



# EVALUATION OF DIET SUPPLEMENTATION WITH A PRODUCT BASED ON HONEY AND SEA BUCKTHORN (HEBE - MELINIS) ON QUALITY OF LIFE AND GASTROINTESTINAL DYSFUNCTION IN PATIENTS WITH PARKINSON'S DISEASE

**Ioan Buraga**

“Carol Davila” University of Medicine and Pharmacy, Bucharest, Romania

**Ioan Buraga**

email: buragaioan@yahoo.com

## ABSTRACT

*Abstract This study aimed to evaluate the impact of a dietary supplement based on a honey and sea buckthorn mixture (Hebe–Melinis) on quality of life, the gut–brain axis, and both motor and non-motor symptoms, including gastrointestinal dysfunction, in patients with Parkinson’s disease. Despite advances in conventional therapeutic approaches, there remains a need to identify adjunctive interventions capable of enhancing clinical outcomes and complementing existing treatments. A total of 30 patients with Parkinson’s disease receiving the Hebe mixture were evaluated at baseline and after three months of administration. Quality of life changes were analyzed using the Wilcoxon signed-rank test. Disease severity was assessed using the Unified Parkinson’s Disease Rating Scale (MDS-UPDRS), while gastrointestinal dysfunction was measured using the Gastrointestinal Dysfunction Scale for Parkinson’s Disease (GIDS-PD). Functional disability staging was performed using the Hoehn and Yahr scale. The median age of participants was 71.5 (68.3–73.0) years. Statistically significant improvements were observed in both MDS-UPDRS and GIDS-PD scores following the intervention. These findings suggest that the Hebe mixture is a safe and effective adjunct therapy for improving quality of life in patients with Parkinson’s disease.*

*Keywords Parkinson's disease, quality of life, gastrointestinal dysfunction, gut–brain axis, dietary supplementation*

## Introduction

Parkinson’s disease is the second most common neurodegenerative neurological disease after Alzheimer’s disease, affecting around 1% of the population over 60 years old. The incidence of Parkinson’s disease is estimated at 5-21 cases per 100,000 inhabitants per year, with a prevalence between 20 and 330 cases per 100,000 inhabitants. (1)

The average age of onset of the disease is around 60 years, but there are also cases with onset under 40 years. The disease is more common in men than in women. (2) Both the incidence and prevalence of the disease increase

with age. (7)

The disease is characterized by motor symptoms, initial rest tremor in the upper limbs, bradykinesia, stiffness, postural disorder and gait disorder, which usually occurs unilaterally and becomes bilateral during the evolution, (6) as well as non-motor symptoms - which may precede motor symptoms. These are characterized by: decreased olfactory function, REM sleep disorders (RBD), constipation, hypersalivation, daytime sleepiness, fatigue, depression, anxiety, forgetfulness, anhedonia. (3,4,5)

Early onset of non-motor symptoms, especially gastrointestinal ones, suggests a potential role that the gut–brain axis might play

in the underlying pathological mechanisms of Parkinson's disease (8). In the last years, evidence has shown that there is a bidirectional communication between the gut microbiome and central nervous system, named "microbiota–gut–brain axis" (9), with an important role in the development and evolution of different neurological and neurodegenerative diseases (10).

The previously described symptomatology leads to a decrease in the patients' QOL, as defined by the World Health Organization (WHO) as "an individual's perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards, and concerns." (11). Thus, improving the QOL of patients with PD, plays a significant role for the management of the disease. (8).

Numerous findings in both observational PD patient studies and experimental animal studies have revealed that gut microbiota is determinant in the regulation of anti-inflammatory and pro-inflammatory profiles (12), suggesting that alterations within an individual's gut microbiome can influence evolution of PD (13). At the same time, gut microbiota is influenced by a variety of internal and external factors, including dietary habits, human lifestyle, age or environmental factors, still diet being considered one of the most important factors.(14) Therefore, there is an increasing interest in manipulating the gut microbiota as a way of improving PD evolution by dietary means (15).

Considering the long and slowly progressive course of PD, also the vast spectrum of symptoms and incomplete benefits of prescribed medications, people with PD are increasingly likely to pursue complementary or alternative therapies to alleviate their symptoms.

In our study (non-randomized experimental) we evaluated the influence of a specific honey and sea buckthorn mixture (Hebe-Melinis) on motor and non-motor symptoms and implicitly on the QOL of patients with PD.

