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# A CRITICAL REVIEW ON KARAVELLAKA (MOMORDICA CHARANTIA L.), AMALAKI (EMBLICA OFFICINALIS. GARETH) AND HARIDRA (CURCUMA LONGA L.) AS FUNCTIONAL FOOD INGREDIENTS IN TYPE 2 DIABETES MELLITUS

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## ABSTRACT

Type 2 Diabetes mellitus is strongly associated with lifestyle and dietary habits. Once diagnosed, modification of diet for life time is a part of management strategy. A food can be regarded as functional if it is satisfactorily demonstrated to affect beneficially one or more target functions in the body, beyond adequate nutritional effects. This is comparable to the concept of *Pathya* in traditional medicine. Functional food has profound importance in Type 2 Diabetes mellitus. *Karavellaka (Momordica charantia L.)*, *Amalaki(Emblica officinalis. Gareth)* and *Haridra (Curcuma longa L.)* are having multiple utility as dietary ingredients and medicine in Type 2 Diabetes mellitus. Results of Reverse pharmacological researches support their utility as functional food in Type 2 Diabetes mellitus.

**Keywords:** Functional food ingredients, Type 2 Diabetes mellitus, *Karavellaka, Amalaki, Haridra*

## INTRODUCTION

Estimates reveal that 366 million people had Type2 Diabetes melitus in 2011; by 2030 this would have risen to 552 million. The number of people with Type 2 Diabetes mellitus is increasing in every country with 80% of people with this disease living in low and middle income countries [1]. Type2 Diabetes mellitus accounts for 90-95% of diabetes. This condition develops when the body is unable to produce an adequate amount of insulin or the insulin which is provided does not work effectively. This is due to lifestyle habits including unhealthy diet, obesity, and lack of exercise, hereditary and environmental factors. Some symptoms of Diabetes mellitus are excess urination, constant thirst, lethargy, weight loss, itching, decreased digestive enzyme secretion and slow wound healing. If left untreated Diabetes mellitus can lead to severe long term complications such as as neuropathy, retinopathy, cardiomyopathy, nephropathy, exocrine gland insufficiency, Stroke and other forms of complications.Type2 Diabetes mellitus can be treated and controlled by prescribed drugs, regular exercise, diet and general change in lifestyle habits[2]. Conventional Oral Hypogycemic agents have known adverse effects[3]. Bleak scenario demands propagation of dietary articles with dual role as food and medicine in this condition.

***Prameha***

Based on etiology and symptomatology, Diabetes mellitus broadly comes under Prameha explained in classics[4].

**Functional food**

The term "functional food" was first introduced in Japan in the mid-1980s and refers to foods containing ingredients that aid specific bodily functions in addition to being nutritious. Generally, they are considered as those foods intended to be constituted as part of a normal diet, and that contain biologically active components, which offer the potential of enhanced health or reduced risk of disease. Research has demonstrated that nutrition plays a crucial role in the prevention of chronic diseases like diabetes, as most of them can be related to diet. Functional food enters the concept of considering food not only necessary for living but also as a source of mental and physical well-being, contributing to the prevention and reduction of risk factors for several diseases or enhancing certain physiological functions. A food can be regarded as functional if it is satisfactorily demonstrated to affect beneficially one or more target functions in the body, beyond adequate nutritional effects. The increasing interest in functional food reflects the fact that epidemiological studies indicating a specific diet or component of the diet is associated with a lower risk for a certain disease like diabetes[5]. This view goes hand in hand with the *Pathyaahaara* (conducive diet) specified in traditional medicine. *Pathya* primarily concerns physical well being and secondarily mental satisfaction[6]. Conducive diet is of profound importance in the management of life style disorders. *Kapha dushti*(derangement) occurs in the primary stage of *Prameha samprapti* (pathogenesis) [7]. *Madhura* (sweet), *Amla* (sour) and *Lavana* (salty) *rasas* are causative for *Prameha* [8], while *Thikta shaaka* (bitter vegetables) are specifically indicated in *Prameha*[9,10,11].

***Karavellaka (Momordica charantia L.)***

*Karavellaka (Momordica charantia L.)* is a widely available bitter vegetable. It possesses *tikta katu rasa, laghu rooksha guna*, *ushna veerya, katu vipaka, kapha pittahara and pramehahara karma*[12]. It is not only a nutritious vegetable, but is also used in traditional medical practices to treat Type 2 Diabetes mellitus. Studies suggest that the vegetable has a possible role in glycemic control. Oral administration of the extract, fruit juice or seed powder of *Momordica charantia* caused a significant reduction in fasting blood glucose and improved glucose tolerance in normal and diabetic animals and in humans. A wide range of compounds have been isolated from *Momordica charantia*, of which, a polypeptide (p-insulin, was named as "plant insulin"), the sterol glucoside mixture charantin and the pyrimidine nucleoside vicine have been identified as the orally antidiabetic principles for humans and animals[5]. Charantin is a typical cucurbitane-type triterpenoid with potential antidiabetic properties. Momordica fruits are nutritionally rich with Vitamins C, A, E, B1,B2, B3,B9 and minerals- Potassium, Calcium, Zinc, Magnesium, Phosphorus and Iron and is a good source of dietary fibre [13]. Charantin rich extract of Momordica charantia caused significant decline in nonfasting blood glucose, plasma glucose intolerance and insulin resistance. It also had protective effect against pancreatic Beta cell toxicity[14]. It can regulate glucose uptake into jejunum membrane brush border vesicles and stimulate glucose uptake into skeletal muscle cells similar to the response obtained with insulin[15].

