

Dietary Supplements, Medicinal Plants and Beverages in Treating Obesity: A Mini Review of Clinical Evidence

Sultana F¹, Hossain MS², Amin MR¹, Abdullah-Al-Masum M^{1,3}, Rubel TH⁴, Faruque MO⁴, Islam MM⁵, Torab MA¹, Hossain MS¹ and Kabir A^{1*}

¹Department of Pharmacy, Atish Dipankar University of Science and Technology, Dhaka, Bangladesh

²Department of Applied Chemistry and Chemical Engineering, Noakhali Science and Technology University, Bangladesh

³Department of Pharmacy, University of Asia Pacific, Dhaka, Bangladesh

⁴Department of Pharmaceutical Sciences, North South University, Dhaka, Bangladesh

⁵Department of Pharmacy, Noakhali Science and Technology University, Bangladesh

***Corresponding author:** Asma Kabir, Assistant Professor, Department of Pharmacy, Atish Dipankar University of Science and Technology, Dhaka, Bangladesh, Tel: +8801970-454876; Email: asmakabir2129@gmail.com

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Abstract

Once considered a problem of developed countries, obesity and obesity-related complications are rapidly spreading around the globe. Increased body mass index and obesity are strongly associated with metabolic dysfunction. The purpose of this study was to review and explain the role of different dietary supplements, medicinal plants, and beverages in reducing obesity. The drug used in treating obesity has so many adverse effects, including drug abuse and drug resistance. This evidence based review article suggested that several dietary supplements including Chitosan, Prolibra, Phosphorus supplementation, Vitamin D3 supplementation and beverages like Yerba Mate, Green coffee bean extract, Green tea extract may be more effective for treating obese individuals.

Keywords: Dietary Supplements; Medicinal Plants; Herbal Formulations; Obesity

Introduction

Excess accumulation of adipose tissue is known as obesity [1]. Normally obesity may be defined as a state of positive energy balance leading to increase in adipose tissue mass. Increased adipose tissue mass is closely related to the changes in the size or number of adipocytes and these cells are good sources of energy consisting of

80% lipid and 20% of water and protein [2,3]. In recent times, obesity is the most frequently encountered metabolic disease all over the world and its incidence is rising rapidly [4,5]. Unfortunately, obesity is rapidly becoming pandemic in the high-income countries as well as in many low-income nations. Overweight and obese individuals are at an increased risk of developing various chronic disorders [6].

Obesity is alarming health issue nowadays and it shows the link between cardiovascular and cerebrovascular diseases [7]. It is recently recommended that overweight is a common condition in Western nations [8]. The frequency of obesity is highest in the USA, Europe and lowest in East Asia and sub-Saharan Africa [9]. Actually obesity is such a condition in which energy intake exceeds energy expenditure [10]. It is a complex disease caused by various factors including genetic, diet, lifestyle and environmental factors [11]. The danger of obesity is very fearful throughout the world because it occurs in people of almost all aged, even in children and adolescents [12,13]. It has been considered as one of the serious global health problems which have close association with various types of diseases including cardiovascular disease, type 2 diabetes, hypertension, dyslipidemia, liver disease and also several types of cancer [14-18]. Recent data indicates that some forms of obesity are commonly associated with chronic low-grade inflammation, also [19]. Obesity treating drugs can be divided into five categories: central appetite suppressants, digestion and absorption blockers, metabolic promoters, obese gene inhibitors, and other drugs for the treatment of obesity [20]. However, the drug used in treating obesity has so many adverse effects, including effecting monoamine neurotransmitters, and also causes drug resistance [21]. Healthy lifestyle and diet can be considered as one of the treatment of obesity and overweight but the pathways is very complex as there is environmental, biological and behavioral factor included [22]. In this mini review, we tried to mention the role of several Dietary supplements, medicinal plants and herbal formulations in treating obesity.

