Potential of Traditional Medicinal Plants for Treating Obesity: A Review

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Abstract:

Obesity is an important global health concern, and is associated with high morbidity and mortality rates. Modern methods of treatment, such as synthetic drugs and surgery, still have to be improved to show safety and efficacy. The main concerns with such treatments are the high costs and serious complications. As a result, there is great interest in the use of plant-based medicinal agents as an alternative therapy. This study aims to provide a review of the studies on accessible botanical sources for the treatment of obesity. Based on published studies, this review attempts to explain how these medicinal plants act in humans to cause weight loss, and which method of usage is safer and more efficient. Information was gathered from books, journals and electronic sources published in the period of 1991 to 2012. The medicinal plants studied can reduce weight through five basic mechanisms, including stimulating thermogenesis, lowering lipogenesis, enhancing lipolysis, suppressing appetite, and decreasing the absorption of lipids. Furthermore, consumption of reliable medicinal plant extracts in a single form and at an optimum dosage could be a safe treatment for obesity. However, based on reviews, some combinations of certain medicinal plants may result in either lower efficacy or cause unexpected side-effects.

Keywords: Complementary/Alternative Medicine, fat absorption, Medicinal plant, adipose-tissue differentiation, slimming aids, dietary supplements

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1. Introduction

Since 1997, the WHO has warned of obesity as a global epidemic, although it was not noticeable during most of the 20th century (Auld & Powell, 2009; Caballero, 2007) Statistics show that the prevalence of obesity had reached up to 400 million adults by 2005 (World Health Organization, 2006). Currently, it is reported that more than half of the adult population in OECD countries are overweight (body mass index [BMI]≥25 Kg/m^2) (Cecchini et al., 2010). According to a report by WHO, obesity is related to several health problems, including cardiovascular diseases, hypertension, diabetes mellitus, gallbladder disease, cancer, endocrine and metabolic disturbances, osteoarthritis, gout, pulmonary diseases, as well as psychological problems such as social bias, prejudice, discrimination, and eating (World Health Organization, 2000). From an economic point of view, obesity and its related health consequences involve enormous costs currently and for future health care, such as physician visits, hospitalization, and other related expenses (Colditz, 1999; Picot et al., 2009; Wolf & Colditz, 1998). Being overweight is a cosmetic problem and a major risk factor for human health (Kopelman, 2000). In short, obesity can cause a decline in life expectancy (Olshansky et al., 2005). Despite vast attempts to address this issue, "Globesity" remains an enormous challenge.

1.1. Challenges in treating obesity

Recently, there has been a proliferation of different anti-obesity products appearing on the market (Jacobs & Gundling, 2009). Despite the high cost of such products, their long-term consumption is still not recommended as they have exhibited several side effects, such as gastrointestinal and kidney problems (Jacobs & Gundling, 2009; Rucker, Padwal, Li, Curioni, & Lau, 2007). For example, among the varieties of anti-obesity drugs, only *Orlistat* and *Sibutramine* can be used long-term. In addition, such products do not satisfactorily impact weight loss or are not tolerated by the body (M. Pittler, Schmidt, & Ernst, 2005; M. H. Pittler & Ernst, 2004). However, the use of natural remedies for weight loss has increased. Scientists believe that botanical sources seem more reliable, safer, and also cheaper than current conventional methods, such as synthetic drugs (Chang, 2000) or surgical procedures (Clegg, Colquitt, Sidhu, Royle, & Walker, 2003) which may have adverse effects or be of limited duration in effectiveness (Mahan & Escott-Stump, 2008).

1.2. Natural medications

Studies show that natural food ingredients and medicinal plant preparations are able to enhance satiety, boost metabolism, and speed up weight loss (Larson, Story, & Nelson, 2009; McCrory, Hamaker, Lovejoy, & Eichelsdoerfer, 2010). Including these foods in the diet on a regular basis will therefore assist an individual to lose weight slowly. However, there is still some doubt about their application for humans (Smyth & Heron, 2006). On the other hand, despite the global market for satiety, fat burning, dietary supplements and other weight management remedies, the awareness of the usefulness of these products is neither sufficient nor clearly perceived by patient (Esmaillzadeh & Azadbakht, 2008). This study aims to provide a review of previous reports about the availability of natural medicinal agents and their potential for assisting in losing weight. This information could aid patients in their selection of the appropriate botanical product to develop a lean and healthy body.

