Chapter

Introductory Chapter: Curcumin and Its Therapeutic Potency

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1. Introduction

Turmeric (Curcuma longa Linn) a natural herb, is a Zingiberaceae plant that is grown mostly in subtropical and tropical climates all over the world. It's a product of Southeast Asia, Indonesia, and India [1]. Mostly, it is utilized to give colors and flavors to curry, gravy, and mustards. In the sub-continent, it is utilized to keep teeth and gums healthy. It is also used to cure some serious diseases like hepatitis and certain other liver problems. Turmeric is used as a source of medicine in some nations, like India and China [2]. Turmeric has about 200 biologically active compounds, which are recently becoming the subject of investigation. The active bi-phenolic component of turmeric is "Curcumin" (diferuloylmethane), which has been commonly utilized as a natural medicine to cure various diseases hundreds of years ago [3]. Curcuminoids, which include curcumin (Cur) and two similar substances called desmethoxycurcumin (dMC) and bisdemethoxycurcumin (bDC), are primarily responsible for turmeric's pharmacological effect (BdMC). Curcumin has a lot of benefits, such as anti-inflammatory, antioxidant, chemoprotective, metabolic regulating, immune-modulating, antibacterial, antifungal, antiviral, and anti-depressant qualities, as well as antineoplastic capabilities [4].

2. History and discovery of curcumin

Curcumin can be obtained from C. longa rhizomes, a plant of Zingiberaceae, and it is the main functional compound in turmeric. Curcumin was initially found around 200 years ago when Vogel and Peltier extracted a "yellow substance" from C. longa Linn's rhizomes and termed it curcumin. Milobedeska et al. [5] described it, and Lampe [6], made it for the first time.

3. Therapeutic potential of curcumin

3.1 Curcumin and its anti-inflammatory properties

Curcumin's anti-inflammatory properties are well-known, and several therapeutic investigations had been approved to assess its bio-active properties in a variety of

inflammatory situations. Curcumin is well-known for its powerful antioxidant activity as well as strong anti-inflammatory activity. It helps and fights with the body's immune cells against foreign invaders. Curcumin helps to suppress the molecules that cause inflammation in the body tissues. It is effective against "Arthritis", a chronic illness defined by acute joint inflammation that leads to joint damage and disability Curcumin's anti-inflammatory efficacy has largely been studied in individuals with osteoarthritis and rheumatoid arthritis and its anti-arthritic activity has been verified [7, 8].

Various doses of oral curcumin administration formulations (200–2000 mg/day) and its combination with other plant extracts have been studied for a period of (2 weeks–6 months) in which different symptoms of inflammatory, stress, and skin diseases were studied. The results suggested by Dcodhar et al., that curcumin and phenylbutazone had similar effects on morning sickness, swelling of the joints, and walking time in patients with rheumatoid arthritis, but none had an impact on erythrocyte sedimentation rate (ESR), grip strength and joint index [9].

Curcumin is an indispensable component in the treatment of many types of skin diseases and allergies as well, including psoriasis, pruritus, and radiation-induced dermatitis. The research was performed for the effects of oral curcumin administration in psoriasis, a severe inflammatory and hyper-proliferative condition of skin [10] in the form of a tonic or an ointment [11]. The ointment of curcumin lowered serine/threonine-specific protein activity of kinase and the expression of keratinocyte transferrin receptor (TRR), as well as parakeratosis severity and epidermal cell density. A poor response rate was noted in the outcome of oral intake of curcumin in psoriasis patients. Only two patients out of a total of 12 showed signs of improvement [12].

Orally given curcumin, on the other hand, lowered Psoriasis Area and Severity Index (PASI) scores when paired with topical treatments [10]. Clinical research on the effect of curcumin on various ophthalmological problems revealed that this chemical has high effectiveness whether administered by oral ingestion. In addition, individuals with central serous chorioretinopathy saw a considerable improvement after taking oral curcumin [13].

3.2 Curcumin in cardiovascular protection

Curcumin's cardioprotective efficiency has been proven in a growing number of clinical investigations, owing to its anti-atherosclerotic and anti-hyperlipidemic properties. The active components of curcumin help in the regulation of epithelium walls of the blood vessels and help in smooth blood flow. An oral administration of curcumin in doses ranging from 20 to 4000 mg has been shown to improve the blood lipid profile of the patient along with the increase in the levels of antioxidant status [14]. The findings of the study by Baum et al., suggested curcumin intake (4000 mg/day) for 180 days altered TG levels and had no effect on other metabolic parameters like TC, HDL-C, or LDL-C. Higher doses, on the other hand, were shown to be ineffective [15].

3.3 Curcumin and gastrointestinal diseases

The bio-active components of turmeric and curcumin help in the proliferation of healthy gut microbiota. Recently, it is also being used for the treatment of gut dysbiosis (unbalance of gut microbiota that is associated with digestive problems and inflammation) that is also linked with a number of metabolic diseases as well.

