

ETHNO-BOTANICAL APPROACH FOR ROOT CANAL TREATMENT –AN UPDATE

Ravishankar.P¹, Lakshmi.T*², Aravind Kumar.S³

¹Endodontist, Department of Conservative Dentistry, Chennai.

²Department of Pharmacology, Saveetha Dental College, Chennai.

³Department of Orthodontics, Saveetha Dental College, Chennai.

Abstract:

Plant and phytochemicals are widely used by the traditional medicinal and dental practitioners for curing various diseases in their day to day practice. Phytomedicine have been the highly esteemed source of medicine throughout human history. About 25-30 percent of today's prescription drugs contain chemical moieties derived from plants. Some of these herbs and their active chemical constituents which have a role in the management of root canal failure caused by *E.faecalis* are compiled here and discussed in this review. The results of our literature studies support the use of this Phytomedicine for human and animal disease therapy and reinforce the importance of the ethno-botanical approach as a potential source of bioactive substances.

Key Words: Phytochemical. *E.faecalis*, Root canal failure, Ethno-botanical approach.

Introduction:

Since antiquity, herbs and spices are derived from medicinal plants rich in minerals and organic matter remain the mainstay of about 75–80% of the world's population for health care and gaining popularity in developed and developing countries. [1] Herbs have medicinal property due to presence of different active principles like alkaloids, volatile essential oils, glycosides, resins, oleoresins, steroids, tannins, terpenes and phenols. [2] In recent years there is an exponential growth in the field of herbal medicine because of their natural origin, easy availability, efficacy, safety and less side effects.[3,4] *Enterococcus faecalis* is a facultative anaerobic microorganism that are commonly detected in asymptomatic, persistent endodontic infections .

E. faecalis is a normal inhabitant of the oral cavity. *E. Faecalis* is responsible for root canal treatment failure cases and is resistant to calcium hydroxide due to its proton pump [5]. *E faecalis* can also survive by genetic polymorphism and its ability to bind to dentin, invade dentinal tubules, and survive starvation. [6] *E. faecalis* possesses virulence factors including lytic enzymes, cytolysin, aggregation substance, pheromones, and lipoteichoic acid [7] It has been shown to adhere to host cells, express proteins that allow it to compete with other bacterial cells, and alter host responses .[7, 8] *E.*

faecalis is able to suppress the action of lymphocytes, potentially contributing to endodontic failure. [9]

E. faecalis is found in 4 to 40% of primary endodontic infections[7] The frequency of *E. faecalis* found in persistent periradicular lesions has been shown to be much higher. In fact, failed root canal treatment cases are nine times more likely to contain *E. faecalis* than primary endodontic infections [7]. Studies investigating its occurrence in root-filled teeth with periradicular lesions have demonstrated a prevalence ranging up to 77% .[10-12, 13 -20]

The most effective method for eliminating *E. faecalis* from the root canal space and dentinal tubules [21-23] is the use of sodium hypochlorite and 2% chlorhexidine, in a 2% gel or liquid concentration form. Due to the disadvantages of sodium hypochlorite like unpleasant taste, toxicity, and potential weakening of the tooth structure by decreasing the hardness and structural integrity of the dentin within the root canal. To overcome this disadvantage Herbal medicine like *Propolis*, *Curcuma longa*, *Acacia nilotica*, *Azadirachta indica*, *Aloevera* are used because of its low side effects.

Hence our review compiles the data related to the ethnobotanical aspects of herbal extracts against *E.faecalis* to prevent the root canal failure that

primarily occurs during endodontic treatment.

Ethno Pharmacology:

Role of herbs against *E.faecalis*

Propolis:

Propolis, a natural antibiotic is a resinous yellow brown to dark brown substance that honey bees collect from tree buds, sap flows, shrubs or other botanical sources to seal unwanted open spaces in the hive, protecting it from outside contaminants [24]. *Propolis* has been used in dentistry for various purpose. propolis possess good Antibacterial activity against *streptococcus sobrinus* and *streptococcus mutans* [25]. Koru *et al* in his study concluded that the antibacterial property of *Propolis* is due to the presence of Flavanoids and aromatic compounds such as caffeic acid.[26].

It also possess good anti oxidant[27]and anti inflammatory activity [28].In dental practice it is used as an pulp capping agent[29],Intracanal Irrigant [30],Mouth rinse,[31]cariostatic agent [32] ,treatment of periodontitis [33] and Denture stomatitis etc.,

Oncag *et al* [34] compared the antibacterial efficacy of three commonly used intracanal medicaments with *propolis* against *Enterococcus faecalis*. He concluded

That *propolis* had potent *antibacterial* activity against *E. faecalis* in the root canals, suggesting that it could be used as an alternative intracanal medicament.

