CHAPTER 2
LITERATURE REVIEW

2. LITERATURE REVIEW

2.1 AIM

To study and understand the traditional practices of *Nāḍī Parīkṣa* as defined in the ancient texts of *Āyurveda*

2.2 OBJECTIVES

To study and understand the physiological significance behind *Nāḍī Parīkṣa*

To explore the significance of arterial stiffness in *Nāḍī Parīkṣa*

2.3 MATERIALS AND METHODS

The art of pulse reading is unique to *Āyurveda* and it has thousands of years of rich experience in *Nāḍī Parīkṣā*. Traditional *Āyurveda* doctors were adept in pulse based diagnosis and used to diagnose diseases effectively by just sensing the variations in *Tridoṣas* measured from *Nāḍī.* The aim of the literary research was to study the classical texts of *Āyurveda* to understand the traditional practices followed in *Nāḍī Parīkṣā* and bring out the physiological significance of *Nāḍī Parīkṣā*. There are very few texts available discussing *Nāḍī Parīkṣā* and it is believed that *Śārṅgadhara* was the first person to introduce pulse examination as a means of diagnosis (Upadhyaya, 2009) in clinical practice. The ancient texts of *Āyurveda* namely *Śārṅgadhara Saṁhitā, Yoga Ratnākara*, *Basavarājīyam,* and *Bhāvaprakaśa* were included in the study as these texts have

discussed the details of *Nāḍī Parīkṣā* wherein *Śārṅgadhara Saṁhitā* and *Bhāvaprakaśa* along with *Mādhava nidāna* are considered to be part of *Lagu Trayi*. *Nāḍī Vijñāna* by *Kaṇada* and *Nāḍī Parīkṣā* by *Rāvaṇa* are other texts which have discussed *Nāḍī Parīkṣā* in detail but these texts were not included in the study as they were not available. The classical texts *Caraka Samhita*, *Suśruta samhita* and *Aṣṭāṅga saṅgraha* come under *Brihat Trayi* and these texts were also not included in the study as these texts have not explicitly discussed the details of *Nāḍī Parīkṣā*. The pulse patterns of *vāta, pitta and kapha doṣas* were studied in detail by *Upadhyaya* as part of the clinical and experimental studies using Dudgeon Sphygmograph (Upadhyaya, 2009) which was compiled as a text by name *Nāḍī Vijñāna* and this text was included as a secondary source for the literary research. It was a detailed study covering the systematic review of *Āyurveda* literature, hemodynamics and statistical analysis of pulse patterns representing *vāta, pitta and kapha doṣas* of normal and diseased persons. The mean pulse rate and mean pulse pressure were studied across *vāta, pitta and kapha doṣas* and the significance of pulse parameters rate, rhythm, volume, force, tension, character and hardness of the artery were analyzed in the context of *Āyurveda*. *Vasant* has analyzed the physiological significance of pulse parameters *gati* (movement), *vega* (rate), *tāla* (rhythm), *bala* (force), *tapamāna* (temperature), *ākṛti* (volume and tension) and *kāṭhinya* (consistency of the vessel wall) across *vāta, pitta and kapha doṣas* (Vasant Dattatray, 2007) in his treatise *Secrets Of The Pulse* which was included as a secondary source for the study. The currently available

reviews on *Nāḍī Parīkṣā* and the studies conducted by S-VYASA on *Nāḍī Parīkṣā*, *Tridoṣa* and *prakṛti* analysis were included in the study.

2.4 SUMMARY OF EARLIER STUDIES ON NADI PARIKSHA

A detailed search was undertaken using key words *Nāḍī* and *Nāḍī Parīkṣa* in pubmed, google scholar, science direct and google. The search yielded only seven papers which discussed *Nāḍī Parīkṣa* in qualitative manner but there were no papers discussing the physiological significance of *Nāḍī Parīkṣa* except that some papers discussed the computational models for *Nāḍī Parīkṣa*.

Goli Penchala Prasad et.al have discussed the important aspects of *Nāḍī Parīkṣa* from *Basavarajīyam* (Prasad, Bharati, & Swamy, 2004). The types of *Nāḍī* and their locations, *Nāḍī Parīkṣa vidhi* for all eight types of *Nāḍī*, *Nāḍī Lakṣaṇa* in relation to *doṣas* and *Nāḍī Parīkṣa niṣedha kāla* were discussed. The review was to highlight the essence of *Nāḍī Parīkṣa* as defined in *Basavarajīyam*.

A comprehensive knowledge on *Nāḍī Parīkṣa* by *Pooja et.al* discussed different types of *Nāḍī*, their location, *Nāḍī Parīkṣa vidhi*, *Nāḍī Lakṣaṇa* in relation to *doṣas*, different *Nāḍī* in females, males, old, young etc., *Nāḍī* according to different conditions, different diseases, healthy and unhealthy persons, *gati* and *Nāḍī* according to *Tridoṣas* were discussed (Dadhich & Pooja, 2016).

Shashirekha et.al have discussed the relationship between *Nāḍī* and *doṣa* and highlighted importance of *kāla* in *Nāḍī Parīkṣa* (Shashirekha & Sukumar, 2014).

In another study *Venkata Shivudu* has defined a standard proforma based on *daśavidha parīkṣa* and included *Nāḍī Parīkṣa* into the proforma (Venkat Shivudu, 2015).

Dhanalaxmi has discussed various computational models and devices used in *Nāḍī Parīkṣa* for early detection of diseases (Gaddam, 2015).

Pampanna Gowda et.al have discussed the details of *Nāḍī Parīkṣa* as defined in *Śārṅgadhara Samhita* and explained its implications in *Āyurveda* (Gouda, Raju, & MB, 2016).

Nāḍī patterns of healthy and diseased persons were analyzed by *Joshi* using computational models with promising results (R. R. Joshi, 2005).

