

Nature's contribution in the management Of Obesity – A Literature Review

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Abstract

Use of natural products as a dietary supplement for the purpose of reducing body weight has become popular in recent years. Owing to toxicity of commercially available drugs for weight reduction, a search has been made to reduce body weight by using herbal drugs. Hence use of herbal drugs which contains phytochemicals in it is safer to consume for the purpose of weight management and to treat obesity.

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INTRODUCTION

Obesity is a serious health concern in developed and developing countries. It leads to cardiovascular disease & diabetes mellitus, certain type of cancer, chronic insomnia, osteo arthritis and depression. Hence the use of herbal products to reduce the cholesterol level has been launched. Generally obesity is confirmed by calculating Body mass index (BMI). If BMI is 25-29.9 it is considered as over weight. A BMI of 30 or higher is considered obese. The typically effective methods in treating obesity & maintain a healthy body weight is obtained by exercise and proper diet. In spite of that certain herbal treatments might help.

Current treatment of weight loss is done by drugs like orlistat, sibutramine which are anorectic agents with appetite suppressor activity. However studies have been done to evaluate its efficacy for weight management.

Orlistat is only drug approved by FDA for long term administration for weight loss, though it reduces weight effectively, several side effects are observed with orlistat like oily faecal spotting, abdominal pain,

and flatus with discharge, faecal urgency, fatty/oily stool, increased defecation, and faecal incontinence.⁵ Another centrally acting antiobesity agent sibutramine which produces unwanted side effects such as inability to sleep, constipation, dry mouth, increased heartbeat, increased blood pressure, awareness of the heartbeat (palpitations), headache, anxiety, and dizziness.

Herbal supplements have been extensively consumed by people to reduce their weight effectively since decades. Some of the toxic herbs present in the herbal supplements may be responsible in causing hepatotoxicity and nephrotoxicity. Hence caution should be exercised before administering any weight loss products.

Many literature surveys were done related to the efficacy of herbal products in weight loss. Most of the articles reveal the use of *green tea*, *guggul*, *psyllium*, *triphala*, *garcinia cambogia* and many spices etc.

Our literature survey has implemented for the first time to report the use of certain herbal products like *Erythrina variegata*, *Erythrina indica*, *Hemidesmus indicus extract*, *Hoodia gordonii extract*, *Gymnema sylvestre*, *Caralluma fimbriata*, *Ginseng* for weight loss in obese patients. The pharmacological aspects and anti hyperlipidemic effects of these herbs are extensively reviewed.

Obesity management:

Erythrina variegata

Common name: Coral tree, Indian coral tree, tiger's-claw



Phytoconstituents: Alkaloids, flavonoids, pterocarpan, triterpenes, steroids, alkyl transferulates, proteins are found in the genus.

Erythrina variegata is used to control obesity. In addition to that the different parts of the plant is used in treatment of cough, fever, bacterial infections, common cold, asthma, CNS disorders like insomnia and epilepsy. The leaves are commonly mixed with castor oil to treat dysentery, used externally to relieve rheumatic joints. Bark is used as a diuretic, laxative, expectorant.

E. variegata is used as an anti-caries agent to prevent dental caries. It acts as an analgesic and anti-inflammatory agent. It is a good antioxidant and it has smooth muscle relaxant property, potent drug to treat osteoporosis.⁷

G. Balamurugan⁸ conducted a research study on methanolic seed extract of *Erythrina variegata* to evaluate the anti hyperlipidaemic activity in reducing the cholesterol levels in wistar rat. Doses of 200 and 400 mg/kg of the extract were evaluated for its effect on lipid profile,

HMG-CoA reductase, and antioxidant enzymes in high-fat diet (HFD) induced hyperlipidemia. The elevated levels of total cholesterol, triglycerides, low-density lipoprotein, and very low density lipoprotein due to HFD was reduced by concurrent treatment with the extract given. Increase in the body weight and mesenteric fat pad weight in HFD fed group ($P < 0.001$) were noticed, which was reduced by the administration of the herbal extract (200 and 400 mg/kg). The antioxidant enzymes such as superoxide dismutase and catalase were reduced significantly in the HFD fed group, whose levels were increased significantly ($P < 0.001$) by the administration of the extract (200 and 400 mg/kg). Lipid peroxidation was increased in HFD fed animals, which was reduced significantly ($P < 0.001$) by the treatment with the *erythrina variegata* extract (200 and 400 mg/kg).

