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Medovaha Srotas And Obesity: An Ayurvedic-Modern Integrated Review

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ABSTRACT:

Obesity is a major metabolic disorder of the modern era, contributing significantly to global morbidity and mortality. In Ayurveda, obesity is described as sthoulya or medovṛuddhi, arising from derangement of meda dhatu and dysfunction of medovaha srotas. An integrative understanding of these classical concepts alongside modern biomedical knowledge provides a comprehensive framework for evaluating obesity.

Objective: To analyze the Ayurvedic concepts of meda dhatu, medovaha srotas, and their moola sthanas in correlation with contemporary anatomical, physiological, and metabolic insights relevant to obesity.

Methods: A conceptual and analytical review of classical Ayurvedic texts, including Charaka Samhita, Sushruta Samhita, Ashtanga Hrudaya, and Ashtanga Sangraha was conducted and correlated with modern literature on lipid metabolism, adipose tissue physiology, and obesity.

Results & Conclusion: Meda dhatu exhibits structural, metabolic, and endocrine functions comparable to modern adipose tissue and circulating lipids. Medovaha Srotas correspond to lymphatic pathways, intestinal lacteals, and vascular networks supplying visceral fat. The moola sthanas - Vrukka, Vapavahana, and Kaṭi - show strong anatomical relevance to renal lipid metabolism, omental fat activity, and central adiposity. The samprapti of sthoulya, characterized by agnimandya, ama, srotorodha, and medodhatvagni mandya, closely parallels modern mechanisms such as insulin resistance, chronic inflammation, visceral adiposity, and hormonal dysregulation. Thus ayurvedic concepts of Meda and Medovaha Srotas align closely with contemporary understanding of obesity. Ayurveda offers a holistic approach emphasizing dietary regulation, lifestyle modification, metabolic correction, highlighting its relevance in modern healthcare.

Keywords: Meda dhatu, Medovaha srotas, Obesity, Sthoulya, Adipose tissue, Ayurveda.

INTRODUCTION:

Meda is derived from the root "Kli", which denotes Sneha (unctuousness). The term Medayati implies Snehana (oleation). Meda represents a specific dhatu originating from mamsa dhatu and signifies corpulence and unctuousness[1].

Utpatti (Formation of meda dhatu)[2]:

- Poshaka mamsa dhatu undergoes paka by mamsa dhatwagni
- Formation of poshya (sthayi) meda dhatu and poshaka(asthayi) meda dhatu.
- Poshaka meda dhatu undergoes paka by medho dhatwagni
- Poshya(sthayi) and poshaka(asthayi) asthi dhatu are formed.

Meda Panchabhoutikatva[3]:

Meda predominantly possesses Pruthvi & Aap mahabhuta, explaining its heaviness, stability and unctuous nature.

Swaroopa[4] (Nature of Meda dhatu)

Meda dhatu
- Poshaka dhatu - gatiyukta - cirulates in whole body & nourishes poshya dhatu.
- Poshya dhatu

Meda dhatu
- Baddha meda - immobile - stored in different parts of the body
- Abaddha meda - mobile - nourishes baddha meda.

Sthana (Seat of Meda dhatu): The principal sites of Meda dhatu are: Udara and anuvasthi (Sarakta meda)[5].

Pramana (Quantity of Meda dhatu) →The normal quantity of Meda dhatu is 2 anjali

Medo Dhatu Karma:

Acharya	Karma
Sushruta[6]	Sneha swedha drudatva, asthipushti
Ashtanga sangraha[7]	Netragatrasnigdhata

Mala of meda: The mala of meda dhatu is Sweda

Upadhatu of meda: The upadhatu of meda is Snayu, contributing to structural stability and support.

Medovaha Srotas:

Medovaha srotas are the channels responsible for nourishment, transport and metabolism of meda dhatu. They facilitate movement of nutrients essential for adipose tissue formation and maintenance. Structurally, they resemble the capillary networks supplying adipose rich regions such as the perinephric tissue and omentum by Dr Ghanekar.