The Risk of Obesity

Obesity causes so many medical disorders among them gastrointestinal disorder more profound and is alarming severe factor for esophagus reflux [23]. Moreover obesity becomes a risk factor for severe heart diseases including hypertension, coronary heart disease, atherosclerosis and many other diseases such as diabetes, insulin resistance, and sleep apnea syndrome [24]. The diagnosis of obesity and atherosclerosis are similar, here inflammation is strongly related to the cardiac problem where lipids, LDL (Low-density lipoprotein) and free fatty acids stimulates the inflammation process. Release of adipocytokines from adipose tissue (found in obese body) trigger insulin resistance, endothelial dysfunction, hypercoagulability, and systemic inflammation which causes atherosclerosis [25]. A few studies have developed a link between insulin resistance and visceral obesity [26]. Hence, obesity has a complex relationship with diabetes mellitus (DM), especially with type 2 diabetes mellitus (T2DM). Obesity

may be a precursor or risk factor for T2DM, following insulin resistance [27]. Nowadays, T2DM in children and adolescents is a public health problem worldwide [28].

Furthermore, the prevalence of obesity among children, adolescents and adults has been increasing during the last decades. The World Health Organization calculates that there are more than 1.6 billion overweight adults in the world and approximately 400 million of these are obese. Thus, obesity has been recognized as one of the major health hazard and this health problem is linked to several types of cancer [29]. For example, the risk of developing breast cancer is increased in obese postmenopausal women [30]. Lorincz et al. [30] have proposed some hypotheses in 2006 to describe the association of postmenopausal breast cancer with obesity. Prostate cancer (PC) which is the most common cancer in elderly male populations of western countries, also related to obesity. Several recent studies report positive associations between adiposity and prostate cancer risk [31]. Besides, the incidence rate of colon cancer which is the third most available cancer in the world is approximately 10-fold higher in high-income than in low-income nations [32]. A possible relation between excess body weight and colon cancer risk has been examined by experts in many epidemiological and cohort studies which have documented that obesity is closely related with a higher risk of colon cancer [33,34]. Liver cancer is another common cancer in the world. Its incidence is increasing day by day [35,36]. Obesity has been established by numerous clinical studies as a significant risk factor for liver cancer [37].

Moreover, a recent findings identifies eight additional cancer sites linked to overweight and obesity such as cancers of endometrial, esophageal, thyroid, mammary gland, pancreas, skin, ovaries, and pituitary gland [38,39]. According to few cohort and case-control studies, obesity increases the risk of endometrial and esophageal cancer. In fact, the development of endometrial cancer risk is about 2-3 fold higher in obese women than in slim women [39]. Obesity and obesity-related disorders constitute a serious threat to the health of all populations on earth. Obese patient have the risk of death higher than any disease occurs. Recently Swedish obese subjects study found a result that 29% death can be reduced if obesity is being controlled after 10.9 years [40]. The severe effect of obesity is, it decreases the life span 4-7 years approximately [41]. Therefore, so many signified attributions have found in various studies and report that obesity becomes one of the most overwhelming problems nowadays.

Dietary Supplements in Reducing Obesity

The growing obesity epidemic is a worldwide concern with over 3 million adults dying each year from obesity related complications [42]. Strategies to lose body fat typically involve a combination of dietary changes limiting caloric intake, increased physical activity, behavioral therapy, pharmacotherapy, and, in extreme cases, surgery [43]. Many believe that use of natural dietary supplements could aid in the struggle against obesity. The availability and popularity of natural dietary supplements intended to help with weight loss has risen dramatically in recent years [43]. One of the most efficient and safe method would be a reduction in fat intake, as obesity is directly associated with total fat consumption. Dietary sources and appropriate lifestyle changes or exercises reduce the risk of obesity to a greater extent [44].

Few dietary supplements are described here:

Chitosan: Is a popular dietary fiber often used to prevent dietary fat absorption as a means for controlling weight. It is derived from the cuticles of crustaceans such as shrimp, crab, and lobster or from the cell wall of mushroom [45]. Due to its cationic nature, chitosan binds to negatively charged lipids, hence reducing their gastrointestinal uptake and also potentially lowering serum cholesterol. There are number of reports, which demonstrate that chitosan binds dietary lipids and bile acids in in-vitro, pre-clinical and human studies [46]. The effects of chitosan as a treatment for overweight and obesity has been evaluated in many clinical trials of great variability [47]. One recent study demonstrates that administration of chitosan (KiOnutrime-CsG® capsules, 500 mg, 5 capsules/day in three divided doses) results in a significant mean weight loss of about 3 kg without diet restriction over a period of 90 days [48]. So Chitosan is a dietary fibre which acts by reducing fat absorption and thus used as a means for controlling weight.