Awawdeh *et al* [35]also evaluated the effectiveness of propolis and calcium hydroxide in *Ex-vivo* as a short-term intracanal medicament against *Enterococcus faecalis*.

He concluded that *propolis* is very effective as intracanal medicament in rapidly eliminating *E. faecalis*.

Al-Qathami and Al-Madi conducted a study to compare the antimicrobial efficacy of *propolis*, sodium hypochlorite and saline as an intracanal irrigants. Bacterial samples

Were taken from the teeth immediately after accessing the canal and after instrumentation and irrigation. The results of their study indicated that the *propolis* has potent antimicrobial activity equal to that of sodium hypochlorite. [30]

Curcuma longa

Curcumin is the principle curcuminoid of the popular Indian spice turmeric, which is a member of the ginger family (Zingiberaceae). Turmeric is used extensively in foods for both its flavor and color, as well as having a long tradition of use in the Chinese and Ayurvedic systems of medicine, particularly as an anti-inflammatory [36]and for the treatment of flatulence, jaundice, menstrual difficulties, hematuria, hemorrhage, and colic.[37] Turmeric can also be applied topically in poultices to relieve pain and inflammation.[38] The active constituents of turmeric are the flavonoid curcumin (diferuloylmethane) and various volatile oils, including tumerone, atlantone, and zingiberone. Other constituents include sugars, proteins, and resins.[38] It possess good antioxidant [39], hepatoprotective [40], antimicrobial [41]and anti cancer activity .[42, 43]

Haukyik *et al* studied the phototoxic effects of curcumin against gram positive bacteria like *E.faecalis* , *streptococcus intermedius* and gram negative bacteria *E.coli* were investigated in Aqueous preparations.he found changes in post irradiation incubation time,curcumin concentration,irradiation dose and preparation strongly influenced the phototoxic efficiency of curcumin *in vitro* aqueous preparation of DMSO,PEG were the most efficient vehicles for curcumin to exert photokilling of gram positive and gram negative bacteria.[44] Prasanna Neelakantan conducted an *in vitro* study to evaluate the antimicrobial efficacy of curcumin against *E. faecalis* considering Sodium hypochlorite (3%) as reference for comparison. The result of his study revealed that curcumin had

significant antibacterial activity against *E.faecalis* .he concluded that the antibacterial activity of curcumin was similar to sodium hypochlorite and thus herbal medicine can be used in endodontics for root canal failure .[45]

Acacia nilotica

Acacia nilotica is also known as Gum Arabic tree, Babul, Egyptian thorn, *Acacia* species contains secondary metabolites including amines and alkaloids, cyanogenic glycosides, cyclitols, fatty acids and seed oils, fluoroacetate, gums, nonprotein amino acids, terpenes (including essential oils, diterpenes, phytosterol and triterpene genins and saponins), hydrolyzable tannins, flavonoids and condensed tannins. [46] The plant is richer source of cystine, methionine, threonine, lysine, tryptophan, Potassium, phosphorus, magnesium, iron and manganese .[47] Babul plant is therapeutic used as Anti-cancer, anti tumours, Antiscorbutic, Astringent, anti-oxidant, Natriuretic, Antispasmodial, Diuretic, Intestinal pains and diarrhea, Nerve stimulant, Cold, Congestion, Coughs, DysenterFever, Hemorrhages, Leucorrhea, Ophthalmia and Sclerosis.[48]It possess good Anti microbial activity [49,50],antioxidant activity [51] anti fungal [52] , anti viral activity [53],antibiotic activity [54],anti cancer [55] and anti hypertensive activity [56] etc.,

Babool is also used for the treatment of skin, sexual, stomach and tooth problems .it has been proved as effective medicine in treatment of malaria, sore throat (aerial Part) and toothache (bark) [57] Rosina Khan *et al* [58]suggested that babool has shown to posses antibacterial activity against *streptococcus mutans* and *Enterococcus faecalis*.

