Exceptional Stability of Kidney Bean Inhibitor to Temperature and Pepsin Digestion

Swatabdi Kamal
Indiana University - Purdue University Fort Wayne

Kali Fridholm
Indiana University - Purdue University Fort Wayne

Tim Byers
Indiana University - Purdue University Fort Wayne

Josiah McMillen
Indiana University - Purdue University Fort Wayne

Follow this and additional works at: http://opus.ipfw.edu/stu_symp2013

Part of the Chemistry Commons

Recommended Citation
http://opus.ipfw.edu/stu_symp2013/28

This is brought to you for free and open access by the IPFW Student Research and Creative Endeavor Symposium at Opus: Research & Creativity at IPFW. It has been accepted for inclusion in 2013 IPFW Student Research and Creative Endeavor Symposium by an authorized administrator of Opus: Research & Creativity at IPFW. For more information, please contact admin@lib.ipfw.edu.
Exceptional Stability of Kidney Bean Inhibitor to Temperature and Pepsin Digestion
Swatabdi Kamal, Kali Fridholm, Tim Byers, Josiah McMillen Mentor: Mohammad A Qasim
Department of Chemistry, IPFW, Fort Wayne, IN 46805

Abstract: Serine proteases form the major class of protein digesting enzymes and are involved in such functions as blood clotting, fertilization of an egg by a sperm, activation of certain enzymes and proteins, and cell death. Despite being vital for a living organism, the uncontrolled action of serine proteases will be catastrophic. One mechanism by which the activity of serine proteases is controlled is through their interaction with serine protease inhibitors. Here, we describe our results on the investigation of the effect of temperature and pepsin digestion on serine protease inhibitors extracted from kidney beans.

Our Research: In our research we have studied a protein from kidney beans that has the property to inhibit enzymes, specifically serine proteases like chymotrypsinogen and trypsinogen, which are found in the small intestine. We have examined the effect of temperature (100 °C) and pepsin treatment on the inhibitory activity in kidney beans.

Method: Raw kidney beans were crushed in a homogenizer and the proteins in the kidney bean were extracted with tris-HCl buffer, pH 7.0. The kidney bean extract was separately exposed to heat treatment at 100 °C for up to 3 hours and to pepsin digestion up to one week. The inhibitory activities of heat treated and pepsin treated extracts were measured against Chymotrypsinogen and Trypsinogen. The kidney bean extracts were analyzed by the techniques of electrophoresis and size exclusion column chromatography. The sodium dodecyl sulfate polyacrylamide gel electrophoresis (SDS-PAGE) of Control [C], Heat treated (H) kidney bean extract. Four standard protein of known molecular weights were used as markers: BSA, Bovine serum albumin (68000); OVA, Ovalbumin (45000); CHYM, Chymotrypsinogen (25000); and RNE, Ribonuclease (13700).

Results:

<table>
<thead>
<tr>
<th>Kidney Bean Extract</th>
<th>% Inhibitor Activity</th>
<th>Chymotrypsin</th>
<th>Trypsin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td></td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>100°C Heat Treated</td>
<td></td>
<td>30%</td>
<td>27%</td>
</tr>
<tr>
<td>Pepsin Treated</td>
<td></td>
<td>15%</td>
<td>70%</td>
</tr>
</tbody>
</table>

Bibliography:

Background: Proteins are vital components of all living organisms. A human cell contains approximately 25,000 different proteins (1). Each protein performs a specific function. The function of a protein depends on its structure and its shape and geometry (2). Proteins lose their specific shape and geometry when they are exposed to high temperatures (~100°C) (3). Proteins also lose their specific shape and geometry when they are treated with pepsin (an enzyme present in stomach that breaks proteins into small pieces) (4).

Conclusion: The results show that the inhibitory protein in kidney bean is exceptionally stable to heat treatment and to pepsin digestion. This shows that even when kidney beans are cooked and consumed, the inhibitor is still active in the digestive tract despite cooking procedures and the presence of pepsin as a digestive enzyme.