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ROLE OF OJAS IN PREGNANCY W.S.R. TO IMMUNOMODULATION

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ABSTRACT

Pregnancy is one of the important epochs in women life. The term pregnancy is used to describe the period in which a fetus develops inside a woman's womb or uterus. The period of gestation lasts about 40 weeks from the start of the last menstrual period (LMP). *Ojas* is a unique concept put forward by Ayurvedic science. *Ojas* is one of the most important elements for the maintenance and sustenance of life. Though Ojas is located in the *Hridya* (heart), it pervades all over the body. It controls and regulates the whole working system of the body. Ojas according to different acharyas considered *sarvadhatusara, shukravishesha, jeevashonita, prana, bala, shleshma, jeeva, ushma* etc., and also considered *Ojas* as *upadhatu* and its *vikruta avastha* is *mala.* Ayurveda explains the importance of *ojas* in fertilization, implantation, growth and development of the foetus in pregnancy. Our ancient theory of *Ojas* supports the modern concept of immunology in pregnancy. Where modern science explains immune system has a key role in the maintenance of pregnancy along with hormonal and other factors.

Keywords: Pregnancy, *Ojas* and Immunomodulation in pregnancy.

INTRODUCTION

The word meaning of *garbha* is the intrauterine living organism. Ayurveda defines, *garbha* as the contribution of *shukra*, *shonita, atma*, in the association of *ashta prakruti* and *shodasha vikaras.* Other factors like *panchamahabhuta, shadbhavas* and *garbha*

sambhava samagri are essential for the formation of *garbha.* [1]

Ojas is a unique concept read in Ayurveda compendia. Ayurveda science assumes an entity that has the strength to bind body, mind, sense organs and soul together in functional harmony. Which is responsible for life and death.[2,3] Our classics explains two forms of *ojas, para* and *apara ojas*. *Para ojas* is the principal form, that originated in the intrauterine life of a living individual. It is situated in the heart and measures 8 drops. It is not affected by simple deviations from physiology. *Apara ojas* is generated by the excellence of seven dhatus. As all entities are nourished by food, *apara ojas* is also nourished by food. Disease and etiological factors affect this form of *ojas.* It measures half anjali.[4,5,6] *Ojas* according to different acharyas considered as *rasa sneha, sarvadhatusara*[7]*, shukravishesha, prana, bala, shleshma, jeevashonita, teja, ushma,* etc.,[8, 9] our classics quoted various references for the role of *ojas* in fertilization, implantation, growth and development of the fetus.

Similarly, modern science explains the concept of immunology throughout pregnancy. Successful pregnancy is an immunological paradox. Basic immunology of pregnancy is one tissue that is repeatedly grafted and repeatedly tolerated is a fetus. The mysterious mechanism of the immune system is that prevents the rejection of the fetus, acts as an antigenically foreign body to pregnant mothers. The mechanism of immunomodulation is reviewed further in detail with concepts of *ojas* explained in our classics.

Literature Review:

Ojas and garbha utpathi: Acharya Charaka while explaining the importance of *ojas* quoted, the *ojas* marks the beginning of the formation of *garbha* (embryo). It is the *sharira rasa* that nourishes *garbha* and get seated in *hridaya*. Acharya Chakrapani elaborates it is originated in *garbha* during *shukra shonita samyoga* and imparts *jeeva* to *garbha*. In this context, *garbha* rasa refers to *kalala roopa* of *garbha* and its essence is *ojas*. When the *hridaya* get manifested in *garbha, ojas* get seated there.[10] This *oja* probably can be taken as para *ojas* formation in *garbha* because acharyas explained *sthana* of *para ojas* as *hridaya*. *Apara ojas* may play important role in further growth and development of body. Here the word *shukravishesha* can be substantiated for *ojas* since the *shukra* is one of the prime factors for the formation of *garbha*.