In summary, all papers on *Nāḍī Parīkṣa* have agreed that *Śārṅgadhara Samhita*, *Yoga Ratnākara*, *Basavarājīyam*, and *Bhāvaprakaśa* are the only texts which have included the concept of *Nāḍī* and discussed the significance of *Nāḍī Parīkṣa* in disease diagnosis. There are two categories of papers, one focussing on theoretical aspects of *Nāḍī Parīkṣa* with a detailed commentaries on classical texts and the other type focussing on computational models for analyzing *Nāḍī* patterns. The classical texts have given significant importance to *Nāḍī Parīkṣa* as part of clinical diagnosis and they have

included it as part of *Aṣṭhavidha Parīkṣa*. The significance of *gati* in *Tridoṣa* analysis, importance of intermittent *Nāḍī* in assessing the critical health conditions and understanding the risks associated with *kaṭhiṇ Nāḍī* are some of the important aspects of *Nāḍī Parīkṣa* in clinical examination which were not discussed in any of the papers till today.

2.5 SUMMARY OF STUDIES DONE AT S-VYASA

As part of the literary research Ph.D and M.D dissertations from S-VYASA focussing on *Nāḍī Parīkṣa* and *Tridoṣa* analysis were included and summarized in **Table 2.1**.

Title	Author
Development and Standardization of Sushrutha Prakriti Inventory and Evolving Life Style based on Ayurvedic Concept of Prakriti	Dr. B.R. Ramakrishna,
Effect of Integrated Yoga Module on Prakriti of children	Suchitra S Patil
First direct experimental evidence correlating Āyurveda based tridosha prakriti with body mass composition and western psychology somatotypes	Dr. Kashinath Metri
Changes in Triguna, Tridosha in Type II diabetes after IAYT A pilot study	Dr. Amit Singh
Nadi Tarangini pulse patterns in type 2 diabetes mellitus	Dr. Pooja More
Nadi Tarangini instrument, the efficacy, reliability and standardization of this instrument and the different disorders where it was used	Dr. Ruchira Rupesh Joshi

Table 2.1 Summary of M.D and Ph.D Dissertations from S-VYASA

2.6 REVIEW OF CLASSICAL TEXTS

The concept of *Nāḍī* and the traditional practices of *Nāḍī Parīkṣā* based on *Tridoṣas* are discussed in detail in the classical texts of *Āyurveda*. According to *Āyurveda , Tridoṣas* (*vāta, pitta and kapha)* play a significant role in *Nāḍī Parīkṣā* and assessing *doṣa* aggravations from *Nāḍī* is considered to as an important factor in disease diagnosis and prognosis. The *Āyurveda* classics have emphasized the significance of various pulse parameters in assessing not only *doṣa* aggravations but also various physiological and psychological states of the person. In this section the concept of *Nāḍī* as defined in ancient texts are discussed with a view to understand the significance of various pulse parameters in *Tridoṣa* analysis and highlight the significance of arterial stiffness in the context of *Āyurveda* . The definition of *Nāḍī,* locations of *Nāḍī Parīkṣā,* assessment of *Tridoshas* and various physiological and psychological conditions from *Nāḍī* are discussed.

The following verse from *Śārṅgadhara Saṁhitā* defines *Nāḍī*

करस्याङ्गुष्ठमूले या धमनी जीवसाक्षिणी ।
तच्चेष्टया सुखं दुःखं ज्ञेयं कायस्य पण्डितैः ॥ (शा. सम्. पू . ख. ३.१) ॥

Karasyāṅguṣṭhamūle yā dhamanī jīvasākṣiṇī ।
Tacceṣṭayā sukhaṁ duḥkhaṁ jñeyaṁ kāyasya paṇḍitaiḥ ।। (sa.sam.purv.kha.3/1) ।।

The radial artery below the root of the thumb, referred as *dhamanī* in the *śloka*, corresponds to *Nāḍī* and as per *Śārṅgadhara;* the healthy and diseased conditions of the individual can be sensed from such *Nāḍī*.

Yoga Ratnākara had similar description of *Nāḍī* and in addition it highlights the significance of *Nāḍī* in diagnosing the diseases as explained below.

यथा वीणागता तन्त्री सर्वान्त्रागान्प्रभाषते।
तथा हस्तगता नाडी सर्वान्त्रोगान्प्रकाशयेत्॥ (यो. र: ३)॥

Yathā vīṇāgatā tantrī sarvānrāgānprabhāṣate।
Tathā hastagatā nāḍī sarvānrogānprakāśayet ।। (yo. ra : 3)।।

According to the text, *Nāḍī* is compared with the string of *vīṇā* and said the way the string of *vīṇā* plays all *rāgās, Nāḍī* from radial artery reflects all the diseased conditions of the patient. This emphasizes the significance of *Nāḍī Parīkṣā* in disease diagnosis and treatment and it is quite evident from the description that almost all diseases can be diagnosed from *Nāḍī.* In modern medicine, the utility of radial artery based diagnostics has been limited to assessing pulse rate and it has been widely used in clinical practice for the initial assessment of the health but warrants the need for further investigations to diagnose the disease whereas as in *Āyurveda* the complete knowledge of disease can be obtained from *Nāḍī* as explained in the above *śloka.*

Yoga Ratnākara has given various other names for *Nāḍī* which are explained in the following *śloka*.

स्नायुर्नाडीं ततो हंसी धमनी धरनी धरा।
तन्तुकी जीवनझाना शब्दा: पर्यायवाचका: ॥ *(*यो. र*: ८)* ॥

Snāyurnāḍīṁ tato haṁsī dhamanī dharanī dharā ।
Tantukī jīvanajhānā śabdā: paryāyavācakā: ।। (yo. ra : 8) ।।

Accordingly *snāyu, haṁsī, dhamanī, dharanī, dharā and jīvanajhānā* are the alternate names for *Nāḍī*.

The ancient texts have laid much emphasis on sensing the pulse at radial artery to assess *doṣas* but it has not limited the pulse location to just radial artery but has clearly defined that the pulse can be sensed from eight other locations. The classical text *Basavarājīyam* has mentioned about eight locations to sense *Nāḍī* as explained in the following *ślokas*.