Hoodia gordonii extract

Common name: cactus of the desert



Active ingredient for anti-obesity activity: P 57

H. gordonii is a succulent plant native to south africa. The flowers smell like rotten meat and are pollinated mainly by flies. The use of *Hoodia* spp. has long been known by the indigenous populations of Southern Africa, who infrequently use these plants for treating indigestion and minor infections. ^{9,10}

The pregnane glycosides in Hoodia exert appetite-suppressant effects via enhanced hypothalamic signaling ,The in vivo anti-obesity effect of *H. gordonii* has been studied in rats and chickens. The first scientific reports of antiobesity activity were done by Tulp et al.¹¹Experiments performed and included in a US patent application revealed a reduction in food intake, increased water consumption, reduced mean body mass gain, and body mass loss in some of the groups.

Studies concluded that P57 has a likely mechanism of action in the central nervous system as suggested by the effects on the hypothalamic neurons and hypothalamus, as the hypothalamus is an area of the brain involved in the control of hunger, appetite, and temperature control. ¹²⁻¹⁴However, this doesnot exclude any peripheral mechanisms of action . In vivo results based on studies done in obese males revealed that reduction in food intake,bodyweight ,blood glucose and triglycerides.S

Another study reported the use of DLE-X capsule containing hoodia extract in overweight subjects reduced the body weight and reduces the calorie intake.

A research published , phytopharm in 18 morbidly obese individuals, it was a double blind study where half of the volunteers had *Hoodia Gordonii* extract, and half consumed only a placebo, without either group knowing which they were getting. Other than the administration of the extract and the placebo, the volunteers were informed to carry on with what they usually did like eating, reading books, watching television, and sleeping.¹⁵

Results concluded that there would be a loss of a considerable two pounds per week at the rate that the calorie intake was reduced, and this was achieved without feeling any hunger, or changing the lifestyle of the subject.^{16,17}

Hemidesmusindicus

Common name: Indian Sarsaparilla



Hemidesmusindicus is a twining shrub, belonging to the family *Asclepiadaceae*.

Roots of this taxon has been used in folk medicine as well as in ayurvedic and unani preparations. They have been prescribed against the diseases of blood, inflammation, diarrhoea, respiratory disorders, skin diseases, syphilis, fever, bronchitis, asthma, eye diseases, epileptic fits in children, kidney and urinary disorders, loss of appetite, burning sensation and rheumatism. It has also been used in combination with other drugs for snake bite.¹⁸⁻²⁰

Study reported by Gayathrimahalingam in *Hemidesmusindicus* root extracts in sreptozotocin

induced diabetic rats, the levels of serum lipids in control and in diabetic rats at the end of 12 weeks of treatment period. Total cholesterol, triglycerides and LDL cholesterol levels were significantly ($F > 0.05$; $P < 0.001$) elevated in diabetic rats with decreased HDL cholesterol level. Oral administration of *H. indicus* aqueous extract brought back the levels of serum lipids to near normal.²¹

Gymnema sylvestere

Common name: Periploca of the woods, gudmar



Gymnema sylvestre promotes weight loss and control blood sugar levels. Many literature studies reveal the anti-obesity activity of *Gymnema sylvestre*.²²

Supplementation with gymnemate extracted from *Gymnema sylvestre* is a novel therapeutic tool for weight management. It has been checked on Otsuka Long-Evans Tokushima Fatty (OLETF) rats which have shown a decrease in food and water intake by 1/3 and 2/3 respectively, along with a body weight reduction during 1 and 2 weeks respectively. GSx has found to suppress body weight gain in rats fed on high fat diet to the same level as chitosan. The efficiency of GSx on body weight, body mass index (BMI) and appetite were monitored moderately obese human volunteers.^{23,24}