Ojas and Panchamahabhuta: Our ancient Indian philosophy believes the physical body is constituted by *Panchamahabhuta.* Each *mahabhuta* have their respective roles in the formation of *garbha. Jala Mahabhuta* stays in the body in the form of all the types of *shleshma, rasa, shukra* etc., fluid substances and is the power of taste organ. And which nourishes the *ojas, dhatus* and moistens the dryness created by the *vayu* and *agni* thus maintaining the life of the foetus.[11]

Acharyas quoted that *prakruta avastha* of *ojas* is *shleshma* which imparts *bala* but its *vikruta avastha* is considered as *mala*.[12] Also, we have classical references of word *ojas* like *rasa sneha, sapthadhatu sara, shukra vishesha* etc., where the dominant *bhoutika* component is *jala,* which plays important role in the maintenance of *ojas* in *garbha.*

Ojas and shadbhavas: The embryo is formed from various types of procreative factors like *matrjadi bhavas.*[13]In this context acharyas explained, the *shareera abhinivrutti*, *abhivriddhi*, *prananubandha*, *trupti*, *pushti* and *utsaha* are due to *rasaja bhava*.[14] And *satmyaja bhava* is responsible for the formation of *ayu, arogya, analasya (*enthusiasm), *ojas, bala, medha* etc., in garbha.[15] Our classics have references for word ojas as *prana, bala* and it imparts the *thushti, pushti* to *shareera.* [16]The functions of *rasaja* and *satmyaja bhavas* are similar to that of *ojas* thus, both the bhavas can be considered as contributing factors for the formation of *ojas* in *Garbha*.

***Garbhavriddhi* and *Ojas*:** Various classical references describe the important role of *ojas* in embryogenesis, organogenesis and further growth and development of the fetus throughout pregnancy. Acharyas explained the month-wise development of *garbha (Masanumasika garbha vridhi)* in this growth phase of *garbha* few direct references for *ojas* are available. As in the sixth and eighth months.

In the sixth month, there will be the formation of *bala*, varna and *ojas* in garbha.[17,18]Almost all the Acharayas explained the importance of *ojas* in the 8th month. To

summarize the 8th month, due to the immaturity of the fetus the ojas remains unstable, it moves from mother to fetus and vice versa. Thus, the fetus attains alternate states of enthusiasm and depression. Also, have the influence of *nairrita* part rakshasas by considering all the above factors 8th month is said to be unfit for delivery. [19-24]

Ojas and Garbhaposhana: Once the embryo is formed the nourishment to *garbha* is through *ahara rasa* taken by the mother and *garbha vridhi* is influenced by *vayu*.[25]

All the Acharyas explained *garbhaposhana,* it can be explained in two ways,

1) Before *apara nirmana* by *upasneha* and *upasweda*[26,27]

2) After *apara nirmana* by *nabhinadi*.

Ahara rasa taken by the mother not only nourishes her but also does *sthanya poshana* and *garbha vridhi*.[28] The *ahara rasa* taken by mother circulates through *nabhi nadi* connected between *nabhi* of *garbha* and *apara* (fetoplacental circulation) and that placenta is connected to *mathru hridaya* (uteroplacental circulation) *poshana* of *garbha* is by *siras*, that imparts *rasa, bala* and *varna to garbha*.[29,30]

In this context, we can understand the *ojo shabdha* as *rasa, saptadhatusara* and *jeeva shonita* (exchange of pools of blood between mother-placenta-fetus).

Garbha is ultimately nourished by *ahara rasa.*

Ojas and Garbhini paricharya: In *samanya* and *vishesha garbhini paricharya* our acharyas explained the use of *hridyam, madhuram, snigdham, drava, deepaneeya samskrita, jeevaneeya gana dravyas, navaneeta, grita, ksheera, santarpana ahara* etc., These possess *madhura rasa, sheeta virya and madhura vipaka* similar to the properties of *ojas* and which are mentioned in *ojokshaya chikitsa*.[32] *Vihara* like *Kasturi Chandana, mala dharana, karpoora anulepana, Chandrika snana, abhyanaga etc.,* [33, 34] *Oushadi dravyas like Gokskura, Vidarikanda, Kadali, Draksha, Dhatri, Panasa, Kushmaanda, Kharjura, Bala, Jeevaniya* and *Garbhasthapaka gana dravyas* are helpful in formation and maintenance of *ojas* in pregnancy.

