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IMPACT OF LIFESTYLE FACTORS ON REPRODUCTIVE PHYSIOLOGY: AN INTEGRATIVE REVIEW FROM AN AYURVEDIC AND MODERN PERSPECTIVE

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ABSTRACT

Reproductive physiology is governed by complex neuroendocrine, metabolic, and cellular mechanisms. Increasing prevalence of infertility among young adults has been strongly associated with modifiable lifestyle factors such as diet, sleep disturbances, stress, smoking, alcohol consumption, and physical inactivity. These factors disrupt the hypothalamic–pituitary–gonadal (HPG) axis, alter hormonal homeostasis, increase oxidative stress, and impair metabolic function. In Ayurveda, reproductive function is dependent on the proper formation and nourishment of Shukra Dhatu, governed by Agni, Dhatu Poshana and balanced Doshas. Disturbance in lifestyle (Mithya Ahara-Vihara) leads to impairment of these physiological processes. This review aims to analyze the impact of lifestyle factors on reproductive physiology from both contemporary and Ayurvedic perspectives, highlighting the role of Dinacharya, Agni, and Ojas in maintaining reproductive health. Adoption of a holistic lifestyle approach may improve reproductive outcomes, particularly in the context of modern fertility challenges.

KEYWORDS: Reproductive physiology, Kriya Sharir, Lifestyle factors, Shukra Dhatu, Agni, Infertility.

INTRODUCTION

Infertility is a global health concern, increasingly affecting individuals in the reproductive age group. While structural and pathological causes are well recognized, lifestyle-related factors have gained prominence as major modifiable determinants of reproductive dysfunction. Normal reproductive function relies on coordinated activity of the hypothalamic–pituitary–gonadal axis along with metabolic balance, oxidative homeostasis, and synchronized circadian rhythms.

Modern lifestyle practices, including irregular dietary habits, reduced physical activity, psychological stress, disturbed sleep cycles, and substance exposure, adversely influence these regulatory mechanisms. These factors contribute to endocrine imbalance, impaired gametogenesis, and reduced fertility potential.

In Ayurveda, functional dynamics of the body are described under Kriya Sharir. Reproductive capability is attributed to the proper development of Shukra Dhatu, which is formed through sequential nourishment of tissues known as Dhatu Poshana Krama. his process is governed by Agni and influenced by the balance of Doshas. Improper lifestyle practices (Mithya Ahara and Vihara) lead to Agni Dushti, Dosha Vitiation, and depletion of Shukra Dhatu, ultimately resulting in infertility (Vandhyatva). This review seeks to correlate these traditional concepts with modern physiological understanding to provide a comprehensive view of lifestyle-related reproductive dysfunction.

MATERIALS AND METHODS

A review of literature was conducted using classical Ayurvedic texts and contemporary biomedical sources. Relevant articles were identified from databases such as PubMed and Google Scholar using keywords including reproductive physiology, lifestyle factors, infertility, oxidative stress, endocrine regulation, and Ayurveda. Classical references describing Kriya Sharir, Dinacharya, Agni, and Shukra Dhatu were reviewed from authoritative Ayurvedic texts. The collected data were analyzed and synthesized to establish correlations between lifestyle factors and reproductive physiology from both modern and Ayurvedic perspectives.

RESULTS

Analysis of the reviewed literature states that lifestyle factors influence reproductive physiology through specific neuroendocrine, metabolic, and cellular pathways.

1. Dietary Imbalance and Metabolic Dysfunction

Irregular dietary habits, processed food intake, and nutritional deficiencies contribute to metabolic disturbances such as insulin resistance and altered leptin signaling. These changes disrupt hypothalamic regulation of gonadotropin-releasing hormone (GnRH), leading to impaired secretion of luteinizing hormone (LH) and follicle-stimulating hormone (FSH), thereby affecting folliculogenesis and spermatogenesis.

