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Title: ***Sodium Content in Processed Foods in the US market***

The accompanying research report is submitted to the **University of Wisconsin-Stout**, **Graduate School** in partial completion of the requirements for the

Graduate Degree/ Major: MS Food & Nutritional Sciences

Research Advisor: Philip McGuirk, MS

Submission Term/Year: Spring, 2013

Number of Pages: 34

Style Manual Used: American Psychological Association, 6th edition

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Kwon, Keehyun. ***Sodium Content in Processed Foods in the US market***

Abstract

Excessive sodium intake can lead to many health issues, such as stroke, heart disease and kidney disease. Many states and localities have begun to develop plans or are taking action on sodium reduction. Canned soup, processed meat, and sauces are typically high sodium sources and are consumed regularly in the United States. The purpose of this study was to investigate these three categories of processed foods in the markets in Menomonie and Minneapolis to help consumers reduce sodium in the diet. Each sample was collected representing two to three different brands, and a low-sodium version of every sample was collected if applicable. Canned soup and smoked sausage samples indicated significantly higher sodium content depending on brand. Hot dogs and pasta sauce samples also reflected a wide range of sodium content depending on the brand and product type. The results of this study supported the need to improve consumers' knowledge on label reading when selecting processed foods. Consumers need to have knowledge about the wide variability of sodium content in processed foods in order to reduce sodium intake.

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Chapter I: Introduction

Sodium chloride is the chemical name of dietary salt. Although inaccurate, the words "salt" and "sodium" are often used interchangeably as consumers often think they are the same. For example, the nutrition facts label uses "sodium," but the front of the package may say "salt-free." Ninety percent of the sodium we consume is in the form of salt (Anderson et. al., 2010). Sodium is perhaps the deadliest ingredient in the food supply. A small amount of sodium is necessary for health, but the amount in the typical American diet is a major cause of high blood pressure, or hypertension. Sodium consumption has increased a lot since the 1970s. According to the Centers for Disease Control and Prevention, the average daily consumption of sodium for Americans aged 2 years and older is more than 3,400 milligrams (CDC, 2009). However, for most American adults, the recommended limit is 1,500 mg of sodium per day. Currently, 65 million Americans suffer from hypertension, which increases the risk of heart disease and stroke. Cardiovascular disease kill about 650,000 people annually (Weiss et. al., 2011). In 2004, the director of the National Heart, Lung, and Blood Institute and two other experts estimated that reducing sodium levels in processed and restaurant foods by 50 percent would save 150,000 lives a year (Havas, Roccella, & Lenfant, 2004).

When people think about salt, most of them think about the salt shaker on their kitchen table, but the salt shaker supplies only a small percentage of a person's daily intake (Everyday foods are top sources of sodium, 2012). Most of the sodium Americans consume comes from processed and restaurant foods. According to a study in 1991, processed foods accounted for more than three quarters of all sodium consumed (Mattes & Donnelly, 1991). That figure is likely higher today. Reducing sodium consumption to recommended limits helps to reduce the risk of hypertension and high blood pressure. Even if a person does not have high blood pressure,

reducing sodium intake is important because the lower blood pressure, the lower the risk for heart disease and stroke. Nearly 400,000 deaths each year are attributed to high blood pressure therefore reducing sodium intake could prevent many thousands of deaths annually (Danaei et al., 2009). This study examined the consumption of processed foods in the US market and their sodium contents. The result will help consumers identify the major sources of sodium between processed foods to help reduce sodium intake.

Justification

The U.S. Food and Drug Administration defines "processed food" as "any food other than a raw agricultural commodity and includes any raw agricultural commodity that has been subject to processing, such as canning, cooking, freezing, dehydration, or milling." Based on this definition, almost all food served in restaurants and many grocery store products are considered processed. Especially, certain type of processed foods, such as canned soup, sauce, and processed meat, were reported as high sodium foods.

