



THERAPEUTIC POTENTIAL OF CULINARY SPICES: APPLICATIONS, EFFICACY, AND OPTIMAL DOSAGE - A REVIEW

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ABSTRACT:

Spices have long been used in the kitchen and have therapeutic properties. Ayurveda prescribes specific instructions for administering any medicine, such as an examination of *Prakriti* (individual constitution), *Agni* (digestive capacity), *Dosha* and so on, as well as the cautious usage of certain medicines to guarantee optimal and safe use. In today's society, spices are used to stimulate the immune system, yet using spices as medicine inadvertently may have an unwanted effect on the body. This review attempts to objectively analyse the probable detrimental effects of medicinal plants used as spices and interpret the concern of Ayurveda in order to use these spices more effectively. According to the Spices Board of India, there are 52 spices classified, and 31 medicinal plants have been discovered for use as spices in Indian cuisine and home medicines beginning with 06 Nighantu. Collected data was checked for reported adversities on several search engines, yielding 20 plants with indications of potential adverse effects. Furthermore, essential Ayurvedic principles were presented to help people use these spices more effectively, get the most out of them, and minimize any potential negative effects. This emphasizes the significance of using spices with caution and getting the opinion of an Ayurvedic physician before consuming them as medicine.

Keywords: Nutraceuticals, Spices, Adverse effects, pharmacological properties

INTRODUCTION:

Since the beginning of human civilization, a variety of Indian medicinal plants has been used in the ancient system of medicine (Ayurveda), with the goal of maintaining health and curing ailments[1]. The term nutraceuticals is derived from the words nutrient and pharmaceutical. Nutraceuticals are therapeutic foods that provide medical or health benefits in addition to their nutritional properties. Spices and herbs are considered as nutraceuticals or functional foods because of the existence of several bioactive components such as essential oils, antioxidants, and vitamins that have been shown to have significant biological actions in the prevention and management of health ailments.[2] Spice is any seed, fruit, root, bark, or other plant substance in a form primarily used for flavouring or coloring food. Indian spices serve various medicinal functions such as food additives, laxatives, preservatives, anti oxidants, expectorant, purgatives, diuretics, flavouring agents and shows anti bacterial, anti fungal activities as well[3].

Being a part of the Indian kitchen, spices are easily available and familiar. Since ages, people have been using kitchen spices as home remedies to treat various health ailments of which the most common are cough, cold and constipation.[4] The self-consumption of spices to treat common ailments has increased manifold post pandemic, without realising that imprudent consumption can lead to various health hazards. According to industry sources,

the demand for spices like turmeric and ginger for food supplements during the pandemic increased by 300%[5] Though the spices have the potential to improve metabolism, their improper or overuse, either singly or in combination may be harmful. Inappropriate consumption is unlikely to cause a problem, but frequent consumption in high doses or in small doses over a longer course of time will lead to disease or may worsen existing disease.[6] People also consume these spices along with modern medicines once the diagnosis is made, without having any knowledge of drug interactions and their hazardous effect on health. It is a myth that herbs and spices being natural are safe.[7] The aim of this review article is to critically analyse the possible adverse effects mentioned for medicinal plants that are used as spices and to decipher the concern of Ayurveda, to utilise these spices more appropriately, to get maximum possible benefit from it and to avoid any side effects. 20 commonly used spices listed under Spice Board India and identified medicinal plants that are used as spices in Indian kitchens as home remedies from 6 Nighantus have been selected for this purpose.[8]

MATERIALS AND METHODS:

The review examines the implications of using medicinal herbs as spices excessively, as seen in Ayurvedic lexicon. The key sources for this study were Dhanvantari, Madanpala, Kaiyadeva, Bhavprakasha, Shodhala, and Raja Nighantu, also known as Ayurvedic lexicons or materia

medica. The Nighantu were reviewed in their e-Nighantu format. Also literature search was done from various research articles from Pubmed and Scopus and various Botanical texts were reviewed for this article.