Medovaha Srotomoola:

Charaka[8]	Sushruta[9]	Vagbhata[10]
• Vrukka • Vapavahana	• Kati • Vrukka	• Vrukka • Mamsa

Different Acharyas have described varied moola sthanas of medovaha srotas. Among them, Vṛukka is unanimously accepted, while Kaṭi, Vapavahana, and Maṃsa are described based on anatomical, surgical, and physiological perspectives.

Vrukka:

- Number: Two
- Location: Kukṣhi-golaka, situated in the abdominal cavity, one on either side[11].
- Development: Formed from the Prasada bhaga of Rakta and Meda dhatu[11].
- Structure: Described as Mamsa pinda, bilaterally placed[12].
- Classification: Considered as a Koshtanga.

Vapavahana:

- The term Vapavahana is derived from Vapa (fat / Vasa) and Vahana (transport).
- It denotes structures responsible for the carriage and distribution of fat.
- Udarastha snigdha vartika[13].
- Anatomically correlated with the omentum, a broad, double-layered, fat-laden fold of peritoneum. Similar to the peritoneum, the omentum has a natural tendency for fat deposition and storage.

Kaṭi:

- Described by Susruta as a moola sthana from a surgical standpoint.
- Acts as a major fat reservoir.
- A considerable amount of adipose tissue is physiologically present around the lumbar region.

Maṃsa:

- Explained by Vagbhaṭa as moola sthana from a physiological perspective.
- Mamsa dhatvagni acts on poshaka mamsa, resulting in the formation of poshaka and poshya meda dhatu

Medo Kshaya

Charaka	Sushruta	AS	AH
• Sandhi sphutana • Akshi glani • Ayasa • Udara tanutva	• Pleeha vruddhi • Sandhi shoonyata • Roukshya	• Pleeha vruddhi • Kati swapa • Sandhi shoonyata • Anga rookshata • Karshya,Shrama	• Kati swapa • Pleeha vruddhi • Krushanga

Meda Vruddhi/ Sthoulya:

Nidana: Atistoola hetu, Medoroga hetu, Medovaha srotodushti, Santarpanakaraka nidana, Prameha hetu, Kapha vruddhikara hetu – ahara, vihara, manasika nidana & miscellaneous.

Roopa[14]:

Ayushohrasa	Decreased lifespan
Javoparodha	Lack of agility
Kruchravyavaya	Difficulty in sexual activity
Dourbalya	Debility
Dourgandhya	Bad odour
Swedabada	Distressful sweating
Kshudatimatra	Increased hunger
Pipasa atiyoga	Increased thirst

Charaka	Sushruta	AH	AS
• Medo-mamsa ativruddha • Chala - sphik,udara, sthana • ↓Upachaya, utsaha	• Snigdhanga • Udara, parshwa vruddhi • Kasa-shwasadi • Dourgandhya	• Shrama • Shwasa • Sphik-sthana-udara lambana	• Prameha poorvaroopa • Shleshma-rakta-mamsa vikara

Sthoulya samprapti[14]:

Nidana
↓
Accumulation of excess amount of meda dhatu
↓
Obstruction of srotas
↓
vata trapped in koshta
↓
Increased agni digests food rapidly
↓
Person feels more hungry
↓
Production of rasa dhatu↑ due to overeating
↓
Excess production of meda leading to Sthoulya

<u>Role of Hormones in Meda Metabolism</u>:

Mamsa agni and Meda agni regulate the formation and metabolism of Meda dhatu, with Meda being formed from mamsa dhatu and subsequently nourishing asthi dhatu. For proper functioning of these, Agni is essential for balanced fat metabolism.

Hormones secreted by endocrine glands closely parallel these processes. Insulin regulates carbohydrate metabolism and promotes nutrient storage, thereby maintaining optimal meda levels. Thyroid hormones control metabolic rate and influence both storage and utilization of meda dhatu. Pituitary hormones further modulate fat metabolism and deposition. Hormonal imbalance can lead to abnormal accumulation of meda, resulting in conditions such as Medo-Arbuda (lipoma). Thus, endocrine regulation plays a central role in the maintenance of normal Meda metabolism[15].

