



SHUKRA IN COMPARISON WITH SPERM- A REVIEW

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ABSTRACT

Human body is made up of seven *Dhatu*s (seven categories of tissues). *Shukra Dhatu* is one among them. *Shukradhatu* is located in entire body. *Shukra* is white, pure, excellent *Dhatu* which is considered as best among all seven *Dhatu*s. Individuals having the excellence of *Shukradhatu* are shown physical & psychological characteristics. According to texts of *Ayurveda*, *Shukradhatu* is pervading all over the body. It gives courage to a person. It creates softness in the mind. It is responsible for strength of individual. In metabolism of *Shukradhatu* nutrients essential for *Shukradhatu* are digested by *Shukradhatwagni* and forms *Shukradhatu*. Vitiating of *Shukradhatu* shows *Shukradhatu dusti* (pathology) in the form of *Vridhhi* (hyper state) or *Kshaya* (waning). This vitiating may lead to mainly infertility and many other physical as well as psychological disorders. Therefore, it has a vital role in context to reproduction as well as to maintain physical and mental health. Similarly sperm is essential in the body for the continuation of biological life cycle and to produce offspring. Healthy sperm is the prime factor involved in the fertilization which is required to produce the progeny. Sperm health is historically been tied to the concept of male virility. Reduced sperm or no sperm affects the individual both physiologically and psychologically.

KEYWORDS: *Shukradhatu*, Sperm, fertilization, *shukradhatwagni*.

INTRODUCTION

According to *Ayurveda* each individual consists of three *Dosha*, seven *Dhatu* and three *Mala* which are the primary basic of living body.^[1] *Shukra Dhatu* is considered as best among all seven *Dhatu*s. *Shukra*'s word originated from '*Shucha*' *Dhatu* which means pure or excellent. *Shukra* means bright, pure and radiant. Individuals having the excellence of *Shukradhatu* are shown physical & psychological characteristics. According to texts of *Ayurveda*, *Shukradhatu* is pervading all over the body. It becomes active after the age of sixteen years, even though it is present since birth.^[2] *Shukra* is pervaded all over the sentient body such as juice in sugarcane, ghee in curd and oil in sesame seed.^[3]

Shukra is *Saumya*^[4] which is derived from *Jala Mahabhuta*.^[5] It possesses *Shadrassa*.^[6] *Shukra* is *pittrija bhava*.^[7] Quantity of the *Shukra Dhatu* is *Ardha* (½) *Anjali* in human body as per Acharya Charaka.^[8] *Shukra Dhatu* is one of *Pranayatanas of Sharira*.^[9] Nearly one month is required for metamorphosis of *Ahara Rasa* into *Shukra Dhatu*. Main function of *Shukra Dhatu* is *Garbhotpadana* (reproduction) Vitiating of *Shukradhatu*

shows *Shukradhatudusti* (pathology) in the form of *Vridhhi* (hyper state) *Kshaya* (waning). This may lead to male infertility. So it is an important entity in context to reproduction.

Shukra is the substance which is responsible for all systemic body activities including metabolic functions and part of which comes out of the body at the time of sexual act and performs specific functions of reproduction. It is the product of four proto elements, *Vayu*, *Agni*, *Aapaa* and *Prithvi* with all six *Rasa*. *Shuddha Shukra Lakshanas* resembles the physical properties of the seminal fluid. *Garbha* is formed by fusion of *Shukra* and *Artava*.^[10]

This main function of *Shukra* is attributed to spermatozoa. While enumerating *Shukra Pradoshaja Vikara*, it has been stated that, the vitiating of *Shukra* hampers one's fertilizing capacity. *Shukra* is one and ultimate *dhatu* of body. *Shukra* is produced as result of successive evaluative metamorphosis of *Ahara rasa*.

