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A HERBAL APPROACH TO OBESITY MANAGEMENT: A REVIEW

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Abstract

World Health Organization (WHO) described obesity as an epidemic hazard worldwide, based on the data analysis of body mass index (BMI). Indeed, obesity facilitates the development of metabolic disorders (e.g. diabetes, hypertension), and cardiovascular diseases in addition to chronic diseases (e.g. stroke, osteoarthritis, sleep apnea, cancers, and inflammation-based pathologies). According to studies in different countries, an obese person incurs health care expenditures at least 25% higher than a healthy person. Obesity as a primary disorder follows a positive energy balance. The identification of the primary causes of this imbalance remains challenging and comprises the majority of cases usually diagnosed after causes for secondary obesity are ruled out. This chronic disease results from complex interactions of genetic, behavioural, and environmental factors correlating with economic and social status and lifestyles. The review emphasized on herbal approach to treat obesity.

Keywords: Obesity management, Herbal formulation.

INTRODUCTION:

Accumulation of fat over the limit led to ill/adverse effect in the body known as obesity. Body mass index (BMI) is an index of weight-for-height that is commonly used to classify overweight and obesity in adults. 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. Obesity and overweight occurs due to imbalance between calories consumed and calories utilized. 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.[1,2]

Overweight and obesity are the fifth leading risk for global deaths. At least, 2.8 million adults die each year as a result of being overweight or obese. In addition, 44% of the diabetes burden, 23% of the ischaemic heart disease burden and between 7% and 41% of certain cancer burdens are attributable to overweight and obesity. WHO global estimates for the year 2008, reported 1.5 billion people were overweight, of these, over 200 million men and nearly 300 million women were obese. Overall, more than one in ten of the world's adult population was obese.[3]

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

Pathologies associated with obesity and its effects on health

In addition to, mechanical effects on the body (i.e., exacerbating osteoarthritis and back pain due to extra weight) because of the extra weight placed on the skeleton, obesity is associated with a higher incidence of several pathologies.[4]

1. Diabetes mellitus

Accumulated data demonstrate the association between obesity and noninsulin-dependent diabetes mellitus, which is the most common primary form of diabetes and impaired glucose tolerance. In obese individuals, adipose tissue releases high amounts of non-esterified fatty acids, glycerol, pro-inflammatory cytokines, and hormones. They are linked with the development of insulin resistance, which generate compensatory hyperinsulinemia with overstimulation of pancreatic cells and reduction of insulin receptors.

2. Hypertension

Epidemiological studies have demonstrated that 65–75% of the risk of hypertension is accounted for by obesity. Endocrinological studies of the adipose tissue revealed links between obesity and hypertension, likely consequent to the fact that the adipose tissue secretes bioactive molecules and immunomodulators.

3. Dislipidemia

Obesity is the most common cause of dislipidemia. Lipid oversupply in a state of obesity, hyperinsulinemia, and/or insulin resistance results in increased non-esterified fatty acid availability and, in turn, higher TG stores in non-adipose tissues, e.g. the muscle, liver, and pancreas. Fatty acid-induced disorders are referred to as lipotoxicity. Thus, elevated TG level is often accompanied by a slight increase in total cholesterol and a marked drop in high-density lipoprotein (HDL) cholesterol. Moreover, low-density lipoproteins (LDL) rich in TG, partially metabolized by hepatic lipase, are converted into small LDL, with higher atherogenic potential.[5]

4. Cardiac alterations

Obesity increases the risk of heart failure, sudden cardiac death, angina or chest pain, and abnormal heart rhythm. Increased electrical alterations in obesity lead to frequent ventricular

dysrhythmias even in the absence of heart dysfunction. The annual sudden cardiac death rate was nearly 40 times higher in obese people than in non obese population.

5. The metabolic syndrome

Obesity is the major component of the metabolic syndrome (multiple metabolic disorders). This syndrome is characterized by the co-occurrence of multiple metabolic disorders, namely overall and abdominal obesity, insulin resistance, hypertension, hyperglycemia, impaired glucose tolerance, and the combination of low HDL cholesterol and elevated TG level.