## **Materials and Methods**

---

The study group included a number of 30 patients diagnosed with PD, according to the

diagnostic criteria of the UK PD Society Brain Bank criteria (16) and the Movement Disorder Society (MDS) (17). The participants were 15 women and 15 men with a median age of 71.5 years (68.3 - 73 years), diagnosed with PD stage between 2 and 4 on the Hoehn-Yahr scale and an evolution of the disease between 8 and 17 years.

A product based on honey and sea buckthorn mixture (Hebe-Melinis) was administered to all patients. This product is made of acacia honey and organic whole sea buckthorn fruit paste, both component with certified bio-origins.

Honey is a complex product, historically recognized for its prebiotic role and antimicrobial activity, acting synergistically with the probiotics. According with ISAPP (The International Scientific Association for Probiotics and Prebiotics) prebiotic is a substrate that is selectively utilized by host microorganisms conferring a health benefit. (18) In the gut, honey inhibits some undesirable microbes and many enteropathogenic organisms (19). Supplementary, numerous vitamins, minerals and enzymes contained in honey contribute to a powerful antioxidant effect. The most important component responsible for antioxidant and anti-inflammatory activity in honey is its phenolic compounds. (20)

Sea buckthorn (*Hippophae rhamnoides*) is a well-known medicinal plant already widely used for its remarkable antioxidant properties. The plant contains a variety of bioactive substances, which are present not only in the berries but also in the seeds and leaves (21). Sea buckthorn usage have proven results in gastrointestinal health, displaying anti-inflammatory effects on the digestive tract and neuroprotective activity (22,23). The main bioactive compounds in sea buckthorn are polyphenols such as phenolic acids and flavonoids. Research suggests that polyphenolic compounds contained in berry fruits exhibit potent antioxidant and anti-inflammatory activities that may reduce the age-related sensitivity to oxidative stress or inflammation and may alter neurodegeneration. (24,25)

Hebe-Melinis is produced extending the processing technology of raw fruits and honey mixtures (EP 3669659 A1) with the introduction of an initial stage of alcoholic fermentation. The mixture of raw sea buckthorn and honey, after

alcoholic fermentation, it is slowly stabilized, through controlled dehydration, at temperatures below 38°C and turns in a whole tasty, stable food, without alcohol (fermentation is stopped), with a creamy texture. In this process is used the whole sea buckthorn fruit, including the seeds, making available also the flavonoids from the seeds.

This new technology links together some very important things: it uses sea buckthorn and honey that are, by themselves, very rich in valuable components (vitamins, antioxidants, omega fatty acids and so on), transformed by alcoholic fermentation to be very easy assimilated by the body (as a predigesting step). The fermented mixture is then stabilized slowly, through controlled dehydration, at low temperature and so it keeps the components - initially existent, transformed and developed during fermentation. The result is a natural, integral product whose components offer synergic benefits. All in a form easy to store and consume, in the long term.

The study consists of the administration of 3 teaspoons of honey and sea buckthorn mixture (Hebe) in a single daily dose, in the first part of the day, regardless of the association or not with other foods. The length of the study was 3 months, with regular, monthly evaluation of the patients.

Participation in the study was based on informed consent, the exclusion criteria were DM, serious heart diseases and oncological diseases, or adverse reactions. It should be noted that there were no adverse reactions.

#### Statistical analysis

Statistical analysis was performed using RStudio version 4.3.3 (RStudio, Inc., Boston, MA). Numerical variables were summarized using median and interquartile range (IQR), while categorical data were summarized using counts and percentages.

To assess the significance of changes before and after intervention, the Wilcoxon signed-rank test was utilized for paired data. This non-parametric test was chosen due to its robustness against violations of normality assumptions and its suitability for ordinal data such as the MDS-UPDRS scores.

A two-tailed p-value of less than 0.05 was considered statistically significant.

## Results and Discussions

### Baseline characteristics

The baseline characteristics of the sample (Table 1) provides insight into the demographics of the patients (age, sex) and their clinical characteristics of the Parkinson's disease, namely their stage and lengths of evolution.

*Table 1 Characteristics of the patients*

| Characteristics of the patients                          | N = 30             |
|----------------------------------------------------------|--------------------|
| Age, Median (IQR)                                        | 71.5 (68.3 – 73.0) |
| Sex, n (%)                                               |                    |
| Female                                                   | 15 (50)            |
| Male                                                     | 15 (50)            |
| Parkinson Disease Stage, n (%)                           |                    |
| 2                                                        | 2 (6.7)            |
| 3                                                        | 20 (67)            |
| 4                                                        | 8 (27)             |
| Parkinson's Disease Evolution Time (years), Median (IQR) | 13.0 (8.0 – 17.0)  |

### Scores Evolution

A significant improvement of the MDS-UPDRS score evolution was observed after the intervention with honey and sea buckthorn mixture (Hebe).

