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Majja–Shukra Axis in Obesity-Associated Male Infertility and MOSH: An Ayurvedic Guna-Dhatvagni Perspective

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ABSTRACT:

The Global pandemic of Obesity has reached alarming proportions worldwide and in India is escalating at a sharp rate. According to NFHS-5(2019-2021), the surge accounts to 91% in adult women and 146% in adult men indicating a nationwide metabolic crisis, synergistic with rising male infertility and male obesity-associated secondary hypogonadism(MOSH). Obese men are also 30% more prone to infertility rather than normal adult. Acharya Charaka has also mentioned that people suffering from *Atisthoulya* are also at a risk of various threatening conditions like *Ayushohrasa* (depleting nourishment towards Meda and subsequent dhatus leading to diseases from *Asthi Kshaya-Majja Kshaya-Shukra Kshaya*) and *Kricchavyavayata* (Altered sperm quantity-quality and synthesis of sex hormones). The Modern correlates- bone marrow adiposity, hematopoietic niche disruption, HPG axis suppression, and MOSH—manifest as *Shukra Kshaya* (oligozoospermia, asthenozoospermia, hypogonadism), fulfil the above mentioned after effects of *Atisthoulya*. This conceptual study dwells on the *guna*-driven pathology wherein *Guru-Snigdha-Madhura-Sheeta guna* dominance in *Ahara-Vihara* leading to vitiation of Jatharagni and Strotorodha which infiltrates the neuroendocrine structures(*Majja Dhatu*). This pathogenic overload compromises *Dhatvagni* sequentially and ultimately starving *Shukra Dhatvagni* producing infertility. This study thoroughly reviews the *guna*-driven pathology as well as *guna*-mediated intervention counteracting the pathology and normalizing the *Majja-Shukra-MOSH* axis. Its high time to prepare a precise Ayurvedic strategy for India's Obesity-MOSH-infertility triad.

Index Terms - Gurvadi Guna, Dhatvagni Vaishamya, MOSH, Majja-Shukra axis.

I. INTRODUCTION

India, a diverse country is undergoing a quick epidemiological transition from underweight to overweight population. This growth is equally proportionate across genders and parallelly has a substantial role in increasing population of metabolic syndrome and infertility. It is clearly evident that among infertile-couple male factors such MOSH and poor semen parameters are documented as the key contributors (20-50%) of this stressful health condition.¹ MOSH is recognized as an entity characterized by low testosterone levels, suppressed HPG axis, and impaired spermatogenesis in obese men. Male-factor infertility accounts for 40–50% of all cases of infertility in India, according to the Indian Society of Assisted Reproduction. This highlights the clinical relevance of the obesity–MOSH–infertility trio in the contemporary environmental and lifestyle context as well as demographic shifts. Obesity and high-fat diets cause a significant increase in bone marrow adipose tissue (BMAT), which results in a low-grade, chronic inflammatory state inside the marrow niche and changes in hematopoiesis and stromal cell function, according to experimental and clinical research. The idea that BMAT is an inert "space-filling fat" is further refuted by new research, which describes marrow adipocytes as active endocrine and paracrine cells that can secrete adipokines and cytokines that affect hypothalamic-pituitary-gonadal axis, regulate systemic metabolism, and influence both local and systemic immune responses.² Hypothalamic-pituitary-gonadal (HPG) signalling can be disrupted by metabolic and inflammatory abnormalities in the bone marrow and neuroendocrine axis, resulting in secondary hypogonadism with low testosterone and decreased gonadotropin drive. Such a modified marrow ecosystem also compromises germ cell regeneration and testicular/ovarian function by impairing stem-cell-mediated support to gonads. When combined, these alterations result in worse reproductive outcomes, such as decreased fecundity, lower sperm quality, and increased rates of clinical infertility.³ According to Ayurvedic texts, *Aharatmak Nidana* such as persistent *Guru-Snigdha-Sheeta Guna & Madhur* Dominant diet, and *Viharatmak Nidana* such as *Diwaswapa* and *Avyayama* are the causes *Sthoulya* (Obesity). The *Aharatmak Nidanas (Gunas)* vitiate Kapha, weaken *Jatharagni*, and produce *Ama*, which ultimately disrupts *Dhatvagni* at various tissue levels and *Viharatmak Nidanas* cause *Strotorodha* leading to malnourishment of subsequent *Dhatus*, particularly *Asthi*, *Majja*, and *Shukra*, leading to complications in *Atisthula* individuals such as *Ayusha Hrasa*, *Asthi–Majja–Shukra Kshaya*, and *Kricchavyavayata*.⁴ According to this perspective, metabolic and inflammatory abnormalities at the *Majja* (marrow/neuroendocrine) level are not isolated occurrences; rather, they represent *Majjagni Vaishamya*, which interferes with the normal *Dhatu Poshan Nyaya*, weakening *Shukra Dhatvagni* and increasing the risk of secondary hypogonadism, suboptimal gametogenesis, and ultimately worse reproductive outcomes.