Americans aged 2 years and up should reduce sodium intake to less than 2,300 milligrams per day. People aged 51 and up and those of any age who are of African American descent or who have high blood pressure, diabetes, or chronic kidney disease (about half of the U.S. population) should further reduce sodium intake to 1,500 mg per day (US Department of Health & Human Service, 2010). Making smart food choices, including limiting daily sodium intake, is critical in protecting the health of individuals.

Purpose Statement

The purpose of this research study was to investigate three categories of processed foods, including canned soup, processed meat, and pasta sauces, in grocery stores located in Menomonie and Minneapolis to determine the sodium content of processed foods to help reduce

individuals' sodium intakes. The data were collected from Marketplace, Wal-Mart, and Cub Foods.

Research Objectives

The researcher hoped that customers, dietitians and other health professionals may use data from this study to gain an understanding of which processed foods contain more sodium and what alternatives are available to help reduce sodium intake. This research study had the following three objectives.

1. To investigate sodium content of three types of processed foods in Menomonie and Minneapolis area grocery stores.
2. To suggest possible alternative products or modifications to reduce individuals' sodium intake.
3. To develop a tool that customers, dietitians, and other health professionals can use to obtain information about the sodium contents of processed foods.

Research Hypotheses

The following are the proposed hypotheses of this study.

1. Sodium reduction in a small number of food categories and focusing on products sold in the highest volumes will lead to a decrease in sodium intake.
2. Sodium content of processed foods varies depending on brand, so comparative sodium contents can help individual's food selection for sodium reduction.

Definition of Terms

The following terms are defined to provide the reader with further clarity when reading this study.

Hedonic quality. Hedonic means of or pleasure-relating to utility. For example, the quality of a product that one might buy.

Renin angiotensin system. The renin angiotensin system (RAS) is a hormone system that regulates blood pressure and fluid balance

Limitations

Sufficient data were collected however the study had the following three limitations. The researcher was able to collect data from a small number of products and study was able to generalize results only from a limited geographical area. A third limitation was that data were collected only during the winter months.

Chapter II: Literature Review

Food processing is the set of methods or techniques used to process raw ingredients into food or to process food into other forms for consumption. People have used processing techniques, such as fermenting, sun drying, salt preserving, and various types of cooking since ancient times (Rastogi, 1012). Salt preservation is a particularly common method in food processing.

Salt (sodium) is an important part of the diet of humans. The first usage of salt is not clear; however, ancient documents recorded the use of salt in both the East and the West from about 4,700 B.C. (MacGregor, 1998). Pickles, beef jerky, and dried fish are some examples of foods which are preserved by salt. The number of food processing techniques have increased; however, sodium is still a widely used food additive for many purposes. Today, almost every processed food in the market contains sodium (Stadler, 2009).

This chapter is divided into three major parts. The first part covers the functions of sodium and the reasons for the salt preference of humans. The second part focuses on possible health issues due to a high sodium diet. The last part discusses the effects of sodium reduction on human health.

Sodium Effects

In different food categories, sodium has various effects. Sodium is primarily used to satisfy consumers' tastes, preserve products, and improve product texture. Processed foods contain sodium for two major proposes; preservation and taste (Sinopoli & Lawless, 2012). Therefore, if foods are more processed, that usually means the food contains higher levels of sodium. Sodium is commonly used in processed foods which are reconstituted with water, such as canned soup or processed meats. Sodium can prevent the growth of microorganisms so food

manufacturers and producers use it to extend the shelf life of products. Sodium also enhances the color and taste of foods. In the blanching process, sodium carbonate is often used in the water to blanch vegetable to preserve chlorophyll and to help retain a green color. Also, enzymatic browning of foods, such as apple and potato cuts, is prevented by a brine application (Wenqiang & Xuetong, 2010).

