

# Role of *Ghrita* on its Hypothalamic Lipid Signaling in Managing Obesity

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## ABSTRACT

### INTRODUCTION

Obesity is a metabolic disorder characterized by excessive adipose tissue accumulation and hormonal dysregulation. Modern science emphasizes the role of incretin hormones, particularly GLP-1 in appetite regulation, insulin secretion. Ayurveda describes obesity as *Sthoulya* or *Medoroga* which primarily caused by impaired *Agni* and dysfunction of *Medodhatvagni*. Exploring parallels between GLP-1 physiology and *Medodhatvagni* provides new insights into integrative obesity management.

### METHODS

Classical texts were analyzed for concepts of *Medodhatvagni*, *Sthoulya Nidana*. Contemporary biomedical literature was reviewed to elucidate incretin hormone pathways, GLP-1 functions and their therapeutic implications. A comparative conceptual analysis was conducted to correlate Ayurvedic metabolic mechanisms with incretin physiology.

### RESULTS

GLP-1 enhances delays gastric emptying and augments insulin secretion which thereby regulating energy balance. Similarly, *Medodhatvagni* governs the transformation and utilization of *Meda Dhatu* and its impairment leads to adiposity and metabolic disturbances. Ayurvedic interventions such as *Langhana*, *Rukshana*, *Udwartana* and formulations like *Triphala*, *Guggulu* have shown potential to restore *Agni* and correct *Medodhatvagni* dysfunction which results in influencing gut hormones. Certain herbs exhibit GLP-1 modulatory or incretin-mimetic effects.

### DISCUSSION

*Medodhatvagni* may include glucocorticoids, insulin, glucagon and secretion of intestinal L-cells. If glucagon levels are excess lipolysis occurs which is equivalent to *Medokshaya*. Along with these hormones all enzymes involved in lipid metabolism may also be regarded as the function of *Medodhatvagni*. The functional role of *Medodhatvagni* aligns with modern incretin pathways in maintaining metabolic equilibrium.

### CONCLUSION

Understanding incretin physiology through the concept of *Medodhatvagni* provides a holistic framework for obesity management, integrating traditional wisdom with modern endocrine insights.

**Key Words** Ayurveda, GLP-1, Incretin hormone, *Medodhatvagni*, Obesity

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### INTRODUCTION

Obesity is a complex chronic metabolic disorder characterized by excessive accumulation of adipose tissue, altered energy homeostasis, low-grade systemic inflammation and significant endocrine dysregulation. It is a major risk factor for insulin resistance, type 2 diabetes mellitus, cardiovascular diseases and neuroendocrine disturbances. Contemporary biomedical science recognizes obesity as a disorder of energy balance regulated by central and peripheral hormonal mechanisms among which incretin hormones, especially Glucagon-Like Peptide-1 (GLP-1) plays a pivotal role in appetite regulation, insulin secretion, gastric motility and satiety signaling<sup>1</sup>.

Ayurveda describes obesity under the concepts of *Sthaulya* and *Medoroga* conditions arising from derangement of *Agni* particularly *Medodhatvagni* leading to abnormal *Meda Dhatu* accumulation. Classical Ayurvedic texts emphasize that impaired digestion, altered tissue metabolism and obstruction of metabolic channels result in disproportionate nourishment of *Medas* while depriving other *Dhatu*<sup>2</sup>.

### METHODS

GLP-1 is secreted from intestinal L-cells in response to nutrient intake and exerts multifaceted actions such as delayed gastric emptying, enhancement of glucose-dependent insulin secretion, suppression of glucagon release and activation of central satiety centers.

Pharmacological GLP-1 receptor agonists have therefore emerged as promising anti-obesity agents though their long-term safety, tolerability and sustainability remain areas of concern. Exploring parallels between GLP-1 physiology and the Ayurvedic concept of *Medodhatvagni* offers a novel integrative framework to understand obesity<sup>3</sup>. The therapeutic principles such as *Langhana*, *Rukshana* and *Lekhana* are followed. Further classical formulations such as *Guggulu Tiktaka Ghrita* traditionally indicated in disorders of *Medas* and *Kapha* may exert therapeutic benefits through mechanisms resembling incretin modulation, including delayed gastric emptying, improved lipid metabolism and appetite regulation<sup>4</sup>.