अथान्यत्संप्रवक्ष्यामि संक्षिप्तं सूक्तमुत्तमम्।
आयुर्वेदोपदेशेऽस्मिन्नष्टधातु निगध्यते ॥ (ब. प्र. प्र*:* ३५) ॥

Athānyatsampravakṣyāmi saṁkṣiptaṁ sūktamuttamam ।
Āyurvedopadeśe'sminnaṣṭadhātu nigadhyate ।। (ba. pra. pra: 35) ।।

नाड्योऽष्टौ पाणिपात्कंठनासोपान्तसमाश्रिता:।
पादयोर्हस्तयोर्घ्राणमूलयो: कंठमूलयो: ॥ (ब. प्र. प्र*:* ३६) ॥

Nāḍyo'ṣṭau pāṇipātkaṇṭhanāsopāntasamāśritā: ।
Pādayorhastayorġhrāṇamūlayo: kaṇṭhamūlayo: ।। *(ba. pra. pra: 36)* ।।

पादयोर्नाडिकास्थानं गुल्फस्यांगुलिकात्रयम्।
हस्तयोस्तु प्रकोष्ठान्ते मणिबंधेऽंगुलित्रयम्॥ (ब. प्र. प्र: ३७) ॥

Pādayornāḍikāsthānaṁ gulphasyāṅgulikātrayam ।
Hastayostu prakoṣṭhānte maṇibandhe'ṅgulitrayam ।। *(ba. pra. pra: 37)* ।।

कंठमूलेऽंगुलिद्वन्द्वं नासमूलेऽंगुलाधिकम्।
स्थानन्येतानि नाडीनां तेषु प्राणो व्यवस्थित: ॥ *(*ब. प्र. प्र: ३८*)* ॥

Kaṇṭhamūle'ṅgulidvandvaṁ nāsamūle'ṅgulādhikam ।
Sthānanyetāni nāḍīnāṁ teṣu prāṇo vyavasthita: ।। *(ba. pra. pra: 38)* ।।

According to the text, *Nāḍī* exists at eight locations two at radial artery, two at ankle, two at neck region and two at nasal region. As per modern physiology, *Nāḍī* known as pulse is palpated at radial, carotid, femoral, brachial and ankle arteries all of which almost matches with *Nāḍī* locations defined in *Basavarājīyam* except that there was no mention of femoral artery in *Āyurveda* and the significance of *Nāsa Nāḍī* is not highlighted in modern physiology. The significance of radial artery based *Nāḍī Parīkṣā* is well understood in *Āyurveda* and has been widely practiced but the significance of *Nāḍī Parīkṣā* done at other locations are not highlighted much. On the other hand, *Nāḍī* at radial artery has a very limited role in modern medicine and they have given much

emphasis on *Nāḍī* at carotid, femoral, brachial and ankle locations which is widely used in measuring pulse wave velocity.

Basavarājīyam has explained the symptoms which can be diagnosed from different *Nāḍī* locations and the following verse explains the symptoms which can be diagnosed from *Pāda Nāḍī*.

जीवितं लाघवं स्वस्थ्यं ज्वरस्य च विमोचनम्।
यत्तु स्थानं न मुच्येत पादनाडीं निदर्शयेत्॥ (ब. प्र. प्र: ४०) ॥

Jīvitaṁ lāghavaṁ svasthyaṁ jvarasya ca vimocanam ।
Yattu sthānaṁ na mucyeta pādanāḍīṁ nidarśayet ।। (ba. pra. pra: 40) ।।

The longevity, overall health and relief from fever are some of the symptoms which can be diagnosed from *Pāda Nāḍī* which emphasizes the diagnostic values of *Pāda Nāḍī*. Interestingly the pulse at ankle has gained significant research interest in the recent past as the results from brachial artery pulse wave velocity (baPWV) are promising wherein the pulse from brachial and ankle locations are measured to assess the pulse wave velocity. In the current context pulse measured at ankle is used to assess the pulse wave velocity and in turn it is used in assessing the cardiovascular risks which is a significant step in cardiovascular studies. As pulse acquisiton has become more sophisticated with advanced sensor and semiconductor technologies, there is a need to extend the studies on pulse measured from ankle to bring out the diagnostic values of *Pāda Nāḍī.*

अजीर्णामदोषं च ज्ववरस्यागमनं क्षुधाम्।
वातपित्तकफान् दुष्टान् हस्तनाडी निदर्शयेत्॥ (ब. प्र. प्र: ४५) ॥

Ajīrṇāmadoṣaṁ ca jvavarasyāgamanaṁ kṣudhām ।
Vātapittakaphān duṣṭān hastanāḍī nidarśayet ।। (ba. pra. pra: 45) ।।

Indigestion, *āma doṣa,* indication of fever, hunger and vitiated *vāta, pitta and kapha doṣas* are diagnosed from *Hasta Nāḍī.* The assessment of vitiated *doṣas* from *Hasta Nāḍī is* well established clinical practice in traditional *Āyurveda* . The diagnostic values of *Hasta Nāḍī* is quite evident from classical texts and our own experience but has lost its significance in the light of evidence based research. As the sophisticated tonometers and pulse acquisition systems are in place there is a dire need to establish the physiological significane and diagnostic values of *Hasta Nāḍī on* the grounds of evidence based research.

आगन्तुकज्वरं तृष्णामायासं मैथुनं क्लमम्।
भयं शोकं च कोपञ्च कंठनाडी निदर्शयेत्॥ (ब. प्र. प्र: ४६) ॥

Āgantukajvaraṁ tṛṣṇāmāyāsaṁ maithunaṁ klamam ।
Bhayaṁ śokaṁ ca kopañca kaṇṭhanāḍī nidarśayet ।। (ba. pra. pra: 46) ।।

Fear, sorrow, anger, lust and fever are some of the symptoms which can be sensed from *kaṇṭha nāḍī*. In modern physiology, *kaṇṭha nāḍī* corresponds to carotid artery and the carotid femoral pulse (cfPWV) wave velocity, a gold standard technique, measures the

pulses wave velocity by acquiring the pulses from carotid and femoral arteries. The studies based on cfPWV have shown significant results in predicting the cardiovascular risks.

मरणं जीवितं कामं नेत्ररोगं शिरोव्यथाम्।
श्रावणान्मुखजान्रोगान् नासानाडी निदर्शयेत्॥ (ब. प्र. प्र: ४७) ॥

Maraṇaṁ jīvitaṁ kāmaṁ netrarogaṁ śirovyathām ।
śrāvaṇānmukhajānrogān nāsānāḍī nidarśayet ।। (ba. pra. pra: 47) ।।

Diseases pertaining to head, eyes and ears can be diagnosed from *nāsā nāḍī* and in modern physiology the significance of *nāsā nāḍī* is not highlighted.