6. Lung diseases

Obesity is associated with an increased risk of chronic respiratory disorders (e.g. asthma, hypoventilation syndrome, andsleep apnea). Accordingly, weight loss often leads to symptomatic improvement.

7. Cancer

The link between diet, obesity, and cancer is not completely understood, but the rising world-wide trend in obesity and cancer might be at least in part causal. The putative cause of these obesity-related cancers has been primarily ascribed to excess estrogen production by the adipose tissue, inflammation due to adipocytokines secreted by adipocytes, infiltrating macrophages or associated stromal cells that might also play an important role.

8. Neurological disorders

Psychological damage caused by overweight and obesity ranges from lowered self-esteem to frank clinical depression. Indeed, rates of anxiety and depression are three to four times higher among obese individuals. Obesity significantly increases the risk of Alzheimer's disease. A strong correlation exists between BMI and high levels of amyloid, i.e. the protein that accumulates in the Alzheimer's brain, destroying nerve cells and producing cognitive and behavioral problems.[6]

Prevention of obesity

As a result of the recent exponential increase in obesity, the American Heart Association has released several guidelines for identification and early intervention for both adult and adolescent weight gain. Losing weight can reverse the harmful health effects attributed to excess weight, and may improve or prevent obesity-related diabetes mellitus, dyslipidemia, hypertension, and diastolic cardiac dysfunction.

1. Dietary intervention

Arrays of diets have been proposed for weight loss in obese patients. Commercial weight loss programs have become increasingly popular for targeted weight loss. However, long-term success is variable, and directly related to patient compliance with these programs. The proposed weight loss programs involved an in person centre-based program, a telephone- based weight loss counselling program, and a control

group of ‘‘usual care’’. The usual care group received individualized weight loss counselling sessions and monthly contacts; however, they did not receive free prepackaged meals. The patients participating in the center and telephone-based groups were provided with prepackaged food items and a planned menu. They were encouraged also to make behavioral changes regarding physical activity.[7]

2. Diet control

The daily requirements of persons with moderate physical activity vary with age and sex, (3200–2550 kcal for males in temperate climate and 2300–1800 kcal for females). 800–1000 kcal/day ranges are frequently used in weight reduction programs. Fasting or semi-starvation is sometimes

proposed as a mean of weight reduction in obesity. Maintaining a well-balanced diet (rich in fibers and low in fats and containing multiple vitamins) will provide the body with nutrients required to function properly. Nutrition education is important for weight management (e.g., low-fat food may still cause weight gain, since both protein and carbohydrates can be metabolically converted to fat). Low calorie diets (<1200 kcal/day) and very low calorie diets (<800 kcal/day) may be associated with diverse effects such as increased uric acid level, increased risk of gall stone formation, loss of lean body mass, electrolyte disturbances and mild liver dysfunction. The number of calories needed to maintain a certain body weight can be estimated by multiplying a person’s REE times an appropriate Activity Factor (AF) where REE is the Resting Energy Expenditure and the AF is the Activity Factor (AF) for different levels of activity.[8]

3. Physical activity

Weight gain and obesity are responses to long term positive energy balance where:

Energy Balance =Energy Intake - Energy Expenditure

Energy balance involves equilibrium between calorie intake and energy utilization (physical activity, basal metabolism, and adaptive thermogenesis). The development of overweight and obesity is a consequence of the easy and cheap availability of high-calorie foods, which is combined with sedentary lifestyle. A variety of exercises such as walking, cycling, swimming, and aerobics are effective and easy to implement. Regular physical activity is an essential component to lose weight. To lose weight, one must achieve a negative energy balance (i.e., decreased energy intake and increased energy expenditure). Overweight patients who participate in at least 30 min of moderate physical activity most days of the week, or who have moderate to high cardio-respiratory fitness have decreased all-cause mortality than those who are sedentary and unfit. Exercise as a treatment for obesity is most effective when combined with diet and weight-loss programs. Exercise alone without dietary changes will have a limited effect on weight because one has to exercise a lot to lose one pound. However, regular exercise is important to maintain a healthy weight for the long term. Another advantage of regular exercise as part of a weight-loss program is a greater loss of body fat versus lean muscle in comparison to diet alone. [9]

