Indiana University of Pennsylvania

Department of Food and Nutrition

Replacement of Beef with Turkey and a Meat Alternative

and the Effects on Meatloaf Production

A Research Project

by

Tiffany R. Myers

Submitted in Partial Fulfillment

Of the Requirements for the Degree

Bachelor of Science

May 2010

Indiana University of Pennsylvania

Department of Food and Nutrition

I hereby approve the project paper of:

Tiffany R. Myers

Completion of requirements for FDNT 362 Experimental Foods of Bachelors of Food and Nutrition

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Mia M. Barker, PhD

Professor of Food and Nutrition

Acknowledgements

I would, first and foremost, like to thank my parents for the mental and financial support they have given me throughout my college career. I would have never been able to participate in FDNT 362 Experimental Foods without them by my side helping me along every step of the way.

I would also like to sincerely thank Dr. Mia Barker for all of the help she has given me, as well as the rest of the Experimental Foods students, throughout this project. The extra time that she spent helping and her willingness to assist everyone beyond what they may ask for is greatly appreciated.

Dr. Bill Barker also set time aside to explain the usage of the SPSS 17.0 Analytical Program and I am very appreciative of that.

Faith has spent many hours, not only assisting our class during the lab sections, but calculating our market orders and doing a wonderful job of making sure every student had the ingredients and supplies they needed each week. Her dedication to our class is greatly appreciated.

I also want to thank everyone who has taken this course with me for their support and participation on the sensory panels.

Title: Replacement of Beef with Turkey and a Meat Alternative and the Effects on Meatloaf Production

Author: Tiffany R. Myers

Instructor of Record: Mia M. Barker, PhD

The purpose of this experiment was to compare the effect of reducing saturated fat in meatloaf by replacing ground beef with meats containing a lower percentage of saturated fats (ground turkey and a vegetable based meat substitute) were used. The experiment was replicated three times. These recipes were tested subjectively by a panel composed of students from FDNT 362 Experimental Foods for the following sensory characteristics: moistness, density, compactness, color. A simple hedonic scale was used to determine whether or not they like the products overall. A penetrometer was used to determine exactly how dense each of the meatloaves were. The recipes were also evaluated by using the USDA Handbook 8 to establish the nutrient analysis for each recipe. The SPSS 17.0 Analytical Software, Analysis of Variance (ANOVA) and Post Hoc Analysis were used to analyze the sensory and objective tests that were performed during the experiment.

TABLE OF CONTENTS

CHAPTER I: THE PROBLEM

Introduction……………………………………………………………………….………8

Research Statement……………………………………………………………………….9

CHAPTER II: REVIEW OF LITERATURE

Introduction……………………………………………………………………..………..10

Symptoms of Lupus……………………………………………………………..……….10

Lupus in Relation to Food……………………………………………………………..…11

Physical Differentiations in Meat Products…………………………………...…………12

CHAPTER III: METHODOLOGY

Introduction……………………………………………………………………………....13

Sensory Panel………………………………………………………………...…………..14

Subjective Evaluation……………………………………………...…………………….14

Objective Evaluation……………………………………………………………………..14

CHAPTER IV: RESULTS

Beef Meatloaf Outcomes……………………………………………………………...…15

Turkey Meatloaf Outcomes………………………………………………...……………15

Meat Alternative “Meatloaf” Outcomes…………………………..……………………..16

Statistical Comparisons………………………………………………..…………………16

CHAPTER V: CONCLUSION……………………………………………………….…………..18

RECOMMENDATIONS………………………………………………..………………………..19

REFERENCES……………………………………………………….…………………………..20

APPENDICES…………………………………………………………………..………………..21

Appendix A-Statistical Analysis of Moistness……………………………..……………21

Appendix B-Statistical Analysis of Density……………………………………………..22

Appendix C-Statistical Analysis of Compactness……………………………….………23

Appendix D-Statistical Analysis of Color……………………………………………….24

Appendix E-Statistical Analysis of Objective Testing…………………………..………25

Appendix F-Score Card…………………………………………………….……………26

Appendix G-Meatloaf Recipe…………………………………………..………………..27

Appendix H-Nutrient Analysis……………………………………………………..……28

Appendix I-Fat Analysis……………………...………………………………………….29

Appendix J-Concept Map………………………………………………………………..30

LIST OF FIGURES

Figure 1…………………………………………………………………………………..10

Figure 2…………………………………………………………………………………..13

CHAPTER I

THE PROBLEM

Introduction

Lupus is a disease in which the immune system is severely weakened and begins to attack other tissues in the body and will eventually harm one’s joints, skin, kidneys, heart, lungs, blood vessels, and eventually the brain (Fast Facts About Lupus). The cause of this disease is unknown; however research has suggested that genetics plays a major role.