Inclusion Criteria: Total 20 medicinal plants which are used as spices in Indian kitchen as well as home remedies for different ailments and reported in Nighantu were selected.

Exclusion Criteria: Spices which are enlisted in Spices Board India, were reviewed and spices like Parsley, *Petroselinum crispum* Mill., Vanilla-*Vanilla planifolia* Andr., All Spice-*Pimentadivora* (L) Merr., Rosemary, *Rosmarinus officinalis* L., Oregano- *Origanum vulgare* L., Star Anise-*Illicium verum* Hook., Horse radish, *Armoracia rusticana* Gaertn., Tarragon-*Artemisia dracunculoides* L. and Chilli-*Capsicum annuum* L. which are not described in Ayurveda were excluded

Concepts Underpinning Ayurvedic Medicine:

Ayurvedic practice is around 3000 years old, with a long history of managing disease. The 3 basic principles, called *Doshas* (*Vata*, *Pitta*, and *Kapha*), are derived from 5 elements of Indian philosophy.[1] Ayurveda's doshas can be identified as regulatory control factors for fundamental physiologic processes in living systems that maintain their identity throughout biologic history.[9] Approximately, 90% of ayurvedic preparations are plant based. Ayurveda first seeks to diagnose patients' conditions before treating them with internal preparations, diet, and habit restrictions.

Ayurveda proposes the potential of using any substance as a drug is subject to its appropriate formulation and judicious administration. The same can be toxic if used improperly. Ayurveda always emphasizes safe treatment which includes alleviating the disease without instigating other diseases.[10] Hence, Ayurveda suggests to examine *Prakriti* (individual constitution), *Agni* (digestive capacity), *Dosha* (individual humors), *Bala* (physical endurance), *Avastha* (phase), etc. of the person before prescribing any medicine. *Ritu* (Season), *Kala* (time of drug administration), *Vaya* (age), *Desha* (location), *Satva* (mental status), *Satmya* (conduciveness of substance to a person), etc. also influence the selection of medicine.[11]

Self Medication of Spices: Apart from adding color, aroma and taste to food, spices have been known for their health benefits in India since ages, but it is observed that people are consuming Ayurvedic medicine without taking proper advice from Ayurveda Physicians and using them imprudently without proper knowledge about dose and method of administration.[12] The use of spices like turmeric, ginger, clove, etc for prevention of disease and self medication as home remedies to combat certain ailments has increased.[13] People are using spices as self medication by watching various videos and by searching about their health benefits online. Herbal tea, immune boosters and many commercial preparations are in demand, considering these spices as natural and hence, safe. which is untrue.[14]

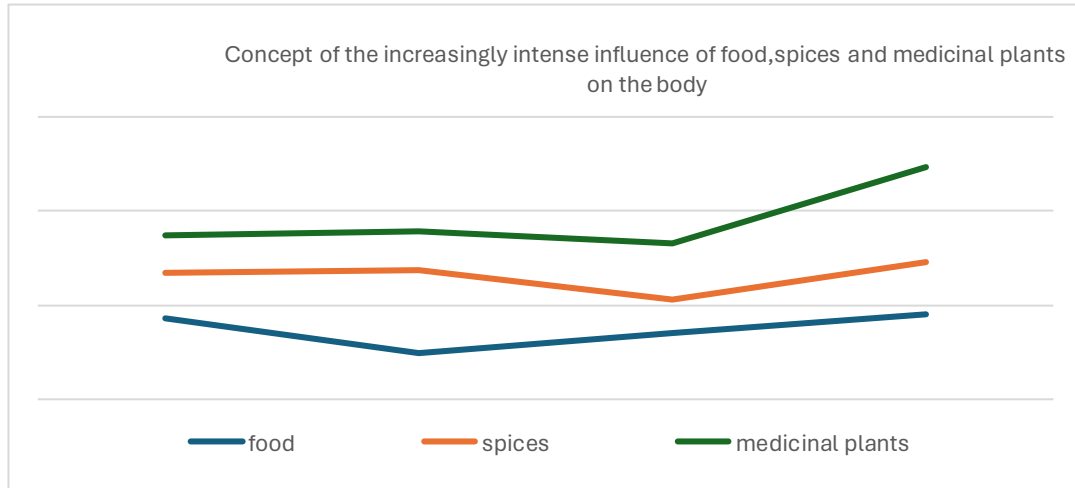


Figure 1. Concept of the increasingly intense influence of food, spices, and medicinal plants on the body.

