Journal of Advanced Zoology

ISSN: 0253-7214
*Volume **44** Issue **S-3 Year 2023** Page **1637:1644***

A Comprehensive Review of the Biochemical Analysis of Cyamopsis Tetragonoloba (*L*) for Anti-Parkinson's Activity

Swetha Sunkugari[1], E. Kayalvizhi[2*]

[1,2]Department of Physiology
Meenakshi Medical College and Research Institute, Meenakshi Nagar, Tamil Nadu-631552

**Corresponding author's E-mail: kayalgkbs@gmail.com*

Article History

Received: 06 June 2023
Revised: 05 Sept 2023
Accepted: 23 Nov 2023

Abstract

*Parkinson's disease (PD) is a neurological disorder that is commonly characterized by tremor, loss of motor abilities and progressive muscle rigidity. The disorder is linked to a progressive loss of brain nerve cells as well as a reduction in dopamine synthesis, which results in movement symptoms. While there is currently no known cure for Parkinson's disease (PD), some medicinal plants, such as **Cyamopsis tetragonoloba**, offer extracts and components that may help patients with the disease's symptoms and avoid impairment. The legume crop Cyamopsis tetragonoloba, (**Guar**) is grown in desert regions of Pakistan and India; India produces 90% of the world's Cyamopsis tetragonoloba (**Guar**) beans. Because of their high protein and amino acid contents, both plants are considered nutritious. The general Bio-chemical components of Cyamopsis tetragonoloba (**Guar beans**), such as fatty acids and amino acids, were examined. The amount of proteins, lipids, and total hydrolysable carbs in Guar beans was high. The percentage of linoleic acid in guar beans was considerable (25.41 and 48.99%, respectively). Guar beans contain significant amounts of glutamic, arginine, leucine, and aspartic acid for a wide range of uses, resulting in a rich supply of essential and non-essential amino acids. This review focuses on the therapeutic effects of a few anti-Parkinson's medications, and the information it contains may be implemented to identify new therapeutic compounds that may be used to treat parkins disease.*

Keywords: *Parkinson's disease, Cyamopsis tetragonoloba, Biochemical Analysis, Guar beans, Essential components.*

1. Introduction

Parkinson's disease (PD) is a chronic and progressive neurodegenerative disorder that primarily affects movement control. Named after James Parkinson, who first described the condition in 1817, PD is characterized by the gradual degeneration of dopaminergic neurons in the substantia nigra, a region of the brain responsible for producing dopamine. Dopamine is a neurotransmitter critical for regulating movement, mood, and various cognitive functions (**Balvinder Kaur and Jyoti Saxena, 2019).** The hallmark pathological feature of Parkinson's disease is the formation of Lewy bodies, abnormal protein aggregates, in the affected brain cells. These aggregates interfere with the normal functioning of neurons, leading to their dysfunction and eventual death (**Gomathi V *et al*., (2023).** As dopaminergic neurons decline, there is a significant reduction in dopamine levels, disrupting the communication between brain cells and causing the motor symptoms associated with PD (**Gomathi V *et al*., 2021**).

The clinical manifestations of Parkinson's disease are diverse, with motor symptoms such as tremors, bradykinesia (slowness of movement), rigidity, and postural instability being the most prominent. However, Parkinson's is not solely a motor disorder; it also presents a range of non-motor symptoms, including cognitive impairment, mood disturbances, and autonomic dysfunction (**Heena Kouser S, *et al*., 2022)**. The onset of symptoms is typically gradual, and their severity varies among individuals. The exact cause of Parkinson's disease remains elusive, and both genetic and environmental factors are believed to contribute to its development. While some cases have a clear genetic basis, most are considered sporadic (**Kaur and Saxena (2021).** Aging is a significant risk factor, with the majority of individuals diagnosed with PD being over the age of 60. Environmental factors, such as exposure to toxins and certain pesticides, have also been implicated in the development of Parkinson's disease.

