CHAPTER 2

REVIEW OF LITERARY SEARCH

Key Messages

- *Sarveindriyāṇāṁ Nayanaṁ Pradhānam,* of all sense organs the eye is the most important.
- According to *Āyurveda*, six procreative factors are responsible for a healthy offspring; *Mātṛtaḥ, Pitṛtaḥ Ātmataḥ, Sātmyato, Rasataḥ, Sattvata.*
- Defect in any of these aforesaid factors can lead congenital, hereditary, and genetic anomalies.
- According to *Āyurvedic* texts, childhood blindness is an untreatable disease, *Asādhya Roga*.
- It may prevent and manage through; Preconception preparation, Mother's pre-, peri-, and post-natal care and Parents' physical, mental, social and spiritual well-being through practice of yoga.

2.0 LITERARY RESEARCH FROM ANCIENT SCRIPTURES

TITLE: THE CONCEPT OF CHILDHOOD BLINDNESS ACCORDING TO ANCIENT SCIENCES

2.1 INTRODUCTION

Vision is an important link to the physical world, providing us with information beyond the range of other senses, and also a basis to integrate information acquired through hearing, touch, smell and taste. Visual stimuli shape our interactions with, and reactions to the environment. However, not everyone is gifted with sight. A significant portion of the population is sightless or visually impaired. Lack of sight has a major impact on the ability to gain knowledge of the external world.

It is impossible to imagine how mankind could exist without eyesight. Thus, as stated by *Vāgbhata Ācharya* सर्वेइन्द्रियाणां नयनं प्रधानम्। of all sense organs the eye is the most important.

It is the window through which we see the world. Nearly 80% of early learning comes through sight. The maximum percentage of memory stored in the mind is from vision. Sensory birth defects such as VI, blindness and loss of hearing and speech not only affect the structure or function of systems in the body, but also result in many developmental and health problems.

Āyurveda, the ancient Indian medical system, gives due emphasis to this, postulating various causes and risk factors of childhood blindness. According to *Āyurveda,* six procreative factors have an important role as causative factors of congenital, hereditary, and genetic anomalies, including: diet and lifestyle of the mother; deeds in the previous life of the foetus; vitiation of *Vāyu*, *Bīja* (ovum and sperm), *Bījabhāga* (chromosome), and *Bījabhāgavyava* (genes) of the parents.

Incidence of congenital anomalies affects an estimated 1 in 33 infants and result in approximately 3.2 million birth defect-related disabilities every year. An estimated 2,70,000 new-borns die during the first 28 days of life every year from congenital anomalies. Reproduction is a primary characteristic of living organisms. Preconception care and maternal pre, post and during pregnancy care are preventive measures to obtain healthy offspring, which can help early identification of risk factors and prevent their adverse effects. The modern era is challenged by the number of congenital, chromosomal and genetic issues in newborns. Purificatory and other methodologies promoted by *Āyurveda*, and recommended in other texts represent great contributions to ensure progeny are healthy. The present literary study thus focuses mainly on the causes and prevention of childhood blindness according to various ancient Indian scriptures.

2.2 AIM

The review aims to summarize the concept of 'childhood blindness' according to various ancient scriptures.

2.3 OBJECTIVES

The objectives of this review are to:

1. Understand the concept of the eye according to ancient scriptures.
2. Recognize the importance of the eye.
3. Elucidate causes of childhood blindness.
4. Discuss prevention and management of childhood blindness in the ancient sciences.

2.4 MATERIALS AND METHODS

This theoretical study started by thoroughly reviewing the ancient texts; *Caraka Saṁhitā, Suśruta Saṁhitā, Aṣṭāṅga Hṛdaya, Aṣṭāṅga Saṅgraha, Garuḍa Purāṇa, Bhāgavata Purāṇa, Hārīta Saṁhitā, Kāśyapa Saṁhitā, Vedānta Sāra, Manu Smṛti* and *Garbhopaniśad*. Research journals and magazines were also utilized. Information obtained is critically analyzed and presented.

2.5 LITERARY SEARCH OUTCOMES

Sense organs along with the mind combine to perceive objects. The five sense faculties, each of which senses one of the five *Mahābhūtas*, predominantly detect one *Mahābhūta* each, as is inferred from their five respective actions, which serve as agents for the manifestation of the intellect (*Ca Saṁ Śā* 1/24). Of these, the eye is said to be soul of the mind as it offers a window on this beautiful world and is considered the most important of all the *Indriyas*.

2.5.1 Concept of Eyes

Eye is *Jñānedriyaṁ Adhiṣṭhānaṁ* meant for *Rūpa Grahaṇaṁ* (perception of form). It is one of the five sense organs and situated in close proximity to the most important organ of all different groups, namely the brain in the head (*Su Saṁ Śā 5/4)*. There are nine outward openings of the body and the eyes are two of them (*Su Saṁ Śā 5/10)*.

The five sense organs develop from *Srotas* where *Kapha* and *Rakta* flow, whereby the essence of one of the functional aspects of the *Pañcamahābhūtas* becomes lodged. Thus in a *Srotas* in which the *Ākāśabhūta* becomes lodged, that *Srotas* or ear becomes capable of receiving sounds. Likewise, from the area of *Agni* dominance, eyes retain the power of visual perception. The same also holds for the other three sense organs.

पञ्चेन्द्रियबुद्धयः चक्षुर्बुद्धयादिकाः ता पुनरिन्द्रियेन्द्रियार्थसत्त्वात्मसत्रिकर्षजाः
क्षणिका निश्चयात्मिकाश्च इत्येतत् पञ्चपञ्चकम्॥ च सं सूत्र ८/१२

Pañcendriyabudghayaḥ cakṣurbudghayādikāḥ tā
punarindriyendriyārthasattvātmasatrikarṣajāḥ
kṣaṇikā niścayātmikāśca ityetat pañcapañcakam|| Ca Saṁ Sū 8/12

There are five kinds of perception: visual, tactile, auditory, gustatory and olfactory. These are again the products of the combination of sense faculties, their objects, the mind and the soul, they are momentary and determinative. This is all that *Caraka* says about the five senses.

Sense perceptions are caused by the distinctive factors like visual faculty. Of all the sense perceptions, visual perception, being of the widest distribution, occupies the first position.

मसुरदलमात्रां तु पञ्चभुतप्रसादजाम्॥
शीतसात्म्यां नृणां दृष्टिमाहुर्नयनचिन्तकाः॥ सु सं उ ७/३-४

Masuradalamātrāṁ tu pañcabhutaprasādajām ||
Śītasātmyāṁ nṛṇāṁ dṛṣṭimāhurnayanacintakāaḥ|| Su Saṁ U 7/3-4

Eye specialists say that *Dṛṣṭi* (area of sight/ vision) is of the size of a cotylidon of the lentil (seed) born from the essence of the *Pañcabhūtas* (five primary elements), resembles a firefly or

a spark of fire, sustained by everlasting *Tejas* (rays of fire) enveloped/ covered by the outer layer of the eye, in the form of a hollow (hole/ apperture) and accustomed to the cold.

विद्याद्व्यङ्गुलबाहुल्यं स्वाङ्गुष्ठोदरसंमितम्॥
द्वयङ्गुलं सर्वतः सार्धं भिषङ्नयनबुद्बदम्॥
सुवृत्तं गोस्तनाकारं सर्वभुतगुणोद्भवम्॥ सु सं उ १/१०

Vidyāddavyaṅgulabāhulyaṁ svāṅguṣṭhodarasaṁmitam ।
Dvyaṅgulaṁ sarvataḥ sārdhaṁ bhiṣaṅnayanabudbadam ।।
Suvṛttaṁ gostanākāraṁ sarvabhutaguṇodbhavam ।। Su Saṁ U 1/10

The *Nayanabudbada* (eye ball) should be understood as two *Aṅgula* (4cm) in depth, one's own thumb in width (thickness), two and half *Aṅgula* (5cm) in circumference; is round, resembles the nipple of a cow and arising from (comprising of) all the *Bhūtas* (five primary elements - *Pṛthvī*, *Āpa*, *Tejas*, *Vāyu* and *Ākāśa*) and their qualities (properties).

मण्डलानि च सन्धींश्च पटलानि च लोचने॥
अनुपुर्वं तु ते मध्याश्चत्वारोऽन्त्या यथोत्तरम्॥ सु सं उ १/१४-१५

Maṇḍalāni ca sandhīṁśca paṭalāni ca locane ।।
Anupurvaṁ tu te madhyāścatvāro'ntyā yathottaram ।। Su Saṁ U 1/ 14-15

In the eye, *Maṇḍala* (areas/spheres), *Sandhī* (joint / fornices) and *Paṭala* (layers / sheaths) are in succesive order, five, six and six in number respectively; *Pakṣma* (areas of hairs/eye lashes) *Vartma* (area of eyelids), *Śveta* (area of white protion/ sclera), *Kṛṣṇa* (area of black proyion/ cornea) and *Dṛṣṭi* (area of sight/pupil are the five *Maṇḍala* (area); four of these are located respectively in preceding order from the centre and one at the end.

महाभूतानि खं वायुरग्निरापः क्षितिस्तथा।

शब्दः स्पर्शश्च रूपं च रसो गन्धश्च तद् गुणाः॥ च सं शा १/२७

Mahābhūtāni khaṁ vāyuragnirāpaḥ kṣitistathā।

Śabdaḥ sparśaśca rūpaṁ ca raso gandhaśca tad guṇāḥ।। Ca Saṁ Śā 1/27

The five *Mahābhūtas* are *Ākāśa, Vāyu, Agni, Jala* and *Pṛthvī.* Their attributess are sound, touch, vision, taste and smell respectively.

2.5.2 Importance of the Eyes

प्रत्यक्षं नाम तद्यदात्मना चेन्द्रियैश्च स्वयमुपलभ्यते।

तत्रात्मप्रत्यक्षाः सुखदुःखेच्छाद्वेषादयः शब्दादयस्त्विन्द्रियप्रत्यक्ष्याः॥ च सं वि ८/३९

Pratyakṣaṁ nāma tadyadātmanā cendriyaiśca svayamupalabhyate।

Tatrātmapratyakṣāḥ sukhaduḥkhecchādbeṣādayaḥ śabdādayastvindriyapratyakṣy ।।

Ca Saṁ Vi 8/39

Things perceived by oneself or with the help of sense organs come under the category of direct observation. For example: happinass, misery, desire, hatred etc. are perceived with the help of sense organs.

Netra (eye) is an important sense organ amongst the five *Indriyas* for *Indriya janya Jñāna* (sensory knowledge), which is considered the source of *Pratyakṣa Jñāna* (direct perception).

चक्षुरिन्द्रियविज्ञेयाः शरिरोपचयापचयायुर्लक्षणबलवर्णविकारादयः ॥ सु सं सू १०/४ ॥

Cakṣurindriyavijñeyāḥ Śariropacayāpacayāyurlakṣaṇabalavarṇavikārādayaḥ ||

Su Saṁ Sū 10/4

Suśruta has mentioned *Netra* as an important *Sādhana* (instrument) for examining a patient, of the five sense organs and the mind, the six instruments. One can examine *Upachaya* (anabolism), *Apachaya* (catabolism), *Bala* (strength, power), *Śotha* (swelling) and *Varna* (colour) with the help of *Netra*.

न शक्यश्चक्षुषा द्रष्टुं देहे सुक्ष्मतमो विभुः ॥
दृश्यते ज्ञानचक्षुर्भिस्तपश्चक्षुर्भिरेवच ॥ सु सं शा ५/५० ॥

Na śakyaścakṣuṣā draṣṭuṁ dehe sukṣmatamo vibhuḥ ||
Dṛśyate jñānacakṣurbhistapaścakṣurbhirevaca || Su Saṁ Śā 5/50||

The pervading, subtlest consciousness in the body cannot be perceived by the eye, as it is known only to the eyes of knowledge and *Tapas* (penance).

चक्षुस्तेजोमयं तस्य विशेषाच्छ्लेष्मतो भयम्।
ततः श्लेष्महरं कर्म हितं दृष्टेः प्रसादनम्॥ च सं सूत्र ५/१३ ॥

Cakṣustejomayaṁ tasya viśeṣācchleṣmato bhayaṁ|
Tataḥ śleṣmaharaṁ karma hitaṁ ddaṣṭeḥ prasādanam|| Ca Saṁ Sū 5/13||

Of the *Mahābhūtas Tejas* dominates the eyes, so they are specially susceptible to *Kapha* problems. Therefore, therapy that alleviates excess *Kapha* is good for keeping vision clear.

तत्रदृष्टिभागमप्रतिपन्नं तेजो जात्यन्धंकरोति
वातानुगतं विकृताक्ष मिति ॥२/३७ ॥

Tatradṛṣṭibhāgamapratipannaṁ tejo jātyandhaṁkaroti
Vātānugataṁ vikṛtākṣa miti || Su Saṁ Śā 2/35-37

A child is born blind due to failure of the organism's fire principle *(Tejas Dhātu)* to reach the region of the still undeveloped eyes; similarly penetration by the same *(Tejas Dhātu)* into the blood accounts for blood shot eyes in a child. *Tejas* entering into *Pittam* makes a child yellow-pupiled *(Piṅgākṣa); while* entering into bodily *Kapham*, it produces white eyes; when mixed with bodily *Vāyu*, a child of defective eyesight.

