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PARALLELL ANALYSIS OF *NADUKKU VATHAM* IN *SIDDHA* LITERATURE WITH THAT OF PARKINSON'S DISEASE

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ABSTRACT
The *Siddha* system of medicine has its origin in South India and is rooted and grounded in Tamil culture as a combination of ancient medicinal practices and spiritual disciplines. Recently there is an emerging increase in traditional medicine research primarily based on phytochemical and pharmacological aspects. Still there exists a lacuna in the analysis of ancient literature which is the backbone of this system and has its own principles and philosophies. The present review is a literary research on the parallel analysis of *Nadukku vatham* which is one among the eighty types of *Vatha* disease with that of Parkinson's disease (PD) of conventional medicine. All the signs and symptoms of *Nadukku vatham* that have been indicated in the selected ancient texts *Yugi vaithiya kaviyam, Para rasa sekaram, Agathiyar-2000, Dhanvantri vaithiyam, Therayar vaagadam* were analysed, interpreted and compared. Through this review, it has been revealed that though these literature were written by ancient sages of South India thousands of years ago, it is quite interesting to know that these age old poems have revealed its correlation with modern texts and terminologies.

KEYWORDS: *Siddha,* Tamil culture, Literary research, Medicine, *Nadukku vatham,* South India.

INTRODUCTION
Parkinson's disease (PD) is a chronic and progressive degenerative disorder of the central nervous system which is caused due to degeneration of the neurons in the nigrostriatal dopaminergic system.[1] The common symptoms results from the loss of neurons in *substantia nigra* that produce an important brain chemical messenger dopamine that is responsible for transmitting signals between the substantia nigra and corpus striatum, to produce smooth, purposeful movement.[2] The incidence and prevalence of PD increases with advancing age, being present in 1% of people over the age of 65 years. PD is twice as common in men than in women in most populations. A protective effect of female sex hormones is observed.[3]

In *Siddha* system, the diagnosis pattern of diseases is attributed to the balance of three humours. According to the *Siddha* concept of humoral pathology, all diseases are caused by the discordant mixture of *Vatham, Pitham,* and *Kapham*. The external air corresponds to the internal *Vatham*, the external heat corresponds to the internal *Pitham* and the external water corresponds to the internal *kapham*. The presence and proportion of these humours within the system is indicated by the pulse, which is vital to correct diagnosis. According to the Siddha pathology, *Vatha* diseases are systematized into 80 types, *Pitha* diseases in 42 types and *Kapha* diseases are sort out as 21 types. *Nadukku vatham* is one among the *Vatha* diseases explained by the Siddhars which hit upon the strong correlation to Parkinsons disease. This article of literary review is undertaken to establish the comprehensive information related to *Nadukku Vatham* recorded in renowned *Siddha* texts and its correlation with the medical terminology of Parkinsonism.[4]

MATERIALS AND METHODS
The present review has been made by manual search of various *Siddha* texts of which classical texts such as *Yugi vaithiya kaviyam, Para rasa sekaram, Agathiyar-2000, Dhanvantri vaithiyam, Therayar vaagadam* were selected to compare its Siddha pathological features and symptoms of *Nadukku Vatham* with that of Parkinson's disease. An extensive literature search was made through various modern texts and search engines such as Pub med, Google scholar, Scopus, Elsevier etc in order to understand the pathological features and symptoms of Parkinson's disease. The results were analyzed, discussed and presented in this review.

SIDDHA PATHOLOGY
In siddha the pivotal concept is "*Thiridhosha theory*" of the three bioentities *Vatha, Pitha* and *Kapha*. This three humors forms the basis of all physical, physiological, physiological activities of the humans. *Vatha* is considered to represent the psychomotor activities, *Pitha*

to digestive and metabolic activities and *Kapha* related to growth aspects. *Vatha* humour is in predominant position in the neurological disorders either by depletion of the factor or by the obstruction of the pathway resulting in *Nadduku vatham*. In this disorder the ascend in *vatham* along with other causative factors hits up the *kapham* which aggravates suppressing the *agni (pitham).* The aggravated *kapham* forms an obstruction to the flow channel of verities of *vatham* such as *Prannan, Udhanan and Vyanan* which sets the clinical features of *Vathaprakobam* (stasis of *vatham*) at different parts of the brain.