### COMPARATIVE CONCEPTUAL ANALYSIS

A structured conceptual correlation was undertaken to map Ayurvedic metabolic constructs especially *Medodhatvagni* with modern endocrine regulators including GLP-1, insulin, glucagon and lipid-metabolizing enzymes.

### RESULTS

#### GLP-1 PHYSIOLOGY IN OBESITY

GLP-1 is secreted postprandially from intestinal L-cells in response to carbohydrates, fats and proteins. Its key actions include: Delay of gastric emptying, leading to prolonged satiety, Enhancement of glucose-dependent insulin secretion, Suppression of glucagon secretion and

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Reduction of appetite through hypothalamic signaling in obesity impaired GLP-1 secretion or resistance contributes to hyperphagia, dysregulated insulin response and excess fat accumulation<sup>5</sup>.

### ROLE OF MEDODHATVAGNI

*Medodhatvagni* governs the transformation, storage and utilization of Meda Dhatu. When *Medodhatvagni* is hypo-functional: Excessive *Meda* is produced *Dhatu* nourishment becomes imbalanced *Kapha* predominance and *Srotorodha* occur Appetite becomes abnormal. This state closely mirrors metabolic dysfunction observed in GLP-1 dysregulation.

Role of Ayurvedic Interventions such as *Langhana*, *Rukshana*, *Udwartana* Herbal formulations like *Triphala* and *Guggulu* have demonstrated potential in restoring Agni, reducing adiposity and influencing gut hormone signaling. Emerging studies suggest that certain phytochemicals modulate incretin pathways and enhance satiety.

### DISCUSSION

#### MEDODHATVAGNI AS AN ENDOCRINE-METABOLIC AXIS

*Medodhatvagni* can be conceptualized as an integrated functional unit encompassing - Insulin and glucagon balance, GLP-1 secretion from intestinal L-cells, Lipolytic and lipogenic enzyme activity and Cortisol-mediated energy regulation. Excess glucagon activity leading to lipolysis correlates with *Medokshaya* while impaired

insulin-GLP-1 signaling leads to *Meda* accumulation or *Medovridhi*.

#### GUGGULU TIKTAKA GHRITA: MECHANISTIC INSIGHTS

*Guggulu Tiktaka Ghrita* is a medicated ghee containing *Tikta Dravya* processed in *Ghrita* with *Guggulu*. Explained in table 1.

**Table 1** Understood through multiple mechanisms

<b>Delayed Gastric Emptying</b>	<b>Ghrita based formulations slow gastric transit, enhancing satiety signals. Lipids are potent stimulators of GLP-1 secretion, suggesting that Ghrita may physiologically augment incretin response.</b>
<b>Tikta Rasa and Kapha Meda Shamana</b>	Bitter principles stimulate digestive enzymes, improve Agni and reduce <i>Kapha Meda</i> dominance, similar to appetite suppression mediated by GLP-1.
<b>Guggulu and Lipid Metabolism</b>	<i>Guggulu</i> modulate lipid metabolism, enhance bile acid secretion and improve insulin sensitivity mechanisms indirectly linked to GLP-1 mediated metabolic regulation.
<b>Gut-Brain Axis Modulation</b>	Herbal lipophilic constituents in <i>Ghrita</i> cross the blood-brain barrier, potentially influencing hypothalamic appetite centers analogous to central GLP-1 action.

#### GLP-1-MEDIATED HYPOTHALAMIC SIGNALING

Peripheral hormones such as GLP-1, insulin, leptin, cholecystokinin and peptide activate neurons while inhibiting neuropeptide Y (NPY) neurons leading to reduced appetite and enhanced satiety. Among these GLP-1 plays a pivotal role by acting both peripherally and centrally, resulting in delayed gastric emptying, reduced food intake and increased energy expenditure<sup>6</sup>.