The most important sensory role of salt in foods is to provide a salty taste. Sodium helps various flavor characteristics of foods and improves food flavor. Also, sodium suppresses the off flavor of foods. For example, as sodium inhibits the bitterness of foods, flavor attributes such as sweetness improve (Albarracin, Sanchez, Grau, & Barat, 2011). Therefore, a sodium reduction program in foods should consider the effects on hedonic quality and other flavor attributes on food due to lowering the sodium content. A human's salt preference is hard to explain with scientific evidence; however, some studies have suggested historical and developmental factors. Salt was added to foods from 10,000 or more years ago, so humans naturally became accustomed to eating salty foods and developed a preference for the salty taste (Desimone et al., 2013). This salt preference is one of the obstacles for sodium reduction of processed foods. Even though there might be some chance to reduce extra sodium content in certain products, manufacturers tend to avoid this because of consumer taste preferences and demands. Manufacturers have reported technological restriction to reducing sodium content of products because of the negative effects on product safety (preservation and shelf life), quality (texture and function), taste, and cost. Sodium content can be reduced only to the point where there are no negative effects on products. Because of the food processing limitations, consumers are unlikely to see significant sodium reduction in processed foods.

Health Issue

Sodium has beneficial effects; however, high sodium consumption is being treated as a major health issue. Americans consume excessive amount of sodium, which can lead to many health problems. The 2010 Dietary Guidelines for Americans recommend that individuals in general should consume no more than 2,300 mg of sodium per day (CDC, 2011). Also, individuals who are in the following population groups should not consume more than 1,500 mg of sodium per day: individuals who are 51 years of age or older, who are African American, who have high blood pressure, who have diabetes, and who have chronic kidney disease. However, the Center for Disease Control and Prevention (CDC) reported that the average daily consumption of sodium in Americans age two years and older is more than 3,400 mg (CDC, 2010a). A diet high in sodium increases the risk of stroke, heart disease, kidney disease and many other chronic health problems.

One of the major risks due to high sodium intake is an increase in blood pressure. A high sodium intake influences the renin angiotensin system and increase blood pressure, a major risk factor of atherosclerosis. A study conducted by Lu et al. (2012) investigated the levels of dietary sodium intake and its effects on atherosclerosis. The study applied different amounts of dietary sodium concentrations in mice for 12 weeks to determine the concomitant effects. This study found that systolic blood pressure was positively related to sodium intake. Therefore, high dietary sodium intake can lead to higher blood pressure and stroke.

A high-sodium diet is also associated with hypertension if consumed long term. Forman et al. (2012) hypothesized that high sodium intake would be associated with increases in biomarkers of endothelial dysfunction which could lead to hypertension. Forman et al. (2012) examined the correlation of sodium intake with the incidence of hypertension (n=5556) among

non-hypertensive participants. The results indicated that a higher sodium intake was correlated with increases in serum uric acid (SUA) and more urine albumin excretion (UAE). Higher SUA, UAE, and sodium intake were risk factors for developing hypertension.

Many studies have examined the relationship between sodium consumption and risk of stroke among multi-ethnic populations. The results of the study presented at the 2011 International Stroke Conference indicated that a daily sodium consumption of more than 1,500 mg (American Heart Association's recommended amount) led to a higher stroke risk. Individuals who consume 4,000 mg/day of sodium had more than double the risk of stroke, compared with 1,500 mg/day. Another study indicated that 2,657 out of 3,166 participants, who consumed more than 10,000 mg/day of sodium, have experienced a previous myocardial infarction (Jones, 2011).

Due to the health issues attributed to high sodium intake, many states and localities have begun to develop plans or are taking action on sodium reduction. Many of these localities have also participated in the National Salt Reduction Initiative (NSRI) led by the New York City Department of Health (CDC, 2010b).

Sodium Reduction

Reducing sodium is probably one of the most important dietary changes which are recommended for Americans. Even if individuals do not have high sodium related issues, such as high blood pressure, sodium reduction is still important because a lower blood pressure can reduce the risk of heart disease or stroke. Almost 400,000 people die each year in the US due to high blood pressure; therefore, reducing sodium intake may prevent thousands of deaths annually (Danaei et al., 2009).

