ANTITROMBOTIC AND ANTICARIOGENIC HYDROLYSATES OF *Phaseolus lunatus* PROTEIN

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Introduction. Recent studies such as those made by Cai et al. (1) have shown that peptides present in milk and whey, exhibit antithrombotic and anticariogenic activities, these amino acid sequences are released during the hydrolysis. Proteins from vegetal sources could be a lower-cost alternative for obtaining this kind of peptides. *Phaseolus lunatus*, which is grown in southeastern Mexico, is rich in protein (29%) therefore could be used to obtain bioactive peptides.
The objective of this study was to evaluate the antithrombotic and anticariogenic activities of *Phaseolus lunatus* protein hydrolysates, and the feasibility of increasing their biological activity by chemical modification.

Methods. Hydrolysis of the protein concentrate was done with the enzyme pepsin. Degree of hydrolysis was calculated by determining free amino groups. The antithrombotic activity was determined according to Miyashita et al. (2) using human blood. The anticariogenic activity was determined according to Wamer et al. (3) using hydroxyapatite to emulate tooth enamel. In order to increase the anticariogenic activity the hydrolysates were phosphorylated with monosodium phosphate, disodium phosphate, and pyrophosphate.

Results. The enzyme pepsin produced a high degree of hydrolysis (12.4%). The results expressed as reduction of platelet aggregation (%) to different concentrations of hydrolysate are showed in Figure 1.

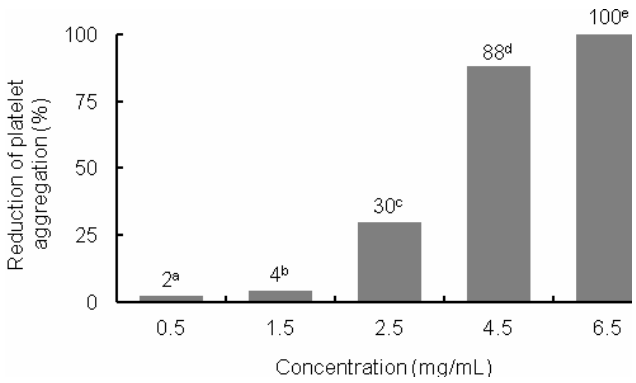

Fig. 1 Reduction of platelet aggregation at different concentration of hydrolysate. Different superscript letters indicate statistical difference ($P < 0.05$).

The phosphorylation increased phosphorus content in the hydrolysates (Table 1).

Table 1. Phosphorus content and demineralization reduction. Different superscript letters indicate statistical difference ($P < 0.05$).

Sample	Phosphorus content (g/100 g)	Demineralization reduction (%)	
		Calcium	Phosphorus
Hydrolysate	0.174^a	50.0^a	55.8^a
Hydrolysate (mono and disodium phosphate)	0.436^c	68.2^b	71.9^b
Hydrolysate (pyrophosphate)	0.374^b	77.3^c	76.9^c

Both methods of phosphorylation increased the anticariogenic activity of hydrolysates.

Conclusions. The enzymatic modification of *Phaseolus lunatus* protein concentrate generated peptide sequences with antithrombotic and anti-cariogenic activity. The phosphorylation increases the anticariogenic activity. The results allow raising the potential use of *Phaseolus lunatus* hydrolysates as nutraceutical ingredients for the development of functional foods or products with pharmaceutical applications.

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References

1. Cai, F., Shen, P., Morgan, M.V., Reynolds, EC. (2003). Aust. Dent. J., 48(4): 240-243.
2. Miyashita, M., Akamatsu, M., Ueno, H., Nakagawa, Y., Nishumura, K., Hayashi, Y., Sato, Y., Ueno, T. (1999). Bios, Biot, Biochem, 63:1684-1690.
3. Warner, E. A., Kanekanian, A. D. & Andrews, A. T. (2001). Trends Food Sci. Tech., 9: 328–335.