

# Phytomolecules for Obesity and Body Weight Management

Sharma T and Kanwar SS\*

*Department of Biotechnology, Himachal Pradesh University, Summer Hill, Shimla, India*

\***Corresponding author:** Kanwar SS, Department of Biotechnology, Himachal Pradesh University, Summer Hill, Shimla, India, Tel: +91-177-2832153; Fax: 2831948; E-mail: [kanwarss2000@yahoo.com](mailto:kanwarss2000@yahoo.com)

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## Etiology of obesity

Obesity is the result of an imbalance between energy intake and expenditure [14]. As in most human pathological conditions, genetic and environmental conditions play vital role(s) in its pathogenesis. Environmental factors like availability and variety of food, amount of

adipogenesis and are required for the synthesis of many adipocyte associated functional proteins. C/EBP up-regulation mediates the

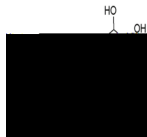
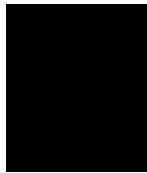
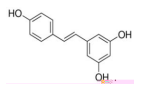
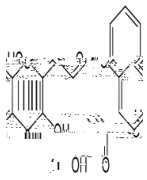
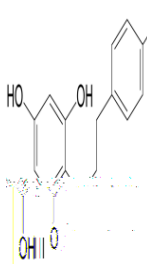
formation and thus inhibit the cholesterol absorption [65].

Changes in intestinal genes and transcription factors make phytosterols the key regulators in metabolism and cholesterol transport in the expression of liver genes [66].

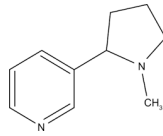
### Terpenoids

Terpenoids (isoprenoids) are natural terpenes usually found in plants, and comprise more than 40,000 compounds of both

primary and secondary metabolism. Gynemic acid (from *Gynema sylvestre*), oleanolic acid (from *Panax ginseng*) and corosolic acid (from *Lagerstroemia speciosa* L) have potential therapeutic on obesity [67-69]. PPAR activation attenuates obesity and type-2 diabetes. Geranyl geraniol, farnesol and geraniol terpenoids are ligands with potential to activate PPAR, dietary lipid sensors that control energy homeostasis as well as lipid and carbohydrate disorders [70,71].

Phytomolecule	Example	Structure	Plant source	Antiobesity effect	Reference
Flavonoids	Quercetin		<i>Coriandrum sativum</i> , <i>Brassica oleracea</i> , <i>Allium cepa</i>	Activates AMPK signal pathway in preadipocytes as a result decrease <i>in vitro</i> adipogenesis.	[72,73]
	Catechins		<i>Camellia sinensis</i> , <i>Coffea</i> and <i>Vitis vinifera</i>	Decreases the carbohydrate absorption because catechin inhibits $\alpha$ -glucosidase activity and small-intestine micelle formation.	[74-76]
	Resveratrol		<i>Arachis hypogaea</i> , <i>Vitis vinifera</i> and <i>Cyanococcus</i>	Inhibits adipogenesis by reducing the transcriptional activity of PPAR and it enhances lipolysis.	[77,78]
	Galangin		<i>Alpinia galangal</i> , <i>Helichrysm aureonitens</i>	Decreases accumulation of hepatic triglycerides, serum lipids, liver weight and lipid peroxidation.	[79]
	Phloretin-3,5-di-C-glucoside		<i>Cyclopia falcata</i> , and <i>Cyclopia subternata</i>	Inhibit adipogenesis, intracellular triglyceride and down regulate peroxisome proliferator-activated	

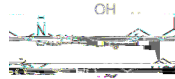
Nicotine



*Nicotiana tabacum* and  
*Capsicum annum*

Nicotine increases metabolic rate and decrease food intake. [84]

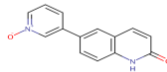
p-syneprine



*Citrus aurantium* and  
*Citrus unshiu*

The active constituent *p*-syneprine increases metabolic rate, energy expenditure and increase in weight loss. [85,86]

Halfordinol

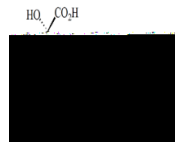


*Aegle marmelos*

Anti-adipogenic activity and responsible for the decrease in adipocyte accumulation. [87]

Phenols

Chlorogenic acid



*Glycine max* and  
*Coffea canephora*

Reduce body fat due to a reduction in the absorption of glucose. [88]

Ferulic acid



*Hordeum vulgare* and  
*Asparagus officinalis*

Hypolipidemic effect, y

## Conclusion

Complete understanding of plant-derived metabolites involved in fat metabolism in our body will open the avenues to develop the phytomolecules-based therapeutic approaches to combat obesity in human. Hardly any of the existing drugs including statins (Orlistat) has been established to cure obesity. Phytomolecules are potential alternative treatment strategies for the development of safe anti-obesity drugs. Phytomolecules being of biological origin have little side effect in comparison to statins. Emerging studies have described the promising role of phytochemicals in treating obesity with little side effect in human. Hence concerted efforts are required to explore plants as important natural resources for their therapeutic potential, not only to manage and treat obesity but other diseases, too.

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