Despite decades of research, there is currently no cure for Parkinson's disease (**Kaur and Saxena (2021).** Treatment strategies primarily focus on alleviating symptoms and improving the quality of life for individuals living with the condition. Medications, physiotherapy, and in some cases, surgical interventions like deep brain stimulation are employed to manage symptoms and enhance daily functioning (**Kaur and Saxena (2021).**

As the global population ages, the prevalence of Parkinson's disease is expected to rise, underscoring the urgency of continued research efforts to better understand its etiology, develop more effective treatments, and eventually find a cure for this challenging and debilitating neurological disorder (**Madiha Jamshed *et al.*, 2018)**. With the increasing prevalence of Parkinson's disease globally, there is a growing impetus to explore novel therapeutic strategies that go beyond symptomatic relief and address the underlying biochemical mechanisms contributing to neurodegeneration (**Maheswari Reddy B *et al.*, 2020**).

Cyamopsis tetragonoloba (L), commonly known as guar gum, has emerged as a subject of interest in the quest for natural compounds with potential anti-Parkinson's activity. This leguminous plant, indigenous to India, has a rich history of traditional medicinal use, and recent research has delved into its biochemical constituents to unravel its therapeutic potential against Parkinson's disease (**Mudgil D, *et al.*, 2014**). This comprehensive review aims to provide a thorough examination of the biochemical analysis of Cyamopsis tetragonoloba, focusing on its potential anti-Parkinson's activity. By synthesizing and critically evaluating existing literature, we seek to shed light on the molecular mechanisms through which Cyamopsis tetragonoloba may exert neuroprotective effects (**Paras Sharma, *et al.*,2011**). From antioxidant properties to anti-inflammatory mechanisms, this review aims to elucidate the intricate biochemical pathways that contribute to the potential therapeutic efficacy of Cyamopsis tetragonoloba in mitigating Parkinson's disease pathology (**Paras Sharma, *et al.*, 2011**). As we delve into the multifaceted biochemical aspects of Cyamopsis tetragonoloba, this review not only seeks to consolidate current knowledge but also aims to identify gaps in our understanding, providing a foundation for future research directions (**Raut *et al.*, 2021).** The exploration of natural compounds like Cyamopsis tetragonoloba holds promise for the development of innovative strategies in Parkinson's disease management (**Santosh Kumar Vaidya *et al.*, 2020).** Through this review, we aspire to contribute to the collective effort in advancing our understanding of the biochemical basis for the anti-Parkinson's activity of Cyamopsis tetragonoloba, fostering potential avenues for therapeutic intervention in this challenging neurological disorder (**Sitty M, *et al.*, 2022**).

Cultivation and Distribution:

Cyamopsis tetragonoloba, commonly known as guar, is an annual leguminous plant cultivated for its seeds, which are rich in galactomannan gum. This versatile crop is predominantly grown in regions with arid and semi-arid climates, where it thrives in well-drained soils. The cultivation of Cyamopsis tetragonoloba is a vital component of the agricultural landscape, contributing to both local economies and global industries (**Togbossi LA, 2020**).

Cultivation:

Guar (Cyamopsis tetragonoloba.L) plants thrive in warm, arid, and semi-arid climates, with well-drained soils required for growth. They are sown throughout the warmer months, with rapid seed germination and vigorous development. They are resistant to water scarcity. Guar plants are ready for harvesting in two to six months, with mechanical methods being used for seed extraction. Guar bean grows best in full sunlight, moderate rainfall, and well-drained soil (**Vikram H. *et al.*, 2011**). It grows best in semiarid climates and is mostly grown in northwestern India and Pakistan. After the first rains in July, the crop is sown and harvested in late October. India accounts for 80% of global guar gum production. To meet the increased demand for guar and other organic crops in the United States, commercial growers have changed their crops to guar production (**Uzma Saleem *et al*.,2021).**

Land Measurement Recommendations for Agriculture:

In February-March and June-July, seeds are planted at a rate of 10 to 12 kilograms/hectare (9-11 lb/acre) at a spacing of 45-60 x 20-30 cm (18- 4 × 8-12 in). During the wet season, seeds are spread 2-3 cm (1 in) deep on ridges and in furrows. FYM is applied at a rate of 25 tones/ha (11.1 tons/acre). The crop's N, P2O5, and K2O requirements are 20:60:80 kg/ha (18:53:71 lb/acre). The average production is 5 to 6 tonnes/ha (2.2-.6 tons/acre) (**Kaur and Saxena (2021)**.