4. Pharmacotherapy

Medications can facilitate weight loss in obese persons. Similar to Weight Loss Surgery, there are certain BMI criteria necessary to prescribe pharmacotherapies. The patient must have a BMI greater than 30 kg/m2 or BMI of at least 27 kg/m2 with obesity-related co-morbidities. Medications are often required long-term as many persons regain weight when they are discontinued. In addition, person's compliance to these daily medications is of concern, especially in light of cost, potential lack of insurance coverage, and possible side effects. The first class of medication used for weight control causes symptoms that mimic the sympathetic nervous system. They cause the body to feel ''under stress'' or ''nervous''. As a result, the major side effect of this class of medication is high blood pressure. These medications also decrease appetite and create a sensation of fullness. Another class of anti-obesity medications suppresses appetite by increasing the level of neurotransmitters at the synapse junction, where hunger and fullness (satiety) are regulated by brain neurotransmitters (e.g., serotonin, norepinephrine, and dopamine).[10]

5. Diuretics

Diuretics cause loss of fluids that may result in gradual weight reduction. Diuretics cause temporary weight loss with no loss in body fat. Their use should be avoided due to the serious side effect of electrolytes imbalance.[11]

6. Surgical treatment for obesity

Bariatric or Weight Loss Surgery (WLS) was previously categorized as malabsorptive, restrictive, or a combination of both. However, with a greater understanding of the extensive neural-hormonal effects of WLS on satiety, hunger and metabolism, the above mentioned broad categories are no longer appropriate. In fact, today Bariatric or WLS is perhaps better referred to as Metabolic Surgery. The most common metabolic surgical procedures include Roux-en-Y gastric bypass, adjustable gastric band, sleeve gastrectomy, and biliopancreatic diversion. The National Institute of Health consensus has suggested the following guidelines for surgery in obese patients.[12]

a- Patients with BMI more than 40.

b- Patients with BMI more than 35 who have serious medical problems such as sleep apnea, that would be improved with weight loss.

7. Natural products for treatment of obesity

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.[13]

7.1. Dietary phytochemicals

Dietary phytochemicals might be employed as anti-obesity agents because they may suppress the growth of the adipose tissue, inhibit differentiation of preadipocytes, stimulate lipolysis, and induce apoptosis of existing adipocytes, thereby reducing adipose tissue mass.[14]

7.2. Natural products

7.2.1. Natural products with lipase inhibitory effect: Dietary fat is absorbed by the intestine when it has been subjected to the action of pancreatic lipases. Pancreatic lipase is a key enzyme in dietary triacylglycerol absorption, hydrolyzing triacylglycerols to monoacylglycerols and fatty acids. Few substances interact directly with the lipases as orlistat. It is a derivative of the naturally-occurring lipase inhibitor from Streptomyces toxytricini. Orlistat inhibits by forming a covalent bond to the lipase's serine active site. Although it is clinically approved for obesity treatment, it has certain unpleasant gastrointestinal side-effects. Natural products provide a vast pool of pancreatic lipase inhibitors. A wide variety of plant products such as saponins, polyphenols, flavonoids, and caffeine possess lipase inhibitory effects. Several carbohydrates also possess pancreatic lipase inhibitory effects, for example chitin/chitosan. Many metabolites from microorganisms, including lipstatin from S. toxytricini and panclicins from Streptomyces sp. also possess pancreatic lipase inhibitory activity. Different types of tea (e.g., green, oolong, and black tea) are among the most widely-studied materials for lipase inhibitors. Various polyphenols (e.g., L-epicatechin, epicatechin gallate (ECG), epigallocatechin (EGC) and epigallocatechin gallate (EGCG)) isolated from tea leaves showed strong inhibitory activity against pancreatic lipase. These polyphenols acquire galloyl moieties within their chemical structures and/or polymerization of their flavan-3-ols for enhanced pancreatic lipase inhibition. [15]

