



Preventive Perspectives on Gut Microbiome Derangements (Gut Dysbiosis): Insights from *Theraiyar Pini Anuga Vithi*- A Literature Review

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ABSTRACT:

Introduction: Siddha medicine, an ancient system emphasizing prevention over cure, aligns holistic practices with modern gut microbiome science. Theraiyar Pini Anuga Vithi (PAV), a preventive Siddha framework, advocates for dietary and therapeutic measures to maintain equilibrium in bodily systems. This review explores the intersection of PAV and gut microbiome modulation for disease prevention.

Methods: Traditional Siddha texts, including Theraiyar's works, were reviewed alongside modern microbiome research. Electronic databases such as PubMed, Scopus, and Web of Science were searched for studies linking Siddha practices and microbiota.

Results: Viresanam balances Thirithodam and expels toxins (Aamam), reducing gut dysbiosis. Studies report improved microbiota diversity, metabolic benefits, and enhanced lipid and glucose metabolism in Viresanam therapy. Oil bathing increases beneficial gut bacteria and reduces oxidative stress via the gut-skin axis. Probiotics like Lactobacillus present in curd and milk enhance immunity, combat gastrointestinal pathogens, and improve gut diversity. High resistant starch in raw bananas promotes Lactobacillus growth, inhibiting harmful bacteria like E. coli.

Conclusions: Siddha principles of balance in bodily systems complement microbiome science in promoting health and preventing disease. Practices like purgation, oil bathing, and consuming probiotics and prebiotics diets align with modern strategies for maintaining microbiota diversity.

1. Introduction

Siddha medicine is an ancient healing system deeply intertwined with philosophical principles, emphasizing holistic well-being by addressing both the physical and mental aspects of health. It emphasizes various preventive health care over cure by promoting harmony between the body and nature (1). Key measures from Noyilla Neri, a Siddha text, include a balanced diet,

seasonal routines, yoga, meditation, daily discipline (Niththiya olukkam), herbal remedies, detoxification, and avoidance of harmful habits, along with Kaaya karpam (2,3). Theraiyar Pini Anuga Vithi (PAV) is a key principle in Siddha medicine that emphasizes specific guidelines to prevent diseases. (4) It highlights dietary habits as a crucial factor in maintaining health, advocating for food choices that align with an



individual's body constitution and seasonal variations. The human gastrointestinal tract is the body's largest immune organ and plays a key role in preventing pathogen infections through the gut microbiota, which produces metabolic products that affect health either positively or negatively (5). It forms a stable system on the intestinal surfaces to prevent pathogen invasion by anaerobic fermentation and anti-inflammatory activity. (6) The microbiome exists throughout the body, with the gut hosting around 10^{14} bacterial cells from over 1,000 species and dominated by Bacteroidetes and Firmicutes. (7) As well as for treating, various Siddha researchers have explored the potential therapeutic actions of the gut microbiome in managing diseases such as COVID-19 (Gut-Lung Axis) and autism by influencing the communication between the brain and gut (Gut-Brain Axis), thereby impacting the mental and neurological functions of the host. (8,9) The intestinal microbiota interacts with the host immune system through the mucosal surface of the intestine, contributing to immune regulation by priming and modulating the mucosal immune response. (10) In this review, the potential effects of gut microbiome diversity, particularly as influenced by diets and therapeutic processes mentioned in PAV, are explored as key factors in disease prevention.

2. Methods

The traditional Siddha books relevant to Siddha gut health concepts, including words of Akkini, Akkini mantham, Manthakkini, Aamam were searched between December 1 to December 7, 2024 at the National Institute of Siddha Library, Tambaram Sanatorium, Chennai. Books like Thotra Kirama Aaraaichiyum Siddha Maruthuvaanga Churukkamum, Pathaartha Guna Chinthamani, Noiyilla Neri, Noinadal Noimuthal Nadal, TV Saambasivam Pillai Agaraathi, Udal Thaththuvam and Meignana Thaththuva Vilakkam were included. Articles were searched from online literature databases, including PubMed, Scopus, Embase, Ayush portal and Web of Science.