The group administered with a combination of HCA-SX (hydroxycitric acid), NBC (niacin-bound chromium) and GSx (400mg, providing 100 mg gymnemic acid) has shown a reduction in body weight and BMI by 7.8% and 7.9%, respectively. Besides, the food intake has reduced by 14.1%. Studies have been conducted to determine the weight-loss effects of Calorie-Care[®], a dietary supplement containing *Gymnema sylvestre* in addition to glucomannan, chitosan, fenugreek, and vitamin C. The novel combination has resulted in significant body weight and fat loss in obese adults.^{25,26}

Caralluma fimbriata

Common name: caralluma



Many species of *Caralluma* are commonly used as traditional medicine for the treatment of rheumatism, diabetes, leprosy, paralysis, and inflammation and have antimalarial, antitrypanosomal, anti-ulcer, antioxidant, antinociceptive, and antiproliferative activities. The genus is known for compounds like pregnane glycosides, flavonoid glycoside, flavones, magastigmane glycosides, pregnane steroids, steroidal glycosides, saturated and unsaturated hydrocarbons, aromatic and nonaromatic volatile compounds, and β -sitosterol.

An extract of *C. fimbriata* (Slimaluna[®]), Gencor Nutrients, Anaheim, CA, USA) is used as an anti-

obesity agent and appetite suppressor. It is also seen that the pregnane glycosides isolated and identified from African *Hoodia* are reported as anti-obesity and appetite-suppressant compounds.²⁷

Caralluma fimbriata, a traditional Indian "famine food" with no history of adverse effects, which also contains pregnane glycosides. This study evaluated the extract of *C. fimbriata* (CFE, Simaluma.) for appetite suppressing, antiobesogenic and antiatherogenic properties in the DIO rat model. Study reported by Soundararajan kamala kannan *et al* in caralluma fimbriata extract(CFE) states that The Diet-Induced Obesity (DIO) rat model showed CFE's anorexigenic effects on investigation. Rats were randomly divided into three groups: (i) untreated control (C), (ii) control for cafeteria diet (CA), and (iii) cafeteria diet fed + CFE treated. Rats in the test group received cafeteria diet and CFE from day one onwards. CFE was administered by gavage at three doses (25, 50, 100 mg/Kg BW per day) for 90 days.²⁸

The antiobesogenic effects of CFE were evaluated by monitoring changes in feed intake, body weight, serum lipid and hormonal (leptin) profiles, fat pads, and liver weight. Antiatherosclerotic effects were measured by histology. CFE induced significant and dose-dependent inhibition of food intake, with dose-related prevention of gains in body weight, liver weight, and fat pad mass. Alterations in serum lipid profiles associated with weight gain were similarly inhibited, as were the typical increases in serum leptin levels. These data substantiate CFE's reported anorexigenic effects. CFE treatment also conferred protection against atherogenesis.

Ginseng

Common name: *Panax ginseng*, *Siberian ginseng*, *American ginseng*, *Korean red ginseng*



Ginseng is one of the most well-known herbal medicines widely used in East Asia as a tonic, restorative and anti-aging agent in traditional Chinese medicine. *Ginseng* is a slow-growing, deciduous, perennial plant of the *Araliaceae* family which includes *Panax ginseng* (Chinese or Korean ginseng), *Panax japonicus* (Japanese ginseng) and *Panax quinquefolius* (*Xiyangshen*, American ginseng).²⁹⁻³²

Ginseng leaf-stem extract contains a number of important bioactive constituents namely ginsenosides, polysaccharides, triterpenoids and flavonoids. Among other constituents, ginsenosides exert main pharmacological actions of ginseng root, leaf-stem and berry. More than 30 ginsenosides have been isolated and identified in *Panax quinquefolius*, *Panax ginseng* and *Panax japonicus*.^{33,34}

Berry, root and leaf extracts of American and Chinese ginseng as well as total ginsenosides of Chinese ginseng leaf-stem had anti-obesity activities in animals and that American ginseng leaf extract significantly reduced body weight in adult *obese* mice.³⁵

