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A REVIEW: NATURAL ANTI-OBESITY DRUGS

Poonam Arora[1], Rajanpreet Kaur[1] and Neelima Dhingra*[2]

[1]GHG Khalsa College of Pharmacy, Gurusar Sadhar, Ludhiana
[1]University Institute of Pharmaceutical Sciences, Panjab University, Chandigarh.
[2]Assistant Professor (Pharmaceutical Chemistry), University Institute of Pharmaceutical Sciences, Panjab University, Chandigarh.

***Corresponding Author: Neelima Dhingra**
Assistant Professor (Pharmaceutical Chemistry), University Institute of Pharmaceutical Sciences, Panjab University, Chandigarh.

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ABSTRACT

Obesity is a global health concern associated with high morbidity and mortality. Obesity is resulting from an energy imbalance caused by an increased ratio of caloric intake to energy expenditure. Therapeutic strategies include synthetic drugs and surgery, which may entail high costs and serious complications. The pancreatic lipase (PL) is the most important enzyme in digestion of triglycerides. Thus altering metabolism of lipids by inhibiting dietary fat absorption, represents a good strategy in the prevention and treatment of obesity. Since the time immemorial, plants have been in use as sources of medicine throughout the world. The demand for plant based medicines is ever growing, as natural derived crude or processed products have been found to be associated with less or no adverse effects. Present study presents brief overview of the natural products and bioactive compounds that have been investigated for their anti-obesity effects.

KEYWORDS: Obesity, lipase, metabolism, pancreatic, absorption.

1. INTRODUCTION

Obesity is a global health problem, resulting from an energy imbalance caused by an increased ratio of caloric intake to energy expenditure. Lipid metabolism is a vital and subtle balance that maintains energy homeostasis. Once this balance is lost, obesity or hyperlipidemia develops, followed by a series of severe diseases, including atherosclerosis, hypertension, diabetes, and dysfunction of certain organs. The recent examination and study by National Health and Nutrition department showed that 68.0% and 33.8% of those studied case were found to be overweight (basal metabolic rate (BMI) ≥ 25) and obese (BMI ≥ 30) respectively.[1]

The inhibition of dietary fat absorption represents a logical treatment for managing obesity, and pancreatic lipase is a key enzyme involved in triglyceride absorption in the small intestine. It is secreted from the pancreas and hydrolyzes triglycerides into glycerol and free fatty acids. Thus, inhibitors of digestive lipases are suggested to function as anti-obesity agents.[2] Orlistat, which can be found in global markets, inhibits the action of gastrointestinal lipase and thus reduces absorption of dietary fat. However, it has serious side effects, such as steatorrhea, stomach pain, irregular menstrual periods, and headaches.[3] Obesity not only predisposes individuals to serious chronic conditions, such as type 2 diabetes, cardiovascular disease and certain cancers, it is also a leading cause of premature death worldwide.

In last one decade, there has been great increase in the use of herbal or natural products and their bioactive compounds as an effective treatment against obesity.[1,4]

This review gives a brief account of rationale and efficacy of different natural plants and bioactive compounds presently available and have been investigated for their anti-obesity effects

2. Natural drugs for the treatment of obesity

Pancreatic lipase (PL) is the most important enzyme responsible for the digestion of triglycerides into mono and diglycerides into smaller fatty acids for their better absorption in body. The primary goal of the treatment is to reduce the digestion of fats, thus their assimilation and absorption and PL inhibition[5] has been found to be optimal approach in obesity treatment. Further, the use of plant-derived compounds with protective or disease-preventive properties for obesity has gained widespread interest, probably due to perceived reduction in side effects, and contribution of additional factors which include that they are natural products, are presumed to be safe, easy to obtain.

2.1 *Terminalia bellerica*.

Terminalia bellirica Roxb belongs to the family Combretaceae and is distributed throughout deciduous forests of India.

