A medicinal plants survey for treatment of obesity

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ABSTRACT

The present day problem right from young people including all the age groups is obesity. It is not just fatness but is the indication of overweight. The plants with several chemical constituents with in themselves act as the source for the treatment of the obesity with their valuable hypolipidemic and hypcholesterolemic agents. Here in, there is a list of plants and main constituents which can be used in the treatment of the obesity by extracting the constituents.

Key words: Obesity, herbs, chemical derivatives

INTRODUCTION

Obesity is simply fatness in a degree higher than overweight, which may even have a worse impact on a person’s mental health. The energy intake coming from food that the body does not use is stored as fat. Obesity may be genetic but more often it is simply because of poor diet and lack of exercise in the child. To be more active is the best way to burn more calories and lose weight (www.icobesity.com). In a country like India, obesity is in association with modernization and urbanization. As the people are moving to urban centers and wealth is increasing, the obesity is becoming epidemic. In Northern India obesity was most prevalent in urban populations (male = 5.5%, female = 12.6%), followed by the urban slums (male = 1.9%, female = 7.2%) when compared to rural populations (male = 1.6%, female = 3.8%). Socioeconomic class also had an effect on the rate of obesity, with women of high socioeconomic class having greater rates (10.4%) than that of low socioeconomic class women (0.9%) (Adam et al 2008). Evidence suggests that obesity often has more than one cause of which genetic, environmental, psychological, physiological play an important apart from other factors. Obesity may increase the risk of developing many health problems which include Type diabetes, Heart disease, Stroke, High blood pressure (hypertension), High cholesterol (hypercholesterolemia), Certain cancers, Sleep apnea, Osteoarthritis, Gallbladder disease and gallstones, Fatty liver disease (also called nonalcoholic steatohepatitis or NASH), Gastroesophageal reflux disease (GERD), Gout and Psychological and emotional effect (Arthur Schoenstadt, 2007). The phospholipids, free cholesterol and protein constitute the outer surface of the lipoprotein particles while the inner core contains mostly esterified cholesterol and triglycerides which serve to solubilize and transport cholesterol and triglycerides in the bloodstream. The lipoprotein lipase hydrolyses triacylglycerol components of VLDLs and chylomicrons to free fatty acids and glycerol in the capillaries of adipose tissue and skeletal muscle, of which the free fatty acids are absorbed by the cells and the glycerol is returned via the blood to the liver (and kidneys) and converted to the glycolytic intermediate DHAP.PPARα induces a massive increase in peroxisomal fatty acid oxidation in hepatic cytes thus providing a powerful action for the clearance of fat from the serum. Direct activation of PPARα leads to contribution of lowering TG and FFA levels, and suppression of TNP-α gene expression, which are potential systemic mediators of insulin resistance (Moller 2001). Changes in hepatic LDL-receptor contribute to the elevation in blood cholesterol levels induced by high-cholesterol diets as well as to the reduction that follows hepatic cholesterol depletion (Brown MS 1986). HMG-CoA reductase is the rate limiting enzyme governing cholesterol biosynthesis and the synthesis of other isoprenoids in mammalian cells (Rodwell VW 1976), on which more than 70% of total production of body cholesterol in humans is derived from denovo synthesis. Acyl coenzyme A: cholesterol acyltransferase (ACAT), catalyses the intracellular formation of cholesterol esters, plays an important role in the intestinal absorption of cholesterol, foam cell formation within the arterial wall and VLDL production in the liver. Food intake and fat deposition are regulated by neurotransmitters peptides, most of the located in the brain, particularly in the hypothalamus and in the gut. This includes peptides that are orexigenic (appetite-stimulating) signals and anorectic peptides. Neuropeptide Y, orexins A and B, galanin, melanin-concentrating hormone, and agouti-related peptide all act to stimulate feeding, while alpha-melanocyte stimulating hormone, corticotropin releasing hormone, cholecystokinin, cocaine and amphetamine regulated transcript, neurtensin, glucagon like peptide 1, calcitonin gene related peptide, bombesin and ciliary neurotrophic factor have anorectic actions.

