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ANTIDIABETIC ACTIVITY OF CHIANG DA (*GYMNEMAINODORUM*)LOCAL PLANT OF NORTHERN THAILAND

JukkritWungrath*

*Faculty of Public Health, Chiang Mai University, Chiang Mai, Thailand

Abstract

Chiang Da (Gymnemainodorum) is a woody, climbing traditional medicinal herb which has many therapeutic applications. It has an important role in plasma glucose levels. Chiang Da has clinical evidence to treat diabetes and tradition antidiabetic formulation showed their hypoglycemic potential by any one or all the mechanism of increase secretion of insulin; promotes regeneration of islet cells and increase utilization of glucose. As the synthetic agents act by only one pathway but the herbal remedies have to show the various pathways due to their phytochemicals to treat diseases. The details of these effects for Chiang Da and their supporting animal and clinical studies have been discussed in this review.

Keywords: Antidiabetic activity, Chiang Da, Gymnemainodorum

Introduction

Chiang Da (*Gymnemainodorum*) is a woody, climbing plant. It is the herbs of milkweed family (Asclepiadaceae)[1]. Mostly found in hot and humid areas of central and southern India and also in South East Asia including Thailand, Loa, Cambodia, Myanmar and Vietnam.[1, 2] Chiang Da is commonly known as Periploca of the woods (English); Gurmar (Hindi); MeshashrinChiang Da, madhunashini (Sanskrit); Kavali, kalikardori (Marathi); Dhuleti, mardashinChiang Da (Gujrathi); Adigam, cherukurinja (Tamil); Podapatri (Telgu) and Sannagerasehambu (Kannada).[3, 4] The word "Gymnema" is derived from a Hindu word "Gurmar" meaning "destroyer of sugar" and it is believed that it might neutralize the excess of sugar present in the body in Diabetes mellitus.[5] Chiang Da plant is a slow growing, woody climber. The trunk of Chiang Da is soft, the leaves are opposite, elliptic or ovate shaped.

*Corresponding Author: JukkritWungrath

Flowers are small yellowish white. Its leaves and stems have been used as vegetables for Thai cuisine, especially in the Northern and Eastern parts of the country.[2]

Chiang Da are known for their antidiabetic properties. Which is an ancient herb used in Ayurvedic, homeopathic and Thai traditional medicine. It is also used to treat various ailments for example asthma, eye irritation, chronic cough, trouble breathing, constipation, abdominal pain due to indigestion. In addition, it also has properties in anti-microbial activities, anti-hypercholesterolemic activity, anti-inflammatory activity and an inhibitor of sweetness.[6] In 1997, Shimizu et al.[7] reported that Chiang Da has been shown an ability to inhibit glucose absorption in guinea pig intestines. They also found that young Chiang Da leaves extract can decrease blood glucose in alloxan-induced diabetic rats. Another plant of the same family and genus is *GymnemaSylvestre*, a discarded plant that is endemic to India and South Asia. However, there are a few studies with regard to hypoglycemic effect of Chiang Da in human. The current review is aimed at providing an overview on Antidiabetic Activity of Chiang Da and constituents along with their available toxicity status.

Chemical components of Chiang Da

Chiang Da contains many nutrients and chemical constituents such as gymnemic acid[7, 8], B-carotene, vitamin C, vitamin E, tannin, xanthophyll, and phenolic substances.[9] As shown in Table 1. It has been known that this vegetable is effective for treatment of several diseases including diabetes mellitus, rheumatic arthritis, and gout. The extracts of Chiang Da leaves suppress the intestinal smooth muscle contraction, decrease the O, consumption, inhibit the glucose absorption as well as prevent the increase of blood glucose level.[7, 8]In Japan, Chiang Da leaves are used for drinking by adding in foods and beverage for diabetes prevention and for blood sugar reduction in diabetic patients[7, 8], Besides diabetes prevention and blood sugar reduction, the Chiang Da roasted tea is shown to be rich in vitamins (especially vitamin C, vitamin E, and B-carotene), amino acids, and essential minerals necessary for the adjustment of biological functions.[10]

It has been reported that Chiang Da has a high antioxidant index[9] and high content of B-carotene.[11]Likewise, Chiang Dah has been found to have a strong antioxidant activity in *in vitro* analysis. However, the antioxidant effects Chiang Da on biological samples including erythrocytes oxidation have never been studied. The damage of erythrocytes and DNA may induce the deterioration of functions in many organs leading to diseases in human.

Table 1 Nutritive values of Chiang Da[11]

Nutrients	Content (per 100 g edible portion)
Proximal composition (grams)	
Protein	5.4
Fat	1.5
Carbohydrate	8.6
Dietary fiber (Crude fiber)	2.5
Minerals (milligrams)	
Calcium	78.0
Phosphorus	98.0
Iron	2.3
Vitamins (micrograms)	
Beta-carotene	5905.0
Total vitamin A	984.0
Thiamin	0.12
Riboflavin	0.35
Niacin	10
Vitamin C	153.0
Vitamin E	36.5
Essential amino acids (milligrams)	
Lysine	30
Phenylalanine	26
Leucine	33
Isoleucine	28
Valine	60
Tryptophan	17
Minerals (milligrams)	
Phosphorus	394
Iron	59.8
Calcium	1.75

Sodium	11.6
Potassium	4.01
Magnesium	544
Copper	7.00
Zinc	34.2
Manganese	163
Selenium	0.19
Aluminum	432