A diet high in saturated fatty acids has been linked to many diseases, including lupus, and it is suggested that lupus patients should avoid foods containing high amounts of saturated fatty acids. Beef is high in saturated fats compared to other meats, such as turkey and a non-meat substitute and is typically a food that is restricted by lupus patients. Imagine during the summertime, going to a cook out and everyone is eating cheeseburgers, and they smell very appealing coming right off the grill. A lupus patient would have to choose another option to avoid a flare of symptoms. These symptoms differ among each and every lupus patient, but the most common symptoms include joint pain, muscle pain, red rashes on the face, chest pains, mouth ulcers, and fatigue. This disease has become a great interest and further exploration will be taken in the alteration of types of meat in a meatloaf. Meatloaf might not sound as appealing as a burger off the grill, but it is a commonly consumed family meal and will serve the purpose for this particular experiment. Meatloaf and chili, both made with beef, are included on a list of foods that are commonly eaten in the Midwest Region of the US (Food in United States Midwest Region).

Research Statement

The purpose of this experiment is to determine the effect that changing the type of meat from beef to a lower saturated fat meat source such as, turkey or a non-meat substitute has on the physical properties, such as moistness, density, texture, and color, of a meatloaf.

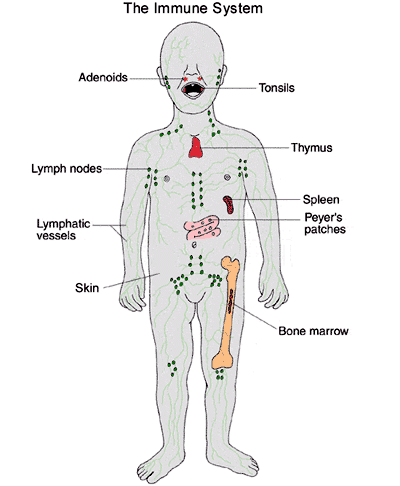
CHAPTER II

REVIEW OF LITERATURE

Introduction

The goal of this experiment is to determine whether the substitutions of meats with different levels of fat content in a meatloaf will work; specifically determining whether or not the end products will be beneficial to the target group and will also be appealing to them. Three different meatloaf recipes were prepared, each with different saturated fat content. Through the sensory panelists, differentiation will be made between the three products. If they are unable to do so, then the recipe is a sensible choice to suggest to the public as a substitution for those with lupus or even others who are trying to limit their saturated fat intake.

Symptoms of Lupus Figure 1

Lupus affects more African Americans than Caucasians and typically occurs in children of fifteen years of age and older (Children’s Hospital Boston). Ninety percent of these patients are female, leaving only ten percent of the total amount of lupus patients being males (Petri). Lupus is an extremely complex autoimmune disease in which it loses the ability to decipher between healthy cells and foreign objects. This, in turn, can cause damage to multiple areas of the body that will lead to severe pain (Fast Facts About Lupus). This is only one of many effects that lupus may have on the body (See Figure 1). When the immune system is compromised, there is a greater risk of contracting other infectious diseases. Not only does lupus have its own symptoms, but it makes one more susceptible and vulnerable to becoming more seriously ill. Like the domino effect, lupus is the beginning piece that leads to more diseases which cause more symptoms.

The above picture shows the parts of the immune system which can all be affected by lupus.

Lupus in Relation to Food

Dr. Mia M. Barker, PhD, of IUP Department of Food and Nutrition stated that, as a result of a lupus diagnosis, the pancreas will slowly begin to decrease in size. Since the pancreas is the organ in which a majority of digestive enzymes are produced, this can cause major difficulty in digestion and have further effects. As the pancreas is secreting fewer enzymes than it would at its normal size, naturally, digestion problems will occur; for example when saturated fatty acids are consumed in the diet, there are not enough lipase enzymes being produced to breakdown all of the fat that was consumed. What is not able to be digested will continue from the stomach to the gastrointestinal tract causing diarrhea and cramping. The fact that saturated fatty acids cannot be broken down causing symptoms, like diarrhea, is what motivated the idea of researching lupus with reducing saturated fatty acid intake. If beef, a meat with a higher amount of saturated fats (as compared to other meat choices), can be replaced in a food product by a meat that contains a lesser amount of saturated fats and still bring the consumer a high satisfaction rating through similar physical characteristics, then that product will be highly recommended to lupus patients.

