

TREATMENT OF OBESITY: AN HERBAL APPROACH

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ABSTRACT

Obesity, a complex interplay between environmental and genetic factors and is associated with significant morbidity and mortality. Usage of herbs for the management of obesity in the recent times is attracting attention. Dietary fat is associated with well-known diseases like diabetes, hypertension and cardio-vascular diseases. Weight management means lifestyle modification, behavioral therapy, pharmacotherapy and surgery. Retardation of nutrient absorption and digestion may be used as an approach to manage obesity and related diseases. Drugs have wide ranging side effects and contraindication for its widespread use. So, herbal drugs are a promising route to treat obesity as it is a disease. Many herbal plants like *Nelumbo nucifera*, *Aloe barbadensis*, *Foeniculum vulgare*, *Holoptelea intergrifolis*,

Myristica fragrans has constituents that are used to treat obesity. Our literature survey also indicated that these herbal products fall under an acceptable level of evidence or with no scientific background at all, or they have a scientific rational but not to an acceptance level. Attempts were made in the review to define the features of possible herbal weight loss product. An ideal herbal anti-obesity product should reduce the weight by 10% over placebo of treatment by showing an evidence of improvement of bio markers like blood pressure, lipids and glycemia without any side effects.

KEYWORDS: Morbidity; Obesity; Medicinal Plants; Herbal Products; Weight Management; Herbal drugs.

1. INTRODUCTION

Obesity, is a complex interplay of environmental, genetic and psychological factors and is associated with significant morbidity and mortality.^[1] Accumulation of fat over the limit led to ill/adverse effect in the body known as obesity. Deposition of excessive fatty acids into fat cells in the form of triglycerides (TGs) is the biochemical basis of obesity, thus any imbalance in food intake and energy utilization may results obesity. This homeostasis is complex and regulated by a host of metabolic and endocrine factors which are poorly understood. 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 increasingly sedentary nature of many forms of work, changing modes of transportation and increasing urbanization. Changes in dietary and physical activity patterns are often results from 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.

Body mass index (BMI) is an index of weight-for-height that is commonly used to classify overweight and obesity in adults.^[2] The World Health Organization (WHO) definition is: 1) A BMI greater than or equal to 25 is overweight and, 2) A BMI greater than or equal to 30 is obesity. BMI provides useful population-level measure of overweight and obesity as it is the same for both sexes and for all ages of adults. However, it should be considered as rough guidance because it may not correspond to the same degree of fatness in different individuals. In recent years, obesity is reaching epidemic proportions worldwide with profound impact on health resulting in reduced quality of life and early death. If obesity will continue to rise, it will undoubtedly increase health care costs and will affect national well- being of many countries. In 2010, around 43 million children under five were overweight. Overweight and obesity are now on the rise in low and middle income countries, particularly in urban settings. Close to 35 million overweight children are living in developing countries and 8 million in developed countries. Childhood obesity is associated with a higher chance of obesity, premature death and disability in adulthood. But in addition to increased future risks, obese children experience breathing difficulties, increased risk of fractures, hypertension, cardiovascular diseases and psychological effects. Overweight and obesity are linked to more deaths worldwide than underweight. For an example, 65% of the world's population live in countries where overweight and obesity kill more people than underweight (this includes all

