



## MEDICINAL HERBS AND OBESITY: A REVIEW

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### ABSTRACT

Since ancient time people have used plants. In the beginning, plant use was restricted to food, medicine and shelter but with the passage of time man explored the potential of plants for a number of other purposes. World Health Organization estimates traditional medicines, mostly plant drugs cater to the health needs of nearly 80% of world population. Obesity is one of the most serious public health problems of 21<sup>st</sup> century. Obesity is a medical condition in which excess body fat has accumulated to the extent that it may have an adverse effect on health, leading to reduced life expectancy and/or increased health problems. Consequently, over consumption of calories and reduced physical activity is the root cause of obesity. Obesity may lead to serious health related complication. Almost all researchers believe that prevention could be the key strategy for controlling obesity. Obesity can be prevented by physical activity (exercise) and diet control. Obese people are getting social injustice & unfair treatment. Since time immemorial, various herbs are used to treat conditions like malaria, cold, cough, kidney stone, diabetes and obesity. Examples of various herbs used in obesity are *Commiphora mukul*, *Pterocarpus marsupium*, *Fucus vesiculosus*, *Gymnema sylvestre*, *Salacia reticulata* etc. An attempt has been made to review medicinal plants which are effective to treat obesity in the present article.

**Keywords:** Ayurveda, Allopathy, Medicinal Plants, Obesity, Antihyperlipidemic, Cholesterol.

### INTRODUCTION

Interest in traditional systems of medicine and, in particular, herbal medicines, has increased substantially in both developed and developing countries over the past two decades. People in the pre-historic times used plants quite intuitively for food, shelter and even curing their many bodily disorders and thereby kept their health in perfect state of fitness and lived a long life. The medicinal plants played a very important role from times immemorial.<sup>1,2</sup>

After decades of serious obsession with the modern medicinal system, people have started looking at the ancient healing systems like Ayurveda, Siddha and Unani. This is because of the adverse effects associated with synthetic drugs. Allopathic remedies are like double-edged swords. They can save lives if used correctly; however, used indiscriminately, they can give rise to side-effects, trigger various allergic responses, or lead to chronic diseases known as iatrogenic diseases. Now a day, people used to rely upon herbal drugs in developing countries. Ancient Indian literature incorporates a remarkably broad definition of medicinal plants and considers 'all' plant parts to be potential sources of medicinal substances. However a key obstacle, which has hindered the acceptance of the alternative medicines in the developed countries, is the lack of documentation and stringent quality control.<sup>3,4</sup>

Ancient texts have recognized and specifically mentioned the difficulty in treating obesity, since failure in self-restraint and discipline with respect to food habits and exercise are common. They are usually the main contributing factors in obesity, though other causes like

heredity and hormonal disturbances may also be responsible. The overweight problem is due to an actual increase in the fat component, or it can be due to malfunctioning glands. Obesity is a physical condition that results from excessive storage of fat in the body. It is a medical condition in which excess body fat has accumulated to the extent that it may have an adverse effect on health, leading to reduced life expectancy and/or increased health problems. Obesity is the most common metabolic disorder of human and once of the oldest documented diseases. In India, as early as 1500 BC, Charak described it under medoroga meaning the diseased state of the adipose tissue. Obesity is increasing to an alarming rate throughout the world. Further, WHO projects that by 2015, approximately 2.3 billion adults will be having overweight and more than 700 million will be of obese. At least 20 million children under the age of 5 years were of overweight globally in 2005. Today, it is estimated that there are more than 250 million obese people worldwide, equivalent to seven percent of the adult population.<sup>5</sup>

