Dietary advanced glycation end products (dAGE) are molecules formed through the process of glycation (when monosaccharides non-enzymatically attach to proteins and lipids). An accumulation of dAGE in the body can lead to atherosclerosis, renal failure, diabetes and Alzheimer’s disease. Specifically in Alzheimer’s disease, the main protein in the Alzheimer’s hypothesis, becomes glycated due to its high content of the amino acid lysine. This glycation induces a positive feedback loop which causes for there to be an increase in senile plaque in the brain. Specifically, dAGE accumulates in the neocortex and the hippocampus. This makes it harder for regions of the brain to communicate with each other which therefore contributes to cognitive decline. 

Glycotic intermediates are often formed in the process of glycation. Oxidation occurs during the formation of these intermediates. Antioxidants are known to scavenge the free radicals that are present during oxidation and therefore have the ability to prevent glycation. Novel research was conducted on dAGE formation in uncooked poultry by treating one group of poultry with Garcinia indica extract, from Kokum fruit, which has a high content of antioxidants. G. indica also can prevent the oxidation of neurons. This makes the fruit an ideal substance for naturally preventing cognitive decline in Alzheimer’s patients. When compared to the control group which consisted of poultry that was not treated with G. indica the experimental group had a lower amount of dAGE. This research indicated that incorporation of G. indica into poultry packaging could reduce dAGE.

BACKGROUND

Previous Research: Research conducted last year examined the effect of shelf life of poultry on the formation of dAGE. The data indicated that as time went on, dAGE increased in poultry. This could be attributed to oxidation of the poultry.

Purpose: The purpose of this research was to determine the efficacy of G. indica as an inhibitor for glycation in poultry during an extended shelf life.

Experimental Hypothesis: If an experimental group of poultry was tested seven days after being butchered and was treated with G. indica, then it would have a lower amount of dAGE than control poultry tested seven days prior to testing. The poultry was then homogenized, ultrasonicated, and cen trifuged at 3,500 rpm for 15 minutes (Fig 2). These steps were taken to prepare the poultry for an ELISA. An ELISA specific for dAGE in poultry was conducted in order to detect the amount of AGE in the samples. A new microplate tip was used for each well to prevent contamination of solutions from different wells. The ELISA used competitive inhibition which caused there to be an inverse relationship between the absorbance and picograms/mL of advanced glycation end products (Fig 5).

The data was then quantified by using a spectrophotometer to record the absorbance of each sample at 450 nanometers. Each sample was removed from a well and placed into a cuvette with 2 mL of water. These measurements of absorbance could then be compared against the standard curve to estimate the amount of dAGE in each sample. Since the ELISA used competitive inhibition, high absorbance indicated a low amount of dAGE while low absorbance indicated a high amount of dAGE.

RESULTS

The graph above depicts that the control had a significantly lower absorbance than the experimental group. These results indicate a higher presence of dAGE in the control group compared to the experimental group. Also, the low standard error indicates that the data was precise.

The absorbance of the experimental group was nearly always more than the absorbance of the control group. This indicates that the experimental group contained less dAGE than the control group in all 24 trials not including the one control outlier.

FIGURES

**Figure 1:** The experimental poultry was treated with G. indica while the control poultry was not treated (Fig 1). Both pieces were left in the refrigerator for seven days prior to testing. The poultry was then homogenized, ultrasonicated, and centrifuged at 3,500 rpm for 15 minutes (Fig 2). These steps were taken to prepare the poultry for an ELISA. An ELISA specific for dAGE in poultry was conducted in order to detect the amount of AGE in the samples. A new microplate tip was used for each well to prevent contamination of solutions from different wells. The ELISA used competitive inhibition which caused there to be an inverse relationship between the absorbance and picograms/mL of advanced glycation end products (Fig 5).

**Figure 2:** The experimental poultry was treated with G. indica while the control poultry was not treated (Fig 1). Both pieces were left in the refrigerator for seven days prior to testing. The poultry was then homogenized, ultrasonicated, and centrifuged at 3,500 rpm for 15 minutes (Fig 2). These steps were taken to prepare the poultry for an ELISA. An ELISA specific for dAGE in poultry was conducted in order to detect the amount of AGE in the samples. A new microplate tip was used for each well to prevent contamination of solutions from different wells. The ELISA used competitive inhibition which caused there to be an inverse relationship between the absorbance and picograms/mL of advanced glycation end products (Fig 5).