3. Results

VIRESANAM AND GUT HEALTH:

Viresanam, meaning the expulsion of thodangal (toxins) through the rectal route, refers to purgation therapy in Siddha medicine. It primarily focuses on

cleansing the sweat glands, small intestine, colon, stomach, liver, and spleen, promoting detoxification and restoring the body's balance. (11) In Siddha medicine, the body's functioning is governed by the three humors likely Vatham, Piththam, and Kabam. Maintaining a balanced equilibrium among these humors is essential for normal physiological functioning. Suguna M et al. validated that Viresana sigitchai (purgation therapy) reduces the vitiated Vatham in our body. (12) Inflammation is primarily linked to Vatham due to its Veengal Vaayu action (Thananjeyan) one among 10 types of Vatham. As noted earlier, the gut microbiota's anti-inflammatory activity helps modulate and reduce inflammation, thereby alleviating this Vatham in Viresana Sikichai. (6)

Dinesh K L et al. compared the concepts of Akkini and gut microbiome. All vital functions are attributed to the balanced and healthy functioning of Akkini. The body's immunity is also connected to Akkini. When Akkini functions well, qualities such as mental courage, vitality, and sharp intellect arise. (13) Akkini mandham occurs when the digestive fire (Akkini) becomes sluggish according to Siddha, often due to imbalances in the humor, poor diet, or lifestyle habits. When the Akkini is disturbed, it leads to improper digestion and metabolism, resulting in the accumulation of toxins (Aamam) in the body.

This Aamam can be compared to exotoxins produced by microorganisms or certain bacteria when they invade the body. (14) These toxic substances disrupt normal physiological processes, leading to gut dysbiosis, emphasizing the need for their elimination to restore balance and health. (15) Thanigainathan A et al. explained the probable mechanism for toxin removal which involves the binding of cytoplasmic toxins to the cell membrane, leading to changes in cell permeability that result in the expulsion of toxin materials outside the cell. These membrane-bound toxins circulate through the veins, irritating the intestinal mucosa. This irritation triggers excessive secretion from the intestinal lining and induces vasodilation. Consequently, toxins accumulate in the gut lumen, along with secretions, electrolytes, and fluids released from the crypts of Lieberkühn in the distal ileum and colon. Finally, this combined mass of toxins, electrolytes, and fluids is expelled through the rectal route, facilitating detoxification. (16) Table 1 depicts the possible comparison of the Gut microbiome and dysbiosis with traditional concepts.



Table 1. Possible correlation of a healthy Gut microbiome and Dysbiosis

Healthy Gut Microbiome	Akkini (13)
Dysbiosis	Amam (14)

In 2019, a study by Chaturvedi et al. investigated the effects of Viresanam on obese individuals through stool microbiological examination. Stool samples were analyzed using MacConkey agar and Enterobacterial Repetitive Intergenic Consensus (ERIC)-Polymerase Chain Reaction (PCR) to assess variations in bacterial flora. The findings revealed a reduction in *Escherichia coli* colonization following Viresanam, highlighting its potential impact on gut microbiota modulation and complete improvement of the gut flora. (17) In 2016, Chaturvedi et al. found that therapeutic purgation in Albino rats reduced fat content in feces, lowered fasting blood sugar and serum triglycerides, and minimized fatty changes in the liver, heart, and kidney. The study also noted increased insulin sensitivity in skeletal muscle insulin receptors, suggesting metabolic benefits of purgation therapy. (18) Peterson CT et al., discovered that gentle purgation, when combined with other therapies and diet as part of the Self-Directed Biological Transformation Initiative (SBTI), could significantly modify metabolomic profiles, particularly those related to signaling and the digestion, mobilization, transport, and biosynthesis of lipids in healthy individuals. (19) Additionally, Pooja and Bhatted showed that purgation enhanced the therapeutic effects of a dyslipidemia-like medicated enema, boosting its benefits. (20) Purgation therapy has also demonstrated benefits in the treatment of migraines and Parkinson's disease (21, 22). Given that lipid metabolism in dyslipidemia and the gut-brain axis in migraines and Parkinson's disease are closely influenced by microbiome health, researchers may hypothesize that purgation could potentially alter gut dysbiosis. So it is evident from PAV that a person should undergo purgation every four months.

“Adar naanku mathikkorukaar bethiyurai nugarvom”

OLEATION, SUN BATH AND GUT-SKIN AXIS:

Emerging research on the skin microbiome highlights its connection with the gut, known as the gut-skin axis, a bidirectional relationship between gut microbiome and skin health. (23) Traditional oil bathing has been shown to influence the gut microbiome, particularly increasing bifidobacteria, among Japanese families. (24) Amy O'Callaghan et al., study revealed the bifidobacterial activity against colorectal cancer, diarrhea, necrotizing enterocolitis and Inflammatory Bowel Syndrome (IBS) (25). Coconut oil, a commonly used oil for oleation, is effective in inhibiting indicator bacteria, including *Escherichia coli*, *Staphylococcus aureus*, and *Bacillus subtilis*, as demonstrated by its significant inhibition zones. (26) Thus, Theraiyar recommends taking an oil bath once every four days.

