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Dietary Capsaicin and Immune System

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Abstract
Capsaicin is a chemical compound that was initially isolated from chili peppers in a crystalline form. It was discovered that capsaicin caused a burning sensation in the mucous membranes of the oral cavity and the gastrointestinal tract . In addition, it increases the secretion of gastric acid and stimulates the nerve endings in the skinHot foods, such as peppers and sauces, contain an ingredient called capsaicin. Capsaicin can be a very effective pain reliever and is even used topically for neuropathy pain. Hot peppers can boost your immune system, helping to ward off germs that can cause illness. Capsaicin is an active component of the immune System

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modulation and is an essential component of chilli peppers. They have also shown beneficial properties on organs in maintaining their health and condition Studies on capsaicin's / chilli peppers efficacy in modulation of immune system, its anti-inflammatory properly, maintaining organ health, anti - carcinogen effects are collected and analysed. Besides having anticarcinogenic properties and killing tumor cells, capsaicin has been identified to have immune-modulating properties, being able to activate DCs through vanilloid receptor 1 (VR1). Previous studies showing its role in immunity, immune responses, reducing insulin spikes in diabetes are focused on. The mechanism of action of capsaicin on the human immune system discussed . Study concludes by providing knowledge regarding the potential of capsaicin and its sale as a potent immune booster.

Key words: - dietary capsaicin, immune system, chilli peppers, health benefits, organ junction, chemopreventive function.

Introduction

The chilli pepper had already acquired a long history of use for medical, culinary and military purposes in Central and South America when Columbus got it to Europe in the 15th Century. It is a native plant in the Western hemisphere. These plants of the genus capsicum belong to the solanaceae family. The most widely adopted family of plants to come from the western hemisphere, it includes tomato, potato and tobacco plants. (1,2). The pungent principle of chilli peppers is a mixture of closely related compounds called capsinoids . The chief among these compounds is the capsaicin, which is known by the Chemical name N-4 - hydroxy - 3-methoxyphenyl - 8 methyl - 6 - nonemide. The compounds are responsible for the heat-generation action .(3). There is a wide range of "heal- associated with the species and rarities of capsicum . The biological benefits of capsaicin are related to its interactions with callous neural receptors. The " hot" sensation while eating chillies arises because of the interaction of the capsaicin with the nocireceptors surrounding the taste sensors of the mouth. It has been suggested that the attraction to foods containing capsaicin on other pain inflicting compounds results in the release of endorphins when the pain sensation arises from their heat sensors. (4)(5,6). The previous studies show capsaicin effect in modulation of immune responses.. Studies by Yu. R et al showing the overall health benefits of dietary capsaicin.The capacity of dietary capsaicin four dietary Strategies to improve health has increased. Similar studies by R Clark (2016) elaborates on the anticancer properties of capsaicin which acts potently against- human cancer. Another study by Berk T in 2000 focuses on the hot peppers and i's content- of vitamin A and Vitamin C which helps in boosting the immune system effectively and helps to ward off germs causing illness. It has also shown significant benefits in dealing congestion and phlegm. Similar studies by Singletary explain the various dietary sources of capsaicin containing foods and explain the properties and mechanism to various benefits offered. (7–9). Capsaicin has known to reduce risks of organ dysfunction and keep a healthy body - functional stale. Dietary capsaicin Shows significant features to enhance and boost the immune system. It also showed a

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potential factor to improve cardiac health, It has also been suggested of its analgesic, antipyretic and anti-inflammatory properties. (10)

The perspective that needs to be considered is that it can cause irritation to the mouth, stomach, intestines, some people may develop vomiting ,diarrhoea and coughing. These are the observed effects due to excess capsaicin incorporated. Study by AMBode (2011) elaborates on the two faces of capsaicin showing the harmful effects pertaining to the negative face . It was shown to induce nausea, abdominal pain and in extreme cases even death. Considering the serious harmful effects it can cause, it has been found that the minimal lethal dose of capsaicin is 100 milligrams / kg body weight. It also has the capacity of reducing the density of epidermal naive fibres in a reversible fashion, hence it has effects on muscles as well . Exposure of capsaicin to the eye produces tearring, pain, conjunctivitis and blepharospasm.(11). The study focuses on the various health benefits offered by capsaicin and it's wale in modulation of the immune system The study elaborates on its anti inflammatory property, organ benefits and immune system. On analysing the various nutritional benefits of capsaicin , it is known to have the potential to reduce oxidative stress, which is a major factor behind a weak immune system. It is concluded that the phytochemical present can strengthen your immune system and immune cells to effectively fight- against- pathogens. Consuming a controlled substance, peppers included in daily intake can maintain overall health .(12).Our team has rich experience in research and we have collaborated with numerous authors over various topics in the past decade (13–37). Our institution is also passionate about high quality evidence based research and has excelled in various fields ((38–48)

The study aims at the array of health benefits by capsaicin and maintaining a healthy body.