Distribution:

Guar farming is widespread, with significant producers including India, Pakistan, and the United States. Guar gum, which is derived from the seeds of Cyamopsis tetragonoloba, is used in food processing, textiles, pharmaceuticals, and oil and gas exploration. It is a popular component due to its thickening and stabilising effects. Because of its significance in fracking, market trends for guar and its derivatives fluctuate (**Kaur and Saxena, 2021)**. The cultivation and distribution of Cyamopsis tetragonoloba play a crucial role in supporting various industries and meeting the demand for guar gum on a global scale. The resilience of this crop in arid environments, coupled with its versatile applications, underscores its significance in agriculture and commercial sectors worldwide (**Mudgil D *et al.*, 2014**).

Pharmacological Activities of Cyamopsis tetragonoloba:

Cyamopsis tetragonoloba, commonly known as guar, has been recognized not only for its industrial applications but also for its diverse pharmacological activities. Extensive research has explored the bioactive compounds present in various parts of the plant, revealing its potential therapeutic effects (**Mudgil D *et al.*, 2014**). The pharmacological activities of Cyamopsis tetragonoloba include:

Anti-Inflammatory properties:

The anti-inflammatory properties of ethanolic and aqueous extracts (50 and 100 mg/kg) of plant seeds were assessed in relation to paw edoema produced by carageenan, paw edoema produced by formaldehyde, and ear edoema produced by xylene. The extract's high flavonoid and saponin concentration may have contributed to its notable inhibitory effects. In comparison to a positive control, the highest percentage inhibition was 85.29% against paw edoema induced by carageenen, 82.10% against paw edoema generated by formaldehyde, and 60.20% against ear edoema induced by xylene (**Sharma *et al,* 2010**).

Antioxidant Activity:

The plant exhibits antioxidant properties attributed to its bioactive constituents. Antioxidants derived from Cyamopsis tetragonoloba may play a role in scavenging free radicals, thereby protecting cells from oxidative stress. **Mak *et al.* (2013) and Yang *et al.* (2015)** state that the FRAP assay measures the change in absorbance at 593 nm caused by the formation of a blue-colored complex between TPTZ and ferrous ions (fe2+). Previously, the action of antioxidants that donate electrons causes a colorless ferric ion (fe3+) to oxidise to a ferrous ion (fe2+). further revealed that the total phenol content and antioxidant activity were positively correlated. This antioxidant potential is valuable in the context of preventing cellular damage and supporting overall health.

Hypolipidemic Effects:

In diabetic guinea pigs, guar feeding has been shown to reduce serum total lipids, cholesterol, triglycerides, and phospholipids. The endosperm of the seeds contains guar gum, which possesses hypocholestremic and anti-diabetic properties **(Frias *et al,* 1998).** The guar gum diet dramatically lowers cholesterol and triglyceride levels, raises HDL cholesterol, and raises the HDL/LDL cholesterol ratio even while diabetes raises blood lipid levels. Additionally, guar gum enhances the absorption and utilization of proteins and encourages weight growth **(Frias *et al,* 1998).**

Antidiabetic Activity:

Some studies suggest that Cyamopsis tetragonoloba may exhibit antidiabetic properties. Compounds found in the plant may contribute to glucose metabolism regulation, making it a potential candidate for further exploration in diabetes management (**Mukhtar *et al.* 2004**). In diabetic rats, 250 mg/kg of Cyamopsis tetragonoloba pod extract dramatically lowers blood glucose levels. In rats with hyperglycemia brought on by alloxane, the impact is more noticeable and lasts for up to 3 hours. It is thought that flavanoids and other plant phenolics are responsible for the impact (**Mukhtar *et al.* 2004**).

Immunomodulatory Effects:

According to Rajeshwari *et al,* Cyamopsis tetragonoloba has been investigated for its immunomodulatory activities. It may have the potential to modulate immune responses, which could be valuable in conditions where immune function needs to be regulated, such as autoimmune disorders (**Rajeshwari Singh *et al.*, 2021**).

