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# A Review on Herbal Approach towards the Treatment of Obesity

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## *ABSTRACT*

*Obesity has been declared one of the major threats to human health in the 21st century. It is a global health concern associated with high morbidity and mortality. It has become the center of much clinical attention and especially clinical laboratories, whose aim is to reduce this new world syndrome. Obesity is associated with many diseases, particularly diabetes, hypertension, osteoarthritis, and heart disease. The obesity incidence has increased at an alarming rate in recent years, becoming a worldwide health problem, with incalculable social costs. Therapeutic strategies include synthetic drugs and surgery, which may lead high costs and serious complications. Two different obesity-treatment drugs are currently on the market: orlistat, which reduces intestinal fat absorption via inhibiting pancreatic lipase; and sibutramine, an anorectic or appetite suppressant. Both drugs have hazardous side-effects, including increased blood pressure, dry mouth, constipation, headache, and insomnia. For this reason, a wide variety of natural materials have been explored for their obesity treatment potential. These are mainly complex products having several components with different chemical and pharmacological features. Plant-based medicinal agents offer an alternative approach. This review aimed to survey the literature covering the natural products with anti-obesity activity, and to review the scientific data.*

***Keywords:*** *Flavonoids, Saponins, Anti-Lipolytic, Hypertension, Pancreatic lipase.*

## INTRODUCTION

A famous ancient proverb states: eat breakfast like a king, lunch like an ordinary person, and your dinner like a beggar. Now these words of wisdom have long been discarded completely. Modern life has brought with it more food with high caloric density and better taste. New technology has made life easier and less physical work, and the result is a worldwide epidemic of obesity and its associated disorders. Obesity involves both increased fat cell size and number. It occurs when energy intake is greater than energy expenditure. This balance between energy input and energy output can be affected by many factors, including the quality and quantity of dietary intake, environmental and genetic inputs and physiological and psychological status [1].

The WHO definition is:

1. A BMI greater than or equal to 25 is overweight
2. A BMI greater than or equal to 30 is obese.

BMI (Body Mass Index) provides the most useful population-level measure of overweight and obesity as it is the same for both sexes and for all ages of adults.

Obesity is a condition in which excess body fat has accumulated to an extent that health may be negatively affected. The excessive storage that creates obesity eventually leads to the release of excessive fatty acids from enhanced lipolysis, which is stimulated by the enhanced sympathetic state existing in obesity. The release of these excessive free fatty acids then incites lipotoxicity, as lipids and their metabolites create oxidative stress in the endoplasmic reticulum and mitochondria. This affects adipose as well as non-adipose tissue [2].

Obesity increases the risk of type 2 diabetes, cardiovascular disease, cancer, and premature death. It results from less physical work and more mental work existing in our present day living and working conditions. 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 increased sedentary nature of many forms of work, changing modes of transportation, and increasing urbanization.

Changes in dietary and physical activity patterns are often the results from a sedentary lifestyle, not sleeping enough, endocrine disruptors, such as some foods that interfere with lipid metabolism, medications that make patients put on weight, medical and psychiatric illness and infectious agents [3].

Plant-based medicines have a respectable position today, especially in developing countries where modern health services are not sufficient. Indigenous remedies are gaining popularity in both rural and urban areas because they are effective, safe and inexpensive [4].

Currently, the potential of natural products for the treatment of obesity is largely unexplored and such products may be safe and effective alternatives to the anti-obesity drugs. Phytochemicals like kievitone and visoltricine are useful in pharmacological treatments. Antinutrients although elicit deleterious effects on human health yet they have been shown to be of pharmaceutical importance. Other phytochemicals like flavonoids, saponins, alkaloids, etc. are reported as biologically active molecules. Anti-nutritional factors (ANF) are natural compounds which act to reduce the nutrient utilization and /or food intake. Plants may prove to be an alternative sources of a variety of anti-lipolytic therapeutic molecules that can either inhibit the pancreatic lipase or the uptake/absorption of fats or both. In this review, we emphasize the potential role of these bioactive compounds. Moreover, medicinal plants are promising sources for isolation, identification and characterization of bioactive compounds for developing effective anti-obesity agents [5].