Antidiabetic activity of Chiang Da

The Antidiabetic or hypoglycemic effect of Chiang Da is a property of a substance called gymnemic acid after it was successfully isolated and purified from the leaves of Chiang Da. The gymnemic acid the main constituent encloses different saponins and delays the glucose absorption in the blood due to the similarity with the atomic arrangement of the glucose. The leaf extract administered to patient stimulate the pancreas and increase release of insulin.[12]

It enhances production or activity of insulin and promotes regeneration of pancreas beta cells. In T1DM, leaf extract reduces insulin requirements and fasting glucose and improves glycemic control. It improves glycemic control in T2DM, reducing hypoglycemic drug needs. Applied to the tongue, gymnemic acid blocks sensation of sweetness. Subjects who had Chiang Da applied to the tongue ate fewer calories at meals compared with control subjects. Chiang Da decreases cravings for carbohydrates and enables patients with T2DM to follow a lower-carbohydrate diet. Capsules or tablets do not produce the same effect. Dose: 200 mg (standardized to 24% gymnemic acid). No side effects reported; diabetics on insulin must monitor blood glucose because insulin doses may have to be decreased.[13]

Chiang Da leaves extract influences the regeneration of cells in the pancreas that produce insulin hormone, effect of increasing the insulin hormone levels. In addition, Chiang Da has the effect of reducing the absorption of glucose in the intestine, increase the ability to deliver glucose into cells enable cellsto use more glucose. it also prevents hormones from the adrenal glands that stimulate the liver to produce glucose, resulting in lower blood glucose levels[14]. In the line with Chiabchalard (2010)[2] studied the effects of Chiang Da in reducing blood sugar, volunteers drink Chiang Da tea immediately and 15 minutes after receiving oral

glucose load. It was found that plasma glucose was found in the volunteers who received Ching Da tea significantly reduced. Moreover, when had Ching Da tea at a double concentration, it can reduce Plasma glucose is better. The researcher also reported that drinking 1 cup of Chiang Da tea a day after meals immediately for 28 days can control blood sugar better than people who don't drink.An et al. (2020)[15] indicated that the compounds of Chiang Da leaves were shown to have a stimulatory effect on glucose uptake in 3T3-L1 adipocyte cells, suggest that the leaves of Chiang Da have the potential to be used as an antidiabetic functional food or tea according their studied. Shimizu (1997)[8] found that saponin extracted from the Chiang Da leaves and triterpenoids extracted from the top of Chiang Da leaves significantly lowered the blood glucose levels of guinea pigs treated with oral glucose tolerance. Clinical tirals conducted in the USA confirmed that Chiang Da has hypoglycemic activity. The level of fasting glucose decreased by 18%; its postprandial level, by 28%; the amount of HbAlc, by 10% in 65 patients with poorly managed hyperglycemia who were administered Chiang Da preparations over 90 d. Use of GS could reduce the dose of peroral hypoglycemic preparations in 16% of the test participants.[1 6] In Russia, the investigated of compositions consisting of Chiang Da extracts in detail under in vitro and in vivo conditions were studied. It was found that use of the preparation reduced glycemia, the amount of HbAlc, the CS level, the content of LDL and VLDL, and the index of atherogenesis[17]; activated repair processes in **β**-endocrinocytes, and prevented the development of apoptosis.[18] The preparation is currently in clinical trials.[17, 18]

Toxicity of Chiang Da

There are reported that no adverse reactions in a long-term study of insulin-dependent diabetic patients consumed or received Chiang Da in any form[19, 20]. In an acute toxicity study in mice, no gross behavioral, neurological, or autonomic effects were observed. The acute LD 50 was 3990 mg/kg. The safety ratio (LD 50 /ED 50) was 11 and 16 in normal and diabetic rats, respectively.[19, 21, 22] Several reports suggest that the reliable toxic dose of Chiang Da has not been found. The LD50 in mice and rats is greater than 5 g/kg. Administration of extract produced by aqueous alcohol extraction of Chiang Da (19.5:1) at a dose of 250 – 8,000 mg/kg perorally to mice did not produce any behavioral or neurological effects. The toxicity of Chiang Da powder was tested for two weeks in Wistar rats. Intermediate hematological and biochemical blood parameters were measured after 26 weeks; final ones, after 52 weeks.

No side effects were found upon administration of Chiang Da at doses of 504 – 563 mg/kg/d in man.[23]

Conclusions

Medicinal plants served as a platform for ancient Ayurvedic system of medicine. In the present scenario, herbal therapeutics are gaining momentum in pharmacological applications and as molecular targets in the drug development. The emerging trend in rising incidence of diseases and associated complications with commercial medications poses a serious threat to mankind.Chiang Da modifying materials of natural origin. The herb accounts for multiple pharmacological significance as a naturopathic medication since ancient times and gaining popularity in the present scenario as well.Chiang Da extract has been used for the treatment of diabetes mellitus. Several clinical trials and experimental studies indicated that the plant is an invaluable source of bioactive compounds and phytoconstituents like gymnemic acids have been used as molecular targets in drug development. Chiang Da is a herb less exploited for its innumerable advantages. The aim of this review is to highlight the prospects of this rare herb as a potential medication for treatment of diseases from diabetes**.** Chiang Da is a herbal preparation which contains gymnemic acid from leaf extract and provides nutritional support to pancreas and maintain healthy blood sugar balance when used as part of diet**.**

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