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Phytochemical Effects of *Aloevera* and *Curcuma longa* on Diabetes Mellitus and Cancer

Ekta Singhal¹, Archana Singh²

Research Scholar, Department of Botany, M.S.J P.G. College, Bharatpur, India¹

Assistant Professor, Department of Botany, M.S.J P.G. College, Bharatpur, India²

ABSTRACT: The present study investigated the effects of intensive glucose regulation and cancer with combined treatment of Aloe vera gel and turmeric. WHO revealed that 422 million people are living with diabetes mellitus and it is the seventh leading cause of death in the world. One in every 11 individual is a diabetic patient. Various medications are generally recommended as the first line of treatment for type II diabetes as there is fair evidence that they decrease mortality, but there are various side effects. Cancer is a leading cause of death in the world and it is increasing year by year. According to the latest global statistics in 2020, 19.3 million new cases were diagnosed and cancer contributed to 10 million deaths. Hence, present study aimed to experimentally develop a home based low cost concoction to reduce the blood sugar level and cancer using aloe vera and turmeric in various proportions

I. INTRODUCTION

Diabetes mellitus is a multifactorial disease that has a significant impact on the health, quality of life and life expectancy of patients, as well as on the health care system. Diabetes is characterized by insulin deficiency or insulin insensitivity resulting in hyperglycaemia together with biochemical alterations of glucose and lipid metabolism (1). Dysregulation of the insulin pathway results in abnormalities in the metabolism of lipids, proteins, carbohydrates and electrolytes. These traits are hypothesized to be responsible for the damage to cell membranes, which, in turn, results in an elevated production of reactive oxygen species (ROS) (2).

Cancer is one of the most serious problem which threaten public. The most prominent factors of cancer are uncontrolled proliferation, local invasion and distant metastasis. The World Health Organization identifies as main causes behind the development of cancer random somatic mutations, ionizing radiation, reactive oxidative species as well as several chemical and biological agents (3). Cancer is a leading cause of death hence, the incidence and mortality of cancer is increasing year by year. According to the latest global cancer statistics in 2020, 19.3 million new cases were diagnosed and cancer contributed to 10.0 million deaths(4)

Natural products have received considerable attention for the management of diabetes and its complications. The spice turmeric, which is derived from the root of the plant *Curcuma longa* and the leaf extract of *Aloe vera* has been described as a treatment for diabetes and cancer.

Aloe vera is a xerophyte and therefore survives very well in highly dried arid conditions found mostly in African countries (5). *Aloe* belonged to the Lily family (Liliaceae) until it was reclassified to its own family known as Aloaceae (6). The name was derived from Arabic word *alloe* meaning bitter, because of bitter liquid found in the leaves. It is also known as "Lily of the desert", the plant of immortality," the medicinal plant" with qualities to serve as alternative medicine (7). The plant has been reported to possess wound healing and anti-inflammatory effects due to the presence of phytochemicals such as tannic acid, glycoproteins, and sulfated polysaccharides among other complex polysaccharides (8).

A. vera gel contains no anthraquinones, which are responsible for the strong laxative effects of aloe. The pharmacological actions of *A. vera* was studied in vitro or in vivo (in most cases the total leaf extract was used), include anti-inflammatory, anti-arthritis, antibacterial and hypoglycemic effects (9). *A. vera* is a medicinal plant that is claimed to have hypoglycemic effect with fewer side effects and less expensive without toxicity (10). The hypoglycemic efficacy of aloe gel was confirmed in streptozotocin-induced diabetic rats (11).



Turmeric, the rhizome derived from the plant *Curcuma longa*, is widely used as an ingredient in common Indian curry spice. It is widely distributed throughout tropical and subtropical regions of the world. It is widely cultivated in Asian countries, mainly in China and India. Turmeric is an essential spice all over the world. Apart from the uses as spice, it is used as traditional medicine in Asian countries such as India, Bangladesh and Pakistan because of its beneficial properties (12). Furthermore, as reviewed by Aggarwal *et al.* 2007 (13), substantial *in vitro* data indicate that curcumin, extracted from turmeric, has antithrombotic, antiatherosclerotic, hypolipidemic, antiinflammatory, and antioxidative effects. The coloring principle of turmeric is its powder which is called **curcumin** and it has yellow color. Its powder is a claimed medicine against gastrointestinal diseases, especially for biliary and hepatic disorder, diabetic wounds, rheumatism, inflammation, sinusitis, anorexia, coryza and cough.

Turmeric has been shown to inhibit the growth of a variety of bacteria, pathogenic fungi, and parasites. Khattak *et al.* 2005(14) studied the antifungal, antibacterial, phytotoxic, cytotoxic and insecticidal activity of an ethanolic extract of turmeric.