high-income and most middle-income countries). Obesity is a major health threat. The extra weight puts added stress on every part of individual's body. People with obesity are at risk for these health problems: Bone and joint problems due to extra weight puts strain on the bones and joints. This can lead to osteoarthritis, a disease that causes joint pain and stiffness, gallstones and liver problems, heart attack from coronary heart disease, congestive heart failure and stroke, high blood cholesterol and triglycerides (dyslipidemia or high blood fats), high blood pressure (hypertension), high blood sugar (glucose) or diabetes, stopping breathing during sleep (sleep apnea). This can cause daytime fatigue or sleepiness, poor attention and problems at work. Obesity is recognized as the most crucial risk factor for type 2 diabetes.^[3] Obesity, in particular intra-abdominal adiposity, is associated with increased free fatty acid (FFA) concentrations in blood plasma which exercise a major negative effect on insulin sensitivity in both muscle and liver. Besides insulin resistance, defective insulin secretion is a prerequisite for the development of type 2 diabetes. Both lipotoxicity and glucotoxicity may initiate and enable a vicious circle dependable for the metabolic impairment. Diabetes occurs as a late phenomenon in obesity and is preceded by years of impaired glucose tolerance. The progression to diabetes is indicated by an inability of the B cells of pancreatic Langerhans to maintain its high rate of insulin secretion in response to glucose in face of insulin resistance. The partial reversibility of the evolution of obesity towards diabetes is well demonstrated today by lifestyle changes and multidisciplinary weight loss programs. Nature is enriched with plant wealth for all living creatures, which possess medicinal virtues. Anti-diabetic activity has been reported in many plants during the last couple of years. Moreover, their mechanism of action differs from that of insulin in that they appear to act as anti-metabolites, capable of blocking the pathway of oxidation of fatty acids. Approximately 343 plants of the world have been tested for the blood glucose which found lowering effect in the laboratory experiments. Of them, 158 species are claimed to be used in traditional system on Indian medicine.

2. Global scenario of obesity

The World Health Organization (2000:14) estimated for the first time in human history that the number of overweight people is higher than the number of starving or undernourished people of the world. WHO's latest projections indicate that globally in 2005: approximately 1.6 billion adults (age 15+) were overweight; at least 400 million adults were obese. WHO further projects that by 2015, approximately 2.3 billion adults will be overweight and more

than 700 million will be obese. At least 20 million children under the age of 5 years are overweight globally in 2005.^[4]

3. Indian scenario of obesity

Statistics point to an increase in overweight or obese citizens by 20% between 1998 and 2005. Presently, one in 6 women and one in 5 men are overweight in India. Obesity figures are bulging dangerously at a staggering 70 million in India. Another study published in the *Lancet*, has revealed that “by 2030, non-communicable disease will account for nearly 70% of all global deaths and 80% of these deaths will occur in developing countries like India”.^[5] The latest obesity statistics shows that 75 percent of Indian women and 58 percent of Indian men are obese. Estimated prevalence (%) of Overweight & Obesity (BMI \geq 25 kg/m²) females and males (Aged 15+) is 18 and 20.1 respectively.^[6]

4. Common Causes of Obesity

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. Factors contribute to the recent increase of obesity.

- (1) Insufficient sleep, Spacing of meals (eating very often), Excess calorie intake.
- (2) Endocrine & metabolic Factors: Both metabolic and endocrine factors rarely cause obesity and complex interactions between the endocrine and metabolic systems
- (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) Genetic & environmental factors: Studies indicate that from 40% to as much as 80% of the variance of BMI can be attributed to genetic factors. It is estimated that heritability is as high as 30-40% for factors relevant to energy balance such as body fat distribution, resting metabolic rate, energy expenditure after overeating, lipoprotein lipase activity and basal rates of lipolysis
- (9) Natural selection for higher BMI, and
- (10) Assortative mating leading to increased concentration of obesity risk factor.

(11) Food intake: Some patients eat more during periods of heavy exercise or during pregnancy are unable to get back to their former eating habits. The increase in obesity can usually be related to the type of food consumed.^{[7][8]}

5. Obesity Treatment

The chief goal of obesity treatment is to maintain healthy weight. The treatment method to be undertaken often depends on the preferred choice of an individual undergoing treatment as well as the level of obesity. The preferred treatment modality for weight loss is dieting and physical exercise. But due to busy schedules and sedentary life-style follow-up the first two methods never seems to be practiced in a regular manner. On the other hand weight loss surgery runs out of the option considering the cost involved. There is a gradual shift towards an increase use of drugs. Drugs are pharmacological agents that reduce or control weight. There are 5 distinct strategies for weight loss are as follows: Reducing food intake either by augmenting the inhibitory effects of anorexigenic signals or factors that suppress food intake or by blocking orexigenic signals factors that stimulate food intake. Modulating the central controller regulating body weight by:

1. Altering the internal reference value sought by the controller or
2. Increasing thermogenesis by uncoupling fuel metabolism from the generation of ATP, thereby dissipating food energy as heat.
3. Blocking nutrient absorption in the alimentary canal, in particular, fat.
4. Modulating fat or protein metabolism or storage by regulating fat synthesis or adipose differentiation (apoptosis). Enhanced fat or protein turnover might reduce body weight by affecting either food or energy expenditure.
5. Modulating the primary afferent signals regarding fat stores analyzed by the controller. This approach would have the potential advantage of forcing the endogenous controller to regulate multiple pathways of energy balance and minimize restitution.

6. Anti-obesity Medications

6.1 Orlistat

Tetrahydrolipstatin isolated from actinomycetes (*Streptomyces toxytricini*) is available commercially as an anti-obesity drug under the brand name 'Orlistat'.^[9] Orlistat is a potent and reversible gastrointestinal lipase inhibitor preventing dietary fat absorption by 30% by inhibiting pancreatic and gastric lipase. Orlistat was approved in 1998 and is currently the only available drug for the long term management of obesity.

The efficacy of orlistat for weight loss has been reported in several random clinical trials for the long term management of obesity.^[6]

Adverse effect of Orlistat

Include diarrhea, flatulence, oily spotting, Steatorrhea (oily stools) and faecal incontinence.

6.2 Sibutramine

Sibutramine is Centrally acting sympathomimetic amine that enhances satiety by inhibiting nonselective uptake of nor adrenaline, serotonin and dopamine.

Adverse effect of Sibutramine: Hypertension, serotonin syndrome.

6.3 Metformin

It activates cAMP-activated protein kinase and suppresses hepatic gluconeogenesis activity.

Adverse effect of Metformin: Lactic acidosis, Gastro-intestinal upset⁰⁰.

6.4 Rimonabant

It is an approved but infrequently used drug. It is a cannabinoid CB1 receptor antagonist. It selectively acts on CB1 receptor in brain and peripheral organs. It reduces lipogenesis in liver. They not only cause weight loss but in addition reverse metabolic effects of obesity.

Adverse effect of Rimonabant

Severe depression and predisposes to neurodegenerative diseases E.g. Alzheimer's disease, amyotrophic sclerosis.

7. Anti- obesity Medication-Risks and Benefits

7.1 Benefits of weight-loss Medication

The possible benefits of these drugs in the short term include weight loss, which may lower the risk of some obesity-related health problems. Whether these drugs actually improve a person's health over the long term is not known.

7.2 Risks of Anti-obesity Medications

The risks include the side effects, which vary from drug to drug. Side effects are especially a concern in patients who may be healthy other than their obesity. Other concerns include the potential for abuse of the drugs (all except Xenical are controlled substances). People taking these drugs often find that their weight loss tapers off after four to six months. This is usually

attributed to development of tolerance, in other words that the medication has reached its limit of effectiveness. The drugs are being studied to see if tolerance really does occur.

8. Herbal Drugs in Obesity

Many herbal interventions are available today which have anti-obesity properties. There are at least 250,000 species of plants out of which more than 1,000 plants have been found to possess significant pharmacological properties.

Natural herbal medicinal plant preparations may enhance satiety, boost metabolism, and speed up weight loss. Including these foods in the diet may therefore assist slow, individual weight loss. However, doubts about human application remain. Despite the global market for satiety, fat burning, dietary supplements and other weight management remedies, patient awareness of these products is insufficient. Here, a brief review of herbal medicinal agents and their anti-obesity potential is presented which could aid patients in selecting a botanical product to develop a healthy body.^[10] Few of these herbal drugs are:

8.1 *Nelumbo nucifera*

Common name: Indian Lotus

Description

Nelumbo nucifera is an aquatic plant with large, showy flowers resembling the water lily, but not closely related to it. It is commonly called as Indian lotus, sacred lotus, bean of India and belongs to family Nelumbo naceae. *Nelumbo nucifera* leave extract was recently used to treat obesity in China.

