Chapter 3
Anticancer Properties of Curcuma longa: Current Status and Future Prospects

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ABSTRACT

Cancer is one of the leading causes of death in the world. Curcuma longa, also known as turmeric, has been traditionally used for the treatment and prevention of various conditions. There has been a growing interest in exploring the potential anticancer properties of C. longa and its bioactive compound, curcumin. Curcumin has been found to exhibit a broad spectrum of anticancer effect by inducing programmed cell death, inhibiting the growth and proliferation of tumors, and suppressing angiogenesis. Its anticancer effect has been reported in many different types of cancer. However, the effectiveness of curcumin is hampered by its poor bioavailability when administered orally. This chapter reviews comprehensively about the anticancer properties of C. longa, mechanisms of anticancer activity of curcumin and update knowledge on the anticancer effect of curcumin in various cancers. Moreover, this chapter discusses about the challenges and future prospects of curcumin in cancer treatment.

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INTRODUCTION

Cancer is widely recognized as a large number of diseases that result from uncontrollable proliferation and lack of cellular differentiation, resulting in tumor formation (Ferlay et al., 2012). In cancer, abnormal cells, which can form malignant tumors, grow out of control in the body and invade nearby tissues. If not controlled, these cells will migrate to different parts of the body via the lymphatic and circulatory systems, contributing to the advancement of the disease. In 2023, it is projected that there are roughly 1,958,310 new cases of invasive cancer, translating to an estimated 5,370 new instances daily in the United States. Furthermore, cancer is projected to result in the demise of 609,820 persons in the same year, corresponding to roughly 1,670 deaths per day (Siegel et al., 2023). The increasing global burden of cancer, the severe side effects of chemotherapy and the expensive treatment cost call for alternative treatment therapies for cancer. Medicinal plants, which contain abundant compounds with antioxidant, immunomodulatory and anticancer activities, have a huge anticancer potential (Ahmadi et al., 2016).

Curcuma longa (turmeric), is a rhizomatous medicinal plant in the *Zingiberaceae* family. It grows wild in Southeast Asia, Indonesia, and India. It has been utilized to treat and prevent many different conditions such as inflammation, diabetes, coughs, hepatic diseases, arthritis, diarrhea, gastric, skin and blood disorders in ancient Indian and traditional medicine for several hundred years. Researchers found that *C. longa* exhibits a broad spectrum of pharmacological actions, such as anti-inflammatory, anti-diabetic, antioxidant, hepatoprotective, anti-microbial, anti-osteoarthritis, neuroprotective, anti-ageing, anti-diarrheal, would healing, anti-depression and anticancer activity. Over the recent years, there has been a growing curiosity in exploring the potential anticancer characteristics of *C. longa*. Particularly, extensive research has focused on the primary bioactive constituent of *C. longa*, curcumin, and its impact on cancer, including both stages of pre-clinical and clinical experimentation (Mansouri et al., 2020). The anticancer activity of curcumin has significant impacts because of its low toxicity for healthy cells. In addition, curcumin has desmonstrated anti-proliferative action in many cancer cell lines such as those found in the pancreas, kidney, colorectal, prostate, breast, and pancreatic cancers. Therefore, *C. longa* and curcumin possess large remedial potential for cancer treatment. However, the use of curcumin is not without challenges. Its main obstacle is the poor bioavailability, which limits its therapeutic effectiveness. Curcumin is ineffectively absorbed in the intestines, rapidly digested, and quickly excreted from the body (Ravindranath & Chandrasekhara, 1980). Various strategies are being explored to address these problems such as the use of nanoparticles, liposomes, and other delivery systems of the drug to improve the curcumin absorption, enhance its concentration in the blood, and improve its distribution in the body (Bisht et al., 2007a, 2007b).

This chapter reviews comprehensively about the anticancer properties of *C. longa* and the important substance curcumin, incorporating data from both *in vitro* and *in vivo* experiments. Based on current scientific findings, information on the anticancer mechanisms of curcumin is provided. Updated knowledge on the anticancer capacity of the important compound curcumin in various cancers is also given. In addition, this chapter discusses about the challenges and potential future of curcumin in the treatment of cancer.