Materials and methods

The study includes a detailed analysis of review and literature of about 33 articles emphasising on the sources of capsaicin, ingestion effects, health benefits, immune boosting capacity of capsaicin, quantity of capsaicin for potential benefits and it's mechanism of action.The detailed study involves the article collection from search engines including Google scholar and pubmed . The articles are chosen based on their accuracy to the factors of capsaicin boosting immune response. Articles collected are based on health benefits and immune modulating capacity.Inclusion criteria for the study includes articles collected from 1996- 2020, articles related to health benefits, uses, effects, immune system and capsaicin, sources, history, potential effects.Exclusion criteria for the study includes the articles that explain the topical uses, harmful effects on overuse , its effect on topical applications, methods to extract medicinal capsaicin, and irrelevant data.

Dietary sources of capsaicin

Capsaicin is present in peppers produced by curtain pepper plants including varieties called cayenne, green on red chilli, spur or tabasco peppers . Hot peppers, and other dietary sources

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include bell, cherry, cone, green /red Paprika . The hot peppers are known to contain 198,000 parts per million of capsaicin . The other sources contain about 4000 parts per million of capsaicin. (49)(50)(51). Ginger also contains capsaicin but in trace amounts. The dietary capsaicin transmits pain and heat, explaining its effect on the tissues of the oral cavity .Other sources of capsaicin containing pepper include sweet peppers because they are not spicy, but they contain capsaicin. Sweet peppers are produced by a pepper plant (capsicum annum). Common dietary sources- chilli peppers, hot chilli, jalapeno, piri-piri, habanero peppers , pepperoni, peppers rich in carotenoids. are all excellent sources. (52,53)

Health benefits

Spicy peppers / chilli peppers containing capsaicin have been used by American Indians for thousands of years. Modern research suggests that consuming capsaicin-rich peppers may have significant health benefits. Studies suggested that capsaicin helps control diabetes and lowers the risk of type-2 diabetes (54)(55). Some studies have shown potential benefits like warding off germs, kills bacteria , anti- immune modulatory effect, antipyretic effect, improves digestion, metabolism, triggers immune response, improves gut health (56,57). A study by European Journal of clinical Nutrition found that some men who consumed chilli peppered in accurate quantities for four weeks showed lower resting heart rate and improvement in other markers of heart function. Hence capsaicin thereby shows significant health benefits and also improves organ function . A good immune system is a sign of a healthy body, capsaicin fulfils the criteria of enhancing body function (58)(59)(60).

Modulation of immune system and mechanism of action

Capsaicin has been essential to our understanding of physiological and pathological processes as well as relevance of TRPV1 Channels. Pharmaceutical formulations involving or targeting the capsaicin - activated receptor TRPV1 (61). Capsaicin causes neurogenic inflammation and has analgesic and anti-inflammatory activities. Dendritic cells, a key cell type in immune responses, have the receptor for capsaicin, and involvement of this receptor has powerful immune consequences. Capsaicin thereby triggers the immune system and reacts with the cells of the immune system to fight conditions (62,63).

Capsaicin - Efficient for chronic conditions

The diverse potential of capsaicin and its mason health benefits and effects on the immune system being discussed This chapter suggests the various chronic conditions that capsaicin is capable of treating. Some conditions include: Rheumatic diseases - rheumatoid arthritis, chronic inflammatory conditions , arthritis, gastrointestinal disorders, improves blood circulation. Capsaicin is an effective antidepressant, it lowers blood pressure, helps treat autoimmune diseases, promotes weight loss. Capsaicin containing foods are Capable of lowering blood cholesterol levels, and improve blood flow(64–66)(67).