7.2.2. Natural appetite suppressants: Body weight regulation through appetite control is a multifactorial event resulting from neurological and hormonal interrelationships. A line of evidence indicates that serotonin, histamine, dopamine, and their associated receptor activities are closely associated with satiety regulation. These receptors may enable better targets for drugs treating obesity through energy intake reduction. Agents that act via peripheral satiety peptide systems alter the various hypothalamic neuropeptide levels. Also, they alter the key CNS appetite monoamine neurotransmitter levels and may be suitable candidates for appetite suppressants. Appetite suppressants control hunger centers in the brain, resulting in a sense of fullness. However, ghrelin secretion in the stomach may increase with decreased food intake, stimulating more food intake. Therefore, ghrelin antagonism may decrease the appetite that potentially occurs with decreased feeding, thus, may be a potential adjunctive treatment for obesity. An example of a natural appetite suppressant is Hoodia gordonii. It regulates appetite and significantly reduces calorie intake and boosts weight loss.

Natural hydroxycitric acid (HCA) from Garcinia cambogia, is a potential natural appetite suppressant. It is available under the names HCA-SX and Super CitriMax. Hypericum perforatum increases the serotonin quantity present within synaptosomes by inhibiting synaptosomal uptake of serotonin, which suppresses the appetite and reduces food intake. Thus increased serotonergic transmission might be the link between antidepressant and anti-obesity activities of H. perforatum.[16]

7.2.3. Natural energy expenditure stimulants: Excessive adiposity results from energy imbalance, where the consequences of excessive food intake are not balanced by increasing energy expenditure. Energy expenditure has many components, and can be classified into physical activity, obligatory energy expenditure, and adaptive thermogenesis. To regulate body weight and energy expenditure, mammalian brown adipose tissue (BAT) establishes non-shivering thermogenesis through dissipation of excess energy as heat. BAT plays an important role in obesity control by controlling energy balance through UCP1 (Uncoupling protein). UCP1 is responsible for oxidative phosphorylation. Thus, searching for substances that upregulate UCP1 gene expression may be a worthy strategy for achieving obesity control through increased energy expenditure. For example, the ethanolic extract of Solanum tuberosum activated the expression of UCP in BAT and the liver, and significantly reduced fat weight. Many natural compounds have been proposed as treatments for obesity via enhanced energy expenditure including caffeine, capsaicin, and green tea and its extract.[17]

7.2.4. Natural adipocyte differentiation inhibitors (decreased lipogenesis): Adipocytes play a central role in the maintenance of lipid homeostasis and energy balance by storing triglycerides
and releasing free fatty acids in response to change in energy demands. Natural products that specifically target adipogenesis inhibition had been considered promising potentials in obesity treatment. Fatty acids, particularly polyunsaturated fatty acids (PUFA) act as signal transducing molecules in adipocyte differentiation. Thus, PUFA play a central role in suppressing lipogenesis and regulating adipocyte differentiation through suppression of late-phase adipocyte differentiation. Several natural products have apoptotic effects on maturing pre-adipocytes (eg. esculetin, resveratrol, quercetin, genistein, EGCG, capsaicin, and conjugated linoleic acids).[18]

7.2.5. Natural lipid metabolism regulators (increased lipolysis): The pharmacological targeting of lipolysis can be achieved by stimulating triglyceride hydrolysis in order to diminish fat stores, thereby combating obesity. The flavonoids from Nelumbo nucifera leaves are examples of the natural products involved in b-adrenergic receptor activation. [19]

7.2.6. Natural products with combined effect: As mentioned above, many natural products show anti-obesity activities with varying mechanisms. Perhaps the recommended approach to search for more efficient obesity treatments and achieving the synergistic effects of natural products should seek treatments using multiple products or products that have multiple activities. Green tea is a good example