2. Methods of Data Collection

Data were acquired from various databases, including Google Scholar, Science Direct, Pub-Med, Scopus, Web of Science, and from library books and theses. The studies ranged from 1991 until January 2012. The key search words included: *traditional medicine, medicinal herbs, plant extracts, anti-obesity, weight loss, overweight, botanical remedy, complementary therapy, natural, alternative, phytonutrients, phytochemicals, efficacy, safety, bioactive compounds, appetite, satiety, metabolism, thermogenesis, lipolysis, lipogenesis,*

adipocytes and *anthropometric indices*. Overall, papers on human and animal studies, clinical trials, and articles related to obesity medication based on plants are used in this discussion.

3. Results and Discussion

3.1 Mechanism of Action

Natural anti-obesity preparations can induce weight loss through several mechanisms. Their functions can be classified into five major categories, as shown in Table 1. Based on the inhibition of pancreatic lipase activity (Birari & Bhutani, 2007), the intake of some medicinal plants will prevent the absorption of lipids in the intestine. Consequently, non-absorbed fat will be excreted through oily faeces. Furthermore, certain bioactive components can promote energy expenditure (Hansen, Gilman, & Odland, 2010) by increasing basic the metabolic rate, which enhances thermogenesis. This function will help the body to burn additional calories and excess body fat. Through prevention of adipocyte differentiation (Uto-Kondo et al., 2009), medicinal plant consumption will inhibit adipogenesis and the formation of fat cells in adipose tissues. Moreover, based on enhancing lipid metabolism (lipolysis) some medicinal plant products can increase lipolysis through inducing β-oxidation or noradrenaline secretion in fat cells (Okuda et al., 2001). Other anti-obesity ingredients are able to suppress appetite and induce satiety (Geoffroy, Ressault, Marchioni, & Miesch, 2011), which will help individuals to control their appetite. Finally, these different functions of antiobesity medicinal plants will cause a reduction of food and energy intake (Haaz et al., 2006).

Table 1. Different functions of anti-obesity medicinal plants in humans

No.	Anti-obesity function	Anti-obesity preparations
1	Inhibiting pancreatic lipase activity	chitosan (Bondiolotti, Bareggi, Frega, Strabioli, & Cornelli, 2007; Jun et al., 2010), levan (Kang et al., 2006), mate tea (Martins et al., 2009), oolong tea (T. Hsu et al., 2006) jasmine tea (Okuda, Han, Kimura, Saito, & Murata, 2001), green tea (Koo & Noh, 2007)
2	Enhancing thermogenesis	sea weed (Maeda, Hosokawa, Sashima, Funayama, & Miyashita, 2005; Maeda, Hosokawa, Sashima, & Miyashita, 2007; Maeda, Tsukui, Sashima, Hosokawa, & Miyashita, 2008), bitter orange (Dallas, Gerbi, Tenca, Juchaux, & Bernard, 2008; Haaz et al., 2006; Preuss, DiFerdinando, Bagchi, & Bagchi, 2002), soybean (Ishihara et al., 2003)
3	Preventing adipocyte differentiation	turmeric (Ahn, Lee, Kim, & Ha, 2010), capsicum (C. L. Hsu & Yen, 2007), palm oil (Uto-Kondo et al., 2009), banana leaf (Bai et al., 2008; Klein, Kim, Himmeldirk, Cao, & Chen, 2007), brown algae (Maeda et al., 2006), garlic (Ambati et al., 2009), flaxseed (Tominaga et al., 2009), black soybean (H. J. Kim, Bae, Ahn, Lee, & Lee, 2007)
4	Enhancing lipid metabolism	herb teas (Okuda et al., 2001), cinnamon (Sheng, Zhang, Gong, Huang, & Zang, 2008)
5	Decreasing appetite	pine nut (Pasman et al., 2008), pomegranate leaf (Lei et al., 2007), ginseng (J. H. Kim, Hahm, Yang, Lee, & Shim, 2005), *Hoodia gordonii* (Van Heerden, 2008)

3.2 Approaches in medicinal plant preparation with maximum efficacy and safety

Medicinal plant samples can be collected from the whole plant, or from parts of the plant, such as the stem, bark, leaf, flowers, and roots. These materials are then processed into different forms, such as powder or capsules. However, most of the medicinal plants which have shown antiobesity properties were prepared in the

form of aqueous or alcoholic extracts. This may be because the decoction, distillation, and infusion procedures can concentrate the constituents responsible for the therapeutic efficacy of the examined herb. Some components which might inhibit the anti-obesity function of the bioactive compounds might be removed by the extraction procedure. Extraction and partial purification, or the isolation of the active principle(s) could increase the bioavailability of the bioactive constituents in medicinal plant extracts which consequently will enhance the efficacy of medicinal agent in losing weight (Calixto, 2000; Schulz, Hänsel, & Tyler, 2001). In other studies, scientists have examined the anti-obesity properties of mixtures of medicinal plants. However, in several cases shown in Table 2, the consumption of different antiobesity preparations in combination with other plant-based ingredients could produce unexpected side-effects.