II. PHYTOCOMPONENTS

Phytocomponents of Aloe vera:

Aloe vera is a succulent plant species that probably originated in northern Africa. Aloe vera is a succulent plant species that probably originated in northern Africa. Aloe vera leaf has been alienated in two major parts namely the external green rind including the vascular bundles and the internal colorless parenchyma containing the aloe gel. Nearly 98.5% of water content is present in the raw pulp of Aloe vera, while 99.5 percentile was shown in the mucilage or gel. It has the pH of 4.5. Aloe vera leaves contain phytochemicals such as acetylated mannans, polymannans, anthraquinone C-glycosides, anthrones and anthraquinones including emodin and various lectins. The residual solid material approximately 0.5 to 1% consists of a range of compounds which include vitamins which are water-soluble and fat soluble, minerals, enzymes, polysaccharides, phenolic compounds and organic acids as reported by [15,16]. Chemical composition of Aloe vera leaf pulp and exudates were reported [17] and is summarized in Table 1.

Table 1: Chemical composition and properties of Aloe vera

Constituents	Number and identification	Property
Amino acids	Provides 20 of the 22 required amino acids and 7 of the 8 essential ones	Basic building blocks of proteins in the body and muscle tissues
Anthraquinones	Provides Aloe emodin, Aloetic acid, alovin, anthracine	Analgesic, antibacterial
Enzymes	Anthranol, barbaloin, chrysophanic acid, smodin, ethereal oil, ester of cinnamonic acid, isobarbaloin, resistannol	Antifungal and antiviral activity but toxic at high concentrations
Hormones	Auxins and gibberellins	Wound healing and anti-inflammatory
Minerals	Calcium, chromium, copper, iron, manganese, potassium, sodium and zinc	Essential for good health
Salicylic acid	Aspirin like compounds	Analgesic
Saponins	Glycosides	Cleansing and antiseptic
Steroids	Cholesterol, campesterol, lupeol, sosterol	Anti-inflammatory agents, lupeol has antiseptic and analgesic properties
Sugars	Monosaccharides: Glucose and Fructose Polysaccharides: Glucmannans/polymannose	Anti-viral, immune modulating activity of acemannan

**Phytoconstituents of Turmeric:**

Turmeric contains 69.4% carbohydrates, 6.3% protein, 5.1% fat, 3.5% minerals, and 13.1% moisture. The essential oil (5.8%) obtained by steam distillation possesses Sesquiterpenes (53%), zingiberene (25%), α -phellandrene (1%), sabinene (0.6%), cineol (1%), and borneol (0.5%). Curcumin (3–4%) is the main component of turmeric, it is also known as diferuloylmethane and is a yellow-orange crystalline solid. Polyphenol of turmeric and curcumin is known as C.I. 75300 or Natural Yellow 3. The systematic chemical name is (1E,6E)-1,7-bis(4-hydroxy-3-methoxyphenyl)-1,6-heptadiene-3,5-dione. It can exist in at least two tautomeric forms, keto and enol. The keto form is preferred in solid phase and the enol form in liquid solution. Curcumin is a pH indicator. In acidic solutions (pH 8.6), it turns bright red. Demethoxy and bis-demethoxy derivatives of curcumin have also been isolated from turmeric. Curcumin has a melting point at 176–177 °C; forms a reddish-brown salt with alkali and is soluble in acetic acid, ethanol, alkali, ketone and chloroform. Phytoconstituents of turmeric were reported by Rohan yadav *et al.* 2016 and is summarized in Table 2

Table 2: Phytoconstituents of *Curcuma Longa*

Sr.	Phytoconstituents in <i>Curcuma Longa</i> Linn
1	1,8-cineole, 2-bornanol, 2-hydroxy-methyl-anthraquinone, 4-hydroxybisabol-2
2	10-diene-9-one; 4-methoxy-5-hydroxybisabol; 4-hydroxy-cinnamoyl-(Feruloyl)-methane, α -atlantone, α -pinene, α -terpineol, Ar-turmerone, Arabinose
3	Ascorbic-acid, Ash, Azulene, Beta-carotene, Beta-pinene, Beta-sesquiphellandrene, Bis-(Para-hydroxy-cinnamoyl)-methane,
4	Bis-desmethoxycurcumin, Bisabolene, Bixin, Borneol, Boron, Caffeic-acid, Calcium, Caprylic-acid, Caryophyllene, Chromium, Cineole, Cinnamic-acid, Cobalt, Copper, Cumylalcohol, Curcumene, Curcumenol, Curcumin, Curdione,
5	Eugenol, Epiprocurcumenol; Eucalyptol; Eugenol; Feruloyl-p-coumaroyl-methane, γ -atlantone, Germacrone, Germacrone-13-al; Guaicol, Isoborneol, L-alpha-curcumene
6	L-beta-curcumene, Limonene, Manganese, Monodesmethoxycurcumin, Niacin, Nickel, norbixin; O-coumaric-acid, P-coumaric-acid, P-cymene, P-methoxycinnamic-acid, P-tolymethylcarbinol, Phosphorus, Protocatechuic-acid, Procurcumadiol
7	Acidic polysaccharides: utonan A, B, C, D.
8	Volatile Oil (4.2%), its main content is turmerone, ar-turmerone, curcumene, germacrone, ar-curcumene,
9	The herbal classics CHMM (Chinese Herbal Materia Medica)
10	Other chemicals: campesterol, stigmasterol, beta-sitosterol, cholesterol, fatty acids and metallic elements potassium, sodium, magnesium, calcium, manganese, iron, copper, zinc, the ratio of copper/zinc.