चक्षुरक्षायां सर्वकालं मनुष्यैयेत्नः कर्तव्यो जीविते यावदिच्छा ।
व्यर्थो लोकोऽयं तुल्यरात्रिन्दिवानां पुंसामन्धानां विद्यमानेऽपि वित्ते ॥

Cakṣurakṣāyāṁ sarvakālaṁ manuṣyaiyetnaḥ kartavyo jīvite yāvadicchā।
Vyartho loko'yaṁ tulyarātrindivānāṁ puṁsāmandhānāṁ vidyamāne'pi vitte।।

A Hṛ Vi 13/98

Humans should take care at all times to protect their eyes until life ends; though they may be wealthy, this world is useless for blind people; for them days are as good as night.

2.5.3 Causes of Childhood Blindness

According to Sage *Ātreya,* the foetus is produced by a combination of factors: father, mother, self, suitability, nutrients, and mind. Concepts and details of congenital anomalies have been described by most *Āyurveda* scholars. *Āyurveda* texts reveal many factors with important roles in congenital, hereditary, and genetic anomalies: before conception, at the time of conception, after conception, that is, during pregnancy *(Ca Saṁ Sā 4/3)*.

मातृतः पितृतः आत्मतः सात्म्यतो रसतः सत्त्वत इत्येतेभ्यो भावेभ्यः
समुदि तेभ्यो गर्भः संभवति ॥ च सं शा ४/४

Mātṛtaḥ pitṛtaḥ ātmataḥ sātmyato rasataḥ sattvata ityetebhyo bhāvebhyaḥ samudi tebhyo garbhaḥ saṁbhavati ।।Ca Saṁ Śā 4/4

The embryo is formed out of a combination of *Ṣaṭgarbhakārabhāva* (six procreative factors): *Mātṛtaḥ* (Maternal), *Pitṛtaḥ* (Paternal), *Ātmataḥ* (Soul), *Rasataḥ* (Nutritional), *Sātmyato* (Health), and *Sattvaja* (Psych / Mind).

बीजात्मकर्माशयकालदोषैर्मातुस्तथाऽऽहारविहारदोषैः।
कुर्वन्ति दोषा विविधानि दुष्टाः संस्थानवर्णेन्द्रियवैकृतानि॥ च सं शा २/२९

Bījātmakarmāśayakāladoṣairmātustathā' 'hāravihāradoṣaiḥ।
Kurvanti doṣā vividhāni duṣṭāḥ saṁsthānavarṇendriyavaikṛtāni।। Ca Saṁ Śā 2/29

Bīja Doṣa, effects of hereditary transmission, due to defective environment in the womb; *Doṣas,* concerning time of conception and time of confinement; poor diet and activities of the gravida will lead to physical, functional or psychological defects.

(i) Mātṛtaḥ Bhāva

Motherhood is a divine blessing. The mother carries and nourishes the foetus from the time of conception until delivery; the foetus derives all its merits and defects from the mother during this time period. Hence, the mother is considered first among the factors responsible for proper growth of the foetus.

Maternal age at the time of conception, health of the reproductive organs, time of conception, *Bīja* of mother, maternal diet during pregnancy, medicines taken by a gravida during her pregnancy, and any disease at that time, can affect the health and normalcy of the foetus. Factors responsible for foetal abnormalities due to mother's life style are discussed below:

मातुरपचारात् पङ्गुजात्यन्धबधिरमूकमि ॥ सु सं सू २४/५

Māturapacārāt paṅgujātyandhabadhiramūkami ।।Su Saṁ Sū 24/5

Mithya Āhāra Vihāra of mother causes congenital anomalies like *Jātyandha*, ptosis, cataract.

तस्य यत्कालमेवेन्द्रियाणि.....विशेषेणोपचरन्ति कुशलाः ॥ च सं शा ४/२५

Tasya yatkālamevendriyāṇi .....viśeṣeṇopacaranti kuśalāḥ ।। Ca Saṁ Śā 4/25

The heart of the foetus which is derived from the maternal source is connected with the mother's heart through channels carrying nutrient material; at this time the mother is known as *Dvihṛdaya* (two hearted lady), who presents herself with longings/desires for specific things. These should be fulfilled, otherwise unfulfilled desires of this kind lead to birth defects such as dwarfism, mental handicaps, or blindness.

ऋतौ प्रथमादिवसाद् ..... तत् कस्य हेतोः ॥ सु सं शा २/२५

Ṛtau prathamādivasād..... tat kasya hetoḥ ।। Su Saṁ Śā 2/25

A foetus may become blind if the gravida applies collyrium during menstruation. Hence from her very first day of menstruation, she should avoid this.

At the time of coitus, if the mother's bowels are heavy, a dullard will be born. If urine exceeds, a dumb will be born and if both are in excess, a blind will be born (*Tirumamdiram Tantra* II/ verse 481).

बिजात्मकर्माशय ..... गर्भस्य कुक्षौ नियतस्य दोषाः ॥ च सं शा २/२९-३०

Bijātmakarmāśaya ..... garbhasya kukṣau niyatasya doṣāḥ ।। Ca Saṁ Śā 2/29-30

Because of defects in *Śukra* (sperms, ovum), actions associated with the soul, uterus, time and food as well as regimen of the mother, *Doṣas* get variously vitiated resulting in impairment of the shape and colour of the offspring's sensory and motor organs. As a tree standing in a river

current gets afflicted by the forceful downward movement of wood, stones and water during the rainy season, so the foetus in a gravida's uterus is afflicted by her vitiated *Doṣas.*

(ii) Pitṛtaḥ Bhāva

A foetus is produced from the father (sperm). Without a father conception is not possible. The organs, hair on the head, hair of face, small hairs of the body, nail, teeth, bones, veins, ligaments, arteries and semen are derived from the paternal source (*Ca Sam Śā 3/7)*.

According to *Caraka*, a genetic defect in a child, like lameness or blindness is not necessarily linked to any overt defect in the mother or father, but in the parents' ovum and sperm. *Ācharya Kaśyapa*, in the *Śārīra Sthāna* section of *Kaśyapa Saṁhitā*, clearly describes fertilization by entry of male *Bīja* (sperm) into the female *Bīja* (ovum). If a *Bīja* (sperm) coming from the male is afflicted, a progeny may have congenital or genetic anomalies. Abnormalities of *Śukra* and *Vāyu*, as well as vitiated *Vāyu* located in the *Śukra* are also held to produce congenital anomalies. *Ācharya Bhāvamiśrā* mentions abnormality of *Śukra* as a cause of congenital blindness (*Bhā Pur* 3/294). Different *Purāṇas* illustrate how a child's birth is affected not only by the *Karma* of the *Jīva* but also of the parents.

According to *Garuḍa Purāṇa*, it is not the karma of the *Jīva* alone that determines birth and nature but the quality of consciousness of the father at the time of impregnation.

कर्मणा दैवनेत्रेण जन्तुर्देहोपपत्तये ।
स्त्रियाः प्रविष्ट उदरं पुंसो रेतः कणाश्रयः ॥ ग पु ६/५

Karmaṇā daivanetreṇa jantурdehopapattaye।
Striyāḥ praviṣṭa udaraṁ puṁso retaḥ kaṇāśrayaḥ ।।Ga Pu 6/5

As the thoughts in his mind at the time of union, so will be the nature of the one who enters the womb, i.e. a man may be driven to intercourse by a soul desiring to incarnate.

(iii) ***Ātmataḥ Bhāva***

The third important factor in a soul (spirit/ ultimate awareness) is called *Cetana Dhātu,* the foundation of experience*,* or ***Ātma***. A new life is produced by the union of sperm, ovum, and incarnating soul (*Ca Sanı Śā 4/5)*. If one of these is missing no new life will be produced.

यानि तु खल्वस्य गर्भस्यात्मजानि .....स्मृतिरहङ्कारः प्रयत्नश्चेति ॥ च सं शा ३/१०

Yāni tu khalvasya garbhasyātmajāni ..... smṛtirahaṅkāraḥ prayatnaśceti ।।

Ca Sanı Śā 3/10

The aspects of the individual which are derived from the soul and which are formed because of the existence of soul are as follows: stimulation and sustenance of sense organs, mind, senses, characteristic shape, voice and complexion of the individual, desire for happiness and sorrow, likes and dislikes, quality of consciousness, courage, intellect, memory, egoism and efforts. The soul is the root of all righteous and unrighteous acts; hence it is considered ultimately responsible for taking birth in different wombs.

Garbhopaniṣad

नानायोनिसहस्राणि..... कृतं कर्म शुभाशुभम्॥ ग पु ४

Nānāyonisahasrāṇi ..... kṛtanı karma śubhāśubham ।।*Ga Pu 4*

Birth and experiences (pain, pleasure, or any types of suffering) are based on the *Śubha Aśubha* (pure and impure) *Karma* from past lives.

Caraka Saṁhitā

निर्दिष्टं दैवशब्देन कर्म…….. प्रशमं यान्ति तत्क्षयात्॥ च सं श १/११६-११७

Nirdiṣṭaṁ daivaśabdena karma…….praśamaṁ yānti tatkṣayāt ।। Ca Saṁ Śa 1/116-117

Actions performed in previous lives known as *Daiva* (fate) also constitute causative factors for manifestation of diseases. No major action (performed in previous lives) has no corresponding result. Diseases arising from such actions are not amenable to any therapeutic measure. They are cured only after results of past action are exhausted i.e. fully paid for.

The soul undergoes a series of births and deaths with qualities depending on its own good or bad actions. Effects of actions from previous lives are carried by the soul to its next life.

अयं तु व्युत्थानसमये …… न पश्यति॥ वे सा २१९

Ayaṁ tu vyutthānasamaye ……na paśyati ।। Ve Sā 219

Under the momentum of past impressions (actions that have already begun to bear fruit), one experiences the effect of those actions through the physical body composed of flesh, blood etc. Thus, the sense organs are affected by blindness, weakness, incapacity etc.

अङ्गप्रत्यङ्गनिर्वृत्तिः ..... धर्माधर्मनिमित्तजाः॥ सु सं शा ३३६

Aṅgapratyaṅganirvṛttiḥ ..... dharmādharmanimittajāḥ।। Su Saṁ Śā 3/36

Formation of parts and sub parts takes place through nature. Whatever merits or defects occur therein should be known to be caused by the foetus' previous righteous or unrighteous deeds.

Garuda Purāṇa

स्त्रीबालाद्युपपतौ वा वाध्यानां सिध्दिकारणाम्।
सङ्करे जातयो ज्ञेयाः पितुर्मातुश्च कर्मतः॥ ग पु १५१/१८

Strībālādyupapatau vā vādhyānāṁ sidhdikāraṇām ।
Saṅkare jātayo jñeyāḥ piturmātuśca karmataḥ ।।Ga Pu 151/18

The child's birth is affected by the karma of the father and the mother. A thought comes to mind that why do the same initial pathological features produce different diseases in different people; why do they manifests quickly in some, whereas in others there is a long latent period required before the disease manifests itself. Such unexplained or idiopathic factors are due to the ***Ātmaja Bhāva***. *Karmas* from previous lives, which can cause congenital blindness in the present life are as follows:

Garuḍa Purāṇa

कूटसाक्षी भवेन्मूकः काणः स्यात्पंक्तिभेदकः।
अनोष्ठः स्याद्विवाहघ्नो जन्मान्धः पुस्तकं हरेत्॥ ग पु ५/८

Kūṭasākṣī bhavenmūkaḥ kāṇaḥ syātpaṅktibhedakaḥ ।
Anoṣṭhaḥ syādvivāhaghno janmāndhaḥ pustakaṁ haret ।। Ga Pu 5/8

He who bears false witness becomes dumb; he who breaks the meal-row becomes one-eyed; he who interferes with marriage becomes hare-lipped; he who steals a book is born blind.

Manu Smṛti

दीपहर्ता भवेदन्धः काणो निर्वापको भवेत्।
हिंसया व्याधिभूयस्त्वमरोगित्वमहिंसया ॥म स्मृ ११/ ५१-६

Dīpahartā bhavedandhaḥ kāṇo nirvāpako bhavet ।
Hiṁsayā vyādhibhūyastvamarogitvamahiṁsayā ।। Ma Smṛ 11/ 51-6

The stealer of a lamp will become blind; he who extinguishes it will become one-eyed; injury is punished by general sickliness; an adulterer (will have) swellings (in his limbs).