T. bellerica is a rich source of tannins which is an antioxidant. Tannins are polyphenolic compounds. Polyphenols from plants have an affinity for proteins, primarily through hydrophobic, as well as hydrogen bonding and therefore exhibit inhibitory activity for enzymes, because of aggregation of enzyme proteins. Seeds of *T. bellerica* were powdered and extracted with ethyl acetate in soxhlet apparatus. The lipase inhibitory activity of extract was found to be dose dependent i.e., higher inhibition of enzyme was observed with increase in the concentration of extract. The plant also contains tannins, alkaloids and terpenoids.[6]

2.2 *Cudrania tricuspidata*

Cudrania tricuspidata belongs to the family Moraceae and is a tree native to East Asia.

C. tricuspidata leaves show the most pronounced effect on pancreatic lipase activity and are able to suppress dietary fat absorption *in vivo*. Low concentrations of *C. tricuspidata* (50 mg/kg body weight) reduced plasma triacylglycerol levels and high concentrations of *C. tricuspidata* (250 mg/kg body weight) delayed lipid absorption significantly.

C. tricuspidata is a rich source of xanthones and flavonoids, including cudraflavone C which inhibited pancreatic lipase activity. Thus, cudraflavone C may be a potential as one of active compounds for preventing and treating obesity.[1]

2.3 *Salacia reticulate*

Salacia reticulate belongs to family Celastraceae and is distributed in Sri Lanka, Japan.

The root and stem extract from *S. reticulata* is consumed as a food supplement that prevents obesity and diabetes in Japan because it suppresses postprandial hyperglycemia. The plant extract inhibited porcine pancreatic lipase and lipoprotein lipase in rat adipocytes in a concentration-dependent manner but it did not inhibit hormone sensitive lipase (HSL) activity. An 18 h treatment with SRHW (*S. reticulata* hot water extract) tended to decrease the remaining triglycerides that reflect lipolysis in adipocytes.

S. reticulate contains mangiferin, 4-methylepigallocatechin and maytenfolic acid which show lipolytic activity. Epigallocatechin and epicatechin, 4-*O*-

methylepigallocatechin inhibited pancreatic lipase activity. Epiafzelechin-4-*O*-methylepigallocatechin, lambertic acid and the tannin fraction had weak inhibitory effects on pancreatic lipase activity. On the other hand, the tannin fraction showed the most potent inhibition of lipoprotein lipase activity. Epicatechin weakly inhibited the activity.[7]

2.4 *Baccharis trimera*

Baccharis trimera belongs to family Asteraceae and distributed mainly in the warmer regions of Brazil, Argentina, Colombia, Chile, Mexico and Americas.

The ethyl acetate fraction (42.6% of the methanolic extract mass) did not present inhibition on the lipase, while the methanolic fraction (53.5% of the methanolic extract mass) inhibited the lipase. The plant contains saponin and polyphenols. Saponins were found in a larger amount in the methanolic extract. The saponins possess lipophilic action that facilitates the complexation of the saponins with steroids, proteins and phospholipids of the cell membranes, altering their permeability or causing their destruction.[8]

2.5 *Lagenaria siceraria*

The plant *Lagenaria siceraria* belongs to the family curcubitaceae and is widely distributed throughout India.

The plant contains phytosterols, terpenoids, sugars alkaloids, tannins, flavanoids, alkaloids, phenols, and saponins in different extracts. It has traditional and folklore claims of usefulness in diabetes, obesity, atherosclerosis, jaundice, asthma, bronchial disorders, constipation, ulcer, piles and as diuretic, tonic for brain and liver. The ethyl acetate and ethanol extracts have good pancreatic lipase activity which is comparable with the standard drug orlistat. A daily intake of this plant may prevent obesity and hyperlipidemia.[9]

2.6 *Stellaria media*

Stellaria media belongs to family caryophyllaceae and widely distributed throughout the Himalayas.