Modern view:

Lipids: Lipids are organic substances that are sparingly soluble in water but readily soluble in organic solvents such as alcohol, ether, and chloroform. They play a crucial role in energy metabolism and cellular structure. Lipids function as precursors for adrenal and gonadal steroid hormones and bile acids (cholesterol), serve as the major stored energy source in the form of triglycerides, and act as intracellular and extracellular signaling molecules (e.g., prostaglandins)[16].

Cholesterol[17]: Cholesterol is a sterol, an alcohol derivative of steroids, present in plasma and cell membranes. It modulates membrane fluidity and influences the function of membrane proteins, including receptors and transporters. Cholesterol serves as a precursor for steroid hormones and bile salts.

Dietary cholesterol is incompletely absorbed in the intestine, with only about 30–60% entering the body. A significant portion is secreted back into the gut as a component of bile. The body synthesizes cholesterol in amounts comparable to dietary intake, highlighting its physiological importance.

Lipoprotein[18]: Since cholesterol and triglycerides are hydrophobic, they require lipoproteins for transport in plasma. Based on density and electrophoretic mobility, lipoproteins are classified into chylomicrons, VLDL, IDL, LDL, and HDL. Each lipoprotein contains apolipoproteins that provide structural stability, receptor-binding sites, and transport of lipid-soluble vitamins.

Chylomicrons: Formed in the intestinal mucosa, chylomicrons contain approximately 85% triglycerides, along with phospholipids, cholesterol, and proteins. They transport dietary lipids and fat-soluble vitamins to adipose tissue for storage.

Low-Density Lipoprotein (LDL): LDL carries nearly two-thirds of plasma cholesterol. Around 75% is cleared by LDL receptors in peripheral tissues, while the remainder is taken up by adrenal and gonadal tissues. Excess LDL leads to cholesterol deposition in arterial walls, forming atherosclerotic plaques; hence, LDL is termed “bad cholesterol.” LDL metabolism is primarily regulated by hepatic LDL receptors, which are targets of dietary and pharmacological interventions.

High-Density Lipoprotein (HDL): HDL is synthesized in the liver as nascent discoidal particles containing apolipoproteins and phospholipids. It mediates reverse cholesterol transport, carrying cholesterol from peripheral tissues to the liver.

Subfractions include:

HDL-1: Associated with hypercholesterolemia

HDL-2: Cardioprotective; removes excess cholesterol

HDL-3: Converts to HDL-2 after cholesterol uptake

VLDL and IDL: VLDL is synthesized in the liver and transports endogenous triglycerides to muscle and adipose tissue. Lipoprotein lipase converts VLDL to IDL, which is either taken up by the liver or further converted into LDL.

Physiological Forms of Lipids In The Body[19]:

1. Element Constant (Structural Lipids)

These lipids form essential components of cell membranes and cytoplasm. Their quantity remains relatively constant even during starvation. They mainly include phospholipids and account for 0.5–1 kg of total body lipid.

2. Element Variable (Stored Lipids)

Stored lipids consist primarily of triglycerides deposited in adipose tissue. Their quantity varies with nutritional and metabolic status. They supply energy during fasting and may become completely depleted in prolonged starvation.

Lipid Transportation In The Body[20]:

Exogenous Pathway (Dietary Lipids)	Endogenous Pathway (Liver-Derived Lipids)
↓	↓
1. Dietary fats absorbed in intestine	1. Liver synthesizes triglycerides
↓	↓
2. Formation of Chylomicrons	2. VLDL secreted into bloodstream
↓	↓
3. Entry into lymphatics (Lacteals)	3. VLDL acted on by LPL → IDL
↓	↓
4. Enters blood circulation	4. IDL → LDL (cholesterol-rich)
↓	↓
5. LPL hydrolyses TG → Fatty acids to muscle/adipose	5. LDL delivers cholesterol to tissues
↓	↓
6. Chylomicron remnants formed	6. Excess LDL returns to liver
↓	↓
7. Remnants taken up by liver	7. HDL formed in liver & intestine
↓	↓

↓

Reverse Cholesterol Transport

↓

HDL collects excess cholesterol

↓

HDL returns cholesterol to liver

↓

Liver converts it to bile acids

↓

Excretion via bile

Storage of Fat[21]: Fat is primarily stored in adipose tissue, with smaller amounts in the liver. Adipose tissue stores triglycerides during caloric excess and mobilizes them during fasting.