(iv) Rasataḥ Bhāva

Rasa refers to balanced *Āhara Rasa* (*diet*). A *Garbha* (gravida) cannot survive without healthy diet and nutrition. Without a proper nutrition the mother's life is also in jeopardy. A *Garbha* is

called *Rasaja* (born of the finest quality digested food, *Rasa*). Although nutrition does not have direct role on an actual event of formation of a *Garbha*, proper intake of food categories described as beneficial for reproduction helps to strengthen the reproductive system and increases the chances of pregnancy. Unhealthy eating habits damage reproductive cells and system, and may reduce chances of reproduction, or may harm the foetus. It does not mean that improper nutrition always definitely leads to incapacity to reproduce or foetal damage. Without proper nutrition, digestion and assimilation of food, and its proper distribution in the body, growth and development of the foetus cannot take place. This function of *Rasa* (the final essence of digested food, vital for the growth, development and maintenance of the body and tissues) is seen after formation of a *Garbha*. The *Rasaja Bhāva* (emerging from *Rasa*) or characteristics apparent in a *Garbha* are growth and development of body and tissues, regular and uninterrupted process of inhalation and exhalation (respiration), a constant supply of energy, nourishment and enthusiasm.

मातुस्तु खलु रसवहायां..... धमनीनामुपस्नेहो जीवयती ॥ सु सं शा ३/३१

Mātustu khalu rasavahāyāṁ..... dhamanīnāmupasneho jīvayatī ॥ Su Saṁ Śā 3/31

The umbilical cord is attached to the mother's *Rasa* carrying channel, which carries the essential power of food from the mother to the foetus; by this indirect nutrition the foetus develops from conception until its parts and sub-parts are distinct and developed. Thus, its life is maintained by nutrition supplied by *Rasa*-carrying vessels pervading and spreading to all organs of the body.

Balanced *diet* taken by the gravida helps in formation of the foetus' *Sapta Dhātus*, in the required amounts.

प्रसवा भवति इत्येके भाषन्ते तत्र..... जात्यन्धं करोति ॥ सु सं शा २/३५

Prasavā bhavati ityeke bhāṣante tatra..... jātyandhaṁ karoti ।।Su Saṁ Śā 2/35

The child will be born blind if the gravida consumes food not rich in *Tejomahābhūta*.

(v) Sātmyato Bhāva

A new life can come into existence and thrive only when all factors contributing to the beginning of a new life are present in harmony. Those factors are a mother, father, soul, mind and nutrition. When these factors combine under the most favourable conditions and environment, then only can a new life sustain. The optimal presence of all these factors defines the suitability for a new life, and is called *Sātmya* for that *Garbha*. The characteristics imparted by the *Sātmya* to a *Garbha* are called *Sātmyato Bhāva*. These attributes are mostly observed after a baby is conceived, but they determine its sustaining capacity and development. They are: health, vigour, freedom from lust, wellbeing of all organs, quality of voice, skin and reproductive cells (sperm or ovum), and satisfaction in sexual activity.

(vi) Sattvaja Bhāva

Manas is the connecting link between a physiological body and a soul (*Ātma*). *Manas* is not actually said to be involved in the conception of a *Garbha*, but its perpetual contact with a soul and the connecting link, which it forms, is of prime importance. If the link is broken or damaged, there will not be a new life; normal growth and development of the *Garbha* will be in danger. *Manas* defines the following characteristics called a person's *Sattvaja Bhāva*: Attachment, character, purity, aversion, awareness, memory, confusion, sacrifice, jealousy, bravery, fear, rage, happiness, enthusiasm, fiery, rude or mild nature, profoundness and unsteadiness. All these qualities are always present in a person but they are expressed at different times. They cannot all be seen at the same time; a person acts differently in different situations, expressing

these traits accordingly. A person may act bravely in one situation, and be scared in another. According to this doctrine, all living beings fall into one of three constitutions of *Manas*: *Sāttvika, Rājasika* and *Tāmasika*. Even though all human beings possess qualities under all three constitutions, those exhibited more often than others define their dominant trait(s). Accordingly, a person is designated *Sāttvika, Rājasika* or *Tāmasika*.

Human beings possess instinct and intelligence, which do not happen without the presence of *Manas* (mind). Factors determining a child's various psychological endowments, i.e. the level of its mental faculties, are:

व्याकुलित मनोभ्यां अंधाः खन्जाः
कुब्जा वामना व्यंगा जायन्ते ॥ ग उ २०

Vyākulita manobhyām andhāḷ khanñjāḷ
Kubjā vāmanā vyaṅgā jāyante ‖ *Ga Pur 20*

If the man or woman's mind is disturbed at the time of *Samyoga* (coitus), to such couples children with conjenital disorders like blindness etc. may be born.

The above-mentioned *Mātṛtaḷ, Pitṛtaḷ,* and *Ātmataḷ Bhāva* cannot be changed as they come from the parents and *Pūrvajanma Saṁskāra* (resulting from quality of conduct), respectively, but the other three *Bhāva -factors, namely; Rasataḷ, Sātmyato* and *Sattvaja Bhāvas*, practiced properly can modify the intrauterine environment and psychosomatic health of the mother, and have a healthy impact on the foetus.

2.5.4 Prevention and management of childhood blindness

According to *Āyurvedic* texts, childhood blindness is an untreatable disease, *Asādhya Roga*. It requires both prevention and management, with emphasis on precautions to be taken before conception. Factors include:

a) Preparations prior to conception, and its planning;

b) Mother's pre-, peri-, and post-natal care;

c) Parents' physical, mental, social and spiritual wellbeing through practice of yoga.

a) Preparations Prior to Conception

Preconception care is defined as precautions to identify and modify medical, behavioural and social risks to a gravida's health or pregnancy outcome through prevention and management. The regimen followed during the period before coitus aims to improve the probability of obtaining excellent progeny. These are:

- **Age for marriage:** When a man of twenty-five marries a lady aged twelve, he will obtain righteousness, money, pleasure and children, and also be able to perform duties to his fore-fathers (*Suśrutasaṃhitā Śārīrasthāna 10/53)*.

- **Selection of Suitable partner:** *Āyurveda* recommends that everyone should choose his or her partner with a different constitution to his or her own, in order to balance the qualities in their children.

- **Age for conception:** If a man less than twenty five years makes a girl of less than sixteen years conceived, the foetus is destroyed in uterus itself; even if born, it does not live long or if lives it possess debilitated organs (*Suśrutasaṃhitā Śārīrasthāna 10/55)*.

- **Four vital factors responsible for conception:** For a better progeny four factors should combine properly: 1. *Ṛtu* (woman's period of ovulation), 2. *Kṣetra* (healthy uterus), 3. *Ambu* (*Rasa Dhātu* of digested food), 4. *Bīja* (ovum and sperm of woman and man) (*Su Sam Śā 2/33*).

- **Regimen for Coitus (intercourse):** *Su Sam Śā 2/31* states that coitus must be avoided for the first three nights of menstruation. Couples should undergo *Snehana* (unction) and *Svedana* (fomentation), and then purify themselves by *Vamana* (emesis) and *Virecana* (purgation) in order to balance their *Doṣas*. Then they should apply *Āsthāpana* and *Anuvāsana Basti* (enema) *(Su Sam Śā 8/4)*. By these *Pañcakarma* procedures excess *Doṣas* and *Malas* of all seven *Dhātus* are eliminated from the body.

- **Time for conjugation (intercourse):** Couples desiring a male child should have coitus on *Yugma Dina*, the fourth, sixth, eighth, tenth or twelfth day (*Su Sam Śā 2/28*), while those desiring a female child should couple on *Ayugma Dina*, the fifth, seventh, ninth or eleventh day. Thirteenth and subsequent days are to be avoided (*Su Sam Śā 2/30*).

- **Method for Coitus (intercourse):** During the time of intercourse both man and wife must be in *Prasanna Citta*, happy states of mind. The woman should be in supine position during intercourse to receive the seed (semen) because in this situation *Doṣas* remain in normal position (*Ca Sam Śā 8/4)*. Intercourse should be avoided after overeating; with any negative feelings; with a longing for someone else; with one who is chronically sick or suffering from obesity; with a woman who is menstruating, or with a gynaecological disorder.

• **Diet for couples:** Diet is key to successful conception for both partners. A good diet and lifestyle is critical for both partners for at least six months before trying to conceive. *Āyurveda* describes many useful herbs and herbal remedies for both partners: *Aśvagandhā* (*Withania somnifera*), *Śatāvarī* (Asparagus racemosus), *Gokṣur* (Tribulus terrestris), *Musalī* (Curculigo orchioides), *Kauncabīja* (Mucuna pruriens), *Śilājīta* (Asphaltum), *Vidārikanda* (Pueraria tuberosa), *Muleṭhī* (Glycerrhiza glabra), *Balā* (Abutilon indicum), *Āmalakī* (Phyllanthus emblica) and drugs of *Prajāsthāpana*.

b) Mother's pre, peri, and post-natal care

Pregnancy and childbirth have great significance in the life of a woman. During this period, a woman needs great care and attention from her family members. *Āyurveda* prescribes a set of rules which are very important for gravidae to follow at different stages of pregnancy. Details concern *Āhāra* (nutrition), *Vihāra* (lifestyle), and *Vicāra* (thought processes).

➢ ***Āhāra* of the Mother**

The essence of food to be taken by the gravida is divided in three parts; 1) nourishes her body, 2) promotes her breast milk, and 3) nourishes the foetus. According to her needs, regular, periodic and systematic supervision (examination and advice) is essential. Such care should start at the beginning of pregnancy and last until childbirth. Proper care results in proper development of the foetus and its delivery, and for the mother, improved health and ability to withstand the strain of labour, and enjoy a problem-free post-natal phase.

The prescribed monthly regimen is broadly discussed under two headings, first, month by month dietary regimen (***Māsānumāsika Pathya***); second, substances benefitting pregnancy (***Garbhasthāpaka Dravya***)

I. *Māsānumāsika Pathya* (Month by Month Dietary Regimen)

Nutritional requirements change as the foetus develops. Dietary requirements of the gravida thus change by the month. Recognizing the importance of changes in requirements, *Āyurveda* preceptors have given detailed monthly dietary regimes from the first to the ninth month.

Table 2.5.4.A: The monthly dietary regimen described by scriptures	
Texts	**Dietary Regimen**
During 1st month	
Ca Saṁ Śā 8/32	Non medicated milk
Su Saṁ Śā 10/3	Sweet, cold and liquid diet
A Saṁ Śā 3/2	Medicated milk
Hā Saṁ Tṛ A 49/2	*Madhuyaṣṭi, Madhūka Puṣpa* with butter, honey and sweetened milk
During 2nd month	
Ca Saṁ Śā 8/32	Milk medicated with *Madhūra Rasa* (sweet taste) drugs
Su Saṁ Śā 10/3	Same as first month
A Saṁ Śā 3/3	Same as *Caraka*
Hā Saṁ Tṛ A 49/2	Sweetened milk treated with *Kākoli*
During 3rd month	
Ca Saṁ Śā 8/32	Milk with honey and *Ghṛuta*
Su Saṁ Śā 10/3	Same as first month
A Saṁ Śā 3/3	Milk with honey and *Ghṛuta*
Hā Saṁ Tṛ A 49/2	*Kṛśara*
During 4th month	
Ca Saṁ Śā 8/32	Milk with butter
Su Saṁ Śā 10/4	Cooked *Ṣaṣṭī* rice with curd, dainty and pleasant food mixed with milk and butter and meat of wild animals
A Saṁ Śā ¾	Milk with 12gm of butter
Hā Saṁ Tṛ A 49/2	Medicated cooked rice
During 5th month	
Ca Saṁ Śā 8/32	*Ghṛuta* prepared with butter extracted from milk

Su Saṁ Śā 10/4	Cooked *Ṣaṣṭīka* rice with milk, meat of wild animals along with dainty food mixed with milk and *Ghṛuta*
A Saṁ Śā 3/5	Same as *Caraka*
Hā Saṁ Tṛ A 49/3	*Pāyasa*
During 6th month	
Ca Saṁ Śā 8/32	*Ghṛuta* prepared from milk medicated with *Madhūra* (sweet) drugs
Su Saṁ Śā 10/4	*Ghṛuta* or rice gruel medicated with *Gokṣura*
A Saṁ Śā 3/6	Same as *Caraka*
Hā Saṁ Tṛ A 49/3	Sweetened curd
During 7th month	
Ca Saṁ Śā 8/32	Same as in sixth month
Su Saṁ Śā 10/4	*Ghṛuta* medicated with *Pṛthaka Parṇyādi* group of drugs
A Saṁ Śā 3/8	Same as *Caraka*
Hā Saṁ Tṛ A 49/3	*Ghṛutakhaṇḍa* (a sweet dish)
During 8th month	
Ca Saṁ Śā 8/32	*Kṣīra Yavāgu* mixed with *Ghṛuta*
Su Saṁ Śā 10/4	*Āsthāpana Basti* with decoction of *Badarī* mixed with *Balā, Atibalā Śatapuṣpā, Paṭala* etc., honey and *Ghṛuta*. *Āsthāpana* is followed by *Anuvāsana Basti* of oil medicated with milk *Madhūra* drugs
A Saṁ Śā 3/7	*Kṣīra Yavāgu* mixed with *Ghṛuta*, *Āsthāpana Basti* with decoction of *Badarī*, *Anuvāsana Basti* with oil medicated with *Madhūra* drugs
Hā Saṁ Tṛ A 49/3	*Ghṛutapūraka*
During 9th month	
Ca Saṁ Śārīra 8/32	*Anuvāsana Basti* with oil prepared with drugs of *Madhūra* (sweet) group, vaginal tampon of this oil
Su Saṁ Śā 10/4	Unctuous gruels and meat-soup of wild animals up to the period of delivery
A Saṁ Śā 3/9	Same as *Caraka*
Hā Saṁ Tṛ A 49/3	Different varieties of cereals