From an ancient years to till now, herbs used for the treatment of obesity by different mechanisms. Herbs contain a wide variety of active phytochemicals, such as flavanoids, terpenoids, lignans, polyphenols, saponins, plant sterols and cartenoids, and there is now a lot of interest in herbs that possess hypolipidemic, antiplatelet, anti-tumour and immune stimulating properties (Craig, 1999). Others like Vitamin E, vitamin C, vitamin B6, beta carotene, dehydrolipic acid, glutathione and coenzyme Q10 (CoQ10, ubiquinone) are inhibiting oxidation of LDL cholesterol. (Alan 1996). In this review we reveal that herbs and its derivatives used for the treatment of obesity and its related diseases/ disorders.

HERBS AND ITS DERIVATIVES:

*Accanthopanax sessiliflorus*: Bioactive-guided fractionation of a saponin-rich fraction of the leaves of *Accanthopanax sessiliflorus* led to the isolation of the active lupane-type saponins, sissolside and chisanside, both of which showed strong inhibition of PL in vitro. Further, sissolside and chisanside inhibited lipase activity in a dose-dependent manner, and their IC50 values were 0.36 and 0.75 mg/ml, respectively (Yoshizumi, K. et al. 2006).

*Antrodia camphorata*: Chin-Hsin huang described that the major bioactive compounds of *Antrodia camphorata* are identified as polysaccharides, triterpenoids, steroids, benzenoids, and malic/succinic acid derivatives. Therapeutic groups were orally administrated dosages of 0.25 silymarin/kg BW and a low dosage of *Antrodia camphorata* (0.025 g/kg BW) and a high dosage of *Antrodia camphorata* (0.1 g/kg BW) per day. *Antrodia camphorata* especially at the high dosage not only showed a hypercholesterolemic effect (p<0.05) but also reduced (p < 0.05) hepatic lipids in alcohol-fed rats. Those beneficial effects could be partially attributed to higher (p<0.05) fecal cholesterol and bile acid outputs, as well as down regulations (p<0.05) of HMG-CoA reductase, sterol regulatory element-binding protein-1c, acetyl-CoA carboxylase, fatty acid synthase, and malic enzyme genes expression; meanwhile, there was an upregulation of low-density lipoprotein receptor and peroxisome proliferator-activated R gene expression.

*Aesculus species*: A mixture of triterpene oligoglycosides (escins) from Japanese horsechest nut (*Aesculus hippocastanum*) have nutraceutical properties associated, potentially, with antidiabetic or anti-obesity effects. Detailed structure activity relationship (SAR) studies of escins and their derivatives deacetylescins and desacycl escins, with respect to their PL inhibitory activity, demonstrated that the potency of these compounds was in the order of escins > desacycl escins > deacycl escins. Escins Bb (IC50 24 mg/ml) and Ib (IC50 14 mg/ml) with angelyo/monoglycosides were found to be more potent than escins Ia (IC50 48 mg/ml) and Ila (IC50 61 mg/ml) with tigloyl monoglycosides. Escins also have inhibitory effect on the elevation of blood glucose in the order of escins > deacycl escins > desacycl escins (Kimura, H. et al. 2006).

*Cajanus cajan*: The effect of (200 mg/kg) stilbenes (Cajanin, Longistylin C, and Longistylin A) containing extract-fraction from C.cajan on lipid metabolism significantly decreased the serum and hepatic total cholesterol, TG and the LDL cholesterol in hypercholesterolemic (high cholesterol plus cholic acid diet) kunming mice compared to model mice. In the same experiment, HMG-CoA reductase mRNA expression level obviously increased in the effect group of extract-fraction on lipid metabolism. *HMG-CoA reductase* is the rate limiting enzyme governing cholesterol biosynthesis and the synthesis of other isoprenoids in mammalian cells (Rodwell VW 1976), on which more than 70% of total production of body cholesterol in humans is derived from denovo synthesis. Acyl coenzyme A: cholesterol acyltransferase (ACAT), catalyses the intracellular formation of cholesterol esters, plays an important role in the intestinal absorption of cholesterol, foam cell formation within the arterial wall and VLDL production in the liver. Food intake and fat deposition are regulated by neurotransmitters peptides, most of the located in the brain, particularly in the hypothalamus and in the gut. This includes peptides that are orexigenic (appetite-stimulating) signals and anorectic peptides. Neuropeptide Y, orexins A and B, galanin, melanin-concentrating hormone, and agouti-related peptide all act to stimulate feeding, while alpha-melanocyte stimulating hormone, corticotropin releasing hormone, cholecystokinin, cocaine and amphetamine regulated transcript, neurtensin, glucagon like peptide 1, calcitonin gene related peptide, bombesin and ciliary neurotrophic factor have anorectic actions.

