

**Taste and Perception of Processed vs. Unprocessed Flour**

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**Author's Note**

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## **Abstract**

While attending an English College Course at the Northern Marianas College, this student researcher explored the taste and analysis between 100% whole wheat flour vs. All-Purpose flour prepared in a sweet dessert. The research hypothesized that for thirty seven residents, including twenty local fire fighters, 13 college students and instructor, as well as four children in the CNMI, it would be difficult to determine which dessert, specifically a cookie, was prepared with 100% whole wheat flour. Literature was reviewed on other taste tests as well as preparation of whole grains to further investigate this hypothesis. The initial results identified by way of surveys (See Appendix B) show 11% more of the tasters correctly determined whole wheat flour cookie (see Appendix F). However, preference of whole grains by survey was not a determining factor in the results. Furthermore, when narrowing the result amongst the largest groups, there were differences in perceptions of taste suggesting future investigation of lifestyles. Future taste tests involving this subject would improve on re-wording the question and answer options, including more children along with adults as well as preparing different types of food such as breads and pastas.

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### Taste and Preference of Processed Vs. Unprocessed Flour in a Desert

#### Introduction

Eating healthy is essential however, quality does not necessarily mean sacrificing taste. Take for example, the option between whole wheat flour and white flour when baking. Some believe whole wheat flour has a bitter taste such as Nancy Shute's article entitled the "Battle Between Health and Taste, Why White Bread Still Wins" who writes the bitter taste is attributed to ferulic acid left in the bran (*the salt*, 2013, para 1-2). Still others sides enjoy the hearty flavor writes in Answers, Hearty Whole Grain Bread Choices for a Heart Healthy Diet (Answers, nd. para 2). Consumers may choose the nuttier flour for the heavier, wholesome texture. Perhaps white flour does taste better, however if the brown flour was prepared in a sweet dessert, it might be difficult to distinguish the flavors. Therefore, the proposed research project entails writing up a report in the amount of time provided followed by an experiment on processed and unprocessed flour taste test with approximately 13 students, 20 firefighters, and four children would give a good cross-section to prove or disprove whole wheat can be detected in a sweet desert. The student writer hypothesizes that in a taste test incorporating the two flours in a desert such as cookies, participants would have a difficult time determining which flour was used.

#### Background

To begin with, processed and unprocessed flours also known as polished and unpolished, derive from the same wheat flour grain. According to Amy Brown in *Understanding Food Principles and Preparation*, The milling or the processing determines the "stream" of the flour, or the amount of endosperm retained in the grain (2000, p 417-418). Brown continues to write whole wheat flour or unprocessed flour mills the flour leaving the high fiber, high protein germ, bran, and endosperm that leaves a bitter taste for some as well as being a coarser flour. However All-Purpose, a finely ground flour", has only the endosperm left after milling, losing some of the protein and fiber. In addition whole wheat flour is 14% protein while All-Purpose or white flour is 10% (Brown, 2000, p 414-417).



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Furthermore, Minnesota Association of Wheat Growers from *Small Grains.org* writes goods baked with whole wheat flour tend to be denser due to the reduction of gluten in relation to the presence of bran (nd, para 8).

### Research Plan

The methodology proposed by the researcher will attempt to perform a taste test as well as distribute a detailed survey to analyze the data. Thus far, on July 10, the surveys were approved by the instructor, of the class and on July 15, the experiment was performed. The experiment involved three types of cookies: chocolate chip, oatmeal and peanut butter cookies. Each cookie type was prepared two ways, one with whole wheat flour and the other with All-Purpose Flour. Furthermore, brown sugar was the added sugar in both cookies in order to mask the colors of the flours, as well as providing more moisture to hide the denseness. The six cookie types were then put into containers and divided into two groups, group A and group B. The three flavors provide a reasonable amount of distinction between deserts.

A thorough literature review was gathered in order to prove this hypothesis. First, this author performed a Google Search which resulted in millions of hits when searching for the history of flour, however, the number narrowed down to approximately 200,000 hits when searching for the health benefits of the grains. Many articles were found on flavor characteristics of breads, health benefits of whole grains as well as sensory perception that will be used in the future for this research assignment, however many of them were based solely on nutrition.

