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Anticancer activity of chemically prepared shrimp low molecular weight chitin evaluation with the human monocyte leukaemia cell line, THP-1

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In the present study, anticancer activities of chitin, chitosan and low molecular weight chitin were evaluated using a human tumour cell line, THP-1. A molecular weight–activity relationship and an electrostatic interaction–activity relationship were determined. The cytotoxic effects of chitin and derivatives were also evaluated using a normal human foetal lung fibroblastic cell line, MRC-5 and the specific cytotoxicity of chitin and derivatives to tumour cell lines was demonstrated. The high antitumour effect of low molecular weight of chitin was established.

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1. Introduction

Chitin is a linear polysaccharide joined by þ-(1,4)-linked N-acetylglucosamine (GlcNAc) units [1]. It is the second most abundant natural polymer after cellulose [2]. Their unique properties, biodegradability, biocompatibility and non-toxicity, make them useful for a wide range of applications. Although chitin has very strong functional properties in many areas, the water-insoluble property of a-chitin is disadvantageous for its wide application [3]. In the research field of chitin, functional property has been developed for pharmaceutical and new drug candidate [4,5]. Cytotoxic drugs continue to play a major role in cancer therapy [6]. However, cytotoxic drugs produce side effects, especially the destruction of lymphoid and bone marrow cells. Therefore, strategic improvements in cancer therapy are needed to ameliorate efficiency while decreasing side effects. Most biological activities of chitin are attributed to their free amino groups [7]. Chemical modification of chitin is difficult in general, because chitin is a highly crystalline material with a strongly hydrogen-bonded network structure [8,9]. The purpose of this work is the determination of the anticancer activities of chitin, chitosan and low molecular weight chitin using a human tumour cell line, THP-1. A molecular weight–activity relationship and an electrostatic interaction–activity relationship were evaluated. The cytotoxic effects of chitin and derivatives were also treated using a normal human foetal lung fibroblastic cell line, MRC-5 and the specific cytotoxicity of chitin and derivatives to tumour cell lines was studied. The function of YKL-40 glycoprotein was also investigated.

Abbreviations: CHI3L1, chitinase 3-like 1; ^{13}C NMR, 13carbon nuclear magnetic resonance; DNA, desoxyribonucleotid; FBS, foetal bovine serum; FPLC, fast performance liquid chromatography; FT-I, Fourier transform infrared; HC gp-39, human cartilage glycoprotein 39; HL-60 cells, human leukaemia-60 cells; HPAEC, high performance anion exchange chromatography; HT 1080, human tumour HT 1080; IC_{50}, inhibitory concentrations 50; LPS, lipopolysaccharids; MEM, minimum essential medium; PMA, phorbol 12-myristate 13-acetate; RPMI 1640, Roserv Park Memorial Institute; R.S.D., relative standard deviation.

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2. Materials and methods

All chemicals used in this study were analytical grade and purchased from Sigma Chemical Co. (St. Louis, MO).

2.1. Test materials

Shrimp shells were obtained from a seafood restaurant. It was confirmed that all shells were from a single species of shrimp *Parapenaeus longirostris*.

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