The high cost of conventional drugs, relatively high incidence of toxicity and side effects, unavailability of orthodox drugs in many rural areas and clinical limitation, especially in the management of some chronic diseases are some of the risks in case of modern medicine. Hence, Indian traditional herbal medicine, which provides an effective solution without side effects of this

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possible risk is preferred here. According to the World Health Organization (WHO), approximately 80% of the world's population currently use herbal medicines in healing different ailments. Among the estimated 400,000 plant species, only 6% have been studied for biological activity, and about 15% have been investigated phytochemically. This shows a need for planned activity guided Phyto-pharmacological evaluation of herbal drugs. This article is aimed to provide an overview of research on anti-obese plants [6].

**Table No. 1: List of herbs indicated for obesity in Ayurveda text books** [3]

| S. No. | Botanical name | Official name | Parts used |
|---|---|---|---|
| 1 | *Acacia Arabica* | Babbula Gum | Bark, leaf, fruit-pods bark, leaf, fruit-pods |
| 2 | *Acacia catechu* | Khadira | Bark, Heartwood, flower |
| 3 | *Achyranthus aspera* | Apamarga | Root, seed, leaf, whole plant |
| 4 | *Aconitum heterophyllum* | Ativisha | Root, rhizome |
| 5 | *Acorus calamus* | Vacha | Rhizome |
| 6 | *Adathoda vasica* | Vasa | Leaf, root, flower |
| 7 | *Aloe vera* | Kumari | Leaf, root |
| 8 | *Alstonia scholaris* | Saptaparna | Bark, latex, flower |
| 9 | *Ananas comosus* | Ananas | Fruit |
| 10 | *Anthocephalus chinensis* | Kadamba | Bark, leaf, fruit, root |
| 11 | *Azadirachta indica* | Nimba | All parts |
| 12 | *Berberis aristata* | Daruharidra | Root, stem, fruit |
| 13 | *Betula utilis* | Burja | Bark, nodes |
| 14 | *Calatropis gigantea* | Arka | Root, bark, flower, leaf, latex, seed |
| 15 | *Calicarpa macrophylla* | Priyangu | Flower, leaf |
| 16 | *Capsicum annuum* | Kutavira | Fruit |
| 17 | *Cassia tora* | Chakramardha | Seed, leaf, root |
| 18 | *Commiphora Mukul* | Guggulu | Gum-resin |
| 19 | *Coriandum sativum* | Dhanyaka | Whole plant, leaf, fruit |
| 20 | *Curcuma longa* | Haridra | Rhizome |
| 21 | *Cuminum cyminium* | Jeeraka | Seed |
| 22 | *Emblica officinalis* | Amalaki | Fruit |
| 23 | *Gymnema sylvestre* | Meshashringi | Leaf, root, seed |
| 24 | *Holarrhena antidysentrica* | Kutaja | Seed, bark |
| 25 | *Piper longum* | Pippali | Fruit, root |
| 26 | *Piper nigrum* | Maricha | Fruit |
| 27 | *Terminalia arjuna* | Arjuna | Bark, root, leaf |
| 28 | *Terminalia chebula* | Haritaki | Fruit |
| 29 | *Trigonella foenum graceum* | Methika | Seed, leaf, whole plant |
| 30 | *Zingiber officinale* | Shunti | Rhizome |

***Morus alba* L:**

The leaves and the fruits of *Morus alba* L., containing active phytochemicals, have been shown to possess antiobesity and hypolipidemic properties. The findings suggest that the antiobesity effects of MFE resulted in the recovery of the cognitive deficits induced by the high-fat diet by regulation of neural and synaptic activities [7].