“Veeru sathur naatkorukaal nei muzhukkai thavirom”

Sunbathing, often recommended in the evening (27), plays a key role in enriching the skin microbiome and aiding in the management of oxidative stress. The studies revealed three distinct findings regarding the role of microbes in high and low exposure sunbathing. In 2023, Harel N. et al. found the noteworthy bacterial families in high exposure sun bathing like *Sphingomonas* and *Erythrobacteraceae*, which may offer protection against Ultraviolet Radiation (UVR) by producing potentially protective compounds like ubiquinone-10, glycosphingolipids, carotenoids and glucagon-like peptides (GLPs). These metabolites help reduce environmental damage to human skin only after long-term exposure to UVR. (28) However, in 2022, Nurit H. et al explained that regardless of high or low sun exposure, seasonal effects on the microbiome are likely tolerable for most skin microbiome members, reflecting their evolutionary adaptation to such changes. (29) In contrast, Thomas W et al. revealed that sun exposure for even a week may affect the diversity and composition of the skin microbiota, which may have downstream effects on skin health and induce photoaging biomarkers and risk of skin cancer, which reflects on the gut by the Gut-Skin axis. (30,31) This aligns with Theraiyar's principle of “Ilaveyilum Virumbom” from PAV, which advises avoiding direct sun exposure.



PROBIOTICS IN MILK AND CURD:

The specific health effects of probiotics from bovine milk can vary between strains of the same species, influenced by their prebiotic combinations and geographical origin. (32) This microbial community includes both harmful bacteria that can cause mastitis and milk spoilage, as well as beneficial probiotics like Lactococcus, Streptococcus, Lactobacillus, Pediococcus, Leuconostoc, and Enterococcus species. (33, 34) Wenli Guo et al. highlighted various studies conducted on the microbiota of colostrum and mature milk from different regional cow breeds. (35) Table 2 depicts the various micro-organism in milk and their actions on the body.

Table No. 2: various micro-organism in milk products and their actions

DIET	DOMINANT MICROBIOTA	ACTION
Mature bovine milk	Bifidobacterium	infant diarrhea, rotaviral infection, and murine colorectal cancer
Mature bovine milk	Enterococcus faecium	inhibiting the growth of pathogenic microorganisms such as Escherichia coli, Listeria monocytogenes, Salmonella typhimurium, Staphylococcus aureus, Shigella dysenteriae, and Streptococcus agalactiae
Mature bovine milk	Lactobacillus species	enhancing the immune system

Colostrum of bovine milk	Firmicutes phylum	genes responsible for fermenting dietary fiber and gut homeostasis
Colostrum and mature goat milk	Proteobacteria firmicutes	Maintains homeostasis
Curd	Lactic acid bacteria	Resistance to antibacterials, which helps in antibiotic-induced diarrhea Inhibit the growth of S. typhimurium and V.cholerae Anti-inflammatory actions in colitis Response for innate immunity and inflammatory response

Curd is one of the richest sources of probiotics, a fermented product, containing live microorganisms like lactic acid bacteria that offer numerous health benefits. It enhances the host's immune system by stimulating both mucosal and systemic immunity. This is reflected in activated macrophages, increased immunoglobulin levels, enhanced Natural Killer (NK) cell activity, and elevated cytokine production in the body, thereby strengthening natural immunity. (36) So it can aid in treating allergies, urogenital infections, HIV, cancer, Helicobacter pylori infections, liver diseases, inflammatory bowel disease (IBD), irritable bowel syndrome (IBS), and pancreatitis. (37) So Theraiyar mentioned "Mooththa Thayir Unbom," which refers to the ancient Siddha practice of consuming well-fermented



curd. This tradition highlights the therapeutic importance of curd, particularly for its probiotic properties, which promote gut health.