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Capsaicin and gut health

Chilli peppers and spicy foods are probably the last preferred foods in cases of stomach ulcer or any discomfort in the gastrointestinal tract. The medical advice for people who have digestion problems is to avoid spicy/hot foods . The actual fact being spicy foods can actually heal the lining of the stomach and slower the production of excess acid. (68)(69)

In fact, researches show that eating chilli peppers may even lower the fire list of ulcers . Chills and gingers have known to reduce stomach inflammation and treat gut - related diseases . The capsaicin containing foods improve bowel movement and help in treating gut- associated diseases like irritated bowel movement, constipation, inflammatory bowel disease. .(70–72)(73)(74)

Chemopreventive property of Capsaicin

The anti-oxidant-, anti-inflammatory and immune-modulatory effect of Capsaicin might be related to 965 Chemopreventive property. Capsaicin has bioactive phytochemical in abundance In sources of red chilli and chilli peppers.(75). Capsaicin induces apoptosis, inhibition-migration, proliferation and invasion of tumours .(76–78)(79). Capsaicin can be beneficial for a number of cancers like being cancers, breast cancers, stomach cancers, colorectal, cervix, prostate and breast cancers (80–82)**.**

Future scope

The brief overview shows the potential benefits of dietary capsaicin, which would encourage the future of incorporation of capsaicin in the diet regularly with the adequate quantities to obtain the desired benefits. Many researches have been put forth to treat various diseases like Poly cystic ovarian disease(83) and breast cancer(84) , infections including stye (85), leprosy (86). It can be by enhancing its immune properties and makes it a potential dietary source , especially for people in countries where diet including capsaicin rich foods is very minimal. Personal protective equipments like mask helps in prevention of spreading airborne disease (87)

Conclusion

Capsaicin contains phytochemical that exhibit numerous characteristics including anti-inflammatory activity, if it reduces the likelihood of inflammatory conditions like asthma, chronic peptic ulcer . From the detailed analysis of studies and exports, a conclusion can be drawn that capsaicin has a significant and potent role in immune boosting property They are rich in Vitamin A and C, bioactive phytochemicals, fights pathogens and strengthens immune cells. As a healthy immune system is a sign of a healthy body, capsaicin Provides the necessary benefit.

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Author contribution:
V Sri Sreshtaa , execution of the work, data collection,drafting of manuscript . Dr Leslie Rani : Concept and design of the study, validation of the data collection, revision and proof-reading of the review. Anjaneyulu K : validation of the data collection. Dr BrundhaMP : Revision and proof-reading of the review

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References

1. Shieh S, Berke T. Capsicum, chillies, paprika, bird's eye chilli [Internet]. Handbook of Herbs and Spices. 2001. Available from: http://dx.doi.org/10.1201/9781439823002.ch8

2. Berke TG, Shieh SC. Capsicum, chillies, paprika, bird's eye chilli [Internet]. Handbook of Herbs and Spices. 2001. p. 111–22. Available from: http://dx.doi.org/10.1533/9781855736450.111

3. Sullivan KM, Bramlage WJ. Chilling Injury of Chile Peppers (Capsicum annuum L.) [Internet]. Vol. 35, HortScience. 2000. p. 829B – 829. Available from: http://dx.doi.org/10.21273/hortsci.35.5.829b

4. Derivative of chilli peppers could help muscle pain [Internet]. Vol. 18, Nursing Standard. 2004. p. 10–10. Available from: http://dx.doi.org/10.7748/ns.18.39.10.s27

5. Website [Internet]. [cited 2020 Jun 11]. Available from: https://www.scopus.com/record/display. uri?origin=recordpage&eid=2-s2.0- 84989287584

6. Website [Internet]. [cited 2020 Jun 11]. Available from: https://www.scopus.com/record/display. uri?origin=recordpage&eid=2-s2.0- 84944874047

7. Andrews J. Chilli Peppers [Internet]. The Cambridge World History of Food. 2000. p. 281–8. Available from: http://dx.doi.org/10.1017/chol9780521402149.030

8. Liu TC. Cell metabolism: Chilli peppers have their benefits [Internet]. Nature China. 2010. Available from: http://dx.doi.org/10.1038/nchina.2010.96

9. Ram RC, Sinha A. Microbial Diversity: Modern Trends. Daya Books; 2007. 313 p.

10. Mozsik G, Takeuchi K, Salam OA-. Capsaicin - Sensitive Neural Afferentation and the Gastrointestinal Tract: from Bench to Bedside. BoD – Books on Demand; 2014. 380 p.