***Green Tea:***

Study proposes that *fermented green tea* (FGT) extract, as a novel processed green tea, exhibits antiobesity effects. FGT reduced body weight gain and fat mass without modifying food intake. mRNA expression levels of lipogenic and inflammatory genes were down regulated in white adipose tissue of FGT-administered mice. Collectively, FGT improves obesity and its associated symptoms and modulates composition of gut microbiota; thus, it could be used as a novel dietary component to control obesity and related symptoms [8].

***Kaempferia parviflora:***

*Kaempferia parviflora* (KP) is a member of the ginger family and is known in Thailand as Thai ginseng, Krachai Dam or Black Ginger. These results demonstrate that KPE promotes energy metabolism by activation of BAT, at both doses and up-regulation of UCP1 protein at a high dose. Despite numerous challenges remain, the present study demonstrated that KPE suppresses HFD-induced obesity through increased energy metabolism [9].

***Achyranthes bidentata Blume:***

This study investigated the antiobesity effect of *Achyranthes bidentata Blu*me root water extract in a 3T3-L1 adipocyte differentiation model and rats fed with a high-fat diet. The results suggest that *Achyranthes bidentata Blume* root water extract could have a beneficial effect on inhibition of adipogenesis and controlling body weight in rats fed with a high-fat diet [10].

***Atractylodes lancea:***

The antiobesity effect of the ethanol extract of *Atractylodes lancea* rhizome was evaluated in a high-fat diet-induced obesity mice model at daily dosages of 250 mg/kg and 500 mg/kg body weight for 4 weeks, and treatment with this extract demonstrated a moderate efficacy at the 500 mg/kg dose level [11].

***Phalaris canariensis:***

Our results demonstrate an antiobesity effect reducing lipid droplet accumulation in the liver, indicating that its therapeutic properties may be due to the interaction plant components soluble in the hexane extract, with any of the multiple targets involved in obesity and diabetes pathogenesis [12].

***Nitraria retusa:***

The study suggests that NRE 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 lipid metabolism in liver [13].

***N. nucifera:***

*N. nucifera* is one among the important medicinal plants assessed for its antiobesity action in various preclinical models. The present study was aimed at investigating the antiobesity effect of methanol and successive water extracts of petals of *N. nucifera* by studying its effect on adipogenesis, adipolysis, lipase, serotonin (5-HT2C), cannabinoid (CNR2), melanocyte concentrating hormone (MCHR1), and melanocortin (MC4R) receptors. Overall, methanol extract of *N. nucifera* petals showed better activity than successive water extract [14].

***Caraway:***

*Caraway* (*Carum carvi L.*), a potent medicinal plant, is traditionally used for treating obesity. This study investigates the weight-lowering effects of the caraway extract (CE) on physically

active, overweight and obese women through a randomized, triple-blind, placebo-controlled clinical trial. Seventy overweight and obese, healthy, aerobic-trained, adult females were randomly assigned to two groups (n = 35 per group). The results of this study suggest a possible phytotherapeutic approach for caraway extract in the management of obesity [15].

***Mulberry Leaf:***

The purpose of this study was to investigate the anti-inflammatory and antiobesity effect of the combinational mulberry leaf extract (MLE) and *mulberry fruit extract* (MFE) in a high-fat (HF) diet-induced obese mice. Taken together, combinational MLFE treatment has potential antiobesity and antidiabetic effects through modulation of obesity-induced inflammation and oxidative stress in HF diet-induced obesity [16].

***Aegle marmelos:***

In continuation of evaluating the anti-obesity effect of *Aegle marmelos*, we have screened the n-hexane, dichloro methane (DCM), ethyl acetate (EtOAc) and methanol (MeOH) extracts of the leaves at the concentration of 25, 50, 75 and 100 µg/ml for adipogenesis inhibition in the adipocytes. We hereby report the adipogenesis inhibition by *A. marmelos* as one of the pathway for its antiobesity effect [17].

