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Research Article

A COMPLEMENTARY APPROACH ON OLFACTORY DYSFUNCTION IN PARKINSONS DISEASE- RETROSPECTIVE OBSERVATIONAL STUDY

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ABSTRACT

Olfactory dysfunction is a frequent non-motor symptom of Parkinson's disease (PD) that involves deficits in odour detection, discrimination, and identification. Hyposmia may be related to neuronal degeneration with deposition of alpha-synuclein in primary olfactory areas as a very early component of the pathology of PD. Olfactory dysfunction also known as *Gandhajnana* or *Gandhanaasha* in Ayurveda is a result of improper functioning of different *Vatas*due to either degeneration of *Dhathus* (Tissues) or obstruction in the normal movement of *Vata.* We analysed the smell test results within the population of Parkinsons patients admitted in Department of Neurology and Complementary medicine in Evangelical Hospital Hattingen from 2012 till 2017. Patients received the prescribed Allopathy and Ayurveda treatment for their ailments along with Ayurveda diet, Ayurveda massage and purification therapies. The primary and the only outcome measure was to assess the results of smelling sensation of the Parkinson's patients already conducted by a Smell test with Sniffing Sticks supplied by Burghart Messtechnik. A paired t-test was conducted to compare scores obtained in smell test before and after treatment in each group separately. There was a significant difference in the scores of smell test in two groups. Results suggest that patients, treated first with *Vasthi* and then *Ksheerabala* oil *Nasya* showed significant improvement in the scores of smell test (t=-2.509, p= 0.017). The results of patients, treated with only *Vasthi* also showed significant improvement in the scores of smell test (t=-2.007, p= 0.053).

KEYWORDS: Olfactory dysfunction, PD, Bio-cleansing therapy, Hyposmia*, Vasthi, Nasya.*

INTRODUCTION

Olfactory dysfunction is a frequent non-motor symptom of Parkinsons disease (PD) that involves deficits in odour detection, discrimination, and identification[1]. Olfactory functioning can be categorized as a range of normal (Normosmic) to diminished (Hyposmic) and absent (Anosmic) ability to detect and correctly label odours. Inability to smell or losing the sense of smell- anosmia- can have a severe impact on health and quality of life[2]. Hyposmia may be related to neuronal degeneration with deposition of alpha-synuclein in primary olfactory areas as an early component of the pathology of PD[3,4]. Hyposmia is a common non-motor symptom in patients with Parkinson's disease (PD) and is frequently observed during the prodromal stage[5-7]. Pathologically, Lewy bodies are observed in the anterior olfactory nucleus, piriform cortex, entorhinal cortex, and particularly the amygdala, regions that are responsible for odour perception, in PD or incidental Lewy body disease[6,8]. Particularly, the amygdala is a principal olfaction hub where α-synuclein pathology may also develop even in the prodromal period. Hyposmia is also a likely marker of future cognitive decline in PD patients[9,10]. Two prospective studies demonstrated that severe hyposmia (SH) was an independent risk factor for developing dementia in PD[11,12]. Sensory complaints in PD include visual changes, decreased olfaction, restless legs syndrome (RLS) and pain. Loss of olfactory sense and discrimination has been considered by some to be the earliest symptom of PD, is seen in up to 90% of PD patients, and increases as the disease advances[3,13]. Therapeutic options in OD are limited and non-responsiveness to therapy often leaves doctors and patients locked in stalemate. Additionally, up to one-quarter of OD patients report a poor management of their disorder[14]. There are other alternative options like Ayurveda, the traditional Indian medicine where we can look for different treatment modalities to improve the

olfactory dysfunction. The Modern world now realizes the importance of the wisdom of Ayurveda; hence the integration of medical systems is gaining popularity throughout the world. During the last decade, Complementary medicine is an emerging field in health care and is considered as a health care approach that is patient centred and healing oriented. Rogers and Sheaff remind us that the 'justification for integrated delivery systems is to meet patients' needs rather than providers'. It includes conventional therapies as well as alternative traditional methods like Ayurveda medicine.

Ayurvedic medicine is a personalized system of traditional medicine native to India and the Indian subcontinent. It is based on a holistic view of treatment which promotes and supports equilibrium in different aspects of human life: the body, mind, and soul[15].

