Research Article

Extraction and estimation of protease from pineapple and assessment of its efficacy in reducing the cooking time of lamb steak

Charanyasuresh, R. Gayathri*, V. Vishnu Priya

ABSTRACT

Introduction: Sales of proteolytic enzymes account for over 60% of total sales of these types of biochemical products, indicating the great importance of proteases as a group of industrial enzymes. Pineapple is a widely grown fruit in tropical and subtropical regions around the globe and is a rich source of stem and fruit proteolytic bromelains. Hence, it is important to find an economical and efficient way of using protease present in pineapple for industrial or household purposes. **Materials and Methods:** Assessment of collagen degradation activity of protease on lamb steak: 400 g of lamb steak were separated into four groups of 100 g each and were soaked in the prepared pineapple extract for different time intervals to assess the collagen degradation activity of bromelain in relation to time. **Results:** The protease activity of bromelain present in pineapple was found to be around 0.165 micromoles per ml. Bromelain extracted from pineapple was proved for its ability to break collagen bonds efficiently and acts in reducing the cooking time of lamb steak. **Conclusion:** This study focuses on one of the efficient applications of protease to reduce the consumption of fuel by reducing the cooking time of lamb steak.

KEY WORDS: Cooking time, Lamb steak, Pine apple, Protease, Protein

INTRODUCTION

Bromelain is an aqueous extract of pineapple that contains a complex mixture of proteases and non-protease components.[1] These enzymes perform an important role in proteolytic modulation of the cellular matrix in numerous physiologic processes, including anti-inflammatory, anti-thrombotic, and fibrinolytic functions.[2]

Plant proteases have received special attention in the field of medicine and biotechnology due to their properties. The best-known plant proteases with commercial value are papain from Carica papaya ficin from *Ficus* spp. and bromelain from Ananas comosus Bromelain is a proteolytic enzyme normally present in pineapple fruit and stem.[3-5] It has been widely used in food, medical–pharmaceutical, cosmetic, and other industries. In the food industry, it has been used for meat tenderization, beer clarification, protein hydrolysate production, and prevention of apple juice browning.[6-8] It has been known for clinical and therapeutic applications, particularly for modulation of tumor growth and third-degree burns. In cosmetic industries, bromelain is used as an active ingredient to provide a gentle peeling effect. In addition, bromelain has also been used for skin pre-tanning, softening, and bating in leather industries, for improving the dyeing properties of protein fibers, decomposing or partially solubilizing protein fiber from silk and wool.[9] Furthermore, novel use of bromelain as hydrolyzing agent for the release of antimicrobial peptides of leatherjacket (*Meuchenia* sp.) insoluble proteins has been reported.

Collagen is the major determinate of the texture of mature and older slaughter animal meat. There is a reasonable correlation between total collagen content and the eating quality of meats.[10] Tenderization of those meats may be achieved using protease for the degradation of connective tissue and myofibrillar proteins. Apart from the food aspect, collagen has extensively been used in cosmetic applications.[1-10]

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Department of Biochemistry, Saveetha Dental College and Hospitals, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai, Tamil Nadu, India

***Corresponding author:** R. Gayathri, Department of Biochemistry, Saveetha Dental College and Hospitals, Saveetha Institute of Medical and Technical Sciences, Saveetha University, 160, Poonamallee High Road, Chennai - 600 077, Tamil Nadu, India. Tel.: +91-9710680545. E-mail: gayathri.jaisai@gmail.com

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MATERIALS AND METHODS

Extraction of Protease from Pineapple

A raw pineapple fruit juice was prepared without the addition of water or any other ingredient. The raw and thick pineapple juice was concentrated using filter paper. The obtained concentrated extract was used for the study, as shown in Figure 1.

Estimation of Protease in Pineapple Extract

Sigma's non-specific protease activity assay was used as a standardized procedure to determine the activity of proteases. In this assay, casein acted as a substrate. The protease, in this case, was bromelain, which digests casein, the amino acid tyrosine was liberated along with other amino acids and peptide fragments, which was measured as an absorbance value on the spectrophotometer. Based on the amount of tyrosine that was released from casein, the activity of the protease was assessed, as shown in Figure 2.

Assessment of Collagen Degradation Activity of Protease on Lamb Steak

400 g of lamb steak were separated into four groups of 100 g each and were soaked in the prepared pineapple extract for different time intervals to assess the collagen degradation activity of bromelain in relation to time, as shown in Figure 3 and Table 1.

The time taken by each group to get cooked was assessed and a graph was made and studied, as shown in Graph 1.

RESULTS AND DISCUSSION

The protease activity of bromelain present in pineapple was found to be around 0.165 micromoles per min. Hence, it could be concluded that pineapple has very good protease activity.