White Adipose Tissue (WAT)

Located in subcutaneous, omental, mesenteric, and perirenal regions, WAT serves as the main energy reservoir. It secretes adipokines such as leptin and adiponectin and contributes to endocrine regulation, insulation, and organ protection.

Brown Adipose Tissue (BAT)

BAT contains multiple lipid droplets and abundant mitochondria. It produces heat via non-shivering thermogenesis using uncoupling protein-1 (UCP-1), particularly important in newborns and metabolic regulation in adults.

Physiology of Adipose Tissue[22]: Adipose tissue functions as both a metabolic and endocrine organ, playing a central role in energy homeostasis. It serves as the primary site for long-term storage of triglycerides and actively regulates the balance between fat deposition and mobilization according to the body's energy demands. Adipocytes secrete hormones such as leptin, which provides feedback to the central nervous system to regulate appetite and energy balance.

Under normal nutritional conditions, adipose tissue stores triglycerides through the action of lipoprotein lipase (LPL), which hydrolyses circulating lipoproteins. This process is predominantly stimulated by insulin and supported by steroid hormones, facilitating energy storage in the post-prandial state. Conversely, adipocytes initiate lipolysis in response to hormonal signals, releasing fatty acids during energy deficiency. Hormones such as growth hormone and cortisol further modulate fat metabolism. Thus, adipose tissue plays a dynamic role in coordinating fat storage, mobilization, and endocrine regulation essential for metabolic balance.

Adipose Tissue Distribution[23]: Adipose tissue is distributed subcutaneously and viscerally (omentum, mesentery). Distribution patterns include:

- Gynoid (pear-shaped): Lower-body fat, common in women, metabolically protective
- Android (apple-shaped): Abdominal fat, common in men, associated with higher metabolic risk

OBESITY: Derived from Greek word "Obesus". 'Ob' (over) and 'esus' (have eaten) meaning "having eaten until fat". A common chronic disorder of abnormal or excessive body fat and exists not only in the developed but also in developing countries, thus it becomes a global epidemic.

Majority of the researchers have used body fat percentage to describe the obesity. When it is > 25% in male and >30% in female then they are considered under obesity. From a person's BMI, the body fat percentage can be evaluated by using the following formula:

$=1.2 \times BMI + 0.23 \times ages - 5.4 - 10.8 \times gender$

Etiology: • Hormonal factors

• Genetic factors

• Psychological factors

• Environmental and physical activity

Pathogenesis[24]: Obesity develops due to a chronic positive energy balance resulting from the interplay of genetic predisposition, hormonal dysregulation, and environmental factors, leading to excessive accumulation of adipose tissue.

Genetic factors contribute significantly (approximately 25–40%) to obesity risk. Obesity is polygenic, involving multiple genes—particularly those related to leptin pathways—and is associated with increased visceral fat deposition. Certain genetic syndromes further highlight the hereditary influence.

Hormonal and gut-derived factors regulate appetite and metabolism. Ghrelin stimulates hunger, while gut hormones such as PYY, CCK, oxyntomodulin, and GLP-1 promote satiety and reduce food intake.

Adipose tissue dysfunction plays a key role, as adipocytes secrete adipokines. Increased TNF-α and IL-6 promote insulin resistance, whereas reduced adiponectin impairs insulin sensitivity. Although leptin normally suppresses appetite, most obese individuals develop leptin resistance, leading to impaired appetite regulation.