Table 2.5.4.B: Foods that a Gravida should Avoid

Texts	**Dietary Regimen**
Su Saṁ Śā 10/3	dry, stale, rotten and decomposed food
Kā Saṁ Śā 5/16-20	cold water, garlic
Aṣ Hṛ Śā 1/44-47	pungent, hot, heavy, hard to digest food, wine and meat

II. *Garbhasthāpaka Dravya* (Substances Benefitting Pregnancy):

According to *Ca Sam Śā 8/20 Garbhasthāpaka Dravya* help to maintain proper health, growth and development of both gravida and foetus, and to prevent abortion; they may also be used in its treatment. *Garbhasthāpaka Auṣadhi* include: *Aindrī* (*Bacopa monnieri*), *Brāhmī* (Centella asiatica), *Śatāvīrya* (Asparagus racemosus), *Sahasravīrya* (Cynodon dactylon), *Amogha* (Stereospermum suaveolens), *Avyatha* (Tinospora cardifolia), *Śiva* (Terminalia chebula), *Ariṣṭa* (Picrorhiza kurroa), *Vātyapuṣpi* (Sida cardifolia), *Visvasenakanta* (Callicarpa macrophylla) etc. These should be taken orally as preparations in milk or ghee. The gravida should bathe in cold decoctions of these drugs on *Puṣya Nakṣatra*. The gravida should keep close contact with them as amulets round the right arm and on the head.

- ***Vihāra* (lifestyle) and *Vicāra* (thought process) of the Gravida:**

अतोऽनुक्तेषु या नारी समभिध्याति दौहृदम्॥
शरीरचारशीलैः सा समानं जनयिष्यति॥ सु सं शा ३/२८

Ato'nuktesu yā nārī samabhidhyāti dauhṛdam||
Śarīracāraśīlaiḥ sā samānam janayiṣyati|| Su Sam Śā 3/28

Whatever desires come to the gravida, she delivers the offspring with similar physique, behaviour and conduct.

गर्भिणी प्रथमदिवसात् प्रभृति सामान्यमेतदाप्रसवात्॥ सु सं शा १०/३

Garbhiṇī prathamadivasāt prabhṛti sāmānyametadāprasavāt|| Su Sam Śā 10/3

From the first day the pregnent women should always be cheerful, clean, ornamented, white-dressed and devoted to auspicious rites, pacifying *Devatās, Brāhmaṇas* and preceptors.

Vihāra and ***Vicāra*** harmful to the *Garbha* (foetus), which may cause defects in the child, are not conducive to birth of a healthy child:

Table 2.5.4C: Substances Harmful for the Foetus		
S.N.	**Text**	***Garbhasthāpaka Bhāva***
1	*Ca Saṁ Śā 4/18*	Pungent drugs, Exercise, Coitus
2	*Su Saṁ Śā 3/19-26*	Coitus, Exercise, Excessive satiation, Excessive Emaciation, Sleeping during the day and waking at night, Grief, Riding in Vehicles, Squatting, Oleation, Bloodletting, Suppression of Natural Urges.
3	*A Saṁ Śā 2/36*	Pungent drugs, Exercise, Coitus, Emaciation, trauma, Conveyance causing excessive jerks, night awakening, day sleeping, Suppression of natural urges, Indigestion, prolonged stay in hot sun or near fire, Anger, grief, fear, terror, fasting, squatting, seeing or hearing disliked things.
4	*Aṣ Hṛ Śā 1/44-47*	Excessive coitus, Exercise, carrying heavy weight, covering herself with heavy sheet, untimely sleep, squatting, grief, anger, excitement, suppression of natural urges, fasting, excessive walking, use of red garment, sleeping in supine position, bloodletting, purifying measures and enemas.
5	*Kā Saṁ Śā 5/16-20*	Lengthy standing or squatting posture, shaking, excessive laughing, trauma, seeing decreasing moon or setting sun, solar or lunar eclipse, being rude to guests or rough with beggars, perform oblations for pacification, with *Ghṛita*, garlands, or pots filled with curd or *Ghṛita*, tying anything from thread or rope, wearing tight garments.

देवताब्राह्मणपराः शौचाचारहिते रताः॥

महागुणान् प्रसूयन्ते विपरीतास्तु निर्गुणान्॥ सु सं शा ३३५

Devatābrāhmaṇaparāḥ śaucācārahite ratāḥ||

Mahāguṇān prasūyante viparītāstu nirguṇān|| *Su Saṁ Śā 3/35*

Those devoted to Gods and *Brāhmaṇas,* engaged in cleanliness, good conduct and benevolence deliver children with great qualities; otherwise, devoid of qualities.

c) Parents' physical, mental, social and spiritual wellbeing through Yoga practices

The limbs of yoga are traditionally presented as a progression, each connected to the others through the central body of yoga. Whichever limb of practice is focused on inevitably causes the other limbs to grow as well. Each limb is essential for optimal functioning of the body. *Mātṛtaḥ, Pitṛtaḥ* and *Ātmataḥ Bhāva* fixed by previous karma can be changed by following the proper law of conduct through yoga limbs; *Yama* and *Niyama*.

- ***Yama***

The five *Yamas* are meant to harmonize one's social and external interactions. They are:

I. *Ahiṁsā* (non-violence): Rather than eliminating violence from our actions, this means the abscence of violence in our personality.

II. *Satya* (truthfulness): Awareness of what is correct, right and true as it manifests from within, together with the ability to express it. When we are able to observe the true manifestation of a vritti, thought, desire, or the influence of some external situation on our life without it being filtered, affected and altered by the intellect, self image and ego, then that truthful state of mind represents the purity and harmony of our inner expression and experiences.

III. *Asteya* (honesty): A way to experience the sincere quality of life where the true nature of the personality is seen and experienced without any kind of suprimposition of external ideas.

IV. *Brahmacarya* (maintenance of vitality): To establish oneself in the awareness of higher consciousness.

V. *Aparigraha* (non-possessiveness or non-attachment): It allows us to perceieve the attachments which bind us to rajasik or tamasik states of mindor to the world of the senses and objects and which do not allow our perception to rise beyound the selfish qualities.

- ***Niyama***

The five *Niyamas* create a sense of discipline in one's inner life. There are:

I. *Śauca* (purity / cleanliness), is to uphold the ethic of purity, avoiding impurity in mind, body, speech and envoirnment.

II. *Santoṣa* (contentment) means to be happy with whatever one has, to enjoy living in present momentwithout craving or desiring anything more.

III. *Tapasa* (purification through discipline) which is practice of intense self-discipline and attainment of will power.

IV. *Svādhyāya* (self-study) is ability to see our true divine nature through the contemplation of our life's lesson.

V. *Iśvarapraṇidhāna* (devotion to God) means "to lay all your actions at the feet of God."

The other procreative factors *Rasataḥ, Sātmyato* and *Sattvaja Bhāvas* can be changed by the following limbs of yoga.

- ***Āsana***

The concept of *Āsana* is a physical posture in which one is at total ease and in perfect harmony with oneself. Usually the word, *Āsana***,** refers to static postures, some or which are used for meditation. When performing an *Āsana*, awareness, balance, comfort and stillness are essential.

- ***Prāṇāyāma***

Practice of *Prāṇāyāma* activates the *Prāṇa* subtle energy and thus invigorates the *Prāṇamaya Koṣa,* By slowing down the breathing process, it facilitates the flow of *Prāṇa* in the body. It also enhances oxygen availability to the brain and thus, in gravidae, to the foetus.

- ***Pratyāhāra***

Pratyāhāra is the turning inwards of the mind, that is essential for meditation practice in yoga's final three limbs. For a gravida, it is vitally helpful during labour and delivery. It helps to restore the *Prāṇa* used to support the new life growing within. Since ancient times, it has been known that even while in the womb the foetus gains impressions from its surroundings and behaviour of its mother, and starts learning things. Practice of *Pratyāhāra* strengthens the inward focus of energy and intention, and provides impulses that help the foetus to grow.

- **Meditation**

'*Dhyāna*' (meditation), the most effective practice for relief at the *Manomaya Koṣa* level, slows the number of thoughts, thereby calming and relaxing the mind. A recent study found yoga more effective than antenatal exercises at reducing duration of all stages of labour and pregnancy complications, need for epidurals and caesarean section, anxiety, depression, and uncomfortable pregnancy-related experiences, and improving quality of life and interpersonal relations. It reduced perceived stress and improved adaptive autonomic response to a relaxation session. Infant birth weight and Apgar scores also improved (Maharana, 2015).

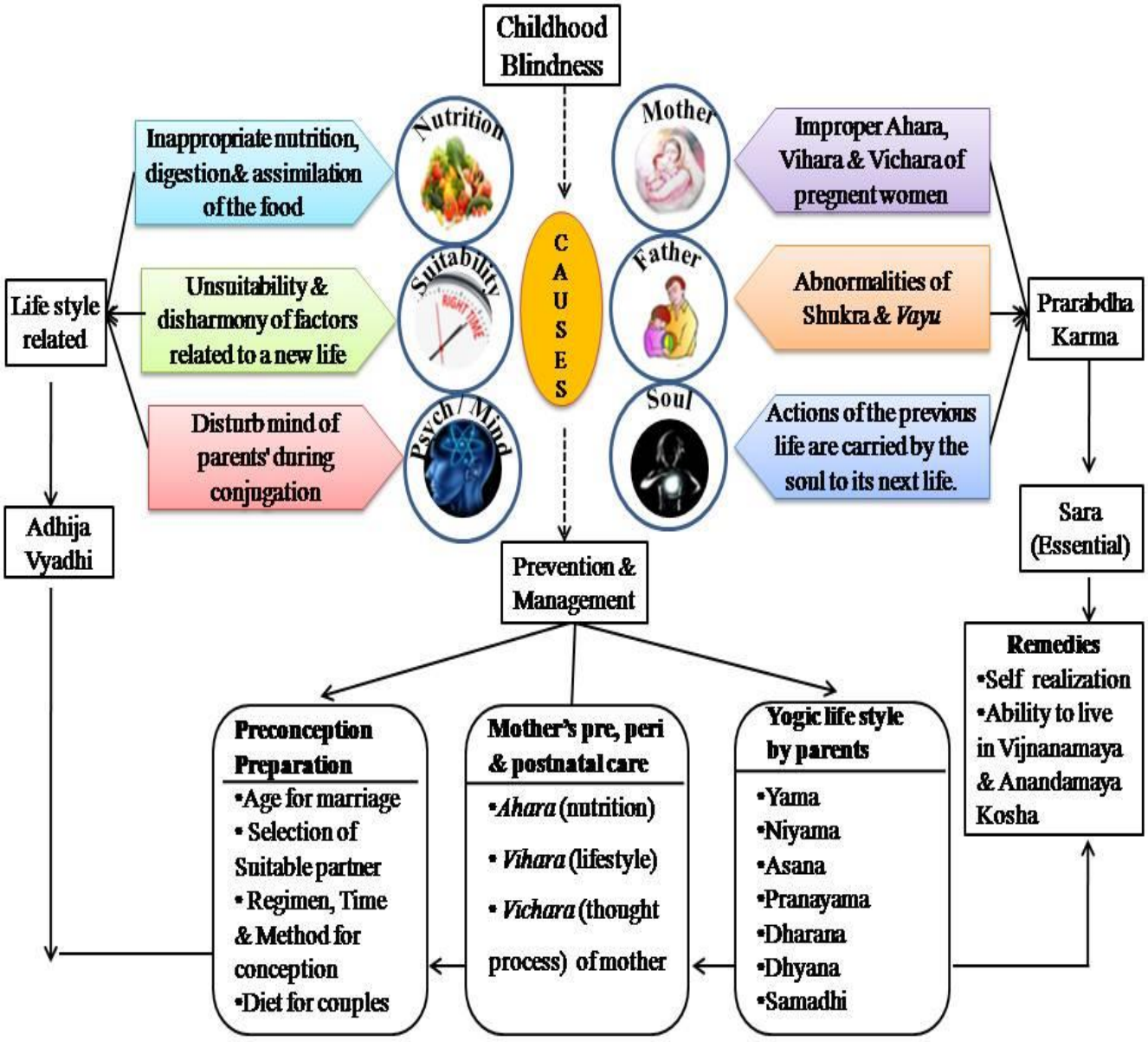
2.6 CONCLUSION

The eye is a small but extremely important organ for all human beings, the value of which we may fail to recognize; however, its absence creates drastic changes at bothphysiological and psychological levels. Childhood blindness is a devastating physical condition with deep socio-economic implications. The eye is a powerful organ requiring and deserving adequate care throughout life.