Thus, for each component of the MDS-UPDRS scoring system, statistically significant decreases of the score were observed. The most notable difference was observed for Part I of the score, where the median value dropped from 23 to 15. For Part II of the scoring system, the difference was less important, but statistically significant (initial median score 26 and post-intervention median score 24). The trend remained the same for Part III of the questionnaire, where the median score decreased from 79 (before intervention) to 62 (after intervention).

Table 2 MDS-UPDRS Score Evolution

| MDS-UPDRS Score Evolution        | Before, N = 30 | After, N = 30  | p-value <sup>1</sup> |
|----------------------------------|----------------|----------------|----------------------|
| MDS-UPDRS Part I, Median (IQR)   | 23 (18 – 25)   | 15 (11 – 18)   | <0.001               |
| MDS-UPDRS Part II, Median (IQR)  | 26 (19 – 33)   | 24 (18 – 29)   | <0.001               |
| MDS-UPDRS Part III, Median (IQR) | 79 (52 – 87)   | 62 (46 – 79)   | <0.001               |
| MDS-UPDRS Total, Median (IQR)    | 123 (88 – 148) | 105 (76 – 123) | <0.001               |

<sup>1</sup>Wilcoxon rank test

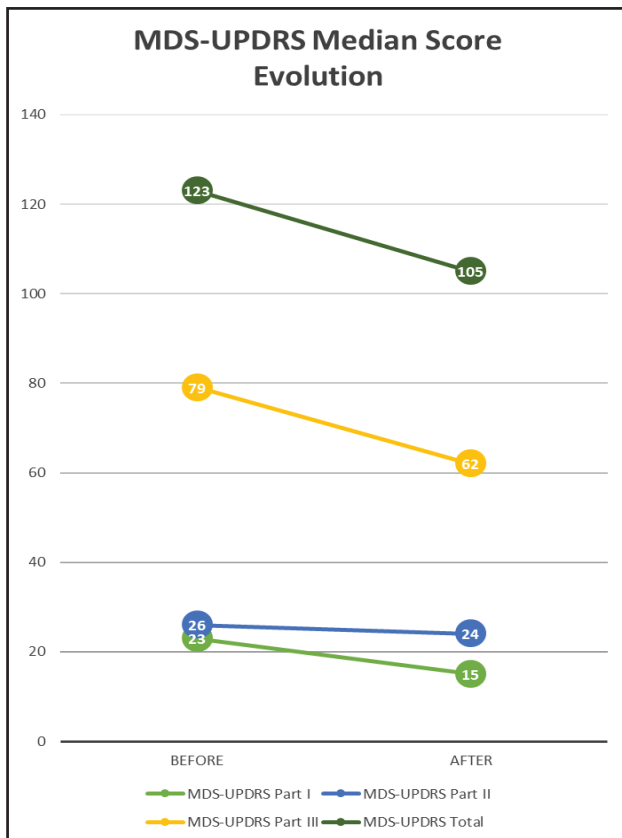


Figure 1 Change in median value before and after the treatment

The change in the distribution of the score can be observed in Figure 2. The change that stands out is observed in MDS-UPDRS Part I where not only the median is significantly lower after the intervention, but also the other quartiles. For all other parts of the core, the changes are less significant from the medical point of view, but nonetheless, statistically significant.

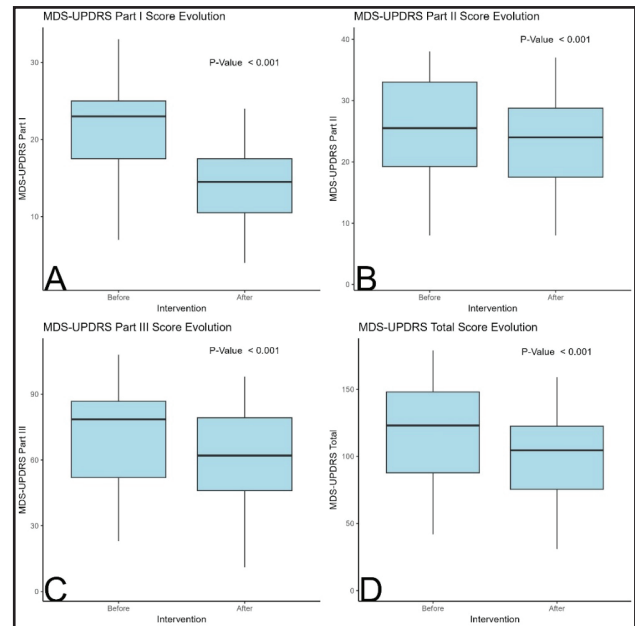


Figure 2 Evolution of the scores. A – MDS-UPDRS Part I, B – MDS-UPDRS Part II, C – MDS-UPDRS Part III, D = MDS-UPDRS Total

Upon analyzing the change in score for each patient (Figure 3), we notice that all patients experience a beneficial effect for part I of the score, reflected in lower scores for each one. The same trend was not observed for Part II, Part III and Total score of the MDS-UPDRS scale, where, for some of the patients, no improvement of the score was observed.