According to ancient texts, *Tridoṣas* form the basis of disease diagnosis and treatment and there is a precise description of *doṣa* predominance in the texts which can be sensed from specific locations on radial artery. In this section *Tridoṣas* and their assessment as per *Āyurveda* texts are reviewed.

वाताधिके वहेच्चाग्रेऽप्यन्ते श्लेष्माधिका वहेत्।
मध्ये पित्तधिका नाडी सन्निपाते विलक्षणम्॥ (ब. प्र. प्र: ५१) ॥

Vātādhike vaheccāgre'pyante śleṣmādhikā vahet ।
Madhye pittadhikā nāḍī sannipāte vilakṣaṇam ।। (ba. pra. pra: 51) ।।

अग्रे वातवहा नाडी मध्ये वहति पित्तला।
अन्ते श्लेष्म विकारेण नाडी ज्ञेया बुध सदाः॥ (यो. र: १३) ॥

Agre vātavahā nāḍī madhye vahati pittalā ।
Ante śleṣma vikāreṇa nāḍī jñeyā budha sadāḥ ।। (yo. ra : 13) ।।

वाते अधिके भवेन्नाडी प्रव्यक्ता तर्ज्नीतले ।
पित्ते व्यक्ता मध्यमायां त्रुतीयाङ्गुलिगा कभे ॥ (भा. प्र ७.१४) ॥

Vāte adhike bhavennāḍī pravyaktā tarjnītale ।
Pitte vyaktā madhyamāyāṁ trutīyāṅguligā kabhe ।। (bhā. pra : 7/14) ।।

As per the texts of *Āyurveda ,* aggravated *doṣas (vāta, pitta and kapha)* can be sensed from the three locations (*agre, madhye* and *ante*) on the radial artery at wrist starting from root of the thumb and spaced by width approximately equal to the width of a thumb as shown in Fig 2.1.

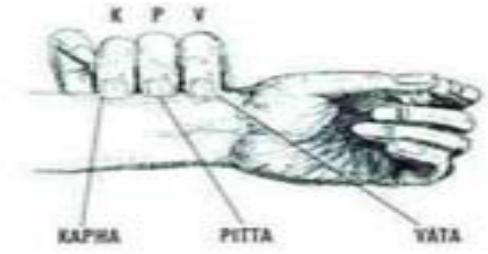

Fig 2.1 Standard Position to obtain Pulse

Basavarājīyam, Yoga Ratnākara and Bhāvaprakaśa have similar description with regards to *Tridoṣa* locations as explained in the above *ślokas* and say that the aggravated *vāta doṣa* is felt at the top, *pitta doṣa* at the middle and *kapha doṣa* at the end. According to

the texts, *agre* corresponds to the top of the *Tridoṣa* locations , *madhye* corresponds to the middle and *ante* corresponds to the end. In addition to *Tridoṣa* locations, *Bhāvaprakaśa* highlights that the aggravated *vāta doṣa* can be sensed by the top of the index finger (*tarjnī)*, the aggravated *pitta doṣa* is sensed by the middle finger (*madhyamā)*, the aggravated *kapha doṣa* is sensed by the ring finger (*trutīyāṅguligā*).

As per classical texts movement of *Nāḍī* is correlated with movement of certain animals and birds and is termed as *Gati* as shown in Fig 2.2

Vata Pulse		Sarpa Gati
Pitta Pulse		Manduka Gati
Kapha Pulse		Hamsa Gati

Fig 2.2 : Types of Pulse and their Gati

This is a very unique way of sensing the aggravated *doṣās* which in turn is used in diagnostics. Though there is no similarities between the movement of pulse and the movement of these living beings, it is interesting to note that the aggravated *doṣās* can be sensed with the said *Gatis*.

The aggravated *doṣa* is sensed primarily by assessing *gati* and *Āyurveda* has given significant importance to *gati* in *Tridoṣa* analysis and the pulse movement has been compared with the movements of animals, birds and reptiles as explained in the below *ślokas*.

नाडी धत्ते मरुत्कोपे जलौकासर्पयोर्गतिं।
कुलिङ्गकाकमण्डूकगतिं पित्तस्य् कोपतः॥ (शा. सम्. पू. ख. ३.२) ॥

Nāḍī dhatte marutkope jalaukāsarpayorgatiṁ।
Kuliṅgakākamaṇḍūkagatiṁ pittasy kopataḥ ।। (śā.sam.pū.kha.3/2) ।।

हंस पारावतगतिं धत्ते श्लेष्मप्रकोपतः।
लावतित्तिरवर्तीनां गमनं संन्निपाततः॥ (शा. सम्. पू. ख. ३.३) ॥

Haṁsa pārāvatagatiṁ dhatte śleṣmaprakopataḥ।
Lāvatittiravartīnāṁ gamanaṁ sannnipātataḥ ।। (śā.sam.pū.kha.3/3) ।।

According to *Śārṅgadhara Saṁhitā* the movement of vitiated *vāta* pulse is similar to the movement of snake (*sarpa*) and leech (*jalaukā)* and is well known as *sarpa gati*. The curved and zigzag nature of movement similar to snake and leech is the significance of *vāta* pulse. The movement of aggravated *pitta* pulse, well known as *maṇḍūka gati*, was compared with the movement of sparrow, crow and frog which will be hopping and jumping in nature. The slow movement (*manda gati*) is the significance of aggravated *kapha* pulse, which is well known as *haṁsa* gati, and was compared with the movement of swan (*haṁsa)* and pigeon (*pārāvata)*. The movement of the pulse will be similar to the movement of quail and patridge when the *Nāḍī* is aggravated by all the three *doṣas*.

