

The effect of aloe vera juice consumption on quality of life and depression levels of people with multiple sclerosis

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Abstract

Background: Multiple Sclerosis (MS) is a demyelinating disease affecting the central nervous system, with no curative medicine available. It is a permanent and incurable disease, with a variety of symptoms. Medications used are known to slow down progression of MS and reduce the number of relapses. Unfortunately, they accomplish this by making the immune system disable. This is the reason that patients need to be examined for a variety of health conditions before any immunosuppressant drug. Major complication of MS medications is the variety of side effects they may cause. Herbal drugs, on the other hand, and dietary supplement use is increasing among people with MS, raising the need for knowledge about potential interactions between conventional MS medicine and herbal drugs/dietary supplements. Moreover, cosmetic, pharmaceutical, and food industries use aloe vera extensively. It is found in a variety of products like creams, gels and ointments. Juice of Aloe Vera is of increased interest due to its pleasant taste and convenience. Because of its high concentration in antioxidants it has the ability to boost the immune system,

Objective: To assess probable positive interactions of aloe vera juice on non-visible disabilities of MS: depression, pain and decreased QoL. Additionally to raise greater awareness of MS symptoms because people tend to sympathy only for visible disabilities (i.e. tremors, slurred speech and difficulties walking). Moreover to educate patients about the possible positive effects of aloe on above mentioned ,non-visible, disabilities.

Design: Google scholar, PubMed and Semantic Scholar were reviewed in order to obtain research, articles, epidemiological studies and abstracts.

Results: From 27,600 articles ,only a small number was relevant. A variety of different studies were used with case-control and animal experimental studies being the most of them. The paucity of available data on humans and variety and differentiation of MS symptomatology calls for further research and investigation .

Conclusions: Aloe vera is possible to cause a significant reduction in severity of the referred symptoms of MS. Further human investigations are needed,

Keywords: pain, depression, Multiple sclerosis

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1.0 Introduction

Multiple Sclerosis (MS) is an autoimmune disease of the central nervous system (CNS). It is a chronic demyelinating disorder which can be manifested from darker lesions on magnetic resonance imaging (MRI). MS is caused when the body attacks its own immune system, causing rupture of myelin sheaths which lead to inflammation. Within the areas of inflammation peripheral cells coexist and damage neural and synaptic elements (Paul, A et al, 2019). This results in demyelinating lesions, inflammation, nerve cell damage and death.

Numbness, dizziness, mobility issues, weakness and pain are only a few of the symptoms that accompany MS. Severity of symptoms depend on the person, location of the damage, the amount of damage done on nerve fibers and from the medical history of the patient i.e. if medication and disease-modifying therapies (DMTs) are been administered. Although MS is an autoimmune disease, a number of studies emphasize, the increased role of environmental factors and specifically quality of nutrition, on the rate of occurrence and severity of the disease. The genetic and environmental factors, as well as the etiology and pathogenesis are of utmost importance for the development of MS. Balanced nutrition is critical in maintaining proper immune system. By feeding the body with the proper nutrients, in sufficient concentrations, the immune system is able to fight against pathogens. Nutrients contained in the diet, strengthen the immune system, allowing it to fight.

Studies have found increased frequencies of autoimmunity and autoimmune diseases over recent decades (Frederick W Miller, 2023 and Andres M Kanner, 2005). There are numerous, yet understanding, reasons for considering environmental and genetic reasons responsible for this increase. Additionally personal lifestyles and attendant increased obesity rates are considered to play a role. Apart from these, during last years there are major changes in people's diets with negative effects on microbiomes (Christovich A et al., 2022).

Beverages that contain a number of phytochemicals and vitamins are known to be of high nutritional value. Thus, they have assimilated nutrition of most people. Especially people interested in healthy living. In order to consume diets of high nutritional value, one has to buy fruits, vegetables and vitamin supplements. This alone means expenses, which an increased number of citizens cannot afford. Even more, products like these have a short shelf life and they depend on the season and climate (Butu M., et al, 2019). Foods and drinks with functional and health benefits are consumed by consumers nowadays due to expansion in nutritional knowledge, thanks to the potent role of social media in everyday living.

A healthy diet may have a positive effect on your MS for several reasons: A steady and healthy body weight is associated with decreased risk of MS activity (such as relapses and lesions on MRI) and related disability. No diet is known to cure multiple sclerosis but current research provides evidence that diet may influence MS onset, course, and quality of life of the patients. Over 50% of people with MS may use complementary and alternative medicine, although percentages vary depending on how alternative medicine is defined. More frequently women, than men, have MS for a longer time, tend to be more disabled and have lower levels of satisfaction with conventional healthcare. Regarding alternative

therapies i.e Aloe Vera, , evidence is weak or absent.. Aloe Vera is a medical plant, containing more than 75 active ingredients, including enzymes, amino acids, vitamins, and minerals, some of which could make it useful for treating diseases. Aloe vera juice is marketed to support the health of the digestive system, but there is neither scientific evidence nor regulatory approval for this claim(Aloe Vera,2020).