Infertility must be taken into consideration when the couple cannot achieve pregnancy after one year of

regular unprotected intercourse.^[11] Apart from anatomical reasons such as cryptorchidism and varicocele, reduced male fertility used to be associated with abnormal semen parameters, including reduced sperm count, motility, and/or abnormal sperm morphology.^[12] Among the various reasons associated with male fertility problems, the most attention is devoted to the sperm disorders. Insemination is the delivery of sperm into the female reproductive tract. Upon ejaculation men produce approximately 4 ml of semen that contains up to 600 million sperm. After coitus these sperm must then traverse the female tract to the oocyte where fertilisation can occur. Ejaculated semen contains a number of constituents, both cellular and acellular. Primarily, semen is regarded as a concentrated fluid of mature sperm. In the event of sperm DNA damage, including that acquired from oxidative stress, pregnancy failure or pathologies can ensue due to embryonic loss. Any pathology regarding sperm will eventually lead to infertility. Hence sperm plays a major role in the reproductive health of a male.

KNOWLEDGE ABOUT - SHUKRA DHATU

Embryological origin

According to *Acharya Charaka*, *Shukra* is considered as *Pitruja Bhava*.^[13]

Sperm cell -Sperm cells are the smallest human cells. They are no more than a nucleus with a small amount of cytoplasm, some mitochondria (the energy suppliers of the cell) and a long tail. They have hardly any content and are the straightest cell.

The development of sperm

From a germ, four equal sperm cells are formed by division. Around the nucleus a hard cap is formed, the acrosome (acros = top, soma = body). Then the cytoplasm is ejected and the cell gets smaller. Mitochondria move to the beginning of the tail, that becomes thicker and longer. The cells are stored for about 60 days, after which they are resorbed. If a small cloud of cytoplasm remains with the nucleus, the sperm is badly damaged and will have trouble moving forward.

Doshik configuration: *Acharya Vagbhatta* stated *Shukra* as *Ashraya Sthana of Kapha Dosha*.^[14]

Rasa of Shukra: As per *Acharya Charaka*, *Shukra Dhatu* contains all the *Shadrasa*.^[15]

Importance of Shukra: *Shukra* is one of vital spots of life: *Shukra Dhatu* is one of *Pranayatana*s of *Sharira*.^[16]

Quantity of Shukra: Quantity of *Shukra* in human body is half *Anjali*.^[17]

Sperm quantity: Over 15 million sperm per milliliter is considered normal, according to the WHO. A lower sperm count (less than 15million/ml) is considered oligozoospermia.

Sudha sukra lakshna

The semen which appears like crystal, is fluid, viscid, sweet and has the odour of honey is normal; while others regard the semen resembling oil or honey as normal.^[18]

PRODUCTION OF SHUKRA DHATU PRODUCTION OF SHUKRA FROM AHARA RASA

Beginning from *Rasa Dhatu* upto *Shukra* all the *Dhatu* are produced in a fashion of progressive evolutive metamorphosis. This means that *Rasa Dhatu* is basically produced from *Ahara Rasa* which is ingested by the action of *Jatharagni*. *Rasa Dhatu* gets converted into *Rakta Dhatu* and so on. Previous *Dhatu* is precursor to next and higher by the action of respective *dhatvagni* in it. So from *Majja Dhatu*, *Shukra Dhatu* is produced.^[19]

The mode of conversion of *Ahara Rasa* into *Shukra* is explained by these hypotheses namely –

1. *Ksira-dadhi Nyaya*, 2. *Khale-kapota Nyaya*, 3. *Kedari-kulya Nyaya* 4. *Eka-Kaal Dhatuposhana Nyaya*

The ingested *Chaturvidha Ahara* converts in to *Ahararasa* after acting upon it by *Jatharagni* and *Bhutagni*. Then the action *Dhatvagni* starts. The former *Dhatu* gets converted and divided into two portions by the action of *Dhatvagni*. They are i) *Prasada Bhaga* ii) *Kitta Bhaga*.

KSHIRA-DADHI NYAYA

According to this hypothesis, prior *Dhatu* is completely transformed into the next *Dhatu* like the milk is completely transformed into curd, then curd into butter and then butter into ghee. It is called *Krama-Parinam Paksha* also because the formation of next *Dhatu* up to *Shukra Dhatu* goes step by step and because the prior *Dhatu* transforms completely into the next *Dhatu* so it is called *Sarvaatma-Parinam Paksha* also. After acting the *Agni*, two parts are formed - *Prasad Bhag* and *Kitta Bhag*. Firstly the *Jatharagni* acts on *Ahara* and forms *Anna Rasa* as the *Prasad Bhag* and *Purisha* and *Mutra* as the *Kitta Bhag*. This *Anna Rasa* is processed by *Rasa Dhatvagni* and forms the *Prasada* and *Kitta Bhaga*.^[20]

Now this *Prasad Bhag* is divided into *Sthula* and *Sukshma Prasadansh*. *Sthula Prasadansh* nourishes the respective *Dhatu - Rasa*. *Sukshma Prasadansh* nourishes the *Upadhatu* and forms the next *Dhatu* by its part resembling to that next *Dhatu - Rakta*. Now this next *Dhatu* nourishing part of prior *Dhatu* is processed by the respective *Dhatvagni* and forms the *Prasad* and *Kitta Bhaga*.