Clinical Features[25]**:**

- Reduced exercise tolerance, dyspnea, and fatigue
- Impaired daily activities, especially in severe obesity
- Increased risk of metabolic and musculoskeletal disorders
- Psychological distress and reduced life expectancy
- Higher perioperative and postoperative risks

DISCUSSION: Meda is described in Ayurveda as one of the Sapta dhatu, characterized by the predominance of sneha (unctuousness). It plays a vital role in lubrication, structural stability, insulation against cold, and maintenance of metabolic energy reserves. Meda dhatu is formed from mamsa dhatu through the action of mamsa dhatvagni and is essential for sustaining vitality and energy homeostasis.

Classically, meda is classified into poshaka and poshya meda, which closely parallel circulating lipids and stored adipose tissue in modern physiology. Abaddha meda represents freely circulating fats such as triglycerides, cholesterol, and phospholipids, whereas Baddha meda denotes compact fat stored in regions like the abdomen, hips, breasts, and omentum. The Acharyas emphasize meda's protective functions, including cushioning of organs, thermoregulation, and long-term energy supply.

Imbalance of Meda dhatu, either as Medovṛddhi or Medo-kṣaya, results in systemic metabolic disturbances, underscoring its central role in health and disease. These Ayurvedic concepts show strong concordance with contemporary understanding of adipose tissue function, lipid metabolism, and metabolic disorders such as dyslipidemia and adiposopathy.

Medovaha srotas comprise the channels responsible for the formation, nourishment, transport, and regulation of Meda Dhatu. Functionally, medovaha srotas include lymphatic pathways, intestinal lacteals, perinephric and omental capillaries, and internal channels that facilitate the movement of lipid-rich nutrients. The Ayurvedic description of Meda transport shows close resemblance to modern lipid digestion and absorption, wherein dietary fats are absorbed through intestinal lacteals, transported via lymphatics, and subsequently released into systemic circulation as lipoproteins.

Medovaha srotoduṣṭi manifests clinically as excessive sweating, oily skin, thirst, lethargy, edema, and obesity - features that correlate with metabolic and endocrine disturbances such as insulin resistance, dyslipidemia, and thyroid dysfunction.

The concepts of srotorodha and agnimandya explain defective lipid transport and utilization, paralleling impaired mitochondrial function and reduced lipid oxidation seen in obesity. Thus, medovaha srotas provide a vital conceptual link between Ayurvedic principles and contemporary understanding of metabolic regulation.

Acharyas describe different yet complementary moola sthanas of medovaha srotas, all of which possess clear anatomical and physiological relevance. Charaka identifies Vrukka and Vapavahana, Susruta mentions Vrukka and Kaṭi, while Vagbhaṭa includes Maṃsa.

The kidneys influence lipid metabolism, glucose regulation, and endocrine balance; their dysfunction is often associated with hypertriglyceridemia, supporting the role of Vrukka in meda dhatu regulation. Vapavahana corresponds to the omentum, a metabolically active visceral fat depot that secretes inflammatory cytokines and contributes to insulin resistance and central obesity, aligning with Ayurvedic views on the pathogenicity of udarastha meda. Kaṭi represents a key site of fat accumulation and correlates with modern indicators of metabolic risk such as waist circumference and waist–hip ratio. The inclusion of Mamsa emphasizes the metabolic role of muscle mass, as reduced muscle leads to lower energy expenditure and increased fat deposition. Collectively, these moola sthana reflect a precise and integrated Ayurvedic understanding of fat metabolism.

Sthoulya (obesity) is described in Ayurveda as a disorder of Medovaha Srotas marked by excessive accumulation of meda dhatu along with mamsa dhatu. It results from Ati-madhura ahara, sedentary habits, day sleep, psychological factors, genetic predisposition, and impairment of Agni, leading to faulty digestion and metabolism. The samprapti involves jatharagni disturbance, medodhatvagni mandya, ama formation, and srotorodha, culminating in pathological meda deposition.