Stellaria media rich in vitamins, minerals, flavonoids, terpenoids, gamma-linolenic acid, phenols and β-carotene and various phytoconstituents *viz* lipids, pentasaccharide and triterpenoids. The plant used to treat various diseases such as inflammations of digestive, renal, respiratory and reproductive tracts. It also possesses diuretic, expectorant, anti-asthmatic and anti-feedant properties.

The lyophilized juice (LJ) of *Stellaria media* inhibited pancreatic amylase and lipase activity *in vitro* and elevated plasma triglycerides levels in mice. LJ suppressed increased body weight, retroperitoneal adipose tissue, liver weight and serum parameters i.e. total cholesterol, triglycerides, LDL-cholesterol level at a dose 900 mg/kg body weight. *Stellaria media* may prevent high-fat-diet induced fat storage in adipose tissues by inhibiting the intestinal absorption of dietary fat and carbohydrates through inhibition of digestive enzymes.[10]

2.7 *Zygophyllum album*

Zygophyllum album is a shrubby plant belonging to Zygophyllaceae family and widely distributed in arid and semi-arid regions of Africa, the Mediterranean Basin, central Asia and Australia.

The main constituents described from *Zygophyllum* species are zygophyllin, quinovic acid, and glycosides, which have been demonstrated to have anti-inflammatory and antipyretic activity. *Zygophyllum album* also contain seven flavonoids together with two phenolic acids and identified as quercetin, quercetin-3,7-di-*O*-*β*-glucopyranoside, isorhamnetin-3-*O*-*β*-galactopyranoside, isorhamnetin-3-*O*-*β*-glucopyranoside and isorhamnetin-3-*O*-*α*-rhamnopyranosyl-(1/6)-*O*-*β*-glucopyranoside (isorhamnetin-3-*O*-rutinoside), isorhamnetin-3-*O*-*α*- rhamnopyranosyl-(1/6)-*O*- *β*-galactopyranoside (isorham-netin-3-*O*-robinoside), isorhamnetin-3-*O*-*β*-glucopyranoside-7-O- *α*-rhamnopyranoside, gentisic acid, and gentisic acid-5-*O*-*α*-rhamnopyranoside.

The leaves, stems, and fruits of this plant are used in the tunisian folk medicine as a drug active against rheumatism, gout, and asthma. It is also used as diuretic, local anaesthetic, antihistaminic, and antidiabetic agent. The inhibition action of extract of *Z. album* on pancreatic lipase activity inhibited the hydrolysis of dietary triglycerides non-absorbable in the intestine into monoglycerides and free fatty acids absorbable by the intestine. This inhibitory action of lipase activity leads to decrease in LDL and TGs levels in both plasma and liver, consequently inhibition of lipid accumulation in liver and other tissues such as muscle consequently decrease in body weight as anti-obesity action.[11]

2.8 *Phoenix deactylifera*

Phoenix deactylifera belongs to the family arecaceae and distributed in northern and central Africa, the extreme southeast of Europe, southern Asia from Turkey east to southern China and Malaysia.

Phytochemically, the whole plant contains carbohydrates, alkaloids, steroids, flavonoids, vitamins and tannins. The phenolic profile of the plant revealed the presence of mainly cinnamic acids, flavonoid glycosides, flavanols. The plant contains steroids namely cholesterol, stigmasterol, campesterol and α-sitosterol. Anthocyanins were detected only in fresh dates. Flavonids from *Phoenix dactylifera* may augment the activity of lecithin acyl transferase (LCAT), which regulates blood lipids. LCAT plays a key role in the incorporation of free cholesterol into HDL (this may increase HDL) and transferring it back to VLDL and LDL which are taken back later in liver cells.[4]

2.9 *Bauhinia purpurea*

Bauhinia purpurea is a shrub or small tree of fabaceae family. The bark of Bauhinia is collected from' Seshachalam forest's of Andhra Pradesh, India.