1. According to *Para rasa sekaram*[5]

Nadukku Vatham

Kai kaal nimirthu viraiviraithu kuruthu naakum puralaathu
Meyye Nadukkum kidukidukkum migavey nadakir thalli vidum
Poiye alla udal kulirum porumum utharam pathaipundaam
Thoyyin mulaiya ikkunangal nadukkum vaatha menasolley

EXPLANATION OF TAMIL POETIC LINES OF *PARA RASA SEKARAM*

S.No	Tamil poetic lines	Interpretation
1.	*Kai kaal nimirthu viraiviraithu kuruthu naakum puralaathu*	Numbness of the extremities , rigidity, decreased mobility of the tongue
2.	*Meyye Nadukkum kidukidukkum migavey nadakir thalli vidum*	Tremor in the body, freezing or falling during distance walking
3.	*Poiye alla udal kulirum porumum utharam pathaipundaam*	Cold sensitivity causing chillness, trembling, fluctuation in blood pressure
4.	*Thoyyin mulaiya ikkunangal nadukkum vaatha menasolley*	These are the features of *Nadduku vatham*

2. According to *Agathiyar 2000*[6]

'Nadukkum suzhatru muyarnaa varatchi yaagum
Madukkum sareera masaiyum -mudukki
Kidukidena kondey Kediyil keezh thallum;
Nadai idarumey nadukku vatham;."

EXPLANATION OF TAMIL POETIC LINES OF *AGATHIYAR-2000*

S.No	Tamil poetic lines	Interpretation
1.	*Nadukkum suzharchi seyyum naaaratchi*	Tremor, dizziness or vertigo, dry mouth(xerostomia)
2.	*Madukadukka vampaavai yarku mudukki*	Neuralgic pain in the body, spasm
3.	*Kidukidena kondey kediyil vizha thallium*	Festinating gait with jerky steps leading to frequent fall.
4.	*Nadai iniya ulnadukka vatham*	These are are the features of *Nadduku vatham*

***3.* According to *Therayar vaagadam*[7]**

Nadukkum vatham udambai nadukkum
Nedunaa lirunthaa lezhumba vottaathu

The above lines explain the characteristic feature of *Nadduku vatham* is tremor in the body with poor prognosis.

DISSCUSSION

Parkinsonism is a disorder resulting from the loss of dopamine- containing nerve cells (neurons). The clinical manifestation of the disease Parkinson's often starts with a tremor in and progress as the disease advance the movement abnormalities such as tremor, slow movement, impaired speech or muscle stiffness. Muscular disability involves stiff muscles, difficulty standing, difficulty walking, difficulty with bodily movements, involuntary movements, muscle rigidity, problems with coordination, rhythmic muscle contractions, slow bodily movement, or slow shuffling gait.[8] Alagappa.

Cognitive impairment

Apart from the motor symptoms, the other manifestations include disturbance in daily sequence such as daytime sleepiness, early awakening, nightmares, restless sleep. With whole body fatigue and dizziness. The cognitive impairment involves amnesia, confusion in the evening hours, dementia, or difficulty thinking and understanding, along with difficulty speaking, soft speech, or voice box spasms distorted sense of smell or loss of smell. The cognitive impairment can be well correlated with the first line in *Para rasa sekaram* which says- *Kai kaal nimirthu viraiviraithu kuruthu naakum puralaathu* which means numbness of the extremities, rigidity, decreased mobility of the tongue.[9]

Tremor

The above said poetic lines of *Nadduku vatham* of different Siddha classical text put forth the symptoms of *Nadduku vatham* which exactly corresponds with the movement abnormalities of parkinsonism. The common widely narrated symptoms are, tremor in the body or extremities, Muscle spasm, rigidity, dyskinesia, frequent

fall with jerky steps, dizziness, speech abnormalities which are the prominent clinical signs of parkinsonism. These symptoms can be found in the second line of Siddha texts *Para rasa sekaram* as *'Meyye Nadukkum kidukidukkum migavey nadakir thalli vidum '*and in third line of *Therayar vaagadam* as '*Kidukidena kondey kediyil vizha thallium*. '

Tremor, one of the most important indication of Parkinson illness (PD) and regularly the introducing sign, happens in around 75% of patients with PD, who rank it as their second most problematic side effect. PD tremor, in the case of resting or activity tremor, is an troublesome effect of this disease. The pathology of tremor has been understood basically due to basal ganglia infection.[10] The ancient Siddha texts also highlight tremor as *Meyye Nadukkum* in the second line of *Para rasa sekaram* and first line of *Agathiyar 2000*. **A** study on the origin of tremor in parkinsonism conducted by Dovzhenok & Rubchinsky[11] has reported that that parkinsonism tremor is normally identified with dopaminergic degeneration. The basal ganglia cells are known to have rich layer properties, which support pacemaking however don't deliver tremor activity in solid basal ganglia circuits. Conversely, in parkinsonian circuits tremor-related movement was seen in the basal ganglia, in the subthalamic core, and in pallidum, in the thalamus, and in cortex Thus the anatomical properties of subthalamo-pallidal circuits are inclined to tremor-like bursting within the sight of generally solid basal ganglia-thalamo-cortical input.