Table no:1 showing possible Adversities of spices as per Ayurvedic Nighantu[15]:

N o.	Name	Latin Name	English Name	Part used	Rasa	Guna	Vipaka	Vir ya	Dose (pow der)/	Adversity
1	<i>Dhanyak</i>	<i>Coriandr um sativum</i>	Coriander	Whole Part, fruit	<i>Tikta, Madhura, Kashaya</i>	<i>Laghu, Snigdha</i>	<i>Madhura</i>	<i>U</i>	3-6gms	<i>Avrishya, Baddhavitak</i>
2	<i>Lavanga</i>	<i>Syzygium aromatic um</i>	Clove	Flower bud	<i>Tikta, Katu</i>	<i>Snigdha, Laghu, Tikshna</i>	<i>Katu</i>	<i>Sh</i>	1-2gms	-
3	<i>Sarshapa</i>	<i>Brassica Campestris</i>	Mustard/ Saraso	Seeds	<i>Katu</i>	<i>Laghu, Tikshna, Ruksha</i>	<i>Katu</i>	<i>U</i>	2-4gms	<i>Raktapittakrut, Drushtibasti pradushini</i>
4	<i>Dalchini</i> [9]	<i>Cinnamomum Zeylanicum</i>	Cinnamon	Stem Bark	<i>Katu, Tikta, Madhur</i>	<i>Laghu, Ruksha, Tikshna</i>	<i>Katu</i>	<i>U</i>	1-3gms	<i>Pitta Vriddhikar</i>
5	<i>Ela</i>	<i>Elettaria Cardamomum</i>	Cardamom	Fruit	<i>Katu, Madhur</i>	<i>Ruksha, Laghu</i>	<i>Madhura</i>	<i>Sh</i>	5-10gms	
6	<i>Jatiphala</i>	<i>Myristica Fragrans</i>	Nutmeg	Seed	<i>Tikta</i>	<i>Laghu, Tikshna</i>	<i>Katu</i>	<i>U</i>	½-1gms	<i>Grahi</i>

7	Saunf/Mishreya	Foeniculum vulgare	Fennel	Fruits	Madhura,Katu	Laghu,Snigdha	Katu	Sh	3-6gms	Shukranul
8	Hingu	Ferula Narthex	Asofoetida	Niryasa	Katu	Laghu,Snigdha	Katu	U	12-15gms	Pittavardhana
9	Javitri	Myristica dactyloides	Mace	Aril	Tikta,Katu	Laghu,Tikshna	Katu,Madhur	U	250mg-1gm	-
10	Krishna Jiraka	Carum Carvi	Caraway	Fruit	Katu	Tikshna	Katu	U	1-3gm	Vaanti Kruta
11	Haridra	Curcuma Longa	Turmeric	Rhizome	Katu.Tikta	Ruksha	Katu	U	1-3gm	-
12	Maricha	Piper Nigrum	Black Pepper	Fruit	Katu	Ruksha,Tikshna,Laghu	Katu	U	½-1gm	Avrishya,Pittakaraka
13	Aardrak	Zingiber officinale	Ginger	Rhizome	Katu	Snigdha	Katu	U	1-2gm	Avoid in Kushtha,Pandu,
14	Tulsi	Ocimum sanctum	Basil	flower	Katu,tikta	Laghu,ruksha	Katu	U	1-3gm	Daha,Pittakruta
15	Lashuna	Allium Sativum	Garlic	bulb	Katu	Tikshna,snigdha,laghu	Katu	U	3-6gm	PittaRatka vriddhikar
16	Jiraka	Cuminum cyminum	cumin	Fruit	Katu	Laghu,ruksha	Katu	U	3-6gm	Pittala,sangrahi
17	Shunthi	Zingiber officinale	Dry Ginger	Rhizome	Katu	Laghu,Snigdha	Madhur	U	1-2gm	Grahi
18	Methi	Trigonella foenumgraecum	Fenugreek seeds	seeds	Katu	Laghu,snigdha	Katu	U	1-3gm	Raktapitta prakopini
19	Ajamoda	Apium graveolens	Celery	Fruit	Katu,Tikta	Laghu,Ruksha,Tikshna	Katu	U	1-3gm	Vidahi,Baddhamala
20	Yavani	Ajowan	Trachyspermum ammi	Fruit	Katu,Tikta	Tikshna,Ruksha,Laghu	Katu	U	1-3gm	Pittala,Shukrahat

