

RESEARCH ARTICLE



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AN OBJECTIVE STUDY OF NADI PARIKSHA

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ABSTRACT

Ayurveda has been prevalent in India since ancient times. The root cause of a disease is found out using Ayurvedic diagnosis. There are 8 ways of diagnosis in Ayurveda out of which Nadi is one of them. Nadi Pariksha is done by feeling the palpations at three adjacent yet specific positions of the radial artery at the root of the thumb. The features corresponding to the pressure signals of the pulse are significant from the point of view of diagnosis. Ayurveda recognizes the health condition by perceiving the wrist pulses in terms of 'Vata', 'Pitta' and 'Kapha', collectively called as Tridoshas as they control the salient features of the human body. Nadi Pariksha requires a lot of experience as well as a high level of skill in pulse reading. The interpretation tends to be subjective as it depends on the expertise of the practitioner. Ayurvedic practice and medicines are being used worldwide. Yet it is not considered as "Science" in modern terms as it lacks mathematical forms and also due to its subjective knowledge. An attempt is made in this paper to transform this subjective knowledge into objective form through the quantifiable study of pulse signals.

KEY WORDS—Ayurveda, Tridosha, Nadi Pariksha

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INTRODUCTION

Ayurveda, the ancient Indian Medical Science has not been given the rightful scientific acceptance in modern times, mainly due to a lack of quantitative foundation for experimental analysis in its traditional practices. Today, there is an ever-more need for efficient noninvasive substitutes to the modern medical system. Ether, Air, Fire, Water and Earth, are the five basic elements in human body, the combination of which manifest Tridoshas namely vata, pitta and kapha [1]. From the Ether and Air elements, Vata which is the bodily air principle is manifested. The Fire and Water elements

combines together to form the fire principle called Pitta. Kapha which is the water principle is a combination of Earth and Water. In the physical body, the subtle energy of movement is denoted by Vata; Pitta is the energy of metabolism and digestion; Kapha is the energy that gives the structure to the body. These three doshas determine an individual's composition and governs the functions of the body in normal circumstances and when they lose their equilibrium the initiation of diseases takes place.

Ayurveda and Traditional Chinese Medicine identify the health status of the human by observing the

pulse signals over the radial artery at the wrist. The place of feeling the pulse is on the lateral section of the right forearm, up by 2cm from the wrist. The ring, middle, and index fingers are used to feel the three pulses in their respective order as shown in figure 1 as given below:

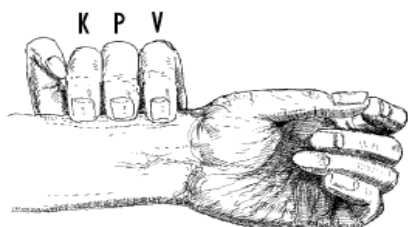


Fig 1. Standard position to obtain pulse [2]

Here K, P and V denote Kapha, Pitta and Vata respectively. Pressure of varying levels is applied with each finger on the artery in order. Application of pressure is repeated as many times as needed for diagnosing the disease. The Vata, Pitta and Kapha pulses are shown below as follows:

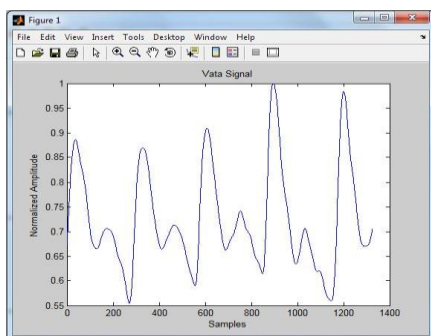


Fig 2. Vata Pulse

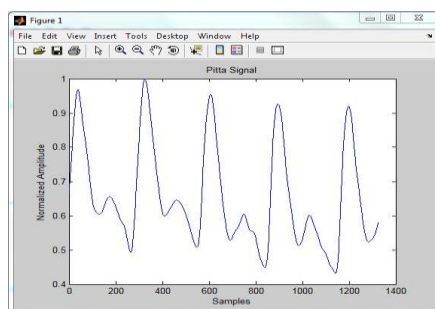


Fig 3. Pitta Pulse

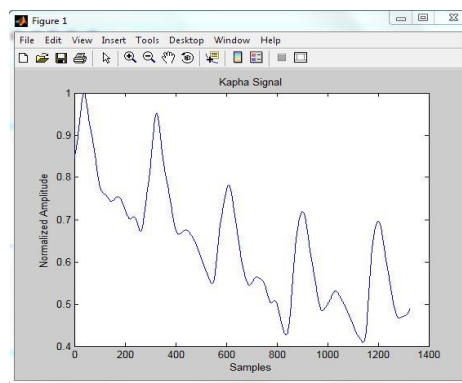


Fig 4. Kapha Pulse

A standard radial pulse encompasses the following waves:

- (i) Percussion wave
- (ii) Tidal wave
- (iii) Valley
- (iv) Dicrotic wave

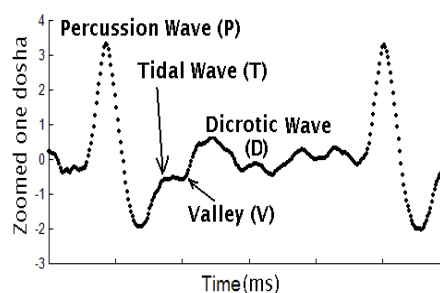


Fig 5. A standard signal of the radial artery [3]

The transformation of subjective knowledge into empirical form can be accomplished by the study of the pulse signals in a quantitative manner. By analyzing the pulse signals in time as well as frequency domain many different features can be extracted which will be useful for the identification of the various diseases.

Instruments for radial pulse detection

The first step in the pulse diagnosis is to acquire the pulse signals from the radial artery. In this section a brief overview of some of the instruments that are currently designed for acquiring the pulse signals have been discussed.

1. Nadi Tarangini [4]

The Nadi Tarangini has been designed by Aniruddha Joshi et al. The system consists of a diaphragm element provided with strain gauge, a transmitter cum amplifier, and the obtained analog signal is sampled at 500 Hz and is quantified by a 16-bit Quantizer. A set of three such pressure transducers

is mounted on the wrist to sense *vata*, *pitta* and *kapha* [2]. The sensor used is a strain gauge transducer with a flexible diaphragm at the center. The transmitter used is a high grade industrial amplifier which gives an output of 4-20mA. The 16-bit digitizer converts the output of amplifier to 2-10 V using a resistor of 500 ohm. The Line diagram of Nadi Tarangini is shown below as follows:

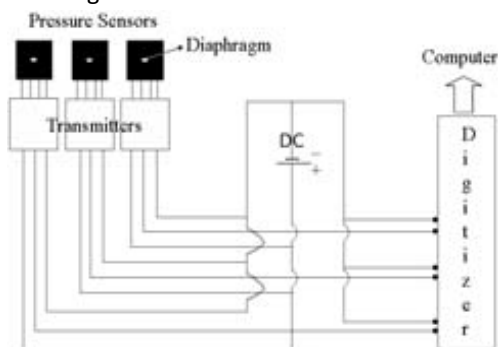


Fig 6. Line diagram of Nadi Tarangini [4]

The data obtained in this way is usually corrupted due to explicit and implicit electrical and electronic noise, but with proper shielding the noise level observed in the developed system was negligible.

2. Nadi Yantra [3]

The Nadi Yantra has been designed by Mahendra Kumar et al. Nadi Yantra consists of three identical piezo based sensor amplifiers and filtering circuitry, a mechanical set-up and a data acquisition subsystem that records the signal from those three specific positions of the radial artery hence giving an objective approach to the Science of Pulse Diagnosis. The system is as shown below:

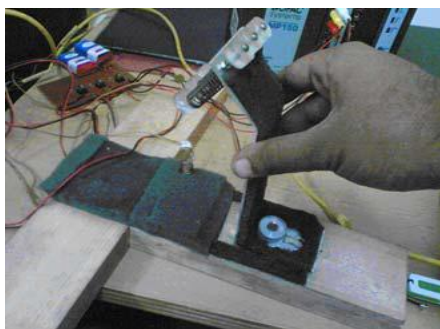


Fig 7. Flexibility of the system [3]

The system has three fingers like protrusion whose positions can be adjusted at the tip region to find out the prominent positions to capture the signal. Springs attached to them help in damping thus

emulating the natural damping at the tip region of the Nadi Vaidya's fingers as shown below:



Fig 8. Simulation of fingers with pressure sensors [3]

In the electrical design three identical piezo film based sensors has been used to capture the waveform. The raw signal has been filtered, amplified, and sent to the PC using BioPac 150TM operating at a sampling frequency of 1000 Hz.

3. Nadi Parikshan Yantra [5]

Nadi Parikshan Yantra has been developed by S. A. Gangal et al. It is a three point radial pulse examination system based on PC used for the collection of the pulse signals. The following figure shows snapshot of Nadi Parikshan Yantra.

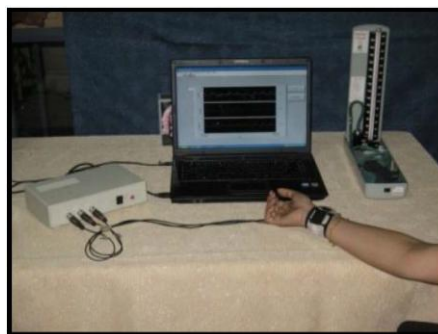


Fig 9. "Nadi Parikshan Yantra" [5]

Three identical data acquisition channels have been used to capture pressure data at three pulse points namely *vata*, *pitta* and *kapha*. For measuring the radial pulse simultaneously at three points three pressure sensors with the identical characteristics are arranged on an acrylic module. The image of the module is shown below:

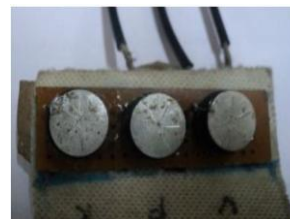


Fig 10. Sensor module for three point pulse

detection [5]

Sensor diameter is 10 mm and the distance between adjacent sensors is approximately 6mm. Coaxial cables are used to connect the three sensors to three identical data acquisition channels. Three different channels are used to display the acquired signal on the PC screen.

