



Review Article

Potential of Herbs in Prevention of Obesity - A Review Article

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ABSTRACT

Obesity and overweight are the major threat to the health of people in the world. There are several drugs available for weight reduction but they sometimes produce adverse toxicities which may be fatal for life. Medicinal herbal supplements are being extensively utilized due to their effectiveness in managing many chronic disorders. They are cost-effective, and have no toxic effects in comparison with many chemically synthesized drugs. There are several herbs which may help in preventing obesity. Herbs such as Amla, Fenugreek, Gurmar, Cocoa, Turmeric, Green Tea, Locust Bean are the examples which have the capacity of reducing the total cholesterol and play significant role in prevention of obesity and related metabolic disorders.

Key Words: *Amla, cocoa, dislipidemia, gurmar, green tea, fenugreek, locust bean, turmeric, obesity.*

INTRODUCTION

Overweight and obesity are the fifth leading risk for global deaths. At least, 2.8 million adults die each year as a result of being overweight or obese. In addition, 44% of the diabetes burden, 23% of the ischemic heart disease burden and between 7% and 41% of certain cancer burdens are attributable to overweight and obesity. World Health Organization (WHO) global estimates for the year 2008, reported 1.5 billion people were overweight, of these, over 200 million men and nearly 300 million women were obese. Overall, more than one in ten of the world's adult population was obese. [1,2] Further, WHO projects that by

2015, approximately 2.3 billion adults will be having overweight and more than 700 million will be of obese. Today, it is estimated that there are more than 250 million obese people worldwide, equivalent to seven percent of the adult population. [3]

Obesity and overweight occurs due to imbalance between calories consumed and calories utilized. Globally, there have been two reasons for overweight and obesity: 1) an increased intake of energy-dense foods that are high in fat, salt and sugars but low in vitamins, minerals and other micronutrients; and, 2) a decrease in physical activity due to the increasingly sedentary nature of many forms of work,

changing modes of transportation, and increasing urbanization. [1, 4] The most important reasons associated with obesity includes changes in dietary pattern, lack of physical activity, sedentary lifestyle, lack of sleep, endocrine disorders, irregular metabolism, medications that make patients put on weight, psychological and infectious disorders.

The sedentary life style and irregular dietary pattern results extra weight gain which adds stress on every part of individual's body. People with obesity are at risk of several health problems such as joint problems (extra weight causes strain on the bones and joints), osteoarthritis, a disease that causes joint pain and stiffness, gallstones and liver problems, heart attack from coronary heart disease, congestive heart failure, and stroke, high blood cholesterol and triglycerides (dislipidemia or high blood fats), high blood pressure (hypertension), high blood sugar (glucose) or diabetes, stopping breathing during sleep (sleep apnea). This can cause daytime fatigue or sleepiness, poor attention, and problems at work.

Diet and behavioral modification programs for weight loss and the prevention of weight regain aim to reduce energy intake and to increase energy expenditure. However, the ineffectiveness of most approaches is seen in the fact that the prevalence of obesity is at an all-time high and that weight regain is common. [5]

The preferred treatment modality for weight loss is dieting and physical exercise. But due to busy schedules and sedentary lifestyle follow-up the first two methods never seems to be practiced in a regular manner. On the other hand weight loss surgery runs out of the option considering the cost involved. There is a gradual shift towards an increase use of drugs. Drugs are pharmacological agents that reduce or control weight. These drugs alter one of the fundamental processes of the human body,

weight regulation, by altering appetite, metabolism, or absorption of calories. Only one anti-obesity medication orlistat is currently approved by the FDA for long term use. It reduces intestinal fat absorption by inhibiting pancreatic lipase. [6] Sibutramine, which acts on the brain to inhibit deactivation of the neurotransmitters, thereby de-creasing appetite was withdrawn from the United States and Canadian markets in October 2010 due to cardiovascular side effects. [7]

The use of allopathic and pharmacological drugs has become a popular means to overcome excess weight gain. [8] While these drugs generally are effective, severe adverse toxicities may limit their overall usefulness. [9, 10] A nutritional based intervention is being hailed as an inexpensive alternative to aid weight loss, and weight management. [11] Medicinal herbal supplements are being extensively utilized due to their effectiveness in managing many chronic disorders. They are cost-effective, and exert less to no toxic side-effects in comparison with many chemically synthesized drugs. [12] Accordingly, recent preliminary reports suggested that herbs with a long history of use and other natural substances less likely to produce severe toxicity might be effective in reducing appetite and promoting significant weight loss are encouraging. [13]

Thus medicinal plants and the chemicals derived from plants have gained the interest of public and scientists for their role in maintaining health and preventing disease. The essential and healthy components derived from many components of the medicinal plants are studied thoroughly and some of their potential preventive and therapeutic properties have been studied extensively. In this review, the medicinal plants with potential efficacy to prevent obesity and associated disorders are briefly discussed.