### Causes

At an individual level, a combination of excessive food energy intake and a lack of physical activity are thought to explain most cases of obesity. A limited number of cases are primarily due to genetics, medical reasons, or psychiatric illness. In contrast, increasing rates of obesity at a societal level are felt to be due to an easily accessible and palatable diet. A 2006 review identified ten other possible contributors to the recent increase of obesity: (1) insufficient sleep, (2) endocrine disruptors (environmental pollutants that interfere with lipid metabolism), (3) decreased variability in ambient



temperature, (4) decreased rates of smoking, because smoking suppresses appetite, (5) increased use of medications that can cause weight gain (e.g., atypical antipsychotics), (6) proportional increase in ethnic and age groups that tend to be heavier, (7) pregnancy at a later age (which may cause susceptibility to obesity in children), (8) epigenetic risk factors passed on generationally, (9) natural selection for higher BMI, and (10) assortative mating leading to increased concentration of obesity risk factors.<sup>6-9</sup>

**Symptoms & Diagnosis:** Excessive body weight, large waist, hips, buttocks and thighs, Fatigue and asphyxia.

BMI (Body Mass Index) more than 30 or body fat levels greater than 25 and 32 for males & females respectively.<sup>10</sup>

**Treatment:** Antihyperlipidemic drugs are used only if diet modification & exercise programs fail to lower LDL to normal levels. These are the group of drugs prescribed in adjuvant therapy to reduce elevated cholesterol levels in patients with high cholesterol and LDL levels in the blood. Table 1 lists the drugs commonly used to lower lipid levels.<sup>11-15</sup>

**Table 1:** Summary of Antihyperlipidemic drugs

Sr. No.	Drug Class	Mechanism of Action	Example	Side effects
1	HMG CoA reductase enzyme inhibitor	Lowering total LDL by inhibiting cholesterol biosynthesis	Atorvastatins, Fluvastatin, Lovastatin, Simvastatin	Congestive Cardiac Failure
2	Fibrates	Enhancing activity of enzyme lipoprotein lipase	Gemfibrozil, Fenofibrate	Upper gastrointestinal disturbance, headache, myalgia
3	Nicotinic acid derivative	Inhibit lipolysis within adipocytes	Niacin	Hyperglycemia, Increase uric acid
4	Bile acid sequestrants(Resin)	Bind with bile acid & promote bile acid excretion	Cholestipole, Cholestyramine	Abdominal fullness, constipation
5	Misc.	Inhibit free radicals	Omega 3 fatty acid, Probuocol	-

### HERBAL TREATMENT

The herbs reported to have effect on obesity by either animal studies or clinical trials are mentioned below

1) ***Euterpe oleracea*** (Family: **Arecaceae**), Syn. **Cabbage palm**



**Figure 1:** *Euterpe oleracea*

Clinical Trial: Open label pilot study conducted with 10 overweight adults (BMI > 25 kg/m<sup>2</sup> and < 30 kg/m<sup>2</sup>) who took 100 g açai pulp twice daily for 1 month. The study endpoints included levels of fasting plasma glucose, insulin, cholesterol, triglycerides, exhaled (breath) nitric oxide metabolites (eNO) and plasma levels of high sensitivity C-reactive protein (hs-CRP). The response of blood glucose, blood pressure and eNO to a standardized meal was determined at baseline and following the 30

day treatment. Compared to baseline, there were reductions in fasting glucose and insulin levels at the end of the 30 days treatment. There was also a reduction in total Cholesterol, as well as borderline significant reductions in LDL-cholesterol and the ratio of total cholesterol to HDL-cholesterol. Daily consumption of food products enriched with carob fiber shows beneficial effects on human blood lipid profile and may be effective in prevention and treatment of hypercholesterolemia.<sup>16</sup>

2) ***Emblica officinalis*** (Family: **Phyllanthaceae**), Syn. **Amla**



**Figure 2:** *Emblica officinalis*

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 to 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.<sup>17</sup>

3) ***Theobroma cacao*** (Family: Malvaceae), Syn. Chocolate



Figure 2: *Theobroma cacao*

Animal studies: 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.<sup>18</sup>