In this series when the *Shukradhatu* resembling part of *Shukshma Prasadansh* of *Majja Dhatu* is processed by the *Shukra Dhatvagni*, *Prasada* and *Kitta Bhaga* should be formed here. Because the *Shukra* is the last and purest *Dhatu* of our body so only *Prasad Bhaga* is formed which totally transforms into *Shukra Dhatu* and no *Kitta Bhaga* is formed here.

KEDARI-KULYA NYAYA

According to this hypothesis, *Anna Rasa* reaches at the specific *Dhatu* formation site of a *Dhatu* and transformed into that respective *Dhatu* by action of respective

Dhatvagni on it. Pattern of reaching of Anna Rasa is like the pattern of a tributary of canal serving water to the field rows. It means which row is near to the tributary, water reaches there first. Like this, Anna Rasa nourishes Rasa Dhatu first and then Rakta and so on. Shukra Dhatu is nourished by the Anna Rasa lastly. Shukra Dhatu resembling part of the Anna Rasa is processed by Shukragni there and produces Prasad Bhaga without producing Kitta Bhaga. Now this Prasada bhaga nourishes the Shukra Dhatu completely without forming any Up.

KHALE-KAPOTA NYAYA

When the pigeons return back to their dwellings after feeding from field, every pigeon takes time according to the distance between the field and their dwelling. According to this hypothesis, there are different paths of the Anna Rasa to reach the site of formation of a Dhatu. So as far as the site of formation of a Dhatu is, the path will also be lengthy and Anna Rasa will take more time to there and nourish that Dhatu. When the part of the Anna Rasa resembling Shukra Dhatu reaches at the site of Shukra formation through proper channels, Shukra Dhatvagni acts upon it and forms the shukra dhatu as described in Kedari-Kulya Nyaya.

EK-KAAL DHATU POSHANA NYAYA

Charaka and Vagbhata says that the Ahara Rasa is spread and distributed into the entire body at the same time, continuously and always by the help of Vyan Vayu.^[21] Arundatta comments that all the seven Dhatus are nourished at the same time due to the entry of this Ahara Rasa into channels of all seven Dhatus at the same time.

PRODUCTION OF SHUKRA FROM SOMA: As described earlier Bhautic origin of Shukra is considered to be Soma or Jalamahabhut. As Soma or Jala mahabhuta is the predominant basic element from which Kapha is derived. So it can be said that Shukra has originated from Jala or Soma mahabhuta.

PRODUCTION OF SHUKRA FROM MAJJA DHATU: Shukra is seventh in order of Sapta Dhatu and is quoted to be produced from evaluative metamorphosis of Majja Dhatu^[22] by the action of Shukradhatvagni on Majja Dhatu. Shukra is produced from prasada bhaga of Majja Dhatu.^[23] Vayu and Akasa Mahabhuta produce porosity in Asthi Dhatu. From this pores, Shukra oozes out like water from a new earthen pot and spreads all over body.^[24]

SPERM IN RELATION WITH MAJJA DHATU

Spermatogenesis originates from stem cell, germ cell in the with modern perspective. Stem cell is abundantly present in bone marrow.

In Ayurveda, majja dhatu can be correlated with bone marrow, and majja dhatu agni acts on majja dhatu to produce shukra dhatu.