Methods

Search strategy:

Databases of Google scholar, Semantic scholar and PubMed were searched using keywords of depression, multiple sclerosis, pain and all possible combinations. Google Scholar is a relatively straightforward search engine which retrieves scientific information through a number of sources, including articles, books, theses, abstracts, conference proceedings, professional societies, universities and research organizations .After searching using the words "aloe vera and MS" there were 27,600 results, from which only those referring to symptoms of MS were collected. Afterword's, the search continued on the specific symptoms of MS and aloe's feasible interactions. Relative literature from the last 10 years has been observed in order to evaluate potential medical Aloe Vera applications.

Inclusion / Exclusion Criteria:

All published papers found were reviewed according to defined inclusion- and exclusion. Publications using aloe vera gel , juice or derivatives and those including a control group with placebo or comparison with other treatments were included in the study. On the other hand, outdated studies were excluded.

Outcomes and Prioritization

Results of the specific review indicate that treatment with Aloe vera is possible to cause a significant reduction in severity of the referred symptoms of MS. Further human investigations are needed though. Cross-sectional studies will be able to measure the prevalence of health outcomes, understand determinants of health as well as quality of life and describe features of a population.

1.1 Aloe Vera

An increased number of literature focuses on the nutritional and phytochemical value of aloe (Naseer S,2018). Also known as Aloe barbadensis miller and Asphobelaceae, it is known to have a variety of therapeutic ,health anti-inflammatory properties (Table 1.1). Although the plant has been used for many years for beauty, medicinal, health and skin care treatments, its influence on the symptomatology of autoimmune diseases, like Multiple Sclerosis, has not been relatively observed .Literature is limited to animal studies (Nadia Mohamed Said Arafa, et al,2025).

Table 1.1 Therapeutic uses of Aloe Vera (L Langmead et al,2004)

Aloe vera (Asphodelaceae)	Wound healing, anti-inflammatory, antioxidant, anti-inflammatory, antidiabetic, sunburn relief, immune boost, anti-ageing and anticancer properties
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Aloe Vera consists of a numbers of leaves, all of which consist of three layers (Figure 0.1).The major component of the layers is that each of them consist of active components, such as minerals, sugars, vitamins, enzymes and amino acids (Das and Srivastav 2015),along with lectins, polymannans, chromones (Mariappan, V et al, 2012) and enzymes (Joseph and Raj 2010)

Fig. 01 Three layers of Aloe vera leaf



. Macronutrient composition:

A high number of polysaccharides make up the majority of Aloe vera gel's dry matter along with monosaccharides such as mannose, free glucose, fructose, and galactose(M. Saleem et al, 2021). Carbohydrates makes up 25–50% of the fraction's solid component and is the largest fraction(0.25%) of the entire gel composition. Polysaccharides make up the majority of Aloe vera gel's dry matter and that is where antioxidants and vitamins are found to exists (Lawless,2000). Regarding amino acids it contains both essential and non-essential, as shown table on table 1.2, whereas chemical compounds, their respective classes and function present in Aloe vera are found in table 1.3 (Rachana Sharma,2014)

Polyphenols are a category of plant compounds. Consumption of polyphenols is thought to boost digestion and brain health and protect against heart disease Polyphenols, found in A.vera are beneficial because they lead to modulation of the immune response and affect the expression of genes encoding pro-survival proteins including antioxidant enzymes (Santangelo, C.,et al,2018), type 2 diabetes, and even certain cancers.

Table 1.2

Amino acid	Aloe vera (Whole Leave) (nM/mg dry mass)	Amino acid	Aloe vera (Whole Leave) (nM/mg dry mass)	Reference
Asparagine	3.29	Leucine	0.09	11.48
Serine	1.27	Phenyl alanine	0.08	11.48
Aspartic acid	1.75	Isoleucine	0.07	11.48
Glutamic acid	4.7	Tyrosine	0.06	11.48
Alanine	0.91	Cystine	0.04	11.48
Lysine	0.18	Histidine	0.03	11.48
Valine	0.36	Methionine	0.02	11.48
Arginine	0.12	Proline	0.25	11.48
Threonine	0.33	Glycine	0.95	11.48
Glutamine	0.83	Concentration	15.33	11.48

