

## VARṆYA MECHANISM OF TWACHA (SKIN) IN AYURVEDA & CONTEMPORARY SCIENCE- A CRITICAL REVIEW

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### ABSTRACT

The existing conception of wellness comprises beauty, health, fitness as well as anti-aging aspects.<sup>[1]</sup> Beauty, especially fairness of skin, is a subject of socio-medical importance and has given escalation to numerous skin-lightening procedures such as dermabrasion, ultrasound, and laser therapy.<sup>[2,3,4,5,6,7]</sup> Unhealthy skin gives rise to social issues whereas healthy-intact skin escalations cheerfulness and assurance. Traditional herbal medicines deliver an interesting source for development of new skin-care cosmetics. Indian Cosmetic market is mounting at 15-20% annually, twice as fast as two leading countries i.e. US and EU market.<sup>[8]</sup> The unique, effective, and long lasting concept of beauty in Ayurveda has steered to the emergence of Ayur-cosmaceuticals. The concept of *varṇa*, *chāyā*, *prabhā* dealt in Ayurveda are innate beings of beauty. The word *varṇa* in Sanskrit means “outward appearance, exterior form, figure, shape, colour”, “colour of the face”, “good colour or complexion, lustre, beauty.”<sup>[9]</sup> *Varṇa* is not just colour but it embraces all the parameters of healthy and radiant skin.<sup>[10]</sup> *Chāyā* is the entity which circumscribes *varṇa* and *prabhā* is the highlighter of complexion.<sup>[11]</sup> Thus whatever carries softness and beauty to skin along with augmentation of complexion, glow or luminescence is termed as *varṇya*. Skin diseases usually require a longer time to be specifically diagnosed and cured. The *Paanchbhautikarachna* of the *Twacha* provides scope of considering the predominance of *Dosha* and *Anubandha* status of *Doshain* sighted the *Chikitsasiddhanta*. The conception of *Varṇa* and *Twacha* which is inherent due to *Prakriti* of the individual should be analysed while allocating with disorders of the skin. The physiological concept of skin, the role of *Dosha*, *Dhatu*, *mala* in *Twacha* controllers us towards diet and regimen to be followed for healthy skin. After all healthy skin is the mirror of healthy body.

**KEYWORDS:** Varṇya Mechanism, Twacha (Skin).

### 1. INTRODUCTION

The existing conception of wellness comprises beauty, health, fitness as well as anti-aging aspects.<sup>[1]</sup> Beauty, especially fairness of skin, is a subject of socio-medical importance and has given escalation to numerous skin-lightening procedures such as dermabrasion, ultrasound, and laser therapy.<sup>[2,3,4,5,6,7]</sup> Unhealthy skin gives rise to social issues whereas healthy-intact skin escalations cheerfulness and assurance. Traditional herbal medicines deliver an interesting source for development of new skin-care cosmetics. Indian Cosmetic market is mounting at 15-20% annually, twice as fast as two leading countries i.e. US and EU market.<sup>[8]</sup> The unique, effective, and long lasting concept of beauty in Ayurveda has steered to the emergence of Ayur-cosmaceuticals. The

concept of *varṇa*, *chāyā*, *prabhā* dealt in Ayurveda are innate beings of beauty. The word *varṇa* in Sanskrit means “outward appearance, exterior form, figure, shape, colour”, “colour of the face”, “good colour or complexion, lustre, beauty.”<sup>[9]</sup> *Varṇa* is not just colour but it embraces all the parameters of healthy and radiant skin.<sup>[10]</sup> *Chāyā* is the entity which circumscribes *varṇa* and *prabhā* is the highlighter of complexion.<sup>[11]</sup> Thus whatever carries softness and beauty to skin along with augmentation of complexion, glow or luminescence is termed as *varṇya*.