Herbs for Treatment of Obesity:

Usage of plants and plant products has potential to keep the increasing prevalence of metabolic syndrome in control. There are few drugs in the market to prevent/manage obesity but there are the costs, efficacy and side effects to consider. For centuries people across the countries have been using natural products as plant based dietary supplements for weight control. [14]

Several animal and clinical studies have reported that the following herbs are effective in controlling obesity and weight management. These are mentioned below-

***Emblica officinalis* (Family: Phyllanthaceae), Amla**



Amla commonly known as Indian Gooseberry is one ancient herb used for various ayurvedic applications since time immemorial. It is used as the cardio protective tonic. In a clinical Trial: Zanjabeel & amla were given at 10g/ day and 3g/ day respectively to all the 40 cases of test groups irrespective of age, sex & lipid levels. Both the drugs were given in powdered form in two divided dosage, before meal orally. Duration of study was 60 days and follow up for all the cases was done at regular interval of 20 days. It may be concluded that the effect of test combination of drugs in lowering the level of serum total cholesterol, serum triglycerides, serum LDL cholesterol, and serum VLDL cholesterol and in increasing the level of serum

HDL cholesterol is significant in patient of primary hyperlipidemia. [15]

***Trigonella foenum-graecum* (Family: Fabaceae)-Fenugreek**



Fenugreek is used as mostly used as vegetables and in the form of spices. Animal studies have shown that fenugreek helps in reducing obesity. In an animal study fenugreek seed was extracted with ethanol and the solution was evaporated. The extract significantly reduced the body weight gain induced by a high fat diet. These obese model mice were fed a high fat diet containing 30% casein, 40% beef tallow (w/w), 11% corn starch, 5% cellulose, 9% sucrose, 1% vitamins and 4% minerals. Female mice (4 weeks old) were used. Fenugreek seed extract administered groups were fed a high fat diet containing 0.3% and 1% fenugreek seed extract in place of 0.3% and 1% casein, because it is known that a small change in casein content does not affect body weight gain. A low fat diet contained 30% casein, 5% beef tallow, 11% cornstarch, 40% cellulose, 9% sucrose, 1% vitamins and 4% minerals. The fenugreek seed extract significantly reduced adipose tissue weights. [16]

***Gynemasylvestre* (Family: Asclepiadiaceae), Gurmar-**



Extract of *Gymnemasylvestre*R. Br Leaves (GE) was orally administered once a day to rats fed a high fat diet or normal fat diet for 3 weeks to investigate its influence on lipid metabolism. As a result, GE did not influence body weight gain or feed intake in both diet groups during the experimental period. The apparent fat digestibility was significantly decreased by GE in both diet groups for the last 2 weeks of the experimental period, though not the apparent protein digestibility. In addition, the excretion of neutral sterols and acid steroids into feces were increased by GE in both diet groups. Furthermore, GE decreased the total cholesterol and triglyceride levels in serum. [17]

***Ceratonia siliqua*(Family: Leguminosae),
Locust bean**



Locust bean is used as texturising agent in various food products. The studies have found that it is beneficial in reducing cholesterol and preventing obesity. In a Clinical trial, volunteers (n=58) with hypercholesterolemia were recruited to participate in a randomized, double-blind, placebo-controlled and parallel arm clinical study with a 6 week intervention phase. All participants consumed daily both, bread (two servings) and a fruit bar (one serving) either with (n=29) or without (n=29) a total amount of 15 g/d of a carob pulp preparation (carob fibre). Serum concentrations of total, LDL and HDL cholesterol and triglycerides were assessed at baseline and after week 4 and 6. Daily consumption of food products enriched with carob fibre shows beneficial effects on human blood lipid profile and

may be effective in prevention and treatment of hypercholesterolemia. [18]

***Theobroma cacao* (Family: Malvaceae),
Chocolate**



Cacao is used as beverage and chocolate is mainly used as confectionery. Studies on rats were fed either of two high-fat diets, differing only in supplementation with real or mimetic cocoa. On day 21, body weights, mesenteric white adipose tissue weights, and concentrations of serum triacylglycerol were measured to investigate the molecular mechanisms underlying the effects of cocoa on lipid metabolism and triacylglycerol accumulation. Gene expression profiles in liver and mesenteric white adipose tissues using the Gene Chip microarray system were examined. It was concluded that ingested cocoa can prevent high-fat diet-induced obesity by modulating lipid metabolism, especially by decreasing fatty acid synthesis and transport systems, and enhancement of part of the thermo genesis mechanism in liver and white adipose tissue. [19]