Physical Differentiations in Meat Products

Ground beef typically comes from the parts of the cow with less tender meat such as the flank and plate areas; however it can be high in fat. The beef that was purchased for this particular experiment was eighty percent meat twenty percent fat. Ground turkey naturally has a lower fat content that beef (See figure 1). The skin of turkey and other poultry meats is where a majority of the fat content comes from and when the skin is eliminated, a large portion of total fat was also eliminated; ground turkey does not contain the skin. The meat alternative that was used was composed of soy proteins and had zero grams of saturated fat content due to the fact that it is not made from an animal origin. Most foods that are not from an animal origin do not contain saturated fats. For lupus patients, this is the substitute that would be best to recommend to replace beef in this recipe according to fat content, but it is not the most appealing of foods.

CHAPTER III

METHODOLOGY

Introduction

All ingredients in the meatloaf recipe were converted from English units to Metric units to yield an accurate recipe. Each week ingredients were premeasured to allow for quick maneuvering when it came time for preparing, baking, and testing. Three meatloaves were made each week and subjective and objective testing was performed. The original recipe for meatloaf that was used in this experiment contained ground beef; this would be the control recipe. This recipe was altered to reduce the saturated fat content and therefore, changed the meat from ground beef, the control, to ground turkey, variable 1, and a non-meat substitute, variable 2 (See Figure 2). Once all the ingredients were weighed precisely, they were all mixed together and formed into loaves and were then ready to bake for one hour. Due to the size of the oven being used, two loaves were placed on the top rack and one on the bottom rack and were rotated to ensure an even cooking process. Equal sized pieces were cut from each meatloaf for the panelists to sample.

Figure 2

|  |  |  |
| --- | --- | --- |
| Meat | Amount (g) | Saturated Fat Content (g) |
| Ground Beef | 454 | 27.867 |
| Ground Turkey | 454 | 15.391 |
| Ground Meat Alternative | 454 | 0 |

Sensory Panel

Six students from the FDNT 362 Experimental Foods Lab were selected at random to serve as panelists to give ratings on each meatloaf product each week. The panel was composed of all females between the ages of 19 years and 22 years; this just slightly older than the age of onset for many lupus patients, which is the target audience of this experiment.

Subjective Evaluations

The identity of each product was concealed by assigning each one its own three digit number; this is to ensure the panelists were not giving biased responses. On a scorecard, the panelists were asked to judge the moistness, density, compactness, and color based on a scale of one to five, each of which were specifically defined (See Appendix F). I also used a simple hedonic scale to determine whether or not the panelists liked the different products. This allowed me to decide if that particular modification would be a good suggestion to make for the target audience. When the sensory panel was finished testing the product samples, objective testing was carried out.

Objective Evaluations

A penetrometer was used to determine how dense each product was and then was further used to determine which product would hold together best. This data will be used to help determine if the fat content was the determining factor of differences in density, as well as compactness.

CHAPTER IV

RESULTS

Beef Meatloaf Outcomes

From what I gathered visually as the meatloaf came out of the oven, the beef meatloaf was extremely moist and did not properly hold a compact loaf formation each week. According to Shirley Corriher, the author of *Cookwise*, fats can come apart when they are heated. This, in turn, means that the higher the fat content of the meat being used to prepare a recipe, the more the product may crumble. This supports the fact that the beef meatloaf was the most crumbly since beef is the meat that contains the highest amount of total fats in this experiment.

Four out of six total panelists circled yes on the simple hedonic scale when asked whether or not they liked the flavor of the product (See Appendix F).

Turkey Meatloaf Outcomes

Each week when the turkey meatloaf came out of the oven, it was noted that, as well as the beef meatloaf, this one was very moist; however, the turkey meatloaf did not crumble. This meatloaf was able to hold its solid and compact loaf formation.