In spite of developments in diagnostic techniques, medical science is unable to keep incidence of birth defects under control. In such situations, *Āyurveda* has immense power to prepare both

partners prior to conception, in antenatal care of the mother, and for the holistic wellbeing of both parents, all of which play primary roles in achieving a healthy offspring, and thus structuring a healthy family, society, and nation.

Figure 2.6: **Conceptual Model of Childhood Blindness**



CHAPTER 3

REVIEW OF SCIENTIFIC RESEARCH

Key Messages

- Physical Activities by children with VI is approximately less per day which is not meeting the daily 60 minutes of physical activity recommended by WHO.
- Various aspects of physical fitness are significantly lower in children with VI compared to their age-matched sighted peers.
- Significantly higher level of anxiety and depression score was observed in children with VI in comparison with sighted counterparts.
- To tackle the problems of visually impaired children, various modes of interventions have been adapted.
- Yoga's benefits for various aspects of health for sighted children has been substantially supported by the literature.
- Yoga's multi dimensional benefits may help to improve the ability of visually challenged children to handle many of their challenges.

3.0 REVIEW OF SCIENTIFIC LITERATURE

The aim of this chapter is to review what is already known about individuals with VI, understand the status of research problems in the field theoretically and methodologically. Identifying key points in current knowledge will help justify the research topic. For this purpose, information has primarily been gathered from journal abstracts, journal and thesis bibliographies, and conference proceedings. The review is organized as follows: (a) physical activities of children with VI, (b) physical fitness in children with VI, (c) their psychological health, (d) interventional studies on children with VI, (e) yoga for normal sighted children, (f) yoga for children with specific diseases, (g) yoga for differently-abled children, (h) yoga for children with VI and (i) scope of the study in light of these facts.

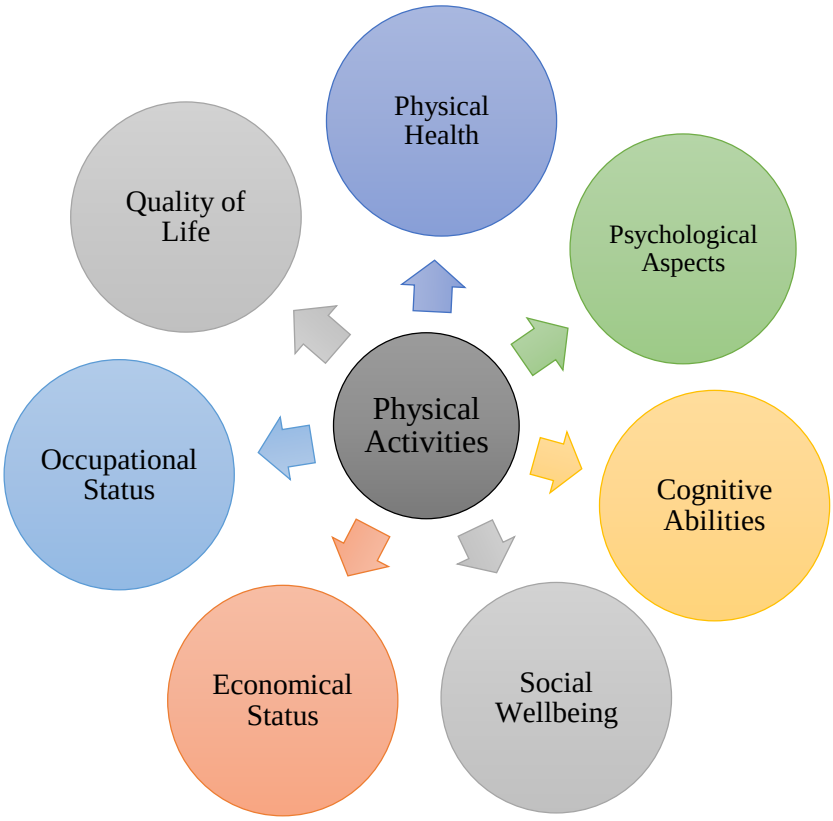
3.1 PHYSICAL ACTIVITIES OF CHILDREN WITH VI

Physical inactivity has been identified as the fourth leading risk factor for global mortality, causing an estimated 3.2 million deaths annually (WHO, 2014). Health benefits of engaging in physical activity during childhood include health and fitness of cardiovascular and respiratory systems, bone health (helps in weight bearing activities) (Janssen & Leblanc, 2010); muscular strength and endurance, better cognitive performance such as working memory (Kamijo et al., 2011), academic achievement (Biddle & Asare, 2011), self-esteem, and lower symptoms of anxiety and depression (Bonhauser et al., 2005; Strong et al., 2005).

Lack of physical activity is a serious concern for the health of individuals with VI, as they spend a moderately low fraction of the day physically active, and then generally insufficient in duration and intensity to improve overall health status (Holbrook, Caputo, Perry, Fuller, & Morgan, 2009). Various factors restrict their participation: (1) lack of social opportunities, such as lack of tools, exercise partners or sighted guides (Shapiro et al., 2005); (2) safety concerns of parents and teachers (Lieberman & McHugh, 2001), and (3) self-imposed barriers, such as

fear of fall or being teased by others while exercising (Stuart, Lieberman, & Hand, 2006). **A**verage level of participation in physical activity by children with VI has been variously estimated at 28 min (Kozub & Oh, 2004), and 18.4 min (Houwen, Hartman, & Visscher, 2009) per day, which does not fulfil the WHO recommendation of 60 minutes moderate to vigorous physical activity daily. The consequence of inadequate physical activity is lower levels of physical fitness and psychological health, as discussed in detail below.

Figure 3.1: Impact of physical activities on various aspects of life



3.2 PHYSICAL FITNESS IN CHILDREN WITH VI

Physical fitness is a powerful marker of health during childhood and adolescence (Ortega, Ruiz, Castillo, & Sjöström, 2008). A recent systematic literature review of 29 publications on children and young adults (age 5–22 years) revealed lower levels of participation in physical activity and poorer physical fitness among children with VI compared to sighted peers. However, the 23 cross-sectional studies confirmed that young adults with VI may need more physical activity to become fitter and have a healthier body composition (Augestad & Jiang, 2015). Various aspects of fitness are significantly lower in children with VI than their age-matched sighted peers (Haibach, Wagner, & Lieberman, 2014; Houwen et al., 2009; Houwen, Visscher, Hartman, & Lemmink, 2007; Reimer, Cox, Boonstra, & Smits-Engelsman, 2008; Wagner, Haibach, & Lieberman, 2013) and is associated with their lack of independence and lower performance in daily activities. Details of vital aspects of physical fitness and their status in children with VI are described below.

3.2.1 Muscle Strength

Muscle strength is a fundamental factor of physical fitness, and a predictor of function, mobility, independence and daily activity. Children with VI are often incapable of generating enough force to execute many actions, as they have to remain more vigilant when performing movements. They find performing tasks, which move their centre of gravity outside their area of base support, more difficult (Horvat, Ray, Croce, & Blasch, 2004). This constitutes a possible reason for the muscle weakness often observed in those with VI. The next section discusses the importance of various muscle groups and their status in individuals with VI compared to their sighted counterparts.

3.2.1.1 Upper Extremity Strength

The upper extremities are essential for performance of many important tasks including most activities of daily living: dressing, combing, writing, and most housework. They are used for reaching and grasping, and involve faster contraction and coordinated steps of precise motor control (Hirschfeld, 2007). Enhancing upper extremity strength can play an important role in improving daily activity. Various studies have demonstrated deficiencies in upper extremity strength in those with VI (Lieberman & McHugh, 2001; Lieberman et al., 2010; Looney & Plowman, 1990). These studies assessed upper extremity function using the Fitnessgram health-related fitness test, Brockport Physical Fitness test and Fitnessgram criterion scores respectively.

3.2.1.2 Lower Extremity Strength

Lower extremity strength is essential for posture and stability, and functional tasks like walking and climbing stairs (Fleisher, Trudelle-Jackson, Thompson, & Smith, 2011; Horvat et al., 2003), maintaining balance (Wu et al., 2016), and preventing falls (Aoyama, Suzuki, Kuzuya, 2015), reducing risk of injury. Muscle force coupled with kinematic adjustments, especially around the knee and ankle, are used to maintain stability and prevent falls (Horvat et al., 2003, 2004). Persons with vision loss are more prone to reduced lower-limb strength and power than their sighted peers, as a study of adults observed (Horvat et al., 2004). Another comparative study concluded that congenitally blind children with low vision had weaker knee and hip extensors than their sighted peers because of poorer body build or restrictions of blindness (Wyatt & Ng, 1997).

3.2.2 Muscle Endurance

A review of psychomotor abilities of individuals with VI found that their cardiovascular endurance, muscular endurance, flexibility, and balance were significantly lower than the

normal sighted (Skaggs & Hopper, 1996). Two studies observed lower levels of muscle endurance in children with VI (Karakoc, 2016; Lieberman & McHugh, 2001).

3.2.3 Coordination

A study of eye-hand coordination used the Movement Assessment Battery to compare 48 children with VI aged 7 to 10 years with 48 sighted children (Houwen, Visscher, Lemmink, & Hartman, 2008). The children with VI showed poorer performance.

3.2.4 Motor Fitness

A recent article reviewed 11 studies of fundamental motor skills; 6 were comparative, 2 were co-relational, 2 were validation studies, 1 was descriptive. None were interventions. Results suggested that, compared to sighted peers, those with VI tended to exhibit significantly greater performance delays in fundamental motor skills (Haegele, Brian, & Goodway, 2015). A study comparing 30 sighted with 30 moderate LV children aged 8-13 found that the LV children had poorer motor skills, especially balance, than the sighted children (Bouchard & Tetreault, 2000). Another study found similar results (Wagner et al., 2013).

3.2.5 Balance

Vision plays a profound role in balance (Blomqvist & Rehn, 2007; Giagazoglou et al., 2009; Hsu, Scholz, Schöner, Jeka, & Kiemel, 2007), especially for dynamic tasks (Monica, Alonso, Morimoto, Bobbio, & Greve, 2013). Absence of vision affects neural control of body, and postural sway increases (Hsu et al., 2007; Sforza, Eid, & errario, 2000) reducing the ability to maintain balance (Sforza et al., 2000), and may cause frequent injuries (Lord & Menz, 2000), including falls (Ray, Horvat, Croce, Mason, & Wolf, 2008).

Studies have shown that visually impaired children have significantly reduced balance (Haibach, Lieberman, & Pritchett, 2011; Houwen et al., 2008), greater instability (Portfors-

Yeomans & Riach, 1995), and poorer equilibrium (Juodžbalienė & Muckus, 2006) than sighted counterparts. A comprehensive review of 17 studies found 12 in broad agreement that children with VI perform worse on static and dynamic balance (Houwen, Visscher, Lemmink, & Hartman, 2009).

3.2.6 Respiratory Function

A study compared the spirometric measurements: vital capacity (VC), forced vital capacity (FVC), forced expiratory volume in 1 second (FEV1), peak expiratory flow (PEF), forced expiratory flow of 25-75% (FEF25-75), maximum voluntary volume (MVV), and VO2 max (maximum oxygen uptake) on 102 blind children and adolescents with 86 deaf children matched group of non-handicapped subjects (control group). All subjects were divided into 3 age groups: children (up to 12 years), junior adolescents (up to 15 years), and senior adolescents (up to 18 years). A significant influence of deafness was found on PEF, FEF25-75, and MVV as compared with the control subjects, mean VC was significantly lower in blind adolescents. Results suggest that sensory defects during childhood and adolescence affect the respiratory system (Zebrowska, Gawlik, & Zwierzchowska, 2007).

3.3 PSYCHOLOGICAL HEALTH IN CHILDREN WITH VI

3.3.1 Depression and Anxiety

Studies have found prevalence of depressive symptoms 2 to 5 times higher among those with VI than the general population (Margrain et al., 2012; Noran, Izzuna, Bulgiba, Mimiwati, & Ayu, 2009). An epidemiological survey of depressive symptoms in 1003 individuals aged 18 to 60 yrs with serious visually disabilities, found them in 40.8% (Zhong, Liu, Dai, & Zhang, 2013). Other, smaller studies comparing adolescents with VI to sighted peers report higher levels of anxiety (Bolat et al., 2011) and depression (Koenes & Karshmer, 2000).

3.3.2 Self-Esteem

Low self-esteem is associated with loneliness, peer rejection, and depression (Orth, Robins, & Roberts, 2008), and aggression and delinquency (Baumeister, Campbell, Krueger, & Vohs, 2003). Self-esteem in those with VI is positively linked to social support, independence in conducting activities of daily living (Beach, Robinet, & Hakim-Larson, 1995), and participation in sports (Ponchillia, Strause, & Ponchillia, 2002).