### 2. AIMS AND OBJECTIVES

- To Critical Review Varṇya Mechanism of Twacha (Skin) in Ayurveda

- To Critical Review Varnya Mechanism of Twacha (Skin) in contemporary science

### 3. Physiology of color formation:

The term Varna is refers to the color of the substance. It is useful visual tool for diagnosis of the various diseases like Pandu, Kamala, Jwara, Netra-Roga, Arsha, Visarpa, Shotha etc and some physiological conditions like normal color of Dosha, Dhatu etc. The term Varna used in different context like Ahara, Nindra, Shukra, Chhaya, Prabha etc. Charaka used the term Roopa for the appearance of the color and shape of the body which seen from distance. Sushruta, in same context said that Avabhasini skin is seat of color and omit the normal and abnormal color as well as luster of the body.

#### 3.1 Types of Varnya formation

Two types of color formation occur in human. The first is considered as constitutive factor which is genetically determined in absence of factors like Ahara, Vihara, Viruddha Ahara etc. We can call it as Sahaja or Prakruta Varna where the amount of melanin pigmentation is decided at the time of Shukra Shonita Samyoga. Charaka mentioned four type of Prakruta Varna like Krishna, Krishna-Shyama, Shyama-Avadata and Avadata. Second is Facultative factor where the skin color resultant as exposure to various Jatottar factor and Nidana. This kind of skin color can be inducible and we can make change in shade of it. We can understand the concept of color formation by various explanations like:

#### 3.2 Theory of agni and paka-kriya

Susruta said that Tejo-Dhatu is responsible for all color. (S.Sh.2/34 and Ch.Sh.8/16). He has given an example that different colors are formed as if when milk is heated

and it gradually changes the color. Similarly due to Paka Kriya, previous color is given up and new color is formed. Paka Kriya is described as phenomenon due to the contact of Agni. (T.San.1/23) Therefore Agni which is responsible for Paka, is the main cause of transformation of color. There are two concepts regarding to the Paka-Kriya in Classics,

- Pilu-Paka and
- Pither-Paka. (By Vaisheshika and Nyaya Darshana).

The theories say that these are the changes which take place at molecular level, and changes the atomic constitutions of the substance. Sushruta adopt the same idea when he discussed the Mahabhautika constituents and color formation.

#### 3.3 Theory of mahabhuta

In the early stages of foetus there was a dominancy of Jala Mahabhuta, and then the contact of Agni Mahabhuta gives rises to Gaura color. Same way if Agni Mahabhuta comes in contact with Prithvi Mahabhuta then the color is slightly blackish. And when Jala and Akasha Mahabhuta comes in contact then it will gives rises to Gaura-Shyama Varna. (S.Sh.2/34) Different Acharya suggest diverse theories in regarding to the question, how different colors are formed when they come in association with Agni Mahabhuta. Charaka explained that the Tejo-Dhatu, which is responsible for color formation in foetus, comes in contact with the union of Jala and Akasha. (Ch.Sh.8/16) If the union is presipited by Prithvi Mahabhuta then dark color is formed. If the union of Jala and Akasha comes in dealings with various Mahabhuta then a spectrum of colors are formed. The possible varieties are described in following table. (S.Sh.2/36).

Table-1:

Varna	Pradhana Mahabhuta	
	Charaka and Sushruta	Vagabhata
Gaura	Jala	Agni-Jala-Akasha
Krishna	Prithvi	Agni-Prithvi-Vayu
Krishna-Shyama	Prithvi-Akasha	
Shyama	Jala-Akasha	Combination of all Mahabhuta

#### 3.4 Theory of shukra and shonita

Vagabhata said that the color of Shukra determines the skin color of child. (A.S.Sh.1/65). The color of Shukra depends upon food, its proper digestion (A.H.Sh.1/6) and Doshika dominancy (S.Sh.2/3). If there is dominancy of Vata then the color is Vata-Varna i.e. Aruna, like wise

Nilapitta and Shveta respectively for Pitta and Kapha. (S.Sh.2/3). At the time of conception, if the color of semen is having color spectrum of oily color, then foetus is having Krishna Varna. Acharya Vagabhata has suggested following possibility in respect to the theory: (A.H.Sh.1/65).