By July 13, this researcher had collected a number of scholarly articles (See Appendix H.). The NMC database provided numerous peer reviewed articles from the Health Journal at EBSCO. First, this writer searched for scholarly articles published between 2009 to present on topics such as the perceptions of eating healthy grains, sensory perceptions in grains, and taste tests narrowed the search to just a few relevant readings. The first public academic article found in Health Journal at EBSCO authored by



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Soldavini, Crawford & Ritchie entitled Nutrition Claims Influence Health Perceptions and Preferences in Fourth and Fifth Grade Children, discussed the perception of taste in foods that were perceived to be healthy vs those that did not “claim” the same health benefits (2012, abstract). The next publication authored by Jinshui Wang and Cristina Rosell, in the journal of *Food Chemistry* entitled “Effect of the Addition of Different Fibres on Wheat Dough Performance and Bread Quality” was extremely relevant abstract (Wang, 2002, 221). Finally, this student researcher found a previous taste test on Coke and Pepsi in International Journal of Application or Innovation in Engineering Management. Many more scholarly journals were published and will be included in the literature review of the research paper.

### Literature Review

Eating whole grains is important, as the Surgeon General recommends half the plate should consist of whole grains (U.S. Department of Health and Human Services, *Healthy Eating*, n.d. para. 8). Moreover, the Dietary Guidelines for Americans suggest that children and adults need two to three and three to five servings respectively a day (Fahey, G. Harnack, L., & Jonnalagadda, S., para. 3). As discussed earlier, the difference in processing the flours has a distinguishable taste. The importance of this study is to justify that 100% whole wheat flour in a cookie is as acceptable when prepared in a sweet dessert. This literature review attempts to incorporate research from previous studies using taste tests on bitter sensitivity, food production, health claims as well as branding. Furthermore, literature from periodicals discussing preparing foods using whole grains will be discussed.

The first study published by Julie Mennella, Yarina Pepino, and Danielle Reed entitled “Genetic and Environmental Detriments of Bitter Perception and Sweet Preferences” researched primarily on bitter-sweet tolerances between mother and child. According to Mennella et al. (2012) the study hypothesized bitter tolerance as well as sweet tolerance were effected by taste genes and cultural ethnicity in children and their mothers. The participants were divided based on DNA samples then consequently divided into three forced taste test groups. The first group consisted of those with bitter intolerance, next, those negative for bitter intolerance, and those bitter sensitive. Questions were asked on food preferences

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as well as ethnicity. The significant findings of the study indicated more children were bitter sensitive than adults. Additionally, children who were found bitter sensitive or bitter intolerance preferred sweet foods such as cereals, whereas the adults with the same bitter tolerance did not. Furthermore, cultural diversity did play a major factor in the results. Therefore the findings of the study agreed with the hypothesis (Mennella et al, *Pediatrics*, 2005, p 218)

This literature is well written as well as extremely thorough with plenty of detail. In the study, flavored water was used to determine bitter sensitivity, if any. Perhaps if food items were utilized, the outcome would be different. In addition, the published study might have a different outcome if children and their fathers were studied. Even further, perhaps if both parents were included in the study the results would have been different. On the other hand, the study does recommend these results be contributed to finding ways to understand food preferences in relation to healthy eating in order to help prevent diabetes and obesity (Mennella et al, *Pediatrics*, 2005, p221).

Next, this published abstract authored by Mozhdeh Bruss, Linda Dannison, Joseph Morris, Mark Orbe, Jackie Quitugua & Rosa Palacios entitled "Food, Culture, and Family: Exploring the Coordinated Management of Meaning Regarding Childhood Obesity" in *Health Journal* actually studied childhood obesity in the CNMI. The study implies improvements are needed in relation to communicating the importance of nutrition in order to lessen the amount of non-communicable diseases (ncd's) such as obesity in the CNMI. The significance to this study is the importance of relaying the message on healthy eating in the CNMI such as adding whole grains to foods (2005, abstract).