Three Humors *(Doshas)* namely *Vata, Pitta and Kapha* are the physiological basis around which practical Ayurveda revolves. The theory of Three *Doshas* is developed primarily as a tool to quantify the pathogenesis and consequently to quantify the need of healthcare interventions in any given condition. As it is practically difficult to assess the status of Five Elements Ether, Air, Fire, Water and Earth, whether they are in a state of balance or not to predict healthy state or diseased state, assessment of the status of the three *Doshas* has become the preferred way of decision-making in therapeutics in Ayurveda. This basic function operating through a constant interplay between the environment and the individual are thought to be required to maintain the integrity of a living system. Hankey's (2007) proposal of input–output, throughput and storage as three basic functions of an open system resemble functions of *Vata*, *Pitta* and *Kapha*, respectively, as proposed in Ayurveda[16]. The functions of input–output, throughput and storage or incidentally of *Vata, Pitta* and *Kapha* are primary requisites for the existence of any living system. In turn, these are the manifestation of compositional complexity of a person. Consequently, a five element root to the *Vata, Pitta* and *Kapha* is identified as described in the table below. By observing the function of their representative *Dosha,* a deficit or the excess of five elements can be identified as the cause behind the state of sickness or health.

Table 1: Five elements and Three *Doshas*

Predominant element	Representative *Dosha*
Ether + Air	*Vata*
Fire	*Pitta*
Earth + Water	*Kapha*

The prime quality of *Vata* is initiation, maintenance, and control of all movements in the body. *Vata* is responsible for the movements of organs, systems and other two *Doshas Pitta* and *Kapha*. It is responsible for the transport of body elements and excretory products[17]. *Vata* gets aggravated by either degeneration of *Dhathus* (Tissues) or by obstruction of macro and micro channels due to *Kapha, Pitta*, Tissues[17]. Analysing the signs and symptoms of different types of Primary Parkinson's disease, we can find the various symptoms like those described in *Vata* disorders.

Olfactory dysfunction also known as *Gandhajnana* or *Gandhanaasha* in Ayurveda is a result of improper functioning of *Vata* due to either degeneration of *Dhathus* (tissues) or obstruction in the normal movement of *Vata.* Hence, all management beneficial in regaining the proper functioning of *Vata* by removing the obstruction or by nourishing the *Dhathus* will lead to proper functioning of all sense organs and their sensory perception, including the perception of smell.

METHODS

We analysed the smell test results within the population of Parkinsons patients admitted in Department of Neurology and Complementary medicine in Evangeliscal Hospital Hattingen from 2012 till 2017. The Clinical Case sheets and computerized data register were used to extract the treatment and outcome details. The treatment for each patient was decided by the team of Neurologists and Ayurveda doctors purely based on diagnosis, signs, and symptoms. Patients received the prescribed conventional and Ayurveda treatment for their ailments along with Ayurveda diet, Ayurveda massage and purification therapies. We included the data of 127 patients diagnosed with Parkinson's disease.

Inclusion Criteria

The smell test results of patients with following inclusion criteria were extracted from records.

Patients diagnosed with Parkinson's disease.

Patients having difficulty in smell detection (Hyposmia or Anosmia).

Patients whose smelling sensation was assessed by a Smell Test with Sniffing Sticks (Burghart Messtechnik) before and after the intervention.

Patients with normal higher mental functions.

Types of Interventions

An Ayurvedic treatment primarily comprises of two parts namely *Shodhana* (Bio-cleansing therapy) and *Shamana* (Pacifying Therapy). Bio-cleansing therapy is a dynamic procedure to cleanse the body from inside out. It is intended to balance the

morbid *Doshas* and eliminate the toxic elements found in the body. It is a comprehensive procedure that helps improve the immunity of the body. Bio-cleansing therapy is superior to pacifying therapy as the benefits acquired in terms of the elimination of the diseases are permanent and long-lasting. In Ayurveda medicine bio-cleansing therapy is collection of five treatment methods for the body to get cleansed inside out. These five procedures can be the steppingstones for complete attainment of a healthy and a purified body. This therapy is believed to impart radical elimination of the disease-causing factors and maintain equilibrium among the *Doshas* that govern a body. Following are the five Bio-cleansing therapies that cleanse the body.

