A CONCEPTUAL STUDY TO UNDERSTAND THE PHYSIOLOGICAL PERSPECTIVE OF SHUKRA DHATU

Resmy Raj. A1, Chitra. M. Gawande2

1Assistant Professor, Dept of Kriya Shareera, SDM Institute of Ayurveda and Hospital, Bangalore, Karnataka, India
2Professor, Dept of Kriya Shareera, SDM Institute of Ayurveda and Hospital, Bangalore, Karnataka, India

Email: resmyrajayu12323@gmail.com

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ABSTRACT

Ayurveda is the ‘Science of Life’ and its aim is to maintain healthy status of healthy living being, i.e. prevention and treatment of disease. As per Ayurvedic Science, Purusha consists of three Dosha, seven Dhatu and three Ma-la which are the primary basis of living body. Dhatu are those which give support and strength to the body. Shukra is the seventh Dhatu, which is responsible for all systemic body activities including metabolic functions and performs specific functions of reproduction. According to Acharya Vagbhatta and Charaka, Shukra is one which responsible for the process of Garbhottpadana (reproduction). According to Susrutha, Shukra provides courage, nourishment, happiness, strength and production of offspring. Main objective of this study is to review the conceptual facts of Shukra Dhatu from different classical Ayurveda texts and to analyse the physiological perspective about the same. In this article, the classical references related to Shukra Dhatu is collected and tried to correlate the concept with modern physiological entities. From the available references in the Samhitas, Shukra Dhatu can be better co related to sperm along with semen, sex hormones (oestrogen, androgen etc.), and sex chromosome.

Keywords: Shukra Dhatu, Sthree Shukra, semen, sex chromosome, sex hormone, Shukradhara kala
INTRODUCTION

Ayurveda is the ‘Science of Life’ and its aim is to maintain healthy status of healthy living being, i.e. prevention and treatment of disease. As per Ayurvedic Science, Purusha consists of three Dosha, seven Dhatu and three Mala which are the primary basis of living body. Dosha, Dhatu and Mala are considered as roots of living body because as roots maintains the life of plant, these three factors also sustains the life of human. Among all seven Dhatu, Shukra Dhatu is considered as the best. Shukra Dhatu is the one which is highly involved in reproductive functions of the body (Garbhotpadana). Every cell in the body is involved in reproduction by mitosis and meiosis; hence the presence of Shukra Dhatu throughout the body gets identified. Main objective of this study is to review the conceptual facts of Shukra Dhatu from different classical Ayurveda texts and to analyse the physiological perspective about the same.

Aim and Objectives

To compile description of Shukra Dhatu as explained in different classical Ayurveda texts.

To review the concept of Shukra Dhatu with specific reference to sex hormones, semen, sex chromosome.

Materials and Methods

Literary materials were collected from all Ayurveda classical texts (Charaka Samhita, Sushruta Samhita Astanga Hridaya, Astanga Sangraha) and commentaries. Modern books of physiology were also reviewed to collect the data. Classical data collected were compared and analysed with modern scientific knowledge. The term Shukra is derived from the Sanskrit root word Shucha+Klede, which means purity. The term has other meanings like bright, resplendent, and white. Shukra Dhatu is the seventh Dhatu and Teja, Reta, Veeryam, are synonyms of Shukra Dhatu. Shukra is Soumya which is derived from Jalamabhuta. It is the product of four proto elements Vayu, Agni, Aapa and Prithvi with all six rasa.

Functions of Shukra Dhatu

Shukra is a factor which is responsible for Garbhotpadana (Production of off springs). It gives Dhairyam (Courage), Chyavanam (ejaculation), Preeti (attraction or love towards opposite sex), Harsham, (pleasure, sexual excitement), Dehabalam (energetic, enthusiastic and nourishing property) also. Functions of Shukra Dhatu can be categorized as Sarvadaihika karma (systemic function) and Garbhotpadana karma (reproductive functions) mainly. Sarvadaihika karma of Shukra Dhatu includes Dhairyam and Dehabalam.

Dhairya is the control over mind, by which one does the good and avoids the bad. By this quality, one can face any difficulties without much anxiety. Acharya Dalhana describes it as the capacity to fight against any condition. Dehabalam includes both Deha Upachaya (body nourishment) as well as Utsaha (enthusiasm). Upachaya is the physical nourishment which imparts Bala to the individual. Whereas Utsaha is the physical and mental enthusiasm to perform any activity.