Dhanya kumar *et al* conducted an *invitro* study on *azardirachta indica*, *glycyrrhiza glabra*, *cinnamum zeylanicum*, *syzygium Aromaticum*, *accacia nilotica* on *streptococcus mutans* and *enterococcus faecalis* .He concluded that the

effectiveness of these herbal extracts was likely due to their active ingredients, the results of this

In vitro study suggest that alcohol extracts of neem, liquorice, clove, Cinnamon, babool showed strong antimicrobial activity against oral micro organisms like

Streptococcus mutans moreover, extracts of Liquorice, Clove, Cinnamon, Babool have strong antimicrobial activity against *E.faecalis* but Babool at a concentration of 50% had the highest antimicrobial activity against *Enterococcus faecalis*.[59]

Azadirachta indica

Azadirachta Indica commonly known as Neem is used as traditional medicine for household remedy against various human ailments, since antiquity [60-65]. Nimbidin, a major crude bitter principle extracted from the oil of seed kernels of *A. indica* demonstrated several biological activities. Few tetranortriterpenes including nimbin, nimbinin, nimbidinin, nimbolide and nimbidic acid have been isolated. [66, 67]

Various Literature indicates that Neem leaf extract possess anti arrhythmic [68],anti arthritic [69], anti viral,[70] anti oxidant [71], Hepato protective activity [72] anti diabetic activity [73]anti ulcer activity [74] , anti malarial [75] antifungal [76],anti carcinogenic activity.[77]Neem leaves, seeds and bark possesses a wide spectrum of antibacterial

action against Gram-negative and Gram-positive microorganisms,including *M. tuberculosis* and streptomycin resistant strains .[78] *In vitro*, it inhibits *Vibrio cholerae*,*Klebsiella pneumoniae*, *M. tuberculosis* and *M. pyogenes* [79]Antimicrobial effects of neem extract have been demonstrated against *Streptococcus mutans* and *S. faecalis* [80] Neem leaf extract is also used to treat dental plaque and gingivitis .[81]

Bohora and co workers in their findings concluded that the Neem (*Azadirachta*

Indica) leaf extract has significant antimicrobial effect against *E.faecalis* derived from infected root canal samples.[82]

Similar study conducted by Naiyak Arathi *et al* also found that aqueous and ethanolic extract of Neem (*Azadirachta Indica*) leaf showed significant antibacterial activity against *E.faecalis* [83] Its antioxidant and antimicrobial properties makes it a potential agent for root canal irrigation as an alternative to sodium hypochlorite.

Aloe Vera (Aloe barbadensis miller)

The botanical name of *Aloe vera* is *Aloe barbadensis miller*.It belongs to Asphodelaceae (Liliaceae) family; the species is frequently used in herbal medicine. *Aloe vera* is found to possess good wound healing activity.[84, 85]*Aloe Vera* gel has

Been reported to have a protective effect against radiation damage to the skin [86, 87].

Aloe Vera is a potent anti inflammatory agent [88] Laxative [89] it exhibits potent

anti viral and anti tumor activity [90].It also possess anti acne effect [91], antiseptic effect. Based on scientific evidence *Aloe Vera* is used in treatment of Seborrheic dermatitis, [92] psoriasis vulgaris,[93,94] genital herpes [95,96] skin burns,[97]diabetes (type 2),[98] HIV infection, [99] cancer prevention,[100,101] ulcerative colitis. [102] *Aloe Vera* possess good anti bacterial and anti fungal activity *Streptococcus pyogenes* and *Streptococcus faecalis* are two microorganisms that have been inhibited by *aloe vera* gel.[103, 104]

In dentistry *Aloe vera* is used in cases of Aphthous ulcers, Lichen planus, and Alveolar osteitis. *Enterococcus faecalis* has been associated with failure of pulp space therapy. It has been shown that *Enterococcus faecalis* may tolerate antibacterial effect of Calcium Hydroxide treatment.[105]

Suresh Chandra conducted a study on *in vitro* antibacterial efficacy of *Aloe vera* extract on resistant antimicrobial strains in endodontics. The antimicrobial effect of water, alcohol, chloroform extracts of *Aloe Vera* gel were investigated on different strains of bacteria and yeasts.His study concluded that chloroform extract of *Aloe vera*

Showed significant Zone of Inhibition against *E.faecalis* hence, *Aloe vera* has shown antimicrobial effect against resistant microorganisms found in pulp space.[105]

Conclusion:

Enterococci have been recognized as being potentially pathogenic microorganism for humans since the turn of the century. *Enterococcus faecalis* has been only occasionally found in cases of primary endodontic infections but frequently isolated or detected in cases in which the endodontic therapy has failed. It is the one of the most isolated or detected species from oral infections, including marginal periodontitis, infected root canals, and periradicular abscesses. The major cause of endodontic failure is the survival of this microorganism in the apical portion of root filled teeth. *E.faecalis* can adhere to the root canal walls, accumulate, and form communities organized in biofilm, which helps it resist destruction by enabling the bacteria to become 1000 times more resistant to phagocytosis, antibodies, and antimicrobials than non-biofilm producing organisms.One of the effective method to eradicate *E.faecalis* is use of Sodium chloride and 2% chlorhexidine solution.