वाताद्वक्रगतिर्नाडी चपला पित्तवाहिनी।
स्थिरा श्लेष्मवती ज्ञेया संसर्गान् मिश्रलक्षणम्॥ *(ब. प्र. प्र: ५०)* ॥

Vātādvakragatirnāḍī capalā pittavāhinī ।
Sthirā śleṣmavatī jheyā saṁsargān miśralakṣaṇam ।। (ba. pra. pra: 50) ।।

पित्ताधिके तु चपला नाडी वहति काकवत्।
बकदर्दुरसंचारा चटकावर्तिकागति: ॥ (ब. प्र. प्र: ५३) ॥

Pittādhike tu capalā nāḍī vahati kākavat ।
Bakadardurasañcārā caṭakāvartikāgati: ।। (ba. pra. pra: 53) ।।

कफेन दुष्टनाडी तु हंसकुक्कुटगामिनी।
कपोतमंदसंचारा वहतीति विनिश्चय: ॥ (ब. प्र. प्र: ५४) ॥

Kaphena duṣṭanāḍī tu haṁsakukkuṭagāminī ।
Kapotamandasañcārā vahatīti viniścaya: ।। (ba. pra. pra: 54) ।।

Basavarājīyam had a similar comparison of pulse movement with the movement of animals and birds. In addition, the nature of *vāta* pulse is explained using the words *vakra* which signifies a curved movement, the word *capala* is used to explain the jumping and hopping nature of *pitta* pulse and the word *sthirā* is used to explain the slow movement of *kapha* pulse.

सर्पजलौकादि गतिं वदन्ति विभुधाः प्रभन्जने नाडीम् ।
पित्तेन काकलावक मण्डूकादेस्तधा चपलाम् ॥ (यो. र: १४) ॥

Sarpajalaukādi gatiṁ vadanti vibhudhāḥ prabhanjane nāḍīm ।

Pittena kākalāvaka maṇḍūkādestadhā capalām ।। (yo. ra : 14) ।।

राजहंस मयूराणां पारावतकपोतयोः ।
कुक्कुटस्य गतिं धत्ते धमनी कफ संज्ञनी ॥ (यो. र: १५) ॥

Rājahaṁsa mayūrāṇāṁ pārāvatakapotayoḥ ।
Kukkuṭasya gatiṁ dhatte dhamanī kapha saṁjñanī ।। (yo. ra : 15) ।।

वाताद्वक्रगतिं धत्ते पित्तादुत्प्लु त्य गामिनी ।
क्फान्मन्दगतिर्ज्ञेया सन्निपातादतिद्रुता ॥ (भा. प्र ७.१७) ॥

Vātādvakragatiṁ dhatte pittādutplu tya gāminī ।
Kaphānmandagatirjñeyā sannipātādatidrutā ।। (bhā pra 7/17) ।।

Yoga Ratnākara and Bhāvaprakaśa have a similar description while explaining the nature of ***gati*** with aggravated *vāta, pitta and kapha doṣas* and *Bhāvaprakaśa* used the words *vakra, utplutya* and *manda* to explain the nature of *vāta, pitta* and *kapha doṣas* respectively.

मुहुस्सर्पगतिं नाडीं मुहुर्भेकगतिं तथा ।
वातपित्तद्वयोद्भूतां प्रवदंति विचक्षणा: ॥ (ब. प्र. प्र: ५७) ॥

Muhussarpagatiṁ nāḍīṁ muhurbhekagatiṁ tathā ।
Vātapittadvayodbhūtāṁ pravadanti vicakṣaṇā: ।। (ba. pra. pra: 57) ।।

भुजगादिगतिं नाडीं राजहंसगतिं तथा ।
वातश्लेष्मसमुद्भूतां प्रवदंति विनिश्चयम् ॥ *(ब. प्र. प्र: ५८)* ॥

Bhujagādigatiṁ nāḍīṁ rājahaṁsagatiṁ tathā ।
Vātaśleṣmasamudbhūtāṁ pravadanti viniścayam ।। (ba. pra. pra: 58) ।।

मंडूकदिगतिं नाडीं मयूरादिगतिं तथा ।
पित्तश्लेष्मसमुद्भूतां प्राहुर्वैध्यविशारदा: ॥ (ब. प्र. प्र: ५९) ॥

Maṇḍūkadigatiṁ nāḍīṁ mayūrādigatiṁ tathā ।
Pittaśleṣmasamudbhūtāṁ prāhurvaidhyaviśāradā: ।। (ba. pra. pra: 59) ।।

वक्रमुत्प्लु त्य चलति धमनि वातपित्ततः ।
वहेद्वक्रञ्च मन्दञ्च वातश्लेष्मधिकत्वतः ॥ (भा. प्र ७.१८) ॥

Vakramutplu tya calati dhamani vātapittataḥ ।
Vahedvakrañca mandañca vātaśleṣmadhikatvataḥ ।। (bhā pra 7/18) ।।

The *Āyurveda* texts have explained the *gati* of the pulse when more than one *doṣa* is present and according to *Basavarājīyam, gati* will be of *sarpa* and *maṇḍūka* in nature if both *vāta* and *pitta doṣas* are in aggravation, similarly it will be of *sarpa* and *haṁsa* in nature if *vāta* and *kapha doṣas* are in aggravation and will be of *maṇḍūka* and *haṁsa* in nature if *pitta* and *kapha doṣas* are in aggravation. Interestingly in *Āyurveda*, *gati* plays a significant role in assessing the *doṣa* predominance and traditional *Āyurveda* doctors were

adept in assessing *gati* from *Nāḍī. Bhāvaprakaśa* had a similar description for the nature of *gati* when more than one *doṣa* is present. The importance of *gati* in *Nāḍī Parīkṣā* is quite evident from the classical texts and there is a need to establish the physiological significance of *gati* to bring the diagnostic values of *gati* to limelight.

The texts have emphasized the significance of *Nāḍī Parīkṣā* in understanding various physiological, psychological and pathological states of the patient as explained in the following verses.

