Journal of Innovations in Applied Pharmaceutical Sciences
www.jiapsonline.com

ISSN: 2455-5177

Review article

Green cure to obesity- A review

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Abstract

The World Health Organization in 1997, described obesity as an epidemic hazard worldwide, based on the data analysis of body mass index since then, obesity incidence increased at an alarming rate and is becoming a major public health concern. Indeed, obesity facilitates the development of metabolic disorders like diabetes, hypertension, and cardiovascular diseases in addition to chronic diseases. The potential of natural products for treating obesity is under exploration. This may be an excellent alternative strategy for developing future effective, safe anti-obesity drugs. A variety of natural products, including crude extracts and isolated pure natural compounds can induce body weight reduction and prevent diet-induced obesity. Therefore, they have been widely used in treating obesity.

Key words: Obesity, body mass index, Herbs.

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Introduction

The word obesity comes from the Latin obesitas, which means stout, fat, or plump. Medically, obesity is a 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 has become one of the fastest growing major disorders throughout the world [1, 2]. Many factors have been attributed to an epidemic of obesity including sedentary lifestyle, high-fat diets, and consumption of modern fast foods [3]. Obesity leads to hypertension, diabetes, myocardial infarction, and peripheral vascular disease. Obesity therapies include reducing nutrient absorption and applying anorectic drugs, thermogenic drugs, or drugs that affect lipid mobilization and utilization. A long history of medicinal use of natural products exists in the management of obesity and hyperlipidemia [4]. They play a principle role in the introduction of new therapeutic agents [5, 6]. Development of inhibitors of nutrient digestion and absorption, which reduce energy intake through gastrointestinal mechanism without altering any central mechanisms, is one of the most important methods in the treatment of obesity. At present, the potential of natural products for the treatment of obesity is still largely unexplored and might be an excellent

alternative strategy for the development of safe and effective antiobesity drugs [7].
In this review, an attempt has been made to compile certain herbs which are reported to be an anti obesity agents.

Melissa officinalis (Labiatae)

The plant has been used traditionally and contemporarily as an anti-stress herb. Studies suggest that not only chronic stress promotes angiogenesis, but angiogenesis also modulates adipogenesis and obesity. Because the herbal extract from the plant has an anti-angiogenic activity, and it could inhibit adipogenesis and adipocyte hypertrophy[8].

Bambusa textilis (Bambusoideae)

The plant is a valuable bamboo species widely distributed in southern China. The methanolic extract of the leaves were examined for its chemical and bioactive properties. As a result, 38 compounds, including organic acids, flavonoids and miscellaneous substances, were identified. Thirteen polyphenols, considered as the most important components, were quantified using LC-MS/MS method. Moreover, the methanolic extract of the leaves had obvious antioxidant and anti-obesity activities *in vivo* in a high-fat diet rat model. It also had a significant antioxidant effect in 2,2-diphenyl-1-picrylhydrazyl (DPPH), ferric reducing antioxidant power (FRAP) and inhibition of β-carotene bleaching assays *in vitro*. These results are useful for further research of the leaves of the plant that may be useful as a functional food ingredient in health-related industries [9].

Crinum asiaticum (Amaryllidaceae)

The plant extract showed strong potential against adipocyte differentiation and lipogenesis. Genes associated with adipocyte differentiation and lipogenesis were inhibited by the extract and the extract also showed an anti-obesity effect in diet-induced and monogenic obese mice. The inhibitory effects of the extract on adipocyte differentiation and adipogenesis were determined using differentiation induction medium in 3T3-L1 cells. The supplementation with this particular herb could highly suppress the body weight gain and epididymal fat accumulation without changes in food uptake in both obese models. Increases in total cholesterol, LDL-cholesterol and triglyceride were highly suppressed in the presence of the extract of the plant. The plant has an anti-obesity effect and this anti-obesity potential might be associated with down regulation of genes involved in adipocyte differentiation and lipogenesis [10].

Vitis thunbergii (Vitaceae)

The anti-obesity effect and safety of the plant extract in high-fat diet-fed mice were investigated and it was evidenced by the decreased body weight gain, epididymal fat pads weight, adipocyte size, liver weight, and hepatic fat deposition. Moreover, the supplementation with the extract lowered the level of blood glucose and serum triglyceride. However, histological changes and parallel elevation of serum GOT and GPT level demonstrated a potential hepatotoxicity in 0.75% extract supplemented group. The augmented liver injury was accompanied by fibrotic change, possibly through activation of α-SMA-positive matrix-producing cells. The findings suggest that supplementation with the plant extract showed anti-obesity effect and preferentially ameliorated glucose and lipid dysregulation in mice fed with a high-fat diet. However, the long-term use of the extract should be cautioned because of a potential hepatotoxicity, at higher doses [11].