Phytopharmacology of Aloe vera and Turmeric:

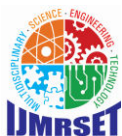
Turmeric and Aloe vera has several therapeutic and pharmacologic activities.

Anti-oxidant activity of Turmeric:

Oxidative damage is one of the mechanisms which are responsible for aging and many kind of disease. The free radicals involved in this mechanism react highly with organic substance in our body which can cause harm. Curcumin doesn't only block the free radicals: it also stimulates the antioxidant mechanism in our body. The antioxidant activity of curcumin was reported (18). It can protect haemoglobin from oxidation (19).

Anti-cancerous activity of turmeric:

Numerous animal studies have explored turmeric influence on the carcinogenesis. Several studies have demonstrated that curcumin is able to inhibit carcinogenesis at three stages: angiogenesis, tumor promotion and tumor growth. Turmeric and curcumin are also able to suppress the activity of several common mutagens and carcinogens. Several in vivo and in vitro studies on breast cancer indicated that the main bioactive component of turmeric rhizome, curcumin is a potent breast cancer inhibitor possessing anti-proliferative and proapoptotic properties (20, 21, 22).



Anti-diabetic effects of Turmeric:

Turmeric exerts cardio-protective effects mainly by antioxidant activity, lowering lipid peroxidation, antidiabetic activity and inhibiting platelet aggregation. Turmeric extract demonstrated decreased susceptibility of LDL to lipid peroxidation, in addition to lower plasma cholesterol and triglyceride levels. Turmeric effect on cholesterol levels may be due to decreased cholesterol uptake in the intestines and increased conversion of cholesterol to bile acids in the liver. Inhibition of platelet aggregation by turmeric constituents is thought to be via potentiation of prostacyclins synthesis and inhibition of thromboxane synthesis. Turmeric also decreases complications in diabetes mellitus. Vascular disease is a common long-term complication of diabetes. Diabetic vascular disease causes damage to large and small blood vessels throughout the body. Curcumin has been reported to be active against diabetic vascular disease.

Anti-oxidant activity of Aloe-vera:

Antioxidants are compounds that prevent or slow down biomolecule oxidative damage caused by ROS through free radical scavenging, metal chelation, and enzyme regulation (23). Kumar et al. 2017 (24) investigated the potential antioxidant activity of crude methanolic extracts of Aloe vera from six agro-climatic zones of India using different in vitro methods (i.e., DPPH, metal chelating, and reducing power assay). Sun *et al.* 2017 showed that the antioxidant activity of Aloe vera is due to anthraquinones and related compounds (10 μ M) which possess peroxy radical scavenging activity and reducing capacity

Anti-diabetic effects of Aloe-vera:

Diabetes is a chronic disease presenting with high levels of glucose in blood because of an insulin resistance or an insulin deficiency. Study on the cause it clears that oxidative stress is a main cause of the beginning and the progression of diabetes complications. Aloe vera showed to reduce blood glucose levels, to increase insulin levels, and to improve pancreatic islets (number, volume, area, and diameter) (25), and this medicinal plant protected from oxidative stress-induced diabetic nephropathy and anxiety/depression-like behaviors (26). Aloe vera polysaccharides (100 μ g/g for 3 weeks) are responsible for the decrease of blood glucose levels. A recent in vitro study showed that the action mechanism of Aloe vera polysaccharides antidiabetic effect is related to its ability to inhibit apoptosis and endoplasmic reticulum stress signaling (27).

Anti-cancerous effect of Aloe-vera:

In the present review are aimed at evaluating cytotoxic and antitumor activity of Aloe-vera against a cancer causing cells. Aloe-vera crude extracts reduced cell viability of cancer cell lines through apoptosis induction and modulation of effector gene expression (28). MCF-7 cells, which express estrogen receptor, are the most popular breast cancer cell line, and the immortal HeLa cell line are the oldest and most used cervical cancer cells (29, 30). The isolated compound aloe-emodin has resulted to be an effective anticancer agent against both MCF-7 cells and HeLa cells by inducing mitochondrial and endoplasmic reticulum apoptosis and inhibiting metastasis oxidative stress (31, 32, 33, 34).

III. CONCLUSION

This study indicate that curcumin and aloevera may have anti-inflammatory, antioxidant and anticancer properties, in particular. However since there is a limited number of clinical studies, its effects on humans are not known clearly. Although, there no serious side effects have been reported of using these products. For now, it would be preferable to abstain from the use of these product for medical purposes.

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