Many studies were performed against irritable bowel syndrome (IBS), inflammatory bowel disease (IBD), pancreatitis, helicobacter pylori infections, and ulcers.

However, there is limited literature on pancreatitis and a lot more work in this field is still required. The patients having pancreatitis were treated with 500 mg dosage of curcumin along with piperine and which results in the reduction of erythrocyte malondialdehyde (MDA) levels significantly, indicating curcumin's antioxidant effect [16].

Hanai et al. found that giving patients with ulcerative colitis 1–3 g of oral curcumin along with mesalamine/sulfasalazine for almost 27 weeks, which resulted in a significant drop in ulcers rate [17]. A study conducted by Lang et al. [18] found that individuals having ulcers were subjected to 3 g dosage of curcumin for 30 days, which resulted in much better results than the placebo group. Indeed, 53.8% of the curcumin group reached a reduction of the ulcers in 4th week compared to 0 percent in the placebo group, however, 65.3 percent of the curcumin group obtained clinical response compared to 12.5 percent in the placebo group.

Curcumin also proved efficient for the treatment of H. pylori-related problems. A dosage of 30 mg curcumin was orally taken by a group of examined patients in combination with 100 mg lactoferrin with 20 mg pantoprazole and 600 mg N-acetylcysteine, for only 7 days and resulted in limited overall inflammation severity [19]. Curcumin alone, given at 2100 mg/day for 4 weeks, had a very poor eradication rate and had little effect on inflammatory cytokines [20].

3.4 Curcumin and liver diseases

As curcumin has an antioxidant activity along with other biological properties, it helps the liver to detoxify and helps eliminate the toxins. It can be helpful in those patients that took medicines and drugs for the treatment of ailments i.e. diabetes and other chronic health problems, to reduce the levels of oxidative stress and eliminates toxins along with the smooth flow of the bile duct. According to Kim et al., curcumin supplementation in fermented turmeric powder form was given to subjects and it resulted in high ALT level, Gamma-glutamyl Transferase (GGT), total bilirubin level (TB), and wrapped profiles [21].

3.5 Curcumin and diabetes

Diabetes is another chronic disease in which the human body fails to produce insulin or the body does not respond to the prepared insulin. As a result, sugar concentration in the blood becomes high (hyperglycemia) and it can cause damage to body organs. This condition describes the production and oxidative stress of highly inflammatory cytokines. Curcumin can be useful to treat this condition and its antioxidant stress. Curcumin, first used in the treatment of diabetes, which resulted in blood sugar was treated with 5 grams of turmeric powder and it resulted in the reduction of blood sugar in the affected patients [22].

The impact of Curcumin (*C. Longa)* was inspected in a trial study on post-Prandal, plasma glucose, glycemic index (GI), and insulin levels in a group of healthy patients [23]. After giving the turmeric dosage (6 g), oral glucose-tolerinus test (OGTT) was conducted and there no change was detected in both glycemic index and glucose levels, but significant changes in the levels of insulin were recorded which was the indication that turmeric has an effect on the release of insulin.

3.6 Curcumin and cancer treatment

Multiple factors are involved in the occurrence of cancer. It can be characterized as uncontrolled cell growth that in some cases can spread to other body organs as

well. Along with the strong antioxidant activity, curcumin has the ability to fight with cancerous cells as well. Many studies were conducted in order to estimate the positive effects of curcumin in cancer patients. Results from studies showed that many symptoms e.g. multiple myeloma, lesions on the skin, cancers of the neck, head, and orbits, cancers of the lungs, brain, colon, breasts, and prostate were eliminated. It has been confirmed that it can be improved [24]. Mostly, the application of the extracts of turmeric oil also improved symptoms of cancer and improved the condition of lesions. When myeloma patients were given curcumin dosage through oral administration (1–12 g/day), it reduces urinary paraprotein and interpeptide levels of type I collagen and downregulates NFκB, STAT3, and COX2 [25]. In addition, the use of curcumin has a positive effect on patients with orbital pseudotumor, squamous cell carcinoma of the head, neck, lung, breast, and prostate cancer, with a decrease in the size of the tumor and a reduction in secretory mutants [21]. In colorectal cancer, the patients ingested curcumin in the form of the C3 complex and it significantly reduced M1G and serum TNFα levels, polyps and abnormal crypt foci, and increased apoptosis. Tumor cell count and Bls_2 [26].

4. Conclusion

Turmeric is a commercially important spice (C. longa L., Zingiberaceae) that is widely utilized as a nutritional component in Asia and Western countries. It has long been renowned for its therapeutic and medicinal properties against a wide range of ailments, as reported in traditional, herbal, and other alternative forms of mainstream medicine. The bioactive component of turmeric (curcuminoid) is famous for its abundant pharmacological properties. Researches had shown that active components in turmeric other than curcuminoids are equally useful and have several medicinal potentials. Finally, as autoimmune-related diseases are increasingly associated with cumulative exposure, special attention should also be paid to their prominent potential in both toxic and pollutant exposures.

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