1. *Vamana* (Therapeutic Emesis)
2. *Virechana* (Therapeutic Purgation)
3. *Vasthi* (Therapeutic Enema)
4. *Nasya* (Nasal Therapy)
5. *Raktamokshana* (Blood Letting)

The imbalance created due to *Vata Dosha* accumulation is best removed by Therapeutic enema *(Vasthi)* treatment. *Vasthi* is a therapeutic enema with herbal oil or herbal mixture of decoction, oil, honey, ghee, and herbal paste. In diseases manifested with signs and symptoms in head and neck region Nasal therapy (*Nasya*) is the treatment opted. Nasal therapy is a localised treatment for head and neck. The effect of localised treatment is enhanced when done after the body is purified by either therapeutic enema, purgation, or emesis. *Nasya* treatment is nasal administration of oil, ghee, herbal powder, or decoction.

All patients received *Vasthi* (therapeutic enema), *Nasya* (nasal therapy) or both treatments during their stay in the hospital. The data of results were divided in to 7 groups as per the received intervention.

Table 2: Types of Intervention

Intervention	**Procedure**
Anutaila oil *Nasya*	Patient received Nasal therapy using a medicated oil *Anu Taila* as an add on therapy to conventional therapy.
Ksheerabala oil *Nasya*	Patient received Nasal therapy using a medicated oil *Ksheerabala Taila* as an add on therapy to conventional therapy.
Brahmi and *Vacha* Powder *Nasya*	Patient received Nasal therapy using a mixture of *Brahmi* (*Bacopa Moneri*) and *Vacha* (*Acorus Calamus*) powders as an add on therapy to conventional therapy.
Ksheerabala oil Nasya after Vasthi Treatment	Patient received first *Vasthi* treatment (Therapeutic Enema) for minimum 5 days and then followed by Nasal therapy using oil *Ksheerabala Taila* as an add on therapy to conventional therapy.
Brahmi and *Vacha Powder Nasya* after *Vasthi Treatment*	Patient received first *Vasthi* treatment (Therapeutic Enema) for minimum 5 days and then followed by Nasal therapy using mixture of *Brahmi* (*Bacopa Moneri*) and *Vacha* (*Acorus Calamus*) powders as an add on therapy to conventional therapy.
Only *Vasthi* Treatment	Patient received only *Vasthi* treatment (Therapeutic Enema) for minimum 5 days as an add on therapy to conventional therapy.
No *Vasthi* and *Nasya* Treatment	Patient received only conventional therapy

Outcome

The primary and the only objective outcome measure was to assess the smelling sensation of the Parkinson's patients by conducting a Riech Test (Smell test) by using Sniffing Sticks supplied by Burghart Messtechnik.

Sniffing Sticks

The smell test was conducted before and after the interventions with the help of Identification test kit of 16 Blue Sniffing Sticks. The identification test consists of 16 Sniffing Sticks with everyday smells which the patient must name using a selection card containing four choices. Among the four choices only one is correct.

Table 3: Selection card of Sniffing Sticks

Sniffing Stick	Choice 1	Choice 2	Choice 3	Choice 4
1	Orange	Blackberry	Strawberry	Pineapple
2	Smoke	Adhesive	Shoe-leather	Grass
3	Honey	Vanilla	Chocolate	Cinnamon
4	Chives	Peppermint	Spruce	Onion
5	Coconut	Banana	Walnut	Cherry
6	Peach	Appel	Lemon	Grapefruit
7	Liquorice	Gummy Bear	Chewing Gum	Cookies
8	Mustard	Rubber	Menthol	Turpentine
9	Onion	Pickled Cabbage	Garlic	Carrot
10	Cigarette	Coffee	Wine	Candle Smoke
11	Melon	Peach	Orange	Apple
12	Cloves	Pepper	Cinnamon	Mustard
13	Pear	Plum	Peach	Pineapple
14	Chamomile	Raspberry	Rose	Cherry
15	Anise	Rum	Honey	Spruce
16	Bread	Fish	Cheese	Ham

Objective and Subjective Parameters

The range of objective score of the smell test was 0 to 16. Patients having score less than 9 had distinct olfactory dysfunction, patients having score between 9 and 13 had mild olfactory dysfunction and scores above 13 were normal. Any increase in the score was considered as a positive outcome. Subjective parameter was the self-evaluation feedback of patient about the quality of smelling (improved smelling, no change, decreased smelling).

The collected data of smell test results were divided in 7 different groups as per the variation in intervention done.

