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Medicinal Applications of Curcumin Nowadays as Nanoform

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ABSTRACT

Curcumin extract from turmeric, a natural polyphenol product from the rhizome. Several studies have revealed that it showed anti-cancerous activity, inhibited cell necrosis, inhibiting cell proliferation, anti-angiogenesis and anti-microbial that makes it more interesting to other one without side effects. It has been nowadays used in clinical trials on varied inflammatory diseases and cancers. So, many incurable diseases like neurodegenerative diseases, vessel diseases and polygenic disease after the clinical application of curcumin confirmed better possibility in the field of drug development in near future. In curcumin have very low bioavailability in nature, so to enhance the bioavailability of it using by numerous strategies, such as add with adjuvant or structural modification in the various form of Nanoparticle, etc. In this article, we summarized the currently using various form of Nanoparticle of curcumin and their efficacy also.

Keywords: Nanoparticle, Curcumin, Anti-teratogen, Bioavailability

INTRODUCTION

Curcumin, a yellow spice, derived from the rhizome of the perennial herb *Curcuma longa* and has a long history of use as a traditional medicine in India and China [1]. It was first time indentified by two people Rougghley and Whitting in 1973 [2]. The major components of *Curcuma longa* (turmeric) is diferuloylmethane or curcumin I (about 77%), demethoxycurcumin (curcumin–II~17%) and bisdemethoxycurcumin (curcumin III~3%) [3] **(Figure 1)**. In ancient times turmeric used as a folk remedy, to cure wounds and burns, any infection and also applied externally if any skin diseases. Moreover, it can also be used as flavor of food and as food additive to enhance the color. In this review, we discussion the modern medical utilization of Curcumin. Also explore its use with modification in various formulations and its potential clinical applications. The curcumin showed pro-oxidant activity which depends on its dose and the chemical environment where these are interacting. Curcumin can have induced cell apoptosis [4,5] antimicrobial [6], anti-fungal [7] properties, anti-angiogenesis by down-regulate HIF-1 (Hypoxia inducible factor-1) expression [8], antiprotozoal, antiviral and it also as anti-teratogen [9], etc.

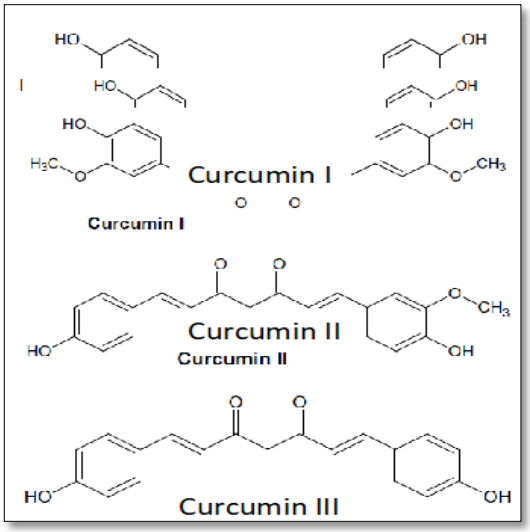

Figure 1. Structure of three form of curcumin I, II and III.

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PROBLEMS WITH CURCUMIN

The major problems with Curcumin because of it have a poor bioavailability caused by its absorption very low and rapid metabolism. Its clinical application suffers because of this. Bioavailability improvement or enhancement is major challenge for its medicinal use. In many previous preclinical studies revealed that the bioavailability could be enhanced through the mixing with adjuvant or with curcumin formulation and the newly formed compound as drug delivered through as a nanoparticles form or liposomes, micelles or phospholipid complexes. By the simple structural modification of Curcumin its activity also could be enhanced. Solid lipid nanoparticles (SLNPs) to enhance the oral bioavailability of curcumin [10].

USE AS NANO-FORM OR OTHERS FORMULATION

THERACURMIN used as the first Nanoparticle formulation of Curcumin which revealed the enhancing bioavailability of Curcumin in human subjects. The experiment however, is a promising tool at the time of testing the potential anticancer effects of curcumin in clinical trials [11]. Curcumin when loaded with ZnO nanoparticles form were successfully synthesized and encapsulated with co-polymer PMMA-AA or Cur/PMMA-AA/ZnO NPs as reported and the result revealed that the formulation PMMA-AA/ZnO nanoparticles with curcumin enhancing the anti-gastric cancer activity of curcumin [12]. Curcumin as in the form of a nano drug delivery agent for doxorubicin hydrochloride (DOX) (commercially known as Adriamycin®) coated with PEG revealed a more effective therapeutic strategy against MDR cancer cells. In this for the result confirmed improved bioavailability [13]. Triptolide and Curcumin Nanoparticles (NPs) showed synergistic effects on ovarian cancer in both in vitro and in vivo model studied and the toxicity caused by triptolide was reduced by the presence of curcumin in the system through anti-oxidative properties. These experiments could be a promising strategy in future for ovarian cancer patient [14]. The 'white curcumin' tetrahydrocurcumin lipid nanoparticles effectively inhibit skin inflammation [15]. Curcumin when loaded into solid lipid nanoparticles (SLNs) to showed much improved therapeutic efficacy for breast cancer in these studies [16]. Curcumin nanoliposomes showed tumor regression in vivo and enhancement of cytotoxic photodynamic activity on HepG2 cancer cells. In this experiment curcumin nanoliposomes and PVP capped gold nanoparticles used but the curcumin nanoliposomes exhibited better performance [17].

In an *in vitro* study revealed the retention of anticancer activity of curcumin after conjugation of the curcumin molecules on the surface of gold quantum clusters. However, *in vivo* study on severe combined immunodeficiency mice showed that conjugates also inhibited the tumor growth efficiently exclusive of any significant adverse effects on the internal organs [18]. In a formulation a novel nano-carrier containing Pluronic-F127 stabilized D-α-Tocopherol polyethene glycol 1000 succinate nanoparticles, applied for the solubilization of curcumin revealed that solubilized a very high concentration (4.3 mg/mL) of curcumin. These Curcumin-loaded nanocarriers showed reduced retinal ganglion cell loss, mark a potential for in future as effective neuroprotective remedy in the patient of glaucoma and such type of other eye diseases [19]. Another studies revealed that curcumin-loaded polyacrylamide-cardiolipin-poly(lactide-co-glycolide) nanoparticles with conjugated 83-14 monoclonal antibody to reduced neuritic degeneration by confirming to protect β-amyloid-insulted neurons [20]

Another study showed that Nano particulate curcumin (poly d,l-lactic-co-glycolic acid entrapped curcumin Nanoparticle) increase bioavailability and stimulated higher early cell-mediated immune response while it significantly stimulated primary humoral immune response and secondary humoral antibody titers also [21].

CONCLUSION

Curcumin from ancient to modern used for the cure of various ailments due to its miracle properties. In the future, several clinical studies carried out generally focused on various diseases. Furthermore, by applied it in different structural modifications form its effects enhance several fold as modification with as adjuvant or drug delivery systems. So, finally further more work needs to explore the more properties of curcumin for its use in near future for human welfare.

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CONFLICT OF INTEREST

The authors confirm that there are no conflicts of Interest.

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