PREBIOTICS MENTIONED IN PINIANUGA VITHI:

Bananas are among the most widely produced fruits globally, with approximately 125 million tons harvested in 2021. They are primarily consumed as fresh fruit. (38) However, Theraiyar specifically recommends consuming unripe bananas over ripened ones, highlighting their unique health benefits and their use in Patthiyam (treatment regimen) in Siddha medicine. (39) This recommendation may stem from the higher resistant starch content in unripe bananas, which offers greater potential benefits in managing type 2 diabetes compared to ripened bananas. (40) However, G M Jayashree et al., investigated the *in vivo* prebiotic efficacy of raw and ripe banana pulp, which found that the high dietary fiber content in raw bananas supports the growth of *Lactobacillus acidophilus* more effectively than ripened bananas. An increase in lactobacilli competitively inhibits the growth of pathogens like *Escherichia coli*, which maintains the gut biodiversity. The lack of significant lactobacilli growth in the ripened banana pulp flour group, compared to the raw banana group, may be attributed to the breakdown of starch, hemicellulose, and pectin, which softens the tissue and reduces available prebiotic substances. (41) Thus, it validate the statement of Theraiyar's principle "Vaazhai ilam pincholiya kaniyarunthal seiyom".

Conclusion:

From this review, it is evident that the microbiome plays a critical role in disease prevention, as its balance and diversity are essential for maintaining health. Similarly, in Siddha medicine, Theraiyar Pini Anuga Vidhi serves as a key prophylactic framework, emphasizing guidelines to prevent diseases by maintaining balance within the body's natural systems. This alignment highlights the interconnectedness between traditional Siddha principles and modern microbiome science in promoting health and preventing illness.

Limitations:

Apart from the principles mentioned above, the role of gut microbial activity in Vamanam (therapeutic emesis), the consumption of elephant foot yam in

preventing anorectal diseases and Gut-Lung Axis in Nasiyam (Nasal administration) has not been addressed in this article.

Recommendations:

A prospective study on the Thirithodam concepts in relation to gut microbiome health can be designed to explore several key areas: identifying microbiome signatures corresponding to Thirithodam principles, discovering specific gut bacteria associated with Thirithoda Samana Porutkal (factors that maintain thodam equilibrium), developing personalized therapeutic approaches by integrating Siddha medicine with microbiome modulation, and investigating the potential role of the gut-brain axis in influencing Sathuva, Rajo, and Thamo Gunam as described in Siddha texts.

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Conflict of interest:

None

References:

1. PRAKASH P, MEENA R, STANLEY ABRAHAM, SWETHA SUNKAR, GOVINDARAJU K, DURGASRUTHI PULLY, et al. EVIDENCE-BASED traditional Siddha formulations for prophylaxis and management of respiratory symptoms in COVID-19 pandemic- a review. *Biocatalysis and Agricultural Biotechnology*. 2021 Jun;102056.
2. Thurairasan K., Noyilla Neri, Directorate of Indian Medicine and Homeopathy, 4th ed, 2017: Chennai-20.
3. Thiagarajan R., Siddha Maruththuva Sirappu, Directorate of Indian Medicine and Homeopathy, 5th ed, 2017: Paalaimkottai.
4. Uththamaraayan K S., Siddha maruththuvanga churukkam, Directorate of Indian Medicine and Homeopathy, 3rd ed, 2003.pg no: 442
5. Gomaa, E. Z. (2020). Human gut microbiota/microbiome in health and diseases: a review. *Antonie van Leeuwenhoek*. doi:10.1007/s10482-020-01474-7