Our review updates the use of Herbal medicine, their pharmacological activity and antibacterial efficacy against *E.faecalis* in prevention of Root canal failure that occurs during Endodontic procedure. The compiled data provided in this article will surely aid the Endodontist to have an interest in implementing the herbal products in their

day to day practice because of its easy availability, safety with minimal side effects.

Acknowledgement:

The authors are grateful to the authors/editors of all those articles, journals and books from where the literature for this article has been reviewed and discussed.

Conflict of Interest:

No conflict of interest in the present article.

References:

- [1] Sekar T.M., Ayyanar, Gopalakrishnan M (2010). Medicinal plants and herbal drugs. *Current Science.*, 98(12): 1558-1559.
- [2] Anees T.P. (2010). International market scenario of traditional Indian herbal drugs: India declining. *Int. J. Green. Pharm.*, 122: 184-190.
- [3] Grover J.K. (2002). Medicinal plants of India with antidiabetic potential. *J. Ethnopharmacol.*, 81: 81-100.
- [4] Kamboj V.P. (2000) Herbal medicine. *Current Science.*,78(1):35-51.
- [5] Charles H Stuart, Scott A Schwartz, Thomas J Beeson(2006).Enterococcus faecalis: its role in root canal treatment failure and current concepts and retreatment. *Journal Of Endodontics* 32 (2): 93-97.
- [6] Joshua M, Davis, James Maki (2007). An in vitro comparison of antimicrobial effects of various endodontic medicaments on Enterococcus faecalis. *Journal Of Endodontics* 33 (5):567- 569.
- [7] Rôças IN, Siqueira JF, Santos KRN. Association of *Enterococcus faecalis* with different forms of periradicular diseases. *J Endod* 2004;30:315-20.
- [8] Love RM. *Enterococcus faecalis*: a mechanism for its role in endodontic failure. *Int Endod J* 2001;34:399-405.
- [9] Lee W, Lim S, Son H, Bae K. Sonicated extract of *Enterococcus faecalis* induces irreversible cell cycle arrest in phytohemagglutinin-activated human lymphocytes. *J Endod* 2004;30:209 -12.
- [10] Molander A, Reit C, Dahlen G, Kvist T. Microbiological status of root-filled teeth with apical periodontitis. *Int Endod J* 1998;31:1-7.
- [11] Sundqvist G, Figdor D, Persson S, Sjogren U. Microbiologic analysis of teeth with failed endodontic treatment and the outcome of conservative re-treatment. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 1998;85:86 -93.
- [12] Hancock HH, Sigurdsson A, Trope M, Moiseiwitsch J. Bacteria isolated after unsuccessful endodontic treatment in a North Am population. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2001;91:579-86.
- [13] Engström B. The significance of *Enterococci* in root canal treatment. *Odontol Revy* 1964;15:87-106.
- [14] Möller AJR. Microbial examination of root canals and periapical tissues of human teeth. *Odontol Tidskr* 1966;74(Suppl):1-380.
- [15] Peciuliene V, Balciuniene I, Eriksen H, Haapasalo M. Isolation of *Enterococcus faecalis* in previously root-filled canals in a Lithuanian population. *J Endod* 2000;26:593-5.
- [16] Peciuliene V, Reynaud AH, Balciuniene I, Haapasalo M. Isolation of yeasts and enteric bacteria in root-filled teeth with chronic apical periodontitis. *Int Endod J* 2001;34:429 -34.
- [17] Pinheiro ET, Gomes BPFA, Ferraz CCR, Sousa ELR, Teixeira FB, Souza Filho FJ. Microorganisms from canals of root-filled teeth with periapical lesions. *Int Endod J* 2003;36:1-11.
- [18] Pinheiro ET, Gomes BPFA, Ferraz CCR, Teixeira FB, Zaia AA, Souza-Filho FJ. Evaluation of root canal microorganisms isolated from teeth with endodontic failure and their antimicrobial susceptibility. *Oral Microbiol Immunol* 2003;18:100 -3.
- [19] Siqueira JF, Rôças I. Polymerase chain reaction-based analysis of microorganisms associated with failed endodontic treatment. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2004;97:85-94.
- [20] Gomes BPFA, Pinheiro ET, Gade-Neto CR, et al. Microbiological examination of infected dental root canals. *Oral Microbiol Immunol* 2004;19:71- 6.
- [21] Vahdaty A, Pitt Ford TR, Wilson RF. Efficacy of chlorhexidine in disinfecting dentinal tubules in vitro. *Endod Dent Traumatol* 1993;9:243- 8.
- [22] Gomes B, Souza S, Ferraz C, et al. Effectiveness of 2% chlorhexidine gel and calcium hydroxide against *Enterococcus faecalis* in bovine root dentine in vitro. *Int Endod J* 2003;36:267-75.
- [23] Basrani B, Santos J, Tjaderhane L, et al. Substantive antimicrobial activity in chlorhexidine- treated human root dentin. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2002;94:240 -5.
- [24] Almas K, Dahlan A, Mahmoud A (2001). Propolis as a natural remedy: An update. *Saudi Dental J.* 13: 45-49.