(U- Ushna; Sh- Sheeta)

Herb-Drug interaction:

1. *Ajmoda* (Celery)[16]: A patient taking celery tablets for Osteoarthritis showed reduced T4 levels, suggesting that it may reduce the level of thyroxine.

2. *Ardraka* (Ginger)[17]: Effectiveness of antacid may be decreased by Ginger. With Warfarin it increases the risk of bleeding. Ginger and Nifedipine showed antiplatelet effect therefore, should avoid in a person having bleeding tendency.

3. *Haridra* (Turmeric)[18]: Curcuma longa and Etoricoxib may potentiate adverse effects of the drug.⁷⁶ High dose of turmeric increased the drug level of Tacrolimus

4. *Lasuna*(Garlic)[19]: Garlic (*Allium sativum*) tablet with Clopidogrel reduced platelet hyperactivity in two patients. Warfarin and garlic increased international normalized ratio and clotting time. It reduced Atazanavir (HIV protease inhibitors) blood levels by more than 70%.

5. *Methika* (Fenugreek)[20] It can also interact with warfarin to cause bleeding.

Adverse effect of spices in clinical studies:

Though the adverse effects are less in the context of the number of subjects involved, they give the alarm to use drugs judiciously and also supports the textual references of Ayurveda regarding the cautious use of drugs.

1. *Ardraka* (Ginger)[21]: Large quantities cause heartburn, bleeding, cardiac arrhythmias, and CNS depression. Headache, abdominal

discomfort, diarrhoea, spontaneous abortion, intolerance, allergic reaction, dry retching, vomiting, belching, drowsiness, dizziness during pregnancy are reported. It is recommended to avoid in patients with thrombocytopenia, platelet function defects or coagulopathy.

2. *Ela* (Cardamom) [22]: Diarrhoea, mild inflammation of skin and glossitis are reported in few patient.

3. *Hingu* (*Asafoetida*)[23] : Large dose can lead to swelling of the mouth, flatulence, diarrhoea, anxiety, and headache. It is prohibited during pregnancy.⁵⁴ Cases of methemoglobinemia in infants are also reported.

4. *Jatiphala* (Nutmeg)[24]: A female ingested 15-24 g of nutmeg over a 3-hour period developed side effects. Nutmeg also showed significant sedative property and symptoms similar to alcohol intoxication.

5. *Lavanga* (Clove)[25]: A single case of ingestion of oil of cloves resulted in fits, and acute liver damage.

6. *Lasuna* (Garlic)[26]: Heartburn, flatulence, and gastrointestinal upset, contact dermatitis, post-operative bleeding, occupational asthma have also been reported occasionally.⁶⁰ Overuse is not recommended during pregnancy, lactation⁶¹ and surgery.

7. *Methika* (Fenugreek)[27]: Nausea, vomiting, diarrhoea, and flatulence are reported along with allergic reactions, exacerbation of asthma, decrease in serum potassium is also reported

with the use of seeds. Adverse effects are also recorded by 38 lactating mothers.