11. Preethikaa S, Brundha MP. Awareness of diabetes mellitus among general population [Internet]. Vol. 11, Research Journal of Pharmacy and Technology. 2018. p. 1825.

Available from: http://dx.doi.org/10.5958/0974-360x.2018.00339.6

12. Tanrıkulu-Küçük S, Başaran-Küçükgergin C, Söğüt İ, Tunçdemir M, Doğru-Abbasoğlu S, Seyithanoğlu M, et al. Dietary curcumin and capsaicin: Relationship with hepatic oxidative stress and apoptosis in rats fed a high fat diet. Adv Clin Exp Med. 2019 Aug;28(8):1013–20.

13. Duraisamy R, Krishnan CS, Ramasubramanian H, Sampathkumar J, Mariappan S, NavarasampattiSivaprakasam A. Compatibility of Nonoriginal Abutments With Implants: Evaluation of Microgap at the Implant-Abutment Interface, With Original and Nonoriginal Abutments. Implant Dent. 2019 Jun;28(3):289–95.

14. Ariga P, Nallaswamy D, Jain AR, Ganapathy DM. Determination of correlation of width of Maxillary Anterior Teeth using Extraoral and Intraoral Factors in Indian Population: A systematic review. World J Dent. 2018 Feb;9(1):68–75.

15. Kannan A, Venugopalan S. A systematic review on the effect of use of impregnated retraction cords on gingiva. J Adv Pharm Technol Res. 2018;11(5):2121.

16. Basha FYS, Ganapathy D, Venugopalan S. Oral hygiene status among pregnant women. J Adv Pharm Technol Res. 2018;11(7):3099.

17. Rajakeerthi, Ms N. Natural Product as the Storage medium for an avulsed tooth – A Systematic Review. CumhurÜnivDişHekimFakderg. 2019 Jun 11;22(2):249–56.

18. Teja KV, Ramesh S, Priya V. Regulation of matrix metalloproteinase-3 gene expression in inflammation: A molecular study. J Conserv Dent. 2018 Nov;21(6):592–6.

19. Menon S, Ks SD, R S, S R, S VK. Selenium nanoparticles: A potent chemotherapeutic agent and an elucidation of its mechanism. Colloids Surf B Biointerfaces. 2018 Oct 1;170:280–92.

20. Siddique R, Sureshbabu NM, Somasundaram J, Jacob B, Selvam D. Qualitative and quantitative analysis of precipitate formation following interaction of chlorhexidine with sodium hypochlorite, neem, and tulsi. J Conserv Dent. 2019 Jan;22(1):40–7.

21. Nandakumar M, Nasim I. Comparative evaluation of grape seed and cranberry extracts in preventing enamel erosion: An optical emission spectrometric analysis. J Conserv Dent. 2018 Sep;21(5):516–20.

22. Manohar MP, Sharma S. A survey of the knowledge, attitude, and awareness about the principal choice of intracanal medicaments among the general dental practitioners and nonendodontic specialists. Indian J Dent Res. 2018 Nov;29(6):716–20.

23. Hema Shree K, Ramani P, Sherlin H, Sukumaran G, Jeyaraj G, Don KR, et al. Saliva as a Diagnostic Tool in Oral Squamous Cell Carcinoma - a Systematic Review with Meta Analysis. Pathol Oncol Res. 2019 Apr;25(2):447–53.

24. Rajendran R, Kunjusankaran RN, Sandhya R, Anilkumar A, Santhosh R, Patil SR. Comparative evaluation of remineralizing potential of a paste containing bioactive glass and a topical cream containing casein phosphopeptide-amorphous calcium phosphate: An in vitro study. Pesqui Bras Odontopediatria Clin Integr. 2019;19(1):1–10.

25. Gheena S, Ezhilarasan D. Syringic acid triggers reactive oxygen species-mediated cytotoxicity in HepG2 cells. Hum Exp Toxicol. 2019 Jun;38(6):694–702.

26. Hussainy SN, Nasim I, Thomas T, Ranjan M. Clinical performance of resin-modified glass ionomer cement, flowable composite, and polyacid-modified resin composite in noncarious cervical lesions: One-year follow-up. J Conserv Dent. 2018 Sep;21(5):510–5.