Bauhinia purpurea plant has been extensively used as Indian traditional and folklore pain, rheumatism,

convulsions, wound healing, delirium analgesic and anti-inflammatory, nephroprotective activity and antidiabetic activity. Methanolic extracts of *Bauhinia purpurea* were evaluated for their anti-lipidemic and anti-obesity efficacy in high fat diet induced male wistar albino obese rats. The plant extract decreased total cholesterol (TC), triglycerides (TG) and low density lipoproteins (LDL) considerably while increased the high density lipoproteins (HDL). The alterations in these lipid profiles were more pronounced with 400 mg/kg. b.w of methanolic extract. The anti-lipidemic effect of the methanolic extract was more effective than sibutramine.[12]

2.10 *Chamaerops humilis.*

Chamaerops humilis belonging to family arecaceae and subfamily coryphoideae and it is mainly found in southwestern Europe (Malta, Sicily, coastal Spain and Portugal, central and southern Italy, some parts of the southern Mediterranean coast of France, as well as northwest Africa (Morocco, Algeria, Tunisia).

The plant has anti-inflammatory, anabolic, urinary antiseptic, antilithic, and diuretic activities. The hypocholesterolemic activity of the extract after sub-chronic administration may be due to a number of mechanisms, some in common with taurine, including a) inhibition of HMG-CoA reductase, b) stimulation of cholesterol-7-alpha-hydroxylase (CYP7A1), which converts cholesterol into bile acids, c) inhibition of cholesterol absorption from the intestine due to formation of complexes with compounds such as glycosides and saponins. A reduction in triglyceride levels may be due to decreased lipogenesis, increased lipolytic activity by inhibition of hormone-sensitive lipase or the lipogenic enzymes and activation of lipoprotein lipase.[13]

2.11 *Carica Papaya*

Carica Papaya belongs to family caricaceae and distribution in tanzania in Africa. Additional crops of *C. papaya* are grown in India, Australia, the Philippines, Brazil, Colombia, The aqueous fruit extract of *C. papaya* L. appears to be a promising health drink capable of modulating weight control without inducing any adverse side effects. The increased HDL facilitates the transport of cholesterol from the serum to the liver, where it is catabolized and excreted from the body. The plant extracts decrease the serum glucose, triglycerides, total cholesterol, LDL and VLDL and increase the HDL.[14]

2.12 *Morus bombycis*

Morus bombycis belongs to family moraceae and is widely distributed in Asia and used in Korean traditional medicine to treat metabolic diseases such as diabetic mellitus and hyperlipemia. *Morus bombycis* root have hepatoprotective and antioxidant activity.

Morus bombycis root extract has a strong anti-lipase activity and shows *in vitro* phosphodiestrase (PDE) inhibitory activity. Extract shows lipolytic effects in adipocytes and adipose tissues.[15]

Table 1: Plants which showed Lipase inhibitory activity.