Benefits of *Nelumbo nucifera*

Nelumbo nucifera shows its anti-obesity effect activity by inhibiting the activity of alpha-amylase and lipase and regulate lipid metabolism. *Nelumbo nucifera* leave extract prevent the increase in body weight, parametrial adipose tissues weight and liver triacylglycerol level.^[11]

***Nelumbo nucifera* as Anti-Obesity agent**

It has recently been used to treat obesity in China. So we investigate the pharmacological mechanism of the anti-obesity effect of *Nelumbo nucifera* leaves extract (NNE). We examined the effect of NNE on digestive enzyme activity, lipid metabolism and thermogenesis and evaluated the effects of anti-obesity using high-fat diet-induced obesity in mice that were treated with NNE for 5 weeks. NNE caused a concentration-dependent

inhibition of the activities of alpha-amylase and lipase, and up-regulated lipid metabolism and expression of UCP3 mRNA in C2C12 myotubes. NNE prevented the increase in body weight, parametrial adipose tissue weight and liver triacylglycerol levels in mice with obesity induced by a high-fat diet. UCP3 mRNA expression in skeletal muscle tended to be higher, when mice were administrated by NNE and were exercised. Therefore, NNE impaired digestion, inhibited absorption of lipids and carbohydrates, accelerated lipid metabolism and up-regulated energy expenditure. Consequently, NNE is beneficial for the suppression of obesity.^[12]

8.2 *Aloe barbadensis*

Common name: *Aloe-vera*

Description

Aloe vera or "*Aloe barbadensis*" is a plant which originated in North Africa and spread to the fertile lands with mild climate. Its physical aspect is similar to that of the cactus; the thick rind hides a succulent core formed mostly of water. Because it is not a pretentious herb, aloe vera can be easily tended for. This herb requires a great amount of light (even if it is artificial - 16 hours a day) and a little bit of water (especially in the cold season).

The most often used substance from this herb is the aloe gel, a thick viscid liquid found in the interior of the leaves. The leaves are used in the treatment of burns and the aloine - a bitter milky yellowish liquid is used as a laxative. It toughens up the immune system owing to the 23 peptides contained by the aloe-vera, it accelerates and regulates the metabolism, purifies the human body from toxins, bringing about a feeling of calm. Moreover, aloe vera has an antiseptic effect (by destroying the bacteria's, viruses and fungi), disinfectant capabilities and can also stimulate the cell- renewing process. Aloe-vera nourishes and supports the digesting of aliments. Cutting across the human organism, aloe-vera manages to bring the human body to a general balanced state.

Benefits of *Aloe barbadensis*

Aloe vera has proved its efficiency from the simplest allergies to the treatment of wounds and skin infections and even to its usage in alleviating more serious afflictions. With the help of this herb a wide variety of internal and external afflictions are controlled, like: asthma, virosis, arthritis, arthrosis, gingivitis, bronchitis, pharyngitis, intestinal inflammations, constipations, obesity, sprains, muscle strains, cutaneous inflammations. The efficiency of the

herb was also proven in the cases of anemia, deficiency illnesses, insomnia and depressions and the B-sisterole from the Aloe vera brings about the lowering of the cholesterol level.