Time domain representation

The vata, pitta and kapha signal that has been obtained varies from disease to disease in terms of time as well as frequency domain. In this paper 1 radial signal of a normal person and 3 radial signals of disorders namely back pain, fever and stomach pain has been considered. These signals have been obtained using a Nadi Tarangini [4]. The time domain representations of the above mentioned signals have been discussed as follows:

The vata pulse of a normal person can be shown below as follows:

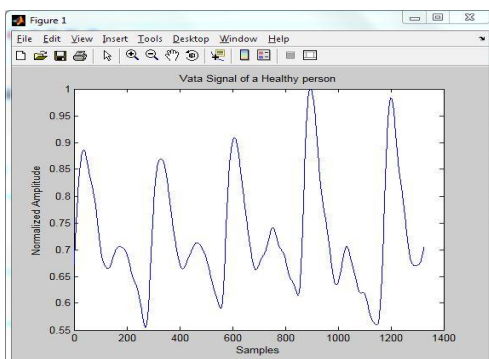


Fig 11. Vata signal of a Normal Person

In this signal the percussion wave and the tidal waves are clearly visible but the valley and the dicrotic waves are not clearly identifiable. Let us now consider the condition for the back pain with the following figure:

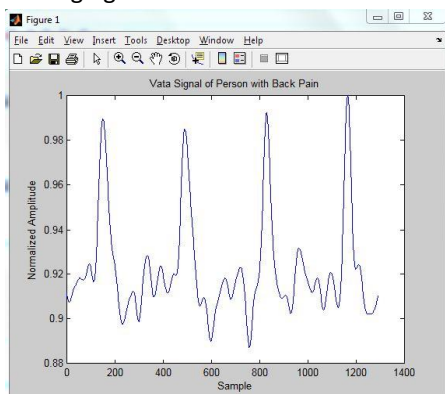


Fig 12. Vata signal of a Person with Back Pain

In this signal all the four waves namely the percussion, valley, tidal as well as dicrotic waves are clearly visible. Also 3-4 secondary peaks can be seen between the two consecutive percussion peaks. The next signal of a person suffering from fever is as shown below:

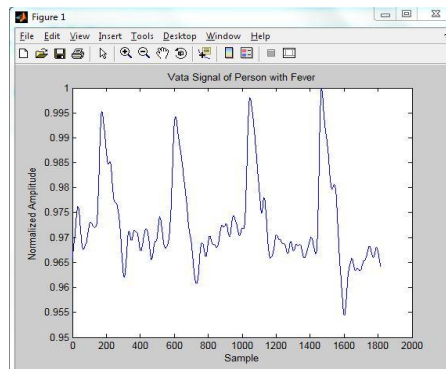


Fig 13. Vata signal of a Person with Fever

As we can see from the above figure that the signal of person with fever is quite irregular in nature. The tidal, valley and the dicrotic components are very difficult to distinguish. Finally the signal of person with stomach pain is shown below as follows:

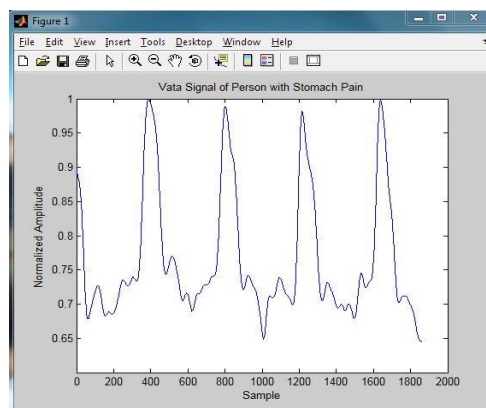


Fig 14. Vata signal of a Person with Stomach Pain

In this signal the percussion and the tidal waves are identical from one beat to the next beat however there are minute variations in the valley as well as the dicrotic waves with changing beats.

These time domain variations can be used for diagnosing the above disorders. Algorithms can be developed to diagnose various disorders that has been mentioned in the Ayurvedic literature.

Conclusion

Nadi Pariksha has been used for diagnosis of diseases since early times. However the diagnosis has been subjective in nature. In this paper Nadi Pariksha has been studied objectively. An extensive literature review has been done on some of the

existing methods for extracting the radial pulse signals. Based on the variations in the time domain properties of the radial pulses different disorders can be identified which can be helpful for their early diagnosis.

Acknowledgment

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