Next, the literature published by Maria Barton, John Kearny, and Barbara Stewart-Knox, "Knowledge of Food Production Methods Informs Attitudes toward Food but Not Food Choice in Adults Residing in Socioeconomically Deprived Rural Areas within the United Kingdom" in the *Journal of Nutrition Education*, focused on food processing in correlation to food choice in rural areas of the U.K. Participants in this study were given visual choices of processed and unprocessed foods and asked to choose which was tastier. Although the voluntary action group knew the unprocessed foods consisted of



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fresh foods, processed foods were inevitably chosen. According to Barton et al, a fast lifestyle may have contributed to the selection (*Journal of Nutrition Education*, 2011, abstract).

One deterrent in the methodology dealt with the number of men and women selected from a volunteer action group, which consisted of forty men and only two women. Consequently the results might have been biased. In addition, the study does not impicably state the type of food being selected, whether the unprocessed foods were fruits or grains. However, the study does correlate to knowledge of food production, whether processed or unprocessed and taste choice (Barton et al, *Journal of Nutrition Education and Behavior*, 2011, abstract). It is still theorized that disguising the healhful ingredient will in fact conceal the taste

Next, the literature review published by Jessica Soldavini, Patrcicia Crawford and Lorrene Ritchie, "Nutrition Claims Influence Health Perceptions and Taste Preferences in Fourth and Fifth Grade Children" studied taste preferences of foods that proclaim to be healthy as opposed to those that lack such claims. According to Soldavini, fourth and fifth grade students had the option of two snacks, those labeled with health benefits, and those without any such label. As a result of the study, the majority of those that identified the healthier food such as whole grain crackers, also preferred the taste. For example out of 81% of children who selected the product labeled with health perceptions, 72% preferred the taste (*Journal of Nutrition Education and Behavior* 2012, abstract.) In fact, the significance of this study greatly emphasizes that healthful foods can be prepared in which the taste compares the same if not better to foods that have no health claims. Even further, this study completely contradicts the previous study in which participants opted for the processed foods.

Lastly, Dr. N. Ramanjaneyalu, Asngi Channabasappa and Kadab Vishwanath discussed the article "Blind Taste Test of Soft-Drinks-A-Comparison Study on Coke and Pepsi". The journal was based on the study of two well-known brands of cola that correlated taste with brand knowledge and recognition using a blind test and an open test. According to Dr. Ramanjaneyalu et al, Pepsi was preferred in the blind taste test. However, in the open taste test where the products were made visible, Coke inadvertently



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had the majority vote. Furthermore, the hypothesis that brand recognition and knowledge play an important role in selecting was proven (*International Journal of Application or Innovation in Engineering Management*, 2013, p. 245)

One limitation to the study was the omission of the number of participants, gender, as well as the specific age range and preference to soft drinks, However the study indicated that perception of the product is related to commercial branding ( Ramanjaneyalu et al, 2013, p. 247). Moreover, this is significant to the current research as branding of ingredients such as flour may be an issue when preparing goods. For this reason, perhaps increased branding of whole grains in addition to health benefits the flavors would help imagery of taste of whole grains would improve.

In contrast to taste tests, this literature review describes an article published in Harvard Health Letter entitled “6 Ways to Tame the Modern Muffin”. The article discussed how to add nutrition as well as improve taste of foods such as the muffin. According to the article, to add nutrition as well as cut back on sugar and carbohydrates, replace all All-Purpose Flour with pastry wheat flour. The Harvard Health letter writes the wheat pastry flour is ideal for reducing the density in the muffin. In addition to the flour, replacing butter with vegetable oil is not only heart healthy but a “good fat” (2012 p.4-5). Furthermore, Harvard writes to add a lighter texture to the muffins, use only egg whites in the batter. The article explains to replace granulated sugar with brown sugar. Since brown sugar contains molasses it is actually sweeter however less of it can be used and at the same time reduce the salt content (*Harvard Health Letter* 2012 p. 4-5).