Five out of the six panelists reported that they liked the turkey meatloaf and many stated in the comments section of the scorecard that this meatloaf was their favorite (See Appendix F).

Meat Alternative “Meatloaf” Outcomes

This version of the meatloaf recipe was noted to have been more dry than it was moist and was able to hold together. This product did crumble slightly, but was able to hold a shape better than the meatloaf made from beef. The color of this product was rather dark as though it had been burned when it had not been.

Five out of six panelists stated on the simple hedonic scale on the score card that they did not like the taste of this variation of the meatloaf recipe. One person commented saying that this loaf had a bland taste (See Appendix F).

Statistical Comparisons

The p-values from the SPSS 17.0 Statistical Data sheets were compared to determine whether or not there was a significant difference in the moistness, density, compactness, and color of each meatloaf recipe. The first pair that was analyzed was the beef meatloaf with the turkey meatloaf and no significant difference was shown between the moistness, density, or compactness; however the color of each were significantly different. This supports the responses of the panelists as it shows that the beef and turkey meatloaf recipe were the most liked. The second pair that was analyzed was the beef meatloaf with the meatloaf made from the meat alternative. They were equally dense, but the moistness, compactness, and color varied. Finally, the turkey meatloaf was compared with the meat alternative recipe and these products were significantly different in moistness and color, but were equally dense. The compactness of these was also analyzed as not significantly different; however, these products were different in their compactness and the numbers were extremely close to being significantly different (See Appendix C). The beef recipe was statistically the most similar to the turkey recipe and this was reflected on the panelists’ scorecards during sensory evaluation. The meat alternative recipe was significantly different from both the beef and turkey recipe and this also was reflected in the sensory evaluations. Many of the panelists wrote comments, as previously mentioned, that the meat alternative recipe was bland and that they did not like the flavor.

CHAPTER V

CONCLUSIONS

Significance testing has proven that the beef and turkey recipe are most similar and that the meat alternative recipe is only similar in some of the dependent variables that were measured, but was overall different from the beef and turkey recipes. After viewing many panelists’ comments about each meatloaf, it was clear that the beef and turkey were the most preferred.

In conclusion to this experiment, it is evident that the turkey meatloaf recipe was a successful alternative to the beef meatloaf. It contains a lower amount of saturated fats and was most comparable to the original recipe. The meat alternative would be the most preferable variation to make to the original recipe due to the fact that it has no saturated fat content; however, it was not enjoyed by the panelists who were very close in age and description to the target audience.

RECOMMENDATIONS

For those who are interested in performing further research on this topic, the following considerations should be made:

* Different variations should be made in order to find a more likeable food to replace high fat meats with.
* The non-meat substitute may be an option if the recipe is altered to make it more moist and to add extra flavor to conceal the taste that was unappealing to the panelists.
* Run the experiment for longer than three weeks to receive more accurate results.

REFERENCES

Corriher, S. (1997). *Cookwise: The secrets of cooking revealed*. New York: William Morrow Cookbooks.

Dzudie, T., Kouebou, C., Essia-Ngang, J., & Mbofung, C. (2004). Lipid sources and essential oils effects on quality and stability of beef patties. *Journal of Food Engineering*, *65*(1), 67-72. doi:10.1016/j.jfoodeng.2003.12.004.

Fast Facts About Lupus. (n.d.). *Arthritis, Musculoskeletal and Skin Diseases Home Page*. Retrieved February 18, 2010, from http://www.niams.nih.gov/health

Food in United States Midwest Region - Midwest American Food, Midwest American Cuisine - popular, dishes, diet, history, common, meals, staple, rice, famous, main, people, favorite, customs, fruits, country, bread, vegetables, bread, typical, stew. (n.d.). *Food in Every Country*. Retrieved February 18, 2010, from http://www.foodbycountry.com/Spain-to-Zimbabwe-Cumulative-Index/United-States-Midwest-Region.html

Lupus (SLE) . (n.d.). *Children's Hospital Boston*. Retrieved February 18, 2010, from http://www.childrenshospital.org

Mcwilliams, M. (2007). *Foods: Experimental Perspectives (6th Edition)* (6 ed.). Alexandria, VA: Prentice Hall.

Palmer, H. H., & Paul, P. C. (1972). *Food theory and applications*. Hoboken, New Jersey: John Wiley & Sons Inc.