Gastroprotective Effects:

Guar gum has shown gastroprotective effects in experimental models. This suggests a potential role in protecting the gastrointestinal mucosa, making it a subject of interest for conditions involving gastric ulcers and related issues (**Shubhra Pande *et al,*.2013**).

Wound Healing Properties:

The plant has been traditionally used for its wound healing properties. Research has explored its potential in promoting tissue repair and regeneration, possibly attributed to its anti-inflammatory and antimicrobial activities (**Sumitra Singh *et al,*.2015**). The most prevalent protein in the human body, hydroxyproline, was shown to be present in higher concentrations in wound-treated gels containing ethanol extracts from fruits and leaves. The amino acid hydroxyproline, which makes up collagen, is essential for mending tissue damage and reestablishing anatomical integrity. The amount of collagen present in wounded tissue can be ascertained using this increase in hydroxyproline concentration (**Sumitra Singh *et al,*.2015**).

Antimicrobial Activity:

Researchers studied C. tetragonoloba's 20%, 60%, and 100% methanolic extract against S. aureus, Lactobacillus Spp., S. Typhimurium, and E. Coli. Lactobacillus Spp had a little antibacterial activity with 20 and 60% methanolic extract. MIC values for 100% MeOH extract against S. aureus and lactobacillus spp. were 3.13 and 0.78 fraction/ml, respectively. When 100% MeOH fraction was exposed to E. coli and S. typhimurium at 1.56 and 0.78 mg fraction/ml, a comparable MIC was seen (**Hassan *et al,* 2010**).

Anti-Parkinson's Properties of Cyamopsis tetragonoloba:

Cyamopsis tetragonoloba, commonly known as guar, has recently garnered attention for its potential anti-Parkinson's properties, offering a novel avenue for therapeutic exploration in the management of Parkinson's disease (PD) (**Balvinder Kaur and Jyoti Saxena (2019)**. The following features highlight the emerging evidence supporting the anti-Parkinsonian activity of Cyamopsis tetragonoloba:

Neuroprotective Effects: Research suggests that Cyamopsis tetragonoloba exhibits neuroprotective properties, particularly in preserving dopaminergic neurons. The degeneration of these neurons is a hallmark characteristic of Parkinson's disease, and the neuroprotective potential of guar implies a capacity to mitigate this degenerative process (**Vivekanandan *et al,*.2022**).

Modulation of Neuro Inflamation: Chronic neuroinflammation is implicated in the progression of Parkinson's disease. Cyamopsis tetragonoloba has demonstrated anti-inflammatory effects, potentially modulating the inflammatory responses in the central nervous system. This anti-inflammatory action may contribute to a neuroprotective environment, hindering the inflammatory processes associated with PD (**Jerine Peter Simon *et al,*.2022).**

Regulation of Apoptotic Pathways: Dysregulation of apoptotic pathways plays a role in the loss of dopaminergic neurons in Parkinson's disease (**Vidushi Asati *et al.,* 2021**). Cyamopsis tetragonoloba has shown potential in modulating apoptotic signaling, potentially inhibiting the programmed cell death that contributes to neuronal degeneration (**Vidushi Asati *et al.,* 2021**).

Enhancement of Dopaminergic Function:

Guar extracts may influence dopamine levels or receptor function, crucial elements in Parkinson's disease pathology. By enhancing dopaminergic function, Cyamopsis tetragonoloba could potentially ameliorate motor symptoms and improve overall neurological function in individuals with PD (**Nimisha Vasava & Vipul Gajera, 2022))**.

