



ENDOCRINOLOGY IN PUBERTY & MENOPAUSE- A CONCEPTUAL STUDY

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ABSTRACT

Puberty and menopause are two periods of vast physiological change demarcate the beginning and the end of the reproductive life cycle and are associated with neuroendocrine reorganization across two key systems, the hypothalamus-pituitary-gonadal (HPG) axis & the hypothalamus-pituitary-adrenal (HPA) axis. In this article an attempt is made to explain in detail about the role of puberty and menopause according to different *Acharyas* and also according to contemporary science.

KEYWORDS: Puberty, Menopause, HPG, HPA.

INTRODUCTION

मातृदेवो भव says an ancient उपनिषत्.

Motherhood in a woman has always been held in great respect. The reproductive phase of woman's life presents her the opportunity to become a mother. This phase gradually starts with puberty and concludes with menopause. Nature brings about a series of changes in a girl physically and mentally in order to transform her into a beautiful woman. Puberty is also called as flowering. Such a flower is shrunk again with series of physical and mental changes which leads to menopause and thus the end of her reproductive phase.

All the physiological activities of the body are regulated by 2 major systems:

- φ Nervous System
- φ Endocrine System

ACC TO AYURVEDA

The onset of puberty is seen due to following reasons.

1. परिपूर्णधातु (भे सं शा ५/६)
2. काल (का सं शा ५/४)
3. स्वकर्म (का सं शा ५/४)
4. आहार (का सं शा ५/४)

AGE OF PUBERTY

Table no 1: Age of puberty acc to different Acharyas.

आचार्य नाम	वयः	आधारः
चक्रपाणिदत्तः	द्वादशवर्षादूर्ध्व	च सं शा ४/३०
सुश्रुताचार्यः	द्वादशादूर्ध्व	सु सं शा ३/११; सु सू १४/९
वाग्भटार्य	द्वादशादूर्ध्व	अ ह शा १/७
भावमिश्रः	द्वादशादूर्ध्व	भा प्र पू ३/१
काश्यपाचार्यः	षोडशवर्षाणि	का सं शा ५/४
अरुणदत्तः	एकादशवार्षिकाणामपि स्त्रीणाम् रक्तप्रवृत्ति दर्शनात् Arunadattasays these are the probable ages. There may be variations in individual cases, like it may come at 11 years also.	अ ह शा १/७

अर्वागपि यदाहार विशेषादारोग्याच्च पूर्णं भवति इति परिषत् ।
(का सं शा ५/४)

परिपूर्णधातुशरीरास्तु यदा भवन्ति तदा विवेकजललोहितं
मासे मासे प्रतिवेदयन्ति ॥ (भे शा ५/६)

आचार्य काश्यप mentions factors influencing puberty as *ahara & arogya*. It is said by भेलाचार्य when there is परिपूर्णधातुता the रजोदर्शन is seen, by using the term विवेकजल; he probably mentions the mental maturity also.

SECONDARY SEXUAL CHARACTERS

यथाहि पुष्पमुकुलस्थो गन्धो न शक्यमिहास्तीति वक्तुं, नैव नास्तीति; अर्थे चास्ति, सतां भावानामभिव्यक्तिरिति न्यात्वा, केवलं सोक्ष्म्यान्नाभि व्यज्यते, स एव विवृतपत्रकेशरे पुष्पे कालान्तरेणाभिव्यक्तं गच्छति ॥

(सु सं सू १४/१८)

As the fragrance in a flower bud can be said neither as present nor as absent; it is present (definitely) in सूक्ष्म form. Hence they are not recognised but they are manifested in कालान्तर, when flower opens its petals and filaments, similarly.....

एवं बालानामपि वयः परिणामात् शुक्रस्य प्रादुर्भावो भवति ।

रोमराज्यादयश्च विशेषाः नारीणाम्

रजसी च उपचीयमाने शनैः शनैः स्तन गर्भाशय योनीनाम् अभिवृद्धिः ॥ (सु सं सू १४/१४)

In boys due to वयः परिणाम as शुक्र is seen, similarly in girls रोमराजि (i.e pubic and axillary hair growth) is seen in specific age. Due to उपचय of रजस् there is gradual development of स्तन, गर्भाशय and योनि. Here रजस् can be understood as sexual hormones.

हीनयोन्यास्तु बालायाः कायं गच्छति शोणितम् ।

अथ पूर्णस्वभावायाः कायं योनिं च गच्छति ॥

(का सं खि ९/१९)

Kashyapa opines that, due to yoni of young girls being under developed, the blood circulates only in the body. Later due to natural maturity of reproductive organs the blood circulates to the body and the reproductive organs.

आचार्य चक्रपाण्डित्त while commenting on बीजभाग अवयवदुष्टि in शरीरस्थान explains

आर्तवं च यद्यपि द्वादश वर्षादूर्ध्वं व्यज्यते तथापि

आर्तवोत्पत्तिः गर्भकाल एव भवति ॥

It is told that though the आर्तव is seen in a girl of 12 years, the presence of आर्तव, is there right from the गर्भकाल.