Table-2:

Color spectrum of Shukra	Color of foetal skin	Doshika precipitation
Taila	Krishna	Vata
Ghrita	Gaura	Kapha
Madhu	Shyama	Pitta

If this normal configuration of Mahabhautika constituents is disturbed by disease or genetically then various abnormal colors will be formed as like in Kilasa.

### 3.5 Theory of ahara and vihara

Vagabhata opines that color of fetus is depending upon Ahara. (A.H.Sh.1/65). Ghanekar discourses that the substance that requires for fetal nutrition, fetal skin formation and fetal melanogenesis is obtained from Ahara. As lack of dietary nutrients leads to deficiency disorders, improper Ahara of mother influences on color of the skin. He also alleged that even racial and geographical factors are also related to Ahara as each race has some custom, related to food and its preparation and they do not change them if possible. In same stanza Vagabhata stated that the people who take more Vidahi and improper Ahara are dark in color e.g. South Indian and Panjabi. He further added that if mother take more milk, sweet substance and every day bath, the color of the skin of child will be white vice versa. (A.S.Sh.1/65).

### 3.6 Theory of dosha and dhatu

It is well known that Ahara is a foundation of building of seven Dhatus. Same way qualities of Dosha are also depends upon quality of Ahara. The Ahara that is KaphaVardhaka in nature leads to Shukra Vriddhi and Gaura Varna. Doshas are responsible for different colors of the skin because it is observed that during the gestation period the formation of constitution occurs in different varieties according to the dominancy of the Doshas and the colors are varying accordingly. The dominancy of the Doshas depends upon the Ahara taken by pregnant women. The quality of the Ahara depends upon Mahabhautika constitution. Ahara has impact on the Doshas and Doshas have impact on color formation. Vagabhata represent the Ahara of pregnant women is directly related to the color complex of the child. If pregnant women indulge more milk, sweet substance and have increase frequency of bath then the skin color of child will be white. Charaka also said that if a eight month pregnant women take the combination of Kshira+Ghee+Yavagu, then the color of the skin will be fair. So if the quality of Ahara is KaphaVardhaka then the color of the skin will be white.

### 3.7 Role of bhrajaka pitta in color formation

Sushruta was the first person to describe the Bhrajaka Pitta as variety of Pitta. He has also used the term Bhrajaka Agni for Bhrajaka Pitta. Dalhana mentioned that when we smear or rub the substance over the skin it is Bhrajaka Pitta which digests them. Charaka has not described the Bhrajaka Pitta separately. He considered the color formation under the general function of Pitta. Chakrapani in commentary of same stanza, has stated the term Bhrajaka Pitta and mentioned location and function of it. Vagabhata cited that location and function of Bhrajaka Pitta, and Arunadutta added the function of Bhrajaka as Dipana and Pachana of the substance applied on it. Bhela opined in different view that said the coloration of the skin is not whole phenomenon; it varies

with part and structure of the body. The Pachaka Pitta and Ranjaka Pitta are also involved as the contributory factors for the maintenance of the normal skin color as well as the production of depigmentation. The other factors which influences on Bhrajaka Pitta are Rasa, Rakta and Mansa associated with Srotas. VyanaVayu that plays an important role in circulation of nutrients is also indirectly responsible for the normal color formation. Dhatvagni of Rasa and Rakta also have contributed their role in color formation.