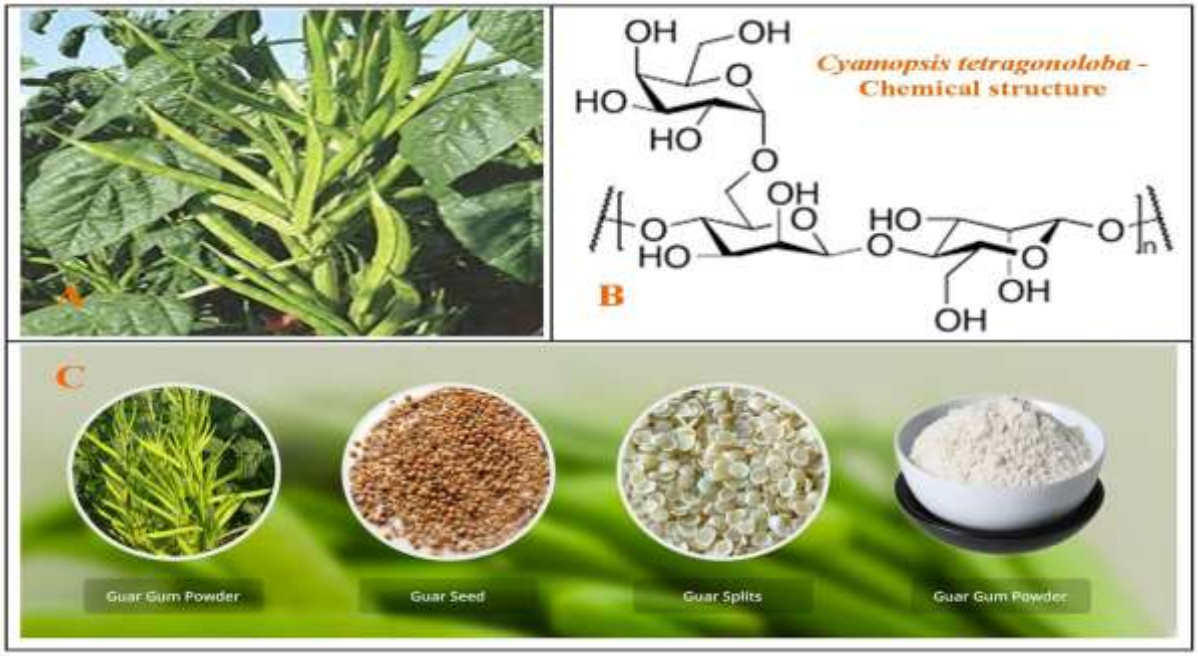
Improvement of Motor Symptoms:

Preliminary studies suggest that Cyamopsis tetragonoloba may have a positive impact on motor symptoms associated with Parkinson's disease, such as tremors and bradykinesia (**Rajeshwari Singh *et al,*.2021**). While further research is needed to establish the extent of these effects, the initial findings are promising (**Vidushi Asati *et al,*.2021**).

Safety and Tolerability:

Guar gum is generally considered safe and well-tolerated, with a long history of use in various applications, including the food industry (**Hassan *et al,* 2010**). This enhances its potential as a therapeutic agent, as substances with established safety profiles are crucial for long-term treatment strategies (**Jerine Peter Simon *et al,*.2022).**

Fig: Cyamopsis tetragonoloba plant and seed extractions



Phytochemical and Biochemical Profile of Cyamopsis tetragonoloba:

Cyamopsis tetragonoloba, commonly known as guar, exhibits a diverse phytochemical and biochemical profile, contributing to its nutritional value, industrial applications, and potential therapeutic properties (**Dr. Pranab Kr *et al.*,2017)**. The plant's seeds, in particular, harbor a rich array of compounds:

Galactomannan Gum: The hallmark phytochemical of Cyamopsis tetragonoloba is galactomannan gum, predominantly present in the endosperm of the seeds. This high molecular weight polysaccharide, composed of mannose and galactose units, is renowned for its thickening, stabilizing, and gelling properties. Guar gum finds extensive application in the food industry, pharmaceuticals, and various industrial processes.

Proteins: Guar seeds contain proteins with a balanced amino acid profile. These proteins contribute to the plant's nutritional content, and their digestibility makes them valuable for both human and animal consumption. The proteins from guar are increasingly recognized as a sustainable protein source.

Lipids: The lipid fraction of guar seeds comprises both saturated and unsaturated fatty acids. While the lipid content is relatively modest, it contributes to the overall energy density of the seeds. Guar lipids may also have implications for its nutritional and industrial applications.

Carbohydrates: Apart from galactomannan, guar seeds contain carbohydrates such as starch. These carbohydrates contribute to the energy content of the seeds and make guar a valuable dietary component.