Unlike the other literature on taste tests, this article discusses ways to incorporate taste along with health. One similarity to the current study by this student researcher is the fact that brown sugar was used to replace the granulated sugar. The detailed article discusses nutritional value as well as adding flavor. Consequently, literature from this article might be used in future comparison taste tests.

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Finally, in an article authored by Jinshui Wang and Cristina Rosell, “Effect of the Addition of Different Fibres on Wheat Dough Performance and Bread Quality” discussed the effect of adding fiber to regular wheat flour is sometimes withheld due to undesirable taste. However, Wang writes that in the case of adding carob fibers, usually found in the Mediterranean, the taste was acceptable. Furthermore, when adding the fiber, the density and “softness” remained nearly identical to regular wheat flour (*Food Chemistry*, 2002, abstract). Accordingly, this article supports adding fiber to regular wheat flour as opposed to 100% whole wheat flour, information ideal to use in any future research.

In closing, based on the results of the combined studies, a significant amount of information is needed to determine if individuals would indeed be able taste a particular ingredient. Individuals have different sensitivities to bitterness and sweets (Mennella et al, 2005), perhaps location or lifestyle helps trigger what type of food production to choose from (Banton et al, 2011). Lastly, nutrition claims, taste and branding (Ramanjaneyalu et al, 2013). Although many studies were presented, this writer found it difficult to find specific actual studies on tastes between whole wheat flour foods and white flour foods that were not based on nutritional facts.

It does not deter from the fact that the hypothesis will be proven that individuals will be not able to identify the whole grain product. If, in that matter that the hypothesis is found to be proven wrong, simple changes to the recipe would be in order. Hence, the article on adding flavor while adding nutrition would be used (Wang & Rosel, 2002). In closing, perhaps in addition to hypothesizing that whole wheat flour could be hidden in foods without detecting a difference in taste, the investigation should also question if taste preference to whole grains would be a factor in determining the outcome.

### Research Questions:

- **The student writer hypothesizes that in a taste test incorporating the two flours in a desert such as cookies, participants would have a difficult time determining which flour was used.**
- **Would preference for whole grains be a determining factor?**



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### Introduction to Plan

The study on preference analysis of whole grains such as 100% whole wheat flour to determine whether the sweetness of a dessert could hide the taste differences between 100% whole wheat flour and All-Purpose Flour was conducted in a blind taste. The test was conducted on thirty seven residents in the CNMI was part of a summer English College course in the CNMI. The convenience based sample included 20 firefighters from a local fire department, thirteen students in a CNMI NMC Summer English course, as well as 4 children from a local village, each tested at different locations. In the end, the participants did in fact choose the dessert prepared with 100% whole wheat flour. It was hypothesized that participants would have difficult time determining which flour was used in the prepared dessert, and the results did show that it was slightly difficult.

### Methodology

#### Preparation

Preparation for the blind taste test consisted of preparing three flavors of home-made cookies, each batch prepared twice (see Appendix A for recipe). The flavors were peanut butter, oatmeal and chocolate chip. (Note: all participants were notified by the survey as well as verbal about the peanut butter in case of an allergic reaction). One batch was cooked with 100% whole wheat flour, subsequently, the other batch with All-Purpose Flour. To hide any resembling factors such as color, brown sugar was substituted for white sugar in all six batches. Afterwards, the cookies were divided into six containers and arranged into two groups of cookies on a tray marked Group A and Group B. Only the flavors were marked on the containers. An NMC Instructor approved survey, which included demographics, dietary restrictions, as well as preferences in relation to processed and unprocessed grains was produced. Also, a detailed schedule of preparation was prepared (see Appendix G).



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### Survey

Prior to the taste test, a survey approved by the NMC College instructor was generated (see Appendix B). The survey was completed in two parts: first collection of age, dietary restrictions, as well as preferences in relation to processed and unprocessed grains, followed by collection of data on the actual cookie tasted (see Appendix C). The survey questions were the same for all participants with the exception of the children. In this case, the questions were read orally to the children as well as verbally describe what whole grains and processed as white bread or brown rice etc. An informal questionnaire was presented to a bakery in which this student researcher posed the question which bread sells more, whole wheat bread or white bread. (see Appendix D) According to the manager, whole wheat bread sells much more than the white bread due to local government subsidies as well as the schools.