Chang Nam Ko *et al* published a study on the mixture of Ginseng Radix and Crataegi Fructus (Gen-CF) which was developed to increase the pharmacological effect of ginseng in the treatment of hypercholesterolemia and prevention of cardiovascular disease. This study evaluated the effects of Gen-CF on serum lipids of

hypercholesterolemic rats *in vivo*, as well as its antioxidant activities *in vitro*, and explored its clinical effects on patients with hypercholesterolemia. *In vitro*, Gen-CF displayed 1,1-diphenyl-2-picrylhydrazyl and superoxide radical scavenging activities, and inhibited hemolysis induced by 2,2'-azobis-2-amidinopropane dihydrochloride in a dose-dependent manner.³⁶

In vivo, Gen-CF significantly inhibited the increases of total cholesterol, low-density lipoprotein cholesterol and triglyceride in high cholesterol-diet and Triton WR-1339 models. It also significantly inhibited the decrease of high-density lipoprotein cholesterol in these models. In the clinical trial, Gen-CF significantly lowered total cholesterol, low-density lipoprotein cholesterol, triglyceride, total lipid and phospholipid, with no adverse events, including hepatic or renal toxicity. The data suggest that Gen-CF has the potential to treat hypercholesterolemia and prevent cardiovascular disease.

Yi-Seong KWAK published a data in Red ginseng acidic polysaccharide (RGAP) isolated from Korean red ginseng carried out to prove the anti hyperlipaemic activity using hyperlipidemic rats acutely induced by Triton WR1339 or corn oil intravenously injected. Oral administration of RGAP (100 to 1000 mg/kg) dose-dependently reduced the serum levels of triglyceride (TG) up-regulated by Triton WR1339, an inducer of endogenous model hyperlipidemia. Moreover, RGAP treatment was shown to significantly decrease the levels of non-esterified fatty acid (NEFA) concomitant with TG reduction.³⁷

However, such reduction effects were not observed in cases of total cholesterol (TC) and phospholipid levels increased under the same conditions, although there was an inhibitory tendency. The exogenous hyperlipidemic rat condition triggered by corn oil also supported the anti-hyperlipidemic activity of RGAP in serum and hepatic parameters of TG and NEFA.

RGAP significantly enhanced the serum activity of lipoprotein lipase, a key hydrolytic enzyme of lipid molecules in lipoprotein, in a dose-dependent manner up to 80%, implying potential involvement of this enzyme in lowering TG and NEFA by RGAP. Therefore, the data suggest that RGAP may play an additional role in reducing hyperlipidemic conditions, which can be used as a valuable nutraceutical application for the treatment of hyperlipidemia.

Erythrina indica

Common name: Coral tree, sunshine tree



Erythrina indica Lam is a common plant found in south India. It is known as kalyana murungai in Tamil. It is being considered useful for treating antihelminthiasis, sedative, anti-inflammatory, nematocidal and worm infection. Flowers, Fruits and Stem are used in anti-helminthiasis and Skin diseases. The presence of active constituents viz. Alkaloids, Glycosides, Phenyl coumarin have been reported from root and seeds.⁴⁰

The leaves are cut into small pieces, mixed with dosa flour and prepared as dosa. When eaten it is helpful as a cure for colds and cold related infections. Chopped leaves fried with coconut oil and eaten with cooked rice help encourage the secretion of breast milk. The leaves are included in infusions and other childrens' medicines used for controlling wheezing trouble.³⁹

Traditionally, cut leaves are mixed with dhal, cooked and given to pregnant women. It is helpful in relieving scanty urination.

Kamalraj⁴³ investigated study on Antihyperlipidemic Studies on Leaf Extract Of *Erythrina Indica* Lam ,the study was performed by administration of Aqueous extract of *erythrina indica* leaf at two dose level 200mg/kg and 300mg/kg for 30 days resulted in the

reduction in total cholestral, triglycerides, low density lipoprotein level and significant increase in high density lipoprotein level in the high fat diet which in dual hyperlipidemia in rats. The results are compared to that of standard drug, simvastatin 5mg/kg. the study support the earlier claims of the plant in obesity.^{41,42}