It is essential to notice that none of the patients had an increased overall score or subscore after the intervention. Also, none of the patients reported any side effects related with the honey and sea buckthorn mixture (Hebe) administration.

Apart from improvement noticed in MDS-UPDRS score after intervention with honey and sea buckthorn mixture (Hebe), the most impressive improvement was noticed in GIDS-PD score (The Gastrointestinal Dysfunction Scale for Parkinson's Disease).

The score change was statistically significant ( $p < 0.001$ ), with a decrease in the median score from 40 before intervention to 14 after the intervention. (Figure 4)

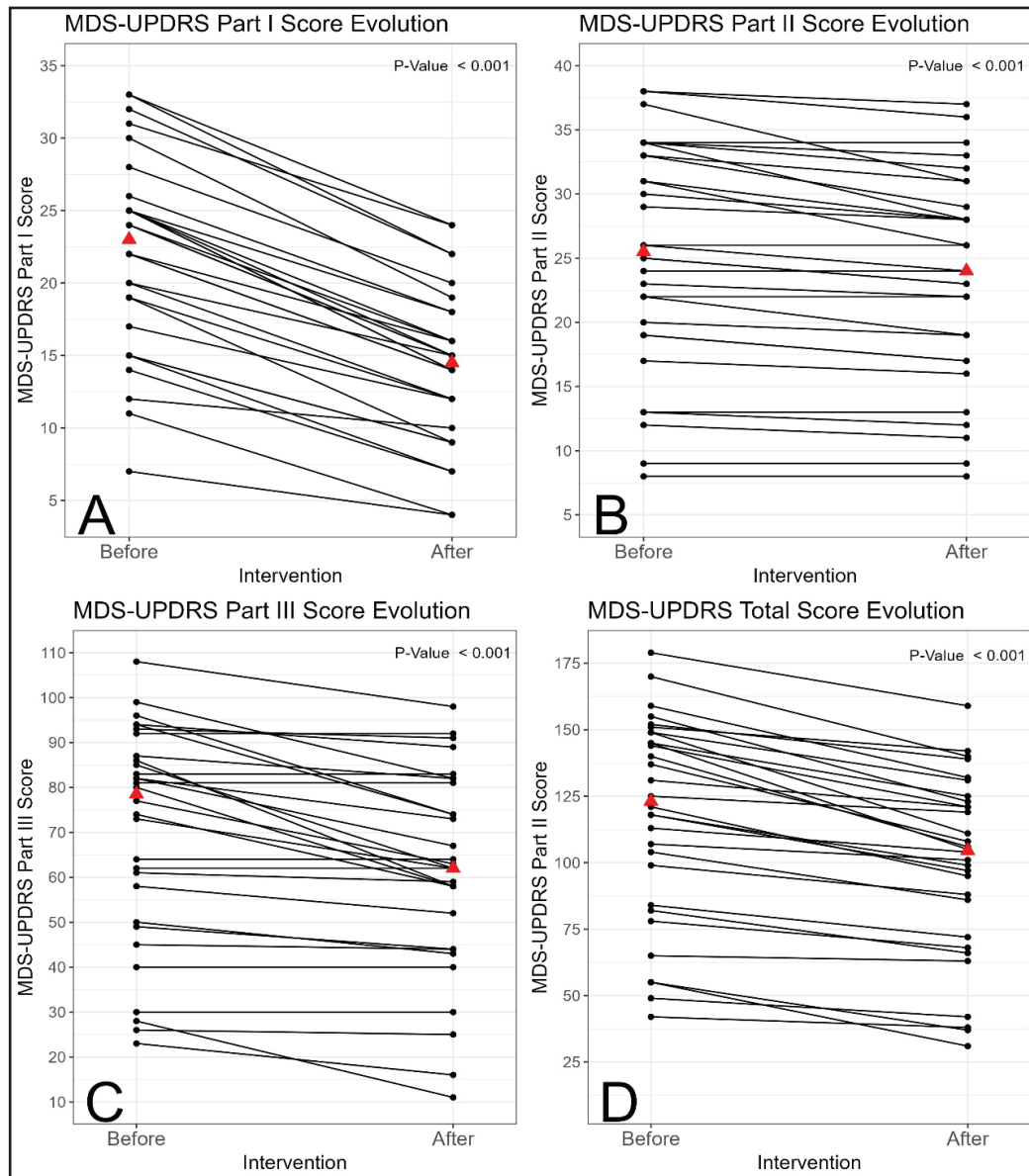


Figure 3 Individual evolution of the scores (with red – median score)