Petri, M., M.D.., & M.P.H.. (n.d.). Lupus Information - Disease Symptoms - Treatment and Management. *Arthritis Information | Symptoms | Diagnosis | Treatment*. Retrieved February 18, 2010, from http://www.hopkins-arthritis.org/arthritis-info/lupus/

Appendix A

Statistical Analysis of Moistness

DESCRIPTIVE STATISTICS

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Condition** | **N** | **Mean** | **Std Dev** | **Range** |
| Control | 6 | 2.94 | .328 | 2.0-3.0 |
| Variable 1 | 6 | 2.72 | .390 | 2.0-3.0 |
| Variable 2 | 6 | 3.83 | .587 | 3.0-4.0 |
|  |  |  |  |  |

ANALYSIS OF VARIANCE with Repeated Measures

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Source of Variation** | **df** | **Mean Square** | **F** | **p** |
| Condition | 2 | 2.1 | 11.67 | .002 |
| Error | 10 | .2 |  |  |

Post-Hoc Table

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Condition** | **N** | **Mean** | **Std Dev** | **Range** | **r** | **t** | **p** |
| Control | 6 | 2.94 | .328 | 2.0-3.0 | .38 | 1.35 | .24 |
| Variable 1 | 6 | 2.72 | .390 | 2.0-3.0 |  |  |  |
|  |  |  |  |  |  |  |  |
| Control | 6 | 2.94 | .328 | 2.0-3.0 | .52 | 4.34 | .01 |
| Variable 2 | 6 | 3.83 | .587 | 3.0-4.0 |  |  |  |
|  |  |  |  |  |  |  |  |
| Variable 1 | 6 | 2.72 | .390 | 2.0-3.0 | .34 | 3.37 | .02 |
| Variable 2 | 6 | 3.83 | .587 | 3.0-4.0 |  |  |  |

Appendix B

Statistical Analysis of Density

DESCRIPTIVE STATISTICS

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Condition** | **N** | **Mean** | **Std Dev** | **Range** |
| Control | 6 | 3.22 | .4 | 3.0-4.0 |
| Variable 1 | 6 | 3.11 | .5 | 3.0-4.0 |
| Variable 2 | 6 | 2.78 | .9 | 2.0-3.0 |
|  |  |  |  |  |

ANALYSIS OF VARIANCE with Repeated Measures

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Source of Variation** | **df** | **Mean Square** | **F** | **P** |
| Condition | 2 | .3 | 1.02 | .394 |
| Error | 10 | .3 |  |  |

Post-Hoc Table

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Condition** | **N** | **Mean** | **Std Dev** | **Range** | **r** | **t** | **p** |
| Control | 6 | 3.22 | .4 | 3.0-4.0 | .44 | .60 | .58 |
| Variable 1 | 6 | 3.11 | .5 | 3.0-4.0 |  |  |  |
|  |  |  |  |  |  |  |  |
| Control | 6 | 3.22 | .4 | 3.0-4.0 | .29 | 1.3 | .26 |
| Variable 2 | 6 | 2.78 | .9 | 2.0-3.0 |  |  |  |
|  |  |  |  |  |  |  |  |
| Variable 1 | 6 | 3.11 | .5 | 3.0-4.0 | .07 | .85 | .44 |
| Variable 2 | 6 | 2.78 | .9 | 2.0-3.0 |  |  |  |

Appendix C

Statistical Analysis of Compactness

DESCRIPTIVE STATISTICS

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Condition** | **N** | **Mean** | **Std Dev** | **Range** |
| Control | 6 | 2.94 | .5 | 2.0-3.0 |
| Variable 1 | 6 | 2.94 | .1 | 2.0-3.0 |
| Variable 2 | 6 | 2.28 | .7 | 2.0-3.0 |
|  |  |  |  |  |

ANALYSIS OF VARIANCE with Repeated Measures

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Source of Variation** | **df** | **Mean Square** | **F** | **p** |
| Condition | 2 | .89 | 4.80 | .035 |
| Error | 10 | .19 |  |  |