Table 1.3

	Chemical compound	Function
Fatty acids	Diisooctylphtalate (11.84%), phytol (14.40%), linolenic acid (16.59%), and palmitic acid (11.91%)	Antioxidant
Phytochemicals	Alkaloid, flavonoids, sterols, triterpenes, tannins	Antioxidant, antiradical
Anthraquinones	Homonataloin B, Aloinoside B, Microdontin B, Aloin B, Aloin A, Microdontin A, Aloinoside A	Laxative, antidiabetic, and antioxidant
Carbohydrates	Arabinose, cellulose, fructose, fucose, galactose, glucose, lactose, maltose, mannose, pectic substance, rhamnase, sucrose, uronic acid and xylose	Anti-inflammatory

Chromones	Isorabaichromone, neoaloesin A, 8-C-glucosyl-(S)- aloesol, 8-C- glucosyl-(2'-O- cinnamoyl)-7-O- methylaloesol, isoaloesin D	Anti- inflammatory
Inorganic Elements	Calcium	sodium, chlorine, zinc, iron, potassium, copper, magnesium
organic compounds and lipids	Potassium sorbate, arachidonic acid-linolenic acid, triterpenoid, triglycerides, salicylic acid and uric acid	Anti-bacterial, essential fatty acid
Amino acids	Alanine, arginine, aspartic acid, cysteine, glutamic acid, glycine, histidine, hydroxyproline, serine, isoleucine, leucine, lysine, methionine, valine, tyrosine, phenylalanine, proline, threonine, serine, tyrosine and valine	Immunity, Regulates metabolic activities, Repairing and rebuilding of muscles
Hormones	Auxins and gibberellins	Wound healing
Proteins	Lectins, lectin-like substance	Anti-bacterial and anti-septic
Saccharides	Mannose, glucose, ,l-rhamnose, aldopentose	Boosts immune system
Vitamins	Vitamin A, C, E, B1, B2, B6, B12, choline, folic acid, α -tocopherol	Antioxidants, cell communications, DNA synthesis
Sterol	Cholesterol, campesterol, β -sitosterol and lupeol	Improves skin barrier function

Vitamin ,mineral and trace element content of Aloe Vera:

This promising plant is rich in Vitamin A, C, E, B12, niacin, riboflavin and antioxidants. Additionally it is rich in Vitamins E, B6, choline and folic acid (Lawless and Allen 2000., Amar Surjushe et al, 2008). Furthermore, it consists of minerals and electrolytes: Ca, Cl, K, Mg, Na, P as well as trace elements (Al, Cr, Cu, Fe, Mn, Se, Zn) (Saleem, A., et al, 2021). Fat soluble vitamins, as those seen in A.V, are involved in cell division and proliferation. All elements found in this magical plant are shown on table 1.4.

Table 1.4 Macro element and micro element composition of Aloe Vera(S. DKamble,2022)

Macro elements	Concentration (ppm)
P	213.53±1.53
K	214.53±9.11
Mg	202.15±1.70
Na	115.18±5.81
Ca	90.61±1.43
Micro elements	Concentration (ppm)
Cr	275.36±87.83
Mn	8.23±0.32
Fe	36.73±0.21
Co	0.09±0.04
Ni	1.54±0.09
Cu	4.51±0.25
Zn	3.78±0.09
Mo	0.58±20.73
B	0

1.2 Aloe vera juice and health properties

Results manifest that A.Vera juice is essential and important in various health problems due to its anti-septic, anti-biotic, anti-microbial, anti-viral, anti-toxic, anti-bacterial and antiallergic effects. Moreover it has anti-inflammatory, anti-ulcer, anti- diabetic, anti-tumour, antifungal and immunostimulant propertied. Last but not least, it has extremely effective intracellular antioxidant properties (Choi S W., 3t al,2001).

Because of Aloe's vera extremely nourishing effects it is widely used in the cosmetic, pharmaceutical industries and in the food industry. It is considered indispensable for all and especially for those who suffer from a variety of mental , physical or autoimmune diseases, as well as those who have nutritional disorders and are undernourished. Flavonoids, found in Aloe species, show promise in a variety of disease prevention and clinical applications. Regarding consumption of flavonoids many studies with different types of flavonoid derivatives have shown a protective action in experimental models of MS, including clinical improvement and a decrease in inflammation, oxidative stress, and demyelination (Song, L.J.; et al.2024)

Table 1.5: Aloe Vera Nutrition One 8-ounce serving of pure aloe vera juice includes ,according to USDA:

Calories	10
Protein:	0.89 grams
Fat:	0.3 grams
Carbohydrates:	31.92grams
Fiber:	1 grams
Sugar:	0 grams
Calcium:	74 milligrams
Sodium:	60 mg
Potassium:	322 mg
Iron	0.77 mg
Selenium, Copper and Manganese	0µg
Vitamin C	9.1 mg
Vitamin K	0mg