ज्वरकोपेण धमनी सोष्णा वेगवती भवेत् ।
कामक्रोधाद्वेगवहा क्षीणा चिन्ताभवप्लुता ॥ (शा. सम्. पू . ख. ३.६) ॥

Jvarakopeṇa dhamanī soṣṇā vegavatī bhavet ।
Kāmakrodhādvegavahā kṣīṇā cintābhavaplutā ।। (śā.sam.pū.kha. 3/6) ।।

मंदाग्नेः क्षीणधातोश्च नाडी मन्दतरा भवेत् ।
असम्पूर्णा भवेत् कोष्णा गुर्वी सामा गरीयसी ॥ (शा. सम्. पू . ख. ३.७) ॥

Mandāgneḥ kṣīṇadhātośca nāḍī mandatarā bhavet ।
asampūrṇā bhavet koṣṇā gurvī sāmā garīyasī ।। (śā.sam.pū.kha.3/7) ।।

लघ्वी वहति दीप्ताग्नेस्तथा वेगवती मता ।
सुखितस्य स्थिरा ज्ञेया तथा बलवती स्मृता ॥ (शा. सम्. पू . ख. ३.८) ॥

Laghvī vahati dīptāgnestathā vegavatī matā ।
Sukhitasya sthirā jñeyā tathā balavatī smrutā ।। (śā.sam.pū.kha.3/8)

The *Nāḍī* will be warm and fast in high fever. When there is a lust and anger in the individual, his pulse will be faster. It is weak in sorrow and fear. If the individual has weak digestive fire, and also when he is emaciated, the pulse is very slow.When there is *āma* in the body *Nāḍī* is full in volume with blood slightly warm and very heavy. When the digestive fire is active, *Nāḍī* is light and fast. The *Nāḍī* of a resting or a healthy person is steady and strong. The hungry person's *Nāḍī* is irregular and that of a person who has just eaten, steady.

उत्प्लु त्य मन्दं चलति नाडी पित्तकफे अधिके।
कामात्क्रोधाद्वेगवहा क्षीणा चिन्ताभयप्लु ता॥ (भा. प्र ७.१९) ॥

Utplu tya mandaṁ calati nāḍī pittakaphe adhike ।
Kāmātkrodhādvegavahā kṣīṇā cintābhayaplu tā || (bhā pra 7/19) ||

चपला क्षुधितस्य स्यात्त्रुप्तस्य भवति स्थिरा।
सुखिनो अपि स्थिरा ज्ञेया तथा बलवती मता॥ (भा. प्र ७.२२) ॥

Capalā kṣudhitasya syāttruptasya bhavati sthirā ।
Sukhino api sthirā jñeyā tathā balavatī matā || (bhā pra 7/22) ||

As per *Bhāvaprakaśa,* by increase of lust and anger, pulse will be very fast and by worry and fear it will be slow. In persons who are hungry, it is unsteady and becomes steady after taking food. It is steady and strong in heathy persons. From the ancient texts it is clear that the physiological, psychological and pathological states of the individual can be

assessed from the speed, stability and volume of the pulse. In modern physiology, pulse wave velocity is studied extensively in assessing cardiovascular risk and there is a need to extend the studies in the context of *Āyurveda .*

The Āyurveda classics have discussed the intermittent *Nāḍī* in detail and the nature of intermittent *Nāḍī* is explained in the following *ślokas.*

कदाचिन्मन्दगमना कदाचिद्वेगवाहिनी।
द्विदोषकोपतो ज्ञेया हन्ति च स्थानविच्युता॥ (शा. सम्. पू. ख. ३.४) ॥

Kadācinmandagamanā kadācidvegavāhinī ।
Dvidoṣakopato jñeyā hanti ca sthānavicyutā ।। (śā.sam.pū.kha. 3/4) ।।

स्थित्वा स्थित्वा चलति या सा स्मृता प्राणनाशिनी।
अति क्षीणा च शीता च जीवितं हन्त्यसंशयं॥ (शा. सम्. पू. ख. ३.५) ॥

Sthitvā sthitvā calati yā sā smrutā prāṇanāśinī ।
Ati kṣīṇā ca śītā ca jīvitaṁ hantyasaṁśayaṁ ।। (śā.sam.pū.kha. 3/5) ।।

According to *Śārṅgadhara,* when there is an aggravation of two *doṣās* the pulse will be sometimes slow and sometimes fast. The pulse which is felt in other than the specified place, indicates early death of the patient. The pulse which stops intermittently also kills the patient. If the pulse is very cold to touch, it indicates the end of the individual's life.

मंद मंदं शिथिलं शिथिलं व्याकुलं व्याकुलं वा
स्थित्वा स्थित्वा वहति धमनी याति नाशं च सूक्ष्मा।

नित्यं स्कंधे स्फुरति पुनरप्यंगुलीस्संस्पृशेद्वा
भावैरेवं बहुविधतरैस्सन्निपाते त्वसाध्या ॥ (ब. प्र. प्र: ६०) ॥

Manda mandaṁ śithilaṁ śithilaṁ vyākulaṁ vyākulaṁ vā
thitvā sthitvā vahati dhamanī yāti nāśaṁ ca sūkṣmā ।
Nityaṁ skandhe sphurati punarapyaṅgulīssaṁspṛśedvā
bhāvairevaṁ bahuvidhataraissannipāte tvasādhyā ।। (ba. pra. pra: 60) ।।

यात्युत्कटा स्थिराऽत्यन्तं यात्येवं मंदगामिनी ।
या च सूक्ष्मा च वक्रा च तामसाध्यां च निर्दिशेत् ॥ (ब. प्र. प्र: ६१) ॥

Yātyutkaṭā sthirā'tyantaṁ yātyevaṁ mandagāminī ।
Yā ca sūkṣmā ca vakrā ca tāmasādhyāṁ ca nirdiśet ।। (ba. pra. pra: 61)।।

व्याकुला शिथिला मंदा स्थित्वा स्थित्वा प्रयाति या ।
स्थानं क्रमेण मुंचंति नाडी मरणशंसिनी ॥ (ब. प्र. प्र: ६२) ॥

Vyākulā śithilā mandā sthitvā sthitvā prayāti yā ।
Sthānaṁ krameṇa muñcanti nāḍī maraṇaśaṁsinī ।। (ba. pra. pra: 62) ।।

अत्यन्तशीतला नासा स्तैमित्यं नेत्रयोरपि ।
स्थानच्युतिश्च नाडीनां सध्योमरणहेतव: ॥ (ब. प्र. प्र: ६३) ॥

Atyantaśītalā nāsā staimityaṁ netrayorapi ।
Sthānacyutiśca nāḍīnāṁ sadhyomaraṇahetava: ।। (ba. pra. pra: 63) ।।

जहति यस्य स्वस्थानं यवार्धमपि नाडिका ।
न स जीवितमाप्नोति त्रिदिनेनैव पंचताम् ॥ *(ब. प्र. प्र: ६४)* ॥

Jahati yasya svasthānaṁ yavārdhamapi nāḍikā ।
Na sa jīvitamāpnoti tridinenaiva pañcatām ।। (ba. pra. pra: 64) ।।

According to *Basavarājīyam also, Nāḍī* which is intermittent in nature and is sensed in the locations other than the specified place indicates to be fatal which may lead to early death of the patient. *Basavarājīyam* has termed it as *asādhya Nāḍī* and is the nature of *mṛtyu Nāḍī* also.