- [25] Ikeno K, Ikeno T, Miyazawa C (1991). Effect of Propolis on dental caries in rats. *Caries Res.* 25: 347-351.
- [26] Koru O, Toksoy F, Acikel CH, Tunca YM, Baysallar M, Uskudar Guclu A, Akca E, Ozkok Tuylu A, Sorkun K, Tanyuksel M, Salih B (2007). Invitro antimicrobial activity of propolis samples from different geographical origins against certain oral pathogens. *Anaerobe.* 13: 140-145.
- [27] Krol W, Czuba Z, Scheller S, Gabrys J, Grabiec S, Shani J (1990). Antioxidant property of ethanolic extract of Propolis (EEP) as evaluated by inhibiting the chemiluminescence oxidation of luminol. *Biochem. Int.*, 21: 593-597.
- [28] Borrelli F, Maffia P, Pinto L, Ianaro A, Russo A, Capasso F, Ialenti A (2002). Phytochemical compounds involved in the anti-inflammatory effect of propolis extract. *Fitoterapia.* 73(S): 53-63.
- [29] Sabir A, Tabbu CR, Agustiono P, Sosroseno W (2005). Histological analysis of rat dental pulp tissue capped with propolis. *J. Oral Sci.*, 47(3): 135-138.
- [30] Al-Qathami H, Al-Madi E (2003). Comparison of sodium hypochlorite, propolis and saline as root canal irrigants: A pilot study. *Saudi Dental J.*, 5: 100-102.
- [31] Ozan F, Sümer Z, Polat ZA, Er K, Ozan U, De_er O (2007). Effect of mouth rinse containing propolis on oral microorganisms and human gingival fibroblast. *Eur. J. dentistry.* 11:195-200.
- [32] Hayacibara MF, Koo H, Rosalen PL, Duarte S, Franco EM, Bowen WH, Ikegaki M, Cury JA (2005). In vitro and in vivo effects of isolated fractions of Brazilian propolis on caries development. *J. Ethnopharmacol.*, 101:110-115.
- [33] Toker H, Ozan F, Ozer H, Ozdemir H, Eren K, Yeler HJ (2008). A morphometric and histopathologic evaluation of the effects of Propolis on alveolar bone loss in experimental periodontitis in rats. *Periodontol.*, 79(6): 1089-1094.
- [34] Oncag O, Cogulu D, Uzel A, Sorkun K (2008). Efficacy of propolis as an intracanal medicament against *Enterococcus faecalis*. *General Dentistry.* 54(5):319-322.
- [35] Awawdeh L, Al-Beitawi M, Hammad M (2009). Effectiveness of propolis and calcium hydroxide as a short-term intracanal medicament against *Enterococcus faecalis*: a laboratory study. *Aust. Endod. J.*, 35: 52-58.
- [36] Dobelis IN, ed. *Magic and Medicine of Plants*. Pleasantville, NY: Reader's Digest Association, Inc. 1986.
- [37] Chandra D, Gupta S. Anti-inflammatory and anti-arthritis activity of volatile oil of *Curcuma longa* (Haldi). *Indian J Med Res* 1972;60:138-142.
- [38] Leung A. *Encyclopedia of Common Natural Ingredients Used in Food, Drugs, and Cosmetics*. New York, NY: John Wiley; 1980:313-314.
- [39] Mortellini R, Foresti R, Bassi R, Green CJ. Curcumin, an antioxidant and anti-inflammatory agent, induces heme oxygenase-1 and protects endothelial cells against oxidative stress. *Free Radic Biol Med* 2000;28:1303-1312.
- [40] Kiso Y, Suzuki Y, Watanabe N, et al. Antihepatotoxic principles of *Curcuma longa* rhizomes. *Planta Med* 1983;49:185-187.
- [41] Apisariyakul A, Vanittanakom N, Buddhasukh D. Antifungal activity of turmeric oil extracted from *Curcuma longa* (Zingiberaceae). *J Ethnopharmacol* 1995;49:163-169.
- [42] Kawamori T, Lubet R, Steele VE, et al. Chemopreventative effect of curcumin, a naturally occurring anti-inflammatory agent, during the promotion/progression stages of colon cancer. *Cancer Res* 1999;59:597-601.
- [43] Donatus IA, Sardjoko, Vermeulen NP. Cytotoxic and cytoprotective activities of curcumin. Effects on paracetamol-induced cytotoxicity, lipid peroxidation and glutathione depletion in rat hepatocytes. *Biochem Pharmacol* 1990;39:1869-1875.
- [44] Haukvik T, Bruzell E, Kristensen S, Tønnesen HH. Photokilling of bacteria by curcumin in different aqueous preparations. *Studies on curcumin and curcuminoids XXXVII. Pharmazie.* 2009 Oct;64(10):666-73.
- [45] Prasanna neelakantan, chandana subbarao, chandragiri venkata subbarao analysis of antibacterial activity of curcumin against *enterococcus faecalis*. *international journal of current research and review.* issue 9 september 2011.
- [46] Seigler D.S. (2003). Phytochemistry of *Acacia-sensu lato*. *Biochem. Syst. Ecology.*, 31(8): 845-873.
- [47] Singh Rajbir, Singh Bikram and Singh Sukhpreet (2008) Anti-free radical activities of kaempferol isolated from *Acacia nilotica* (L.) Willd. Ex. Del. *Toxicology in Vitro.*, 22(8): 1965-1970.