There have been fewer researches exploring the downstream impact of *Sthoulya* (Obesity) on the *Majja-Shukra* axis leading to the most discussed problem in recent era i.e. infertility. Modern Researches also lack an marrow-reproductive framework resonating with *Dhatu Poshan Nyaya*. By combining *Gurvadi Guna Samprapti*, *Dhatvagni* theory, and modern metabolic-reproductive science, this conceptual study creates a *Guna-centric Majja–Shukra–MOSH* model that reframes obesity as a *Meda–Majja–Shukra* continuum and proposes specific *Guna-based* therapeutic approaches.

II. AIM & OBJECTIVES

To develop an Ayurvedic conceptual framework linking *Sthoulya*, *Gurvadi Guna*, *Dhatvagni Vaishamya*, and the *Majja–Shukra* axis with obesity-associated male infertility and male obesity-associated secondary hypogonadism (MOSH).

III. MATERIALS AND METHODS

This conceptual review employed textual research methodology, carefully analysing both contemporary biomedical evidence (PubMed, Scopus 2014–2025) and traditional Ayurvedic literature (*Brihatrayi* with commentaries) to create a *Guna-centric Majja–Shukra* axis model for obesity-associated MOSH and male-infertility. The methodology included conceptual mapping using *Dhatu Poshan Nyaya*, a critical textual study of *Sthoulya Samprapti*, and a literature synthesis connecting *Gurvadi Guna* dominance to marrow-reproductive dysfunction.

IV. CONCEPTUAL FRAMEWORK FOR THE STHOULYA-MEDIATED MALE INFERTILITY MEDA DHATU

Acharyas have mentioned *Meda Dhatu* as one of the seven *Dhatus* explained in texts. Being 4th in the sequence, it is formed when balanced *Mamsa Dhatvagni* acts on *Poshak Mamsa*. The *Meda* thus formed is further subjected to metabolism by *Meda Dhatvagni* dividing itself into *Poshya* and *Poshak Meda*. The basic function is *Lepana karma* (i.e. providing lubrication and insulating the tissues and organs). Comparing it to contemporary science, it can be correlated to adipose tissue (white adipose tissue in subcutaneous and visceral depots—serving energy storage, insulation, and endocrine functions via adipokines). Excess of *Meda Dhatu* leads to drooping of fat predominant structures, fatigue, increased breathing etc.^{5 6} Excess adipose tissue leads to obesity mirroring the *Meda Dhatvagni* dysfunction.

MAJJA DHATU

It is the sixth in the sequence of the seven *Dhatus*, defined as soft, unctuous substance filling the bone cavities providing strength (*bala*), lubrication (*Snehana*), and specifically nourishing *Shukra Dhatu*. It can also be correlated with *Mastulunga* which is brain tissue. It is formed from *Asthi Dhatu* when *Majja Dhatvagni* acts upon the precursor *Dhatu*. This maps to bone marrow (hematopoietic/mesenchymal stem cell niche) and neuroendocrine structures (pituitary, hypothalamus), where marrow adipocytes/stromal cells regulate immunity and HPG axis signalling. *Majja Kshaya* manifests as giddiness, bone pain, and infertility.

SHUKRA DHATU

The culminating dhatu which is omnipresent in the body like ghee pervades in milk. Nourished solely by *Majja's poshak ansha*, *Shukra Dhatvagni* produces reproductive essence responsible for procreation, strength, and pleasure. *Shukra* is described as pervading the body through pores in *Asthidhatu* due to the influence of *Akash* and *Vayu*, like water seeping from a fresh clay pot.⁷ Similarly, during embryonic development, germ cells migrate to the testis and settle on its inner surface as spermatogonia. These cells later proliferate at puberty and differentiate into sperm. *Shukra Kshaya* leads to *Klaibhya*, Debility, delayed ejaculation and scanty semen.

