

Obesity and its Treatment with Natural Product

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Abstract: A condition known as obesity is defined by an abnormal buildup of body fat. It occurs as a result of an imbalance between calories burned and calories ingested. Long-term disregard for this illness could result in serious complications such as fatty liver, cardiac problems, stroke, diabetes, and arthritis. Obesity's rising prevalence causes more deaths globally. Controlling the complications has indeed been accomplished by treatment. This review will concentrate on using natural cures to manage obesity.

Keywords: obesity

I. INTRODUCTION

Obesity is a complex disorder involving an excessive accumulation of body fat. It is usually caused by the consumption of more calories than the body can use. Simply, it may be defined as a state of imbalance between calorie intake and calorie expenditure, leading to abnormal fat accumulation. Obesity is not just a cosmetic concern. It is also a medical problem. It is not a single disorder but a heterogeneous group of conditions with multiple causes which is expressed as an obese phenotype. It is not the same as being overweight. Being overweight may be due to extra muscle, bone, or water, as well as too much fat.[1]

Obesity is a metabolic syndrome. World Health Organization [WHO] considers a "NEW WORLD SYNDROME" due to a lack of physical activity. Being overweight and obese are increasing problems that lead to significant health and social difficulties for people. It is commonly determined by measuring BMI [Body Mass Index].[2]

Types of obesity:

According to some studies, obesity is of 6 types. They are:

- **Nervous obesity:** In this type, obesity was caused by anxiety, stress, and depression.
- **Genetic obesity:** It is genetically transferred obesity. In this type, obese people have a swollen stomach like a balloon, and fat accumulated in the middle parts of the body.
- **Dietary obesity:** It is caused by leading a sedentary lifestyle and eating more calories than burned.
- **Obesity due to poor regulation:** This type of obesity is due to continuously feeling unsatisfied eating.
- **Endocrine obesity:** In this type, obesity was caused by an imbalance of thyroid hormones.
- **Thermogenic Obesity:** In this type, the body does not reach the temperature required for burning calories.

Etiology

The following causes are responsible for getting obesity.

- Obesogenic environmental factor (sedentary lifestyle).[3][4][5][6]
- Medications (anti-seizures, anti-depressants, anti-psychotics, steroids, and beta-blockers).
- Psychological factors.
- Hormones (leptin, insulin, sex hormones, growth hormones, thyroid hormones).[7][8][9]
- Bacteria (Gut microbiome, Bacteroidetes, Firmicutes).[10][11]
- Genetics (body weight, body fat, and other obesity-related traits are linked to 15 chromosomal loci that lead to Prader-Willi Syndrome & Cushing Syndrome).[12]

Epidermiology

- Obesity is defined as an increasing body mass index greater than 30 or 30.[13]
- Obesity prevalence can increase the day by day in developing countries.
- In the 1970s obesity is a rare condition but in nowadays obesity is a common disease.
- In the 21st century; obesity or overweight is an endemic condition.
- Overweight or obesity in children and adolescents is 95% of a specified population.[14]
- Worldwide obesity has nearly tripled since 1975.
- In 1975, 20.2% of individuals were obese or overweight.
- In the 1980s, 4.8% of men and 7.9% of women increase their obesity yearly.
- According to the United States, obesity increased by 12% in 1990.
- In 1997, the World Health Organization formally recognized obesity as a global epidemic condition.
- In 2003-2004, 32.9% of adults 20-75 years old were obese and more than 17% of teenagers are noted as obese patients.[15]
- In 2016, more than 1.9 billion adults 18 years older were overweight or obese.
- 39 billion children under 5 years were overweight in 2020.
- The overall worldwide prevalence of obesity nearly tripled between 1975 and 2016.
- The prevalence of obesity doubled between 1980 and 2014.
- As of 2008, WHO estimates that at least 500 million adults are obese with higher rates among women than men.[16]
- In 2014, more than 600 million adults were obese.
- In 2013 has estimated 2.1 billion adults were overweight as compared with 857 million in 1980.[17]
- Obesity has reached epidemic proportions in India in the 21st century.[18]
- In India, the obesity rate is increased in urban areas than in rural areas.[19]
- Obesity rates have increased in all ages and both sexes irrespective of geographical locality, ethnicity, or socioeconomic status, although the prevalence of obesity is generally greater in older persons and women.[19]
- In the United States, obesity among adults and overweight among children and adolescents has increased markedly since 1980.[20]
- A complex, multifactorial disease, with genetic, behavioral, socioeconomic, and environmental origins, obesity raises the risk of debilitating morbidity and mortality.[21][22]

Risk factor

- Hereditary (inheritance of eating habits)
- Unhealthy diet (junk food)
- Sedentary lifestyle [23][24][25]
- Sudden stoppage of smoking[26]
- Drugs used in pregnancy and insomnia condition[27]
- Arthritis[28][29]
- Gender (more women are obese than men in developing countries & more men are obese than in developed countries).[30]