6. Geva-Zatorsky N, Sefik E, Kua L, Pasman L, Tan TG, Ortiz-Lopez A, et al. Mining the human gut microbiota for immunomodulatory organisms. *Cell*. 2017; 168(5):928-43. <https://doi.org/10.1016/j.cell.2017.01.022> PMID:28215708 PMCID:PMC7774263
7. Bien J, Palagani V, Bozko P, et al. The intestinal microbiota dysbiosis and *Clostridium difficile* infection: is there a relationship with inflammatory bowel disease? *Ther Adv Gastroenterol*. 2013;6:53–68.
8. Das M, Nooruddin Thajuddin, Gangatharan Muralitharan, Patra S, Megha Pundir. Effect of Phyto Constitutes of Ayurveda and Siddha Herbs on SARS-CoV-2/CoVID-19 Management by Modulating the Human Gut Microbiome. *Journal of Natural Remedies*. 2024 Oct 7;1877–93.
9. Elangovan P, Ramasamy G, Ananthathandavan P, Malayappam MS. The Effect of Siddha Medicine in Treating Autism Spectrum Disorder: A Case Report. *JOURNAL OF CLINICAL AND DIAGNOSTIC RESEARCH*. 2023;
10. Li J, Butcher J, Mack D, et al. Functional impacts of the intestinal microbiome in the pathogenesis of inflammatory bowel disease. *Inflammatory Bowel Diseases*. 2015;21(1):139–153.
11. Sambasivam Pillai T V, Tamil-English dictionary, The research institute of Siddhar science, Madras: 1931;
12. Suguna. M, None Arthi. G, None Mohanaprabha. G, None Dhineshraman. G, None Manjula. V, None Kavitha. S, et al. An Open-Label Non-Randomized Clinical Trial on Siddha Purgation Therapy (Bhedhi) for Pacifying Vatha disease using diagnostic tool Neikuri. *International Journal of Ayurveda and Pharma Research*. 2022 Dec 15;95–102.
13. Dinesh KS, Shanthi K, Concept Of Human Gut Microbiome In Health And Disease -An Ayurveda Perspective. *World Journal of Pharmacy and Pharmaceutical Sciences* 9(5):771 DOI:10.20959/wjpps20205-16140
14. Amrit G et al., Virechana karma (therapeutic purgation) in the restoration of gut microbiota concerning Amavata (RA): A scientific exposition, February 2021[TANG[HUMANITAS MEDICINE] 11(1):1-4DOI:10.5667/CellMed 2021.0001
15. Kulkarni AA, Dohare RA. AMA FROM AYURVEDIC AND MODERN PERSPECTIVE. *International Ayurvedic Medical Journal*. 2021 Dec 15;9(12):3055–62
16. A T, Selvalenin C, Lakshmi Kantham T, Vetha Merlin Kumari H, Nalini Sofia H, Mary Sharmila C, Anbarasan B, Meenakumari R. VIRESANAM - PURGATION THERAPY IN SIDDHA. *JOS* [Internet]. 2024Mar.29 [cited 2024Dec.5];5(1):52-60. Available from: <https://jos.nischennai.org/index.php/jos/article/view/34>
17. Singh J, Chaturvedi A, Nath G, Yadav V, Meera Antiwal, Shakya N, et al. A clinical study on Virechana Karma (therapeutic purgation) over the gut flora with special reference to obesity. *Ayu*. 2019 Jan 1;40(3):179–9.
18. Chaturvedi A, Rao PN, Kumar MA, Ravishankar B, Rao N, Ravi M. Effect and mechanism of Virechana Karma (Therapeutic Purgation) over fructose-induced metabolic syndrome: an experimental study. *J Evid Based Complementary Altern Med*. 2016;21(3):194-201. doi:10.1177/2156587215596283
19. Peterson CT, Lucas J, John-Williams LS, et al. Identification of altered metabolomic profiles following a panchakarma-based ayurvedic intervention in healthy subjects: The Self-Directed Biological Transformation Initiative (SBTI). *Sci Rep*. 2016;6(1):32609. doi:10.1038/srep32609
20. Pooja BA, Bhatted SK. A standard controlled clinical study on Virechana Karma and Lekhana Basti in the management of dyslipidemia (Medoroga). *Ayu*. 2016;37(1):32-37. doi:10.4103/ayu. AYU_14_15
21. Vasudha MS, Manjunath NK, Nagendra HR. Lifestyle - A common denominator for the onset and management of migraine headache: complementing traditional approaches with