Dietary Formula Containing *Phaseolus Vulgaris* Extract: As the major ingredient produced significant decreases in body fat while essentially maintaining lean body mass. *Phaseolus vulgaris* extract appears to be a safe and effective aid to consider in weight loss/maintenance programs [49]. One research indicates that a dietary formula containing 445 mg *Phaseolus vulgaris* extract taken daily by overweight human subjects is more effective at reducing body weight and body fat mass than placebo [49].

Dietary Supplementation with Salmon Protein Hydrolysate (SPH): It may activate different metabolic pathways to increase fat burn. SPH lowers BMI (Body Mass

Index) via interaction with the metabolic pathways [50]. One recent study shows that a daily dietary intake of 16 g of salmon protein hydrolysate powder for 42 days statistically significantly reduced Body Mass Index by 5.6% in overweight subjects; in comparison with a placebo-control of whey protein isolate [50]. Hence, Salmon protein hydrolysate powder in supplemental doses may be a useful tool in the long-term management of obesity.

Prolibra: A dairy-derived ingredient containing whey proteins, peptides and milk minerals. Whey proteins modulate several hormones that influence body composition. Supplementation with Prolibra during dieting increased the loss of body fat and the retention of lean muscle mass compared to supplementation with an isocaloric control that had a lower calcium and lower protein content [51]. According to a study, individuals taking Prolibra loss significantly more body fat (6.1% of their body fat mass) and showed a greater preservation of lean muscle compared to subjects consuming the control beverage [51].

Vitamin D₃ Supplementation: Serum 25-hydroxyvitamin D concentrations are low in obese adults and linked to components of body composition, particularly body fat mass [52]. Alterations in the vitamin D endocrine system have been reported in obesity [52]. Recent literature reveals that vitamin D receptor (VDR) gene polymorphisms are associated with adiposity phenotypes. It has been postulated that both 1,25 (OH)₂D and VDR have imperative roles in adipocyte differentiation [52]. A current study shows that a 12 week supplementation with 25 µg vitamin D₃ in overweight and obese women with mean serum 25(OH)D concentrations of 41.8±31.4 nmol/L decreases body fat mass [52].

Phosphorus Supplementation: Low phosphorus status has been positively associated with increased body weight [53,54]. This may be attributed to the impact of hepatic adenosine triphosphate (ATP), which depends on adequate dietary supply of phosphorus, on suppressing food intake [55]. This mechanism is supported by an inverse relation between body weight and hepatic ATP status. Actually, High protein diets were constantly found to induce weight loss, probably because of their capacity to decrease energy intake and increase energy expenditure [56,57]. One study found that the ingestion of 375 mg phosphorus with each main meal, over a period of 12 weeks, was able to prevent weight gain and to reduce waist circumference among overweight and obese adults. These findings support a promising role of the mineral phosphorus in the prevention and management of obesity,

especially abdominal adiposity [58]. Hence, phosphorus supplementation for a certain period significantly decreases body weight, BMI, waist circumference and subjective appetite scores.

Medicinal Plants, Herbs or Beverages in Treating Obesity

Natural products primarily helping consumers to fight the battle against obesity have been widely explored. A variety of medicinal plants is expected to be potential ingredients for the development of anti-obesity products. Numerous anti-obesity interventions have been studied including lifestyle modification, behavioral therapy, pharmacological treatments, and surgery [59]. However, the limited efficacy and high incidence of adverse events with side effects observed in conventional therapies have motivated practitioners to investigate complementary and alternative medicine therapies for weight loss such as dietary supplements, herbal products, medicinal plants or beverages and acupuncture [60].

Yerba Mate: The dried leaves of the plant *Ilex paraguariensis*. Yerba Mate beverages are reported to have biological activities, probably due to their high polyphenol content. Phenolic compounds have long been known to possess biological functions. In addition to polyphenols such as flavonoids (quercetin and rutin) and phenolic acids (chlorogenic and caffeic acids) [61]. Yerba Mate extracts are especially rich in chlorogenic acids that might contribute to hypocholesterolemic and weight loss effects [62]. Chlorogenic acid inhibits adipogenesis by reducing the expression of genes regulating adipogenesis in 3T3-L1 cells [63]. In these regards, it is likely that Yerba Mate may potential alternative for controlling body fat accumulation and weight. Yerba Mate suppresses body weight gain and visceral fat accumulation and decreases serum levels of cholesterol, triglycerides, LDL cholesterol [64]. So Yerba Mate supplementation decrease body fat mass, and percent body fat. Yerba Mate does not produce significant adverse effects. All of these information suggested that as a potent anti-obesity reagent, Yerba Mate supplementation may be effective for treating obese individuals.