Garbhotpadana and Maithinagata karma includes Preeti, Harsham, Chyavanam and Beejartham. The word meaning of Chyavana is “to secrete”. According to Acharya Dalhana, Chyavana is the ejaculation of semen. Harsha in relation to sexual act may be understood as desire or exhilaration (Utkantha Jananam). Preeti is the love and affection towards opposite sex. Since cellular division and proliferation take place in entire living body, the Garbhotpadana karma of Shukra Dhatu can be included in both Sarvadaihika and Beejarthagata karma. All these functions intimate that Shukra Dhatu is not only responsible for production of progeny, but also involved in other systemic bodily functions.

Location of Shukra Dhatu

Like every other Dhatu, it is also located in the entire body. Various Acharyas have quoted different description about Shukra Dhatu Sthana as: As fragrance is not manifested in a flower bud, but the same gets exhibited once it blossoms similarly is the Shukra. In childhood Shukra is present in body in Aayaktaroopa, as puberty is achieved, functions of Shukra starts manifesting. Shukra is pervaded all over the body like juice in sugarcane, ghee in curd and oil in sesame seed. Location of Shukradhara kala is also throughout the body. The Moola sthana (source of origin) of Shukravahasrothas are testes, penis, breast and...
maja\textsuperscript{15,16,17}. These all references as cited above reveal that *Shukra Dhatu* is present generally in each and every cell and specifically in reproductive organs of the body.

**Shukra Dhatu, Shukravahasrotas in modern viewpoint**

Based on functions, *Shukra Dhatu* can be primarily understood as sex hormones and semen with sperm. Action of sex hormones can be counted for all the above metabolic functions of *Shukra Dhatu*. Beejar-thagata karma may specify semen along with sperm and it is mainly involved in reproduction.

*Shukravaha Srotas* can be understood as all micro, macro channels responsible for production, transformation and transportation of sperm. Hypothalamo hypophyseal gonadal axis involved in sex hormone production can also be taken here. Hypothalamic hypophyseal gonadal axis (HPG) directs secretion of FSH and LH. Both of these hormones are very much essential for production of sex hormone and gametogenesis. In male, *Shukravaha Srotas* correlation might be HPG axis and semen producing, transforming and transporting pathway. In female it might be the hypothalamo hypophyseal gonadal axis only, because *artavavahasrotas* are directed for the transformation and transportation of ovum.

**Formation of Shukra Dhatu and Shukradhatvagni**

*Shukra Dhatu* is formed from *Snehamsa* of maja *Dhatu*\textsuperscript{18,19}. One month is required for conversion of *Ahara Rasa* into *Shukra Dhatu*\textsuperscript{20}. By the action of *Majja Dhatu Agni* on Majjasadharmiamsa; Prasada and Kittabhaga get formed. Prasadabhaga formed as *Shoola* and *Sookshmabhaga*. *Sthoolabhaga* is Majja Dhatu and *Sookshmabhaga* is Majjaupadhatu and Shukrasadharmiamsa. Shukrasadharmiamsa is again acted upon by *Shukradhatvagni* and *sthayi Shukra Dhatu* gets formed. The unctuous portion of Majja which oozes out from *Asthi* also forms *Shukra Dhatu*\textsuperscript{21}.  

*Mastishka* (brain) is also made up of Majja Dhatu only\textsuperscript{22,23}. So, the hypothalamo hypophyseal gonadal/testicular axis and its role in regulation of spermatogenesis can be previewed, if *Mastishkamajja Dhatu* is considered in *Shukra Dhatu Utpatti*. Gonadotropin releasing hormone (GnRh) from hypothalamus initiates secretion of Follicular stimulating hormone (FSH) and Luteinizing hormone (LH) from pituitary. FSH helps to increase LH receptors on Leydig cells which are the sites of formation of testosterone. LH helps to increase secretion of testosterone which in turn promotes spermatogenesis. FSH can initiate the proliferative stage of spermatogenesis too\textsuperscript{24}. Hence *Majja* as *Mastishka Majja* involvement in *Shukra Dhatu utpatti* gets clarified.

Haematopoeisis from uncommitted pluripotent haemopoietic stem cells takes place in bone marrow also could prove the importance of *Majja Dhatu*. Here also production of new cells (*Beejartha karma of Shukra Dhatu*) is happening\textsuperscript{25}. If sex steroids including androgen are taken in the preview of *Shukra Dhatu*, it is originated from cholesterol. Cholesterol undergoes conversion to pregnenolone which converts into progesterone and 17 alphas hydroxy pregnenolone. Progesterone ultimately turns into androstenedione. 17alpha hydroxy pregnenolone converts into DHEA. DHEA is ultimately converted to form androstenedione and eventually forms testosterone\textsuperscript{26}. The importance of *Snehamsa* in production of *Shukra Dhatu* proved from the evidence that sex hormones too produced from cholesterol\textsuperscript{27}.