Table 4: Intervention groups and sample size

Intervention Group	Sample Size
Anutaila oil *Nasya*	5
Ksheerabala oil *Nasya*	13
Brahmi and *Vacha* Powder *Nasya*	9
Ksheerabala oil *Nasya* after *Vasthi* Treatment	39
Brahmi and *Vacha* Powder *Nasya* after *Vasthi* Treatment	9
Only *Vasthi* Treatment	36
No *Vasthi* and *Nasya* Treatment	16

RESULTS

A paired t-test was conducted to compare scores obtained in smell test before and after treatment in each group separately. There was a significant difference in the scores of smell test in the following two groups.

a. ***Ksheerabala* oil *Nasya* after *Vasthi*:** There was a significant difference between the scores obtained before treatment (M=8.18, SD=3.478) and after treatment (M=8.85, SD=3.337); t=-2.509, p= 0.017. These results suggest that patients, treated first with *Vasthi* and then *Ksheerabala Nasya* show significant improvement in the scores of smell test.
b. **Only *Vasthi* Treatment:** There was a significant difference between the scores obtained before treatment (M=7.00, SD=3.711) and after treatment (M=7.72, SD=3.477); t=-2.007, p=0.053. These results suggest that patients, treated with only Vasthi also show significant improvement in the *scores* of smell test. There was no significant difference found in the scores of smell test in the following five groups.
c. ***Anutaila* oil *Nasya*:** There was no significant difference between the scores obtained before treatment (M=14.60, SD=2.542) and after treatment (M=17.40, SD=2.821); t=-2.419, p= 0.073. These results suggest that patients, treated with *Anutaila* oil *Nasya* does not show significant improvement in the scores of smell test.
d. ***Ksheerabala* oil *Nasya*:** There was no significant difference between the scores obtained before treatment (M=8.54, SD=3.777) and after treatment (M=8.69, SD=3.301); t=-0.365, p=0.721. These

results suggest that patients, treated with *Ksheerabala* oil *Nasya* does not show significant improvement in the scores of smell test.

e. *Brahmi Vachapowder Nasya*: There was no significant difference between the scores obtained before treatment (M=7.22, SD=4.206) and after treatment (M=7.44, SD=4.333); t=-0.359, p= 0.729. These results suggest that patients, treated with *Brahmi Vacha Nasya* does not show significant improvement in the scores of smell test.

f. *Brahmi Vacha Nasya* after *Vasthi*: There was no significant difference between the scores obtained before treatment (M=6.89, SD=3.655) and after treatment (M=7.33, SD=3.937); t=-0.353, p= 0.733. These results suggest that patients, treated first with *Vasthi* and then *Brahmi Vacha Nasya* does not show significant improvement in the scores of smell test.

g. No *Vasthi* and *Nasya*: There was no significant difference between the scores obtained before treatment (M=6.94, SD=3.623) and after treatment (M=6.63, SD=4.064); t=0.443, p=0.664. These results suggest that patients, not treated with either *Vasthi* or *Nasya* does not show significant improvement in the scores of smell test.

Table 5: Statistical analysis of scores obtained in smell test before and after treatment in each group

Paired T Test									
		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	ABT - AAT	-2.800	2.588	1.158	-6.014	.414	-2.419	4	.073
Pair 2	KBT - KAT	-.154	1.519	.421	-1.072	.764	-.365	12	.721
Pair 3	BVBT - BVAT	-.222	1.856	.619	-1.649	1.204	-.359	8	.729
Pair 4	KVBT - KVAT	-.667	1.660	.266	-1.205	-.129	-2.509	38	.017
Pair 5	BVVBT - BVVAT	-.444	3.779	1.260	-3.349	2.460	-.353	8	.733
Pair 6	VBT - VAT	-.722	2.160	.360	-1.453	.008	-2.007	35	.053
Pair 7	NBT - NAT	.313	2.822	.705	-1.191	1.816	.443	15	.664

Pair 1 (Group 1): *Anu Taila Nasya* before treatment (ABT) and *Anu Taila Nasya* after treatment (AAT)

Pair 2 (Group 2): *Ksheerabala Taila Nasya* before treatment (KBT) and *Ksheerabala Taila Nasya* after treatment (KAT)

Pair 3 (Group 3): *Brahmi Vacha Nasya* before treatment (BVBT) and *Brahmi Vacha Nasya* after treatment (BVAT)

Pair 4 (Group 4): Ksheerabala Taila Nasya and Vasthi before treatment (KVBT) and *KsheerabalaTaila Nasya* and *Vasthi* after treatment (KVAT)