27. Hannah R, Ramani P, Herald. J. Sherlin, Ranjith G, Ramasubramanian A, Jayaraj G, et al. Awareness about the use, ethics and scope of dental photography among undergraduate dental students dentist behind the lens. J Adv Pharm Technol Res. 2018;11(3):1012.

28. Sharma P, Mehta M, Dhanjal DS, Kaur S, Gupta G, Singh H, et al. Emerging trends in the novel drug delivery approaches for the treatment of lung cancer. Chem Biol Interact. 2019 Aug 25;309:108720.

29. Ravinthar K, Jayalakshmi. Recent advancements in laminates and veneers in dentistry. J Adv Pharm Technol Res. 2018;11(2):785.

30. Jose J, Ajitha, Subbaiyan H. Different treatment modalities followed by dental practitioners for Ellis class 2 fracture – A questionnaire-based survey. Open Dent J. 2020 Feb 18;14(1):59–65.

31. Sekar D, Lakshmanan G, Mani P, Biruntha M. Methylation-dependent circulating microRNA 510 in preeclampsia patients. Hypertens Res. 2019 Oct;42(10):1647–8.

32. Kumar D, Antony SDP. Calcified canal and negotiation-A review. J Adv Pharm Technol Res. 2018;11(8):3727.

33. Johnson J, Lakshmanan G, M B, R M V, Kalimuthu K, Sekar D. Computational identification of MiRNA-7110 from pulmonary arterial hypertension (PAH) ESTs: a new microRNA that links diabetes and PAH. Hypertens Res. 2020 Apr;43(4):360–2.

34. Janani K, Palanivelu A, Sandhya R. Diagnostic accuracy of dental pulse oximeter with customized sensor holder, thermal test and electric pulp test for the evaluation of pulp

vitality: an in vivo study. Braz Dent Sci [Internet]. 2020 Jan 31;23(1). Available from: https://bds.ict.unesp.br/index.php/cob/article/view/1805

35. Seppan P, Muhammed I, Mohanraj KG, Lakshmanan G, Premavathy D, Muthu SJ, et al. Therapeutic potential of Mucuna pruriens (Linn.) on ageing induced damage in dorsal nerve of the penis and its implication on erectile function: an experimental study using albino rats. Aging Male. 2018 Feb 15;1–14.

36. Jeevanandan G, Govindaraju L. Clinical comparison of Kedo-S paediatric rotary files vs manual instrumentation for root canal preparation in primary molars: a double blinded randomised clinical trial. Eur Arch Paediatr Dent. 2018 Aug;19(4):273–8.

37. Nandhini JST, Babu KY, Mohanraj KG. Size, shape, prominence and localization of gerdy's tubercle in dry human tibial bones. J Adv Pharm Technol Res. 2018;11(8):3604.

38. VijayashreePriyadharsini J. In silico validation of the non-antibiotic drugs acetaminophen and ibuprofen as antibacterial agents against red complex pathogens. J Periodontol. 2019 Dec;90(12):1441–8.

39. Pc J, Marimuthu T, Devadoss P. Prevalence and measurement of anterior loop of the mandibular canal using CBCT: A cross sectional study. Clin Implant Dent Relat Res [Internet]. 2018; Available from: https://europepmc.org/article/med/29624863

40. Ramesh A, Varghese S, Jayakumar ND, Malaiappan S. Comparative estimation of sulfiredoxin levels between chronic periodontitis and healthy patients - A case-control study. J Periodontol. 2018 Oct;89(10):1241–8.

41. Ramadurai N, Gurunathan D, Samuel AV, Subramanian E, Rodrigues SJL. Effectiveness of 2% Articaine as an anesthetic agent in children: randomized controlled trial. Clin Oral Investig. 2019 Sep;23(9):3543–50.

42. Sridharan G, Ramani P, Patankar S, Vijayaraghavan R. Evaluation of salivary metabolomics in oral leukoplakia and oral squamous cell carcinoma. J Oral Pathol Med. 2019 Apr;48(4):299–306.

43. Ezhilarasan D, Apoorva VS, Ashok Vardhan N. Syzygiumcumini extract induced reactive oxygen species-mediated apoptosis in human oral squamous carcinoma cells. J Oral Pathol Med. 2019 Feb;48(2):115–21.

