



Spectrophotometric Investigation of Bromelain Protease for the Pancreatic Insufficiency



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Introduction

In patients with cystic fibrosis (CF) and other conditions with pancreatic insufficiencies, the pancreas is unable to supply the enzymes required for digestion and absorption of food in the small intestines. Pancreatic inadequacies leads to malnourishment in patients that may be decreased by prescribed supplemental pancreatic enzymes (Singh and Schwarzenberg 2017), but there may be additional enzymes with better digestive efficiencies. Bromelain is an enzyme concentrated in the stems and leaves of pineapple plants, *Ananas comosus*, and shown to aid in digestion of proteins (Roxas and Mario 2008, Rathnavelu et al. 2016). Additionally, bromelain enzyme has alkalizing powers to supplement the decreased release of sodium bicarbonate from the pancreas in CF patients (Rathnavelu et al. 2016). The hypothesis is bromelain will have significantly higher qualitative amounts of proteins (milk protein isolate, pea protein and whey protein isolate) digested and will have significantly faster digestion rates compared to prescribed supplemental pancreatic enzymes.



Materials and Methods

Protein powder (whey, pea isolate, and milk isolate) was prepared with 28.5 g dissolved in 350 mL of distilled water. Bromelain (raw pineapple leaves and stock) was blended with 200 mL distilled water and strained. Protease was prepared with Micrazym 10,000 USP Supplemental Pancreatic Enzyme dissolved in 25.6 g sodium bicarbonate and 45mL distilled water. Absorbance was measured using a Vernier UV-Vis Spectrophotometer and Bradford reagent. After calibrating with Bradford reagent as the blank, 3 mL of Bradford reagent and the following combinations were combined in the curvet and absorbance was measured between 400-740 nm.

- 60 μ L protein
- 60 μ L protease
- 60 μ L bromelain
- 60 μ L protein + 30 μ L bromelain + 30 μ L protease
- 60 μ L protein + 60 μ L protease
- 60 μ L protein + 60 μ L bromelain
- 60 μ L protein + decreasing amounts of bromelain 60 μ L, 30 μ L, 15 μ L, and 5 μ L

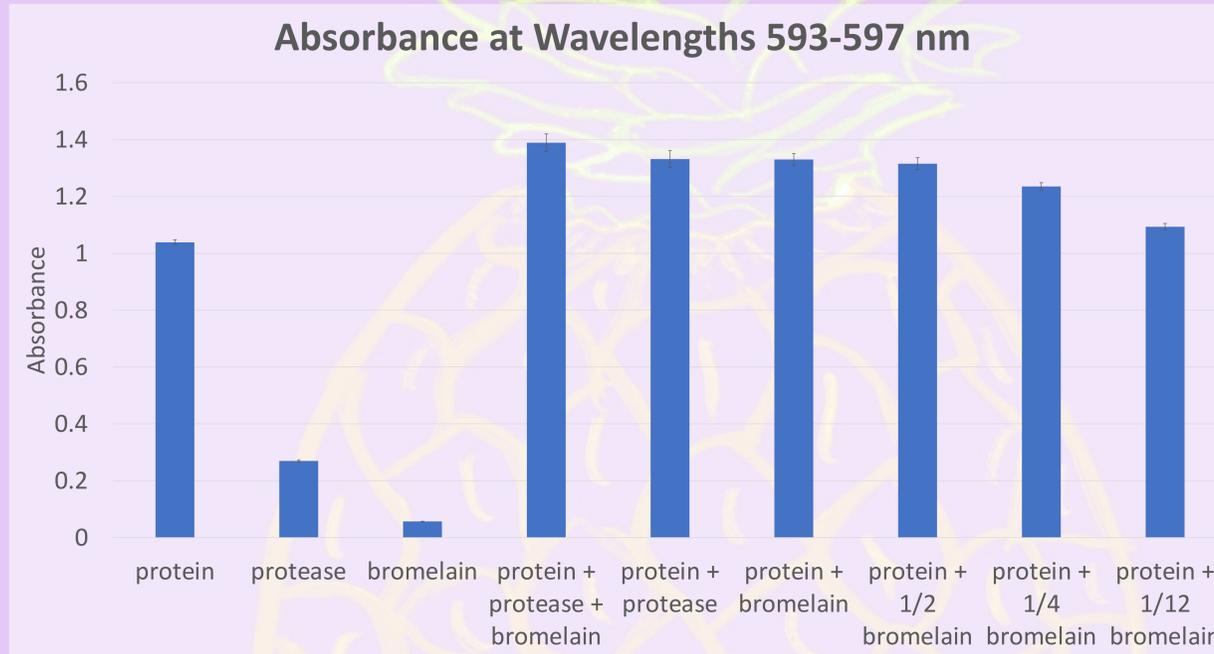
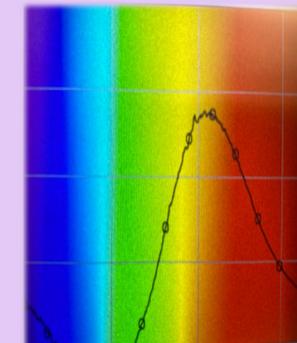