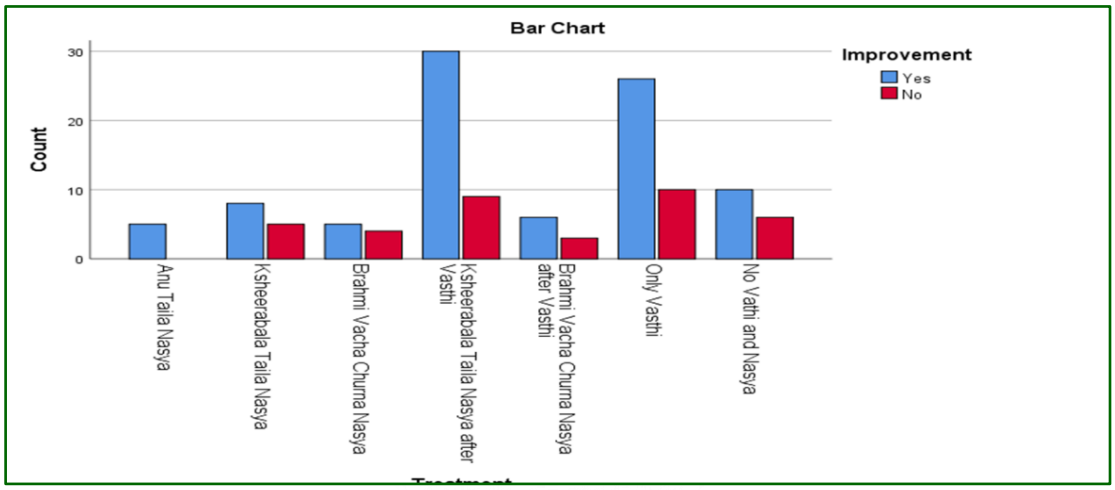
Pair 5 (Group 5): *Brahmi Vacha Nasya* and *Vasthi* before treatment (BVVBT) and *Brahmi Vacha Nasya* and *Vasthi* after treatment (BVVAT)

Pair 6 (Group 6): Only *Vasthi* before treatment (VBT) and Only *Vasthi* after treatment (VAT)

Pair 7 (Group 7): No *Vasthi* and *Nasya* before treatment (NBT) and No *Vasthi* and *Nasya* after treatment (BVAT)

Image of sniffing sticks and the procedure

Picture courtesy : https://www.burghart-mt.de/de/medizintechnik/sniffinsticks-taste-strips/sondertests.html



DISCUSSION

Summary of Main Results

Neurodegeneration in PD has also been shown to occur with early involvement of the olfactory bulbs[3]. Clinically, olfactory dysfunction has a prevalence of up to 90% in the PD population and often predates motor signs[5]. The main purpose of this study was to evaluate the effect of Complementary therapy on Olfactory dysfunctions in Parkinson's patients. Data of outcome measures (smell test results) from 127 patients were divided into 7 groups based on the interventions. These results were evaluated to analyse the effect of different therapies.

The evidence found in our study was, that *Ksheerabala* oil *Nasya* (a type of nutritive Nasal therapy) done after *Vasthi* (Therapeutic enema) treatment may enhance the sensory perception of smell in Parkinsons patients. Furthermore, the study revealed that only *Vasthi* treatment as intervention was also effective in improving the smelling sensation. The other five groups of interventions *Anutaila Nasya*, *Ksheerabala Nasya* alone, *Brahmi Vacha Nasya*, *Brahmi Vacha Nasya* after *Vasthi* and group of patients without *Vasthi* and *Nasya* did not show significance. The possible effect when explained in Ayurvedic principle is that evacuation of the accumulated *Vata Dosha* is not the only action, rather major action of the *Vasthi* treatment and may also act as a palliative or nutritive treatment which in turn ensures the proper functioning of *Vata Dosha*. Nourishment effect may also be obtained by *Nasya* treatment. Hence *Vasthi* treatment does the purification of the body and regains the proper functioning of *Vata*, followed by nutritive *Ksheerabala* oil *Nasya* which enhances the functioning of the sensory perception of smell. From the significant improvement in patients who got only *Vasthi* treatment we can infer that the normalisation of *Vata Dosha* leads to the improvement of sensory perception.