***Aloe barbadensis* as Anti-Obesity agent**

Aloe-vera is a herb traditionally used to ease digestion as a folk remedy, and to alleviate pain from burns when used topically. It has recently gained popularity as an anti-obesity agent. Preliminary studies show benefit with aloe-vera in controlling weight, but the mechanisms do not seem as potent as other anti-obesity supplements. Aloe-vera is also a generally healthy compound, but has been implicated in multiple cases of liver problems (which are not too common, although resurgent) and has a lower toxicity threshold than other herbal supplements.^[13]

8.3 *Foeniculum vulgare*

Common name: Fennel

Description

Fennel (Family: Apiaceae) (*Foeniculum vulgare*) is an edible, perennial herb which resembles dill. It was discovered in the Mediterranean region and south-east Asia (from east of Morocco and Portugal all the way to Pakistan). The biggest growers of fennel today are: the United States, France, India and Russia. Fennel was brought to North America by the Spanish missionaries to be grown in their own medicinal gardens.

It was believed that this herb has a rejuvenating effect on man and helps the eye sight. Moreover, fennel stimulates lactation and loss of weight. Plant is antibacterial and very useful to the immune system. Fennel bulb helps reduce the cholesterol level. Also, the fibers from this herb can prevent intestinal cancer owing to the fact that they can eliminate toxins and cancerous substances from intestines. The herb is rich in potassium - an essential mineral which helps decrease the high blood pressure that can cause a heart attack.

Benefits of *Foeniculum vulgare*

Owing to the invigorating and purifying effects that fennel has over the human body, it can be used in treating bruises, cellulitis, obesity, retaining water, eliminating the toxins from the body, halitosis, inflammations of the mouth. Fennel helps eliminate the common cold and reduce the bouts of cough due to its expectorant nature (contains big quantity of alpha-pinen). The steam resulting from the boiling of the fennel leaves in water alleviates asthma and

bronchitis. The tea from fennel leaves and seeds is beneficial for removing intestinal worms and bacteria. The syrup made from fennel juice alleviates the violent bouts of cough.^[14]

***Foeniculum vulgare* as Anti-Obesity agent**

In animal study to examine the effect of inhalation of essential oils on body weight, feed intake and food efficiency rate, fennel lowered food efficiency rate but not feed intake. However, in another animal feed experimental study, the essential oil of fennel added to the diet resulted in a reduction of feed amount and intake.^[15]

8.4 *Holoptelea integrifolia*

Common name: Indian Elm

Description

H.integrifolia is a large deciduous tree that grows up to 15 to 25 meters in height. Its bark: is whitish yellowish grey and exfoliates with regular intervals and offensive smell when cut. Leaves: are simple alternates, elliptic, usually distichously, acuminate and the base is rounded or cordate. Leaf: margin is entire glabrous and leaf blade is pinnately veined with 3 to 7 veins on each sides.^[16]

Benefits of *Holoptelea integrifolia*

The bark and leaves are used as bitter, astringents, anthelmintic and used in treatment of diabetes, skin disease, intestinal disorder, leprosy, rheumatism and wound healing in the form of paste.it is an important pollen allergent plant of India. Plant is useful in treatment of obesity, edema and bronchitis.^[17]

***Holoptelea integrifolia* as Anti-Obesity agent**

The petroleum ether extract and methanolic extract of *H.integrifolia* leaves showed antidiabetic effect induced by alloxan and standard drug used for comparision is gilenclmide. In which petroleum ether extract given at concentration of 100 and 200 mg/kg whereas methanolic extract given at concentration of 200 mg/kg showed positive Antidiabetic potentials.^[18]

8.5 *Myristica fragrans*

Common name: Nutmeg

Description

It is an aromatic tree. The plant is a native of Moluccas, now cultivated in many tropical countries of both hemispheres. In India, it is grown in Tamil Nadu.

Benefits of *Myristica fragrans*

The ethanolic extract of this plant extract demonstrated significant hypolipidaemic effects in experimentally induced hyperlipidaemia in rabbits. It lowered the lipoprotein lipid levels, total cholesterol, LDL cholesterol and triglycerides. HDL cholesterol was not significantly affected. Total cholesterol, HDL and LDL: HDL ratios were also significantly lowered. It lowered the level of total cholesterol in the heart and liver and demonstrated platelet anti-aggregatory activity. Seed extract administration reduced both total and LDL cholesterol, lowered the cholesterol/ phospholipid ratio and elevated the decreased HDL ratio significantly in hypercholesterolemic rabbits. This extract also prevented the accumulation of cholesterol, phospholipids and triglycerides in liver, heart and aorta and dissolved atheromatous plaques of aorta. Fecal excretion of cholesterol and phospholipid were significantly increased in these rabbits.^[19]