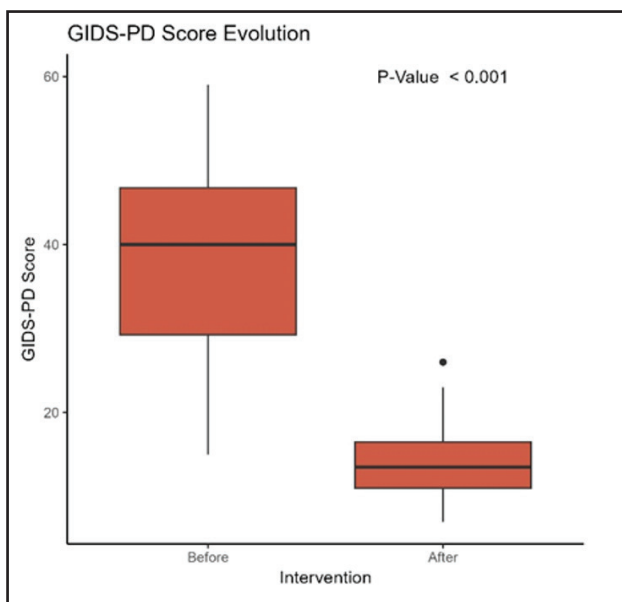


Figure 4. GIDS-PD Score evolution

## Discussions

Parkinson's disease (PD) is a neurodegenerative disease, mainly characterized by the degeneration of dopaminergic neurons in substantia nigra pars compacta.

This multidimensional condition results from various factors, some still under debate. Oxidative stress and the deprivation of antioxidants, the main culprits which contribute to dopamine cell degeneration, are closely linked to other components of the degenerative process, such as inflammation (26). Recent evidence suggests that gut dysbiosis might trigger and/or exacerbate the progression of PD (27) by regulating the gut-brain axis through endocrine, immune, and direct neural mechanisms, thus

supporting the hypothesis that the pathological process of PD spreads from gut to brain (28).

No conventional treatment has been demonstrated to cure or to stop the progression of Parkinson's disease (PD) by addressing the root cause of the disturbance. Significant research is being conducted to investigate and determine the availability of other prospective natural medications that are similarly effective and lack side effects to overcome the limits of current therapies available for neurodegenerative illnesses (29).

In search of managing multiple aspects of the disease and improve quality of life, nearly half of all patients with PD use different alternative therapies in conjunction with conventional treatments. (30) These therapies often aim to treat the entire person, rather than symptoms alone and involve a large number of lifestyle, dietary, nutritional and physical approaches to address underlying neurodegenerative process.

The most commonly used form of complementary therapies are practices as massage, acupuncture and physical/well-being therapy. Patients also use several different nutritional supplements (Coenzyme Q10, Omega-3 fatty acid, creatine, magnesium, vitamin, etc.) to compensate for low dietary intake and to prevent health deterioration that could worsen PD symptoms.

Clinical trials suggests that herbal medicines and natural products exhibit various biological activities and can be employed in PD treatment, reducing neurotoxicity and improving both motor and non-motor symptoms (31). In general, alternative treatments are linked to reasonable justifications based on their mechanism of action and current theories on causes of neurodegeneration in PD. (32)

In the current study we investigated a honey and sea buckthorn mixture (Hebe-Melinis) influence on quality of life and gastrointestinal dysfunction in patients with Parkinson's disease, considering the cumulative beneficial effects of both components.

Honey, a historically well-known natural product, has been indicated as a potential remedy for various ailments due to its antimicrobial, antiviral, antifungal, anticancer, and protective effects on the digestive, respiratory, nervous,

and cardiovascular systems. Among other active compounds, honey contains a variety of antioxidants which protect neurons against neurotoxins by inhibiting the generation of free radicals. The most powerful antioxidants are flavonoids and phenolic acids, which can potentially reduce oxidative stress and repair the damage caused by it (33). Also, it has been reported to inhibit the activity of monoamine oxidase (MAO), which is involved in reducing the free radical scavenging activity and causing oxidative damage in neurodegenerative disorders such as Parkinson's disease (34). In literature can be found evidence of the anti-neurodegenerative properties of honey presented by in vitro and in vivo studies.