The prime quality of *Vata Dosha* is initiation, maintenance, and control of all movements in the

body. The ancient Ayurvedic scholar Sushruta said that *Vata* is a single entity but it can be categorized into five according to its different names and actions. The five types of *Vata* are *Prana*, *Udana*, *Vyana*, *Samana* and *Apana*. These five perform their specific actions at their normal place. *Vata Dosha* is divided into five divisions to support the body's functions of movement, perception, nourishment, division, and retention[17]. The capacity of sense organs to receive sensations is subject to certain limitations and this strength or capacity is causally related to the strength of relevant *Dhathus* (tissues) and proper physiological functioning of *Doshas* especially *Vata*. *Vata* in its normal state, protects the body by bestowing enthusiasm, expiration and inspiration, all activities physical, mental, and verbal, maintenance of *Dhathus* and proper functioning of Sense organs and sensory perception. Out of the five *Vatas Prana* and *Udana* play an important role in maintaining the proper functioning of sense organs and there-by maintaining the sensory perception[17].

In recent studies the relation between the pattern change in gut microbiomes and the progress in clinical features of PD has been established. There are sufficient evidences that targets within the brain gut microbiome axis have the potential to become targets for novel drug development for brain gut disorders[18]. Dietary interventions and bowel cleansing are sufficient methods to impact the gut microbiome in patients with PD. Therefore, a positive impact on the clinical course is feasible[19]. Professor Braak in his hypothesis on 6 stage pathogenesis of PD has mentioned caudorostral trajectory of pathology in brain. After years of research, it now appears that the earliest lesions could develop at nonnigral sites, where the surrounding environment is potentially hostile: the olfactory bulb and, possibly, the ENS[20].

The effect of therapeutic enema may also be influencing gut microbiome pattern and thereby improving the clinical features. *Vasthi* therapy is one of the most important therapeutic procedures in Ayurveda. This is most probably due to its controlling and regulating mechanism over the enteric nervous system (ENS). Mode of action of therapeutic enema can be explained in following ways:[21]

1. Action of *Vasthi*, due to its unique procedure (Procedural effect)
2. Action of *Vasthi* due to drug used in process (Drug effect)
3. Action of *Vasthi* by cleansing the channels of body (Purification effect)
4. Action of *Vasthi* by regulating the entericnervous system (Regulating effect on gut brain).

The possible mode of action of Nasal therapy on brain is through vascular system, nerve plexus of olfactory nerve and ophthalmic and maxillary branches of trigeminal nerves to the brain. As it is concerned with olfactory stimuli and the olfactory nerve differs from other cranial nerves in its close relation with the brain, nasal oil therapy can influence the olfactory function.

CONCLUSION

Implications for Practice

The results of this study indicate that there is evidence for the effectiveness of *Vasthi* treatment followed by nutritive *Nasya. Vasthi* followed by *Nasya* normalizes the distorted *Vata Dosha*, thereby improving the sensory perception of smell in Parkinson's patients. The effects were statistically significant when *Ksheerabala* oil *nasya* was done after *Vasthi* treatment in Parkinson's patients and in patients who received only *Vasthi* therapy as the intervention. *Ksheerabala* oil is one of the most popular oil preparations in Ayurveda and recognized as a remarkably effective remedy for neurological disorders like facial paralysis, sciatica, hemiplegia, paraplegia, poliomyelitis, and other such conditions. Therapeutically its used internally, externally and for nasal therapy[22].

Implications for Research

There is a need for well-designed randomised controlled studies with large sample sizes to evaluate the effects of *Vasthi* and *Nasya* on Olfactory dysfunction in Parkinson's patients. Above all, further research should compare bio cleansing therapy with other conventionally applied or newly developed and effective therapies. Further research should address specific questions with respect to the effectiveness of bio cleansing therapy in other non-motor and motor symptoms of Parkinson's disease by using UPDRS III, TUG Task, Timed Steps and FOG-Q assessments as outcome measures.

REFERENCES

1. Kranick SM Duda JE. Olfactory dysfunction in Parkinson's disease. Neuro signals journal. 2008: 35-40.
2. Sanne Boesveldt Elbrich M Postma, Duncan Boak, Antje Welge- Luessen, Veronika Schöpf, Joel D Mainland, Jeffrey Martens, John Ngai, and Valerie B Duffy. Anosmia-A Clinical Review. Chemical Senses. 2017 Sep; 42(7): 513-523.
3. Braak H, Del Tredici K, Rüb U, de Vos RA, Jansen Steur EN, Braak E Staging of brain pathology related to sporadic Parkinson's disease. Neurobiology Aging. 2003 Mar-Apr; 24(2):197-211.