8. *Tulasi* (Basil)[28]: Transient mild nausea was reported in 13 weeks clinical study conducted in 16 obese adults

9. *Twak* (Cinnamon)[29]: Reported with gastrointestinal disorders and allergic reactions in some cases reported in 5 clinical studies. Hypoglycemia, tachycardia, and arrhythmia are reported with overdose in pregnancy. Nausea, cold sweating, palpitations, trembling, were reported in a 76 years old lady.

10. *Yavani* (Ajowan)[30]: It is reported for its use in abortion, therefore should be used with caution during pregnancy.

DISCUSSION:

1. Importance of pharmacological properties of spices:

According to Ayurveda, the drug exhibits its action either by its *Rasa* (Taste), *Guna* (Property), *Vipaka* (Post digestive effect), *Virya* (Potency), or *Prabhava* (exceptional activity). It is evident from the table that most of the spices are having *Katu Rasa* (pungent taste), *Katu Vipaka* (Pungent-post digestive effect) and *Ushna Virya* (Hot potency)[31].

Katu Rasa performs gustatory stimulation action and thus are sialagogues. Spices are mostly *Laghu* and *Ushna* in properties, *Ushna* in *Virya* and *Katu* in *Vipaka* and thus they increase digestive fire and performs *Deepana* and

Pachana Karma. Some spices works as *Rasayan* also by virtue of its properties.[32]

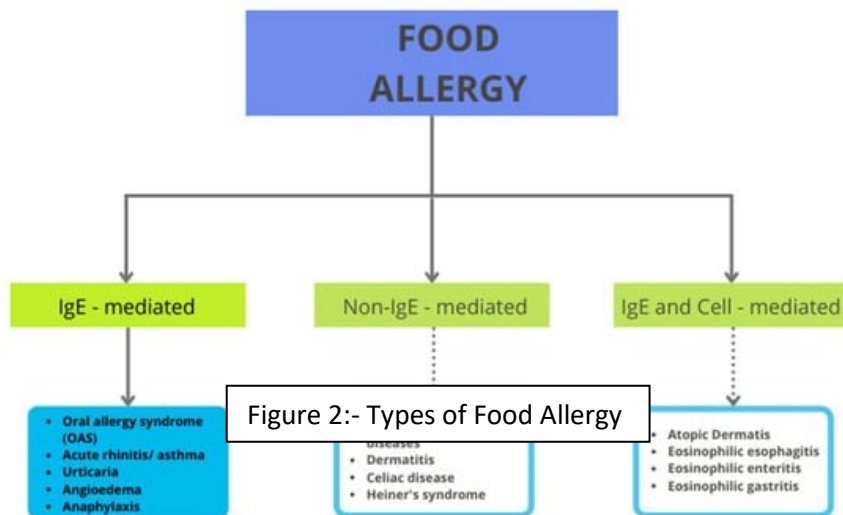
Doshaprakopa (Vitiating of *Dosha*)[31] *Katu Rasa* predominant drugs vitiate *Pitta Dosha*, in certain conditions. So overconsumption of *Katu Rasa* and *Ushna Veerya* predominant spicy food (Spices with hot potency), by *Pitta* predominant *Prakriti* in *Ushna Kala* (Summer season) may be one of the causative factor of many diseases.[33]

2. Mode of action of spices:

Indian spices serve various medicinal functions such as food additives, laxatives, preservatives, expectorant, purgative, diuretic, flavoring agents etc.[34] These all activities are due to potential active constituents such as flavonoids, terpenes, anthocyanine, phenylpropanoids etc. present in them. Many spices have a wide range of biologically active constituents and their synergistic action is helpful in enhancing human health and combating various diseases.[35]

3. Concept of Food Allergy:

Occupational contact dermatitis is the most frequent Type IV reaction with spices, while rhinitis, bronchial asthma, gastrointestinal symptoms, oral allergy syndrome, and anaphylactic shock are the consequences of IgE-mediated Type I reactions which may occur with spices.[36] The best known cross-reactivity is the so-called celery-mugwort spice syndrome.



