known in maritime or archipelagic areas in Asia).

It is widely cultivated for its young seed pods and leaves, used as vegetables and for traditional herbal medicine. It is also used for water purification.

Phytoconstituents: The leaves are the most nutritious part of the plant, being a significant source of B vitamins, vitamin C, provitamin A as β -carotene, vitamin K, manganese, and protein. Some of the calcium in moringa leaves is bound as crystals of calcium

oxalate. Oxalate levels may vary from 430 to 1050 mg/100g compared to the oxalate in spinach (average 750 mg/100g). **Traditional medicine and research:** The bark, sap, roots, leaves, seeds, and flowers are used in traditional medicine. Research has examined how it might affect blood lipid profiles and insulin secretion. Extracts from leaves contain various polyphenols, which are under basic research to determine their potential effects in humans. Despite considerable preliminary research to determine if moringa components have bioactive properties, no high-quality evidence has been found to indicate that it has any effect on health or diseases.

Phyllanthus emblica

Phyllanthus emblica, also known as emblic, emblic myrobalan, myrobalan, nelikai, Indian gooseberry, Malacca tree, amlaki or amla, is a deciduous tree of the family Phyllanthaceae. Its native range is tropical and southern Asia.

Phytoconstituents: The fruits contain high amounts of ascorbic acid (vitamin C), and have a bitter taste that may derive from a high density of ellagitannins, such as emblicanin A (37%), emblicanin B (33%), punigluconin (12%), and pedunculagin (14%). Amla also contains punicafolin and phyllanemblinin A, phyllanemblinin other polyphenols, such as flavonoids, kaempferol, ellagic acid, and gallic acid. (Bhattacharya, A.; Chatterjee, A.; Ghosal, S.; Bhattacharya, S. K. (1999).

Azadirachta indica

Azadirachta indica, commonly known as neem, margosa, nim tree or Indian lilac, is a tree in the mahogany family Meliaceae. It is one of the two species in the genus *Azadirachta*. It is native to the Indian subcontinent and to parts of Southeast Asia, but is naturalized and grown around the world in tropical and subtropical areas. Its fruits and seeds are the source of neem oil. Nim is a Hindustani noun derived from Sanskrit Nimba

Phytoconstituents: Margosa fruit, seeds, leaves, stems, and bark contain diverse phytochemicals, some of which were first discovered in *Azadirachta* seed extracts, such as azadirachtin established in the 1960s as an insect antifeedant, growth disruptor, and insecticide. The yield of azadirachtin from crushing 2 kg of seeds is about 5 g. In addition to azadirachtin and related limonoids, the seed oil contains glycerides, diverse polyphenols, nimbolide, triterpenes, and β -sitosterol. The yellow, bitter oil has a garlic-like odor and contains about 2% of

limonoid compounds. The leaves contain quercetin, catechins, carotenes, and vitamin C.

Allium sativum

Allium sativum is a species of bulbous flowering plants in the genus *Allium*. Its close relatives include the onion, shallot, leek, chives, Welsh onion, and Chinese onion. Garlic is native to central and south Asia, stretching from the Black Sea through the southern Caucasus, northeastern Iran, and the Hindu Kush; it also grows wild in parts of Mediterranean Europe. There are two subspecies and hundreds of varieties of garlic. Garlic has been used for thousands of years as a seasoning, culinary ingredient, traditional medical remedy; it was known in many ancient civilizations, including the Babylonians, Egyptians, Romans, and Chinese, and remains significant in many cuisines and folk treatments, especially across the Mediterranean and Asia. Garlic propagates in a variety of climates and conditions and is produced globally; China is by far the largest producer, accounting for over two thirds (73%) of the world's supply in 2021.

Phytoconstituents: Raw garlic contains some micronutrients in rich amounts (20% or more of the DV), including vitamins B6 (73% DV) and C (35% DV), and the dietary mineral, manganese (73% DV), raw garlic is a moderate source (10–19% DV) of the B vitamins, thiamin and pantothenic acid, as well as the dietary minerals, calcium, potassium, phosphorus, and zinc. The composition of raw garlic is 59% water, 33% carbohydrates, 6% protein, 2% dietary fiber, and less than 1% fat. (Yanagino, Toshiya; Sugawara, Etsuko; Watanabe, Masao; Takahata, Yoshihito (June 2003).

Allium cepa

Allium cepa, from Latin *cepa* meaning "onion also known as the bulb onion or common onion, is a vegetable that is the most widely cultivated species of the genus *Allium*. The shallot is a botanical variety of the onion which was classified as a separate species until 2011. The onion's close relatives include garlic, scallion, leek, and chives.

The genus contains several other species variously called onions and cultivated for food, such as the Japanese bunching onion *Allium fistulosum*, the tree onion *Allium × proliferum*, and the Canada onion *Allium canadense*. The name wild onion is applied to a number of *Allium* species, but *A. cepa* is exclusively known from cultivation. Its ancestral wild original form is not known, although escapes from cultivation have become established in some regions. The onion is most frequently a biennial or

a perennial plant, but is usually treated as an annual and harvested in its first growing season.

Phytoconstituents: Onion varieties vary widely in phytochemical content, particularly for polyphenols, with shallots having the highest level, six times the amount found in Vidalia onions. Yellow onions have the highest total flavonoid content, an amount 11 times higher than in white onions. Red onions have considerable content of anthocyanin pigments, with at least 25 different compounds identified representing 10% of total flavonoid content. Like garlic, onions can show an additional colour – pink-red – after cutting, an effect caused by reactions of amino acids with sulfur compounds. Onion polyphenols are under basic research to determine their possible biological properties in humans. (Fearon K, Strasser F, Anker SD, Bosaeus I, Bruera E, Fainsinger RL, et al. (May 2011). "Definition and classification of cancer Brewster JL (1994).

CONCLUSION

The Indian botanicals can be used to modify the pH in T2DM and several stages of Hepatocarcinoma. One of the etiologic factors implicated in the development of diabetes and cancer and its complications is the damage induced by free radicals and hence an antidiabetic compound with antioxidant properties would be more beneficial. Therefore, information on antioxidant effects of these medicinal plants is also studied and further studies are done to understand the pathway responsible for T2DM and Hepatocarcinoma.

ACKNOWLEDGMENTS

We are thankful to all the staff members of Raigad college of pharmacy, Mohopre Mahad-Raigad Affiliated to (DBATU).

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