कम्पते स्पन्दतेऽत्यन्तं पुन: स्पृशति चाङ्गुली: ।
तामसाध्यां विजानीयान्नडीं दूरेण वर्जयेत् ॥ *(यो. र: २७)* ॥

Kampate spandate'tyantaṁ puna: spṛśati cāṅgulī:।
Tāmasādhyāṁ vijānīyānnaḍīṁ dūreṇa varjayet ।। (yo. ra : 27) ।।

स्थिरा नाडी भवेध्यस्य विध्युद्वध्युतिर्वेक्ष्यते ।
दिनैकं जीवितं तस्य द्वितीये मृत्युरेव च ॥ *(यो. र: २८)* ॥

Sthirā nāḍī bhavedhyasya vidhyudvadhyutirvekṣyate ।
Dinaikaṁ jīvitaṁ tasya dvitīye mṛtyureva ca ।। (yo. ra : 28) ।।

मुखे नाडी यदा नास्ति मध्ये शैत्यं बहि: कृम: ।
यदा मन्दा भवेन्नाडी त्रिरात्रं नैव जीवति ॥ *(यो. र: ३१)* ॥

Mukhe nāḍī yadā nāsti madhye śaityaṁ bahi: kṛma: ।
Yadā mandā bhavennāḍī trirātraṁ naiva jīvati ।। *(yo. ra : 31)* ।।

अतिसूक्ष्माऽतिवेगा च शीतला च भवेध्यदि ।
तदा वैध्यो विजानीयाद्रोगिणं च गतायुषम्॥ *(*यो. र: ३३*)* ॥

Atisūkṣmā'tivegā ca śītalā ca bhavedhyadi ।
Tadā vaidhyo vijānīyādrogiṇaṁ ca gatāyuṣam ।। *(yo. ra : 33)* ।।

विध्युद्वन्नमिता नाडी दृश्यते च न दृश्यते ।
अकालविध्युत्पातेन स गच्छेध्यमशासनम्॥ *(*यो. र: ३४*)* ॥

Vidhyudvannamitā nāḍī dṛśyate ca na dṛśyate ।
Akālavidhyutpātena sa gacchedhyamaśāsanam ।।*(yo. ra : 34)* ।।

तिर्यगुष्णा च या नाडी सर्पगा वेगवत्तरा ।
कफपूरितकण्ठस्य जीवितम् तस्य दुर्लभम्॥ *(*यो. र: ३५*)* ॥

Tiryaguṣṇā ca yā nāḍī sarpagā vegavattarā ।
Kaphapūritakaṇṭhasya jīvitam tasya durlabham ।। *(yo. ra : 35)* ।।

Yoga Ratnākara had a similar description for intermmitent *Nāḍī.*

The Āyurveda classics have discussed the rhythm of the pulse in detail with a mention of intermittent *Nāḍī.* The rhythm of the pulse is closely associated to pulse rate variability

(PRV), a surrogate of heart rate variability (HRV) and considering the importance of intermittent *Nāḍī* as explained by classical texts extensive studies need to be done with pulse rate variability.

The arterial stiffness, a measure of hardness of the artery, is considered as a potential indicator for cardiovascular risk and is closely associated to *kāṭhinya* in the context of *Āyurveda* and *Basavarājīyam* has discussed the nature of *kāṭhin Nāḍī* in detail.

वाते वताधिका नाडी व्यालीव कुटिला सदा ।
अत्यन्तदुष्टा वहति स्तब्धा तन्त्रीसमाकृतिः ॥ (ब. प्र. प्र: ५२) ॥

Vāte vatādhikā nāḍī vyālīva kuṭilā sadā ।
Atyantaduṣṭā vahati stabdhā tantrīsamākṛti: ।। (ba. pra. pra: 52) ।।

As per *Basavarājīyam, vāta Nāḍī* will be hard and the hardness of the artery has been explained with the words *kaṭhor* and *kaṭhin* whereas the hardness of the artery due to *pitta* and *kapha doṣas* was not mentioned. The hardness and roughness of the artery corresponds to *vāta doṣa* as per *Āyurveda* and *Basavarājīyam* compared *vāta Nāḍī* with string of *vīṇā* which signifies the hardness of the *vāta Nāḍī*. The blood flow in hardened arteries will be fast compared to normal arteries which implies that *vāta* pulse will be fast which is in agreement with *Āyurveda* . According to *Basavarājīyam,* if *Nāḍī* is *kaṭhin*, very slow moving in a curved manner and if it is displaced from its original position then it is considered as *mṛtyu Nāḍī* indicating early death of the patient. The significance of

arterial stiffness is well understood from modern studies but classical texts have emphasized the significance of arterial stiffness very well.

In this review the traditional practices of *Nāḍī Parīkṣā* as per classical texts of *Āyurveda* were discussed in detail and the physiological significance of various pulse parameters and pulse measuring locations used in *Tridoṣa* analysis were highlighted. The parameters *gati* (pulse movement), speed of the pulse, rhythm of the pulse and hardness of the artery known as *kāṭhinya* were reviewed in the context of *Nāḍī Parīkṣā*. The significance of *kāṭhinya* in *Tridoṣa* analysis is studied as part of this review.