APPLIED ASPECT OF PUBERTY AND ITS PATHOLOGY

The cause of the diseases mostly seen during this age, is the *Beeja dosha* (genetic factor), congenital factors and the developmental defect, which causes diseases concerned with attaining menarche, puberty and early sexual functions.

• षंडी

ENDOCRINOLOGY in PUBERTY

Puberty in girls is the period which links childhood to adulthood. It is the period of gradual development of secondary sexual characters. There are profound biological, morphological and psychological changes which lead to full sexual maturity and eventually fertility^[1].

STAGES OF PUBERTY^[2]: 5 important physical changes are evident during puberty.

1. Thelarche
2. Pubic hair growth
3. Axillary hair growth
4. Peak Growth in height
5. Menarche

1. THELARCHE (breast development):

∅ It is the first sign of puberty.

∅ It usually begins between 8 to 10 years of age is associated with increased oestrogen Production.

ROLE OF HORMONES IN THE GROWTH OF MAMMARY GLANDS

∅ Oestrogen – Growth of Ductile System

∅ Progesterone – Growth of Glandular Tissues

∅ GH, Thyroxin and cortisol enhance the overall growth and development of mammary glands.

∅ Relaxin also facilitates the development of mammary gland.

∅ Prolactin – Growth of mammary gland during pregnancy.

2,3. PUBIC AND AXILLARY HAIR GROWTH ADRENARCHE

∅ Pubic and Axillary hair development also term as **Pubarche**. It is one of the physical changes of puberty.

∅ Pubic and Axillary hair growth is primarily due to rising levels of androgens from the adrenal glands.

∅ Adrenal glands increases their activity of sex steroid synthesis from about 7 years of age.

TANNER STAGES OF PUBERTAL DEVELOPMENT IN GIRLS^[3]**Table no 2: Stages of pubertal development.**

Stage	Breast	Pubic hair
Stage 1	Pre pubertal state, elevation of papilla only.	No pubic hair present
Stage 2	Breast buds and papilla slightly elevated, and areola begins to enlarge.	Sparse, long hair on either side of labia majora.
Stage 3	Further enlargement of entire breast tissue.	Darker, coarser and curly hair over the mons pubis.
Stage 4	Secondary mound of areola and papilla projecting above the breast tissue.	Adult type hair covering the mons only.
Stage 5	Areola recessed to general contour of breast.	Adult hair with an inverse triangle distribution covering the medial thighs.

4. PEAK GROWTH IN HEIGHT

∂ Growth in height in an adolescent girl is mainly due to hormones.

The important hormones are:

∂ Growth Hormone, Oestrogen and Insulin like Growth Factor-1

5. MENARCHE

∂ The onset of first menstruation in life is called menarche

∂ It may occur anywhere between 10 and 16 year, the peak time being 13 years. The normal upper age limit of menarche is 15 years

∂ There is endometrial proliferation due to ovarian oestrogen but when the level drops temporarily, the endometrium sheds and bleeding is visible

COMMON DISORDERS OF PUBERTY^[4]

∂ **Precocious puberty** –

○ Secondary sexual characteristics before the age of 8 or menstruate before the age of 10

∂ **Delayed puberty** –

○ The breast tissue and/or pubic hair have not appeared by 13-14 years or menarche appears as late as 16 years

∂ **Menstrual abnormalities** -

○ Menorrhagia

ACCORDING TO AYURVEDA-MENOPAUSE**RAJONIVRITTI VAYA**

रसादेव स्त्रिया रक्तं रजः संज्ञं प्रवर्तते।

..... याति पन्चाशतः क्षयम्॥

(सु. सं सू. १४/६)

The *rakta* (i.e. menstrual blood) in women is produced by *rasa* at the age of 12 years and continues upto the age of 50 years.

तदार्तवं..... पंचाशत् ऊर्ध्वं जरा अपचीयमान शरीरधातूनां

क्षयं याति, 'शनैः' इति शेषः ॥

(सु. सं शा ३/११ डल्हण)

योषितश्चोनद्वादशातीत पंचाशद्वर्षया रजस्तन्यादय इति ॥

(अ. सं. शा १/२१)

After 50 years, because of age the integrity of *dhatu*s are lost leading to slow deterioration of *raja* and *stanya* etc.

ENDOCRINOLOGY in MENOPAUSE

Menopause is defined as a time of cessation of ovarian function resulting in permanent amenorrhea. It is a retrospective diagnosis⁵.

Hypothalamo-pituitary gonadal axis^[6]**Flow chart 1: Hypothalamo-pituitary gonadal axis**

Few years prior to menopause along with depletion of the ovarian follicles, the follicles becomes resistant to pituitary gonadotropins.



Effective folliculogenesis is impaired with diminished oestradiol production.



Disturbed folliculogenesis



Anovulation, Oligo-ovulation, premature corpus luteum



The mean cycle length is significantly shorter



Ultimately no more follicles are available and even some exist, they are resistant to gonadotropins.