The second part of the study was to assess if the protease, i.e., bromelain present in pineapple, has the ability to break collagen bonds efficiently and acts in reducing the cooking time of lamb steak.

From Table 2 it was evidently shown that the cooking time significantly keeps reducing as the soaking time increases. The cooking time of lamb steak soaked in the pineapple extract for 15 min was found to be 45 min; the cooking time of lamb steak soaked in the pineapple extract for 30 min was found to be.

30 min and cooking time of lamb steak soaked in the pineapple extract for 45 min was found to be 15 min. Hence, it could be concluded that bromelain has a high time-dependent collagen degradation activity, which could be efficiently used for reducing the consumption of fuel in cooking industries.

Figure 1: Pineapple extract

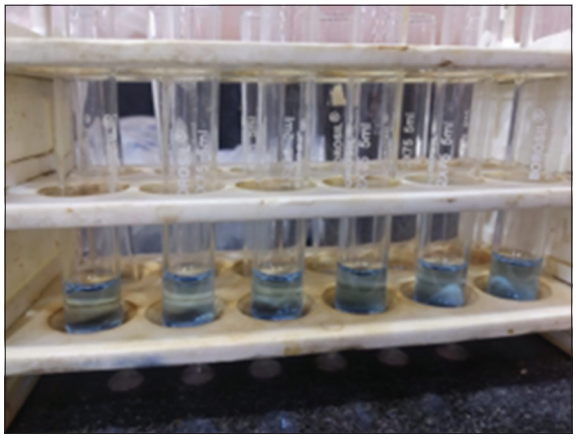


Figure 2: Estimation of protease

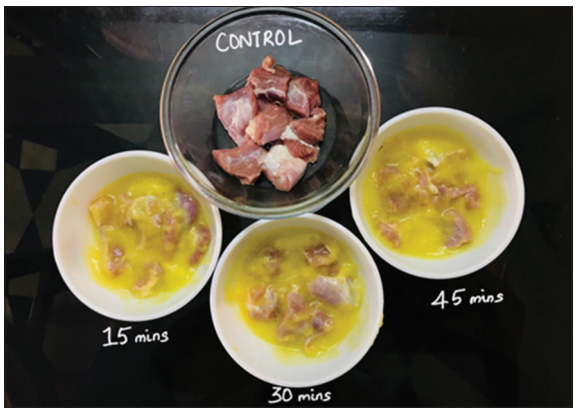


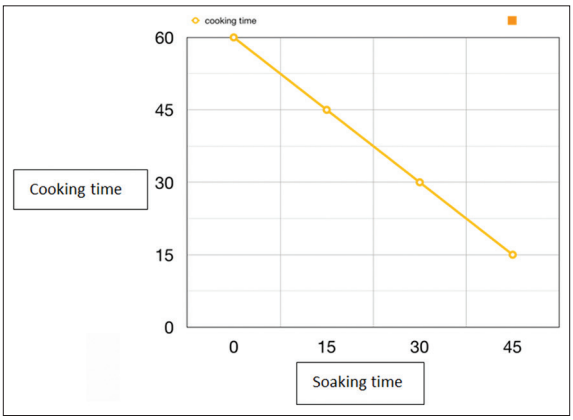
Figure 3: Tenderization of meat with pineapple extract

Table 1: Tenderisation of meat

Group 1	100 g of lamb steak	Control (no soaking)
Group 2	100 g of lamb steak	Soaked in the extract for 15 min
Group 3	100 g of lamb steak	Soaked in the extract for 30 min
Group 4	100 g of lamb steak	Soaked in the extract for 45 min

Table 2: The cooking time of all the groups of lamb steak soaked in the extract for different time intervals

Group 1	Control (no soaking)	Cooking time: 55 min
Group 2	Soaked in the extract for 15 min	Cooking time: 45 min
Group 3	Soaked in the extract for 30 min	Cooking time: 30 min
Group 4	Soaked in the extract for 45 min	Cooking time: 15 min



Graph 1: The cooking time of all four groups of lamb steak soaked in pineapple extract for various time intervals

This is an important application of bromelain, especially at this point in time, when the environmental deterioration is at its peak.

Graph 1 also proves that the soaking time of lamb steak in pineapple extract is inversely proportional to the cooking; hence, the key here is to alter the soaking time to get desired results with minimal fuel and time consumption for cooking.

Further studies could be conducted to use this application of bromelain on a large scale, especially in the cooking industry.

CONCLUSION

The cooking time was found to be inversely proportional to soaking time. As the soaking time increased, the cooking time kept reducing. Hence, it can be concluded that the bromelain present in pineapple juice has a protease activity, which in turn has the ability to tenderize lamb steaks by simultaneously reducing the fuel consumption.

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