***Amalaki (Emblica officinalis .Gareth)***

*Amalaki (Emblica officinalis .Gareth)* is one among the best single drugs indicated for Prameha[16]. It is conducive for daily use as a dietary ingredient[17], is an important *Rasayana*[18,19] and possesses *Amla, Madhura, Tikta, Kashaya, Katu rasa, Rooksha, Laghu, Sara guna, Sheeta veerya, Madhura vipaka, Thridoshahara, Rasayana and Pramehahara karma*[20]. It is also widely available. Ellagic acid in Emblica officinalis (Gareth) exerts anti-diabetic activity through the action on β-cells of pancreas that stimulates insulin secretion and decreases glucose intolerance, immunostaining of pancreas showed that Emblica officinalis increased Beta cell size and number in diabetic rats. It also stimulated glucose stimulated insulin secretion from isolated islets and de-

creased glucose intolerance in diabetic rats[21]. Studies have shown that the fruits of Emblica officinalis Gaertn and/or some of its important constituents (including gallic acid, gallotanin, ellagic acid and corilagin), possess anti-diabetic effects through their antioxidant and free radical scavenging properties. It has also been reported to prevent/reduce hyperglycemia, cardiac complications, diabetic nephropathy, neuropathy, cataractogenesis and protein wasting[22].

***Haridra (Curcuma longa L.)***

*Haridra (Curcuma longa L)* is the drug of choice in *Prameha*. It has *tikta katu rasa, rooksha laghu guna, ushna veerya, katu vipaka, kapha pittahara and pramehahara karma*. Curcuma longa L., commonly known as turmeric, has been used as spice and coloring agent in food with long history. Its rhizomes have been reported to possess anti-diabetic properties in experimental animal models. Researchers reported that active ingredient curcumin is responsible for anti-diabetic action[5] .

Anti-diabetic activity of curcumin may be due to its potent ability to suppress oxidative stress and inflammation. Moreover, it shows a beneficial role on the diabetes induced endothelial dysfunction and induces a down-regulation of nuclear factor-kappa B - a micro inflammatory molecule leading to pro-inflammatory states hypothesized to contribute to diabetes[23] Curcumin possesses a protective role against advanced glycation as well as collagen crosslinking and through this way, mitigates advanced glycation end products-induced complications of diabetes. Curcumin also reduces blood glucose, and the levels of glycosylated hemoglobin in diabetic rats through the regulation of polyol pathway. It also suppresses increased bone resorption through the inhibition of osteoclastogenesis and expression of the AP-1 transcription factors, c-fos and c-jun, in diabetic animals[24]

## DISCUSSION

The development of Type 2 Diabetes Mellitus is strongly influenced by eating practices. Also once diagnosed, a critical part of treatment is a life time modification of food and eating habits. Functional herbal foods might have a particularly high impact for prevention or treatment of overweight and diabetes. It is ideal to incorporate functional herbal food ingredients in the day-to-day food consuming system for preventive and curative purpose.

*Karavellaka* is a *Thikta shaaka* with *kaphapitha* alleviating action, indicated in *Prameha*. It has 225 identified chemical constituents which together act at nutritional and treatment aspects. *Amalaki* possesses antioxidant action which helps to prevent complications of Diabetes mellitus apart from hypoglycemic action. *Haridra* has *thikta katu rasa*, *ushna veerya*, *katu vipaka*, acting especially against *Kapha dushti* in the pathogenesis. *Haridra* and *Karavellaka* act as *sampraptivighattana* and *Amalaki* is *Thridosha hara* and *Rasayana*, contributing to management of Prameha and prevention of complications *(Upadrava),* as per pharmacological parameters of traditional medicine. These are validated by reverse pharmacological research. Other such available and suitable functional food ingredients can also be utilized accordingly.

## CONCLUSION

Active principles of Momordica charantia, Emblica officinalis and Curcuma longa act at various levels such as reduction of glucose intolerance, insulin resistance, oxidative stress and cause Beta cell regeneration, etc. contributing to long term management of Type 2 Diabetes mellitus & prevention of complications. While including these in food, mental satisfaction element of *Pathya* can be incorporated by proper *Samyoga* (Mixing) and *Samskara* (processing). Inclusion of functional food articles like *Karavellaka, Amalaki* and *Haridra* in various forms and suitable quantities in patients of Type 2 Diabetes mellitus as well as genetically predisposed individuals is strongly suggested by this review.

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