4.Safety Concerns of Ayurveda: In Ayurveda, the drug is extensively described with all its properties, actions, and possible undesirable effects, prone to specific *Prakriti* (constitution of person) and specific conditions. Many of its desired action could be harmful effects in certain conditions, e.g. *Grahi/Stambhana* (absorptive/ constipation) action may be harmful in person already suffering from constipation. Hence, it is highly recommended to seek proper guidance from physicians of Ayurveda because selection of the drug is based on the tolerance and strength of the individual[37]. Safety is given utmost importance in Ayurveda and individualized treatment is recommended for more precise benefit. The spices are inevitable part of the food, but when they are taken as medicine its dose increases which makes it prone to produce adverse effects.

If any medicine is taken in excess or in long term in normal dose without considering factors *Prakriti, Desha, Kala*, etc it may lead to

undesirable effects, and to avoid this, treatment based on the fundamental principles of Ayurveda should be prescribed, e.g. person having *Pitta* and *Vataprakriti*, *Pitta Dosha* predominant diseases, *Tikshnagni* (intense state of *Agni*),[38]should take spices in minimum dose range, co-administer with *Sharkara* (sugar), *Ghrit* (clarified butter), *Draksha*, etc. to neutralize the dominance of *Ushna Virya* (Hot potency) of drugs specifically in summer season to avoid any undesirable effect and may opt drugs with *Shita Virya* (Cold Potency) like *Twak* (Cinnamon), *Dhanyaka* (Coriander), etc. based on the concept of *Hetuviparita Chikitsa* (cause opposing treatment).[39]Children, elderly people residing in dry and hot climatic conditions, weak person, pregnant and lactating women should use spices as per their suitability with a minimum range of dose.[40] Along with the above stated parameters, *Dinacharya* (proper daily regimen) and *Ritucharya*(seasonal regimen), exercise, diet, sleep should be followed to get the maximum benefit from

spices, which are being used as home remedies.[41]

CONCLUSION:

From the above discussion, it is clear that many factors must be considered in prescribing or taking ayurvedic medicine. Despite the fact that ayurvedic medicines are based on natural herbal materials, their safety depends on their dose, method of administration and duration taking account of individuals' needs and their specific disease conditions. Ayurveda recommends considering the factors like *Dosha* (individual humours), *Prakriti* (individual constitution), *Desha* (Location), *Kala* (time), *Vaya* (age), *Agni* (digestive capacity), etc. while consuming any drug. The unguided consumption of ayurvedic preparations, in the mistaken belief that spices and herbs will necessarily be safe, may lead to serious health issues.

REFERENCES:

1. Anilakumar K R, Saritha V, Khanum F, Bawa A S. Ameliorative effect of ajwain extract on hexachlorocyclohexane-induced lipid peroxidation in rat liver. Food Chem Toxicol. 2009; 47: 279-282.
2. Anilakumar K R, Saritha V, Khanum F, Bawa A S. Effect of coriander seed powder on 1,2-dimethyl hydrazine-induced changes in antioxidant enzyme system and lipid peroxides in rats. J Dietary Supplements. 2010; 7: 9-20.
3. Ravindran PN, Nirmal K, Sivaraman K. Turmeric. The golden spice of life. In: Turmeric. The Genus Curcuma. Boca Raton, FL, USA: CRC Press; 2007, 1-14.
4. Chattopadhyay I, Biswas K, Bandyopadhyay U, Banerjee RK. Turmeric and curcumin: Biological

actions and medicinal applications. Curr Sci India 2004; 87:44-53.

5. Ammon HP, Anazodo MI, Safayhi H, Dhawan BN, Srimal RC. Curcumin. A potent inhibitor of leukotriene B4 formation in rat peritoneal polymorphonuclear neutrophils (PMNL). Planta Med 1992; 58: 226.