TIME REQUIRED FOR PRODUCTION OF SHUKRA DHATU

According to Acharya Sushruta nearly one month is required for metamorphosis of Ahara Rasa into Shukra Dhatu.^[25] But Parashara opines that eight days are enough for Shukra Nirmana from the Ahara Rasa. Finally, Acharya Vagbhata quoted all views of different authors, and either it may take twenty four hours or six days or one month.^[26] Acharya Chakrapani has correlated all the above opinions and brought the concept according to the status of Dhatvagni.^[27] According to Acharya Chakrapani, if Dhatvagni is at optimum level, then process of Shukra production occurs at speed of "Archi" (Fire) and produced within eight days. If Dhatvagni is at moderate level, Shukra Nirmana takes place at the speed of "Shabda" (Sound) and produces Shukra Dhatu within two to three weeks. And if Dhatvagni is at mild level, the process of Shukra production takes place at the speed "Jala" (water).

SPERMATOGENESIS

In male Spermatogenesis begins at an average age of 13 years. It includes the three steps like proliferation, meiosis and spermatogenesis. The complete process requires near about 74 days in humans (Heller and Clermant 1963). Thus the production, maturation, storage and expulsion of sperms occurs in these stages. The entire process involves so many organs, which also can be divided into two types i.e. organs involved in the production and organs involved in expulsion.^[28]

Factors influencing spermatogenesis

GnRH

Hypothalamus stimulates the Adenohypophysis and secretes GnRH, F.S.H. these in turn stimulate the spermatogenesis. The gonadotropin releasing hormone also stimulate the LH Secretion and LH in turn causes the secretion of Testosterone from the testes. Ultimately the combined presence of FSH and testosterone stimulate spermatogenesis. High dose of oestrogen damages the seminiferous tubules and the spermatogenetic process. Inhibin produced by sertoli cells depresses the FSH secretion by negative feedback mechanism. Sertoli cells & Leydig cells also play an important role in nutrition and phagocytosis of sperm cells.

Organs involved in spermatogenesis- The process of spermatogenesis involves so many organs, which can be divided into two groups.

- 1) Sperm productions
- 2) Sperm expulsion

(1) Sperm productions

Testes

The human testis is ovoid in shape and is located within the scrotum. The length and weight are approximately 4.5 cm and 34-45 gm respectively. It is divided into 200-300 lobules, which contains the convoluted seminiferous tubules. Each seminiferous tubule contains several layers of spermatogonium, which are germinal cells, which

further produces sperms (Clermant 1963). The spermatozoa enter into ductus epididymis, where they stay from 10 -14 days for complete maturation. The functions of the testis are limited to steroidogenesis and spermatogenesis. The hormones of anterior pituitary secrete FSH & LH which are necessary for spermatogenesis. The Leydig cells of testis stimulated by LH secrete Testosterone which is responsible for expulsion of sperms. Sertoli cells are nursing cells to the adjacent germinal cells. They play a crucial role in the regulation of spermatogenesis.

Epididymus

The human epididymus originates from the mesonephrons. The epididymus is covered by the tunica albuginea and rest close the testis. The length of epididymus and associated ducts has been measured to be 5-6 m (Lanz & Leuhavser 1964). The Epididymis is a convoluted canal in which the final steps of sperm maturation and development take place. The Testosterones and DHT are the major Androgens controlling Epididymal function.

The Prostate

The prostate, which live behind the pubic symphysis, is the largest accessory sex gland. In young and middle aged, adults, the gland is 3-4 cm in diameter and approximately 20gms in weight. The prostate secretes 0.5- 1.5 ml of a thin milky fluid (15-30% of ejaculate volume) which is usually slightly alkaline (pH = 7.2) in nature.

Seminal Vesicles

The seminal vesicles of men are paired, highly convoluted pyriform gland. Each vesicle is 5-6 cm long and 1-2 cm wide. The secretion of the seminal vesicles is viscid, slightly yellowish in color and alkaline in pH. About 70% of the human ejaculate originates in the seminal vesicle.

Cowper's or Bulbourethral glands

Cowper's glands are paired bodies of 3-5 mm in diameter, which are homologous to Bartholin's glands in the female. The clear viscid, mucus like secretions of the gland are discharged during erection and possibly also during ejaculation.

(2) Sperm expulsion

Vas deferens

The vas deference is a tube, 35-45 cm long, with a diameter of 0.85 ± 0.07 mm (Brueschke et al 1974). It extends from the tail of epididymus, runs along its medial site, through the Inguinal canal, to the neck of seminal vesicles. It then fuses with Seminal vesicles, forming Ejaculatory duct, which passes through the prostate and opens into the floor of the prostate urethra. The Vas deferens acts as a canal transporting spermatozoa from the cauda Epididymus to the Ampulla.