of a natural drug which possesses multi-functional anti-obesity activities. Researches have proved the anti-obesity activity of catechins which is due to the combined actions of appetite reduction, greater lipolytic activity and energy expenditure, and less lipogenic activity and adipocyte differentiation. The aqueous extract of Hibiscus sabdariffa (mainly anthocyanins) has potential anti-obesity mechanisms including anti-hyperglycemic, lowering plasma cholesterol level, gastric and pancreatic lipase inhibition, thermogenesis stimulation, inhibition of lipid droplet accumulation in fat cells (no effects on adipose conversion), and fatty acid synthase inhibition. G. cambogia extract (HCA) has multi-functional anti-obesity effects. It inhibits adipocyte differentiation, reduces fatty acid synthesis (lipogenesis) and epididymal fat accumulation through reducing ATP-citrate lyase activity, and suppresses appetite. Pomegranate extract (ellagic and tannic acids) also has dual anti-obesity effects. It inhibits pancreatic lipase activity and suppresses energy intake. Its effect on energy intake was similar to sibutramine but with a different mechanism. Arachis hypogaea (Peanut) shell extract inhibits fat absorption, activates lipid metabolism in the liver, and reduces adipocyte lipolysis. Apium graveolens juice significantly lowers TG concentrations and total cholesterol levels in animals fed with high-fat diet. Ginger has a dual antiobesity effect. Gingerol and shogaol increase the metabolic rate and thus help to ‘‘burn off’’ excessive fat and also suppress the absorption of calorie-dense dietary fats from the intestines. The ginger extract inhibits the absorption of dietary fat by the intestine. [20]

7.2.7. Enzymatic treatment of obesity: Eating a whole fresh pineapple (Ananas comosus, A. sativus) per day can decrease the body weight by 100 pounds on a pineapple regimen. Its content of bromelain enzyme helps to digest both proteins and fats. [21]

7.2.8. Laxatives

7.2.8.1. Bulk producers: Many herbs and natural products are significant in the treatment of obesity through bulk-producing activity that produce a sense of fullness, thereby reducing appetite. Fibers act through slowing the movement of food and acidic fluid from the stomach to the intestines. They may help people with duodenal ulcers by reducing the exposure of the small intestine to stomach acids. Dietary fibers lower cholesterol, reduce elevated blood levels of triglycerides, and protect against cancer and digestive disorders. National cancer Institute recommends incorporating 30 g of fibers into the daily diet. The bulk producers include natural polysaccharides or celluloses, in addition to semisynthetic polysaccharides (methylcellulose and carboxymethylcellulose) and synthetic resin polycarbophil. The bran layers of grains are the most important source of fibers. Bran contains more than 40% dietary fibers and is a convenient source of intestinal bulk. Mucilages in plant seeds have been shown to decrease glucose and insulin levels during post-meal and fasting periods in healthy and diabetic persons. When taken before meal they have also been shown to decrease weight and hunger in obese persons. It was also

reported that mucilage contents of bran such as oat bran are effective cholesterol lowering agents. A diet with 5% oat bran showed reduction in total cholesterol and LDL levels of 19% and 29%, respectively.

Pectin consists mainly of partially methoxylated galactouronic acids. It is found in a number of fruits and vegetables (e.g. apples, white inner layer of citrus rind, carrots, cabbage and okra). It slows down food digestion, helps the body to get rid of toxic metals, and reduces cholesterol levels by reducing the plasma LDL fraction. Psyllium is a good source of soluble and insoluble fibers and can be indicated in the treatment of obesity because it absorbs water in the stomach creating a feeling of fullness and decreases appetite. It is also beneficial in diabetes and for lowering the cholesterol level. Other examples of bulk producers are Laminaria spp. (mucilage algin, polysaccharides laminarin), chitosans, Fucus vesiculosis (mucilage algin and fucin, cellulose), agar agar from Gelidium and Petrocladi spp. (polysaccharides agarose and agaropectin).

7.2.8.2. Stimulant laxative (anthraquinones): Some herbal preparations used in obesity include anthraquinones containing plants such as senna (Cassia species), cascara (Rhamnus species), rhubarb (Rheum palmatum), and aloe (Aloe vera, A. ferox). The laxative effect of anthraquinones leads to rapid excretion of foods and water loss which can aid in weight reduction. [22]