Minerals: Guar is a source of essential minerals, including calcium, phosphorus, potassium, and magnesium. These minerals are vital for various physiological functions and contribute to the nutritional richness of guar.

Vitamins: Guar seeds contain vitamins, including thiamine and niacin. Although not present in high concentrations, these vitamins contribute to the overall micronutrient content of the plant and may have implications for human and animal health.

Flavonoids and Polyphenols: Cyamopsis tetragonoloba harbors flavonoids and polyphenolic compounds with potential antioxidant properties. These bioactive compounds play a role in scavenging free radicals, contributing to the plant's defense mechanisms and potential health benefits.

Phenolic Compounds: Guar seeds contain phenolic compounds, including flavonoids and polyphenols, known for their antioxidant properties. Spectrophotometric assays and chromatographic methods are employed to identify and quantify these bioactive compounds.

Alkaloids: Some studies suggest the presence of alkaloids in guar seeds, adding to the plant's biochemical complexity. Alkaloids, known for their pharmacological activities, may contribute to the overall bioactivity of Cyamopsis tetragonoloba.

Understanding the comprehensive phytochemical and biochemical profile of Cyamopsis tetragonoloba is crucial for exploiting its applications in various industries and exploring its potential health benefits (**Uzma Saleem *et al.*, 2020).** As research continues, the multifaceted nature of guar's chemical composition opens avenues for innovative uses in food, medicine, and industrial processes.

Table: Available phytochemicals from Cyamopsis tetragonoloba plant and sees methanol extraction.

Phytochemicals (Secondary Metabolites)	**Methanol extract**
Alkaloids	
a. Wagner s Test	++
b. Dragendorff s Test	++
c. Mayer s Test	++
d. Hager s Test	++
Flavonoids	
a. Ferric Chloride Test	- +
b. Alkaline reagent Test	- +
Cardiac glycosides	
a. Keller-Kilani Test	++
Glycosides	
a. Borntrager s Test	--
b. Baljet Test	--
Proteins and Amino acids	
a. Ninhydrin Test	--
b. Biuret Test	++
Carbohydrates	
a. Benedict s Test	++
b. Fehling s Test	--
Vitamins	++
Minerals	++
Galactomannan Gum	++
Phenolic Compounds:	
Litmus test	++

4. Conclusion

The pharmacological activities of Cyamopsis tetragonoloba extend beyond its industrial utility, showcasing its potential in various therapeutic areas. While these findings are promising, continued research is essential to fully understand the mechanisms of action and to explore its practical applications in healthcare and medicine. While these findings suggest promising Anti-Parkinson properties of Cyamopsis tetragonoloba, it is important to note that further preclinical and clinical studies are necessary to validate and elucidate the mechanisms behind these observed effects. The potential of guar in Parkinson's disease management adds a new dimension to the exploration of natural compounds in neurodegenerative disorders, offering hope for future therapeutic developments.

Acknowledgements:

The author would like to express their heartfelt gratitude to the Research supervisor Dr.E.Kayalvaizhi, Professor. In Department of Physiology, Meenakshi Medical College and Research Institute, Meenakshi Nagar, Tamil Nadu, for their support for collection of literature and necessary facilities. We also want to thanks Dr.V.Uday Kiran for devoting so much time to the supporting of literature of this work.

Future scope:

There is no major scientific data on the anti-Parkinson's action of guar gum, a natural thickening agent and one of the medicinal related plants, as of January 2022. Preclinical investigations, active molecules, clinical trials, and combining guar gum with existing Parkinson's drugs should be prioritized in future research.

Conflict of Interest

The authors have not declared any conflict of interests.

References:

Andrea Dario Frias, Valdemiro C. Sgarbieri (1998). Guar gum effect on blood serum lipids and glucose concentration of wistar diabetic rats. Ciencia Techno De alimentos, 1998; 18 (2): 1-10.

Balvinder Kaur and Jyoti Saxena (2019). HPLC Estimation of L-DOPA in *Phaseolus vulgaris* and *Cyamopsis tetragonoloba* for the Anti-parkinson's Activity. International Journal of Pharmacy and Biological Sciences-IJPBSTM (2019) 9 (3): 225-229.