### 4. Varnya Mechanism Twacha (Skin) in Ayurveda & contemporary Science

Normal skin color is dependent on hemoglobin (in both the oxygenated and reduced state), carotenoids and melanin pigment. Carotenoids are yellow pigments that found in the epidermis and subcutaneous fat. (Zuckerman S. & Parkes A.S. Endocrinol I 430,1939) Melanin was produced by melanocytes and are transferred to the surrounding epidermal keratinocytes. The factors which affecting the skin color, apart from melanin, are as Absorption coefficient of the dermis and epidermis, Reflection coefficient of skin surface, Developmental status of granular layer, Water content of granular layer, Content of UV light absorbing component, Thickness of overlying tissue, Optical properties of overlying tissue & Melanin. Amongst them melanin is the major color determinant, which depends upon:

1. Racial difference
2. Ethnic difference
3. Number of melanin
4. Size of melanin
5. Shape of melanin
6. Distribution of melanin
7. Degradation of melanin

Two types of melanin pigmentation occur in humans. The first is constitutive, that is genetically determined melanin pigmentation in the absence of sun exposure and other influence. The next is facultative, which results from sun exposure. Other factors like endocrine influence, pregnancy, nutrition status and some autoimmune disorder also influence the skin color (Fitzpatrick TB1974). Variations in the degree of pigmentation occur in various region of body and are different in various ethnic groups. In Asian people, the lightest area is lumber region and the darkest is upper thigh (Br. Jr. Of Dermatol 1973). Females are generally lighter than males.

### The Melanocyte

A Melanocyte is a specialized cell located in the skin, which produces melanin (pigment). All humans have roughly the same number of pigment cells in their skin. Those with darker toned skin, have pigment cells that are able to store more melanin within them. Following aspects, related to melanin, are very important to understand the coloration of skin and pathology of Kilasa;

### Embryology

Melanocytes arise from the neural crest (Boyd J D 1960). This is a region of embryonic ectoderm that originates from the margins of the neural plate. Sagebiel have shown the presence of melanocyte in the epidermis by the 8th week of gestation and that by 10th week these cells contain melanosomes showing early melanization (Silver impregnation technique) then later on melanocyte in the skin continues to reproduce themselves by cell division. Rodahl 1978 shows that this mitosis was stimulated by U-V radiation. The mitotic index of the melanocyte is quite lower than keratinocytes. There are some hypotheses related to melanocytes. Okun and co-workers have shown morphological, enzymatic and histological correlation between mast cell and melanocytes. Hunter JAA opines that Langerhans cell might be related to melanocytes.

### Epidermal melanin unit

Melanin pigmentation in the skin also depends upon the distribution and transfer of pigmented granules to surrounding epidermal keratinocytes. Each melanocyte in epidermis is surrounded by few keratinocytes, which is functionally known as 'Epidermal melanin unit' (Fitzpatrick 1967), likewise the nephrons of the kidney. The concept of EMU is structural and functional. Frenk E 1969 says this active unit is very in number of different regions of human body but the number of keratinocytes served by melanocyte is constant. A single melanocyte supplies melanosomes to a group of about 36 keratinocytes. According to Hadley, in the animal like frog this unit can produce melanin as well as it also rearranges melanin so that they can adapt skin color as per the background. Three different mechanisms may be involved in the control of the color changes that are individual, humoral and nervous. Third mechanism said that the activity of the pigment cell might be under humoral control (Montagna W. & Hu F. *Advance in biology of skin*. Vol. VIII, Oxford Pergamon, 1967). Pituitary hormones cause expansion of melanophores, or promote the formation of melanin in epidermis.

### Distribution

Melanocytes are most commonly found in epidermis and less frequently in hair bulb, eyes, around blood vessels, peripheral nerves, sympathetic chain, and lining of coelomic cavity, leptomeninges and inner ear. Some facts related to distribution of melanocytes given as Total epidermal melanocyte population is about  $2 \times 10^9$ , The melanocyte mass forms a tissue 1.0-1.5 cm<sup>3</sup>, The population density is high in the face 2900/mm<sup>2</sup> & Melanocyte density decreases by 6-8 % per decade. The number of melanocytes is about twofold higher in exposed skin.