- [48] Saini M.L. (2008) Comparative Pharmacognostical and antimicrobial studies of *Acacia* species (Mimosaceae). *Journal of Medicinal Plants Research.*, 2(12):378-386
- [49] Solomon G.O. and Shittu G.A. (2010) *In vitro* antimicrobial and phytochemical activities of *Acacia nilotica* leaf extract. *J. Med. Plants. Res.*, 4(12):1232-1234.
- [50] Khan R (2009) Antimicrobial Activity of Five Herbal Extracts Against Multi Drug Resistant (MDR) Strains of Bacteria and Fungus of Clinical Origin. *Molecules.*, 14(2): 586-597
- [51] Duganath N (2010) Evaluation of anti-denaturation property and anti-oxidant activity of traditionally used medicinal plants. *Int. J. Pharma. Bio Sciences.*, V1(2): 1-7.
- [52] Satish S, Mohana D.C. and Raghvendra M.P (2007) Antifungal activity of some plant extracts against important seed borne pathogens of *Aspergillus* sp, *J. Agri. Tech.* 3(1): 109-119.
- [53] Mohamed L.T., Bushra E.I.S and Abdelrahman M.N (2010) The antibacterial, antiviral activities and phytochemical screening of some Sudanese medicinal plants. *Eur. Asian. J. BioSciences.*, 4: 8-16.
- [54] Shanab S.M.M (2007) Antioxidant and Antibiotic Activities of Some Seaweeds (Egyptian Isolates). *Int. J. Agri. Biol.*, 9(2): 220-225.
- [55] Arora S, Kaur K, Kaur S (2003) Indian medicinal plants as a reservoir of Protective phytochemicals. *Teratogenesis Carcinog. Mutagen. Suppl.*, 1:295-300.
- [56] Shah B.H. Safdar B and Virani S.S. (1997) The Antiplatelet Aggregatory Activity of *Acacia nilotica* is Due to Blockade of Calcium Influx through Membrane Calcium Channels. *General Pharmacology: The Vascular System.*, 29(2):251-255.
- [57] Mohan Lal Saini, Ritu Saini, Shikha Roy and Ashwani Kumar. Comparative pharmacognostical and antimicrobial studies of *acacia* species (Mimosaceae) (2008). *Journal of Medicinal Plants Research* 2(12): 378-386.
- [58] Rosina Khan, Barira Islam , Mohd Akram , Shazi Shakil , Anis Ahmad ,S. Manazir Ali (2009). Antimicrobial Activity of Five Herbal Extracts Against Multi Drug Resistant (MDR) Strains of Bacteria and Fungus of Clinical Origin. *Molecules* 14: 586-597.
- [59] Dhanya Kumar et al The Antimicrobial Activity Of *Azadirachta Indica*, *Glycyrrhiza Glabra*, *Cinnamum Zeylanicum*, *Syzygium Aromaticum*, *Accacia Nilotica* On *Streptococcus Mutans* And *Enterococcus Faecalis* - An *In Vitro* Study *Endodontology journal* available at <http://medind.nic.in/ea/t11/i1/eaat11i1p16.pdf>
- [60] Chopra, R. N., Nayer, S. L. and Chopra, I. C., *Glossary of Indian Medicinal Plants*, CSIR, New Delhi, 1956.
- [61] Chopra, R. N., Chopra, I. C, Handa, K. L. and Kapur, L. D. (eds), *Indigenous Drugs of India*, U.N. Dhur and Sons, Kolkata, 1958, pp. 51-595.
- [62] Kirtikar, K. R. and Basu, B. D., in *Medicinal Plants* (eds Blatter, E., Cains, J. F., Mhaskar, K. S.), Vivek Vihar, New Delhi, 1975, p. 536.
- [63] Thakur, R. S., Singh, S. B. and Goswami, A., *Curr. Res. Med. Aromat. Plants*, 1981, 3, 135-140.
- [64] Koul, O., Isman, M. B. and Ketkar, C. M., *Can. J. Bot.*, 1990, 68, 1-11.
- [65] Chatterjee, A. and Pakrashi, S. (eds), *The Treatise on Indian Medicinal Plants*, 1994, vol. 3, p. 76.
- [66] Siddiqui, S., *Curr. Sci.*, 1942, 11, 278-279.
- [67] Mitra, C. R., Garg, H. S. and Pandey, G. N., *Phytochemistry*, 1971, 10, 857-864.
- [68] Hanson nat prod rep ,1991,54,6.
- [69] Dastur useful plants 40 mitra Indian oil seeds J 1956-57 1,256 information from Dr.c.r mitra nbri from Lucknow.shankaranarayanan & sirshi ,Indian journal pharm,1961,25,53.
- [70] Rao, A. R., Kumar, S., Paramshivam, T. B., Kamalakshi, S., Parashuram, A. R. and Shantha, M., *Indian J. Med. Res.*, 1969, 57, 495-502.
- [71] Rao, A. D., Devi, K. N. and Thyagaraju, K., *J. Enzyme Inhib.*,
- [72] Bhanwra, S., Singh, J. and Khosla, P., *Indian J. Physiol.*
- [73] Murty, K. S., Rao, D. N., Rao, D. K. and Murty, L. B. G., *Indian J. Pharmacol.*, 1978, 10, 247-250
- [74] Garg, G. P., Nigam, S. K. and Ogle, C. W., *Planta Med.*, 1993, 59,215-217.
- [75] Badani, L., Deolankar, R. P., Kulkarni, M. M., Nagsampgi, B. A. and Wagh, U. V., *Indian J. Malariol.*, 1987, 24, 111-117
- [76] Khan, M. and Wassilew, S. W., in *Natural Pesticides from the Neem Tree and Other Tropical Plants* (eds Schmutterer, H. and Asher, K. R. S.), GTZ, Eschborn, Germany, 1987, pp. 645- 650.)