Clinical features such as breathlessness, excessive sweating, heaviness, fatigue, reduced libido, and pendulous abdomen closely correspond to modern features of metabolic syndrome, decreased exercise tolerance, and hormonal imbalance. Charaka's eight doshas of sthoulya parallel contemporary observations of reduced longevity, stamina, sexual dysfunction, and psychological distress. Ayurvedic recognition of central (android) and peripheral (gynoid) fat distribution further aligns with modern evidence highlighting the greater metabolic risk of visceral obesity. Overall, the Ayurvedic concept of sthoulya offers a holistic and anticipatory framework for understanding obesity and its systemic consequences.

Lipids and Adipose Tissue:

Modern lipid science closely complements the Ayurvedic concept of meda dhatu. Lipids function as energy stores, structural components of cell membranes, and precursors of steroid hormones and prostaglandins. The action of lipoprotein lipase in hydrolysing triglycerides for tissue uptake parallels the Ayurvedic concept of dhatvagni.

Adipose tissue is classified into white and brown types. White adipose tissue serves as the primary site of triglyceride storage and acts as an endocrine organ by secreting adipokines such as leptin, adiponectin, and resistin. Brown adipose tissue, rich in mitochondria, regulates thermogenesis, corresponding to Ayurvedic notions of metabolic heat. Visceral adipose tissue, particularly in the omentum and perinephric regions, is metabolically active and pro-inflammatory, supporting Ayurveda's identification of Vapavahana and Vrukka as moola of medovaha srotas. Overall, lipid biology and adipose tissue physiology provide strong scientific validation for the Ayurvedic understanding of meda and its disorders.

Obesity is a chronic, multifactorial metabolic disorder characterized by excessive fat accumulation that adversely affects health. It results from the interaction of dietary habits, sedentary lifestyle, psychological stress, hormonal imbalance, genetic predisposition, and environmental factors. Central obesity, marked by visceral fat deposition, is strongly associated with hypertension, type 2 diabetes mellitus, dyslipidemia, cardiovascular disease, fatty liver disease, and chronic kidney disease—conditions comparable to medo-pradoshaja vikaras described in Ayurveda and the pathogenesis of sthoulya.

Modern classifications of obesity, such as gynoid (pear-shaped) and android (apple-shaped) patterns, closely parallel Ayurvedic descriptions of fat distribution in sphika, udarastha, and sthana regions. Diagnostic parameters including BMI, waist circumference, waist–hip ratio, skinfold thickness, and biochemical markers correspond with Ayurvedic clinical assessment of meda accumulation. The escalating global burden of obesity highlights the need for integrative management approaches, wherein Ayurveda offers holistic interventions through dietary regulation, lifestyle modification, shodhana therapies, and mind–body practices addressing both physiological and psychological dimensions of obesity.

CONCLUSION: This review highlights the relevance of the Ayurvedic concepts of Meda Dhatu and Medovaha Srotas in understanding obesity as a complex metabolic disorder. Ayurveda views Sthoulya as a consequence of impaired metabolic regulation rather than mere excess fat accumulation, emphasizing the role of disturbed Agni, faulty tissue metabolism, and obstruction of metabolic channels. This perspective offers a broader understanding of obesity that extends beyond caloric imbalance.

The correlation of Medovaha Srotas with modern lipid transport and metabolic pathways underscores the scientific depth of Ayurvedic anatomy and physiology. The identification of specific Moola Sthanas provides insight into regional fat deposition and metabolic vulnerability, which aligns with current clinical observations related to central obesity and metabolic risk. Similarly, the functional classification of Meda reflects a dynamic system involved in energy regulation and tissue nourishment.

By integrating classical Ayurvedic principles with contemporary biomedical knowledge, this study supports a unified approach to obesity that recognizes both physiological and behavioral determinants. The Ayurvedic emphasis on dietary discipline, lifestyle modification, metabolic correction, and purification therapies offers a preventive and therapeutic model that is holistic and sustainable. Such an integrative framework is particularly valuable in addressing obesity as a long-term lifestyle disorder and reinforces the continued relevance of Ayurveda in modern metabolic health management.

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