### Ultra structure

Melanocytes are dendritic cells in the basal layer of the skin. They behave as unicellular glands producing melanosomes, which are transferred to surrounding epidermal keratinocytes, a cytocrine activity. These are

known as secretory variety. Non-secretory melanocytes are melanophores. Studies have shown that melanocytes are rather inactive and non-mobile, and become dendritic in relation to keratinocytes. The tip of the dendrite of the melanosome becomes embedded in the cytoplasm of the keratinocyte. Melanosomes are packaged according to the size, the larger ones as single units, and the smaller units as complex of two or more (Jr. Ultrastruct. Res 1974). The action of melanocyte transfer to keratinocyte is like phagocytosis. The characteristic feature of the cell is the presence of special cytoplasmic organelles, the melanosome, on which melanin is formed by the action of the enzyme tyrosinase. On electron microscopy, the melanocyte is readily distinguishable from the keratinocyte by the lack of desmosomes and tonofibrils and by more lucent cytoplasm. Melanosomes are the site of melanogenesis and shown tyrosinase activity. The developing melanosome shows varying degrees of electron density, the more fully melanised being very dense. Melanocytes are fine, cytoplasmic filaments about 100nm in diameter.

### Stages of melanocyte development

**Stage: 1** In this stage a spherical vesicle derived from Golgi apparatus. It shows tyrosinase activity and contains melanofilament having length of 7nm. How tyrosine is available in vesicle is uncertain. Tyrosinase is membrane-bound ribosome and transferred via the endoplasmic reticulum to the Golgi apparatus where it accumulates in vesicles that were derived from the Golgi.

**Stage: 2** Here melanosomes are oval in shape and they contain numerous melanofilaments.

**Stage: 3** In this stage melanin is deposited in melanosomes.

**Stage: 4** Now they become electron dense. Studies have shown they are partially amorphous in nature. It also contains micro vesicles called vesico-globular bodies. These bodies are key units for the development of macro melanosomes.

### Biochemistry of melanin synthesis

Melanin is a dark brown pigment of skin and hair in animals, particularly vertebrates, derived from the amino acid tyrosine. It is synthesized by special cells called melanocytes, which also store the melanin. Melanin pigment can be classified as:

- a. Eumelanin
- b. Pheomelanin
- c. Neuromelanin

**(1) Eumelanin:** Eumelanin is a nitrogenous pigment having black or reddish brown color. It is formed by oxidative polymerization method. It is insoluble in all solvents. In the presence of metal ions, eumelanin oxidizes chemically or photochemically to a soluble form.

### (2) Pheomelanin

Pheomelanin is an alkali soluble pigment ranging from yellow to reddish brown color and containing sulphur

and nitrogen. It arises by oxidative polymerization of cysteinyl group.

### (3) Neuromelanin

Cytoplasmic organella are contained in the pigmented nuclei in the brain stem and dorsal root ganglia. These

organelles are decrease or increase in case of parkinson's disease.

**Table-3: Difference between Eumelanin and Pheomelanin.**

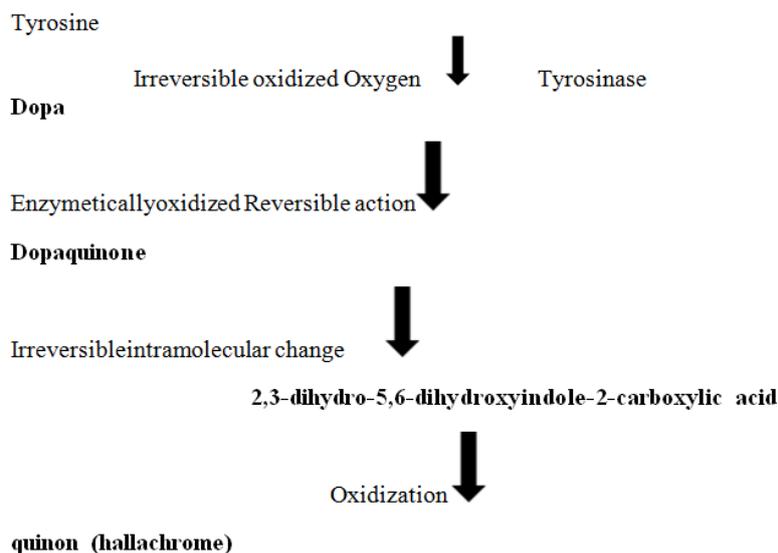
Factors	Pheomelanin	Eumelanin
Color	Yellow	Brown or black
Site	Hair	Hair, skin, retina, brain
Shape	Spherical	Ellipsoidal
Solubility	Alkaline solvent	Insoluble
Formation	From cystenyl DOPA	From tyrosine