1.3 Symptomatology of MS and its possible, positive , connection with Aloe Vera:

Depression - MS - Immune system -Nutrients and Aloe Vera

Depression: Depression is mainly characterized by a continuous feeling of sadness ,tiredness and inability of coping with everyday problems .As a result it leads to disabilities physically, emotionally ,mentally, socially as well as biologically. World Health Organization(WHO 2022) has published the International Classification of Diseases (ICD) in order to distinguish depressive disorders from moderate to severe, with or without psychotic and severe symptoms (Cobley J.N et al,2008). A number of studies linked depression with neuroinflammation(Romain Troubat, et al, 2020 and Maria Antonietta Nettis et al,2020) ,mitochondrial dysfunction(Chengchao Zuo et al,2022),incorrect sleep architecture (Fabio Giuseppe Masuccio et al,2021) and many more. Depression is directly linked to Multiple Sclerosis (C.B. Tauil et al,2021). WHO states that , as we speak. about 5% of the worldwide population suffers from depression (Mathers, C.D,et al,2006) .

It has been reported that cytokines, hormones, oxidative stress markers, and neuropeptides have a close relation with depression occurrence and severity(Stefan Harsanyi, et al,2023).The role of cytokines on the immune system is scientifically documented. They have a strong relationship with antioxidants and inflammation , increasing the importance of a well-balanced nutrition, providing consumers with the needed amount of vitamins, micro-macronutrients, as well minerals. The result that A.V is considered salubriousness and has a crucial role in immune cells growth and maturity, possibly explains the reason why A.V can positively interact with CNS, decrease depression ,anxiety and the feeling of pain.

Noor Hadi Farhan et al conducted an experimental study in 2023 in order to shed light on the potential benefits and mechanisms that A.vera can promote healing and balance to the human body. During this study, rats were divided into eight groups: one control and seven treatment groups. The rats received drugs, Aloe vera extract, or acupuncture once daily, orally for 2 weeks. Evaluation of their behavior was observed on days 1, 7, and 14. Blood samples were also collected from the rats hearts and analyzed to assess kidney and liver function. Results demonstrated that a dose of 150 mg/kg, had antidepressant effects and negative effects on kidney and liver function. Tavakol in 2022 studied the effects of A.V on cells on productions of dopamine. An increase in focal adhesion kinase (FAK) activity was revealed with a decrease in the Bax/Bcl2 ratio, the generation of reactive oxygen species (ROS), and minor changes in the sub- G1 phase of the cell cycle. These alternations were not observed in brain- derived neurotrophic factor (BDNF), which is associated with depression (Foadoddini, M. et al,2020).

Findings suggest that A.V encourages cells growth and decreases cell death rate. Maurya, A.K et al, observed that intake of 500mn of A.V capsule for 8 weeks, managed to decrease depressive rate inpatients. This was possibly caused by Selective serotonin reuptake inhibitors (SSRIs) which reduced symptoms of depression in mice (Maurya, A. et al,2021). Regards to the use of A.V and depression, Sumita Halder and colleagues used the forced swim test and tail suspension test in order to test effect of A.V on depression in mice. It was observed that AV. is possible to alleviate depression in mice, as well as to enhance learning and memory skills (Sumita Halder et al, 2013). Additionally in order to examine the effects of A.V on depression and QoL in colorectal cancer patients undergoing radiotherapy, 3% of A.vera or placebo ointment was given repeatedly, 1 g twice daily for 6 weeks. At the end of the study lifestyle score improved significantly with A. vera. Preeti Gautam et al. studied plants that reduce depression and anxiety (Preeti Gautam et al, 2022) and A.V was among them.

Pain: Aloe vera gel has been shown to be beneficial in reducing the severity of pain and wound growth (Saleem, A., et al,2022). Due to these anti-inflammatory properties A.V is useful to reduce joint pain (Juice Akira Ataka, 2022). As noted by Juice Akira Ataka, pain is decreased as Aloe Vera blocks the secretion of bradykinin, cyclooxygenase-2 and thromboxane synthase, biologically active metabolites that play a major role in inflammation (Paul B, et al,2020). Bradykinin, an inflammatory molecule that causes pain, is broken down by aloe vera. Paul et al (Fareeha Iqbal et al,2023) refers to Aloe Vera as an antiinflammation agent which decreases inflammation and pain through possessing the enzyme peptidase bradykinase. Peptidase brady kinase, collapses the bradykinin i.e., the key inflammatory element involved in causing pain. As mentioned in LGU Journal of Life Sciences, efficacy of Aloe vera to reduce pain in COVID-19 patients was caused due to this healing mechanism (Díaz, C.; et al,2019).