Factor affecting obesity:

- **Genetic factors:** Obesity tends to continue in families not only through sharing of genes, but family members also share eating habits and activities.
- **Energy imbalance:** An imbalance between the consumption of high calories daily without the expenditure of that calories.
- **Sedentary lifestyle:** It is known that around 31% of people over 15 years lead a sedentary lifestyle.[31]

Complications:

Obesity can cause severe complications to the body.[32]

- Diabetes Mellitus, Hypertension, Dyslipidemia, Heart disease, Coronary artery disease, Heart failure, Atrial fibrillation, Cerebrovascular disease, Obstructive sleep apnoea, asthma, Gastroesophageal reflux, Hepatobiliary disease, Fatty liver, Osteoarthritis, certain types of cancers, Psychosocial problems, Gynecological and obstetric complications, chronic kidney disease.[33]
- Inflammation, Gut microbiome, stroke, neurological disease, dysregulated immune system, Infertility, and Musculoskeletal problems.[34]

Pathogenesis:

The generation of adipose tissue, known as adipogenesis, is the primary source of obesity. Adipose tissue is one of the most sophisticated organs in the human body. Pre-adipocytes undergo a process of cell differentiation to become adipocytes. Several transcription factors control the differentiation of adipocytes. It consists of the melanocortin-4 receptor gene, the beta-3-adrenergic receptor gene, the peroxisome-proliferator-activated receptor gamma 2 gene, chromosome 10p, and additional genetic polymorphisms. Peroxisome proliferator-activated receptor (PPAR)-mediated activation of adipocyte-specific genes and CCAAT/enhancer binding protein (C/EBP-1) is demonstrated.[35][36]

They have a significant role in the growth arrest necessary for adipocyte differentiation. Triglyceride molecules are digested by lipoprotein lipase (LPL). In adipose tissue, it is plentiful. Since LPL mRNA production is frequently seen as an early indicator of adipocyte development, it is essential for regulating lipid synthesis. Blood glucose levels are regulated, and fatty acid oxidation is promoted by a protein hormone called adiponectin, which is produced by adipose tissue. The etiology of obesity necessitates the resetting of body weight and a persistent positive energy balance (energy intake > energy expenditure).[37]

These days consumption of calories will is higher than what the body needs. The calories that are not used by the body are stored as fat. This causes fat cells to grow, which in turn causes an increase in the number of fat cells. Even if a person regulated their food intake after their number of fat cells increased, the size of their adipose cells may have decreased, but their total number of fat cells did not change. Lack of self-control or lack of willpower may be the cause of eating a high-calorie diet or eating a lot of food. One can simply get rid of this illness by making small modifications to their lifestyle.[38]

The basic issue with obesity is eating habits, which have significantly changed in recent decades. Examples include irregular mealtime, bad timing, wrong proportions between different product groups, or excessive consumption of certain items, particularly fats and monosaccharides. In 1961, the average person consumed 2,300 calories per day. It climbed to 2,800 in 1998 and surpassed 3,000 in 2015. Additionally, because food is so inexpensive, there is a greater overall supply of it. Consumption of fruits and vegetables is also down in the same period. Only 30% of boys and 37% of girls (aged 13 to 15) consume fruit every day, according to the WHO European Office.

Treatment:

To reduce obesity, one should cut back on calories and adopt healthy eating practices (Eat less, Work more). Exercise may result in lipolysis, which releases free fatty acids from triglycerides stored in fat for later usage by muscle as an energy source.[39]

A moderate and steady weight loss over time is seen to be the safest approach to losing weight and the greatest way to keep it off permanently, even though may initially drop weight quickly. The subjects who had engaged in the daily exercise had successfully lost weight over the long term, as seen in multiple research projects.[40][41]

Natural products for the treatment of obesity

To solve this issue, numerous anti-obesity drugs have been tried. The depressing history of anti-obesity drugs points to their unreliability and the necessity for other methods. Currently offered anti-obesity drugs are pharmacological therapies that can lower or manage weight by changing appetite, metabolism, or calorie intake. They are not only challenging to create, but they also have negative side effects.

Furthermore, restricting the intake of sugar and fatty foods and increasing physical exercise are the cornerstones of treatment interventions for the condition of obesity. However, due to their bioactive components, plant-based meals have garnered significant attention in recent years as a unique preventative and potential therapeutic approach for the treatment of numerous disorders, particularly obesity. Along with calorie restriction and exercise, management through meals can be accomplished by discovering active ingredients that could modify molecular pathways and gene/protein expressions in a good way.