Rigidity and spasm

The next common symptom set forth in all the classical poem is the rigidity of the muscles. Rigidity, or a resistance to movement, affects most people with PD. The muscles remain constantly tense and contracted so that the person aches or feels stiff. The rigidity becomes obvious when another person tries to move the individual's arm, spasmodic contraction which move only in ratchet-like or short, jerky movements known as "cogwheel" rigidity. The line of Agathiar 2000, '*Madukadukka vampaavai yarku mudukki*' reports the pain experienced by the patients of parkinsonism. About 40-85% of patients with Parkinson's disease (PD) commonly experience pain and find this non-motor symptom more distressing than motor disturbance. Patients with PD experience two different types of pain, nociceptive and neuropathic.[12]

Neuralgic pains

Nociceptive pains are extremely frequent typically related to musculoskeletal and visceral. Musculoskeletal pain usually originates from abnormal posture, rigidity, and akinesia causing motor fluctuations, thus leading to painful dystonia that manifest in the early morning, when dopaminergic stimulation is low and akinesia and rigidity are severe with plantar flexion and foot inversion. Visceral pain that frequently accompanies constipation, autonomic failure involving the enteric nervous system. Dystonic contractions involving the anal sphincter can cause painful anismus.

PD-related neuropathic pain comprises radicular pain and central Parkinson's pain. Radicular pain probably reflects the lumbar discal structure damage due to festination, kyphosis and dystonia. Central Parkinson's pain is a relatively rare condition. It mainly affects the body side with predominant motor symptoms and patients usually describe it as a burning, cramping sensation. This type of pain arises directly from basal ganglia dysfunction that alters sensory processing of nociceptive inputs.[13]

Dizziness

The indication of Dizziness is much frequent in the verses quoted above as "*Suzharchi seyyum*" in the very first line of *Agathiyar* 2000 highlighting the prime importance. Dizziness being a chief complaint of aged people includes sensations such as faintness, light headedness, vertigo and imbalance. For constituting the balance system, sensory inputs, integrating system or effector organs must be intact. Alterations in functions of one of these systems cause the dizziness or vertigo. Sensory inputs accepted from vestibular apparatus, visual system, and proprioceptive system pass into the central nervous system and are integrated by the activity of the cerebellum, the extrapyramidal system, the limbic system and cerebral cortex . Causes of dizziness are neurologic problems, cervical vertigo and multi-sensory dizziness syndrome is commonly related to peripheral vestibular disease.[14]

Cervical-Vertebral degeneration may be a common cause of dizziness in Parkinson's disease patients. In the coordination of eye, head, and body posture, the proprioceptive inputs from neck are important as the neck and head move together, disorder in cervicoproprioceptive mechanisms leads to unsteadiness or dizziness associated with neck movements. The head rotation sense is mediated by vestibular, proprioceptive or visual receptors. So, vestibular and visual disorders, neck proprioceptive abnormalities may induce dizziness. This proprioception is generated by the deep short intervertebral neck muscles that include extensive muscle spindles. The unilateral irritation or deficit of neck afferents cause cervical tone imbalance and abnormalities of vestibular and neck inputs.[15] Autonomic features are often together with PD, the occurrence of orthostatic hypotension may be caused by the course of disease progression or dopaminergic drug that too causes dizziness.[16]

The dysfunction of vestibular system causing dizziness is often associated with postural instability relatively few studies of the vestibulo-ocular reflexes emphasis it. However, substantial evidence of vestibulo-spinal reflex deficits for Parkinson's neuropathological changes in the vestibular nucleus complex, including Lewy bodies as

well as reduced non-phosphorylated neurofilament and increased lipofuscin.[17]

Sensitivity to cold and Hypotension

According to the line of *Pararasa Sagaram*, '*Poiye alla udal kulirum porumum utharam pathaipundaam*' the patients affected by *Nadduku vatham* are sensitive to cold, experience chillness of body. About 40-50% of patients of Parkinson's disease (PD) is frequently associated with vasomotor symptoms such as distal cold limbs or sensitivity to cold. Cold limbs usually occur in the winter and are often accompanied by pain, potentially causing difficulty in walking or standing.[18] Autonomic or peripheral autonomic impairment has been suggested to participate in the mechanism of vasomotor abnormalities such as distal cold in PD.[19] A study on skin biopsy in PD conducted by Dabby et al, assessing skin sympathetic nerve activity in PD patients with cold showed that the skin blood circulation was decreased by prolonged vasoconstriction, and denervation hypersensitivity of adrenergic receptors in cutaneous blood vessels might lead to vasoconstriction. A histological study of skin specimens in patients with PD demonstrated decreased autonomic innervations of cutaneous vessels.[20] Thermoregulatory central autonomic failure has been shown to be caused by lesions in the hypothalamus.[21,22]