4) ***Ceratonia siliqua*** (Family: Leguminosae), Syn. Locust bean



Figure 3: *Ceratonia siliqua*

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.<sup>19</sup>

5) ***Cocos nucifera*** (Family: Palmae), Syn. Coconut



Figure 4: *Cocos nucifera*

Clinical Trial: The randomized, double-blind, clinical trial involved 40 women aged 20-40 years. Groups received daily dietary supplements comprising 30 mL of either soy bean oil (group S; n = 20) or coconut oil (group C; n = 20) over a 12-week period, during which all subjects were instructed to follow a balanced hypo caloric diet and to walk for 50 min per day. Data were collected 1 week before (T1) and 1 week after (T2) dietary intervention. Energy intake and amount of carbohydrate ingested by both groups diminished over the trial, whereas the consumption of protein and fiber increased and lipid ingestion remained unchanged. At T1 there were no differences in biochemical or anthropometric characteristics between the groups, whereas at T2 group C presented a higher level of HDL and a lower LDL: HDL ratio. Reductions in BMI were observed in both groups at T2, but only group C exhibited a reduction in Waist Circumference. Group S presented an increase in total cholesterol, LDL and LDL:HDL ratio, whilst HDL diminished. Such alterations were not observed in group C. It appears that dietetic supplementation with coconut oil does not cause dyslipidemia and seems to promote a reduction in abdominal obesity.<sup>20</sup>

6) ***Oenothera biennis*** (Family: Onagraceae), Syn. Hog-Weed



Figure 5: *Oenothera biennis*

Animal studies: The hypolipidemic and anti-obesity effects of the soft capsule from evening Primrose [*Oenothera biennis*] oil, Semen Cassiae and *Lotus* leaf were studied. Rats were divided into 4 groups (model group and 3 dosage groups) according to the serum TC [Total Cholesterol] level. The rats were given food with high lipid content, and the soft capsule was administered orally at 0.082, 0.163 or 0.489 g/kg body weight for 30 days. The levels of serum TC and TG [triglyceride] and HDL [high density lipoprotein] were monitored. The levels of TG and TC in the serum of group treated with the extract at 0.498 g/kg were significantly reduced compared to the model group. On the 3rd week, the body weight increased, whereas the body fat weight was reduced in the model group. The results indicated that the evening primrose oil capsule has significant hypolipidemic and anti-obesity properties.<sup>21</sup>

7) ***Foeniculum vulgare* miller (Family: Umbelliferae), Syn. Fennel**



Figure 6: *Foeniculum vulgare*

Animal studies: White male albino rats weighing 80-90 gm, 60 days old. 10 rats were fed a normal basal diet, 30 rats fed a high fat diet (HFD) for 14 weeks during the entire study. Rats of the HFD group were equally divided into 3 subgroups each one include 10 rats. The 1<sup>st</sup> group received HFD with no supplement (HFD), the 2<sup>nd</sup> group HFD+L-carnitine and the third group received HFD+HMF (Herbal Mixture Formulation). Carnitine and HMF were administered at 10<sup>th</sup> week (start time for treatments) for 4 weeks. Body weight, lipid profile were analyzed. Data showed that feeding HFD diet significantly increased final body weight, triglycerides (TG), total cholesterol & LDL concentration compared with controls, while significantly decreasing HDL; meanwhile treatment with L-carnitine, or HMF significantly normalized the lipid profile.<sup>22</sup>

8) ***Trigonella foenum-graecum* (Family: Fabaceae), Syn. Fenugreek**

Animal studies: 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 administrated 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 (w/w), 11% cornstarch, 40% cellulose, 9% sucrose, 1% vitamins and 4% minerals. The fenugreek seed extract significantly reduced adipose tissue weights.<sup>23</sup>