Oestradiol production drops down



No endometrial growth



Absence of menstruation

OESTROGENS

- ∂ Following menopause, the predominant oestrogen is oestrone and to a lesser extent oestradiol.
- ∂ Serum level of oestrone – 30 -70 pg/ml is higher than Oestradiol – 10 – 20 pg/ml.

ANDROGENS

- ∂ After menopause, the stromal cells of the ovary continue to produce androgens (mainly androstenedione and testosterone) because of increase in LH.
- ∂ The cumulative effect is a decrease in oestrogen: androgen ratio.

- ∂ This results in increased facial hair growth and change in voice

PROGESTERONE

- ∂ A trace amount of progesterone detected is probably adrenal in origin.

GONADOTROPINS

- ∂ The secretion of both FSH & LH are increased due to absent negative feedback effect of oestradiol and inhibin or due to enhanced responsiveness of pituitary to GnRH.

PHYSICAL CHANGES DURING MENOPAUSE**Table no 3: Physical changes during menopause.**

VAGINA	VULVA	OVARIES	FALLOPIAN TUBES	UTERUS	BREAST FAT
1.Becomes narrower due to gradual loss of elasticity 2.Vaginal epithelium becomes thin 3.There is no glycogen. Doderlein's bacillus is absent. The vaginal pH becomes alkaline.	1.Shows features of atrophy. 2.The labia becomes flattened.	1.Shrinks in size, become wrinkled and white. 2.There is thinning of the cortex with increase in medullary components.	1.Shows feature of atrophy. 2.The muscle coat becomes thinner & cilia disappear.	1.Uterine Body and Cervix ratio – 1 : 1 2.Becomes smaller 3.Endometrium becomes thin and atrophic 4.Cervical secretion becomes scanty.	1.The nipples decrease in size. 2.Ultimately, the breasts becomes flat and pendulous

MENOPAUSAL SYMPTOMS^[7]**VASOMOTOR SYMPTOMS**

- ∂ Hot flush-Low level of Oestrogen is a prerequisite for hot flush.

GENITAL AND URINARY SYSTEM

- ∂ Atrophic epithelium changes in vagina, urinary bladder and urethra because of Oestrogen deficiency.

SEXUAL DYSFUNCTION

- ∂ Oestrogen deficiency is often associated with decreased sexual desire. This may be due to psychological changes (depression, anxiety) as well as atrophic changes of the genito urinary system.

SKIN

- ∂ Oestrogen receptors are present in the skin and maximum present in the facial skin.
- ∂ Due to low level of oestrogen there is thinning, loss of elasticity and wrinkling of the skin - Purse String (wrinkling around the mouth) and Crow feet (wrinkling around the eyes).

HAIRS

- ∂ After menopause, due to low level of oestrogen, there is some loss of pubic and axillary hairs and slight balding.

OSTEOPOROSIS AND FRACTURE

It is primary due Oestrogen deficiency –

- ∂ Increased osteoblastic activity in the bones
- ∂ Decreased bone matrix
- ∂ Decreased deposition of bone calcium and phosphate
- ∂ In some women this effect is extremely sever and resulting condition is osteoporosis
- ∂ Because this can greatly weaken the bones and lead to bone fracture

CARDIOVASCULAR DISEASES

- ∂ Risk of cardiovascular disease is high in post menopausal women due to deficiency of Oestrogen.
- ∂ Eg. Ischaemic heart disease, coronary artery disease.

ABNORMAL MENOPAUSE

∅ **Premature menopause –**

- If the menopause occurs at or below the age of 40 years, it is said to be premature.

φ **Delayed menopause** –

If the menopause fails to occur even beyond 55 years it is called delayed.

φ **Artificial Menopause-**

Permanent cessation of ovarian function done by artificial (means eg. Surgical removal of ovaries or by radiation) is called artificial menopause.

DISCUSSION

In *Ayurvedic* classics there is no direct description of hormones,

As per some references we can consider *Artava* for 3 following meanings:

Menstrual blood

Ovum

Ovarian hormones

- *Vagbhata*, *Kashyapa* and *Dalhana* accept presence of *raja* or *shonita* from the childhood.
- *Chakrapani* opines that *Artava* though seen at 12 years of age it is formed in *garbha kala* itself.
- This reference probably indicates description of hormones, as the HPO axis is active and functional from approximately 20 weeks of foetal life.

CONCLUSION

Ayurveda has great role to play in treating physiological disturbances that occur during menarche and perimenopause period.

Disorders that are seen around the period of menarche such as irregular menstrual rhythm, excessive bleeding etc. can be effectively handled administering *ayurvedic* medicines and *pathya ahara*.

Peri menopause – symptoms like emotional disturbances, excessive sweating, hot flushes, vaginal dryness can be very well treated with *ayurvedic* medicines.

Menopause is the period of *vata vridhhi*, so *vata shamaka aahara vihara* can be advised.

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