Immunology in pregnancy:

The successful pregnancy itself is an immunological paradox. It is a state in which various immunological interactions occurs between fetal trophoblast and maternal decidua for the establishment, maintenance, and completion of a healthy pregnancy. Numerous cells and molecules of the immune system are key players in the development and function of the placenta and the foetus. [35]

Immunogenicity of decidua:

In women, invasion by the trophoblast is extensive, encompassing the endometrium as well as the inner third of the myometrium. To accommodate this, a pronounced remodelling process must occur, involving multiple cellular compartments of the uterus in preparation for implantation and establishment and support of pregnancy. This process, decidualization, occurs in humans on a cyclic basis beginning in the mid-luteal phase of the menstrual cycle. About decidual immune cell populations during early pregnancy, the majority of first-trimester human decidual leukocytes are uterine NK cells (~70%), followed by macrophages (~20%). T-cells make up approximately 10%–20% of decidual leukocytes, and dendritic cells (DCs) and B-cells are rare.

Uterine NK cells

uNK cells are distinctive lymphocytes that are believed to be originated in the bone marrow and belong to natural killer cell lineage. In early pregnancy, a large number of uNKs are present in the decidua mainly at the site of implantation. By term, however, there are relatively few uNK cells in the decidua. Their infiltration is increased by progesterone, IL15 and decidual prolactin. These specific types of NK cells are weakly cytotoxic and do not normally kill trophoblast cells. In addition, uNK cells are a potent source of immunoregulatory cytokines, matrix metalloproteinases (MMPs), and angiogenic factors. These various factors mediate extracellular matrix remodelling, trophoblast invasion, and angiogenesis, which are key processes in placentation and the establishment of early pregnancy at the maternal-fetal interface. There is a high proportion of uNK cells in foetal circulation (13 weeks). Due to their high number, early presence and

ability to kill cells, NK cells are likely very important in the fetal innate Immunity system.

Macrophages

Decidual macrophages are relatively abundant, comprising ~20% of the human decidual leukocyte population in the first trimester. In normal pregnancy, most of the macrophages at the maternal-fetal interface is of the M2 (immunomodulatory) phenotype. Present in decidua before the presence of extravillous trophoblast, macrophages play a role in early spiral artery remodelling by producing factors associated with tissue remodelling (MMP-9) and angiogenesis (vascular endothelial growth factor [VEGF]).

Immunogenicity of trophoblast:

Human leukocyte antigens

Human leukocyte antigens (HLAs) are the human analogue of the major histocompatibility complex (MHC). These are expressed in the fetal membranes are tolerogenic rather than immunogenic, and expression proteins at the maternal-fetal interface are tightly regulated during pregnancy. There are two classes of MHC antigens. The MHC class I genes are subdivided into classes Ia (classic) and Ib (nonclassic). The MHC class Ia is further subdivided into HLA-A, B, and C and class Ib is subdivided into HLA-E, F, and G. MHC class II (HLA-D) genes are not translated in human trophoblast cells. Human trophoblast cells (extravillous cytotrophoblasts) express one MHC class Ia (HLA-C) and all MHC class Ib molecules. Almost all the cells of the human body express a "badge" that identifies "self" and therefore privilege against attack by immune responses. For most cells of the body, this "badge" is known as MHC Class Ia. In the human placenta, fetal trophoblast cells do not express MHC class Ia (HLA-A and B) molecules that are responsible for the rejection of allografts in humans. Interactions between class I genes and decidual NK cells cause infiltration of trophoblast into maternal tissues.