44. Mathew MG, Samuel SR, Soni AJ, Roopa KB. Evaluation of adhesion of Streptococcus mutans, plaque accumulation on zirconia and stainless steel crowns, and surrounding gingival inflammation in primary molars: Randomized controlled trial. Clin Oral Investig. 2020;1–6.

45. Samuel SR. Can 5-year-olds sensibly self-report the impact of developmental enamel defects on their quality of life? Int J Paediatr Dent. 2021 Mar;31(2):285–6.

46. R H, Hannah R, Ramani P, Ramanathan A, R JM, Gheena S, et al. CYP2 C9 polymorphism among patients with oral squamous cell carcinoma and its role in altering the metabolism of benzo[a]pyrene [Internet]. Vol. 130, Oral Surgery, Oral Medicine, Oral Pathology and Oral Radiology. 2020. p. 306–12. Available from: http://dx.doi.org/10.1016/j.oooo.2020.06.021

47. Chandrasekar R, Chandrasekhar S, Sundari KKS, Ravi P. Development and validation of a formula for objective assessment of cervical vertebral bone age. Prog Orthod. 2020 Oct 12;21(1):38.

48. VijayashreePriyadharsini J, SmilineGirija AS, Paramasivam A. In silico analysis of virulence genes in an emerging dental pathogen A. baumannii and related species. Arch Oral Biol. 2018 Oct;94:93–8.

49. Mp B, Brundha MP, Nallaswamy D. Hide and seek in pathology- A research on game-based histopathology learning [Internet]. Vol. 10, International Journal of Research in Pharmaceutical Sciences. 2019. p. 1410–4. Available from: http://dx.doi.org/10.26452/ijrps.v10i2.606

50. John DA, Brundha MP. Awareness of Vitamin A Deficiency among Middle Aged Men-Research [Internet]. Vol. 05, Vitamins & Minerals. 2016. Available from: http://dx.doi.org/10.4172/2376-1318.1000144

51. Swetha S, Brundha MP. Analysis of knowledge about the hospital warning symbols among the postgraduate dental students-A comparative study [Internet]. Vol. 10, Research Journal of Pharmacy and Technology. 2017. p. 975. Available from: http://dx.doi.org/10.5958/0974-360x.2017.00177.9

52. Saleh BK, Omer A, Teweldemedhin B. Medicinal uses and health benefits of chili pepper (Capsicum spp.): a review [Internet]. Vol. 6, MOJ Food Processing & Technology. 2018. Available from: http://dx.doi.org/10.15406/mojfpt.2018.06.00183

53. Olatunji TL, Afolayan AJ. The suitability of chili pepper (Capsicum annuum L.) for alleviating human micronutrient dietary deficiencies: A review [Internet]. Vol. 6, Food Science & Nutrition. 2018. p. 2239–51. Available from: http://dx.doi.org/10.1002/fsn3.790

54. Palevitch D, Craker LE. Nutritional and Medical Importance of Red Pepper (Capsicum spp.) [Internet]. Vol. 3, Journal of Herbs, Spices & Medicinal Plants. 1996. p. 55–83. Available from: http://dx.doi.org/10.1300/j044v03n02_08

55. Brundha MP, Pathmashri VP, Sundari S. Quantitative Changes of Red Blood cells in

Cancer Patients under Palliative Radiotherapy-A Retrospective Study [Internet]. Vol. 12, Research Journal of Pharmacy and Technology. 2019. p. 687. Available from: http://dx.doi.org/10.5958/0974-360x.2019.00122.7

56. Cronin JR. The Chili Pepper's Pungent Principle: Capsaicin Delivers Diverse Health Benefits [Internet]. Vol. 8, Alternative and Complementary Therapies. 2002. p. 110–3. Available from: http://dx.doi.org/10.1089/10762800252909865

57. Bhattacharya A, Chattopadhyay A, Mazumdar D, Chakravarty A, Pal S. Antioxidant Constituents and Enzyme Activities in Chilli Peppers [Internet]. Vol. 16, International Journal of Vegetable Science. 2010. p. 201–11. Available from: http://dx.doi.org/10.1080/19315260903529709

58. Brundha MP, Saivignesh S. Myeloid sarcoma [Internet]. Vol. 3, International Journal of Clinicopathological Correlation. 2019. p. 41. Available from: http://dx.doi.org/10.4103/ijcpc.ijcpc_11_19