Dr. Pranab Kr. Paul, Dr. Kalpana Gohain, Dr.Swarnamoni Das.(2017). Sedative and Hypnotic Activities of Ethanolic Leaves Extract of *Solanum Torvum* Sw. in Albino Mice. International Journal of Pharmacy and Pharmaceutical Research. 2017; 8 (3): 52-67.

Gomathi V *et al*.,(2023). Evaluation Of Anti Parkinson's Activity Of Barleria Cuspidata Enhanced With GSH In Rotenone Induced Animal Model In Albino Rats. Journal of Survey in Fisheries Sciences. 2023; 10(1): 3727-3737.

Gomathi V, Sheeja MTL, Jaykar B (2021). In-vitro Screening of Anti Parkinson's Activity of Ethanolic Extract of Malaxis Acuminata against Rotenone – Induced Toxicity in Sh-Sy5y Neuroblastoma Cell Lines. Asian Journal of Biological and Life sciences. 2021;10(3):649-655.

Heena Kouser S, *et al*,. (2022). Investigation of Antiparkinsonism Activity of *Musa Paradisiaca* Unripe Fruit Juice against Chlorpromazine Induced Parkinsonism in Swiss Albino Mice. International Journal of Pharmaceutical Research and Applications.2022; 7(3): 211-216.

HM Mukhtar, S.H. Ansari, M. Ali, A.Z Bhat, T. naved (2004). Effect of aqueous extract of Cyamopsis tetragonoloba Linn.beans on blood glucose level in normal and alloxan- Induced diabetic rats. Indian journal of Experimental Biology. 2004; 42(12): 1212-1215.

Jerine Peter Simon, Arunraj Namachivayam, RamKumar Katturajan, Sangeetha Nithiyanandam, Manisha Parthasarathy, Evan Prince Sabina (2022). Protective Effect of the Aqueous Extract of Cyamopsis tetragonoloba Seed against the Paracetamol-induced Toxicity in Female Wistar Albino Rats. Indian Journal of Pharmaceutical Education and Research | Vol 56 | Issue 2 | Apr-Jun, 2022.

Kaur and Saxena (2021). Evaluation of Anti-Parkinson's Activity of *Cyamopsis Tetragonoloba* Methanol Plant Extract with Behavioral and Biochemical Analysis. International Journal of Pharmaceutical Sciences and Research. 2021; 12(6): 3236-3242.

Madiha Jamshed, Syed Tahir Ali, Ghazala H Rizwani, Hina Zahid and Syeda Tayyaba Asif (2018). Pharmacognostic evaluation of pods of Cyamopsis tetragonoloba L. International Journal of Herbal Medicine 2018; 6(1): 51-53.

Maheswari Reddy B, Dhanapal CK, Lakshmi BVS (2020). Anti-Parkinson Activity of Aqueous Extract of Leaves of *Murraya Koenigii* against Paraquat-Induced Parkinsonism in Wistar Rats. Asian Journal of Pharmaceutical and Clinical Research.2020; 13(10):150-153.

Mak WY, Chuah LO, Ahmad R, Bhat R (2013). Antioxidant and antimicrobial activities of hibiscus (Hibiscus rosa-sinensis L.) and Cassia (Senna bicapsularis L.) flower extracts. J King Saud Uni Sci 2013; 25:275-282.

Mudgil D, Barak S, Khatkar BS (2014). Guar gum: Processing, properties and food applications-A Review. Journal of Food Science and Technology 2014; 51(3):409-18.

Nimisha Vasava , Vipul Gajera (2022).In Vivo Studies of various Antiparkinson's agents: A Systematic Review. International Journal for Research in Applied Science & Engineering Technology. Volume 10 Issue XI Nov 2022

Paras Sharma, Gargee Dubey and Sunil Kaushik (2011). Chemical and Medico-biological profile of *Cyamopsis tetragonoloba* (L) Taub: An overview. Journal of Applied Pharmaceutical Science 01 (02); 2011: 32-37

Paras Sharma, Kirankumar Hullatti, I.J. Kupastt, Sakshy Sharma (2010). Studies on Anti-asthmatic effect of leaves of Cyamopsis tetragonoloba (L) Taub. J Natural Remedies. 2010; 10 (1).