- [77] Balasenthil, S., Arivazhagan, S., Ramachandran, C. R. and Nagini, S., *J. Ethnopharmacol.*, 1999, 67, 189–195
- [78] Chopra, I. C., Gupta, K. C. and Nair, B. N., *Indian J. Med. Res.*, 1952, 40, 511–515.
- [79] Satyavati, G. V., Raina, M. K. and Sharma, M. (eds), *Medicinal Plants of India*, 1976, vol. I.
- [80] Almas, K., *Indian J. Dent. Res.*, 1999, 10, 23–26.
- [81] www.neemamerica.com/PDF/Neem_Teeth-Jan2005.pdf
- [82] Naiyak Arathi *et al* Evaluation of Antibacterial and Anti candidial efficacy of Aqueous and Alcoholic extract of Neem (*Azadirachta indica*)-An In Vitro study *International Journal of Research in Ayurveda & Pharmacy*, 2(1), Jan-Feb 2011 230-235.
- [83] Bohora A, Hegde V, Kokate S. Comparison of antibacterial efficacy of neem leaf extract and 2% sodium hypochlorite against *E. faecalis*, *C. albicans* and mixed culture- an in vitro study. *Endodontology* 2010; 22: 8-12.
- [84] Hegggers J, Kucukcelebi A, Listengarten D, Stabenau J, Ko F, Broemeling LD, *et al*. Beneficial effect of aloe on wound healing In an excisional wound model. *J Altern Complement Med* 1996;2:271-7.
- [85] Roberts DB, Travis EL. Acemannan-containing wound dressing gel reduces radiation-induced skin reactions in C3H mice. *Int J Radiat Oncol Biol Phys* 1995;32:1047-52.
- [86] Sato Y, Ohta S, Shinoda M. Studies on chemical protectors against radiation XXXI: Protective effects of *Aloe arborescens* On skin injury induced by x-irradiation. *Yakugaku Zasshi* 1990;110:876-84.
- [87] Hutter JA, Salmon M, Stavinoha WB, Satsangi N, Williams RF, Streeper RT, *et al*. Anti-inflammatory C-glucosyl chromone from *Aloe barbadensis*. *J Nat Prod* 1996;59:541-3.
- [88] Ishii Y, Tanizawa H, Takino Y. Studies of aloe. V: Mechanism of cathartic effect. *Biol Pharm Bull* 1994;17:651-3.
- [89] Sydiskis RJ, Owen DG, Lohr JL, Rosler KH, Blomster RN. Inactivation of enveloped viruses by anthraquinones extracted from plants. *Antimicrob Agents Chemother* 1991;35:2463-6.
- [90] West DP, Zhu YF. Evaluation of aloe vera gel gloves in the treatment of dry skin associated with occupational exposure. *Am J Infect Control* 2003;31:40-2.
- [91] Vardy AD, Cohen AD, Tcheto T. A double-blind, placebo-controlled trial of Aloe vera (*A. barbadensis*) emulsion in the treatment of seborrheic dermatitis. *J Derm Treatment* 1999;10:7-11.
- [92] Paulsen E, Korsholm L, Brandrup F. A double-blind, placebocontrolled study of a commercial Aloe vera gel in the treatment of slight to moderate psoriasis vulgaris. *J Eur Acad Dermatol Venereol* 2005;19:326.31.