59. Brundha MP, Visha MG. A review on ankylosing spondylitis [Internet]. Vol. 3, International Journal of Clinicopathological Correlation. 2019. p. 44. Available from: http://dx.doi.org/10.4103/ijcpc.ijcpc_12_19

60. Singletary K. Red Pepper [Internet]. Vol. 46, Nutrition Today. 2011. p. 33–47. Available from: http://dx.doi.org/10.1097/nt.0b013e3182076ff2

61. Westerterp-Plantenga M, Pilou L H. Red Pepper Can Enhance Energy Metabolism and Satiety [Internet]. Vol. 49, Nutrition Today. 2014. p. S6–7. Available from: http://dx.doi.org/10.1097/01.nt.0000453845.91592.11

62. Yang D, Luo Z, Ma S, Wong WT, Ma L, Zhong J, et al. Activation of TRPV1 by Dietary Capsaicin Improves Endothelium-Dependent Vasorelaxation and Prevents Hypertension [Internet]. Vol. 12, Cell Metabolism. 2010. p. 130–41. Available from: http://dx.doi.org/10.1016/j.cmet.2010.05.015

63. Deng Y, Huang X, Wu H, Zhao M, Lu Q, Israeli E, et al. Some like it hot: The emerging role of spicy food (capsaicin) in autoimmune diseases. Autoimmun Rev. 2016 May;15(5):451–6.

64. Sun F, Xiong S, Zhu Z. Dietary Capsaicin Protects Cardiometabolic Organs from Dysfunction [Internet]. Vol. 8, Nutrients. 2016. p. 174. Available from: http://dx.doi.org/10.3390/nu8050174

65. Szallasi A. Vanilloid (capsaicin) receptors in health and disease. Am J Clin Pathol. 2002 Jul;118(1):110–21.

66. Yasar, M.The remember regeneration therapy method: An overview of new therapy protocol to approach diseases(2019) Journal of Complementary Medicine Research, 10 (1), pp. 68-80.

67. Kumar MDA, Ashok Kumar MD, Brundha MP. Awareness about nocturia-A questionnaire survey [Internet]. Vol. 9, Research Journal of Pharmacy and Technology. 2016. p. 1707. Available from: http://dx.doi.org/10.5958/0974-360x.2016.00344.9

68. Website [Internet]. [cited 2020 Jun 3]. Available from: Kalaiselvi, R., & Brundha, M. P. (2016). Prevalence of hysterectomy in south Indian population. Research Journal of Pharmacy and Technology, 9(11). https://doi.org/10.5958/0974-360X.2016.00398.X

69. Website [Internet]. [cited 2020 Jun 11]. Available from: https://www.scopus.com/record/display. uri?origin=recordpage&eid=2-s2.0- 84984998171

70. Website [Internet]. [cited 2020 Jun 3]. Available from: Hannah, R., Ramani, P., Brundha, M. P., Sherlin, H. J., Ranjith, G., Ramasubramanian, A., … Archana, S. (2019). Liquid paraffin as a rehydrant for air dried buccal smear. Research Journal of Pharmacy and Technology, 12(3), 1197–1200. https://doi.org/10.5958/0974-360X.2019.00199.9

71. Website [Internet]. [cited 2020 Jun 3]. Available from: Timothy, C. N., Samyuktha, P. S., & Brundha, M. P. (2019, August 1). Dental pulp stem cells in regenerative medicine – A literature review. Research Journal of Pharmacy and Technology. Research Journal of Pharmacy and Technology. https://doi.org/10.5958/0974-360X.2019.00698.X

72. Surh YJ, Lee SS. Capsaicin in hot chili pepper: carcinogen, co-carcinogen or anticarcinogen? Food Chem Toxicol. 1996 Mar;34(3):313–6.

73. Website [Internet]. [cited 2020 Jun 3]. Available from: Prashaanthi, N., & Brundha, M. P. (2018). A comparative study between popplet notes and conventional notes for learning pathology. Research Journal of Pharmacy and Technology, 11(1), 175–178. https://doi.org/10.5958/0974-360X.2018.00032.X

74. Patcharatrakul T, Gonlachanvit S. Chili Peppers, Curcumins, and Prebiotics in Gastrointestinal Health and Disease [Internet]. Vol. 18, Current Gastroenterology Reports. 2016. Available from: http://dx.doi.org/10.1007/s11894-016-0494-0

75. Pramanik KC, Srivastava SK. Role of Capsaicin in Cancer Prevention [Internet]. Role of Capsaicin in Oxidative Stress and Cancer. 2013. p. 1–18. Available from: http://dx.doi.org/10.1007/978-94-007-6317-3_1

76. Erin N. Role of sensory neurons, neuroimmune pathways, and transient receptor potential vanilloid 1 (TRPV1) channels in a murine model of breast cancer metastasis. Cancer

Immunol Immunother. 2020 Feb;69(2):307–14.