Th1–Th2 shift in pregnancy

Pregnancy is a complex immunological state, wherein the mother must tolerate the “foreign” fetus, and thus requires a degree of immunosuppression. One mechanism that plays a role in the maintenance of successful pregnancy is a switch from the Th1 cytokine (proinflammatory) profile to the Th2 (anti-inflammatory) profile. This decreases the secretions of interleukin-2, interferon-γ, tumour necrosis factor β (TNFβ), thus suppression of Th1 response is requisite for pregnancy continuation. In addition, macrophages and Tregs present within decidua during pregnancy also produce IL-10 and are involved in the maintenance of immune tolerance toward allogeneic fetal antigens.

Anti-inflammatory cytokines IL-4 and IL-10 inhibit Th1 cells and macrophages, which in turn prevent fetal allograft rejection. In addition, these cytokines also inhibit TNF-α, cyclooxygenase-2 (COX-2), and prostaglandin E2 in amnion-derived cells, which prevent the onset of labour.

Labour is often associated with a pro-inflammatory state with a reversal back to Th1 rather than Th2. Studies indicate increases in Th1 proinflammatory cytokines and reduction in Th2 cytokines in women who are in active labour. Fetal membranes, myometrium, amnion, amniotic fluid, and decidua produce pro-inflammatory cytokines IL-1β and TNF-α at term and can induce nuclear factor kappa B. This transcription factor regulates the expression of labour-associated genes such as COX-2, IL-8, and MMP-9 and triggers a cascade of labour-inducing events. The T helper 1 (Th1) to T helper 2 (Th2) immune shift during pregnancy is well established. A fine balance between pro-inflammatory and anti-inflammatory influences is required in pregnancy. [36, 37,38]

DISCUSSION

For sustenance and maintenance of pregnancy, classics explains the prime role of *Ojas* and modern science explains the concept of immunology along with other factors. Both theories have got equal and greater importance throughout pregnancy. The impact of malfunctioning of *Ojas* or immune system leads to failure of implantation, placentation, embryogenesis, growth and development of foetus or termination of pregnancy. The function of *Ojas* in *garbha utpathi* can be considered similar to the immunogenicity of decidua and trophoblast explained in 1st trimester. Further in second, there is rapid growth and development of fetus seen. The nutrients taken by the mother nourishes the

fetus initially through *upasneha* and *upasweda* (diffusion and osmosis) later through *apara-garbha-nabhi nadi* (uteroplacental and fetoplacental circulation). *Apara ojas* is generated due to the excellence of seven dhatus and is nourished by food, small deviations may lead to disease conditions like anaemia, HTN, GDM, repeated infections etc., in the mother and IUGR, fetal insufficiency etc., in the fetus. Usually, *para ojas* is not affected by the deviation in physiology, if got affected there may be chances of IUD or stillborn. Hence, our classics explains that equal importance should be given to *garbha* and *garbhini* by providing *priya-hitakara ahara* and *vihara* to safeguard from *garbhopaghtakara* bhavas. At the end of the third trimester, complete fetal development is seen. By analysing the classical concept of *ojas* in the eighth month i.e., instability of *ojas*, this probably can be considered as complications of prematurity and preterm delivery of fetuses like birth asphyxia, RDS, IVH, Recurrent infections etc., and their improper management may cause the death of the fetus. Might be for the above reasons acharyas have told the eighth month is unfit for delivery.

CONCLUSION

An attempt has been made to analyse the concept of *Ojas* concerning immune modulation throughout the pregnancy.

- Pregnancy is a physiological state of immunomodulation.
- *Ojas* remains as a chief participating entity in fertilization, implantation, growth and development of the foetus in intrauterine life.
- *Ahara*, *rasayana* and *aushadha* mentioned in *garbhini paricharya* are having properties similar to *ojas*, thereby it maintains ojas in *garbha* and *garbhini* throughout the pregnancy

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