Research on self-esteem in children and adolescent with VI is relatively limited, but shows them to have lower self-esteem compared to sighted counter parts (Fotiadou, Christodoulou, Soulis, Tsimaras, & Mousouli, 2014). A similar result obtained for girls aged 12 to 17 (Garaigordobil & Bernarás, 2009) A comparison of 54 adolescents with VI (40 boys, 14 girls) with 385 normal sighted adolescents (172 boys, 213 girls) of comparable age found self-esteem, school achievement and social skills lower in girls with VI than control girls (Huurre & Aro, 1998).

3.3.3 Working Memory

A study of verbal working memory also found correlations between visual cortex activation and task performance in early the blind (Amedi, Raz, Pianka, Malach, & Zohary, 2003), but those with VI have better memory for auditory verbal information (Raz, Striem, Pundak, Orlov, & Zohary, 2007; Röder, Rösler, & Neville, 2001). Another study found children with VI superior to sighted children on measures of short term memory, but not on measures of working memory (Swanson & Luxenberg, 2009).

3.4 INTERVENTIONAL STUDIES ON CHILDREN WITH VI

A recent review article found only limited physical activity interventions for children and youth with VI (Piva da Cunha Furtado, Allums-Featherston, Lieberman, & Gutierrez, 2015).

Dynamic balance was assessed in 19 children who were randomly assigned to a balance-training and control group. After 8 weeks training, the experimental group improved their mean score significantly from 11.11 to 34.11, whereas the control group mean score reduced from 11.5 to 10.5, though not significantly (Jazi et al., 2012). Another study was conducted at a summer sports camp on 11 children with VI to assess the effectiveness of Skiing Game on balancing skills. Significant improvement was observed after playing the game many times (Morelli, Liebermann, Foley, & Folmer, 2014). An 8 week study of training in a combination of Greek dance and pilates compared to a control group participating in their school physical education lessons, found significant improvement in both static and dynamic balance in the experimental group, but no improvement in controls (Mavrovouniotis et al., 2013).

Two studies tested goalball training as an intervention to improve fitness in children with VI; the first (Tuncay, Belgin, Aydin, Bergun, & Aydin, 2004), compared 51 goalball players to 52 controls undergoing movement education. It found significant improvements in motor fitness components of balance, handgrip strength, flexibility, vertical jump, and isokinetic concentric peak torque strength. The goalball group showed significant decreases in BMI and body fat % compared to controls (Calıskan et al., 2011).

Another study examined the impact of ten weeks of rope jumping exercise intervention on the health-related physical fitness of students with VI. Significant improvements were observed in flexibility, aerobic capacity and physical fitness in the experimental group, while the control group showed no significant improvement (Chena & Linb, 2011).

A study to assess a motor training program had 40 participant children with LV: 20 in the training group practiced under supervision; 20 controls were under Home Training. The Snellen Chart and Bruininks Oseretsky Motor Proficiency Test were used for assessment. Significant

differences were found on all skills in the Training Group, but, apart from visual motor control, none were observed in controls (Aki, Atasavun, Turan, & Kayihan, 2007).

A 6-week attention training program (Çalik, Kitiş, Cavlak, & Oğuzhanoğlu, 2012) used 20 children with LV in 2 groups: The first participated in an attention training program for 30 mins 3 times per week; the second group of 10 were controls. Assessments included a modified child Mini Mental State Examination, the Northwick Park Index of Independence, and the LV-QOL questionnaires. Pre-Post differences were significant in all variables for the experimental group but the control group shows no significant changes.

Gymnastic skills on motor capabilities were evaluated in 20 girls with VI, randomly divided into control and experimental groups. Motoric module test was used to measure the selective motor capabilities before and after the 12 weeks (two sessions/week) of training. Within group comparison showed significant difference in experimental group for all tests while no significant difference was observed in control group (Hashemi et al., 2012).

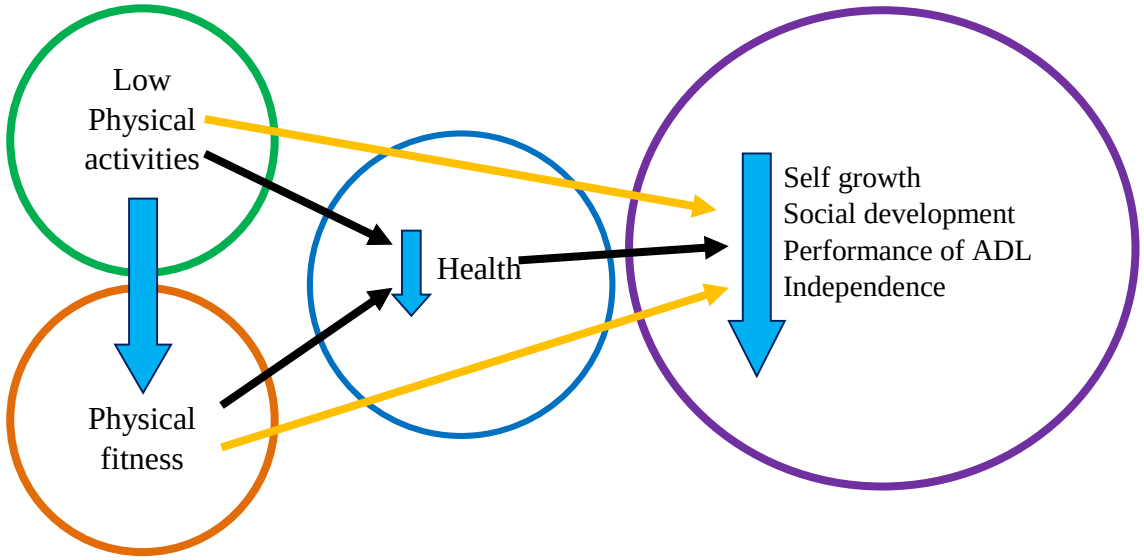
An example of a study on children with VI due to failure to appreciate their fear of falling compared 20 visually impaired and 20 hearing impaired children, assessing sleep quality, self-concept, and behavioural and emotional states before and after 3 months learning to ice skate. Significant improvements on all the variables were observed in children with hearing impairment. The children with VI showed significant improvement in sleep quality and emotional problem scores, but their self-concept, peer relations and hyperactivity scores deteriorated (Dursun et al., 2015).

Table 3.4: Interventional studies on Physical and Psychological variables in Children with Visual Impairment						
S. No	**Author &Year**	**Design**	**Participants**	**Intervention**	**Outcome measure**	**Results**
1	Aki et al. (2007)	NRCT	40 participants with severe low vision: school training group (TG) (10 Male and 10 Female; mean age 8:9 yr:mo) and home training group (HTG) (10 Male and 10 Female; mean age 8:10 yr:mo).	Motor-training program: 3 months; 3 sessions/wk; 60 min/ session	Bruininks-Oseretsky Motor Proficiency Test-Short Form	HTG: Significant increases in all subtests, except in visual motor control. Differences between groups were found in school TG (balance, bilateral coordination, upper limb coordination, response speed, and visual motor control).
2	Çalik et al. (2012)	RCT	20 children with low vision (age 7–12 years): attention training group (n= 10), control group (n= 10).	Attention training: 6 wk; 3 sessions/ wk ; 30 min/session	Child Mini Mental State Examination, Northwick Park Index of Independence, & Low Vision-Quality of Life questionnaires	Only attention training group showed significant increases in all tests.
3	Caliskan et al. (2011)	NRCT	46 participants with severe VI: goalball group (n= 22; 12 Male and 10 Female) and movement education group (n= 24; 14Male and 10 Female); age 10–15years.	Goalball and movement-education training: 1 months; 2 sessions/wk; 90 min/session	Percent body fat (PBF), Body-mass index (BMI)	Significant reduction in BMI and PBF for goalball group. Only PBF was reduced in the movement-education group. Higher reductions of PBF were found for girls in goalball group.

4	Chen & Lin (2011)	RCT	16 youth with VI: experimental group (n= 8) and control group (n= 8); age 15–17years;	Rope-jumping exercise: 10 wk; 3 sessions/wk; 50 min/ session	BMI; sit-and-reach; sit-up; progressive aerobic cardiovascular endurance run (PACER)	Significant post-training increases in the sit-and-reach and PACER tests. Control group did not show any significant changes.
5	Dursun et al. (2015)	NRCT	40 students (age 8-16 yrs): visually impaired group (n= 20; 12 Male and 8 Female, mean age 2.0yr); hearing impaired (n= 20; 12 Male and 8 Female, mean age 12.4yr)	Ice skating: 3 months; 2 sessions/wk; 60min/session	sleep quality, self-concept, behavioural and emotional states	Hearing impaired: significant improvement in all variables; Visually impaired: significant improvement in sleep quality & emotional problem but self-concept & hyperactivity scores reduced.
6	Hashemi et al. (2012)	RCT	20 girls: experimental group (n= 10, mean age 9.2yr), control group (n=10, mean age 10.4yr).	Gymnastic skill: 12 wk; 2 sessions/wk; 60 min/ session	Motoric module test	Only experimental group showed significant increases in all tests.
7	Jazi et al. (2012)	RCT	19 participants with visual acuity worse than 6/18, no blind: balance-training (n=9; 7 Male and 2 Female) and control group (n= 10; 5 Male and 5 Female); age 8–14 years.	Balance training: 8 wk; 2 sessions/wk; 60 min/session	Modified Bass Test of Dynamic Balance	Only experimental group showed significant increases in all tests.
8	Mavrovouniotis et al. (2013)	RCT	14 participants who were blind: experimental group (n= 9, mean age 15.7yrs) or physical education classes (n= 5, mean age 16.40yrs).	Experimental gr; Greek dances/ Pilates and physical education gr: 8 wk; 2sessions /wk; 45 min/ session	Movement Assessment Battery for Children-2nd ed.; Bruininks-Oseretsky Test of Motor Proficiency-2 Short Form	Significant increases found in the experimental group for 3 tasks of static balance and 4 tasks of dynamic balance. No differences in the physical education group.

9	Morelli et al. (2014)	NRCT Single group	11 participants (8 Male and 3 Female; mean age 13: 2 yr:mo)	Skiing game; 3 dys for 2 hours	Balance: Nintendo Balance board and two Wii remote controllers.	Significant improvement in balancing skills.
10	Tuncay et al. (2004)	NRCT	103 male (age13–15 yrs) with varying degrees of blindness: goalball n=51, non-goalball n= 52	Goalball: 6 hours/wk. Non-goalball: No participation	Motor fitness balance, handgrip, flexibility, vertical jump,	Non-goalball players were inferior in all motor fitness compared with goalball players.

Figure 3.2: Impact of low physical activities on children with visual impairment



3.5 YOGA FOR CHILDREN

Belief that attitudes and behaviours established in childhood lay the foundations for adult activities (Commonwealth Department of Health and Family Services, 1998) make children a priority group for health promotion campaigns. A growing research literature documents benefits of yoga in children and adolescents, concluding preliminary evidence has been established for the benefits of yoga on various mental and physical health outcomes with no adverse events (Galantino, Galbavy, & Quinn, 2008; Birdee et al., 2009). Yoga studies of physical and psychological health in normal sighted children are discussed below.

3.5.1 Yoga for Physical Fitness in Normal Sighted Children

Yoga practices have been shown to have a positive impact on problems related to the musculoskeletal system; flexibility, muscle strength, and endurance. (Table 3.5.1)

Musculoskeletal Problems: An RCT conducted in 1976 found yoga practice of 30 mins per day for 3 weeks to result in significant improvement in minimum muscular fitness in normal school children. No improvement was observed in controls (Gharote, 1976). Another RCT comparing a yoga group of 49 with 49 controls reported significant within group improvement in muscle endurance, but no significant improvement in muscle strength (Telles et al., 2013). A study of hand grip strength and endurance, and respiratory pressure with 20 in the yoga group and 20 controls, showed significant improvement in hand grip strength and endurance and respiratory pressure in the yoga group after six months training, but no significant improvement in the control group (Madanmohan, Jatiya, Udupa, & Bhavanani, 2003).

A study of the yogic breathing technique, *pranayama* increased hand grip strength following participation in a 10-day yoga camp for children aged 11 to 18 years (Raghuraj, Nagarathna, Nagendra, & Telles, 1997). Pranayama practices involving manipulating the nostrils, are

supposed to balance and awaken the life energy. This may be an explanation for the improved grip strength following.