Akebia quinata (Lardizabalaceae)

The dry ripe fruit of the plant is used as an analgesic, an antiphlogistic, and a diuretic in

traditional medicine. *The plant* has also been used in Korea as a crude drug for treating obesity. A study was conducted to determine the anti-obesity and hypolipidemic effects of the fruit extract in mice consuming a high-fat diet and in 3T3-L1 adipocytes. The fruit extract significantly reduced gain in body weight, adipose tissue weight, and serum lipid levels in mice consuming a high-fat diet. The fruit supplementation reduced expression of genes related to adipogenesis and increased acetyl-CoA oxidase, and adiponectin in the epididymal adipose tissue. The fruit extract also showed an increase in phosphorylation of adenosine monophosphate-activated protein kinase and acetyl-CoA carboxylase, both of which are related to fatty acid oxidation, *in vivo* [12].

Morus bombycis (Moraceae)

Morus bombycis root extract exhibited strong anti-lipase activity, with an IC_{50} value of 2.07 µg/mL. In differentiated adipocytes and adipose tissues, the extract increased lipolytic effects such as decreased intracellular triglyceride and the release of glycerol. The extract inhibited phosphodiesterase activity in a dose-dependent manner. The study suggests that *Morus bombycis* root extract might be of therapeutic interest with respect to the treatment of obesity [13].

Ephedra sinica (Gnetaceae)

The stems of this Chinese plant have been used in traditional Chinese medicine for the treatment of various conditions, including modern day obesity. Ephedra has been used as a supplement for weight loss and its effects have been reported. The studies investigated the influence of Ephedra on the composition of gut microbiota, and its correlation with weight loss. Body weight, body mass index and body fat percentage of subjects were reduced after the consumption of the stem extract of the plant. The influences of gut microbiota are unique according to indigenous microbiota and differences in individual sensitivity to Ephedra. Alteration of gut microbiota by Ephedra intake showed correlation with loss of Body weight and body mass index [14].

Achyranthes aspera (Amaranthaceae)

The effect of *Achyranthes aspera* extract on food consumption, body, retroperitoneal adipose tissue and liver weights, and serum parameters in mice fed a high-fat diet for 6 Weeks. The mean food consumption per week per mice was different between the control and high-fat diet groups throughout the whole experimental period, but it did not differ between the groups fed high-fat diet alone and high-fat diet plus extract treated group, suggesting that the anti obesity effect of *Achyranthes aspera* extract was not mediated by a reduction of food intake. The change in body weight of the groups during the experimental period of 6 weeks is shown. The extract of the plant significantly suppressed the body weight gain when compared to the control group fed on high-fat diet alone [15].

Nelumbo nucifera (Nelumbonaceae)

Nelumbo nucifera is known as sacred lotus and found to have various pharmacologically active substances including alkaloids, flavonoids, triterpenoids, polyphenols, steroids, and glycosides. A phytochemical investigation of leaves led to the isolation of eight alkaloids and some of these significantly inhibited pancreatic lipases. Extracts of flowers, seeds, rhizomes, and leaves have been reported to have varied therapeutic potential including antistress, antiobesity, antioxidant, activities. Several bioactive phyto compounds derived from these plant parts were belonging to different chemical groups, including alkaloids, flavonoids, glycosides, triterpenoid, and vitamins. Bis benzyl isoquinoline alkaloids from the plant were shown to be bioavailable after oral administration to rats at a dose of 20mg/kg. The

alkaloid from the plant was shown to inhibit 3T3-L1 preadipocyte differentiation and improve high-fat diet-induced obesity and body fat accumulation in rats. Dietary fat is not directly absorbed by the intestine unless the fat has been subjected to the action of pancreatic lipase. Therefore, pancreatic lipase is one of the most widely studied mechanisms for determining natural products and potential efficacy as antiobesity agents. Methanol extract of *Nelumbonucifera* elicited an inhibitory effect on lipase enzyme with an IC50 value of 47μg/mL [16].

Codonopsis lanceolata (Campanulaceae)

A study was performed to investigate the influence of the water extracts of wild and cultivated *Codonopsis lanceolata* on the serum and body fat levels of rats fed a high-fat-diet and it was found out that the plant is very effective in treating obesity. The plant is composed of various active components including tannins, saponins, polyphenolics, alkaloids, essential oils, and steroids, which have pharmacological properties including antiobesty, antioxidant, antimicrobial, anti-inflammatory, and immune modulatory activities [17].

Nitraria retusa (Nitariaceae)

The present study investigated the antiobesity effects of *Nitraria retusa* ethanol extract in 3T3-L1 cells using different doses and in high-fat diet-induced obesity in mice. Male C57B6J/L mice were separately fed a normal diet or a high fat diet and daily administrated with extract of the plant. The administration of the plant extract significantly decreased bodyweight gain, fat pad weight, serum glucose, and lipid levels in high fat diet induced obese mice. To elucidate the mechanism of action of the plant extract, the expression of genes involved in lipid and carbohydrate metabolism were measured in liver. Results showed that mice treated with the plant extract demonstrated a significant decrease in cumulative body weight and fat pad weight, a significant lowering in glucose and triglycerides serum levels, and an increase in the HDL-cholesterol serum level. Moreover, mRNA expression results showed an enhancement of the expression of genes related to liver metabolism. The findings suggest that the extract treatment had a protective or controlling effect against a high fat diet-induced obesity in C57B6J/ L mice through the regulation of expression of genes involved in lipolysis and lipogenesis and thus the enhancement of the metabolism in liver [18].