Green Coffee Bean Extract: coffee is one of the most commonly consumed beverages worldwide, and its health effects, are related to its high consumption [65]. Roasted coffee is a common form of coffee, and its beneficial effects can be particularly attributed to its caffeine content. However, the use of green coffee or unroasted coffee is rather uncommon [66]. Raw coffee beans are rich in chlorogenic acid (CGA) and related compounds. Similar compounds are present in green coffee and roasted coffee,

however, during the roasting process, several of its compounds are destroyed. Several studies have reported the positive effect of green coffee bean extract (GCBE) and CGA on weight management [67]. The reduction of body fat can be related to changes in adipose-derived hormones, therefore, investigating the effects of GCBE on the concentration of serum adipocytokines can confirm the anti-obesity properties of GCBE [68,69]. A study explained that GCBE combined with an energy-restricted diet affects fat accumulation and lipid metabolism and is thus an inexpensive method for weight control in obese people.

Green Tea Extract (GTE): Green tea (*Camellia sinensis*), one of the most popular beverages in Asia, has been studied extensively for its beneficial effects [70]. It is believed to have beneficial effects in prevention and treatment of many diseases, one of which is obesity. An epidemiological human study showed that consumption of tea for more than 10 years led to a lower percentage of total body fat and smaller waist circumference [71,72]. The anti-obesity effects of green tea are mainly attributed to its polyphenol content, in particular, epigallocatechin gallate (EGCG), which is most abundant in green tea and has been found to inhibit adipocyte proliferation and differentiation in in vitro studies [73]. A recent research work showed that 12 weeks of treatment with high-dose green tea extract resulted in significant weight loss, reduced waist circumference, and a consistent decrease in total cholesterol and LDL plasma levels without any side effects or adverse effects in women with central obesity [74].

Medicinal Plants, E.G., *Cissus Quadrangularis* and *Irvingia Gabonensis*: These plants are also applied as natural supplements in reducing body weight. *Cissus quadrangularis* (CQ), a succulent vine native to West Africa and Southeast Asia, has been used in traditional African and Ayurvedic medicine for more than a century. The unique chemical constituents of CQ—novel flavonoids and indanes, as well as phytosterols and keto-steroids—have shown promise as powerful and efficient antioxidants [75-77]. They also appear efficient for lipase and amylase inhibition, thereby providing a mechanism for weight loss via reduced oxidative stress, dietary fat, and carbohydrate blocking. Another potentially synergistic substance—*Irvingia gabonensis* (IG)—belongs to the *Irvingiaceae* family. The *Irvingia* tree is indigenous to West Africa. IG contains 50% fat, 26.4% total carbohydrate, 2.3% ash, 7.5% crude protein, and 14% fire [76,77]. The high soluble fibre content effects the lowering of plasma cholesterol, triglycerides, and glucose concentrations. IG seeds have shown promise as an anti-obesity agent. A 2005 randomized, double-blind, placebo-controlled study

reported significant differences between the IG treatment and placebo groups in weight and fat loss, as well as reductions in hip and waist circumference [77]. A study proved that the *Cissus quadrangularis*-only group showed significant weight reductions on all variables compared to the placebo group, the *Cissus quadrangularis/Irvingia gabonensis* combination resulted in even larger reductions. This apparently synergistic formulation should prove helpful in the management of obesity and its related complications [78].

Concluding Remarks

The incidence of obesity has significantly increased worldwide during recent decades. Besides, lifestyle changes and therapeutics that may reduce adiposity could offer the benefit of preventing obesity-related morbidity and mortality. This evidence based review article clearly shows that dietary supplementation medicinal plants, herbs or beverages may be a good option for treating overweight and obesity.

Conflicts of Interest

The Authors declare no conflict of interest.

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