6. Yadavaji Trikamaji(editor).Commentary: Ayurveda Dipika of Chakrapani on Charaka Samhita of Charaka, Sutrasthana,Chapter no 26,verse no 12,2nd edition ,Varanasi; Caukhambha Surbharati Prakashana;2009:142.

7. Yadavaji Trikamaji and Narayana Ram Kavyatirtha(editor).Commentary: Nibandhasangraha by Dalhanacharya and NyayachandrikaPanjika of Gayadasacharyaa on Sushruta Samhita of Sushruta, Chikitsasthana,Chapter no 3,Verse no 4,2nd edition,Varanasi; Chaukhamba Surabharati Prakashana;2008:112.

8. Hari Sadashiva Shastri Paradakara(editor).Commentary: Sarvangasundara of Arunadatta and Ayurvedarasayana of Hemadri on Ashtanga Hridaya on Vagbhata,Sutrasthana,Chapter no 12,verse no 51,2nd edition,Varanasi; Chaukhamba Surbharati Prakashan;2007:95

9. Parshuram Shastri(editor).Commentary: Gudharthadipika Sanskrit on Sharngadhara Samhita of Sharngadhara,Madhyam Khanda,7th edition,Varanasi; Chaukhambha Orientalia,2008

10. Yadavaji Trikamaji(editor).Commentary: Ayurveda Dipika of Chakrapani on Charaka Samhita of Charaka, Sutrasthana,Chapter no 2,verse no 17,2nd edition ,Varanasi; Caukhambha Surbharati Prakashana;2009:26.

11. Pandey G.S(editor).Commentary: Chunekar K.C on Bhavprakash Nighantu of Bhavprakash, Chaukhamba Bharti Academy,2018

Prachi Sanjayji Ghodeswar, Sumeeta S. Jain. Therapeutic potential of culinary spices: applications, efficacy, and optimal dosage - A review. *Jour. of Ayurveda & Holistic Medicine*, Vol.-XII, Issue-IV (April 2024).