**Figure 3:** Poultry packaging that allows for naturally preventing cognitive decline in Alzheimer’s disease.

**Figure 4:** G. indica extract in the poultry packaging process. This can be done by including garcinia, the specific compound in G. indica that inhibits glycation, into the plastic used to seal poultry into containers to be shelved at grocery stores. This application of G. indica would inhibit glycation for the consumer during the poultry’s shelf life. Another application this research can have to biotechnology is the creation of an ELISA that could be administered over the counter that would allow consumers to check for abnormally high levels of AGE in their circulation. This application would be realistic due to the use of an ELISA that can be used to detect the amount of AGE in poultry.

**Figure 5:** The results display a trend of decreasing values of absorbance as the amount of dAGE increases indicating that absorbance and dAGE have an inverse relationship.

**Figure 6:** The absorbance of the experimental group was nearly always more than the absorbance of the control group. This indicates that the experimental group contained less dAGE than the control group in all 24 trials not including the one control outlier.

**Figure 7:** The absorbance of the experimental group was nearly always more than the absorbance of the control group. This indicates that the experimental group contained less dAGE than the control group in all 24 trials not including the one control outlier.

**Figure 8:** Bonferroni corrected alpha value = 0.025

The absorbance of samples were compared using a t-test. When the control group was compared to the experimental group, the t-value calculated exceeded the t-critical value. Also, the calculated p-value was less than the alpha value of 0.05 as well as the Bonferroni corrected alpha value of 0.025 indicating that the null hypothesis was able to be rejected.

**STATISTICS**

- t-stat: 7.35
- t-crit: 1.644
- p two-tailed: 6.13x10^-4

**REFERENCES**


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**CONCLUSIONS**

By analyzing the data it can be concluded that G. indica decreased AGE in poultry (Fig 6 and Fig 7). The null hypothesis can be rejected with 98% confidence (Fig 8) indicating that there is only a 2% chance that these results were due to random chance alone. This research could lead to new legislation that would allow a finite amount of AGE in food. This would increase the awareness of consumers regarding the negative effects of an increase of dAGE in the body. This research could also affect the way doctors and dieticians create meal plans for their patients with Alzheimer’s disease. Eventually research should be conducted with an animal model to determine whether G. indica treated poultry improves cognitive function when consumed. Further research should focus on how the cooking process affects the formation of AGE in poultry after the application of G. indica.

**APPLICATION TO BIOTECHNOLOGY**

The application of G. indica to decrease glycation in poultry can have several applications to biotechnology. The researcher strives to partner with poultry distributors to include treatment of poultry with G. indica in the poultry packaging process. This can be done by including garcinia, the specific compound in G. indica that inhibits glycation, into the plastic used to seal poultry into containers to be shelved at grocery stores. This application of G. indica would inhibit glycation for the consumer during the poultry’s shelf life. Another application this research can have to biotechnology is the creation of an ELISA that could be administered over the counter that would allow consumers to check for abnormally high levels of AGE in their circulation. This application would be realistic due to the use of an ELISA that can be used to detect the amount of AGE in poultry.

**INTRODUCTION**

The purpose of this research was to determine the efficacy of G. indica as an inhibitor for glycation in poultry during an extended shelf life. If an experimental group of poultry was tested seven days after being butchered and was treated with G. indica, then it would have a lower amount of dAGE than control poultry tested seven days prior to testing. The poultry was then homogenized, ultrasonicated, and centrifuged at 3,500 rpm for 15 minutes (Fig 2). These steps were taken to prepare the poultry for an ELISA. An ELISA specific for dAGE in poultry was conducted in order to detect the amount of AGE in the samples. A new microplate tip was used for each well to prevent contamination of solutions from different wells. The ELISA used competitive inhibition which caused there to be an inverse relationship between the absorbance and picograms/mL of advanced glycation end products (Fig 5). The data was then quantified by using a spectrophotometer to record the absorbance of each sample at 450 nanometers. Each sample was removed from a well and placed into a cuvette with 2 mL of water. These measurements of absorbance could then be compared against the standard curve to estimate the amount of dAGE in each sample. Since the ELISA used competitive inhibition, high absorbance indicated a low amount of dAGE while low absorbance indicated a high amount of dAGE.