Sea buckthorn is a plant that has been used in traditional medicine since ancient times. The plant has a high content of nutrients and bioactive compounds, including antioxidants, essential fatty acids, phytosterols, amino acids, as well as vitamins (35). Polyphenolic compounds have attracted tremendous attention due to their health-promoting effects, including their antioxidant, anti-inflammatory, antibacterial and neuro-protective activities, suggesting that polyphenols may be effective in reversing neurodegenerative pathology. Sea buckthorn berries contain large amounts of lipids which enhance the bioavailability of carotenoids, another known antioxidant, facilitating their absorption in humans (36).

The present study showed that a dietary supplement based on honey and sea buckthorn (Hebe-Melinis) can provide statistical relevant improvements in quality of life in patients with Parkinson's disease.

These results suggested that Hebe-Melinis product maintain neuroprotective and neurorestorative effects previously noticed in both honey and sea buckthorn, now presented in a convenient ready-to-eat mixture.

## **Conclusions**

---

Our study reveals that selected patients with PD who receive diet supplementation with a product based on honey and sea buckthorn mixture (Hebe Melinis) had improved their non motor, less gross and fine motor activity

and gastrointestinal dysfunction. Also, after the first month after the administration of the product, patients had better physical and social functioning, less pain, a better level of energy and a good general health perception, results maintained throughout the period without any side effects related with the product. All these aspects lead to an improved quality of life in patients with PD.

The current research suggests that a dietary approach with a specific honey and sea buckthorn mixture (Hebe Melinis) rich in anti-oxidants and vitamins may be a useful adjuvant therapy to improve quality of life and activities of daily living in patients with Parkinson's disease.

This study also provides a first confirmation regarding the efficacy and safety of a specific combination between two natural components, honey and sea buckthorn, both being previously known with exhibiting effects on PD. Since Parkinson is a progressive neurological condition, any symptom's amelioration or, even better, a delay in disease progress can make a big difference in everyday life for people with the disease.

### Availability of data and materials

The data generated in the present study are included in the figures and/or tables of this article.

### Conflict of interest

The authors declare no conflict of interest.

### References

1. Tysnes OB, Storstein A. Epidemiology of Parkinson's disease. *J Neural Transm* (Vienna). 2017;124(8):901–905.
2. Cooper G, Eichhorn G, Rodnitzky RL (2008). "Parkinson's disease". In Conn PM (ed.). *Neuroscience in medicine*. Humana Press. ISBN 978-1-6032-7454-8.
3. Garcia-Ruiz PJ, Chaudhuri KR, Martinez-Martin P. Non-motor symptoms of

Parkinson's disease A review... from the past. *J Neurol Sci*. 2014;338(1-2):30–33.

4. Prasuhn J, Piskol L, Vollstedt EJ, et al. Non-motor symptoms and quality of life in subjects with mild parkinsonian signs. *Acta Neurol Scand*. 2017;136(5):495–500.
5. Leonardi M, Raggi A, Pagani M, Carella F, Soliveri P, Albanese A, Romito L, (2012), Relationships between disability, quality of life and prevalence of nonmotor symptoms in parkinson's disease, *Parkinsonism Relat Disord*. Jan. Vol 18 (1); 35-39
6. Chapuis S, Ouchchans L, Metz O, Gerbaud L, Durif F. (2005), Impact of the motor complications of Parkinson's disease on the quality of life. *Mov Disord*; 20: 224–30.
7. Bloem BR, Okun MS, Klein C: Parkinson's disease. *Lancet*. 2021, 397:2284-2303. 10.1016/S0140-6736(21)00218-X
8. Klann EM, Dissanayake U, Gurrula A, Farrer M, Shukla AW, Ramirez-Zamora A, Mai V and Vedam-Mai V (2022) The Gut–Brain Axis and Its Relation to Parkinson's Disease: A Review. *Front. Aging Neurosci*. 13:782082. doi: 10.3389/fnagi.2021.782082
9. Tan, A.H., Lim, S.Y. & Lang, A.E. The microbiome–gut–brain axis in Parkinson disease — from basic research to the clinic. *Nat Rev Neurol* 18, 476–495 (2022). <https://doi.org/10.1038/s41582-022-00681-2>
10. Morais, L. H., Schreiber, H. L. & Mazmanian, S. K. The gut microbiota–brain axis in behaviour and brain disorders. *Nat. Rev. Microbiol*. 19, 241–255 (2021).
11. WHO. The World Health Organization quality of life assessment (WHOQOL): position paper from the World Health Organization. *Soc Sci Med*. 1995;41(10):1403–1409.
12. David J. Sanders, Saskia Inniss, Gregory Sebepos-Rogers, Farooq Z. Rahman, Andrew M. Smith; The role of the microbiome in gastrointestinal inflammation. *Biosci Rep* 28 May 2021; 41 (6): BSR20203850. doi: <https://doi.org/10.1042/BSR20203850>
13. Kwon D, Zhang K, Paul KC, Folle AD, Del Rosario I, Jacobs JP, Keener AM, Bronstein JM, Ritz B. Diet and the gut microbiome in patients with Parkinson's disease. *NPJ Parkinsons Dis*. 2024 Apr 22;10(1):89. doi: 10.1038/s41531-024-00681-7. PMID:

- 38649365; PMCID: PMC11035608.
14. Hasan N, Yang H. Factors affecting the composition of the gut microbiota, and its modulation. *PeerJ*. 2019 Aug 16;7:e7502. doi: 10.7717/peerj.7502. PMID: 31440436; PMCID: PMC6699480.
  15. Scott, K. P., Jean-Michel, A., Midtvedt, T., & van Hemert, S. (2015). Manipulating the gut microbiota to maintain health and treat disease. *Microbial Ecology in Health and Disease*, 26(1). <https://doi.org/10.3402/mehd.v26.25877>
  16. Hughes AJ et al. UK Parkinson's Disease Society Brain Bank, Clinical Diagnostic Criteria, *J Neurol Neurosurg Psychiatry* 1992;55:181-4)
  17. Wenning, G.K., Stankovic, I., Vignatelli, L., Fanciulli, A., Calandra-Buonaura, G., Seppi, K., Palma, J.-A., Meissner, W.G., Krismer, F., Berg, D., Cortelli, P., Freeman, R., Halliday, G., Höglinger, G., Lang, A., Ling, H., Litvan, I., Low, P., Miki, Y., Panicker, J., Pallecchia, M.T., Quinn, N., Sakakibara, R., Stamelou, M., Tolosa, E., Tsuji, S., Warner, T., Poewe, W. and Kaufmann, H. (2022), The Movement Disorder Society Criteria for the Diagnosis of Multiple System Atrophy. *Mov Disord*, 37: 1131-1148. <https://doi.org/10.1002/mds.29005>
  18. Gibson, G.R.; Hutkins, R.; Sanders, M.E.; Prescott, S.L.; Reimer, R.A.; Salminen, S.J.; Scott, K.; Stanton, C.; Swanson, K.S.; Cani, P.D.; et al. Expert Consensus Document: The International Scientific Association for Probiotics and Prebiotics (ISAPP) Consensus Statement on the Definition and Scope of Prebiotics. *Nat. Rev. Gastroenterol. Hepatol*. 2017, 14, 491–502. [CrossRef]
  19. Mohan A, Quek S, Gutierrez-Maddox N, Gao Y, Shu Q Author Notes, Effect of honey in improving the gut microbial balance Food Quality and Safety, Volume 1, Issue 2, 1 May 2017, Pages 107–115, <https://doi.org/10.1093/fqsafe/fyx015>
  20. Ranneh Y, Akim AM, Hamid HA, Khazaai H, Fadel A, Zakaria ZA, et al. Honey and its nutritional and anti-inflammatory value. *BMC Complement Med Ther*. (2021) 21:30. 10.1186/s12906-020-03170-5
  21. Yue, X.F.; Shang, X.; Zhang, Z.J.; Zhang, Y.N. Phytochemical composition and antibacterial activity of the essential oils from different parts of sea buckthorn (*Hippophae rhamnoides* L.). *J. Food Drug Anal*. 2017, 25, 327–332.
  22. Dubey R, Shukla S, Shukla V, Singh S: Sea buckthorn: A Potential Dietary supplement with multifaceted therapeutic activities; Intelligent Pharmacy, Available online 22 December 2023 <https://doi.org/10.1016/j.ipha.2023.12.003>
  23. WangZ,ZhaoF,WeiP,ChaiX,Phytochemistry, health benefits, and food applications of sea buckthorn (*Hippophae rhamnoides* L.): A comprehensive review, *Front Nutr*. 2022; 9: 1036295. Published online 2022 Dec 6. doi: 10.3389/fnut.2022.1036295
  24. Rudrapal M, Khairnar SJ, Khan J, Dukhyil AB, Ansari MA, Alomary MN, Alshabrm FM, Palai S, Deb PK, Devi R. Dietary Polyphenols and Their Role in Oxidative Stress-Induced Human Diseases: Insights Into Protective Effects, Antioxidant Potentials and Mechanism(s) of Action. *Front Pharmacol*. 2022 Feb 14;13:806470. doi: 10.3389/fphar.2022.806470. PMID: 35237163; PMCID: PMC8882865.
  25. Joseph J, Cole G, Head E, Ingram D, Nutrition, Brain Aging, and Neurodegeneration, *Journal of Neuroscience* 14 October 2009, 29 (41) 12795-12801; DOI: 10.1523/JNEUROSCI.3520-09.2009
  26. Jenner P. Oxidative stress in Parkinson's disease. *Ann Neurol*. 2003;53 Suppl 3:S26-36; discussion S36-8. doi: 10.1002/ana.10483. PMID: 12666096.
  27. Cryan JF, O'riordan KJ, Sandhu K, Peterson V, Dinan TG. The Gut Microbiome in Neurological Disorders. *Lancet Neurol* (2020) 19(2):179–94. doi: 10.1016/s1474-4422(19)30356-4
  28. Braak H, de Vos RA, Bohl J, Del Tredici K. Gastric alpha-synuclein immunoreactive inclusions in Meissner's and Auerbach's plexuses in cases staged for Parkinson's disease-related brain pathology. *Neurosci Lett*. 2006 Mar 20;396(1):67-72. doi: 10.1016/j.neulet.2005.11.012. Epub 2005 Dec 5. PMID: 16330147.
  29. Fadzil, M.A.M.; Mustar, S.; Rashed,

