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Synergistic anti-inflammatory activity of combination of shrimp shells derived chitosan with *Cynara cardunculus* var. *scolymus* (L.) polyphenols

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Abstract

Inflammation is a symptom associated with many diseases. This symptom is treated with steroidal and non-steroidal anti-inflammatory drugs, which can cause severe side effects when used as long-term treatments. Natural products are an alternative source of new compounds with anti-inflammatory activity. The present work investigates the anti-inflammatory activity of chitosan extracted from shrimp shells waste, both alone and combined with polyphenols of *Cynara cardunculus* var. *scolymus* (*C. scolymus*). First, Shrimp shells were washed, dried, and ground. Second shrimp shells flour was demineralized and deproteinised to prepare chitin. Finally, Chitosan was obtained by deacetylation of chitin and then analysed based on its moisture, ash, protein, molecular weight and degree of deacetylation. The polyphenols of *C. scolymus* were prepared using methanol as solvent. The total phenolic and flavonoid content of *C. scolymus* were determined using spectrophotometric methods. The anti-inflammatory activity of Chitosan and *C. scolymus* extract alone or in combination was assessed using *in vitro* (Inhibition of protein denaturation and human red blood cell membrane stabilization methods) and *in vivo* (carrageenan induced mouse paw edema) methods. Results have shown that the amount of chitosan extracted was 5.80 ± 1.09 %; it contains 4.43 ± 0.57 , 1.32 ± 0.62 and 0.18 ± 0.04 % of moisture, ash and protein, respectively. Its molecular weight is 859.48 ± 21.62 KDa and its degree of deacetylation is 75%. The combination of chitosan and *C. scolymus* extract resulted in the most effective in preventing protein denaturation and erythrocytes membrane injury. Furthermore, the combination significantly inhibits the inflammation induced by injection of carrageenan to mice ($83,66 \pm 21,21\%$) in comparison with chitosan ($63,67 \pm 17,14$) and *C. scolymus* extract ($51,11 \pm 20,9$) when used alone. This suggests that chitosan, in conjunction with *C. scolymus* polyphenols might be used to prevent inflammation.

Key Words: chitosan, *Cynara scolymus*, polyphenols, inflammation