Two studies examined effects of a *Suryanamaskar* intervention with no control group. One study comparing slow and fast *Suryanamaskar* found significant improvement in isometric hand grip strength, hand grip endurance and pulmonary function in both groups (Bhavanani, Udupa, Madanamohan, & Ravindra, 2011). The second study of 24 weeks practice divided participants into groups of different gender, 49 male, and 30 female. Upper body (bench press and shoulder press techniques) and lower body (back and leg muscles) muscle strength were assessed pre and post, with general body endurance similarly evaluated by push-up and sit-up tests. Both groups showed significant within group improvements on all tests (Bhutkar, Bhutkar, Taware, & Surdi, 2011). Another study measured upper and lower extremity muscle strength, endurance and aerobic capacity in 91-school children (aged 7-9 yrs), randomly assigned to yoga and physical exercise groups. The yoga group received a 3-month intervention of 45 minutes daily. Both groups showed significant improvement in all variables except forearm muscles strength (D'souza & Avadhany, 2014).

Motor Speed: One study assessed effects of yoga training on finger tapping task in children and adults with a no intervention control group. Findings included significant increases in tapping speed in the children's group after ten days yoga training (Dash & Telles, 1999).

Coordination: The plate tapping test measures upper body reaction time, hand-eye quickness and coordination. A 3-month study comparing a yoga group to a physical exercise group found significant decrease in the time taken to perform the task by the yoga group (Telles et al., 2013).

Balance: A systematic review conducted by Jeter and colleagues identified 15 studies of yoga for balance in healthy populations, concluding that yoga may have a beneficial effect on balance

(Jeter et al., 2014). A study, conducted in New York on fourth- and fifth-grade students, found that children in the yoga group had better post intervention balance scores than the non-yoga group after the training period of 12 weeks (1 hour per week) (Berger, Silver, & Stein, 2009). In contrast, two other studies did not find any result attaining significance after yoga training. The first, an RCT with 98 school children participants, used the Flamingo Test to assess single leg balance. It found no significant improvements in the yoga group, but unexpectedly, a decrease was observed in the control group who participated in physical exercise, that reached significance (Telles et al., 2013). The second study, divided 33 girls into 2 groups, both of which practiced yoga: an instructor-led group of 14; and a video-led group of 19. During the 7 weeks intervention, both groups practiced yoga for 30 to 40 minutes twice a week, and also a walking program of similar duration thrice a week. Assessments used the Bruininks-Oseretsky Test of Motor Proficiency, second edition (BOT-2) to measure balance and flexibility. Neither groups' balance scores changed significantly (Donahoe-Fillmore, Brahler, Fisher, & Beasley, 2010).

Peak expiratory flow rate (PEFR): Two RCT studies showed significant improvement in PEFR in the yoga group after six months (Madanmohan et al., 2003) and three months of training (D'Souza & Avadhany, 2014), while the control groups showed no significant improvement for either study. In another study of PEFR, which was non-randomized, significant improvement was observed in the yoga group children after the four months of intervention, but not in the control group (Jiwtode & Rathod, 2015). Other studies of specific yoga practices, *Suryanamaskar* (Kumar, Sivapriya, & Thirumeni, 2011), *Nadishodhana Pranayama* (Sivapriya, Suba, & Thirumeni, 2010), and slow and fast *Suryanamaskar* (Bhavanani et al., 2011), have seen significant improvement in children's PEFR. All studies that we found reported significant improvements in PEFR, and we found no study of children that failed to observe significant improvement in this variable.

Table 3.5.1: Yoga studies on Physical variables in normal sighted children						
S.No	**Author & Year**	**Design**	**Participants**	**Intervention**	**Outcome measures**	**Result**
1	Berger et al. (2009)	Two group pre post study	4th & 5th grade: yoga group: n=39 CG: n=32	12 weeks; 1 hour per week	Harter's Global Self-Worth and Physical Appearance subscales, emotional & physical wellbeing,	Yoga group had better post intervention; Negative Behaviours scores and balance than the non-yoga group.
2	Bhavanani et al. (2011)	RCT	n =42 (21 males and 21 females) Age 12-16 years Two groups of 21	6 months;30–40 minutes Fast Suryanamaskar (FSN) and Slow Suryanamaskar (SSN)	1. Physiological: systolic pressure. isometric hand grip (IHG) strength and hand grip endurance(HGE) 2. Pulmonary functions (PF)	FSN group showed a significant improvement in systolic pressure & IHG strength. Both the group showed improvement in HGE and PF tests. But FSN group was better than SSN group in HGE test.
3	Bhuktar et al. (2011)	Sequential self-control study	79 volunteers, 49 M, 30F, age 17.5-20 yrs	24wks ;6 days/wk; 60 min per session (24 cycles of SN)	Upper and lower body muscle strength and endurance	Both groups showed significant post training increases in all tests
4	D'souza & Avadhany (2014)	RCT	91-school children, age7-9 yr, YG:46, PE:45	3 months; 45 mins daily, **YG**: A+P+M **PE:** passive stretching & aerobic exercises	Endurance and aerobic capacity. muscle strength	Both the group showed significant improvement for all other variables except forearm muscles strength
5	D'souza & Avadhany (2014)	RCT	91 Children, age7-9 yr, YG: 46, PE: 45	3 months; 45 mins daily; **Yoga**: A+P+M **PE:** passive & aerobic exercises	Peak expiratory flow rate (PEFR), and pulmonary pressures	Significant increase was observed in PEFR in YG after post-intervention. YG performed significantly higher than the PE gr.

6	Dash & Telles, 1999	Two group pre post study	YG:53 adults &152 children and CG: 38 adults	8hr/day for 10 days for children, 30 days for adults Yoga: A, P, kriya & Devotional session	Motor speed	Significant increase in baseline tapping speed between 0-10 sec, 10-20 sec, & 20-30 sec in both adults and children after yoga practice but not in strength and endurance.
7	Fillmore et al. 2010	NRCT 2-gr pre-post design	33 female: instructor-led yoga (14) and video-led yoga (19);14 to 18yrs	7 wks; Yoga training 2 times/wk & a walking program 3 times/wk	hamstring flexibility, body fat, strength, and balance	Both groups showed improvement but did not reach to significant level; Balance scores and body fat percentages remained constant over the intervention period
8	Gharote (1976)	RCT	9 students; YG-4, CG-5	3wks; 6dys/wk, 30 mins/session, National fitness corps syllabus used to teach YG	Minimum Muscular Fitness	YG showed improvement. CG: No significant changes
9	Jiwtode (2015)	NRCT	100 children, age 12 to 15 yrs. YG: n =50, CG: n= 50	4 months: 6dys/wk ; 45 mins/session IYM	Peak Expiratory Flow Rate (PEFR) and respiratory pressures like maximum expiratory pressure (MEP), maximum inspiratory pressure (MIP).	YG: statistically significant increase in MEP, MIP, FEV1 and PEFR. CG: improvement was statistically insignificant
10	Mandanmohan et al. (2003)	RCT	N=40,age 12-15yrs, n=20 in each YG and CG	6 months;5dys/wk; 45 min/ session, YG: A +P+ R, CG: Regular activities	HGS, HGE, Respiratory pressures and Pulmonary function and PEFR	YG: statistically significant in all variables. CG: No significant changes

11	Raghuraj et al. (1997)	RCT	130, school children, age 11-18yrs formed 5 grs & each gr assigned to one practice	10 dys; 4times/dy (27 rounds), 1. Right, 2. Left, 3. alternate nostril breathing 4. BA, 5.Mudra	Hand Grip Strength	Group 1,2,3 showed significant changes and 4,5 showed no change
12	Kumar, 2011	RCT	115 school students aged 8-14 years	SN, 45 days daily practice of 12 poses were held for a duration of 30 seconds.	blood pressure(BP), heart rate (HR), respiratory rate (RR), forced vital capacity (FVC) and PEFR	Systolic blood pressure, PEFR and FVC increased significantly and RR, HR and diastolic blood pressure decreased significantly after the practice of SN
13	Sivapriya, 2010	RCT	115 school students aged 8 – 14 years	45 days daily practice of Nadi Shodhana Pranayama	PEFR, FVC, forced expiatory volume in 1 sec (FEV1) and RR	Showed significant increase in PEFR, FVC, FEV1. The RR declined after the practice
14	Telles et al. (2013)	RCT	98 children, age 8 -13 yr, n=49 in each groups, YG (15 girls) & PE (23 girls)	3months ; 5dys/wk; 45 min/ session YG: A+P+R+ chanting, PE: jogging, rapid movements & games	(i) Eurofit physical fitness test battery, (ii) Stroop color-word task for children, (iii) Battle's self-esteem inventory and (iv) Teachers' rating scale.	Both groups showed an improvement in BMI, sit-ups & stroop task. Balance worsened in the PE group, while plate tapping & self-esteem improved in the YG.
Note: RCT- Randomized control trial, NRCT- Non-Randomised Controlled Trial, A- Asanas, P- Pranayama, M-Meditation, R-Relaxation, YG-Yoga group, CG- Control group, PE- Physical Exercise, NS- Not significant, BA-Breath Awareness, IYM- Integrated Yoga Module, MR- Mentally retarded, MEP- maximum expiratory pressure						

3.5.2 Yoga for Psychological Health in Normal Sighted Children

Most adults suffering from mental health disorders have ages of onset that can be traced to childhood and adolescence. About 7.5% of adolescents meet the criteria for mental disorder laid out in the Diagnostic and Statistical Manual for Mental Disorders, Fourth Edition (DSM-IV) criteria, some unfortunately for more than one mental health conditions (Kessler & Wang, 2008). Here we summarize current observed effects of yoga interventions on anxiety and depression, self-esteem and working memory in children. (Table 3.5.2)

Anxiety and Depression: A recent systematic review examined the evidence base for the reduction of anxiety by yoga. 80 articles over the period 1990 to 2014 were analyzed, in which a yoga intervention addressed anxiety in children and adolescents aged from 3 to 18 years. The review stated that nearly all studies observed reduced anxiety (Weaver & Darragh, 2015). An 11 week RCT of secondary school students compared 30 to 40 mins yoga sessions with similar physical education classes. Students completed pre and post assessments on mood, anxiety, Depression, perceived stress, resilience, and other mental health variables. Yoga participants showed statistically significant difference on ager control and fatigue as compared to control group (Khalsa et al., 2012). In another study, fifty-one 11^{th} and 12^{th} grade student participants, who had registered for physical education classes, were cluster-randomized to yoga or physical education. The yoga group received a Kripalu yoga-based program for 10 weeks; controls received normal physical education classes. Self-report questionnaires were administered to participants, pre and post the intervention. The Profile of Mood States-Short Form and Tension-Anxiety subscales improved in yoga group students, but worsened in controls, indicating that yoga practice benefits psychosocial wellbeing, and prevents its disruption (Noggle et al., 2012).

Self-Esteem: An RCT conducted on 98 school children aged 8 to 13 years found a significant improvement in self-esteem for yoga group after 3 months of intervention (Telles et al., 2013). Another RCT assessed the efficacy of an 8-week mindfulness training through yoga on 155 middle school girls (mean age 9.9 years) on stress and coping abilities, self-esteem, and self-regulation (White, 2012). The experimental group met for one hour on a single day per week, but also completed 10 minutes of yoga homework on the other six days per week; they showed significant improvement in self-esteem and self regulation. In a third study, effects of yoga practice were compared to traditional physical education activities. Self-esteem was measured pre and post an 8-week intervention with both groups showing improvements (Bridges & Madlem, 2007).

Memory: A study of two groups of 30 children aged 11 to 16 years, one attending a yoga camp and the other a fine arts camp, 10 days yoga practice, consisting of asanas, pranayama, meditation and guided relaxation, assessed effects on verbal and spatial memory tests. The study found significantly improved delayed recall of spatial information, with the yoga group showing a significant 43% increase in spatial memory scores, while the fine arts control group showed no change (Manjunath & Telles, 2004).

Table 3.5.2: Yoga For Psychological Health In Normal Sighted Children						
S.No	**Author & Year**	**Design**	**Participants**	**Intervention**	**Outcome measures**	**Result**
1	Bridges & Madlem, (2007)	NRCT	Age: 13 to 14 yrs YG: (n=26,13 M), CG:(n= 27, 16 M)	Both the grs: 2 dys/wk, 40-min.Other 3 dys/wk engaged in CRE activities	Self-esteem was given pre, mid, and post test	self-esteem did increase in both the experimental and control groups
2	Khalsa et al. (2012)	RCT	PE: physical education; YG: yoga group	11 wks; 2-3times/wk; 30-40 mins session	mood, anxiety, perceived stress, resilience	YG: slight improvement in anxiety PE: reduced anxiety score
3	Manjunath et al. (2004)	NRCT	60 children: age 11 to16yrs; Yoga & fine arts:(n=30,13G); CG: (n=30,16 G)	10 days: 8hrs/dy	verbal and spatial memory	Only yoga group showed a significant increase of 43% in spatial memory scores.
4	Noggle, et al. (2012)	RCT	Grade 11 or 12 students (N = 51) cluster-randomized by class 2:1 yoga: PE-as-usual	Kripalu-based 10 weeks; 2 to 3 times /week yoga program A+B+R+M .	POMS-SF, PANAS, PSS, IPPA, RS, STAEI, and Mindfulness	PE: showed decreases in primary outcomes, YG maintained or improved. Total mood disturbance improved in YG and worsened in CG, as did in POMS-SF, STAEI. Positive affect remained same in both, negative affect significantly worsened in CG, & improved in YG.
5	Telles et al. (2013)	See above in Table3.5.1 no.14				self-esteem improved in the YG
6	White et al. (2012)	RCT	190 children, age 8-11 yrs	8 weeks: 1 hr / wk, 10 mins of daily homework	Perceived stress, Coping abilities, Self-esteem, & Self-regulation	Self-esteem and self-regulation improved in both Mindful Yoga and wait list control group

Note: RCT- Randomized control trial, NRCT- Non-Randomised Controlled Trial, A- Asanas, P- Pranayama, B- Breathing Practice, M-Meditation, R-Relaxation, YG-Yoga group, CG- Control group, PE- Physical Exercise, PMS-Profile of Mood States, PANAS- Positive and Negative Affect Schedule for Children, PSS- Perceived Stress Scale, IPPA- Inventory of Positive Psychological Attitudes, RS- Resilience Scale, STAEI- State Trait Anger Expression Inventory-2™, CRE- cardio-respiratory endurance

3.6 YOGA FOR CHILDREN WITH SPECIFIC DISEASES

This section lists and describes scientific literature evaluating the effectiveness of yoga interventions for children and adolescent with medical conditions. (Table 3.6)

Irritable Bowel Syndrome (IBS): A **s**tudy of 25 participants with IBS, age 11 to 18 years (20 girls and 5 boys), who practiced yoga daily for four weeks, reported decreased anxiety for the yoga practitioners compared to a wait list control group (Kuttner et al., 2006).