PATHOPHYSIOLOGY OF MALE-OBESITY ASSOCIATED SECONDARY HYPOGONADISM(MOSH)

The vicious cycle of obesity is explained by the hypogonadal-obesity-adipocytokine hypothesis: increased adipose tissue overexpresses aromatase, which converts testosterone to estrogen, suppresses the HPG axis by negative feedback, and prevents compensatory LH/FSH surge. While testosterone shortage encourages adipogenesis over myogenesis, the testosterone-oestradiol shunt and adipocyte hypertrophy worsen fat storage (lipoprotein lipase, lipolysis via β -adrenoreceptor downregulation). Systemic inflammation and metabolic instability are caused by proinflammatory cytokines (leptin, TNF- α , IL-6, and adiponectin) from defective adipocytes that cause insulin resistance and further inhibit HPG through poor kisspeptin-GnRH signalling.⁸

Acharya Charaka in *Sutrasthana* defines *Sthoulya* as a pendulous build-up of *Meda* and *Mamsa* in the breasts, hips, and abdomen together with decreased vigor and metabolism.⁹ *Atisampurana* (overeating), *Ati Guru-Snigdha-Sheeta-Madhura sevana*, *Divaswapna*, and *Avyayama* are examples of primary *Nidana*, which aggravates *Kapha*, weakens *Jatharagni*, produces *Ama*, and causes *Medovaha-Mamsavaha Srotorodha*. The *Aharatmak Nidanas* like *Guru-Snigdha-Sheeta* and *Madhura* predominant *Dravyas* possessing similar properties to *Meda Dhatu* establish *Guna Samanya Siddhant*, promoting excess *Meda* formation and *Viharatmak Nidana* (*Diwaswapa* and *Avyayama*) lead to obstruction of *Strotas* starving the subsequent *Dhatus* by causing *Dhatvagni-Mandya*. As described above that all the *Dhatus* (functional units of the body) are formed by the concept of *Dhatu Poshan Nyayas* sequentially which represents their quality and quantity. Therefore, any qualitative or quantitative defect at the *Meda–Asthi–Majja* level necessarily compromises *Shukra* formation. Building upon this mechanism of *Dhatu Poshan Nyayas*, a precise Ayurvedic framework

to interpret the interconnected metabolic, endocrine, and reproductive disturbances seen in the hypogonadal–obesity–adipocytokine hypothesis can be formed.

Excessive obesity is correlated with excess *Meda* created by *Guru-Snigdha-Sheeta* dominance; the disrupted *Medo Dhatvagni* produces inflammatory metabolites and toxic *Ama*-like adipocytokines that vitiate the *Majjavaha Strotas*. The increased inflammatory cytokines and aromatase activity seen in MOSH are similar to *Meda Dushti*, which prevents *Majja Dhatu*—associated with bone marrow and neuroendocrine tissue—from receiving nourishment, hence impeding its regulating function in hormonal secretion and gametogenic signalling. This causes *Majjagni* function to be disrupted, which results in hormonal inefficiency similar to the pituitary and gonadal suppression seen in obesity-induced hypogonadism. Defective *Meda*-derived *Ahara rasa*, according to *Kedari Kulya Nyaya*, cannot adequately irrigate later *dhatu*s, resulting in *Majja Kshaya* and weakening *Shukra Dhatvagni*. The result is similar to current findings: subfertility, reduced spermatogenesis, and decreased testosterone synthesis.

Apart from this, *Acharya Charaka* has stated some threatening conditions related to *Atisthula Purusha* in which *Ayushohrasa* and *Kricchavyavayata* are important here.

Ayushohrasa or a lack of lifespan could be understood in a way that by over-nourishment of *Meda Dhatu* the other *dhatu*s are left starving, causing a number of diseases associated with *Asthi kshaya*, *Majja kshaya*, and *Shukra kshaya* to appear. *Kricchavyavayata*, which denotes trouble engaging in sexual activity as well as changes in the quantity and quality of sperm and the production of sex hormones.