Dr. Sonal Madan et al, completed a study with 10 patients that undertook tooth removal. Following routine surgical protocol the wound, on the control group, was closed with 3.0 black silk sutures while on the experimental side, the wound Aloe-vera soaked AB gel was placed before closure. Both groups had post-operative pain, soft and facial swelling, inter-incisal distance and bone injury. Clinical evaluations on 1st, 3rd and 7th post-operative day, as well as 1 month, 3 months, and 6 months showed that swelling was lower for the

experimental group at all time points when compared with the control group, mean maximum inter-incisal distance (MID) were better among patients in the experimental group as compared to the control group and soft and facial soft tissue swelling was lower for the experimental group at all time points when compared with the control group (Dr.Sonal Madan et al,2021). In 2022 the assistant Professor at College of Nursing, Chennai concluded that application of aloe vera gel had reduced pain perception in mothers undergoing episiotomy. Application of aloe vera gel over the episiotomy wound twice a day at the interval of 8 hours for three days resulted in significant reduction in pain in the experimental group as oppose to controls (Jayashree S.,2022). This agrees with the study of Forozan Hajiabadi et al , that found that application of Aloe vera, instead of warm compresses, can easily be used in order to decrease pain caused by phlebitis (Forozan Hajiabadi et al., 2023 and Nicola, M.A., et al,2024). A systematic review and Meta-Analysis confirmed pain relief benefits as well as lower side effects after second or third degree burns (Nicole.j.Levin, 2022)

Multiple Sclerosis.

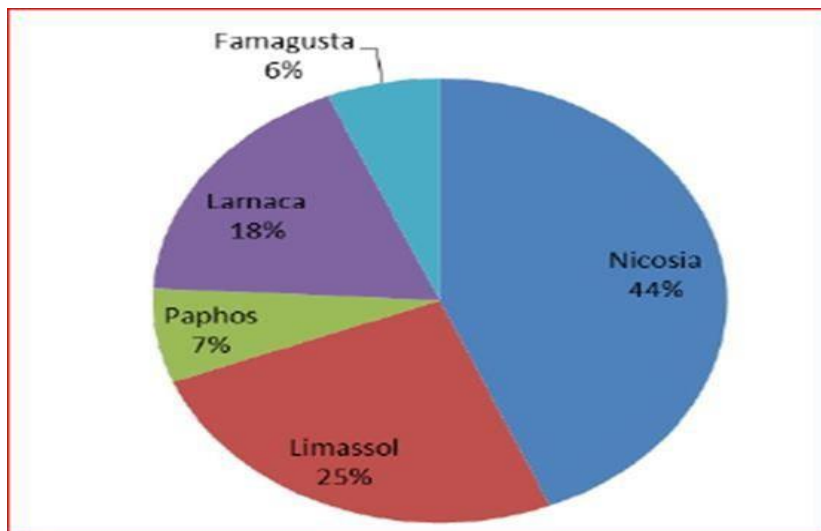
MS causes instability, movement and vision problems, loss of coordination, dizziness and many more. Symptoms, as well as their severity, depend on the location of the inflammation on the CNS and degree of nerve damage severity. Although MS is an autoimmune disease, a number of studies emphasize ,the increased role of environmental factors and specifically quality of nutrition, on the rate of occurrence and severity of the disease(Florica Voiță-Mekereș et al, 2023, Natalia Mogilko et al,2023). As one of the key factors in the pathogenesis of MS is oxidative stress, which enhances inflammation and neurodegeneration. Vitamin A , as an antioxidant vitamin, decreases ,damage of the myelin sheath and death of the neurons. Royal W. et al,(1Royal W.,et al,2002) had found that MS patient have lower levels of vitamin A in plasma than patients not experiencing neurogenerative diseases. Additionally a negative correlation was found between Vit A and the development of the disease because plasmatic level of the vitamin was found lower in MS patients (Naziroglu M, et al,2014). As the brain uses chemically reverse reactive species it is susceptible to oxidative stress (Jared Manning et al,2013) which cause cell death and nerve damage. As the brain has a relatively low level of production of antioxidants ,the need of a diet providing human body with antioxidant vitamins, through metabolism, is a necessity.

Animal study was conducted by A. Mirshaiey et al,2010, in order to test the therapeutic effect of Aloe vera in experimental model of MS. Results, on an experimental model , indicated that treatment with Aloe vera caused a significant reduction in severity of the disease .Additionally, an experimental study of 30 adult female Wistar rats, showed that Aloe vera alcoholic extract gel in a dose-dependent manner can reduce ethidium bromide(EB) effects on serum levels of TGF- β , interleukin-1 and interferon gamma in the rats with MS(Sedigheh Tanoomand et al. 2019).

. A number of studies(Patel, R.et al,2015, Maiuolo, J ,et al,2021) carried out in the last few years have demonstrated that there is a relationship between the intestinal microflora and the progression of multiple sclerosis. Results of these studies demonstrated that intestinal microflora plays a major role in progression of MS, allowing many experts ,related in health and nutrition industry , to suggest the incorporation of Aloe vera mucilage in the development of a variety of prebiotic food products. By this gastrointestinal health is believed to improve and incidence of MS reduced. To this end, acemannans, contained in Aloe vera show to cause positive change in the composition of the gut microbiota and could be considered good prebiotic adjuvants in the treatment of MS.