*Shukradhatvagni* which helps in the formation of *Shukra Dhatu* can be understood as CYP 11 A 1 enzymes,17 alpha hydroxyase,3 beta HSD 2,17 20 alpha hydroxylase which are involved in the formation of sex hormones from cholesterol. Testosterone exerts its action in tissues as DHT.5 alpha reductase (secreted from Sertoli cells) which takes part in the formation of DHT can also be included in the umbrella of *Shukra dhatvagni*\textsuperscript{28}. Oestradiol and oestrone are originated from testosterone by the action of aromatase enzyme from sertoli cells. GnRh, FSH, LH hormones which are involved in spermatogenesis and oogenesis also can be taken as *Shukradhatvagni*. *Shukradhatvagni* might comprise all the hormones and enzymes which are involved in spermatogenesis and sex hormones production.

**Existence of Shukra in childhood and Shukra abhivyakti**
According to Caraka and Susrutha, even though Shukra Dhatu is seen from the childhood, but its action is more exhibited during puberty (Vaya Parinamat) 29, 30. The spermatogenesis starts from the seventh week of intra uterine life. Amount of testosterone increases during the first three months after the birth and then fall by one year and remain low until the onset of puberty. Oogenesis takes place before birth, but the ovum is still in primary oocyte stage during puberty and further progress happens during ovulation only. Hence the importance of Vaya Parinamat may be understood as the onset of puberty. Developments of axillary and pubic hair during puberty (Romaraji Udbhavam) are also due to the effect of sex hormones. Till puberty, a slightest secretion of sex steroid hormone produces a strong negative inhibitory feedback to GnRh secretion and to testosterone. 

**Shukra Dhatu in female**

As per Susrutha and Caraka, Sthree Shukra is produced during the sexual intercourse and it is not responsible for the production of offspring31, 32. Bartholin secretion at the time of copulation can be taken as Sthree Shukra. And the same secretion is not garbhagotpadana samartha (involved in production of offspring). All the secondary sexual characters in female like development of pubic and axillary hairs etc. are due to the presence of sex hormones 33. So, Shukra-the seventh Dhatu which can be viewed as sex hormones which is helpful for the systemic body functions and takes part in the development of secondary sexual characters, and other glandular secretions like Bartholin secretion which are related to reproduction in females. In another context, it is said that predominance of Shukra can produce male progeny and predominance of artava results in female offspring34 which suggest that these two entities can also be understood as X, Y sex chromosomes. So, it can be concluded that artava may be a factor which is responsible for ovulation, menstruation and gender determination. Shukra might be the sex hormones involved in the formation of secondary sexual characters and the Bartholin secretions.

**Existence of Shukra in old age**

Function of Shukra Dhatu is progressively decreasing during oldage35. Serum free and total testosterone also progressively decreasing after 70 -80 years of age36. 

**Shudha Shukra lakshana**

As per various references, pure Shukra has the characteristic features like white crystalline colour, heavy, sweet taste, dense and has the consistency of ghee, honey and oil37,38. Madhura rasa of shudha Shukra is due to the fructose content in semen, from seminal vesicle and Ghruta makshika tailabham (consistency) might be the weak coagulum formation and its secondary liquefaction during semen ejaculation39. Sphatikabha (sankhabham, shuklam) indicates the colour of semen which is milky white due to prostatic secretion40. pH of the semen is 7.3-7.4 which is referred by the term Avidahi i.e., not causing burning sensation indicating neither acidic nor highly alkaline. Gurutvam and bahalam (heaviness) indicates the specific gravity (1.028) imparted by seminal contents. Bahu indicates the sperm content (50-200 milliom/cu mm) 41. All the above properties of shudha Shukra well match to the physical properties of seminal fluid only.

**Shukra Dhatu sara purusha lakshana**

Shukra Dhatu sara purusha lakshana includes gentle behaviour, good looking, charming, eyes with milky appearance, even and compact teeth, compact bones, charming, soothing voice and radiant complexion etc42. Excess testosterone provides aggressiveness (Asoumyatva). It is proved that androgen deficiency can cause meibomian gland dysfunction and dry eyes. The sex steroid hormonal status plays a role in the homeostasis and function of ocular surface, accomplished by estrogenic and androgenic receptors located on corneal, conjunctival epithelia and in Meibomian gland. The ocular surface dysfunction leads to unstable preocular tear film which produce dry eye43(Ksheerapoornalochana). Testosterone also provides the attraction towards opposite sex (Sreepriyopabhoga). Radiant appearance (Bhrajishnutha) in Shukra Dhatu sara purusha may be produced due to the vasodilation produced by sex hormones especially.
Testosterone can influence the bone-mineral metabolism (*Samasamhata shikhara dasana, Sama-samhatataasthi*) and also in deposition of subcutaneous fat (*Mahasphik*). Testosterone can cause the hypertrophy of laryngeal muscles and thickening of vocal cord also (*Prasannasnigdhaswara*). Testosterone can increase the quantity of melanin pigment in skin and also increases the thickness and ruggedness of skin.