Urethra

It is 20 cm in length. It can be sub divided into three parts like prostatic, membranous and spongy. It serves as the passage for both sperms and urine.

Penis

The external genitalia in man originate in the urogenital sinus and Genital tubercle. The penis is attached to the front and sides of the pubic arch and is composed of three cylindrical masses of erectile cavernous tissues, blood vessels, lymph & nerves. The penis is supplied with blood by the deep dorsal artery and nerve supply from pudendal nerve and pelvic plexus.

Spermatozoa

The fully matured spermatozoa are 50 μ m long. Spermatozoa can be divided into four parts. 1) Head 2) Neck 3) Middle Piece / Body 4) Tail.

(1) Head: - It is elastic, oval in shape, tapering to a thin leading edge and flattened & about 4.6 μ m long, 2.6 μ m widths and 1.5 μ m in thickness. Head contains Nucleus & Acrosome, Nucleus consists of closely packed Chromatid which is composed of DNA and it contains in normal human spermatozoa. Acrosome lies under the plasma membrane like cap covering the Nucleus. It is developed from Golgi apparatus. It possesses an important structure known as Acrosin, which penetrates the zona pullicida of ovum.

(2) Neck:- It contains Basal body and connect Head to Body. It is very short and weak.

(3) Middle piece / Body:- It has Enzymatic material which concerned with metabolic activity. It has double layer Mitochondrial sheath & Lipid.

(4) Tail:- It consist of two central fibrils and surrounded by ring of fibrils. Tail is separated into proximal and terminal ends. The proximal end of the tail is covered by Mitochondrial sheath. It contains enzyme like Adenosine Triphosphate which help in movement of sperm. The terminal is necked. Portion which functions like Cilia.

MECHANISM OF SHUKRA VISARGA (EJACULATION)

The *Shukra Dhatu* formed by the evolutionary metamorphosis pervades all over the body in the *Shukradhara Kala* and the *Kala* performs the following functions:

-Abode for the pervading *Shukra Dhatu*: it holds and provides the abode for performing the *Sarvadaihika* (whole body) functions of *Shukra*.

- Helps further transformation of *Shukra Dhatu* into *Roopa Dravya*. The ejaculated part of *Shukra* is termed as *Roopa Dravya*^[29] which is the only visible part of the *Shukra Dhatu*.

The formation of the *Roopa Dravya* takes place in the *Vrishana*, the *Mula* of the *Shukravaha Srotas*. The

process of its explained metaphorically in classics with following example - similar to water coming out of wet cloth when squeezed, *Shukra* comes out of man, out of its site during copulation between man and woman because of *Cheshta*, *Sankalpa* and *Pidana*.^[30] Above these, *Sankalpa* is said to be *Parama* (best) *Vrishya* by *Acharya Charaka*. Process of ejaculation is due to *Cheshta* (love play – physical stimulus) and *Sankalpa* (psychological stimulus) of *Stri* and *Purusha*, followed by *Harsha* (Passionate desire for enjoyment) & *Tarsha* (longing for women or psychic excitement) of both; and *Saratva* (fluidity), *Pichchhilata* (slimness), *Gaurava* (heaviness), and most important is *Anutva* (atomic nature) and *Pravanattva* (tendency to move from higher to lower concentration) of *Shukra Dhatu*. *Anutva* of *Shukra Dhatu* and at the same time *Anutva* of *Mana* are coincidental to bring out *Shukra* as ejaculatory part – *Roopa Dravya* which pervades all over the body. The filling up of *Shukravaha Sira* under influence of psychological and physical stimulus i.e. *Harsha* result in tumescence, leading to erection of penis which facilitate sexual act. *Shukra* is secreted due to libidinous stimulation generated by woman's sight, memory and touch. *Vyana Vayu* controls *Rasavaha Sansthana* - circulatory system of the body and *Shukra* is also present in whole body while *Apana Vayu* influences sex orgasm acting locally.