Cancer: A community-based yoga study of paediatric cancer out-patients found that a 12-week yoga intervention benefitted physical fitness and activity levels (Wurz, Chamorro-Vina, Guilcher, Schulte, & Culos-Reed, 2014). Another study found 2 months yoga practice to improve perception of gross motor function (Geyer, Lyons, Amazeen, Alishio, & Cooks, 2011), while significant decreases in anxiety score were seen in adolescents with cancer aged 13 to 18years (Thygeson, Hooke, Clapsaddle, Robbins, & Moquist, 2010).

Asthma: In a 7 week RCT carried out on 31children aged 7 to 12 years diagnosed with asthma, the yoga group improved in muscle strength and endurance compared to the control group (Chen, Mao, Lai, Li, & Kuo, 2009). Potential benefits of yoga practice have also been observed on pulmonary function and exercise capacity (Jain et al., 1991); and spirometric tests (Jasrotia & Kanchan, 2013).

Diabetes: A 12-week prospective pilot Ashtanga yoga program enrolled 20 (aged 8–15 yr) children at risk of development of type 2 diabetes. Participants showed improved self-esteem, and reduced anxiety symptoms (Benavides & Caballero, 2009).

Eating Disorders: A study on children showed decreased in anxiety and depression scores after an 8 week yoga intervention (Carei, Fyfe-Johnson, Breuner, & Brown, 2010), but a study of young adults showed no significant differences in anxiety scores between yoga and control groups (Mitchell, Mazzeo, Rausch, & Cooke, 2007).

Table 3.6: Yoga for Physical & Psychological Health of Specific Diseased Children						
S. No.	**Author & Year**	**Design**	**Participants**	**Intervention**	**Outcome measures**	**Results**
1	Benavides & Caballero, (2009)	NRCT	YG: n=26, (13 M and 13 F). CG: n=27, (16 M and 11 F) Age: 13 to 14 yrs	8 wks; 2 dys /week;40-min/ sessions CG: PE activities	Coopersmith Self-Esteem Inventory	There was no significant difference in self-esteem between regular physical education activities and yoga
2	Carei, et al. (2010)	RCT;3 time assessments: baseline, post inter (9 wk)& 1mon follow-up (12wk)	54 adolescent, age: 11–21 ys; 27 standard care and 26 yoga plus standard care	8 consecutive weeks;1 hour of yoga semi-weekly	Eating Disorder Examination (EDE), Body Mass Index (BMI), BDI, ST AI questionnaire.	Both groups maintained current BMI levels and decreased in anxiety and depression over time.
3	Chen et al. (2009)	Quasi-experimental research design	31asthmatic children, age 7-12 yr,YG: n =16; CG:n=15	2 weeks; 60-minutes	BMI, flexibility, muscle strength and endurance, and cardiopulmonary fitness.	Improvement of BMI, flexibility, muscle strength , and cardiopulmonary fitness after 2 weeks of self-practice at home, yoga exercise.
4	Geyer, et al. (2011)	NRCT	Six children participated	2 months; 5 yoga sessions	Quality of life	Statistically significant differences were found in child perception of gross motor function
5	Jain et al. (1991)	NRCT	46 young children with a history of childhood asthma	90mins/daily in the morning and evening ;YG: Kriya, A+P	resting pulmonary functions, exercise capacity & exercise induced bronchial lability index	YG: statistically significant in all variables. CG: improvement was statistically insignificant

6	Jasrotia & Kanchan (2013)	NRCT- 2 armed study	30 asthmatic children; age 11.47 ± 1.55 YG: 15, CG:15	3 months: , 6dys/week; 45 minutes /session A+P	Spirometry testing was done at baseline, 6 and 12 weeks in all subjects.	YG: Significant increase in VC, FVC, PEFR; CG: showed increase in VC after 12 weeks
7	Kuttner et al. (2006)	RCT	25 adolescents, age 11-18 yrs with IBS divided yoga or wait list control group.	1 hr instructional session, followed by 4 wks of daily home practice guided by a video	gastrointestinal symptoms, pain, functional disability, coping, anxiety and depression	Adolescents in the YG tended to report lower levels of functional disability, fewer emotion-focused avoidance pain coping strategies (ie, internalizing and externalizing), and less overall anxiety than adolescents in the CG.
8	Thygeson, et al. (2010)		11 children: (age 6 to 12 yrs): 5 adolescents aged 13 to 18 years	A single yoga session	Sense of wellbeing through Spielberger State Anxiety Scale	Children had normal anxiety scores pre-class that did not change. Adolescents and parents experienced significant decreases in anxiety score
9	Wurz, et al. (2014)	NRCT	8 pediatric cancer out-patients (4 M; 4 F; mean age 11.88 ±4.26	12-week 2times/week	Physical fitness Functional mobility, Flexibility, Range of motion, Physical activity level (PAL)	Significant improvements for patient and parent reported HRQL, functional mobility, hamstring flexibility (left and right),and total PAL pre to post intervention.

3.7 YOGA FOR DIFFERENTLY ABLED CHILDREN

As for children with specific diseases, numerous studies have suggested that yoga can also assist children with special needs. (Table 3.7)

Mentally Retarded: A 9-month study of 45 children with mild, moderate, and severe levels of mental retardation, found improvements in IQ, social adaptation and locomotors skills in the yoga group, compared to the control group (Uma, Nagendra, Nagarathna, Vaidehi, & Seethalakshmi, 2008). An RCT, in which 30 girls received eight weeks of yoga training found that static balance, dynamic balance and gait significantly improved in the yoga group (Parisa, Yahya, & Reza, 2015). Another study showed that 60 days of *pranayama* practice was effective in improving fine motor coordination (Singh & Singh, 2014).

Autism: A two year specially adapted yoga therapy program improved skills in imitation, cognition, social-communication, eye contact, non-verbal communication and receptivity to verbal commands related to spatial relationships (Radhakrishna, Nagarathna, & Nagendra, 2010).

Table 3.7: Yoga for differently abled children						
Sl.No.	**Author & Year**	**Design**	**Participants**	**Intervention**	**Outcome measures**	**Results**
1	Parisa et al. (2015)	RCT	30 MR girls experimental and control groups. In each gr, n=15	8 weeks; 3sess /wk; 1hr/sess with 10 replications for each exercise	Static balance, Dynamic balance and Gait	YG: statistically significant in all variables. CG: No significant changes
2	Radhakrishna, et al. (2010)	Assessment 3 points. Pre, mid and post	6 in each group	YG: 10 mon; 5 sess/wk; 45mins /sess for and regular practice at home	Imitation and other skills, and behaviour	IAYT may offer benefits as an effective tool to increase imitation, cognitive skills and social-communicative behaviours in children with ASD
3	Singh & Singh, (2014)	RCT one group pre post	5 mild intellectually impaired children of age 7 - 10 yrs	Omkar-5min for 5days, LNB and RNB for 10 minutes, M-5min 60 days	fine motor coordination abilities	significant differences between mean/average time taken in performing the inserting pegs task in pre-test and post-test
4	Uma, et al. (2008)	RCT	90 children; n=45 in both the group YG & CG	YG: 1 academic year (5hr/ week) with an integrated set of yogic practices	IQ and social adaptation parameters	YG showed significant improvement in all variables as compared to CG
Note: LNB- Left Nostril Breathing, RNB- Right Nostril Breathing, M- Meditation, MR- Mentally Retarded, IAYT-Integrated Approach of Yoga Therapy, ASD-Autism Spectrum Diseases, YG-Yoga Group, CG- Control group						

3.8 YOGA FOR CHILDREN WITH VISUAL IMPAIRMENT

Yoga for children with VI is not yet mainstream, although efforts have been made to make practice more accessible. CD sets http://www.yogacenterofmarin.com/propshop.htm have been developed for home practice. Another home solution, sound yoga board, communicates through body sensations, when a person is out of alignment, indicating which parts of the body are under stress http://www.sosoundsolutions.com/yoga-board/. A special yoga mat for the visually impaired provide tactile cues for foot and hand placement http://rousettus.com/products/yoga-equipment/visuallyimpaired-yoga-mat-viym. An eyes-free yoga, 'exergame', was developed using Microsoft Kinect to act as a yoga instructor. It teaches six yoga postures, and has customized auditory-only feedback based on skeletal tracking (Rector, Bennett, & Kientz, 2013).

Since 1974, yoga practices have been recommended as solutions to both physical and psychological difficulties in the VI population (Heyes, 1974). To the best of our knowledge, only 3 studies have been performed to measure effects of yoga on children with VI.

In the early 90s, an RCT was carried out, which compared measurements of autonomic variables, including heart rate, breath rate, skin resistance, mood pressure, and respiration for groups of children aged 12 to 17 years with impaired vision and normal sight. It had two parts; the first showed that children with VI had higher diastolic blood pressure, heart and breath rates compared to normal sighted. The second part compared effects on two groups of 12, of one hour of yoga daily, and gardening as a physical activity. After three weeks, the yoga group showed significant reduction in breath rate, whereas no changes were observed in controls (Telles et al., 1999). A more recent wait-listed two-armed-matched case–control study with 54 adolescents with VI (28 yoga versus 26 controls) of both genders aged 10 to 19 years, from two blind schools were assessed for proprioceptive function on a kinesthesiometer on the 1st and

last (30^{th}) days. The yoga group practiced for 1½ hr daily for 30 days, while the controls followed their regular activities. Significant decrease in error scores for proprioceptive sense measurement were found at 20° and 120° right elbow position in the yoga group, whereas controls show no improvement (Mohanty et al., 2014). A study measured effects of yoga on self-concept and emotional maturity in 15 students with VI. After four weeks of yoga training a significant improvement was observed in levels of self concept and emotional maturity (Berwal & Gahlawat, 2013). These findings suggest that yoga may be an excellent, integrated solution for many problems facing children with VI.

Table 3.8: Yoga for children with visually impaired

Sl. No	Authors & year	Design	Participants	Intervention	Outcomes measures	Results
1	Telles et al.(1999)	RCT	28 children (age 12-17 yrs) matched for age and degree of blindness	3 weeks: daily /1 hr. yoga group (Asana 50 mins & Relaxation 10 mins), Control Group: Physical activities	Blood Pressure, Electrocardiogram, volumetric pressure transducer (for respiration and skin resistance)	Yoga group showed significant reduction in breath rate and marginal reduction in arousal. No change in control group
2	Mohanty et al. (2014)	NRCT	54 students: yoga group: 28, Control group:26 age10-19 yrs	28 days: daily/ 90 mins	Elbow Joint position sense using Kinesthesiometer	Yoga group showed significant improvements in right hand 20° & 120°. No significant improvement in control group
3	Berwal & Gahlawat, (2013)	NRCT Single group	15 visually impaired students	4weeks	Saraswat's Self-Concept Inventory and Yashvir Singh & Mahesh Bhargava's Emotional Maturity	Significance differences were found between mean gain scores on all the Scale.

3.9 SCOPE OF THE STUDY

Results of this review are important to gaining an accurate estimate of participation in physical activity by children with VI. This then identifies their health status compared to their sighted peers. Numerous studies have highlighted deficiencies in their comparative physical and psychological performance. However, little effort has been directed towards exploring rehabilitative interventions aimed at meeting the specific needs of children with profound vision loss. To fill this gap, we undertook this study of a 16 week yoga training program for children with VI, assessing physical and psychological variables pre / post the intervention. It was intended to develop a unified strategy to improve basic health status that could play a vital role in helping those with VI remain active and independent throughout their lives.