Laminaria japonica (Laminariaceae)

Laminaria japonica Areshoung, a widely consumed marine vegetable, has traditionally been used in Korean maternal health. The ethanol extract of the plant and its molecular mechanism in high fat diet induced obese rats were studied. Six week old Sprague Dawley male rats were separately fed a normal diet or a high calorie high fat diet for 6 weeks then they were treated with the plant extract for another 6 weeks. The extract administration significantly decreased the body weight gain, fat-pad weights, and serum and hepatic lipid levels in high diet induced obese rats. The histological analysis revealed that extract treated group showed significantly decreased number of lipid droplets and size of adipocytes compared to the high diet group [19].

Carum carvii (Umbelliferae)

The weight-lowering property of caraway as a known medicinal plant in Iran was examined in a triple blind, placebo controlled, and clinical trial in Iranian overweight and obese women. Since diet and physical activity are the two lifestyle principles which induce normal weight, subjects were selected who were regularly performing aerobic exercises during the entire period of study without modifying their diet and lifestyle habits. The results indicated a moderate

effect of Caraway extract on losing weight, without any severe adverse effects. This finding is consistent with a recent study which reported data of antiobesity effect of this plant in an animal model. Additionally, numerous studies have reported the therapeutic effects of caraway on different diseases such as diabetes mellitus, cardiovascular disease and hypertension, which are known as common complications of obesity [20].

Coleus forskohlii (Lamiaceae)

The extract of the plant showed a substantial effect on weight loss and was safe and effective in reducing body fat in overweight/obese people. However, additional trials with high quality are required to establish a high level of evidence for the appropriate use of the plant extract as a personalized supplement or a pharmacological intervention [21].

Picrorrhiza kurroa (Plantaginacea)

A hypolipidemic effect of the water extract of *Picrorrhiza kurroa* was observed in a high fat diet feeding hyperlipidemic mouse at doses of 50, 100 and 200 mg/kg, orally, once a day for 12 weeks. Liver weight, serum aspartate transferase, alanine transferase, low density lipoprotein, triglyceride and total cholesterol levels were significantly reduced by the treatment. On the contrary, serum HDL level seems not affected by *Picrorrhiza. kurroa* water extract [22].

Ligustrum robustum (Oleaceae)

The leaves of *Ligustrum robustum* were commonly used in the treatment of obesity and hyperlipidemia. Phenylpropanoid glycosides from the leaves of the plant were investigated in fatty diet-fed C57BL/6J mice to evaluate the anti-obesity effect. The anti-obesity effects of the leaves in all treated mice were shown as decreased body weight, fat mass, total cholesterol level, and adipocyte area. The anti-obesity effect of the plant in fatty diet fed mice was related to the up-regulation of leptin, which may provide scientific evidence supporting the traditional usage of the leaves of the plant on obesity in China [23].

Perilla frutescens (Lamiaceae)

The leaves of *Perilla frutescens* are often used as a new source of additives for the food and pharmaceutical industries due to its unique bioactivities. This study was to evaluate the chemical composition and hyperlipidemic and antioxidant effects of total flavonoids of *P. frutescens* leaves in the hyperlipidemia rats induced by a high-fat diet. By HPLC analysis, flavonoids mainly consisted of apigenin with a smaller amount of luteolin. At doses of 50–200 mg/kg, oral administration of flavonoids to hyperlipidemia rats was highly effective in decreasing the levels of serum total cholesterol, triacylglycerols low density lipoprotein cholesterol and adipose tissue lipid accumulation, increasing the levels of serum high density lipoprotein cholesterol, adjusting metabolic disturbance of lipoprotein, increasing antioxidant enzyme activity and repressing development of atherosclerosis. It suggested that flavonoids of the plant had significant health benefits and could be explored as a potentially promising food additive for the prevention of hyperlipidemia diseases [24].

Conclusion

Dietary fat is not directly absorbed by the intestine unless the fat has been subjected to the action of pancreatic lipase. Therefore, pancreatic lipase is one of the most widely studied mechanisms for determining natural products and potential efficacy as antiobesity agents [7]. Several bioactive phytocompounds derived from the above described plants and parts of plants were belonging to different chemical groups, including alkaloids, flavonoids,

glycosides, triterpenoid, and vitamins. Hence plant drugs and their products are considered to be the safest choice in treating obesity due to the drastic side effects of synthetic drugs.

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