Various crops include active or functional components that may have anti-obesity benefits and lower the chance of becoming obese. In order to reduce the oxidative inflammatory condition linked to weight gain to be utilized for the treatment of numerous ailments brought on by obesity, antioxidants such as polyphenols, flavonoids, and quercetin are believed to work as protective agents. This paper's objective is to investigate new research on plant-derived active ingredients and how it affects the control of obesity.[42][43]

Flavonoids:

The most abundant phenolic substances found in plants, fruits, seeds, and vegetables are flavonoids, which are also known as polyphenols. Flavonoids are the most frequently found coupled to sugars (glycosides) or aglycones and have the same fundamental structure as Di phenylpropanes (C6-C3-C6). Flavonoids are divided into 13 categories that include more than 5,000 different chemicals. Flavones, flavanols, and their glycosides are the most prevalent flavonoids. The anti-obesity benefits of flavonoids such as rutin, quercetin, kaempferol, myricetin, hesperidin, naringenin, naringin, green tea catechins (catechin, epigallocatechin gallate, and epicatechin gallate), theaflavins, cyanidins, and isoflavones have been the subject of several research (genistein, daidzein, and glycitin).[44][45]

Quercetin:

The most frequent flavonoid, quercetin, serves as the building block for numerous other flavonoids, including rutin (glycosylated quercetin), hesperidin, and naringenin. Numerous foods consumed by people contain quercetin, including red onions, grapes, apples, berries, cherries, broccoli, citrus fruits, and tea (*Camellia Sinensis*), with capers and lovage having the highest quantities (180 mg per 100g). Depending on dietary patterns, the typical daily intake of quercetin for human's ranges from 10 to 100 mg. [46] As demonstrated in animal models and, to some extent, in people, quercetin has a wide range of biological actions, including lowering blood pressure [47][48], reducing body weight [47], and ameliorating disorders connected to hyperglycemia [49][50]. By lowering the potential of the mitochondrial membrane, inhibiting peroxisome proliferator-activated receptors (PPARs) and Bcl-2, and activating caspase 3, Bax, and Bak, quercetin causes preadipocytes to undergo apoptosis.[51]

Active components for plant sources with anti-obesity activity

Mulberry leaf:

The scientific names of red mulberry and white mulberry are *Morus rubra* and *Morus alba* respectively. This belongs to the Moraceae family. These are grown in Asian nations. Numerous phytochemical components, including flavonoids and polyphenolic chemicals, are present in these leaves. HPLC is used to extract Mulberry Leaf Extract (MLE) and Mulberry Leaf Poly Extract (MLPE). The mulberry-water extract has demonstrated some biological effects, such as antiobesity, antidiabetic, anti-inflammatory, and antioxidant properties. In comparison to other solvents, ethanol works best to extract the phenolic component from mulberry leaves. Mulberry leaves contain polyphenol, quercetin, caffeic acid, hydroxy Flavin, and hesperidin, which are all active substances. These substances work by inhibiting the expression of the target genes adipocyte-specific fatty acid binding protein and fatty acid synthase, as well as PPAR proteins and sterol regulatory element binding proteins-1c.[52][42]

Pepper:

The scientific name of pepper is *Capsicum annum L.* The main agricultural by-product and waste product created during the manufacturing of pepper paste or powder is pepper seeds. Due to its possible antioxidant, antifungal, and antiadipogenic properties, pepper seed has attracted a lot of attention as a useful resource. Additionally, pepper seeds include beneficial bioactive substances such as tocopherols, sterols, triterpenes, and organic acids. Pepper's active

ingredient is Capsicoside G, a furostanol saponin. Adenosine monophosphate-activated protein is activated in order to decrease adipogenesis.[53][42]

Cocoa:

The scientific name of cocoa is *Theobroma cacao*. Polyphenols from cocoa have been shown to be effective in preventing visceral fat accumulation. Additionally, flavonols, the primary class of polyphenols, have been proposed to have anti-obesity properties. By utilizing column chromatography, high-performance liquid chromatography, and 80% ethanol, the polyphenolic components in the cocoa powder were extracted. Cocoa polyphenols are the cocoa bean's active ingredient (CPs). The device is to control obesity-induced steatosis indicators, genes in lipid catabolism, particularly in fatty acid oxidation, were up-regulated, whereas genes in lipid synthesis pathways were down-regulated.[54][42]

Barley:

The scientific name of barley is *Hordeum vulgare L.* Hull less barley is also known as naked barley, is separated from the husk, and hulled barley, also known as covered barley. Ferulic acid, along with coumaric acid are the active ingredients in barley. The mechanism is dysregulated lipid profiles, inhibited adipocyte development, and prevention of body weight increase.[55][42]

Citrus lemon:

The scientific name of lemon is *Citrus limon L.* It belongs to the Rutaceae family. It has been reported that dietary lemon polyphenols extracted from the lemon peel (0.5% w/w) on high-fat diet-induced obesity in C57BL/6j mice for 12 weeks suppressed body weight gain (44%) and body fat accumulation (36%). Citrus limon contains many important phytochemicals, including phenolic compounds (primary flavonoids). Up-regulation of acyl-CoA oxidase mRNA levels in the liver and white adipose tissues, which was likely mediated by up-regulation of the mRNA levels of peroxisome proliferator-activated receptor (PPAR), is one anti-obesity mechanism identified for lemon.[42]

Black soyabeans:

The scientific name of black soybean is *Glycine max L.* These are only a dark-colored kind of soybean that contains several phytochemicals. These black soybean compounds may be beneficial to human health. Black soyabeans-decrease hunger, heighten feelings of fullness, and result in fewer calories consumed overall. Black soybean seed coat extract, a dietary item rich in polyphenols, contains 39.8% procyanidins, 6.2% catechins, and 9.2% cyanidin-3-glycoside. The anti-obesity benefits of black soybean seed coating can counteract the negative effects of a high-fat diet on body weight, adipose tissue weight, and serum lipid content. These include phytochemicals such as isoflavones, saponins, and anthocyanins. It has been widely employed in oriental medicine for centuries. One of the most common natural plant pigments, anthocyanins come in a wide spectrum of hues, from orange and red to purple and blue shades.[56][42]

Red chili pepper:

The scientific name of red chili is *Capsicum annuum*. The hot ingredient in red chili peppers known as capsaicin has been shown to enhance energy expenditure in part via activating the sympathetic nerve-adrenergic receptors in humans. Chronic use of capsaicin has been shown to prevent diet-induced obesity, and it has been hypothesized that UCP1(uncoupling protein 1) plays a role in this action. Capsaicin can treat human obesity, however, it is challenging to utilize because of its extreme pungency. Capsinoids, which are less potent counterparts of capsaicin derived from CH-19 sweet peppers, include capsiate, dihydrocapsiate, and nordihydrocapsiate. The mechanism is suppressing diet-induced obesity through an uncoupling protein 1-dependent mechanism.[57][42]

Garlic:

The scientific name of garlic is *Allium sativum L.* According to studies, dried garlic's main constituents are fructose-containing carbohydrates, followed by sulfur-containing compounds, protein, fiber, and free amino acids. Garlic is a

species of the onion genus and has been used as both a flavoring agent and complementary medicine. The organosulfur chemicals oversee both garlic's favorable health effects and distinctive odor. The active ingredient in garlic is S-allyl-1-cysteine sulphoxide and S-allyl-cysteine. In high fat diet, decreased relative masses of liver and fat tissues, serum triacyl glyceride levels, hepatic oxidative stress, and increased fecal lipid contents were associated with upregulation of Sirtuin 1, adenosine monophosphate-activated protein kinase, adipose triacyl glyceride lipase, hormone-sensitive lipase, Acyl-CoA oxidase, palmitoyl transferase 1 were downregulated.[58][42]

Saffron:

The active ingredient is Crocin. It can able to reduce the plasma levels of triacylglycerol and total cholesterol.[59][42]

Oiltea Camellia:

The active ingredient of camellia is polyphenols. The metabolic effects appear to be partially mediated by inhibiting fatty acid synthase activity and suppressing adipogenesis in adipocytes. These effects include suppressed increases in body weight and fat storage, decreased serum levels of total cholesterol and triacylglycerols, and activity of fatty acid synthase in the animal liver was significantly lower in the inhibited adipogenesis.[60][42]

Strawberry & Raspberry:

The active ingredient is salidroside. It inhibits inflammation and triglyceride accumulation brought on by obesity in the liver and the muscles while promoting adiponectin signaling, fatty acid oxidation in the liver and skeletal muscle, and liver PPARs.[61][42]

Coffee:

The active ingredients in polyphenols. It acts by downregulating sterol regulatory element binding protein, acetyl-CoA carboxylase-1 and -2, stearoyl-CoA desaturase-1, and pyruvate dehydrogenase kinase-4 in the liver, suppressed postprandial hyperglycemia and hyperlipidemia prevented lipogenesis.[62][42]

Bilberry:

The active ingredient in bilberry is anthocyanidins. It acts by lowering PPARs, sterol regulatory element-binding protein-1c, and tyrosine residues of insulin receptor substrate-1 phosphorylation, which all served to inhibit adipocyte development.[63][42]

II. CONCLUSION

Obesity is a condition that is rapidly becoming more prevalent in the modern world, and it causes numerous health complications and death in some instances, though usage of medications will cure the conditions to an extent, the side effects that arise from these are not be overlooked so, utilizing natural products will be giving us a chance to avoid the forthcoming adverse effects that occur due to this disease and sometimes they may also show greater action when compared to the allopathic drugs.

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