



General Health and Pharmacological Benefits of Curcumin – A Natural Healing Agent

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ABSTRACT

The use of therapeutic agents in medicine has led to the development of resistant strains of many pathogens. As an alternative medicine, many herbal formulations were introduced. From ancient times, various medicinal plants have been used as a treatment agent for various diseases due to their alarming herbal properties. Turmeric, a rhizome of curcumin longa is one among them which has anti-infective and anti-inflammatory properties. Due to its novel properties, it is used in various treatments options for oral health and systemic health. Curcumin, due to its complex interaction between inflammation, immunity and oxidative stress, it was used in various oral and neck pathologies also apart from general health benefits. Curcumin suppresses pro-inflammatory cytokines in head and neck pathologies showing various changes in salivary Ph and salivary stress biomarkers. In dentistry, curcumin has been proved to have antiplaque efficiency in various studies, but long term study is required to substantiate its properties. Recently nanostructured lipid carrier containing curcumin was used in dentistry to bring about bone regeneration. This article depicts various properties, applications of curcumin in healthcare and its pharmacological action for systemic and oral health.

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powder (Borra *et al.*, 2014; Chattopadhyay *et al.*, 2004). Components of turmeric such as curcumin (diferuloylmethane), demethoxycurcumin, and bis-demethoxycurcumin are together called curcuminoids. Curcumin (diferuloylmethane) is the active component obtained from curcumin longa. It is known for its variety of biologic and non-toxic action (Chainani-Wu, 2003). It exhibits various therapeutic properties such as antioxidant, analgesic, anti-inflammatory, antiseptic activity, anticarcinogenic activity, chemotherapeutic activity, anti-tumour, antiviral, antibacterial, antifungal properties, antiplatelet activity and anti-cariogenic activity.

INTRODUCTION

Turmeric is a natural herbal product obtained from a rhizome named *Curcuma longa*. It is a yellowish orange spice. An orange-coloured component inside this rhizome gives rise to turmeric

Supplementation of curcumin through oral route acts by passing through the gastrointestinal tract unmodified with most of the flavinoids being metabolized in the liver and curcumin is formulated with bromelain to enhance its absorption and to make

it more effective (Wahlström and Blennow, 1978; Ravindranath and Chandrasekhara, 1980). Various studies were done to evaluate the bioavailability and solubility of curcumin in the human body by using alcoholic extract and aqueous extract of curcumin and they proved that alcoholic extract of curcumin showed highest antibacterial activity (Al-Musawi, 2015) and it also shows anti-cariogenic property against streptococcus mutans in the field of dentistry. It also shows antiadhesive property by inhibiting the growth of gram-positive and gram-negative microorganism. This article gives an overview of pharmacodynamics and therapeutic properties of curcumin implemented in various medical treatment to maintain the oral health and overall health of an individual.

DISCUSSION

Curcumin has an anti-inflammatory property by lowering the levels of histamine and increasing the production of natural cortisone by adrenal glands. TNF (Tumor Necrosis Factor Alpha) is the mediator of inflammation and it is activated by a nuclear factor (NF) B. These factors are stimulated by inflammatory cytokines, trauma, pathology, any physical, chemical or environmental causes. Certain in vitro studies showed that curcumin has an anti-inflammatory action on vascular cells by attenuating inflammatory response of TNF-alpha stimulated human endothelial cells and it is also capable of preventing platelet aggregation by inhibiting PDGF (Platelet-Derived Growth Factor) (Baum and Ng, 2004; Kim *et al.*, 2007) which further improves circulation. It exhibits antioxidant activities by scavenging reactive oxygen species produced by macrophages such as superoxide, nitric oxide, hydrogen peroxide (Joe *et al.*, 2004).

The antioxidant property of curcumin also plays a role in the inhibition of oxidative stresses which is one of the major aspects of many of the HIV diseases. The efficacy of turmeric in HIV (Human Immuno Deficiency Virus) diseases were examined using water-soluble extract called turmerin and lipid-soluble extract called curcumin, together called Tm. These formulations of Turmerin along with less toxic doses of AZT showed better recovery in HIV patients (Cohly *et al.*, 2003)

It shows hepatoprotective activity which may be due to its ability to decrease the formation of pro-inflammatory cytokines and by eliminating the toxic compounds. Sodium curcumin, which is considered as a salt of curcumin promotes excretion of bile pigments, cholesterol by increasing the bile solubility and bile output, thus helps in treating gall

stones and cholelithiasis through its choleric activity (Park *et al.*, 2000; Ramprasad, 1957)

Curcumin through its antimicrobial action, it inhibits the growth of various bacterial strains such as Streptococci, Staphylococci, Lactobacillus and also prevents Helicobacter pylori strains in vitro (Moghadamtousi *et al.*, 2014; Neelakantan *et al.*, 2013). The cariogenic property of streptococcus mutans is inhibited by curcumin and it is also used as root canal medicament in endodontics (Neelakantan *et al.*, 2013). Curcumin also has antifungal and anti protozoan activity against strains such as Aspergillus flavus, Entamoeba histolytica, Plasmodium falciparum (Rangel-Castañeda *et al.*, 2019). Curcumin also has antihyperalgesic activity by modifying the action of transient receptor potential vanilloid 1 (TRPV1), which plays an important role in nociception (Yeon *et al.*, 2010).

Curcumin has antimutagenic effect in various pathways such as oncogene expression, cell cycle regulation, apoptosis, tumorigenesis and angiogenesis. It prevents the formation of new tumour cells due to radiation and chemotherapy. Anti-tumour characteristics of curcumin were due to inhibitory activity of cyclooxygenase (cox) - 2 in colon cancer and breast cancer in humans (Goel *et al.*, 2001; Alok *et al.*, 2015) and by inhibiting nitrosamine formation and also by detoxifying carcinogen and mutagens.