77. Prasad KN, Cole WC. Cancer and Nutrition. IOS Press; 1998. 251 p.

78. Lu M, Chen C, Lan Y, Xiao J, Li R, Huang J, et al. Capsaicin-the major bioactive ingredient of chili peppers: bio-efficacy and delivery systems. Food Funct. 2020 Apr 30;11(4):2848–60.

79. Website [Internet]. [cited 2020 Jun 11]. Available from: https://www.scopus.com/record/display. uri?origin=recordpage&eid=2-s2.0- 84989348627

80. Du Y, Lv Y, Zha W, Hong X, Luo Q. Chili Consumption and Risk of Gastric Cancer: A Meta-Analysis. Nutr Cancer. 2020 Apr 2;1–10.

81. Sastry SK, Mandal B, Sano T, Hammond J. Capsicum annuum and Capsicum frutescens (Bell pepper, Chilli, Pepper, Sweet pepper) [Internet]. Encyclopedia of Plant Viruses and Viroids. 2019. p. 372–431. Available from: http://dx.doi.org/10.1007/978-81-322-3912-3_174

82. Perla V, Nadimi M, Reddy R, Hankins GR, Nimmakayala P, Harris RT, et al. Effect of ghost pepper on cell proliferation, apoptosis, senescence and global proteomic profile in human renal adenocarcinoma cells. PLoS One. 2018 Oct 31;13(10):e0206183.

83. Shenoy PB, Brundha MP. Awareness of polycystic ovarian disease among females of age group 18-30 years. Res J Pharm Biol Chem Sci. 2016;8(8):813.

84. Balaji S, Brundha MP, Path DNB. Awareness of About Breast Cancer among Dental Surgeons. Res J Pharm Biol Chem Sci. 2016;8(8):797.

85. P Jannathulferdioz BM. Awareness of Stye. Int J Pharm Sci Rev Res,. 40(1):30–2.

86. Brundha MP. A Comparative Study-The Role of Skin and Nerve Biopsy in Hansen's Disease. Res J Pharm Biol Chem Sci [Internet]. 2015; Available from: https://www.researchgate.net/profile/Brundha_Mp/publication/283561218_A_comparative_study-_the_role_of_skin_and_nerve_biopsy_in_hansen's_disease/links/5892ba5d458515aeac946451/A-comparative-study-the-role-of-skin-and-nerve-biopsy-in-hansens-disease.pdf

87. Ravichandran H, Brundha MP. Awareness about personal protective equipments in hospital workers (sweepers and cleaners). International Journal of Pharmaceutical Sciences Review and Research. 2016;40(1):28–9.

30. Shreya, S., & Brundha, M. P. (2017). Alteration of haemoglobin value in relation to age,

sex and dental diseases- a retrospective correlation study. Research Journal of Pharmacy and Technology, 10(5), 1363–1366. https://doi.org/10.5958/0974-360X.2017.00241.4

32. Kalaiselvi, R., & Brundha, M. P. (2016). Prevalence of hysterectomy in south Indian population. Research Journal of Pharmacy and Technology, 9(11). https://doi.org/10.5958/0974-360X.2016.00398.X

34. Hannah, R., Ramani, P., Brundha, M. P., Sherlin, H. J., Ranjith, G., Ramasubramanian, A., … Archana, S. (2019). Liquid paraffin as a rehydrant for air dried buccal smear. Research Journal of Pharmacy and Technology, 12(3), 1197–1200. https://doi.org/10.5958/0974-360X.2019.00199.9

35. Timothy, C. N., Samyuktha, P. S., & Brundha, M. P. (2019, August 1). Dental pulp stem cells in regenerative medicine – A literature review. Research Journal of Pharmacy and Technology. Research Journal of Pharmacy and Technology. https://doi.org/10.5958/0974-360X.2019.00698.X