7.2.9. Non calorie sweeteners: Sucrose substituents (e.g. saccharin, aspartame, sorbitol) may allow significant calorie reduction in certain patients. Glycyrrhizin is a non caloric triterpene of liquorice root (50–100 times sweeter than sucrose). Stevioside (Stevia rebaudiana) is 300 times sweeter than sucrose. There are a number of additional low calorie sweeteners waiting for approval for use in foods and beverages as neohesperidin dihydrochalcone derived from bioflavonoids of citrus fruits. Currently neohesperidin-DHC synthesized from Seville oranges has been found to have great potential in food applications. Naringin isolated from grapefruit (Citrus paradisi) is converted to naringin dihydrochalcone which is 1000 times sweeter than sucrose and is used to reduce body weight. [23]

7.2.10. Marine natural products: Iodine is the most important active component in Fucus vesiculosus, also it contains polyphenols, polysaccharides, sterols, and other minerals. Iodine is known to play an important role in the treatment of obesity. Iodine was believed to stimulate the thyroid gland, causing weight-loss.

The brown seaweed Undaria pinnatifida contains fucoxanthin and fucoxanthinol. It was found that fucoxanthin significantly reduced plasma and hepatic triglyceride concentrations and the activities of adipocytic fatty acid synthesis, hepatic fatty acid and triglyceride synthesis, and cholesterolregulating enzymes, and significantly increased the concentrations of plasma high-density lipoprotein-cholesterol, fecal triglyceride and cholesterol, as well as fatty acid oxidation

enzyme activity, indicating that fucoxanthin ameliorated the plasma and hepatic lipid profile, fecal lipids and body fat mass, hepatic cholesterol metabolism, fatty acid synthesis, and lipid absorption. In addition,

fucoxanthin and fucoxanthinol inhibited both lymphatic triglyceride absorption and the increase of triglyceride concentration in systemic blood, likely due to their inhibitory effects on lipase activity in the gastrointestinal lumen.

Astaxanthin, a xanthophyll carotenoid, isolated the marine algae Haematococcus pluvialis, Chlorella zofingiensis, and Chlorococcum sp. was found to inhibit the increases in body weight and weight of the adipose tissue, whereas reduce liver weight, liver triglyceride, plasma triglyceride, and total cholesterol.

Krill oil is extracted from Antarctic krill, Euphausia superba, a zooplankton crustacean rich in phospholipids carrying long-chain omega-3 PUFAs, mainly EPA and DHA. Additionally, Krill oil also contains various potent antioxidants, including vitamins A and E and astaxanthin. It has been reported that krill oil could reduce the level of glucose, total cholesterol, triglycerides, LDL and HDL, and could increase plasma eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), with no indication of adverse effects on safety parameters. [24]

Traditional Medicine and Obesity

Ayurveda (Ayur = life, Veda = knowledge), which is “Science of Life”, originated from the Vedic times and is a part of holistic health care system. The chief source of ancient Indian Aryan culture and medicine are the four Vedas that are traditionally believed to be revealed to the sages by Brahma (the creator) some 6000 years before Christian era. Ayurveda’s primary emphasis is on preservation and promotion of health, it also provides treatment for disease. Many undesirable constitutions (about eight) in the body are mentioned in “Charaka Samhita”, an authentic source of ayurveda. Obesity or “Medoroga” is one among them. It is said that it is comparatively easy to help an underweight person, rather than an overweight person. The overweight problem can be due to an actual increase in the fat component (Meda Dhatu), or it can be due to malfunctioning. These, accordingly, will need different approaches. In very few cases it can be an off-shoot of other metabolic disorders. We have reviewed the available ayurvedic/traditional texts books for searching plants which are indicated for obesity. The detailed list of plants has been depicted in **Table 1**