Table 2 - Comparison between safety and efficacy of single and mixed medicinal plant anti-obesity preparations

Medicinal Plant ingredient	*Result	Adverse effects	Combination formula	Result	Adverse effects
Rhubarb (rheum) (Jin & Jiao, 1994)	+	Not reported	In combination with ginger, astragulus, red sage, and turmeric, combined with gallic acid (FL Greenway et al., 2006; Roberts et al., 2007)	greater weight gain in intervention group/ (-)	Musculoskeletal, gastrointestinal, oral, dermatologic, vaginal irritation, headache, etc.
Green tea (*Camellia sinensis*) (Nagao, Hase, & Tokimitsu, 2007)	+ ($p<0.05$)	Not reported	In combination with asparagus, black tea, guarana, kidney bean, *Garcinia cambogia* and chromium yeast (Opala, Rzymski, Pischel, Wilczak, & Wozniak, 2006)	no inter group difference in weight (-)	Gastrointestinal complaints
Bitter orange *Citrus aurantium*) (Stohs, Preuss, & Shara, 2011)	+	Not reported	In combination with pantothenic acid, green tea leaf extract, guarana, white willow bark and ginger root (F. Greenway et al., 2006)	greater weight gain in intervention group ($p<0.04$)	Hypertension, musculoskeletal, neurological, migraine, anxiety
kidney bean (*Phaseolus vulgaris*) (Udani, Hardy, & Madsen, 2004)	+ ($p=0.07$)	Not reported	In combination with green tea extract (Birketvedt, 2009)	inter group differences (+)	Flatulence, soft stool, constipation
Garcinia cambogia (Mattes & Bormann, 2000)	+ ($p=0.03$)	Not reported	in combination with natural caffeine (Rothacker & Waitman, 1997)	No inter group differences ($p=0.3$)	Not reported
Glucomannan fiber (Walsh, Yaghoubian, & Behforooz, 1984)	+ ($p<0.005$)	Not reported	in combination with chitosan, fenugreek, *Gymemna sylvestre*, vitamin C (Woodgate & Conquer, 2003)	inter group differences (+) ($p<0.01$)	Constipation, headache, indigestion

* Results indicate the efficacy and intergroup differences

Based on previous studies, the application of single medicinal plants has not caused any adverse events. On the other hand, the undesired effects on the human body could be due to interactions between the different phytochemical constituents present in the different plants (Heber, 2003).

4. Summary and Conclusion

In summary, there is evidence from a large number of *in vivo* studies regarding the efficacy of anti-obesity medicinal plant preparations. These preparations can demonstrate their effects in various ways, including stimulating thermogenesis, lowering lipogenesis, enhancing lipolysis, suppressing appetite and decreasing absorption of lipids. Single and mixed anti-obesity medicinal plant preparations can have different effects. However, there are other factors which can also affect the results of such studies, including the botanical sources and the route of administration, the presence of various bioactive components and their respective functions, the experimental methods used, the treatment dosage applied, the study design, the duration of treatment, and the safety and efficacy of the ingested plant. In conclusion, the dietary intake of these medicinal plants in the natural form, when taken singly, can apparently provide a higher degree of safety and efficacy than when mixed medicinal plant preparations are applied. These findings support the recommendation of many health organizations regarding the consumption of natural ingredients on a regular basis, especially vegetables and selected herbs, such as turmeric, capsaicin, ginger, and green tea. Efforts to improve knowledge for individuals on the consumption of anti-obesity medicinal preparations, and encouragement to overweight and obese patients to consume them at an optimum dosage, along with an enhanced exercise regimen and a healthy diet should be continued. In addition, more chemical, biological and clinical studies are needed on the effectiveness of selected medicinal plants, particularly those used as spices and condiments, in ameliorating and treating obesity in humans. These anti-obesity data would be useful for food and drug manufacturers as they consider the development of new products and to government as they consider the regulation of food products as a way to promote and enhance public health.

5. Acknowledgment

This review study was carried out under Research Grant No. RG108/11SUS, Department of Science & Technology Studies, Faculty of Science, University of Malaya, Kuala Lumpur, Malaysia.

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