Various studies revealed that curcumin has a protective action on the cardiovascular system by lowering the cholesterol and triglyceride levels, even with the lower dose of curcumin. It is also very effective in conditions such as metabolic syndrome, a condition where multiple systems are affected in the human body showing symptoms of hyperglycemia, insulin resistance, low high-density lipoprotein, arthritis, low-grade inflammation due to release of pro-inflammatory cytokines. Curcuminoids, along with placebos, were effective in cases of metabolic syndrome by inhibiting the inflammatory cytokines, tumor necrosis factor, Interleukins through its immunomodulatory effect. Curcumin is considered as effective, safe CRP lowering agent (Panahi *et al.*, 2015; Ganjali *et al.*, 2014). It is also found to be very effective in gastric ulcers (Snow, 1995; Prucksunand *et al.*, 2001). The juice or the fresh extract of turmeric is sometimes used locally to treat snake bites and leprosy.

Role of curcumin in dentistry

The oral malignant lesion presents the clinical features of restricted mouth opening, stiffness of oral mucosa representing the condition of oral submucous fibrosis. Limited mouth opening was due to fibrosis of mucosal fibres and reduced vascularity.

Though various surgical and non-surgical methods were followed the effect of curcumin on patients with some were studied, and they concluded that curcumin presents anti-inflammatory activity by their ability to increase the level of vitamin c and vitamin E, inducing apoptosis, inhibiting lipid peroxidation and check cellular proliferation, thereby decreasing the amount of collagen synthesis (fibrinolytic property), reduces the connective tissue growth factor (Agarwal *et al.*, 2014; Khoury *et al.*, 2015). Thus, the use of on preventive agent called turmeric (curcumin) and its extract was also used in the treatment of various other precancerous lesions like leukoplakia, lichen planus (Das *et al.*, 2010)

Dental plaque being one of the carriers of oral microbes, can be detected by Plaque detection system which constitutes staining agent such as benji-koji and turmeric. These produce yellow stain on the attached dental plaque on the teeth, thus helping in plaque detection (Haruhiko and Kouichi, 2007). Turmeric is used as a topical agent in cases like periodontitis. It is believed that the combination of turmeric, salt, mustard oil in the form of paste reduces pain due to periodontitis and gingivitis (Mozioglu *et al.*, 2008). In a study done by Washerman, et al. concluded that the use of chlorhexidine gluconate with turmeric mouth wash is effective in controlling plaque accumulation and gingivitis.

Turmeric mouthwash is prepared by dissolving 10 mg of curcumin extract in 100 ml of distilled water with the addition of flavouring agent (peppermint oil) with pH adjusted to 4 is found to be effective (Chaudhari *et al.*, 2011). Curcumin is used as effective sublingual irrigating agent followed by clinical procedures like scaling and root planning which ceases inflammation of the gingiva and produces fast recovery (Suhag *et al.*, 2007). Curcumin is used as root canal disinfecting agent, and it has better efficacy similar to a triple antibiotic paste with a minimal concentration of 2.5mg/ml. Greater biofilm activity can be obtained using photoactivation of curcumin (Sotomil *et al.*, 2019)

Pit and fissure sealants are used in restorative dentistry to prevent dental caries. Another application in dentistry where Curcumin is used as one of the constituents in pit and fissure sealant containing acrylic monomer and at least one colorant among Annatto extract, turmeric extract, and β -Apo-8'-Carotenal (Haruhiko and Kouichi, 2007). This composition forms the polymerized acrylic system.

Post extraction wound healing after extraction is very important for prosthetic reconstruction using implants to re-establish the functions of the stomatognathic system. Many bone regenerative proce-

dures such as block grafting, guided bone regeneration, platelet aggregate as autologous sources, platelet-rich plasma found to promote cell proliferation, matrix remodeling and angiogenesis. Since the presence of infection due to periodontal or any oral pathology may hinder the healing process, metronidazole antibiotics were given in the post-surgical phase, which promotes healing. But due to resistance developed due to these antibiotic strains and due to overproduction of reactive oxygen species, the healing process is hampered or slowed down altering the bone metabolism.

Thus, with the recent advent of nanotechnology, nanostructured lipid carriers were developed, which played an important role in regenerative procedures. In a study done by Murgia *et al.* (2020), a nanocomposite containing hyaluronate sponge with metronidazole and nanostructured lipid carriers with curcumin and PRF (Plasma Rich Fibrin) was used and the study showed better dental tissue regeneration when used with PRF and curcumin. (Murgia *et al.*, 2020) Curcumin conjugated with silver nanoparticles were used as an anticancer agent in the field of medicine (Khoury *et al.*, 2015). Some of the in vivo studies of curcumin proved that curcumin has the ability to kill *Candida Albicans* by Photodynamic therapy (Dovigo *et al.*, 2013)

CONCLUSIONS

Thus, turmeric named as golden spices from ancient times serves as one of the best natural healing agents with various systemic action preventing microbial proliferation and infection. Its pharmacological actions produce a curative effect in many patients promoting health and well-being of an individual. Inventions in the field of nanotechnology also incorporated curcumin as one of the constituents in various treatments of the healthcare field—these treatment modalities with curcumin help to counteract multi drug resistance microorganism. Much recent research, in vitro and in vivo studies are being conducted to prove the efficacy of curcumin in combination with antibacterial agents to reduce the healing period post-surgically.

Conflict of Interest

The authors declare that they have no conflict of interest for this study.

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