Rajeshwari Singh,[1] Sumeet Goel,[1] Pascale Bourgeade,[2] Lotfi Aleya, [2] and Devesh Tewari · (2021). Ayurveda *Rasayana* as antivirals and immunomodulators: potential applications in COVID-19. Environ Sci Pollut Res Int. 2021; 28(40): 55925–55951.

Raut *et al*.,(2021). Anti-Parkinson's Activity of Acorus Calamus Linn using Haloperidol Catalepsy Model. World Journal of Pharmacy and Pharmaceutical Sciences.2021; 10(10): 1272-1286.

S.M. Hassan, A U Byrd, M A Berhow, A.L Cartwright, C. A. Bailey (2010). Haemolytic and antimicrobial activities of saponin-rich extract from guar meal. J of Ethanopharmacol, 2010; 119: 600-605.

Santosh Kumar Vaidya *et al*.,(2020). Evaluation of Antioxidant and Anti-Parkinson Activity of Portulaca oleracea Seed Methanolic Extract. European Journal of Medicinal Plants. 2020; 31(2): 10-17.

Shubhra Pande and Krishnapura Srinivasan (2013). Protective effect of dietary tender cluster beans (Cyamopsis tetragonoloba) in the gastrointestinal tract of experimental rats. Appl. Physiol. Nutr. Metab. 38: 169–176 (2013).

Sitty M, Vineela C (2022). Anti-Parkinson's activity and *in vitro* antioxidant activity of *Origanum majorana* plant extract. Journal of Research in Pharmacy. 2022; 26(6): 1814-1824.

Sumitra Singh* and Bhagwati Devi Rohilla (2015). Formulation and evaluation of herbal gel from different parts of cyamposis tetragonoloba (l.) Taub. For wound healing. World journal of pharmacy and pharmaceutical sciences, 2015,Volume 5, Issue 3, 740-752.

Togbossi LA, Lawson-Evi P, Diallo A, Eklu-Gadegbeku K, Aklikokou K (2020). Evaluation of antioxidant and antidepressant activity of hydro-alcoholic extract of *Ximenia americana* stem bark. The Journal of Phytopharmacology. 2020; 9(5):323-328.

Uzma Saleem *et al*,(2020). Anti-Parkinson's Activity of Tribulus terrestris via Modulation of AChE, α Synuclein, TNF-α, and IL-1β. ACS Omega.2020; *5* (39): 25216-25227.

Uzma Saleem *et al*.,(2021). Anti-Parkinson's evaluation of *Brassica juncea* leaf extract and underlying mechanism of its phytochemicals. Frontiers in Bioscience-Landmark.2021; 26(11): 1031-1051.

Vidushi Asati * , Ab hilasha Srivastava, Sudeshna Mukherjee, Pankaj Kumar Sharma (2021).Comparative analysis of antioxidant and antiproliferative activities of crude and purified flavonoid enriched fractions of pods/seeds of two desert legumes Prosopis cineraria and Cyamopsis tetragonoloba. Heliyon 7 (2021) e07304.

Vikram H. Potdar, Swati J. Kibile (2011). Evaluation of Antidepressant-like Effect of *Citrus Maxima* Leaves in Animal Models of Depression. Iranian Journal of Basic Medical Sciences.2011; 14(5): 478-483.

Vivekanandan, Lalitha; Murukeasan, Rajalakshmi; Natarajan, Kiruthiga; Sheik, Hajasherief; Singaravel, Sengottuvelu; Thangavel, Sivakumar (2022). Anti-Alzheimer's Activity of Methanolic Tender Green Pod Extract of *Cyamopsis Tetragonoloba (L.)* Taub. on Scopolamine Induced Amnesia in Mice. Current Bioactive Compounds, Volume 18, Number 7, 2022, pp. 39-49(11).

Yang M, Shen Q, Li LQ, Huang YQ, Cheung HY (2015). Phytochemical profiles, antioxidant activities of functional herb Abrus cantoniensis and Abrus mollis. Food Chem 2015; 177:304-312.