Each types of melanin are derived from tyrosinase, by same initial steps. The copper containing enzyme tyrosinase converts tyrosin into 3, 4-dihydroxyphenylalanine (DOPA). It has been found that not only tyrosinase is involved in melanogenesis but also tyrosinase related protein TRP-1, TRP-2, and peroxidase are involved in the initial conversation of tyrosine to DOPA. If further oxidized into dopaquinone. At the level of dopaquinone, the pathway melanogenesis is bifurcate. In the formation of eumelanin, dopaquinone undergoes cyclization to cyclodopa. Pheomelanin are formed by dopaquinone with cystine. Then they form the isomer 5-S and 2-S-cysteindopa. The former product is oxidized

and produced intermediates that give rise to pheomelanin group.

The stages of melanin formation are explained as given below:

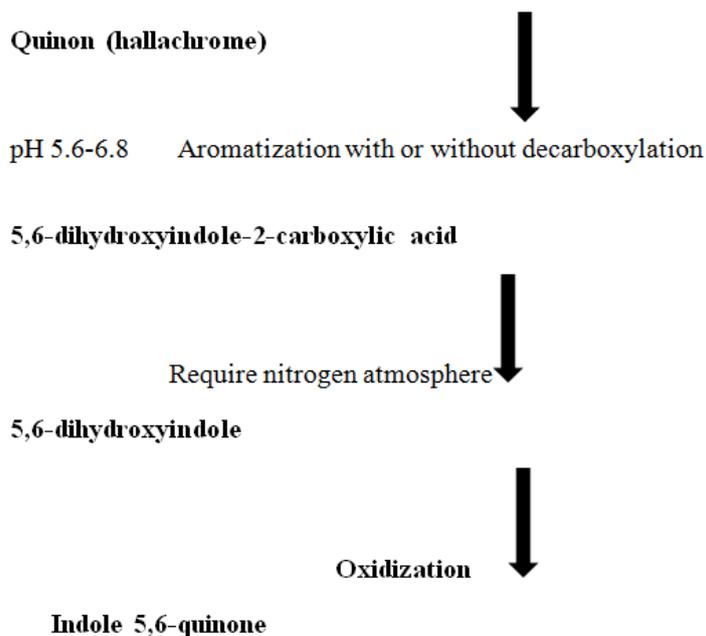
**Stage 1:** Tyrosine is converted into DOPA. This process is very slow at start, but becomes very fast after an induction period. The reaction being accelerated by *o*-dihydroxyphenyl compounds. DOPA further converted into dopaquinone and 2, 3-dihydro-5, 6-dihydroxyindole-2-carboxylic acid. It is rapidly oxidized to quinone. It is red pigment and is characterized by the absorption at 305-310 m $\mu$ .



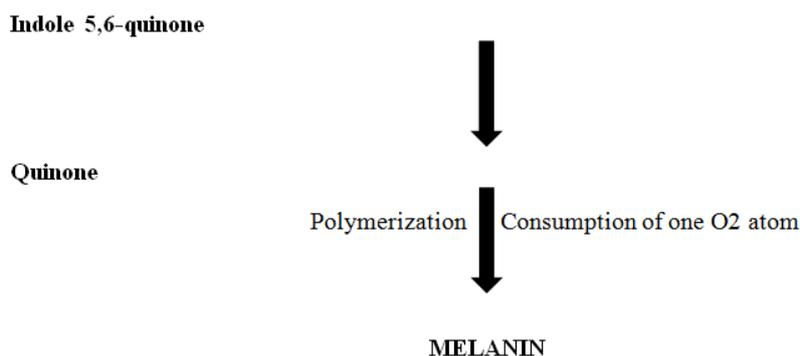
### Stage: 2

At the pH 5.6-6.8, hallachrome undergoes aromatization with or without decarboxylation to afford two colorless

compounds. These steps are not clearly oxidative and are found to proceed in nitrogen atmosphere. Indole 5,6-quinone is characterized by purple color.