According to Insights from the Atlas of MS, third edition (Clare Walton et al, 2020), MS affects an estimated 900 000 people in the US and is increasing globally! According to Cyprus Multiple Sclerosis Association, in November 2021, there were 1750 registered people living with multiple sclerosis. Today, as referred by officials of the General Health System, 3,052 people are registered as MS patients in Cyprus. Figure 1.0, seen below, shows the distribution of patients according to the province of residence, as obtained from data collected in 2016 (Marios Pantzaris et al, 2016).

Fig.1.0



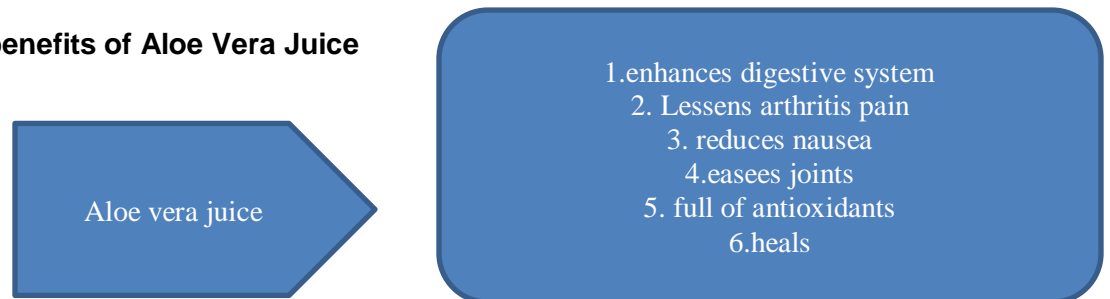
Aloe vera juice and health properties

Results manifest that Aloe Vera juice is essential and important in various health problems due to its anti-septic, anti-biotic, anti-microbial, anti-viral, anti-toxic, anti-bacterial, anti-allergic, anti-inflammatory, anti-ulcer, anti-diabetic, anti-tumour, antifungal, immunostimulant and extremely effective intracellular anti-oxidant properties (Choi S W., et al, 2001).

The standard common barrier of autoimmune diseases like MS is the cost to the government, healthcare system or insurance provider. It will thus be unconceivable if the beneficial properties of Aloe Vera Juice are recognized by citizens, pharmacological industries, physicians, neurologists and especially those living with autoimmune diseases. Needless to say about the positive effects and improvement in QoL that MS patients will notice. Nutritional status is critical in maintaining proper immune system. Feeding the body with the proper nutrients, vitamins, antioxidants and elements, in sufficient concentrations, the immune system is able to fight against pathogens

Aloe Vera Juice: Aloe Vera juice is used worldwide (sport drinks, electrolyte drinks, laxatives etc.). Aloe vera gel has been shown to be beneficial in reducing severity of pain and wound growth (Noor Hadi Farhan et al,2023). Due to these anti-inflammatory properties Aloe vera is useful to reduce joint pain (JuiceAkira Ataka et al,2022). Any A.vera juice found in the industry is be checked from quality ((ISO9000: 2000) and safety ((HACCP) management systems in order to reassure its quality . A. vera juice is a liquid form of the plant's extract, distinguished from the gel by its higher water content and sometimes additional processing steps. It includes an increased amount of water (98-99%) and may also contain citric acid or preservatives to enhance shelf life and flavor. It is rich in vitamins, minerals, enzymes, and amino acids, similar to the aloe vera gel but tailored for ingestion. Literature suggest the aloe vera juice mainly consists of vitamins A, C, E, and B ,,minerals(mostly calcium, magnesium, zinc, and potassium), both essential and non-essential amino acids and a high amount pf antioxidants (Jesse Williams, The Ultimate Guide to Drinking Aloe Vera Juice for Weight Loss.,<https://leafybark.com>). Aloe vera juice is recognized for its many health benefits (Figure 1.1)(Anika Tahosin et al,2024)

Fig,1.2 .Health benefits of Aloe Vera Juice



In a randomized crossover study obese and overweight men were divided a follows: for 14 days : 1) consumption of high fat diet(HF) ,2)consumption of HD diet with 350ml aloe vera juice,3) HF meal with A. vera juice plus 0.5 g acemannan, and (4) HF meal with A. vera juice plus 1 g acemannan. Purpose of the study was to examine changes in plasma antioxidant capacity. Throughout the study participants were instructed to continue their normal nutrition habits . The study concluded that both A. vera juice and its combination with acemannan, enhanced postprandial antioxidant status and mitigated the inflammatory response (Thavaree Thilavech ,et al, 2024).Acemannan was incorporated as it is known to play a very important role as a functional element in Aloe Vera. It indicates many biological activities such as antioxidant, antiviral, anticancer and anti-hyperglycemia effects (Kim, S.-H et al, 2023).