12. Ammon HP, Wahl MA. Pharmacology of Curcuma longa. *Planta Med* 1991; 57:1-7.
13. Sharma .P.V. Dravyaguna Vigyana, Chaukhambha Bharati Academy, Varanasi: 1996, 719
14. Kumar S, Kamboj J, Suman, Sharma S. Overview for various aspects of the health benefits of Piper longum Linn. fruit. *J Acupunct Meridian Stud.* 2011; 4(2):134-40.
15. Rastogi S, Pandey DN, Singh RH. COVID-19 pandemic: A pragmatic plan for ayurveda intervention. *Journal of Ayurveda and Integrative medicine.* April 23, 2020
16. Liu Q, Meng X, Li Y, Zhao CN, Tang GY, Li HB. Antibacterial and Antifungal Activities of Spices. *Int J Mol Sci.* 2017; 16:18(6)-1283.
17. Kochhar KP. Dietary spices in health and diseases (II). *Indian J Physiol Pharmacol.* 2008; 52(4):327-54.
18. Joshi K. Phytopharmacological study on certain Katu Rasa Predominant plants w.r.t Atiyoga. [dissertation] MD thesis: Gujarat Ayurveda University Jamnagar; 2012
19. Sharma .P.V. Dravyaguna Vigyana, Chaukhambha Bharati Academy, Varanasi: 1996, 719
20. Bernard GT, Esteban P, Christopher JS. Turmerones: Isolation from turmeric and their structure determination. *Chem Commun* 1982; 6: 363.
21. Sachan AK, Doli R. Das, Kumar Mukesh. Carum carvi An important medicinal plant. *Journal of Chemical and Pharmaceutical Research* 2016; 8(3): 529-533.
22. Khajehdehi P. Turmeric: Reemerging of a neglected Asian traditional remedy. *J Nephrothol* 2012; 1(1): 17- 22.
23. Coronavirus myth-vs-fact whatsapp forward claiming turmeric and black pepper home remedy to cure covid 19 is fake. <https://timesofindia.indiatimes.com/life-style/health-fitness/healthnews/>. Accessed November 15, 2020.
24. Spices under the purview of the spices board. <http://indianspices.com/sites>. Accessed November 15, 2020.
25. Sharma R and Lal D. Effect of dahi preparation on some water-soluble vitamins. *Indian J Dairy Sci* 1997; 50: 318- 20.
26. Singh G, Kawatra A and Sehgal S. Nutritional composition of selected green leafy vegetables, herbs and carrots. *Plant Foods Human Nutr* 2001; 56: 359-64.
27. Sachan AK, Kumar A. Stability testing of herbal products. *Journal of Chemical Pharmaceutical Research* 2015; 7(12) 511-514.
28. Dey YN, Kumari S, Ota S, Srikanth N. Phytopharmacological review of *Andrographis paniculata* (Burm.f) Wall. ex Nees. *Int J Nutr Pharmacol Neurol Dis.* 2013; 3:3-10.
29. Modha J. Ayurveda: adverse drug reaction of ayurveda medicines. <http://www.boloji.com/index.cfm?md¼Content&sd¼Articles&ArticleID¼1103>. Accessed June 29, 2016.
30. Bauer R, Tittel G. Quality assessment of herbal preparations as a precondition of pharmacological and clinical studies. *Phytomedicine.* 1996; 2:193-198.
31. Krebs NF. Bioavailability of dietary supplements and impact of physiologic state: infants, children and adolescents. *J Nutr.* 2001; 131:1351S-1354S.
32. Youdim KA, Shukitt-Hale B, Joseph JA. Flavonoids and the brain: interactions at the blood-brain barrier and their physiological effects on the central nervous system. *Free Radic Biol Med.* 2004; 37:1683-1693.
33. Reddy VC, Vidya Sagar GV, Sreeramulu D, Venu L, Raghunath M. Addition of milk does not alter the antioxidant activity of black tea. *Ann Nutr Metab.* 2005; 49:189-195.

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34. Shukla SD, Bhatnagar M, Khurana S. Critical evaluation of ayurvedic plants for stimulating intrinsic antioxidant response. *Front Neurosci*. 2012;6:112.

35. Atal CK, Zutshi U, Rao PG. Scientific evidence on the role of ayurvedic herbals on bioavailability of drugs. *J Ethnopharmacol*. 1981;4:229-232.

36. Williamson G1, Manach C. Bioavailability and bioefficacy of polyphenols in humans. II. Review of 93 intervention studies. *Am J Clin Nutr*. 2005;81:243S-255S

37. Sachan AK, Doli R Das, Senah L Dohare, Shuaib, Mohd. *Asparagus racemosus* (Shatavari): An Overview. *International journal of pharmaceutical and chemical sciences* 2012; 1(3) 588-592.

38. Muhammad N, Anwar G, Gilani H and Janssen JJ. Ginger attenuates acetylcholine-induced contraction and Ca²⁺ signalling in murine airway smooth muscle cells. *Can J Physiol Pharmacol* 2008; 86(5): 264-271.

39. Maqsood S, Singh P, Samoon MH, Munir K. Emerging role of immunostimulants in combating the disease outbreak in aquaculture. *International Aquatic Research* 2011; 3: 147-163.

29. Szallasi A. Piperine: Researchers discover new flavor in an ancient spice. *Trends Pharmacol. Sci* 2005; 26(9): 437-439.

40. Martins N, Petropoulos S, Ferreira IC. Chemical composition and bioactive compounds of garlic (*Allium sativum* L.) as affected by pre-and post-harvest conditions: A review. *Food Chemistry*. 2016;211:41-50.

27. Natalia Martins B, Spyridon Petropoulos, Isabel CFR. Ferreira. Chemical composition and bioactive compounds of garlic (*Allium sativum* L.) as affected by pre- and postharvest conditions: A review. *Food Chemistry*. 2016;211:41-50.

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