- [93] Syed TA, Ahmad SA, Holt AH, Ahmad SH, Afzal M. Management of psoriasis with Aloe vera extract in a hydrophilic cream: A placebo-controlled, double-blind study. *Trop Med Int Health* 1996;1:505-9.
- [94] Syed TA, Afzal M, Ashfaq AS. Management of genital herpes in men with 0.5% Aloe vera extract in a hydrophilic cream: A placebo-controlled double-blind study. *J Derm Treatment* 1997;8:99-102.
- [95] Syed TA, Cheema KM, Ahmad SA, Ashfaq A. Aloe vera extract 0.5% in hydrophilic cream versus aloe vera gel for the measurement of genital herpes in males: A placebo-controlled, double-blind, comparative study. *J Eur Acad Derm Venereol* 1996; 7:294-5.
- [96] Visuthikosol V, Chowchuen B, Sukwanarat Y, Sriurairatana S, Boonpucknavig V. Effect of aloe vera gel to healing of burn wound a clinical and historic study. *J Med Assoc Thai* 1995;78:403-9.
- [97] Yeh GY, Eisenberg DM, Kaptchuk TJ, Phillips RS. Systematic review of herbs and dietary supplements for glycemic control in diabetes. *Diabetes Care* 2003;26:1277-94.
- [98] Montaner JS, Gill J, Singer J. Double-blind placebo-controlled pilot trial of acemannan in advanced human immunodeficiency Virus disease. *J Acquir Immune Defic Syn Hum Retrovirol* 1996;12:153-7.
- [99] Furukawa F, Nishikawa A, Chihara T, Shimpo K, Beppu H, Kuzuya H, *et al*. Chemopreventive effects of *Aloe arborescens* on N-nitrosobis (2-oxopropyl) amine-induced pancreatic carcinogenesis in hamsters. *Cancer Lett* 2002;178:117-22.
- [100] Fenig E, Nordenberg J, Beery E, Sulkes J, Wasserman L. Combined effect of aloemodin and chemotherapeutic agents on the proliferation of an adherent variant cell line of Merkel cell carcinoma. *Oncol Rep* 2004;11:213-7.
- [101] Langmead L, Feakins M, Goldthorpe S, Holt H, Tsironi E, De Silva A, *et al*. Randomized, double-blind, placebo-

- controlled trial of oral aloe vera gel for active ulcerative colitis. *Aliment Pharmacol Ther* 2004;19:739-47.
- [102] Su K, Mehta V, Ravikumar L, Shah R, Pinto H, Halpern J, *et al.* Phase II doubleblind randomized study comparing oral *aloe vera* versus placebo to prevent radiation- related mucositis in patients with head-and-neck neoplasms. *Int J Radiat Oncol Biol Phys* 2004;60:71-7.
- [103] Robson MC, Heggors JP, Hagstrom WJ. Myth, magic, witchcraft or Fact? Aloe vera revisited. *J Burn Care Rehab* 1982; 3:157-163.
- [104] Cera LM, Heggors JP, Robson MC, Hagstrom WJ. The therapeutic efficacy of aloe vera cream (Dermaide Aloe) in thermal injuries. Two case reports. *J Am Animal Hosp Assoc* 1980;16:768-772.
- [105] B. Sureshchandra And Arun J. Kumar in vitro antibacterial efficacy of Aloevera extract on Resistant antimicrobial strains in endodontics.available at <Http://Medind.Nic.In/Eaa/T11/I1/Eaat11i1p56.Pdf>