**DISCUSSION**

From all the above classical references like formation, function and *Shukra Dhatu sarata*, the particular *Dhatu* can be better correlated with sex hormones. Following table illustrates the same.

<table>
<thead>
<tr>
<th>Table 1: <em>Shukra Dhatu</em> comparison with sex hormone</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Shukra Dhatu</strong></td>
</tr>
<tr>
<td><strong>Location and action</strong></td>
</tr>
<tr>
<td><strong>Shukravaha sroto moolam</strong> (Source of Origin)</td>
</tr>
<tr>
<td><strong>Formation</strong></td>
</tr>
<tr>
<td><strong>Time of manifestation of action</strong></td>
</tr>
<tr>
<td><strong>Influence on sexual drive</strong></td>
</tr>
<tr>
<td><strong>Influence of hormone on morphology</strong></td>
</tr>
</tbody>
</table>
### Effect on Muscular system

<table>
<thead>
<tr>
<th>Bones with shaft</th>
<th>Act as anabolic hormone and increase the muscle bulk. Also cause nitrogen retention in body (positive nitrogen balance). Muscle mass increases by about 50%, after puberty.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dehabalam</strong></td>
<td><strong>Dehaupacayam</strong></td>
</tr>
</tbody>
</table>

### Changes in pelvic bone

<table>
<thead>
<tr>
<th>Lengthening of pelvis</th>
<th>Funnel-like shape of pelvis.</th>
<th>Subcutaneous fat deposition in hip, breast, buttock. Broadening of pelvis with increased transverse diameter.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mahasphik</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Influence of hormone on psyche

<table>
<thead>
<tr>
<th>Aggressiveness</th>
<th>Yes</th>
<th>Empathy etc. emotions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Soumya</strong> in Shukra-Dhatu sarata, Dhairyam</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Influence of hormone on physiology

<table>
<thead>
<tr>
<th>Voice</th>
<th>Bass masculine voice</th>
<th>Hypertrophy of laryngeal muscles, Enlargement and lengthening of larynx, Thickening of vocal cords.</th>
<th>Larynx in prepubertal stage</th>
<th>High pitched voice</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Prasanna swara</strong></td>
<td><strong>Snigdha swara</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Skin</th>
<th>Thickness and ruggedness of subcutaneous tissue. Deposition of proteins in skin. Increases the quantity of melanin pigment. Enhances the secretory activity of sebaceous glands.</th>
<th>Skin becomes soft and smooth. Vascularity of skin also increases.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Prasanna varna</strong></td>
<td><strong>Snigdha varna</strong></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>BMR</th>
<th>Increases the basal metabolic rate to about 5% to 10%. Anabolic effects on protein metabolism.</th>
<th>Increases the whole-body metabolism slightly 1/3rd increase as caused by male sex hormone.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DehaUpachayam, Utsaham</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Haemopoietic system</th>
<th>Testosterone can enhance erythropoiesis. Increases the blood volume by increasing the water retention and ECF volume.</th>
<th>Vasodilation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pandutvam</strong> in Shukrakshaya.</td>
<td><strong>Bhrajishnuta in Shukra sara</strong></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Secondary sexual characters like hair growth</th>
<th>At the onset of puberty, Causes male type of hair distribution on the body. Hair growth over the pubis, along linea alba up to umbilicus, on face, chest and other parts of the body, such as back and limbs.</th>
<th>At the onset of puberty, Hair develops in the pubic region and axilla. Body hair growth is less. Scalp hair grows profusely.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Balanamapi vaya: parinamat Shukra pradurbhavanti Romarajyadayana-nareenam</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Few other references show that Shukra can also be correlated to semen along with sperm. The secretion of Shukra during the copulation (Stthree purusha samyoga) and the shudha Shukra lakshanas like the consistency of Shukra prove the same. Existence of Shukra throughout the entire body and its predomi-
nance decide the gender exemplifies that it could be sex chromosome too. Shree Shukra concept can be understood as sex hormones in female which are involved in the general metabolic functions and the Bartholin gland secretion too.

CONCLUSION

Human being has seven Dhatu. Even though all these Dhatu have specific locations in the body, but they are present in subtle form in each cell. In the same way, every cell has a part of Shukra Dhatu, as every cell is replicated by mitosis and meiosis. It can function as an anabolic hormone; along with contributes to reproduction. On broad aspect, stem cells which have the self-renewal and reproduction ability can be taken as Shukra Dhatu. Focusing on reproductive physiology, it could be sex hormones, seminal secretions along with sperm and sex chromosomes.

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