2.7 REVIEW OF MODERN TEXTS

In this section, modern texts on *Nāḍī Parīkṣā* are reviewed and as part of the review *Nāḍī Vijñāna* by *Upadhyaya* and *Secrets of The Pulse* by *Vasant* are studied. The ancient science of pulse has been discussed in *Nāḍī Vijñāna* in four parts. In part one, the historical perspective of *Āyurveda* in the context of origin of Indian pulse examination is reviewed thoroughly and as part of it the Egyptian, Greek, Chinese, Arabic and Tantrik pulse-lore were discussed. According to the text, the pulse-lore in Tantrik literature from Tamil Sidhars seems to be the main source of origin and development of Indian pulse examination. In part two, the classical texts which dealt with *Nāḍī Parīkṣā* were discussed and texts included were *Śārṅgadhara Samhita*, *Yoga Ratnākara*, *Bhāvaprakaśa*, *Nāḍī Vijñāna* by *Kaṇada* and *Nāḍī Parīkṣā* by *Rāvaṇa*. *Śārṅgadhara* has introduced pulse

examination and the concept of *Nāḍī Parīkṣā* was explained in eight *ślokas*, *Yoga Ratnākara* has discussed the details of *Nāḍī Parīkṣā* in forty eight *ślokas*, *Bhāvaprakaśa,* an authentic work in *Āyurveda* literature compiled by *Bhāvamiśra,* deals with the pulse examination in twelve verses, *Nāḍī Vijnāna* by *kaṇāda* deals with pulse examination in one hundred and sixteen verses and *Nāḍī Parīkṣa* by *Rāvaṇa* explains the pulse examination in ninety six verses. *Basavarājīyam* deals with pulse examination in *pradhama prakaraṇa* and various aspects of *Nāḍī Parīkṣa* are discussed in forty two verses. All the texts have explained the nature and qualities of *Nāḍī* in various physiological, mental and general pathological conditions of the person and also highlighted the unfavorable conditions for *Nāḍī Parīkṣa*. *Basavarājīyam* is an important classical texts which *Upadhyaya* has not included in the literature review. In part three the review of pulse as per modern literature was done. The anatomy and physiology of arteries, mechanism of pulse formation, hemodynamics of pulsating stream, peripheral pulses and role of reflected waves, formation of radial pulse, arterial diseases and clinical examination of the pulse were discussed in detail. As part of clinical examination of pulse the rate, rhythm, force, volume and character of the pulse were discussed and the condition of the vessel which represents the hardness or thickness of the artery was also included in the discussion. In part four, the results of clinical and experimental studies were discussed. The normal and diseased persons were included in the study and the pulse tracings were recorded at *vāta, pitta* and *kapha* locations using Dudgeon's Sphygmograph. Patients with cardiac vulvular lesion, hypertension, jaundice and

thyrotoxicosis were included in the disease group. The pulse was studied both in qualitative and quantitative manner. The qualitative study included the rate, rhythm, force, volume and character of the pulse and the quantitative study included the mean pulse rate, mean pulse pressure as measured from pulse tracings were analyzed statistically. The study is considered to be first of its own kind in the field of *Āyurveda* which has focused on *Tridoṣa* analysis from pulse tracings recorded from the respective *doṣa* locations using instrument. The results of the study were closely matching with the literature and it has shown new direction in the field of *Nāḍī Parīkṣa* which is the need of the day. In the recent past the sensor and semiconductor technologies have advanced further and the pulse acquisition has become much more sophisticated with the latest sensors. *Nāḍī Taraṅgiṇi* is one such pulse acquisition system which can acquire the pulse very precisely at *Tridoṣa* locations and stores the digitized data in computer for further analysis. *Nāḍī Yant*ra and *nāḍī parīkṣan yantra* are other instruments in this category.

Secrets of The Pulse by *Vasant* is an exclusive text on *Nāḍī Parīkṣa* and the author has covered many aspects of *Nāḍī Parīkṣa*. The characteristics of *vāta*, *pitta* and *kapha* pulses were discussed with reference to *gati* (movement), *vega* (rate), *tāla* (rhythm), *bala* (force), *tapamāna* (temperature), *ākṛti* (volume and tension) and *kāṭhinya* (consistency of the vessel wall). The variations of pulse characteristics across *Tridoṣas* were discussed in precise manner. As per the text, pulse rate varies from high, moderate to low across *vāta*, *pitta* and *kapha* pulses, *vāta* pulse is irregular when compared to *pitta* and *kapha* pulses

which are more regular in nature, the *bala* (force) and *ākṛti* (volume and tension) of the pulse is low for *vāta* pulse, high for *pitta* and moderate for *kapha*, *vāta* pulse is cold, *pitta* pulse is hot and *kapha* pulse is warm to cold. In this text the hardness of the artery has been discussed and accordingly the rough and hard artery corresponds to *vāta*, elastic artery corresponds to *pitta* and soft thickening artery corresponds to *kapha*. The hardness of the artery was not discussed much in classical texts except in *Basavarajīyam* where in nature of *kaṭhin nāḍī* was discussed and later *Vasant* in his treatise has explained the variations in *kaṭhinya* across *Tridoṣas*. Apart from the pulse characteristics the assessment of *prakṛti* and *vikṛti* from pulse and organ pulses were discussed.

CONCLUSION

In this review the traditional practices of *Nāḍī Parīkṣa* as explained in classical and modern texts of *Āyurveda*, were discussed and compared with the recent advances in pulse wave analysis. The currently available papers on *Nāḍī Parīkṣa* and the studies conducted by S-VYASA on *Āyurveda* were reviewed as part of the literary research. The *Āyurveda* classics have emphasized the significance of pulse parameters in assessing not only *doṣa* aggravations but also various physiological and psychological states of the person. *Āyurveda* has not limited the *Nāḍī Parīkṣa* to just radial artery though it plays a significant role in many ways but extended it to totally eight locations which more or less matches with the pulse locations as per modern physiology. Recently the arterial

stiffness which represents the hardness of the artery is considered as a potential indicator of cardiovascular risk. The reference to arterial stiffness can be found in the classical texts of *Āyurveda* and arterial stiffness is closely associated to *kāṭhinya*. There are no papers reviewing the physiological significance of *Nāḍī Parīkṣa* and the association of arterial stiffness with *kāṭhinya* is not discussed. In this review the diagnostic values of *Nāḍī Parīkṣa* as defined in classical texts were highlighted and the association of arterial stiffness with *kāṭhinya* is discussed.