From an Ayurvedic perspective, improper diet leads to Agni dushti and formation of Ama, which interferes with Dhatu Poshana and results in inadequate nourishment of Shukra Dhatu, ultimately impairing reproductive function.

2. Sleep Disturbance and Circadian Disruption

Sleep plays a crucial role in maintaining circadian rhythm and regulating neuroendocrine function, including reproductive hormone secretion. Disruption of sleep patterns, particularly Ratri Jagaran and irregular sleep timing, alters the hypothalamic–pituitary–gonadal (HPG) axis, leading to disturbed GnRH secretion and subsequent changes in LH and FSH secretion.

Melatonin, regulated by the light–dark cycle, modulates GnRH activity and protects gametes from oxidative stress. Its disruption can impair ovarian function, follicular development, and spermatogenesis.

In Ayurveda, disturbance of Dincharya, including improper sleep and wake patterns, leads to Vata and Pitta aggravation in Ratri Jagaran and Kapha imbalance in Diwaswapna. These changes impair Agni and promote Ama formation, disrupting Dhatu Poshana and ultimately affecting Shukra Dhatu.

3. Psychological Stress and Neuroendocrine Imbalance

Chronic stress activates the hypothalamic–pituitary–adrenal (HPA) axis, leading to elevated cortisol levels. Increased cortisol suppresses hypothalamic GnRH secretion, resulting in decreased LH and FSH levels. This suppressive effect impairs ovulation and spermatogenesis.

In Ayurveda, stress is associated with aggravation of Vata Dosha, which governs movement and regulation. Vata vitiation disrupts normal physiological coordination, including reproductive function, leading to conditions such as Vandhyatva.

4. Physical Inactivity and Hormonal Dysregulation

Sedentary lifestyle contributes to obesity and metabolic syndrome, which are associated with altered levels of insulin, androgens, and adipokines. These changes disrupt ovarian function and impair spermatogenesis through endocrine imbalance.

From an Ayurvedic standpoint, lack of physical activity leads to stagnation in metabolic processes, contributing to Kapha aggravation and impaired Agni, ultimately affecting tissue nourishment and reproductive health.

5. Smoking and Alcohol-Induced Oxidative Stress

Smoking and alcohol consumption increase the production of reactive oxygen species (ROS), leading to oxidative damage of reproductive tissues. This affects sperm motility, DNA integrity, and oocyte quality.

In Ayurveda, this condition can be correlated with depletion of Ojas, which represents vitality and resistance. Loss of Ojas weakens reproductive strength and reduces overall physiological resilience.

DISCUSSION

1. Role of Agni and Dhatu Poshana in Reproductive Physiology

In Ayurveda, Agni is considered the central factor responsible for digestion, absorption, and transformation of nutrients at both systemic (Jatharagni) and tissue (Dhatvagni) levels. Proper functioning of Agni ensures the sequential nourishment of tissues through the process of Dhatu Poshana Krama, ultimately leading to the formation of Shukra Dhatu, which is essential for reproduction.

The process begins with digestion of food into Ahara Rasa, which nourishes Rasa Dhatu. Subsequently, through the action of respective Dhatvagni, each Dhatu is formed in sequence: Rasa → Rakta → Mamsa → Meda → Asthi → Majja → Shukra.

Any disturbance in Agni leads to incomplete digestion and formation of Ama, which interferes with nutrient assimilation and disrupts tissue formation. As Shukra Dhatu is the final and most refined tissue, it is particularly susceptible to deficiencies arising from impaired upstream processes.

From a physiological perspective, this sequential tissue nourishment can be correlated with

metabolic processing, nutrient distribution, and cellular differentiation. Disturbances in metabolism, such as insulin resistance or micronutrient deficiencies, may impair this cascade, ultimately affecting reproductive cell development and function.

Improper diet leads to Agni dushti, resulting in incomplete transformation of nutrients and formation of Ama. This disturbs Dhatu Poshana Krama, ultimately leading to inadequate nourishment of Shukra Dhatu, thereby impairing reproductive capacity.