4. Hawkes CH Del Tredici K, Braak H. Parkinson's disease: a dual-hit hypothesis. Neuropathology Applied Neurobiology. 2007; 33:599–614.
5. RL Doty. Olfaction in Parkinson's disease. Parkinsonism Related Disorders. 2007; 13(3): S225-8.
6. Silveira-Moriyama L Holton JL, Kingsbury A, Ayling H, Petrie A, Sterlacci W. Regional differences in the severity of Lewy body pathology across the olfactory cortex. Neuroscience Letters.2009;453:77–80.
7. Takeda A Baba T, Kikuchi A, Hasegawa T, Sugeno N, Konno M. Olfactory dysfunction, and dementia in PD. Journal of Parkinsons Disorders.2014; 4:181–7.
8. Hubbard PS Esiri MM, Reading M, McShane R, Nagy Z. Alpha- synuclein pathology in the olfactory pathways of dementia patients. Journal of Anatomy. 2007; 211:117–24.
9. Domellöf ME Lundin KF, Edström M, Forsgren L. Olfactory dysfunction, and dementia in newly diagnosed patients with Parkinson's disease. Parkinsonism Related Disorders. 2017; 38:41–47.
10. Stephenson R Houghton D, Sundararajan S, Doty RL, Stern M, Xie SX. Odor identification deficits are associated with increased risk of neuropsychiatric complications in patients with Parkinson's disease. Movement Disorders.2010; 25:99–104.
11. Baba T Kikuchi A, Hirayama K, Nishio Y, Hosokai Y, Kanno S. Severe olfactory dysfunction is a prodromal symptom of dementia associated with PD: a 3-year longitudinal study. Journal Brain. 2012; 135:161–9.
12. Fullard ME Tran B, Xie SX, Toledo JB, Scordia C, Linder C, et al. Olfactory impairment predicts cognitive decline in early Parkinson's disease. Parkinsonism Related Disorders. 2016; 25:45–51.
13. Katzenschlager R Zijlmans J, Evans A, Watt H, Lees AJ Olfactory function distinguishes vascular parkinsonism from Parkinson's disease. Neurology Neurosurgery Psychiatry 75:1749–1752.
14. Landis BN, Stow NW, Lacroix JS, Hugentobler M, Hummel T Olfactory disorders: the patients' view. Rhinology 2009; 47:454–459.
15. S. Mishra, B. Trikamji, S. Singh, P. Singh, and R. Nair. Historical perspective of Indian neurology. Annals of Indian Academy of Neurology.2013; 16: 4.
16. Hankey A. A test of the systems analysis underlying the scientific theory of Ayurveda's Tridosha. Alternative Complementary Medicine. 2005 June; 11(3):85-90.
17. K.R Srikantha Murthy. Sushruta Samhita Sutra sthanawith english translations Chapter 15, verse 1. Varanasi; Chaukhambha; 2017; page 97, 98.
18. Vadim Osadchiy, Clair R Martin, Emeran, A Mayer. The Gut-Brain Axis and the Microbiome: Mechanisms and Clinical Implications. Clinical Gastroenterology Hepatology. 2019 Jan; 17(2): 322–332.
19. Tobias Hegelmaier, Marco Lebbing, Alexander Duscha, Laura Tomaske, Lars Tönges, Jacob Bak Holm, Henrik Bjorn Nielsen, Sören G. Gatermann, Horst Przuntek and Aiden Haghikia. Interventional Influence of the Intestinal Microbiome through Dietary Intervention and Bowel Cleansing might Improve Motor Symptoms in Parkinson's Disease. Cells 2020; 9(2): 376
20. Braak, Heiko and Del Tredici, Kelly. Neuropathological Staging of Brain Pathology in Sporadic Parkinson's Disease: Separating the Wheat from the Chaff. Journal of Parkinson's Disease; 2017:71-85.
21. Gupta PK, Sigh RH. A conceptual study on vasti effect. Ancient Science of Life. 2001 Jan;20(3):54-9.
22. Rao VN, Shankar T, Dixit SK, Ray AB. Standardisation of Ksheerabala taila. Ancient Science of Life. 1996 Jul; 16(1): 21-5.

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