Post-Hoc Table

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Condition** | **N** | **Mean** | **Std Dev** | **Range** | **r** | **t** | **p** |
| Control | 6 | 2.94 | .5 | 2.0-3.0 | .28 | .000 | 1.00 |
| Variable 1 | 6 | 2.94 | .1 | 2.0-3.0 |  |  |  |
|  |  |  |  |  |  |  |  |
| Control | 6 | 2.94 | .5 | 2.0-3.0 | .52 | 2.74 | .04 |
| Variable 2 | 6 | 2.28 | .7 | 2.0-3.0 |  |  |  |
|  |  |  |  |  |  |  |  |
| Variable 1 | 6 | 2.94 | .1 | 2.0-3.0 | .28 | 2.24 | .08 |
| Variable 2 | 6 | 2.28 | .7 | 2.0-3.0 |  |  |  |

Appendix D

Statistical Analysis of Color

DESCRIPTIVE STATISTICS

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Condition** | **N** | **Mean** | **Std Dev** | **Range** |
| Control | 6 | 2.28 | .328 | 2.0-3.0 |
| Variable 1 | 6 | 4.44 | .344 | 4.0-5.0 |
| Variable 2 | 6 | 1.17 | .279 | 1.0-2.0 |
|  |  |  |  |  |

ANALYSIS OF VARIANCE with Repeated Measures

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Source of Variation** | **df** | **Mean Square** | **F** | **P** |
| Condition | 2 | 16.7 | 126.2 | <.001 |
| Error | 10 | .1 |  |  |

Post-Hoc Table

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Condition** | **N** | **Mean** | **Std Dev** | **Range** | **r** | **t** | **P** |
| Control | 6 | 2.28 | .328 | 2.0-3.0 | .53 | 9.04 | <.001 |
| Variable 1 | 6 | 4.44 | .344 | 4.0-5.0 |  |  |  |
|  |  |  |  |  |  |  |  |
| Control | 6 | 2.28 | .328 | 2.0-3.0 | .12 | 5.98 | .002 |
| Variable 2 | 6 | 1.17 | .279 | 1.0-2.0 |  |  |  |
|  |  |  |  |  |  |  |  |
| Variable 1 | 6 | 4.44 | .344 | 4.0-5.0 | .23 | 16.36 | <.001 |
| Variable 2 | 6 | 1.17 | .279 | 1.0-2.0 |  |  |  |

Appendix E

Statistical Analysis of Objective Testing

DESCRIPTIVE STATISTICS

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Condition** | **N** | **Mean** | **Std Dev** | **Range** |
| Control | 1 | 162.0 | .0 | 160.0-170.0 |
| Variable 1 | 1 | 127.7 | .0 | 120.0-130.0 |
| Variable 2 | 1 | 112.7 | .0 | 110.0-120.0 |
|  |  |  |  |  |

ANALYSIS OF VARIANCE with Repeated Measures

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Source of Variation** | **df** | **Mean Square** | **F** | **P** |
| Condition | 2 | 639.6 |  | <.001 |
| Error | 0 | 1279.2 |  |  |

Post-Hoc Table

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Condition** | **N** | **Mean** | **Std Dev** | **Range** | **r** | **t** | **P** |
| Control | 1 | 162.0 | .0 | 160.0-170.0 |  |  |  |
| Variable 1 | 1 | 127.7 | .0 | 120.0-130.0 |  |  |  |
|  |  |  |  |  |  |  |  |
| Control | 1 | 162.0 | .0 | 160.0-170.0 |  |  |  |
| Variable 2 | 1 | 112.7 | .0 | 110.0-120.0 |  |  |  |
|  |  |  |  |  |  |  |  |
| Variable 1 | 1 | 127.7 | .0 | 120.0-130.0 |  |  |  |
| Variable 2 | 1 | 112.7 | .0 | 110.0-120.0 |  |  |  |

Appendix F

Score Card

Judge\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Date\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Meatloaf Scorecard**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Characteristic | Sample | | |  |
| 315 | 856 | 194 |  |
| Moistness: 1=too wet, 2=slightly wet, 3=not too wet, not too dry, 4=slightly dry, 5=too dry |  |  |  |  |
|  |
| Density: 1=too dense, 2=slightly dense, 3=not too dense, not too spongy, 4=slightly spongy, 5=spongy |  |  |  |  |
|  |
| Compactness: 1=requires too much chewing, 2=requires slightly too much chewing, 3=not too much chewing, not too soft, 4=slightly soft, 5=melts in mouth |  |  |  |  |
|  |
| Color: 1=dark brown, 2=light brown, 3=brownish green, 4=yellow, 5=yellowish white |  |  |  |  |
|  |
|  |  |  |  |  |
| Do you like the flavor? (circle one) | yes/no | yes/no | yes/no |  |
|  |  |  |  |  |
| Feel free to write comments: |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