2. Sleep Disturbance and Reproductive Health

Circadian rhythm represents an intrinsic biological clock that synchronizes physiological processes with environmental light–dark cycles. Proper alignment of this rhythm is essential for maintaining hormonal balance, particularly in reproductive physiology. Sleep deprivation and irregular sleep patterns disrupt this synchrony, leading to altered secretion of melatonin and cortisol, both of which influence reproductive hormone regulation.

Late-night wakefulness (Ratri Jagaran) leads to increased sympathetic activity and stress hormone release, which may suppress hypothalamic signaling and affect downstream gonadotropin secretion and reproductive function. Daytime sleep (Diwaswapna), on the other hand, disturbs metabolic balance and may contribute to impaired glucose metabolism and hormonal dysregulation.

In Ayurveda, adherence to Dinacharya, including waking during Brahma Muhurta (early morning period before sunrise) and timely sleep, is considered essential for maintaining physiological balance. Ratri Jagaran leads to aggravation of Vata and Pitta Dosha, causing functional disturbances in the body. Conversely, Diwaswapna (daytime sleep), especially when inappropriate, contributes to Kapha aggravation and metabolic sluggishness.

These disturbances affect Agni, leading to improper digestion and formation of Ama, which interferes with Dhatu Poshana. Over time, this results in inadequate nourishment of Shukra Dhatu, thereby impairing reproductive function. Thus, disruption of circadian rhythm can be understood as both a neuroendocrine imbalance and a disturbance in Dosha and Dhatu equilibrium. Sleeping early and maintaining regular sleep–wake cycles help preserve Dosha balance and support optimal functioning of Agni. Since Shukra Dhatu is the final and most refined tissue, it is highly sensitive to chronic disturbances in metabolism and daily routine. Persistent disruption of circadian rhythm may therefore lead to gradual depletion of Shukra,

affecting reproductive capacity.

3. Psychological Stress and reproductive function

Psychological stress is a significant modulator of reproductive physiology, primarily through its effects on neuroendocrine regulation. Activation of the hypothalamic–pituitary–adrenal (HPA) axis during chronic stress leads to increased secretion of cortisol, which exerts an inhibitory effect on hypothalamic gonadotropin-releasing hormone (GnRH) release. This results in reduced secretion of luteinizing hormone (LH) and follicle-stimulating hormone (FSH), ultimately impairing ovulation in females and spermatogenesis in males. Prolonged stress may also contribute to increased oxidative stress and altered metabolic function, further compromising reproductive health.

From an Ayurvedic perspective, psychological stress is closely associated with aggravation of Vata Dosha, particularly Prana and Vyana Vata, which are responsible for regulation and coordination of physiological processes.

Chronic stress also impairs Agni, leading to irregular digestion and the formation of Ama, which obstructs normal physiological channels (Srotas). This interference affects the process of Dhatu Poshana which may manifest as Shukra Kshaya, which can be correlated with reduced gamete quality, hormonal imbalance, and decreased reproductive potential.

Furthermore, sustained Vata aggravation may accelerate tissue depletion due to its Ruksha (dry) and Chala (mobile) properties, leading to progressive weakening of bodily tissues. This aligns with the concept of reduced physiological resilience seen in chronic stress states. The associated depletion of Ojas, which represents vitality and systemic strength, further compromises reproductive capacity.

Addressing stress through lifestyle regulation and appropriate interventions is therefore essential for maintaining hormonal balance, tissue integrity, and overall reproductive health.

4. Physical Inactivity and Hormonal Dysregulation

Sedentary lifestyle is closely associated with obesity, insulin resistance, and altered adipokine secretion. These metabolic disturbances interfere with the hypothalamic–pituitary–gonadal (HPG) axis. In females, this may manifest as anovulation and hormonal imbalance, while in males it contributes to reduced spermatogenesis and compromised semen quality. In addition to endocrine effects, physical inactivity promotes a pro-inflammatory state and increases

oxidative stress, both of which can negatively affect gamete integrity and reproductive function.