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Cyclocariosides are dammarane type of triterpene saponins isolated from the leaves of Cyclocarea paliurus, against Brownlee's formaldehyde-induced arthritis in albino rats. It is also indicated in the treatment of guggul produced lower cholesterol levels and lessened serum turbidity. The ages) and its anti-inflammatory effects (Elizabeth Williamson et al. 2009). Oral administration of gugulsterone, E-gugulsterone, and Gugulsterols I, II and III. Guggul has undergone a number of compounds including a diterpene hydrocarbon, a diterpene alcohol, Z-stigmasterol, and steroidal saponins (Bader et al., 2003). Caralluma fimbriata has a potential appetite suppressing action. Studies have found conflicting results for its lipid-lowering effects. Guggul resin contains total glycosides, and its anti-inflammatory effects (Elizabeth Williamson et al. 2009). Oral administration of caralluma produced lower cholesterol levels and lessened serum turbidity. The cholesterol lowering effects have been seen in monkeys kept on a high cholesterol diet, with results comparable to those of Atorvastatin. It has a high anti-inflammatory potential against Brood’s formaldehyde-induced arthritis in albino rats. It is also indicated in rheumatic disorders and obesity (Aditya Sharma, 2006).

Cyclocariosides: The key phytochemical ingredients in Caralluma are pregnane glycosides, flavone glycosides, mestigumane glycosides, bitter principles, saponins and various other flavonoids. Caralluma fimbriata has a potential appetite suppressing action. While there was no significant effect of Caralluma on BW, there was a significant reduction in waist circumference. The effect of appetite suppression translated into a net decline in body weight in combination with caffeine are effective for helping to treat obesity. As a result, supplements containing caralluma alkaloids became widely available as a stimulant for losing weight and increasing energy. A recent randomized, double-blind trial of 67 human subjects reported that E.sinensis in combination with Paullinia cupana (guarana) led to increased short-term weight and fat loss. Ephedra sinensis: The principal alkaloid constituents are ephedrine, pseudoephedrine, and sometimes small amounts of phenylpropanolamine. Other constituents that have been isolated include norephedrine, methylephedrine, and norephedrine. Early studies showed that ephedrine (derived from the ephedra plant) has thermogenic and anti-obesity properties in rodents. Follow-up double-blind, placebo-controlled trials in humans found that ephedrine increased the lipolytic effect of norepinephrine in adipocytes. This result means that NNE upregulated lipolysis in adipocytes. The lipolytic effect of NNE was mediated by ß-adrenoceptors, because a ß-adrenoceptor antagonist blocked this effect. Stimulation of the ß-adrenoceptor in white adipocytes leads to increased lipolysis, primarily through the production of cAMP and activation of hormone-sensitive lipase and PPARγ, during adipogenesis in 3T3-L1 preadipocytes. The increase in phosphorylation and expression of PI3K/Akt during adipocytic differentiation was blocked by the ß-adrenoceptor antagonist. This suggests that hibiscus extract inhibits the adipocyte differentiation through the modulation of PI3K/Akt and ERK pathway that play pivotal roles during adipogenesis (Jin-Kyung Kim et al., 2003).