***Myristica fragrans* as Anti-Obesity agent**

In vitro, meso-dihydroguaiaretic acid and otobaphenol, constituents of *Myristica fragrans*, have been shown to inhibit protein tyrosine phosphatase 1B, a proposed drug target for treating type 2 diabetes and obesity. Inhibition of protein tyrosine phosphatase 1B (PTP1B) has been proposed as one of the drug targets for treating type 2 diabetes and obesity. Bioassay-guided fractionation of a MeOH extract of the semen of *Myristica fragrans* Houtt. (Myristicaceae) afforded PTP1B inhibitory compounds, meso-dihydroguaiaretic acid (1) and otobaphenol (2). Compounds 1 and 2 inhibited PTP1B with IC (50) values of 19.6 +/- 0.3 and 48.9 +/- 0.5 microM, respectively, in the manner of non-competitive inhibitors. Treatment with compound 1 on 32D cells overexpressing the insulin receptor (IR) resulted in a dose-dependent increase in the tyrosine phosphorylation of IR. These results indicate that compound 1 can act as an enhancing agent in intracellular insulin signaling, possibly through the inhibition of PTP1B activity.^[20]

8.6 *Ziziphus mauritiana*/ *Ziziphus jujube*

Common name: Chinese date

Description

Ziziphus mauritiana are shrubs belong to family *Rhamnaceae*, distributed in warm temperate zone from Western Africa to India. Seeds and leaves of both these plants are used as folkloric medicine for treating hyperlipidemic and hyperglycemic conditions.^[21]

***Ziziphus mauritiana* as Anti-Obesity agent**

Anti-obesity activity of *Ziziphus mauritiana* bark powder in high fat diet (HFD) induced obese rats. HFD induced obese rats did show characteristic increase in body weights, body fat and insulin resistance. At the end of 90 day schedule of ZMBP administration, obese rats showed significant reduction in body weight gain over standard drug treatment. The anti-obesity activities of several medicinal herbs have been ascribed to increase fecal fat excretion via the inhibition of lipase activity. Thus, reduction in body weight gain, loss of triglyceride content associated with increased fecal lipid excretion in ZMBP fed obese animals suggest an inhibitory mechanism in lipid absorption.^[22]

8.7 *Arachis hypogaea*

Common name: Peanut

Description

This is a legume or "bean" belongs to family *Fabaceae*. Its common name is peanut. It is probably domesticated in Paraguay or Bolivia around seven thousand years ago and is now cultivated throughout the tropical and warm-temperate zones of the world.

***Arachis hypogaea* as Anti-Obesity agent**

This plant is free from Trans-fats. So, it decreases body weight gain, liver triglyceride content and liver size in association with increased fecal lipid excretion, suggesting an inhibitory mechanism on lipid absorption.^[23]

8.8 *Citrus aurantium*

Common name: Bitter Orange

Description

Its common name are bitter orange, seville orange, naran-jaagria, neroli. It belongs to family *Rutaceae*. Antiobesity effect of *C. aurantium* contains synephrine which is a stimulant with

similar properties as caffeine and ephedrine. It claims to have similar effects by increasing energy expenditure, increasing metabolism, and suppressing appetite.^[24]

Benefits of *Citrus aurantium*

Bitter orange has become a very widely used stimulant in fat burners. *C. aurantium* aided in weight loss and increase thermo genesis, at least to some extent. In contrast, the loss of fat mass in the test group was significantly greater compared to the placebo and control groups.^[25]