Several published studies principally emphasize the importance of monitoring nocturnal hypertension, postprandial hypotension, and orthostatic hypotension in the Parkinson's patients. Autonomic nervous system disorder in PD, and is the main reason for postprandial and/or orthostatic hypotension. PD is often associated with anxiety and sleep disorders, which can cause nocturnal and early morning hypertension.[23]

Cognitive fluctuations which is a common co morbidity in PD may be associated with cardiovascular instability leading to hypotension. While Allcock and colleagues[24] postulated that the appearance of orthostatic hypertension in PD is a marker for disease progression with spread of Lewy body pathology.[25] suggested that orthostatic hypertension may also directly exacerbate the symptoms arising from a diseased brain through repeated episodes of cerebral hypoperfusion The term '*porumum utharam pathaipundaam'* of *Pararasa Sagaram* justifies the fluctuation of blood pressure in the patients of parkinsonism metaphorically termed as *nadduku vatham*.

Xerostomia (Dry mouth)

The poetic line Agathiar 2000, **'***Nadukkum suzharchi seyyum naaaratchi***'** quotes the non motor symptom of PD, problem associated with oral cavity ie, xerostomia or dry mouth. The common oral cavity problems include increased prevalence of gingivitis and dental diseases, diurnal and nocturnal sialorrhea and drooling, xerostomia, orofacial pain, the burning mouth syndrome, and bruxism. The pathogenesis of these disturbances in PD may be multifactorial. Some disorders occur due to general motor impairment and hypokinesia (dental and periodontal diseases due to difficulties in maintaining oral hygiene); others may be a manifestation of involuntary movements (facial dyskinesias/ dystonia), due to medication (xerostomia), as a part of sensory dysfunction (taste impairment), or in relation to depressive symptoms (burning mouth syndrome, orofacial pain).[26]

PD patients had significant reduction of both basal and stimulated salivary secretions. These findings confirm that hyposialorrhea or xerostomia is an early autonomic manifestation of PD. This is supported by recent neuropathological evidence of involvement of salivary gland by alpha synuclein pathology in both autopsy and biopsy. Xerostomia could be drug induced, and indeed drugs that induce dry mouth are the tricyclic antidepressants, antipsychotics, anticholinergics, beta-blockers and antihistamines.[27,28]

Gait disturbances

The prominent characteristic feature of the disease is the disturbance in the gait. Which is quoted in *Pararasa sagaram* as '*Kidukidukkum migavey nadakkir thallividum*' in *Agathiyar* 2000 & Dhanvanthri Vaithiyam as '*Kidukidena kondey kediyil vizha thallium*.' These lines emphasis the jerky nature of gait with frequent fall. The gait disturbances in PD may be divided into two types: (1) continuous and (2) episodic.[29] The episodic gait disturbances is commonly experienced by patients with advanced PD, which occurs occasionally, intermittently include festination, start hesitation, and freezing of gait. Conversely, the continuous gait refer to alterations in the walking pattern that appear, at least at first glance, to be more or less consistent from one step to the next, i.e., they persist and are apparent all the time. Continuous gait disturbances include slowed ambulation (bradykinesia) with decreased or absent arm swing, longer double limb support and impaired postural control. One of the keys to these gait problems is the inability of patients with PD to generate sufficient stride length.[30]

While both types of gait disturbances are a result of basal ganglia dysfunction. As the disease progresses, gait impairment and falls become increasingly important and develop into one of the chief complaints among PD.[31] Jankovic and Tolosa,[32] suggests the degeneration of dopaminergic cells in substantia nigra in basal ganglia, which might result in its impaired excitatory output and affect its functioning (autonomic control of movement planning, scaling and initiation). Likewise, ageing together with parkinsonism results in rigorous denervation and re-innervation due to progressive reduction in functional motor units in spinal cord and myelinated ventral root fibers.[33]

Together, these neurological dysfunctions impair the ability to execute and maintain autonomic motor tasks such as, posture and gait.[34] The impairments in

neuromuscular functioning promotes instability, weakness, reduces physical activity, further leading to musculoskeletal deformities and a higher predisposition to fall. Such fall-prone population groups have a differential cortical activation pattern, which could possibly be linked with changes in task prioritization and conscious attention while carrying out cognitive or motor tasks.[35]

CONCLUSION

Through this extensive review of literature, the *Siddha* pathological terminology *Nadduku vatham* has been found to bear a resemblance to the clinical features of shaking palsy called parkinsons disease. The various *vatha* symptoms listed in the literature of *Nadduku vatham* such as '*naddukam*'(tremor), "*virapu*'(stiffness), *nadai edarum* (gait abnormality) and many other symptoms goes parallel with the present concept parkinsonism. Although it is difficult to deduce precisely the ancient classical texts in *Siddha* and relate the information to the understanding of the modern medicine, the evidence from the above poetic lines is essential to realize that *Parkinsons disease* has been known for thousands of years and been treated by *Siddhars*.

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