In the willingness to examine new areas in medicine and examine the use of modern pharmaceutical development , 36 male Wistar rats ,in condition of acute and proliferative inflammatory reaction where given aloe vera juice. Animals in the acute inflammation phase showed reduction in inflammation edema severity in contrast to the untreated rats (E.O. КУЛИЧЕНКО,et al.,2023). A cross sectional study examined the effect of Aloe vera on memory and depression in laboratory rats. Rats were divided into two groups, group having depression and the second decreased memory. Though Aloe vera showed no effect on memory after consumption, rats with high depression rates showed that it was significantly decreased ($p<0.05$)(Halder S, et al,2016). Another study showed that a daily dose of 50 mg/kg dose of Aloe Vera Juice decreased inflammation, ulcers, and tissue damage caused by Ulcerative Colitis (Bahrami G ,et al,2020).Symptoms attributable to

Ulcerative Colitis have a negative effect on the QoL of patients and are responsible for the occurrence of depression to these patients.

Aloe Vera was found to heal stomach ulcers and decrease level of pain (Alexendru Retiu.,et al ,2021).Further more Aloe vera syrup (10 mL/day) for 4 weeks reduced the frequency of symptoms of gastroesophageal reflux diseases including heartburn, dysphagia and stomach pain (Panahi, Y.,et al,2015).Shirish B., et al reports that Aloe Vera has beneficial effects on digestive problems , treat ailments, , constipation, and back pain. It can also improve digestion and reduce arthritis and joint pain(Shirish B.,et al,2024). Study by Tahany S. Aldaye et al,2020 , highlighted the phytochemical profile, antioxidant and potential antidiabetic activity of the Aloe Vera gel on blood and lymphatic circulation, kidney, liver and gall bladder functions, and digestion. Azal Shaikh, made apparent that the antioxidant enzymes and electrolytes in Aloe Vera juice paly a beneficial role in combating pathological conditions induced by ROS (Azal Shaikh, et al, 2024).Moreover, an online survey conducted at Howard University College of Pharmacy investigated the knowledge and opinions of the students on the use of aloe vera juice as well as other tastes of teas on their role in treating gastroesophageal reflux disease (GERD).Highest positive opinions (85.7%) were referring to aloe vera’s ability in treating GERD (F. Fullas, et al,2024).

Natural flavonoids ,found in A.Vera, have neuroprotective effects on the brain, protecting neurons from neurotoxic injury, enhancing learning, memory, and cognitive functioning, and reducing inflammation. They protect neurons from neurotoxins, promoting learning, memory, and cognitive processes, and reducing inflammation(Kesharwani V., et al,2024)..Recently a study by Payam Bayat et al, proved the considerable role of flavonoids ,thus comprehensive nutrition ,solid with vitamins and minerals, might play a vital role in the alleviation of effects on MS patients. Identified flavonoids .

Table1.6. Flavonoids found in Aloe Species in Aloe vera are shown in table 1.6 (Adamu Tizazu and Tigabu Bekele, 2024)

Detected flavonoid	
Apigenin	Myricetin
Naringenin	Rutin
Kaempferol	Quercitrin
Quercetin	Catechin
Saponarin	Epicatechin
Lutonarin	Isovitexin

A cross-sectional survey, found that aloe may help improve the treatment outcomes of immune mediated disorders(ie multiple sclerosis) due to increase the peripheral percentage of CD4 and CD8 cells, activation of the NF-κB protein and stimulation of interleukin production(Sarwat Jahan , et al, 2021). Aloe Vera experimentally was found to suppress the immune response of the proinflammatory helper T cells, which if left unchecked ultimately leads to the initial appearance of the disease(Jadidi-Niaragh F et al, 2011). Mechanisms of aloe therapeutics in MS , as well as other auto-immune disorders, is presented in table 1.8

Table 1.7:
Mechanisms of aloe therapeutics in various auto-immune disorders(Jadidi-Niaragh F et al, 2011)

Autoimmune Disease:	Mechanism:
Hyperthyroidism	<ul style="list-style-type: none"> *Decreased levels of T3 *Inhibition of conversion of T4 into T3 peripherally *Decreased expression of TSHR
Multiple Sclerosis	<ul style="list-style-type: none"> * Suppression of immune response of the pro inflammatory helper T cells * Decreased IFN-γ Production * Decreased NO synthesis
Psoriasis	<ul style="list-style-type: none"> * Macrophage and lymphocyte activation * Increased collagen activity *Decreased erythema and cellular infiltration
Lichen Planus	<ul style="list-style-type: none"> * Inhibition of arachidonic acid metabolism * Decreased adhesion of leukocytes and TNF alpha

Aloe Vera and Quality of Life (QoL)

Several studies found a significant association between the severity and number of symptoms and the decline of QoL in MS(Bishop M ,et a;,2015).Aloe vera exhibits antioxidant activity(Ajeena et al. ,2023), and Metabolic and endocrine effects(Indah et al. ,2022). Additionally a wide number of studied have proved its beneficial role in pain management (Kanyadhara et al. ,2014) and regulation of immune deficiencies (Channa et al.,(2014).All these highlight the promising effect of aloe on the improvement and mental innovation and wellbeing.