Figure 7: *Trigonella foenum-graecum*

9) ***Camellia sinesis* (Family: Theaceae), Syn. Tea**



Figure 8: *Camellia sinesis*

Animal studies: To elucidate the anti-obesity effects of three major components of green tea, catechins, caffeine and theanine, female ICR mice were fed on diets containing 2% green tea powder and diets containing 0.3% catechins, 0.05% caffeine and 0.03% theanine, which correspond, respectively, to their concentrations in a 2% green tea powder diet, singly and in combination for 16 weeks. Body weight and food intake were determined monthly during this period, kidneys, adrenals, liver, spleen, brain, pituitary and intraperitoneal adipose tissues (IPAT) were weighed and lipid levels in the serum and liver were measured at the end of this period. The body weight increase and weight of IPAT were significantly reduced by the diets containing green tea, caffeine, theanine, caffeine + catechins, caffeine + theanine and caffeine + catechins + theanine. Noticeably, the IPAT weight decreased by 76.8% in the caffeine + catechins compared to the control group. Serum concentrations of triglycerides (TG) and non-esterified fatty acids (NEFA) were decreased by green tea, catechins and theanine. Moreover, caffeine + catechins, caffeine + theanine and caffeine + catechins + theanine also decreased NEFA in the serum. The TG level in the liver was significantly reduced by catechins and catechins + theanine in comparison with the control. These results indicated that at least caffeine and theanine were responsible for the suppressive effect of green tea powder (GTP) on body weight increase and fat accumulation. Moreover, it was shown that catechins and caffeine were synergistic in anti-obesity activities.<sup>24</sup>

10) *Tinospora cordifolia* (Family: Menispermaceae),  
Syn. Guduchi



Figure 10: (*Tinospora cordifolia*)

Animal studies: Administration of the aqueous extract of *T. cordifolia* roots (2.5 and 5.0 g/kg body weight) for 6 weeks resulted in a significant reduction in serum and tissue cholesterol, Phospholipids and free fatty acids in alloxan diabetic rats. The root extract at a dose of 5.0 g/kg body weight showed highest hypolipidemic effect. The effect of *T. cordifolia* roots at 2.5 and 5.0 g/kg body weight were better than glibenclamide. Insulin restored all the parameters to near normal values.<sup>25</sup>

11) *Gymnema sylvestre* (Family: Asclepiaceae), Syn.  
Gurmar



Figure 11: *Gymnema sylvestre*

Animal studies: Extract of *Gymnema sylvestre* 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.<sup>26</sup>

12) *Hoodia gordonii* (Family: Apocynaceae), Syn.  
Hoodia

14 $\beta$ -hydroxy pregnane glycosides extracted from *Hoodia gordonii*, a succulent plant isolated from Apocynaceae are suggested to have appetite suppressant properties in animals and humans. However, limited reports on biological studies concerning the appetite suppressant

properties are available in the open literature. One reason for that is the poor availability of these glycosteroids because *H. gordonii* is a protected plant and the yield of extraction lies between 0.003% and 0.02%. Starting from 3 $\alpha$ , 12 $\alpha$ -diacetoxy-pregnanone.<sup>26</sup>



Figure 9: *Hoodia gordonii*

13) *Bauhinia variegata* (Family: Fabaceae); Syn. Orchid.



Figure 10: *Bauhinia variegata*

In pharmacological screening the anti obesity of 90% ethanolic extract and aqueous extract was studied using parameters like a) body weight, b) body temperature, c) serum biochemical parameters, d) internal organ weight and e) Histopathological study of liver tissue. Suspension of both the extracts were prepared using 2% gum acacia to make 100mg/ml concentration and both the extracts, results were compared to result of standard drug Sibutramine. The extracts exhibited significant activity in reducing the body weight, increasing the body temperature by inducing thermo genesis and in maintaining the serum biochemical parameters at normal level.<sup>27</sup>

### CONCLUSION

Ayurveda classics give sufficient focus on obesity (sthulya or medoroga) and serves as a guideline to advise diet etc. and to prevent or to control the disease. Obesity is not limited to developed countries but it is spreading globally. Traditionally obesity was believed to be associated with life style; several studies have shown that changes in dietary pattern, physical activity levels, and life styles are related to increasing frequencies of obesity and risk of associated diseases. With this study, we have made an attempt to present collective information about the various herbs showing effects on obesity.

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