***Citrus aurantium* as Anti-Obesity agent**

The effects of repeated oral administration of 2.5–20 mg/kg of two *Citrus aurantium* fruit extracts standardized to different concentrations of synephrine (4 and 6%, respectively) on food intake, body weight gain, arterial blood pressure, electrocardiogram (ECG) and mortality have been investigated in the rat. *C. aurantium* administration significantly reduced food intake and body weight gain. However, mortality (not observed in controls) was present in all *C. aurantium* treated groups. Arterial blood pressure was not modified, but ECG alterations (ventricular arrhythmias with enlargement of QRS complex) were evident in animals treated with both extracts. Our data indicate that, in the rat, antiobesity effects of *C. aurantium* are accompanied by toxic effects probably due to cardiovascular toxicity.^[26]

8.9 *Hoodia gordonii*

Common name: Kalahari cactus

Description

Its common name bobbejaanghaap, bergghaap, bitterghaap and it belongs to family Apocyanaceae.^[27] It grows in parts of the Western Cape, the North and Northwestern regions of the Northern Cape as far as Kimberley, and just into the Southmost parts of the Free State as well as in South-western Namibia.

***Hoodia gordonii* as Anti-Obesity agent**

Animal research on hoodia includes that a purified extract of *Hoodia gordonii*, revealed a reduction in food intake, increased water consumption, reduced mean body mass gain and body mass loss in some of the rat groups.^[28]

8.10 *Murraya koenigii*

Common name: Curry Tree

Description

The curry tree (*Murraya koenigii*) is a tropical to sub-tropical tree in the family Rutaceae, which is native to India and Sri Lanka.

***Murraya koenigii* as Anti-Obesity agent**

The results obtained in this study clearly demonstrate that *Murraya koenigii* leaves treatment was associated with a potent improvement of glucose intolerance. The results demonstrate clearly that repeated oral administration of *Murraya koenigii* leaves evoked a potent anti-hyperglycemic activity in high fat diet obese rats. In other hand, high fatty diet group increased the both total cholesterol and triglycerides levels as compared to control group.^[29]

9. Reason for using herbal drug

The Probable Reasons for Obese Person to Prefer Herbal Products for Weight Management:

- (1) Health benefits of weight loss without any side effects,
- (2) Less demanding than accepted lifestyle changes, such as exercise and diet,
- (3) Easily available without a prescription,
- (4) More easily accepted than a professional consultation with a physician or a nutritionist and
- (5) 100% natural origin and perception that natural means safe.^[30]

Herbal plants for weight reduction may be effective in the treatment of obesity and associated disorders. Consistent and safe herbal product for weight reduction is a need of developed and developing countries. In our literature survey, herbal plants showed potential effects on weight control. However, for the majority of products, more data are needed to assess the suitability as an anti-obesity plants.

10. An Ideal Herbal drug for Obesity: A Suggestion

Herbal products for weight reduction may be effective in the management of obesity and associated disorders.

Consistent and safe herbal product for weight reduction is a need of developed and developing countries. In our literature survey, herbal products showed potential effects on weight control. However, for the majority of products, more data are needed to assess the

suitability as an anti-obesity product. We have attempted to provide salient futures for an ideal herbal product for the management of obesity.

- 1) Should bring down the body weight by 10% over placebo in a well-designed randomized placebo controlled clinical trial.
- 2) Should show evidence of improvement of bio markers like blood pressure, lipids and glycemia.
- 3) Should have known mechanism of action.
- 4) Should be standardized with bioactive phytochemicals which is/are responsible for anti-obesity activity.
- 5) Should not have any kind of side effects.^{[32][33]}

11. CONCLUSION

There are several plants described in *ayurveda* for weight management. But so far, no systematic and well-designed screening is attempted to come up with an effective herbal weight loss product. A better understanding in the existing evidence based science on herbs will further guide a qualitative research in obesity management that will attract the end users by the effective benefits. True randomized, double blinded, placebo-controlled clinical trials using herbal products will demonstrate their potential benefits. Significant weight loss after placebo subtraction along with known mechanism of action are required in order to generate conviction amongst users as effective agent for weight management.

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