Nelumbo nucifera: Blend tea or extract of leaf of N. nucifera has recently been used to treat obesity in China. Active substances were separated from different parts of N. nucifera mainly including flavonoids, sterols, terpenoids, polyphenols, and glycosides. Alcohol, Nelumbo nucifera leaves extract (NNE) had an inhibitory activity on α-amylase and lipase, and these inhibitory activities disappeared by elimination of phenolic compounds from NNE. Extracts of N. nucifera leaves (NNE) inhibited PL with an IC50 value of 0.46 mg/ml. The inhibitory activity was attributed to the phenolic constituents of the leaves. NNE caused a concentration dependent increase in glycerol release due to the break down of oil droplet in adipocytes. This result means that NNE upregulated lipolysis in adipocytes. The lipolytic effect of NNE was mediated by α-adrenoceptors, because a α-adrenoceptor antagonist blocked this effect. Stimulation of the α-adrenoceptor in white adipocytes leads to increased lipolysis, primarily through the production of cAMP and activation of hormone-sensitive lipase and other pathways whereas stimulation of the a2-adrenoceptor leads to increased lipid storage, through the inhibition of cAMP production. Feeding NNE with exercise is beneficial for the suppression of diet-induced obesity. However, this effect of NNE was not shown in the treated group without exercise, suggesting that the anti-obesity effect of NNE requires exercise. Feeding the high-fat diet for 6 weeks produced slight increases in UCPC mRNA expression in the soleus and gastrocnemius muscles. On the other hand, UCPC mRNA expression was significantly increased in only the trained group and in the group treated with NNE and exercise and up-regulation of UCPC mRNA expression in the group treated with NNE and exercise was greater than that in the only trained group. Thus, the up-regulation of UCPC mRNA expression in the mouse skeletal muscle treated with NNE was due to exercise. As a result of increasing thermogenesis and lipid metabolism, NNE prevented an increase in BW in the mice fed the high-fat diet (Yuka Ono et al., 2006). Flavonoids from Nelumbo nucifera Gaertn were orally administered once a day after 3 days of allloxan induction at 50 and 200 mg/kg for 28 days, and the results showed that fasting blood glucose, serum TC and TG levels were significantly decreased.
Traditionally, oolong tea has been used to prevent obesity and improve lipid metabolism. In a relatively recent trial, oolong tea given to high-fat diet-induced obese mice for 10 weeks was found to prevent obesity and fatty liver typically induced by a high-fat diet. The positive effects of the tea may be due to caffeine stimulation of norepinephrine-induced lipolysis. Of the polyphenols identified from oolong tea, (-)-epigallocatechin 3,5-di-O-gallate (IC50 0.098 mM), pordelphinidin B-2 3,3,3,3-di-O-gallate(IC50 0.107 mM), assamcinin A (IC50 0.120 mM), oolonghomobiflavan A (IC50 0.048 mM), oolongtheanin D (IC50 0.098 mM), oolongtheanin C (IC50 0.068 mM), theaflavin (IC50 0.166 mM), and theaflavrin 3,3-O-gallate (IC50 0.092 mM) showed the most potent PL inhibitory activities. Furthermore, detailed SAR studies suggested that functional galloyl moieties and the polymerization of flavan-3-ol were required for PL inhibition (Nakai, M. et al. 2005).

Withania somnifera (L.)

The major constituents of the plant are steroidal lactones, with several series known as the withanolides (designated A–Y to date), glycowithanolides (sitoindosides), the withasomniferols (A–C), withastramonomide and withafarin A. The extract also contains phenolic acids and alkaloids such as shanagrene, withanhydrigenine, withanoside, withanine, and others. It has sedative and anti-inflammatory effects and is used for a wide range of conditions including hypercholesterolemia (Elizabeth Williamson et al. 2009).

MISCELLANEOUS:

Oil

Research on the monounsaturated fatty acid (MUFA) olive oil and its components suggest it plays an important role in the prevention of heart disease. There are multiple mechanisms by which olive oil might impact the development of atherosclerosis: reduction of hypertension and LDL oxidation, beneficial changes in lipid ratios, and reduction of macrophage uptake of LDL cholesterol (Aviram et al., 1993). Several studies have shown phenolic compounds (PCs) extracted from extra-virgin olive oil significantly inhibited the oxidation of LDL cholesterol (Caruso et al., 1999). In one study PCs from virgin olive oil were compared with single PC components such as tyrosol and oleuropein (polyphenols found in olive leaf and olive oil). They were also compared with probucol, a synthetic antioxidant medication demonstrated to prevent restenosis after balloon angioplasty, as a result of its antioxidant activity. Probucol (a diomer of hydroxytyohuene) also inhibited LDL oxidation when compared to alpha-tocopherol and inhibited LDL uptake into atherosclerotic lesions (Hakkarl et al., 1998). PCs were a more potent inhibitor of oxyester (oxidized LDL) formation than single PC components or probucol. The IC50 values for oxyesters were approximately 48, 21, 8, and 7.5 mM for tyrosol, probucol, oleuropein, and PC's, respectively. In another study, healthy men were supplemented daily with 50 g olive oil for 10 weeks. The susceptibility of LDL to oxidation was reduced 73 percent. In addition, macrophage uptake of LDL was reduced 61 percent. Significant reductions in both parameters were observed after only one week. Both oxidation and macrophage uptake of LDL are key factors initiating intimal cell injury, foam cell formation, and ultimately atherosclerosis. While the high ratio of unsaturated to saturated fats found in the Mediterranean diet may contribute to its substantial benefit in CHD, it appears olive oil may be working in other ways as well. The antioxidant activities of its phenolic compounds, shown to inhibit key elements in the pathogenesis of heart disease, are very likely important (Lyn Patrick et al., 2001).