IV. DISCUSSION

Around the world, couples' inability to conceive is upsetting. The WHO reports that 17.5% of couples globally suffer from this concerning circumstance, which highlights the pressing need to provide high-quality, accessible, and reasonably priced treatment in this world of subpar care.¹⁰ Data from the Global Burden of Disease 2021 shows that DALYs from male infertility rose by 17.79%, and that male factors alone account for an estimated 20% to 30% of infertility cases. One of the main causes of male infertility include hypogonadism, obesity, and elevated BMI.¹¹ Ayurveda, the age-old wisdom encompasses a holistic approach towards management of infertility which include tailored treatment for each individual. Ayurveda treatment includes *Shodhana*(purification) and *Shamana*(pacification) *chikitsa* which are useful in clearing clogged channels(*Strotas*), pacifying imbalanced *dosha-dushya* and facilitating optimum functioning of affected *dhatu*s(*Meda-Majja-Shukra*). With remarkable conceptual congruence, the suggested *Majja–Shukra–MOSH* axis skilfully connects traditional Ayurvedic pathophysiology with modern endocrinology. Similar to how obesity causes bone marrow adiposity and inflammatory niche disruption, *Guru-Snigdha* dominance in *Sthoulya* yields *Meda dushti* and *Ama-padartha*(for example, adipocytokines) that vitiate *Majjavaha Strotas*. *Majjagni Vaishamya* precisely corresponds to the hypogonadal-obesity-adipocytokine hypothesis, where kisspeptin-GnRH signalling is suppressed by aromatase excess, leptin resistance, and proinflammatory cytokines (TNF- α , IL-6). *Majjagni Vaishamya* manifests as marrow stem cell impairment and HPG suppression. The complications arising from *Atisthoulya* are precisely explained by the *Dhatu Poshan Nyaya's Kedari Kulya* mechanism, which explains why deficient *Meda*-derived *Ahara Rasa* starves *Majja* and *Shukra*, resulting in *Ayushohrasa* (oligozoospermia) and *Kricchavyavayata*. This cohesive approach reframes obesity as a series of *dhatu* cascades leading to reproductive failure rather than as a single *Meda* disease. The interventional framework of Ayurveda mainly focuses on *Guna-Vishehsa Siddhanta* wherein, *Laghu-Ruksha-Ushna-Teekshna guna* predominant *Ahara* and *Aushadha Dravyas* counters *Vata* and *Kapha Dosha* as well as correcting *Meda Dushti*.¹² The line of treatment could be framed in the following sequence:

Initially, *Agnimandya* and *Ama* should be corrected by *Deepana-Pachana chikitsa* which involves use of *Laghu* and *Ushna guna*. Then the *Udvartana chikitsa* can be clicked in which is *Medohara* in nature (*Ruksha guna Pradhana*).

Later the, *Basti Chikitsa* which is best *Vatanulomaka* can be implied. *Lekhana Basti* and *Vrushya Basti* improve the *Meda-Majja-Shukra* axis restoring *Dhatvagni* and nourishing the *dhatu*s. Later, *Shamana Chikitsa* and *Rasayana chikitsa* should be used to normalise the axis and prevent recurrence.

This tailored-treatment regime is best suited to current obesity-infertility epidemic which is cost-effective and reliable. Ayurveda in recent years has shown quite effective results in infertility cases due to its holistic approach.

V. CONCLUSION

This conceptual work demonstrates that male obesity is a multi-layered disorder that eventually affects *Majja* and *Shukra* and manifests clinically as infertility and MOSH. When current data on bone marrow adiposity, HPG-axis suppression, and poor semen parameters are compared to *Charaka's* descriptions of *Ayushohrasa*, *Asthi-Majja-Shukra Kshaya*, and *Kricchavyavayata*, it becomes clear that both knowledge systems—although in different languages—are discussing the same axis of breakdown. The research explains why so many obese men appear with poor energy, metabolic disruption, and reduced fertility in the clinics/hospitals, at the same time by framing this model as a *Majja-Shukra* axis controlled by *Gurvadi Guna* and *Dhatvagni*. Additionally, it suggests that treatment should not be fragmented—diet for weight, hormones for testosterone, procedures for fertility—but rather should focus on correcting the underlying *Guna* imbalance and sequential *dhatu* nourishment using carefully selected *Vajikarana-Rasayana* support for *Majja-Shukra* axis and *Guna Pratikatmak Chikitsa* which involves use of *Laghu-Rūksha-Ushna* measures for *Meda*. This theoretical framework encourages indigenous researchers and clinicians to see obesity-related hypogonadism as a disordered tissue-nourishment tale that can be traced and treated from *Meda* to *Shukra*, rather than just as a biochemical deficiency. Additionally, it creates useful opportunities for integrative study, such as developing research in which contemporary metabolic and endocrine markers are assessed alongside traditional Ayurveda protocols (*Dhatvagni* correction and *Guna Pradhan Chikitsa*) with the same objective of restoring fertility and health in a society where both are under threat.

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