Table 1: Anti-obesity activity of herbal drugs

| Source | Active ingredient | Experimental design | Anti obesity activity | References |
|-------------------------------------|---|--|---|---|
| <i>Ginseng</i> | Crude ethanolic extract | 500 mg/kg, ICR mice with HFD, 8 weeks | 16% decrease in body weight gain | Yun et al. (2004) ⁴⁶ |
| <i>Caralluma fimbriata</i> (cactus) | Crude ethanolic extract (pregnane glycosides) | 1g/day, overweight adult Indian men and women, 60 days | 2.5% decrease in body weight gain | Kuriyan et al. (2007) ⁴⁴ |
| <i>Erythrina variegata</i> | Methanolic seed extract | 200-400mg/kg | Lipid peroxidation is reduced by the extract in high fat diet induced wistar rats | G.Balamurugan A.Shantha ⁸ |
| <i>Hoodia gordonii</i> | Leaf extract P57 & DLX capsules | 18 morbidly obese individuals | Decreased the body weight and calorie intake Contains pregnane glycoside | Y.J shukla et al ¹⁶ |
| <i>Hemidesmus indicus</i> | Ethanolic root extract | Streptozotocin induced diabetic rats | Decrease in total cholesterol, triglycerides, LDL & HDL | Gayathri mahalingam & Krishnan kannabiran ²¹ |
| <i>Gymnema sylvestere</i> | Hexane Leaf extract | 150 mg/kg -250mg/kg sprague dawley rats | Reduction of cholesterol level | Kaushik manish et al ⁴⁵ |
| <i>Erythrina indica</i> | Aqueous leaf extract | 200mg/kg & 300mg/kg wistar albino rats | Decrease in total cholesterol, triglycerides, LDL & HDL. compared to simvastatin | Kamalraj.R ⁴³ |

CONCLUSION

Based on a number of in vivo studies regarding the efficacy of anti-obesity botanical preparations it has been observed that these drugs act by stimulating thermogenesis, lowering lipogenesis, enhancing lipolysis, suppressing appetite, and decreasing lipid absorption. Single and mixed anti-obesity medicinal plant preparations may have different effects.

The consumption of bioactive compounds from the diet or dietary supplementation is one possible way to control obesity and to prevent or reduce the risks of getting various obesity-related diseases. Recently, there has been a remarkable interest in finding, lipid inhibitors from natural products to replace synthetic compounds. Natural substances are presumed to be safe since they occur in plant foods, and are therefore

seen as more desirable than their synthetic counterparts. various literature shows that natural products contain a large variety of substances that possess lipid inhibition activity. Especially, a variety of herbs from plants have been used as traditional natural medicines for healing many diseases. In particular, various medicinal herbs are reported to have biological activity.

To treat and control obesity, pharmacological approaches such as drugs to induce loss of appetite, inhibit nutrient absorption, and promote weight loss have been used. Clinically available antiobesity agents include orlistat, a pancreatic lipase inhibitor, and sibutramine, a centrally acting inhibitor of serotonin and norepinephrine uptake . However,

these antiobesity agents cause serious adverse effects, including constipation, insomnia, emesis, headache, stomachache, and myocardial infarction.(5,6)

To overcome these type of side effects botanicals play a role as a remedy to treat obesity by causing weight loss. The active ingredients present in various herbal extracts reviewed in this article is responsible for weight loss, they reduce the body weight, suppresses appetite, and causes reduction in calorie intake.

Many slimming agents as patented have launched for weight loss. Before administering the drug the safety of the drug should be assessed by FDA. Currently orlistat is recommended by the physicians for weight reduction. It is less toxic than sibutramine.

Coming to herbal drugs hoodia capsules show good reduction in body weight. It contains pregnane glycoside responsible for anti obesity activity. On the other hand *caralluma fimbriata* marketed as slimmaluma capsules patented by US FDA. It is also safe to consume as a slimming agent. Further work should be carried out in *hemedesmus indicus* extract extensively for its anti obesity activity, then even though *Gymnema sylvestere*, *Erythrina variegata*, *Erythrina indica* also causes reduction in cholesterol level further work should be done to prove its safety.

Conflict of interest: Nil

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