***Camellia sinensis*(Family: Theaceae), Tea**



One of the most popular beverages which are widely consumed worldwide is- Tea. It is taken in several forms such as green, black, oolong and white teas are prepared

from the harvest of leaves from the *Camellia sinensis* plant. The teas differ by their processing and bioactive chemical contents. Green tea contains five major catechins including: catechin, epicatechin, epicatechingallate, epigallocatechin, and epigallocatechingallate (EGCG); the latter comprises more than 40% of the total polyphenolic mixture of green tea catechins. Epidemiological, experimental, and clinical studies have suggested several anti obesity beneficial effects from consuming green tea. The anti-obesity effect of green tea is mainly attributed to catechins, which exhibits its anti-obesity effects through several mechanisms including suppression of adipocyte differentiation and proliferation, inhibition of fat absorption from the gut, and suppression of catechol-o-methyl transferase (COMT), an enzyme that inhibits fatty acid oxidation in brown adipose tissue. EGCG has been shown to inhibit 3T3-L1 adipocyte proliferation by decreasing levels of phosphorylated ERK1/2, cdk2 and cyclin D1 proteins and cell growth arrest at Go/G1 [20] and by inducing apoptosis in mature adipocytes. [21]

In adipocytes, lipid storage and energy metabolism is tightly controlled. Adenosine monophosphate (AMP) activated protein kinase (AMPK) is the master switch in the regulation of energy metabolism. It is activated in response to an increase in the AMP: ATP (adenosine triphosphate) ratio within the cell, and therefore acts as a sensor for cellular energy regulation. AMPK is a heterodimer protein, which is formed from three subunits: α , β and γ . [22] The binding of AMP with AMPK allosterically phosphorylates and activates AMPK, [23] which in turn shuts down anabolic pathways and supports catabolic pathways through regulating the activity of several key enzymes of energy metabolism. AMPK inhibits the accumulation of fat by modulating downstream-signaling

components. For example, it phosphorylates acetyl CoA carboxylase (ACC) and inhibits activity of this enzyme, down regulates fatty acid synthesis pathways, and prevents fat accumulation. Of particular importance, AMPK, by direct inhibition of HMG-CoA reductase, regulates the cholesterol synthesis pathway in the liver. [24] EGCG has been shown to increase both the expression and phosphorylation of AMPK in 3T3-L1 cells and the phosphorylation of downstream target, ACC, which leads to suppression of esterification of fatty acids to triglyceride and which increases fatty acid oxidation. [25] Therefore, through several mechanisms, EGCG and other catechins of tea contribute to the reduction of adipogenesis and prevent the growth and expansion of adipose tissue. A lower weight gain and a lower adipogenesis observed in mice fed a high-fat diet supplemented with EGCG was suggested to be due in part to EGCG's inhibitory effect on pancreatic lipase activity resulting in reduced fat absorption from the gut as indicted by the presence of a high fecal fat content. [26,27] In addition to decreasing fat absorption, several studies have shown that supplementing the diet of mice with EGCG decreases diet-induced adipogenesis and obesity by enhancing fat oxidation. [28] In brown adipose tissue, lipid-metabolizing enzymes are up-regulated by catechins through suppression of COMT, which leads to an increase in norepinephrine with prolonged sympathetic stimulation of thermogenesis along with an increase in adenylyclase, lipolysis, and fat oxidation. Therefore, consumption of green tea, which also contains caffeine with its own thermogenesis activity (reviewed in [29]), is regarded to be an effective way to reduce and maintain body weight through increasing fat oxidation and energy expenditure. Administration of green tea extract or catechins not only has been shown to be effective on reduction of weight gain

but also has resulted in weight loss as observed in overweight and genetically obese laboratory animals. [30]

***Curcuma Longa* (Family:Zingiberaceae),
Turmeric-**



Turmeric contains various medicinal properties. Curcumin is the active ingredient of turmeric, which is used daily in Indian and other South Asian cuisines as a spice. Most commercial turmeric preparations consist of ~2-8% active curcumin. [31]

The first report referring to curcumin's effect on disease in humans was published in *The Lancet* about 80 years ago. [32] Rao *et al.* reported that curcumin supplementation at the dose of 500–1,000 mg/kg in rat diet reduced liver cholesterol and increased bile acid excretion. [33] At a dose of 250 mg/kg, curcumin was also reported to reduce weight gain in rats after 4 weeks and tended to reduce liver weight as well as blood triglyceride and free fatty acids levels. [34]

In addition to the above-mentioned earlier studies, recent cell culture and animal studies have explored the impact of curcumin on lipid metabolism, adiposity, and inflammation in more detail. Curcumin may have a significant effect on adiposity and lipid metabolism through several mechanisms including modulation of energy metabolism, inflammation, and suppression of angiogenesis. It has been well established that angiogenesis plays pivotal roles in the growth and expansion of adipose tissue (reviewed in [35-38]).

CONCLUSION

Obesity is today a serious problem and it is essential to focus on the weight management. Medicinal plants have the capacity of weight management. Several traditional texts provide clues regarding the medicinal herbs which are beneficial for weight reduction. Evidence from clinical study showed that herbs contain several active compounds which have the potential of reducing the total cholesterol and preventing the obesity. Recent studies and current knowledge suggests that the potential of the herbs occur through several mechanisms that is suppression of fat absorption from gut, modulation of lipid metabolism, lower adipogenesis, and reduction of inflammation due to adiposity. The dietary modification with the inclusion of medicinal herbs may help to prevent obesity.

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