### Taste Test

The first group tested were the firefighters from the local fire department, followed by children and college students. Before each taste test, a brief introduction was presented stating the reason for the test in this case a college class. Furthermore, this student researcher explained the object was to determine which cookie was prepared with 100% whole wheat flour. Then tasters were guided to choose a cookie flavor from Group A and Group B, analyze the taste, and afterwards indicate by survey which group was prepared with 100% whole wheat flour, along with which batch was preferred. Thereafter, the completed surveys were manually entered into Survey Monkey to analyze the results. Results were also analyzed by comments contributed by the participants as well as take into consideration the fore mentioned groups (See Appendix C & E).

The survey and taste test took place on July 15, 2014. First, the firefighters tested at around 9:00am at the Aircraft Rescue Firefighter station in Saipan, CNMI. Of that group, thirty six were between the ages of 18-50 while one was over fifty. The tasters were all residents of the Marianas Islands. Second, the children were tested at around 11:00am on the same morning. The children's age were between 5 and

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7 and were from a local village in San Vicente, Saipan. Finally, the test at the college class at NMC, Saipan, took place at around 1:30pm during the English 202 course. The age demographics for this group shows eleven were between 18-50 and two were over fifty. Gender was not collected, however both genders were part of this taste test.

**Analysis**

By conducting an a preference analysis, 43% the of the participants preferred whole grain while only 11% preferred processed grains as seen through Survey Monkey (see appendix F). However, by a wide majority the participants preferred the cookies made with All-Purpose flour. In total, 33% preferred the whole grain flour which was Group A, while 67% preferred Group B, white flour. The next conclusive result indicated that a slim margin of difference in taste could be detected between the two groups with 56% of participants correctly selecting Group A as the cookie prepared with whole wheat flour. However, the batches prepared with white flour were selected as being made with whole wheat flour 45% of the time (See table 1 and 2).

