CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)

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Project Number

J0506

Project Title

The Effects of Microwave Radiation Relative to Conventional Cooking Systems on the Denaturation of Proteins

Abstract

Objectives/Goals

Our project explores and compares the effects of microwave radiation on the denaturation of proteins relative to conventional cooking systems. Protein denaturation involves the disruption and possible destruction of the secondary and tertiary structures of the protein resulting in loss of biological activity, loss of solubility, destruction of toxins, improved digestibility etc. For example, the body absorbs protein safely from a cooked egg at the rate of 91%, while raw egg protein is absorbed at a rate of 50%.

Methods/Materials

Three precisely measured samples of egg white were cooked for one minute, two minutes, and 2.5 minutes each in both a microwave and a conventional stove. The cooked substance was then placed in a specialized test tube that was optimized for colorimeter use. After properly calibrating the colorimeter with plain egg white, the cooked material was placed in the machine to determine the light absorbance of each of the sample. The egg white would become more opaque as denaturation progressed. Measuring the percentage of absorbance would enable us to find which sample had been denatured more. A total of 16 tests were conducted.

Results

The microwave consistently denatured the proteins more relative to the conventional stove for each time period. For one minute time lapse, the microwave sample had an absorbance rate of 9.362%, while the stove sample had an absorbance rate of 11.929%. For two minute time lapse, the microwave sample had an absorbance rate of 8.322%, whereas the stove sample had an absorbance rate of 9.563%. For 2.5 minute period, the microwave sample had an absorbance rate of 1.593%, while the stove sample had an absorbance rate of 4.444%. These results were well within the standard deviation range and hence conclusive.

Conclusions/Discussion

From our data, we concluded that microwaves denature proteins consistently and significantly more than the conventional cooking stove. We further confirmed our findings through statistical error analysis. This provides evidence that cooking protein-rich food in microwaves is beneficial and not harmful. Our entire project work and other interesting facts can be found at http://proteindenaturation.webs.com.

Summary Statement

Our project highlights the effects of protein denaturation and protein absorption loss by cooking food in a microwave relative to a conventional stove thereby highlighting the benefits of cooking food in a microwave.

Help Received

Teacher helped obtain materials.