Future perspective and Conclusions:

Although therapeutic effects via drug administration are upsurge ,they remain limited when it comes to the therapeutic effects of herbal supplements . Up to date, Acceptance and Commitment therapy (ACT) or Cognitive behavioral therapy (CBT) are known to benefit patient symptoms. On the other hand supplementation with herbal remedies is delimited, probably due to fear and limited scientific backing. Aloe can be used for therapeutic benefit in disorders triggered by an abnormal immune response. It is undoubtedly, the nature's gift to humanity. MS is a complex autoimmune disease

characterized by inflammation, demyelination, and neurodegeneration. Current therapies for treatment of MS, suffer from safety concerns when needed for permanent use, so use of therapies derived from natural products have increased popularity both among healthy and unhealthy population. Aloe Vera has proved to aid in symptoms of MS (depression, pain) and improve overall wellbeing through its antioxidant and antiviral effects, as well as its ability to reduce oxidative stress, inflammation, and neurodegeneration. Health-aware people, people with autoimmune diseases and many more, seek nutritionally enriched functional food products for a new, convenient, healthier nutrition plan. Functional beverage market is growing and various beverages like isotonic and hypertonic beverages, sports and energy drinks, reduced energy/ zero calorie beverages as well as fruit based functional beverages exist in the market with expected growth. On the other hand A.Vera has also undertaken a wide range of pharmaceuticals therapies. The cooperation of recommended scientific medication in order to alleviate symptoms of MS and NDD with natural remedies is highly needed to proceed so that patients can have an integrated approach to slow down the course and severity of their symptoms. More studies are also needed to specifically investigate the effects of Aloe Vera Juices on MS symptomatology. Given that most studies of herbal therapy effects in MS have been done on animal models, there is a great need for approving these studies by clinical trials to recommend these mentioned plants for MS patients. Aloe has other beneficial effects for MS patients, such as sedation, improving sleep quality, antidepressant effects, relief muscle stiffness and reducing bladder disturbance.

Studies have confirmed that A.Vera has a potential to be used in the cosmetic industry especially creams, skin and hair products. Limited research is done in the food industry and specifically in aloe vera beverages and their interaction on MS symptoms. On the other hand continued research to optimize antioxidant therapies to slow disease progression and improve QoL for people with MS is needed. Consequently there is a need for exploration of the favorable effects of the nutritional and functional value of Aloe vera juices on people whose quality of life is adversely affected due to autoimmune diseases symptoms. Benefits of aloe and autoimmune disorders need to be solidified and investigated more through more rigorous clinical trials. No systematic reviews or meta-analyses on the effects of using aloe vera in patients with MS have been found, probably because of fear of progression of the disease if patients are medication free. The fear that the illness will progress, the limited amount of existing cross sectional studies and the variety of symptoms found in MS, are probably among the reasons for distress in patients with autoimmune diseases. As stated in the review, studies identified effects of A,V on isolated symptoms of the disease. Further studies are needed to disclose the exact mechanisms of action, through which aloe Vera exhibits anti-inflammatory and neuroprotective effects. Studies of A.V and MS have been done on animal models! There is a great need for approving these studies by clinical trials to recommend these mentioned plants for MS patients.

Abbreviations:

TNF- α : tumor necrosis factor CD8: cytotoxic T cell
SSRI: selective serotonin reuptake inhibitor MDD: Major Depressive disorder
WHO : World Health Organization
ICD: International Classification of Diseases ROS: Reactive Oxygen Species
RAR: Retinoic Acid Receptors

PPMS: Primary Progression Multiple Sclerosis
HCy: Homocysteine levels
NDD: Neurodegenerative disease IFN- γ : Interferon gamma
NO: Nitric Oxide
EAA: Essential Amino Acid Zn: zinc
Ph: phosphorus Na: sodium
Ca: calcium
QoL: Quality of Life
A.Vera: Aloe Vera

IFN- γ : IFN- γ or type II interferon
TSHR: Thyroid-stimulating hormone receptor
T3: Triiodothyronine
T4: Thyroxine
TNF-alpha: Tumor necrosis factor alpha
MOG (35-55) : Myelin oligodendrocyte glycoprotein

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