From an Ayurvedic perspective, lack of physical activity (Avyayama) leads to aggravation of Kapha Dosha and accumulation of Meda Dhatu. The increase in Kapha results in heaviness, sluggishness, and reduced metabolic efficiency, which can be correlated with decreased cellular activity and impaired endocrine responsiveness. Simultaneously, excessive Meda interferes with the proper functioning of Agni, leading to Mandagni (reduced digestive and metabolic capacity). Impaired Agni results in incomplete transformation of nutrients and formation of Ama, which obstructs physiological channels (Srotas). This disruption affects the process of Dhatu Poshana, leading to improper nourishment of successive tissues. As a result, Shukra Dhatu formation is compromised, affecting reproductive capacity.

Furthermore, excessive accumulation of Meda may create a state of metabolic imbalance that parallels conditions such as obesity-related infertility described in modern physiology.

Thus, physical inactivity contributes to reproductive dysfunction through both metabolic-endocrine disturbances and Ayurvedic mechanisms involving Kapha aggravation, Meda vriddhi, and Agni impairment. Regular physical activity (Vyayama) helps restore Agni, balance Doshas, and support proper Dhatu formation, thereby enhancing reproductive health.

5. Smoking and Alcohol-Induced Oxidative Stress

Smoking and alcohol consumption are well-established factors adversely affecting reproductive physiology through oxidative stress, endocrine disruption, and direct cellular toxicity. Exposure to toxic substances damage cellular structures, including lipids, proteins, and DNA. In the reproductive system, this manifests as impaired spermatogenesis, reduced sperm motility, and compromised oocyte quality. Additionally, these substances alter hormonal balance further impairing reproductive function.

From an Ayurvedic perspective, smoking and alcohol consumption lead to Dhatu Kshaya (progressive depletion of body tissues). These habits predominantly aggravate Pitta and Vata Dosha. Pitta aggravation leads to increased internal heat and metabolic instability, while Vata aggravation contributes to tissue depletion and functional irregularity.

Chronic exposure to these factors impairs Agni, leading to the formation of Ama and vitiation of Rasa and Rakta Dhatu. Since Dhatu Poshana occurs sequentially, disturbances at these

initial levels adversely affect the formation of subsequent tissues. As a result, the quality and quantity of Shukra are compromised, leading to reduced reproductive potential.

Oja represents vitality, immunity, and overall physiological resilience. Smoking and alcohol consumption are known to cause Ojas Kshaya, resulting in decreased strength, reduced tissue integrity, and impaired reproductive capacity.

Furthermore, the drying (Ruksha) and depleting (Kshaya Kara) nature of these substances contributes to progressive weakening of tissues, particularly affecting Shukra Dhatu, which is inherently delicate and requires optimal nourishment. This aligns with findings of reduced sperm quality, DNA damage, and hormonal imbalance in individuals exposed to chronic toxins.

Thus, smoking and alcohol consumption impair reproductive physiology through oxidative stress and endocrine disruption, while in Ayurveda, they lead to Dosha imbalance, Agni impairment, Dhatu Kshaya, and Ojas depletion. Avoidance of such factors and adoption of a balanced lifestyle are essential for preserving reproductive health.

CONCLUSION

Reproductive physiology is highly sensitive to lifestyle-related influences that act through interconnected neuroendocrine, metabolic, and cellular pathways. Disturbances in diet, sleep patterns, psychological stress, physical inactivity, and substance use can collectively impair hormonal regulation and gamete quality. Ayurvedic principles explain these changes through Agni dushti, Dosha imbalance, and disruption of Dhatu Poshana, ultimately affecting Shukra Dhatu. An integrative approach combining lifestyle modification with Ayurvedic principles such as Dinacharya offers a practical and preventive strategy for maintaining reproductive health and improving fertility outcomes.

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