***Korean mistletoe:***

This study investigates the inhibitory effects of *Korean mistletoe* extract (KME) on adipogenic factors in 3T3-L1 cells and obesity and nonalcoholic fatty liver disease (NAFLD) in mice fed a high-fat diet. Male C57Bl/6 mice fed a high-fat diet were treated with KME (3 g/kg/day) for 15 weeks for theantiobesity and NAFLD experiments. Therefore, KME may be an effective therapeutic candidate for treating obesity and fatty liver caused by a high-fat diet [18].

***Gymnema sylvestre R:***

*Gymnema sylvestre R*. (Asclepiadaceae) has been used frequently in traditional Indian folk medicine for the treatment of diabetes. Study was performed in high fat diet (HFD)-induced obesity in murine model. The results of this study show that water soluble fraction of *G. sylvestre* extract possesses the antiobesity effect [19].

***Populus balsamifera L.:***

*Populus balsamifera L.es* (BP) is a medicinal plant stemming from the traditional pharmacopoeia of the Cree of Eeyou Istchee (CEI-Northern Quebec). These results confirm the validity of the CEI pharmacopoeia as alternative and complementary antiobesity and antidiabetic therapies [20].

***Onion peel:***

The aim of the present study was to examine the effect of quercetin-rich onion peel extract (OPE) on anti-differentiation in 3T3-L1 preadipocytes and the antiobesity in high-fat fed rats. These results suggest that quercentin-enriched OPE may have antiobesity effects by suppressing pre adipocyte differentiation and inhibiting adipogenesis [21].

***Aegle marmelos:***

The study was carried out to investigate the anti-obesity effects of *Aegle marmelos* leaves extracts and its phytochemical constituents in vitro and in vivo. A. marmelos DCM extract and compounds isolated from it has the potential of counteracting the obesity by lipolysis in adipocytes [22].

***P. aviculare:***

The antiobesity effects of a *P. aviculare* ethanol extract (PAE) in high-fat diet- (HFD-) induced obese mice were investigated. These results suggest that PAE exerts antiobesity effects in HFD-induced obese mice through the suppression of lipogenesis in adipose tissue and increased antioxidant activity [23].

***Vigna nakashimae:***

In this study, we evaluated the antiobesity effects of *Vigna nakashimae* (VN) extract and elucidated the underlying mechanisms. VN extract suppressed adipocyte differentiation and significantly attenuated the expression of adipogenic genes in 3T3-L1 cells. These findings suggest that *Vigna nakashimae* prevents obesity through suppression of PPARγ expression and activation of AMPK, and that it might be a useful dietary supplement for the prevention of obesity [24].

## CONCLUSION

Obesity is a complex mal relationship between energy intake and expenditure that results in a homeostasis that is resistant to change. Obesity clearly has negative health implications that are well documented in consensus literature. Likewise, correction of body weight reduces the incidence and severity of comorbid diseases. A key aspect to this end is a significant amount of physical activity that is appropriate supervised and quantified. The present review clearly revealed that nature provides a huge number of plants that show significant anti-obese activities. These natural sources are rich target for the development of alternatives to synthetic drugs. The combination of traditional and modern knowledge can produce better drugs for treatment of obesity with fewer side effects. However, there is a need for scientific validation, standardization and safety evaluation of plants of the traditional medicine before these could be recommended for treatment. From the above discussion, the findings of the study envisage that the herbal medicine has great potential to cure different kinds of disease. The indigenous rural community depends on traditional health care system. About 80% of human population in India are using herbal medicine to cure different kind of disease. The herbal medicines are generally free from side effect. Tribal people should be made aware about the value of their indigenous knowledge and erroneous method of plant collection and their seasons of growth, reproduction and dispersal. Traditional system of medicine has a rich collection of herbs for the treatment of various acute and chronic ailments. Obesity is coming as one of the leading health problem worldwide, especially in developing countries like India. The herbs in traditional system are having least side effects, proven to be useful for the management of obesity and the above told plants broadly used by traditional practitioners. From this review it should be evident that there are many traditional plants which can successfully use for the management of obesity.

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