**Stage: 3**

In this stage, quinone is polymerized to melanin with the consumption of approximately one atom of oxygen.



5,6-dihydroxyindole is a likely intermediate in a pathway of tyrosine to melanin. Indole 5,6-quinone is has been recognized as a bifunctional monomer capable of undergoing itself. The mechanism of above reaction is obscure. The work of bulock and Harley has thrown considerable light on the mechanism of transformation of indole 5,6-quinone to melanin. The reaction is polymerization.

**Endocrine influence****Endocrine**

The biologically important lightening agents are serotonin, noradrenalin and adrenalin. Estrogens, androgens, pituitary and adrenalin hormone controls melanin pigmentation.

**Melatonin:** Lerner at all has isolate melatonin from pineal gland. However the role of melatonin on mammalian epidermal melanocyte is tentative. It is a 5,6-dihydroxyindole derivative and is the powerful lightning agent in human.

**MSH:** Two melanocyte stimulating hormone ( - and β-MSH) have been isolated from the intermediate lobe of pituitary gland. These are polypeptide in nature and are found to be the most powerful darkening agent in human skin. The melanin content of the skin is lowered by injection of melatonin into frogs.

**Factors which effect melanogenesis**

Proper digestion, absorption and distribution of nutrients Metabolic disorders like phenyl-ketone urea.

Trace minerals like copper, zinc, iron etc. Folic acid, vitamin C. And vitamin D.

Hormones like adrenalin, noradrenalin, MSH etc., Enzymes like tyrosinase, Physical agent like UV rays, Therapeutic agent like 8-methoxy trypsin, Genetic disorders like defect in gene mutation and migration & Sun exposure.

### Biological significance of melanin

Melanin is a substance that is responsible of variety of appearance in human kind. It is concern with protection of the tissue, and the major function of it is to protect the lower layer of skin against UV radiation. When epidermal keratinized cell move outward they contained melanosome, which they received from melanocyte. Pigmentation is geographical phenomenon and varies in relation to solar intensity. Not all the effect of pigmentation is advantageous. On the one hand, it protects against damage by sunburn. It is an efficient photo sensitizer, Which eliminate genetically damaged cell by phototoxic mechanism. It also increase heat load in hot climate. Disadvantage of pigmentations are they absorbed more heat (30% more). It vitiates against vitamin D synthesis and the loss of pigmentation may facilitate vitamin D synthesis in temperate climate. One of the most important property of the melanin is its free radical character. Electron spine resonance study shoes that melanin is stable free radical. Skin irradiated with UV radiation shows increase in free radical. (Mangus IA). Melanin acts as optical fashion by diffusing and absorbing light. It also acts as a trap for electron and possibly free radical (Menon IA). Melanin in the skin has a photoprotective role. It acts as a neutral density filter redusing all the wavelength of light. The superior photoprotection of the dark epidermis is due not only to its increase melanin count, but to the packaging and distribution of melanosomes.

### 5. CONCLUSION

Skin diseases usually revenue a longer time to be specifically diagnosed and cured. The *Paanchbhautikarachna* of the *Twacha* provides scope of considering the predominance of *Dosha* and *Anubandha* status of *Doshain* sighted the *Chikitsasiddhanta*. The conception of *Varna* and *Twacha* which is inherent due to *Prakriti* of the individual should be analysed while allocating with disorders of the skin. The physiological concept of skin, the role of *Dosha*, *Dhatu*, *malain Twacha* controllers us towards diet and regimen to be followed for healthy skin. After all healthy skin is the mirror of healthy body.

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