Table 1. List of herbs indicated for obesity in ayurveda text books

Botanical name	Sanskrit/official name	Part(s) used
Acacia arabica	Babbula	Gum, bark, leaf, fruit-pods
Acacia catechu	Khadira	bark, heartwood, flower
Achyranthus aspera	Apamarga	Root, seed, leaf, whole plant
Aconitum heterophyllum	Ativisha	Root, rhizome
Acorus calamus	Vacha	Rhizome
Adathoda vasica	Vasa	Leaf, root, flower
Aloe vera	Kumari	Leaf, root
Alstonia scholaris	Saptaparna	Bark, latex, flower
Ananas comosus	Ananas	Fruit
Anthocephalus chinensis	Kadamba	Bark, leaf, fruit, root
Azadirachta indica	Nimba	All parts
Berberis aristata	Daruharidra	Root, stem, fruit
Betula utilis	Burja	Bark, nodes
Calatropis gigantea	Arka	Root, bark, flower, leaf, latex, seed
Calicarpa macrophylla	Priyangu	Flower, leaf
Capsicum annuum	Kutavira	Fruit
Cassia tora	Chakramardha	Seed, leaf, root
Cedrus deodara	Devadaru	Heartwood oil
Cinnamomum zeylanicum	Twak	Bark, leaf, oil
Cissampelos pareira	Patha	Root, stem
Clerodendrum phlomidis	Agnimantha	Root, bark, leaf
Cocus nucifera	Narikela	Fruit, flower, oil, root
Commiphora Mukul	Guggulu	Gum-resin
Coriandum sativum	Dhanyaka	Whole plant, leaf, fruit
Costus speciosus	Kebuka	Rhizome
Cuminum cyminium	Jeeraka	Seed
Curcuma longa	Haridra	Rhizome

Desmostachya bipinnata	Kusa	Root
Dolichos biflorus	Kulatta	Seed
Embelia ribes	Vidanga	Fruit
Emblica officinalis	Amalaki	Fruit
Euphobia nerifolia	Snuhi	Latex, stem, leaf, root
Ferula nortex	Hingu	Oleo-gum resin
Ficus Glomerata	Udumbara	Bark, fruit, latex
Ficus lacor	Plaksha	Bark
Ficus religiosa	Ashwattha	Bark, fruit, leaf
Ficus rumphii	Asmanthaka	Stem, bark, latex, fruit
Garcinia indica	Vrikshamla	Fruit, root, bark, oil
Gymnema sylvestre	Meshashringi	Leaf, root, seed
Holarrhena antidysentrica	Kutaja	Seed, bark
Innula racemosa	Pushkaramula	Root
Marsdenia tenacissima	Murva	Root
Momordica charantia	Karavellaka	Fruit, whole plant, leaf, root
Moringa oleifera	Sigru	Root, bark, seed
Ougenia dalbergioides	Tinisa	Heart wood
Picrorhiza kurroa	Katuka	Root
Piper chaba	Chavya	Root, fruit
Piper longum	Pippali	Fruit, root
Piper nigrum	Maricha	Fruit
Plumbago zeylanica	Chitraka	Root, bark
Pongamia pinnata	Karanja	Fruit, seed, oil, root
Pterocarpus marsupeum	Bijaka	Heart wood
Randia dumetorum	Madanaphala	Fruit
Santalum album	Candana	Heartwood
Saussurea lappa	Kushta	Root
Sphaeranthus indicus	Munditaka	Whole plant
Stereosprmum sauvealens	Patala	Root, bark, flower, seed, leaf
Symplocos racemosa	Lodhra	Bark

Terminalia arjuna	Arjuna	Bark, root, leaf
Terminalia bellerica	Bibhitaka	fruit
Terminalia chebula	Haritaki	fruit
Terminalia tomentosa	Asana	Bark, heartwood
Thea sinensis	Oolong tea	Leaf
Tinospora cordifolia	Guduchi	Stem, root
Trachyspermum ammi	Yavani	Fruit
Tragia involucrata	Yavasa	Whole plant
Tribulus terrestris	Gokshura	Fruit, root, whole plant
Trigonella foenum graceum	Methika	Seed, leaf, whole plant
Valeriana jatamansi	Tagara	Root
Zingiber officinale	Shunti	Rhizome
Ziziphus mauritiana	Badara	Root, leaf, fruit

Conclusion

Natural products with potential action in treatment of obesity act as a general body cleanser, regulate metabolism, dissolve fat in the body, help to eliminate craving of food, stimulate glandular secretions, reduce water retention, boot energy and help in constipation. However, their use should be in conjunction with regular exercise, as well as dietary and behavioral modifications. The use of multiple phytochemicals might result in synergistic and enhanced effects.

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 sub-traction 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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