S.No	Scientific name	Family	Part used
1.	*Solidago serotina*	Compositae	Whole plant
2.	*Kalopanax pictus*	Araliaceae	Bark
3.	*Oenothera odorata*	Onagraceae	Whole plant
4.	*Platycarya strobilacea*	Juglandaceae	Branch and stem
5.	*Actinidia arguta*	Actinidiaceae	Fruit
6.	*Tilia amurensis*	Tiliaceae	Branch and leaf
7.	*Euscaphis japonica*	Staphyleaceae	Branch
8.	*Carpinus cordata*	Betulaceae	Branch and stem
9.	*Prunus serrulata*	Rosaceae	Branch and stem
10.	*Celtis sinensis*	Ulmaceae	Branch and stem
11.	*Hypericum ascyron*	Hypericaceae	Whole plant
12.	*Rhus chinensis*	Anacardiaceae	Branch and stem
13.	*Staphylea bumalda*	Staphyleaceae	Branch and stem
14.	*Pinus densiflora*	Pinaceae	Pinaceae Stem
15.	*Indigofera kirilowii*	Leguminosae	Branch, leaf, flower
16.	*Tilia mandshurica*	Tiliaceae	Flower, leaf
17.	*Cuscuta japonica*	Convolvulaceae	Whole plant
18.	*Magnolia denudate*	Magnoliaceae	Flowers
19.	*Bupleurum longeradiatum*	Umbelliferae	Whole plant
20.	*Styrax japonica*	Styracaceae	Flower
21.	*Scopolia japonica*	Solanaceae	Branch and stem
22.	*Lindera obtusiloba*	Lauraceae	Branch and stem
23.	*Quercus aliena*	Fagaceae	Branch, leaf
24.	*Descurainia pinnata*	Brassicaceae	Whole plant
25.	*Thlaspi arvense*	Brassicaceae	Whole plant
26.	*Vicia villosa*	Leguminosae	Whole plant
27.	*Paulownia coreana*	Paulowniaceae	Flower
28.	*Alisma canaliculatum*	Alismataceae	Aerial part

3. CONCLUSION

Obesity is a chronic disease that affects millions of people worldwide and contributes to substantial morbidity and mortality. Natural products which contain fibers, polyphenols, sterols, and alkaloids can play a safe and effective role in controlling obesity. In addition, they are a good source of vitamins and minerals. These natural products act as 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, if these natural products are used along with regular exercise and lifestyle modifications a synergistic effect can result leading to enhanced effects.

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REFERENCES

1. Kim YS, Lee Y, Kim J, Sohn E, Kim CS, Lee YM, Jo K, Shin S, Song Y, Kim JH, Kim JS. Evidence-Based Complementary and Alternative Medicine, 2012; 1-8.
2. Gargouri Y, Ransac S, Verger R. Biochimica et Biophysica Acta, 1997; 1344: 6–37.
3. Filippatos T D, Derdemezis CS, Gazi IF, Nakou ES, Mikhailidis DP, Elisaf MS. Drug Safety, 2008; 31: 53–65.
4. Vembu S, Sivanasan D, Prasanna G. J Chem Pharm Res, 2012; 4(1): 348-352.
5. Sahib NG, Saari N, Ismail A, Khatib A, Mahomoodally F, Hamid AA. The Scientific World Journal, 2012; 1-8.
6. Kumar A, Bopanna MM, Thimme GS, Raphael JR, Somanna SH. Res Rev Biomed Biotech, 2010; 1(1): 60-63.
7. Yoshikawa M, Shimoda H, Nishida N, Takada M, Matsuda H. J Nutr, 2013; 1819-1824.
8. Stefânia P de S, Pereira LLS, Souza AA, Custódio D dos S. Braz J Pharmacog, 2011; 21(3): 450-455.
9. Nithya AR, Jayshree N. Int J Pharm and Integr Life Sci, 2013; 1(4): 140-148.
10. Rani N, Vasudeva N, Sharma SK. BMC Complement Altern Med, 2012; 12: 1-8.
11. Kais M, Khaled H, Hichem BS, Mouna K, Mbarek N, Sadok S, Fatma D, Noureddine A, Abdelfattah E. J Evid Based Complementary Altern Med, 2012;1-9.
12. Mopuri R, Attitalla IH, Avinash P, Balaji M. Acad J Plant Sci, 2010; 3(3): 104-107.
13. Farah G, Zafar HI, Badiaa L. Pak. J. Pharm. Sci, 2010; 23: 212-219.
14. Athesh K, Karthiga D, Brindha P. J Pharm Sci, 2012; 4(5): 327-330.
15. Young Sook Kim, Yun Mi Lee, Hyojun Kim, Junghyun Kim, Dae Sik Jang, Joo Hwan Kim, Jin Sook Kim. J. Ethnopharm, 2010; 130: 621-624.