Appendix G

Original Recipe

Easy Meatloaf

Ingredients

* 1 lb ground beef\*
* 2 eggs
* ½ onion, chopped
* 1 cup saltine crackers, crushed
* 1 tbsp mustard
* ¼ cup ketchup
* 2 tbsp parsley

Directions

1. Preheat oven to 350 degrees F (175 degrees C)
2. In large bowl, combine beef, eggs, onion, parsley, mustard, crackers, and half the amount of ketchup listed. Place in a lightly greased 5X9 inch loaf pan, OR form into a loaf and place lightly greased 9X13 inch baking pan AND top with remaining amount of ketchup.
3. Bake for 1 hour.

\*Turkey and a Meat Alternative were used to substitute beef in the same amount.

Appendix H

Nutrient Analysis

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Nutrient** | | Water | Energy | Protein | Total Lipid | Ash | Carbohydrates | Fiber | Sugars |
|  | **Unit of Measure** | | g | kcal | g | g | g | g | g | g |
| **Ingredients** | **Amount** | |  |  |  |  |  |  |  |  |
| **English** | **Metric (g)** |  |  |  |  |  |  |  |  |
| Ground Beef | 1 lb | 454 | 261.96 | 1153 | 114.64 | 73.41 | 4.09 | 0 | 0 | 0 |
| Ground Turkey | 1 lb | 454 | 269.77 | 1076 | 124.21 | 59.7 | 5.4 | 0 | 0 | 0 |
| Ground Meat Alternative | 1 lb | 454 |  |  |  |  |  |  |  |  |
| Medium White Onion | 1/2 ea. | 55 | 49.01 | 22 | 0.61 | 0.06 | 0.19 | 5.14 | 0.9 | 2.33 |
| Large Eggs | 2 ea. | 100 | 87.57 | 48 | 10.9 | 0.17 | 0.63 | 0.73 | 0 | 0.71 |
| Saltine Crackers | 1 cup | 70 | 2.82 | 295 | 6.65 | 6.2 | 2.3 | 52.04 | 2 | 1.55 |
| Ketchup | 1/4 cup | 60 | 41.49 | 58 | 1.04 | 0.19 | 2.2 | 15.09 | 0.2 | 13.66 |
| Yellow Mustard | 1 tbsp | 15 | 12.4 | 10 | 0.66 | 0.6 | 0.55 | 0.8 | 0.5 | 0.13 |
| Parsley | 2 tbsp | 2.4 | 0.14 | 7 | 0.64 | 0.13 | 0.27 | 1.22 | 0.6 | 0.17 |

Appendix I

Fat Analysis

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  | **Total Fats** | | | | |
|  | **Nutrient** | | Saturated | Monounsaturated | Polyunsaturated | Trans | Cholesterol |
|  | **Unit of Measure** | | g | g | g | g | g |
| **Ingredients** | **Amount** | |  |  |  |  |  |
| **English** | **Metric (g)** |  |  |  |  |  |
| Ground Beef | 1 lb | 454 | 27.867 | 32.534 | 2.129 | 5.126 | 409 |
| Ground Turkey | 1 lb | 454 | 15.391 | 4.131 | 14.664 | 0 | 463 |
| Ground Meat Alternative | 1 lb | 454 | 0 | 0 | 0 | 0 | 0 |
| Medium White Onion | 1/2 ea. | 55 | 0.023 | 0.007 | 0.009 | 0 | 0 |
| Large Eggs | 2 ea. | 100 | 0 | 0 | 0 | 0 | 0 |
| Saltine Crackers | 1 cup | 70 | 1.401 | 1.573 | 2.848 | 0.31 | 0 |
| Ketchup | 1/4 cup | 60 | 0.026 | 0.028 | 0.076 | 0 | 0 |
| Yellow Mustard | 1 tbsp | 15 | 0.037 | 0.394 | 0.143 | 0.002 | 0 |
| Parsley | 2 tbsp | 2.4 | 0.019 | 0.009 | 0.099 | 0 | 0 |