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GLP-1 receptors are widely distributed in hypothalamic regions. Activation of these receptors results in: Suppression of hunger-promoting NPY signaling, Activation of satiety-promoting neurons and Reduction in reward driven feeding through interaction with mesolimbic dopamine pathways<sup>7</sup>.

This neuroendocrine signaling explains the potent appetite-suppressing effects of GLP-1 receptor agonists used in obesity management. Importantly dietary lipids are strong physiological stimulators of endogenous GLP-1 secretion, linking nutrition directly to hypothalamic appetite control.

### ROLE OF GHRITA IN HYPOTHALAMIC APPETITE REGULATION

*Ghrita (Ghee)* is rich in chain fatty acids and bioactive lipids that stimulate intestinal L-cells, enhancing endogenous GLP-1 release. This leads to delayed gastric emptying, Prolong satiety and reduced caloric intake. This mechanism parallels the action of pharmacological GLP-1 agonists though in a physiological and food-based manner<sup>8</sup>

**Table 2** *Rasapanchaka and Karma*

<b>GANA</b>	<i>Madhura Skandha</i>
<b>YONI (Source)</b>	<i>Jangama Sneha</i>
<b>RASA</b>	<i>Madhura</i>
<b>GUNA</b>	<i>Snigdha, Guru</i>
<b>VEERYA</b>	<i>Sheeta</i>
<b>VIPAKA</b>	<i>Madhura</i>
<b>KARMA</b>	<i>Medhya, Agnivardhak, Rasayana, Vajikarana, Rasavardhaka, Swarya, Varnya, Balya, Oja Vardhaka, Medha, Smruti, Agni and Indriyabala</i>

In Ayurveda ghee is described as *Agnideepana* and *Samskara Anuvartana* and the properties explained in table 2. Contrary to the

misconception that ghee promotes obesity, classical texts emphasize that properly used ghee regulates appetite rather than increases it. Ghee supports *Samagni*, preventing both excessive hunger and suppressed appetite. By normalizing *Medodhatvagni* ghee ensures appropriate transformation and utilization of *Meda Dhatu*. The *Snigdha* and *Sukshma guna* of ghee allows it to penetrate microchannels, influencing central regulatory centers, including *Manovaha* and *Medovaha Srotas*. This aligns with the modern understanding that lipid-mediated signaling influences hypothalamic neurons controlling appetite<sup>9</sup>. Studied shows *Goghrita* contains butyric acid which is having short chain fatty acid gives distinct flavor and help in digestion. Beneficial microorganisms in intestine which converts fibers into butyric acid are used for source of energy and intestinal wall support. Studies have confirmed that people with unhealthy digestive tracts do not produce butyric acid. Researchers suggest that the production of killer T cells in the gut get adequate support from production of butyric acid and as a result strong immune system<sup>10</sup>.

### INTEGRATIVE INSIGHT

Hypothalamic appetite regulation is a finely tuned neuroendocrine process influenced by gut hormones, neural pathways and dietary components. Ghee through its ability to stimulate GLP-1 secretion, activate vagal pathways and restore *Agni* and *Medodhatvagni* serves as a unique nutritional and therapeutic agent in appetite regulation<sup>11</sup>. This convergence of

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Ayurveda and modern neuroscience highlights the potential of traditional lipid-based formulations in sustainable obesity management.

## CONCLUSION

Understanding GLP-1 physiology through the Ayurvedic concept of *Medodhatvagni* offers a holistic, integrative framework for obesity management. While modern medicine targets isolated hormonal pathways, Ayurveda emphasizes restoring metabolic intelligence through *Agni* regulation, *Dhatu* balance and *Srotas* integrity. *Guggulu Tiktaka Ghrita* emerges as a promising therapeutic formulation capable of influencing gastric emptying, appetite regulation, lipid metabolism and gut-brain signaling. Integrating classical Ayurvedic wisdom with contemporary endocrine insights may lead to safer, sustainable and personalized strategies for obesity management.

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