Fiber

Preliminary evidence suggests that dietary fiber may be key in regulating circulating insulin levels by slowing nutrient absorption following a meal. According to the multicenter Coronary Artery Risk Development in Young Adults (CARDIA) Study that included 2909 healthy Black and White, 18- to 30-year-old adults, higher insulin levels, which are associated with low-fiber diets, may contribute to excessive weight gain via mechanisms such as alterations in adipose tissue physiology, shunting metabolic fuels from oxidation to storage, and increased appetite.

L-glutamine

In a small study of mice that underwent high-fat feeding to induce obesity and insulin resistance, L-glutamine supplementation was shown to reduce BW and attenuate hyperglycemia and hyperinsulinemia. These effects may stem from the action of amino acid on the conversion and storage of consumed energy, rather than from inducing fat malabsorption. Animal studies suggest that glutamine may act as an appetite suppressant. Large-scale clinical trials would be needed to determine if glutamine is useful as an anti-obesity and anti diabetic agent.

Vitamin C

A study of 102 obese women and 33 control non-obese women found a negative correlation between degree of obesity and ascorbic acid status, with extreme obesity resulting in the lowest serum ascorbic acid level. It is theorized that a suboptimal supply of certain vitamins, such as ascorbic acid, may decrease metabolic rate and energy expenditure.

Vitamin D

Vitamin D insufficiency and secondary hyperparathyroidism have been associated with obesity. A study of healthy, White, obese subjects found that these patients had lower

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basal plasma concentrations of 25-hydroxyvitamin D and higher serum parathyroid hormone concentrations when compared to age-matched non-obese control subjects. The results of the study suggest that obesity-associated vitamin D3 insufficiency was likely due to decreased bioavailability of cutaneous and dietary sources of the vitamin D3 because of its deposition in BF compartments. Supplementation with oral vitamin D may correct the vitamin D deficiency associated with obesity.

Pyruvate
Pyruvate, a 3-carbon ketoacid produced from phosphoenolpyruvate, has been touted as a BW, fat, and cholesterol reducer. Although early animal studies and later small-scale studies of obese women being fed on metabolic wards offer preliminary evidence that pyruvate may influence weight and fat loss, there is no substantive body of research to date that supports marketing claims, especially those that say pyruvate has been “clinically proven”. Further research in this area, however, may be warranted (Sukala 1998).

CONCLUSION:
Here we discussed the some herbs and its derivatives used for treatment of obesity and its associated health problems, still so many unexplored herbs are there in the world, those are used only in traditional and folk medicine but are not scientifically proved. By this review we bring out list of herbs used for the treatment of obesity, even we hope that it will give a idea for further research in listed herbs and its derivatives as well as new herbs.

ABBREVIATION:
- PL - Pancreatic lipase
- BW - Body weight
- HDL - High density lipoprotein
- HMG-CoA - 3-hydroxymethylglutaryl-CoA
- TC - Total serum cholesterol
- HDL - High density lipoprotein
- LDL - Low density lipoprotein
- VLDL - Very low density lipoprotein
- PL - Phospholipid
- TG - Triglyceride
- TL - Total lipid
- LDL - Low density lipoprotein
- VLDL - Very low density lipoprotein
- LDL-C - Low density lipoprotein cholesterol
- HDL-C - High density lipoprotein cholesterol
- cAMP - Cyclic Adenosine Monophosphate
- BF - Body fat percentage
- FM - Fat mass

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