- A.A. The Potential Use of Honey as a Neuroprotective Agent for the Management of Neurodegenerative Diseases. *Nutrients* 2023, 15, 1558. <https://doi.org/10.3390/nu15071558>
30. Rajendran PR, Thompson RE, Reich SG. The use of alternative therapies by patients with Parkinson's disease. *Neurology* 2001;57:790–794.
  31. So, Y.-J.; Lee, J.-U.; Yang, G.-S.; Yang, G.; Kim, S.-W.; Lee, J.-H.; Kim, J.-U. The Potentiality of Natural Products and Herbal Medicine as Novel Medications for Parkinson's Disease: A Promising Therapeutic Approach. *Int. J. Mol. Sci.* 2024, 25, 1071. <https://doi.org/10.3390/ijms25021071>
  32. Rabin ML, Stevens-Haas C, Havrilla E, Rosenstein A, Toffey B, Devi T, Earnhardt MC, Kurlan R. Complementary Therapies for Parkinson's Disease: What's Promoted, Rationale, Potential Risks and Benefits. *Mov Disord Clin Pract.* 2015 Jun 29;2(3):205–212. doi: 10.1002/mdc3.12170. PMID: 30363487; PMCID: PMC6178661.
  33. Iftikhar A, Nausheen R, Muzaffar H, Naeem MA, Farooq M, Khurshid M, Almatroudi A, Alrumaihi F, Allemailem KS, Anwar H. Potential Therapeutic Benefits of Honey in Neurological Disorders: The Role of Polyphenols. *Molecules.* 2022 May 20;27(10):3297. doi: 10.3390/molecules27103297. PMID: 35630774; PMCID: PMC9143627.
  34. Yildiz, O.K.T.A.Y.; Karahalil, F.A.T.M.A.; Can, Z.; Sahin, H.; Kolayli, S.E.V.G.İ. Total monoamine oxidase (MAO) inhibition by chestnut honey, pollen and propolis. *J. Enzym. Inhib. Med. Chem.* 2014, 29, 690–694
  35. Chen Y, Cai Y, Wang K, Wang Y. Bioactive Compounds in Sea Buckthorn and their Efficacy in Preventing and Treating Metabolic Syndrome. *Foods.* 2023 May 13;12(10):1985. doi: 10.3390/foods12101985. PMID: 37238803; PMCID: PMC10217465.
  36. Ranjith A., Kumar K.S., Venugopalan V.V., Arumughan C., Sawhney R.C., Singh V. Fatty acids, tocols, and carotenoids in pulp oil of three sea buckthorn species (*Hippophae rhamnoides*, *H. salicifolia*, and *H. tibetana*) grown in the Indian Himalayas. *J. Am. Oil Chem. Soc.* 2006;83:359–364. doi: 10.1007/s11746-006-1213-z.