- scientific evidence. *Int J Yoga*. 2019;12(2):146-152. doi:10.4103/ijoy.IJOY_59_18
22. Nagashayana N, Sankarankutty P, Nampoothiri MRV, Mohan PK, Mohanakumar KP. Association of L-DOPA with recovery following Ayurveda medication in Parkinson's disease. *J Neurol Sci*. 2000;176(2):124-127. doi:10.1016/S0022-510X(00)00329-4
23. Thye AYK, Bah YR, Law JWF, Tan LTH, He YW, Wong SH, et al. Gut-Skin Axis: Unravelling the Connection between the Gut Microbiome and Psoriasis. *Biomedicines*. 2022 Apr 30;10(5):1037.
24. Odamaki T, Bottacini F, Mitsuyama E, Yoshida K, Kato K, Xiao J, et al. Impact of a bathing tradition on shared gut microbes among Japanese families. *Scientific Reports*. 2019 Mar 13;9(1).
25. O'Callaghan A, van Sinderen D. Bifidobacteria and Their Role as Members of the Human Gut Microbiota. *Front Microbiol*. 2016 Jun 15;7:925. doi: 10.3389/fmicb.2016.00925. PMID: 27379055; PMCID: PMC4908950.
26. Syukur S, Syafrizayanti, Rajagukguk H, Syaputri Y, Iwahashi H. Probiotic research in several products of virgin coconut oil from Padang, Indonesia. *Journal of Physics: Conference Series*. 2018 Dec;1116:042039.
27. Uthamarayan K S HPIM. Siddhar Aruvai Maruthuvam. ed. 2009. Chennai-600016: Directorate of Indian Medicine & Homoeopathy; 1968.
28. Harel N, Ogen-Shtern N, Reshef L, Biran D, Ron EZ, Gophna U. Skin microbiome bacteria enriched following long sun exposure can reduce oxidative damage. *Research in Microbiology [Internet]*. 2023 Nov 1;174(8):104138. Available from: <https://www.sciencedirect.com/science/article/pii/S0923250823001134>
29. Bhat, Bilal Ahmad; Dar, Shabir Ahmad; Hussain, Arshad; Mir, Rouf Ahmad. Electroconvulsive therapy: Knowledge and attitudes among medical interns and the general public. *Muller Journal of Medical Sciences and Research* 11(1):p 1-7, Jan-Jun 2020. | DOI: 10.4103/mjmsr.mjmsr_5_20
30. Harel N, Reshef L, Biran D, Brenner S, Ron EZ, Gophna U. Effect of Solar Radiation on Skin Microbiome: Study of Two Populations. *Microorganisms*. 2022 Jul 27;10(8):1523. doi: 10.3390/microorganisms10081523. PMID: 36013941; PMCID: PMC9415396.
31. Diffey B. (2008). A behavioral model for estimating population exposure to solar ultraviolet radiation. *Photochem Photobiol*. 84 (2), 371-375. 10.1111/j.1751-1097.2007.00271
32. Quigley L, O'Sullivan O, Stanton C, Beresford TP, Ross RP, Fitzgerald GF, et al. The complex microbiota of raw milk. *FEMS Microbiology Reviews [Internet]*. 2013 Sep;37(5):664-98. Available from: <https://academic.oup.com/femsre/article/37/5/664/541439>
33. Kim IS, Hur YK, Kim EJ, Ahn YT, Kim JG, Choi YJ, et al. Comparative analysis of the microbial communities in raw milk produced in different regions of Korea. *Asian-Australasian Journal of Animal Sciences [Internet]*. 2017 Nov 1;30(11):1643-50. Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5666200/>
34. Ashraf R, Shah NP. Immune system stimulation by probiotic microorganisms. *Crit Rev Food Sci Nutr* 2014; 54(7): 938-56. <http://dx.doi.org/10.1080/10408398.2011.619671>
35. Guo W, Liu S, Khan MZ, Wang J, Chen T, Alugongo GM, et al. Bovine milk microbiota: Key players, origins, and potential contributions to early-life gut development. *Journal of Advanced Research [Internet]*. 2023 Jul 7; Available from: <https://www.sciencedirect.com/science/article/pii/S2090123223001790#:~:text=Bovine%20milk%20microorganisms%20originate%20from>
36. Di Cerbo A, Palmieri B, Aponte M, Morales-Medina JC, Iannitti T. Mechanisms and therapeutic effectiveness of lactobacilli. *Journal of Clinical Pathology [Internet]*. 2015 Nov 17;69(3):187-203. Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4789713/>



37. Shadnoush M, Shaker Hosseini R, Mehrabi Y, Delpisheh A, Alipoor E, Faghfoori Z, Mohammadpour N, Zaringhalam Moghadam J. Probiotic yogurt Affects Pro- and Anti-inflammatory Factors in Patients with Inflammatory Bowel Disease. *Iran J Pharm Res.* 2013 Fall;12(4):929-36. PMID: 24523774; PMCID: PMC3920683.
38. Shahbandeh M. Fruit: world production by type 2017 | Statistic [Internet]. Statista. Statista; 2017. Available from: <https://www.statista.com/statistics/264001/world-wide-production-of-fruit-by-variety/>
39. Uththamaraayan K S., Siddha maruththuvanga churukkam, Directorate of Indian medicine and Homeopathy, 3rd ed, 2003, pg no:414
40. Costa ES, França CN, Fonseca FAH, Kato JT, Bianco HT, Freitas TT, et al. Beneficial effects of green banana biomass consumption in patients with pre-diabetes and type 2 diabetes: a randomised controlled trial. *The British Journal of Nutrition* [Internet]. 2019 Jun 1;121(12):1365–75. Available from: <https://pubmed.ncbi.nlm.nih.gov/30887937/>
41. Gajananrao Mahore J, Shirolkar SV. Investigation of Effect of Ripening and Processing on Prebiotic Potential of Banana. *Journal of Young Pharmacists.* 2018 Oct 12;10(4):409–13.