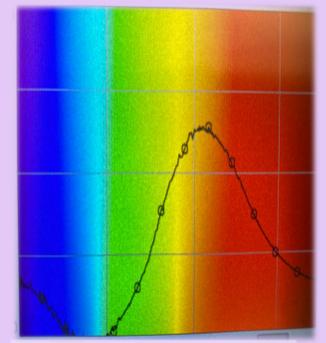
Figure 1. Absorbance of protein, protease, and bromelain combinations using Bradford reagent at light wavelengths of 593-597 (n=7, $X \pm SD$).

Results

Peak absorbance was 593-597. The absorbance was significantly different between protein, protease, and bromelain combinations using Bradford reagent at light wavelengths of 593-597 (1-way ANOVA, $F_{8,54}=4885.77$, $p<0.05$). Individually, protease and bromelain were significantly lower absorbances than any of the samples with protein. Protein without protease or bromelain had significantly higher absorbance than individual protease or bromelain, but significantly lower absorbance than protein with protease and/or bromelain. Protein with protease was not significantly different from protein with bromelain or protein with protease and bromelain. Protein with 1/4 bromelain was significantly lower than protein with higher levels of bromelain; and protein with 1/12 bromelain was significantly lower than protein with higher levels of bromelain.



Protein + Protease



Protein + Bromelain

Discussion

This study found bromelain and protease of the supplemental enzyme equally digested the proteins. This indicates that bromelain may be an alternative option as a protease supplementation for patients with pancreatic insufficiencies, including cystic fibrosis (CF) patients. In previous studies, bromelain has been found to have anti-inflammatory properties and anti-microbial properties in the intestinal track, resulting in lower amounts of fat in stool as well as a reduction in pain (Rathnave et al., 2016). Bromelain was also found to have an alkalizing effect when introduced to the digestive track, which could be of particular interest to the CF community because of the lack of bicarbonate released by the duodenum (Rathnave et al., 2016). The results of this study indicate that bromelain may be a viable alternative to supplemental protease enzymes currently prescribed to CF patients. Bromelain is plant based and therefore may be a more desirable option for religious or dietary practices as opposed to most prescribed pancreatic supplemental enzymes that are derived from pigs. Studies have shown that malnourishment appears to have a direct correlation to lung function and overall health in CF patients (Singh and Schwarzenberg 2017). Having alternative options for supplemental enzymes may enable more patients with CF to thrive. Further research will investigate bromelain with other protein sources and will investigate plant-derived alternative sources for amylase and lipase enzymes that have similar half-lives as bromelain (6-9 hours) to compose an effective long-acting enzyme supplementation.

Acknowledgements

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Citations

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