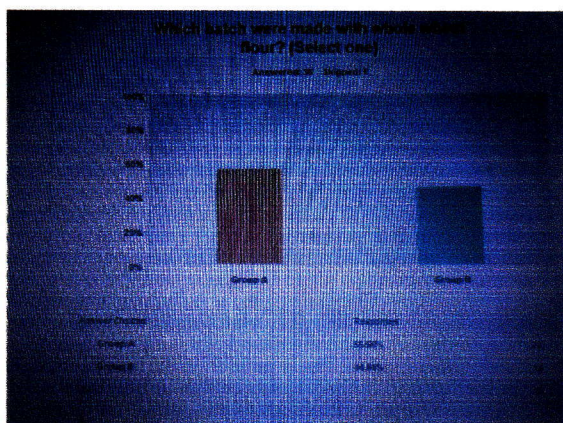


Table 1

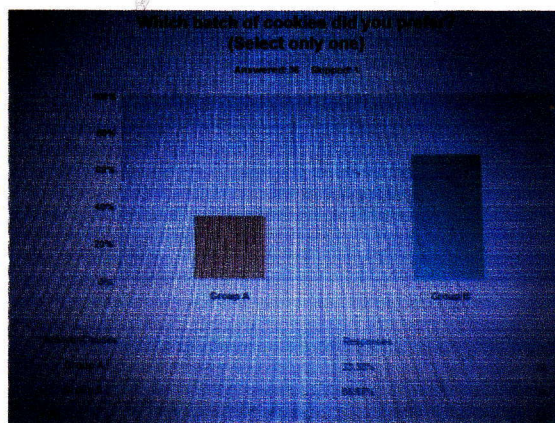


Table 2

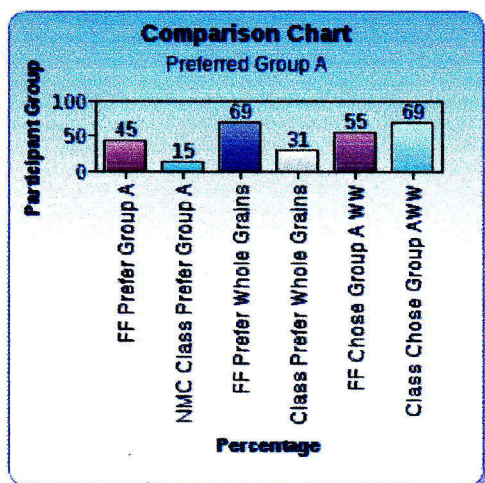


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## Findings

One significant finding, was found when comparing the results between the three convenience selected groups. Analysis (see Appendix E for notes) indicates that roughly half (50%) of the local firefighters thought Group A was prepared with whole wheat flour (correct answer), as well as preferred this batch 45% of the time. On the other hand, the college students correctly guessed 69% of the time while preferring the whole wheat flour cookie or Group A 15% of the time. Answering the question whole grain preference did not make a difference. Also, the firefighters preferred whole grains 69% of the time while the college students preferred whole grains 31% of the time (see table 1). The children surveyed preferred group A 50% of the time and preferred group B 50% of the time. However, only four children were tested.

Another significant finding was found in the comments left by participants on the survey on the taste and texture. The comments based on the whole wheat flour cookies were “hard-like flavor, “dry but soft”, “chunkier, sweet,” lighter taste”, and oily”, “stronger taste”. The batch prepared with white flour included some of the following comments: “had more moisture”, “more chewy”, “slightly sweeter, “better taste- not dry”. However, 16% of the comments mentioned both batches were very similar or “no difference”.





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Table 1

**Discussion**

The initial findings between the largest groups tested, show that lifestyle may have played a role in the difference of preferences of grains as reviewed in the literature by Banton et al. (*Journal of Nutrition Education & Behavior*, 2011). As the firefighters preferred whole grains more than college class. The comments do suggest that wheat pastry flour might have been a better option to avoid comments such as dry or hard as Harvard Health Letter (2012, p. 4) discussed in the article. After reviewing the literature on the fourth and fifth grade children selecting foods with health claims (Soldavini et.al.*Journal of Nutrition Education & Behavior*, 2011) the present study revealed that the food with hidden health claims, although hidden, was not selected by majority.

As a whole, participants in the taste test correctly guessed which cookie was prepared with whole wheat flour, however the margin was very small suggesting that similarities between tastes was apparent. Moreover, when narrowing the results collected from the college students and firefighters, there was a difference in findings. The college students more often correctly guessed the whole wheat flour cookie, whereas the participants from the fire station preferred whole grains to a higher degree. Therefore, preference in whole grains did not play a role in the answer. In future surveys of this experiment, collection of food preference as well as omitting the "no preference" option would benefit future findings. Additionally, testing other foods such as pastas, breads and other foods would improve results. Finally, perhaps if more children were included in this experiment, an analysis of taste perception between children and adults of whole grains could be provided.

**Conclusion**

As a whole this study provided evidence that the convenience based groups did detect the cookies prepared with whole wheat flour. Furthermore, the hypothesis stated it would be difficult to detect, and as the results show, the selection was quite difficult. However when narrowing the findings to specific

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groups of participants, analysis shows a significant difference in preference of whole grains, as well as being able to detect the whole wheat flour, although that did not make a difference in this taste test. One draw back was the fact that only four children took part in the taste test. This suggests future studies be performed on more select groups, specifically children and adults. This future study would detect taste perception of whole grains as people age. Research on different products and recipes to use would benefit any future findings.

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**Appendix**

Appendix A.....Recipe

Appendix B.....Approved Survey

Appendix C.....Completed Survey for Analysis

Appendix D .....Questionnaire

Appendix E.....Notes for Analysis

Appendix F.....Graphs

Appendix G.....Schedule

Appendix H.....Reading Notes

Appendix I.....Brainstorm