Vyana Vayu and *Apana Vayu* are mainly responsible for expulsion of *Shukra* to exterior through penis. Here both act as interdependent central and peripheral controls of process of ejaculation. The eight psychosomatic factors related to *Mana* and *Shukra* play a major role in regulation of ejaculation. In total it is psycho- somatic endocrinal mechanism.

SPERM AND SHUKRA

- *Shukra dhatu* is *sarva dahika* similarly stem cell which is prime factor in spermatogenesis is *sarva dehika*.
- *Dalhana* opines *shukra dhatu* in men gives *dhairyam* / valor to the men. Similarly, if a person with no sperm or azzospermia is found to be having lack of confidence and mentally depressed with reduced secondary sexual characters.
- *Maiduna agata*- sperm is normally produced during sexual intercourse- ejaculation of sperm. *Shukra visarga* occurs during *maiduna*.
- *Roopa dravyagata*- Even though *shukra* present all over the body, it can be seen in visible form only as *shukra* after ejaculation. Similarly, Sperm present in semineferous tubules will be seen in visible form only after ejaculation.
- *Moola sthana*- *Charakacharya* says *moola sthana* of *shukravaha srotas* as *vrushna* and sheaf, Similarly spermatic pathway can be considered as testis (scrotum) and pennies.

Any impairment in *shukravaha srotas* can cause *dusti*, and cause *shukra kshaya* same way atherosclerosis of

artery of pennies, dysfunction of spermatic duct, vericocele, hydrocele etc can cause impairment.

- *Dhatu parinama-Shukra* in *drava* form can be considered as the end product of *dhatu parinama* Similarly sperm in *drava* form can be considered as end product of spermatogenesis.
- *Vrudhi kshaya of shukra- sperm*- Depending upon its *vrudhi* and *kshaya* features are similar like increased libido, decreased libido etc.
- **PH of the semen** is referred by the term *Avidahi* i.e., not causing burning sensation during ejaculation indicating neither acidic pH, nor highly alkaline.
- **Normal consistency** of semen is indicated by the characters like *Drava* (liquid), *Picchila* (viscous), *Snigdha* (unctuous) and *Sara* (fluid) due to various constituents of seminal plasma.
- The tendency to flow out (*Pravana Bhava*) also indicates the semen that is expelled during intense pleasure of coitus.
- **Madhura taste** of *Shukra* is due to the presence fructose of the seminal plasma.

DISCUSSION

Shukra is the *Param Sara* of *ahara rasa*. *Garbhotpadana* is the main function of *shukra* as well as sperm. The *Shukra* mentioned in *Ayurveda* can be compared easily to that of semen of modern medicine. *Sphatikabham* indicates the colour of semen which is white and translucent. *Bahala* and *Bahu* indicate the adequate volume of semen and the sperm count respectively.^[31] *Madhugandhi* is the special odour imparted to *Shukra*. *Madhura rasa* of *Shukra* is due to fructose of the seminal plasma.

Majja Dhatu is responsible for *Shukrotapatti*, this may be justified by Erythropoiesis, which takes places in Red Bone Marrow along with Leucopoiesis; this is having same bearing on the *Shukrotapatti*. The sperm and semen are produced in the testes and accessory sexual glands. They are transported to the vagina through the penis. Thus *Shukra vaha Srotas* can be correlated with the Sperm- Semen producing and transporting system.

CONCLUSION

Shukradhatu is produced from *ahara ras* through *Majjadhatu* it is *somya* or *Jala mahabhuta pradhana*. *Shukra* is situated entire body. There are so many functions of *Shukradhatu* but main function of *Shukra Dhatu* is reproduction. *Shukra* is responsible for all systemic body activities including metabolic functions and part of which comes out of the body at the time of sexual act and performs specific functions of reproduction. *Shukra* is the essence of all the *dhatu*s, it is *sarvadaihika*. Its level maintained very carefully by consuming nourishing foods, leading a healthy life and practicing healthy sexual life. All the terminology, mentioned in *Ayurveda* can be compared as *Shukra Dhatu* with Endocrine hormone, *Shukra* with Semen and *Stree Shukra* with different secretion in female genital

tract during intercourse. The features of sperm and *shukra* are similar and the functions are also same. The appearance, consistency, smell, taste and the other features go hand in hand. *Sukra kshaya* or low Sperm count will end up eventually in Infertility.

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