Most heart failure symptoms are related to excessive sodium intake. Thus, the American Heart Association and the Heart Failure Society of America have recommended a sodium-

restricted diet (SRD) to individuals with heart failure. A study conducted by Son et al. (2011) examined the effects of a sodium-restricted diet on heart disease. A total of 232 participations with heart failure received a 24-hour urinary sodium excretion test, then divided into two groups. The SRD group was assigned a daily sodium intake of less than 3 g and the regular diet group was assigned more than 3 g. The results indicated that the SRD improved the symptom burden and the clinical health outcomes in participants with heart failure. Also, the study suggested further sodium reduction would enhance these positive effects. Previous researchers have studied the effect of sodium reduction on the treatment of hypertension. Whelton et al. (1998) examined the difference between a reduced sodium diet and a normal diet with 585 participants aged 60 to 80 years. After three months of intervention, the study proved that lowered sodium intake was an effective treatment of hypertension in elderly people. The study hypothesized that sodium reduction would reduce the risk of hypertension in people of all ages but was especially effective in the elderly.

Sodium intake from table salt (salt shaker) or cooking processes is only a small amount of total daily intake. According to the CDC report, Americans consume most of their sodium from processed and restaurant foods (CDC, 2010b). There are many foods that contain high levels of sodium. Canned soup, processed meat, and sauces are high sodium sources and have a high consumption in the United States (US Department of Health & Human Service, 2010). Once accurate and comparative sodium contents in target foods are analyzed, many solutions or alternatives can be identified to reduce consumers' sodium intake.

Chapter 3 will discuss the methodology utilized to study the sodium content of some processed foods in grocery stores. This study will gathering evidence to determine solutions or alternatives which might lower consumers' intake of sodium.

Chapter III: Methodology

The purpose of this study was to investigate the sodium content of processed foods so that possible alternatives or modifications to reduce an individual's sodium intake would be developed. During the winter of 2012, the sodium data of processed foods were collected from three different grocery stores. The methodology chapter will outline the sample selection and data collection. This chapter includes sections about selection of sample, instrument, data collection procedure, and data analysis. The choice of samples selected will be described as well as the methodological limitations. The purpose of this chapter is to demonstrate techniques and procedures used to complete the study and to show how the research was conducted.

Samples

Processed foods were selected in three grocery stores. Two of the stores, Market Place and Wal-Mart, were located within Menomonie, Wisconsin. The third store, Cub Foods, was located in Minneapolis, Minnesota. The categories of processed foods included canned soup, smoked sausage, hot dogs, and sauces. Two to three different brands of each category were collected. Brands included were Campbell, Progresso, Johnsonville, Hillshire, Shurfresh, Oscar Mayer, Farmland, Classico, Newman's Own, and Prego. Some of selected brands were sold in all three grocery stores. Also, the low-sodium version of each sample was collected if applicable. In collaboration with the research advisor and a registered dietitian, this thesis focused on these categories of processed foods because the chosen items tend to be higher in sodium content.

Data Collection Procedures

The processed foods were selected from the shelves of Market Place, Wal-Mart, and Cub Foods in the Menomonie and Minneapolis areas. The researcher contacted the store managers and got prior permission to collect research data from each individual store. Campbell and

Progresso were selected as a canned soup samples because those two brands had significant sales volume in the United States (Ziobro, 2012). Processed meat brand was selected which was sold in all three stores (Johnsonville, Hillshire, Shurfresh, Oscar Mayer, and Farmland). Prego, Newman's Own, and Hunt's were the brands for pasta sauce. Sample products were sorted by type and brand. For example, two brands of chicken noodle soup were analyzed for sodium content.

The data of low sodium versions was collected and compared with the same brand and type of regular product if the low sodium version was available. For example, Campbell vegetable beef soup was compared with Campbell low sodium vegetable beef soup. Then Progresso low sodium vegetable beef soup was compared to Campbell low sodium vegetable beef soup and the regular products were compared for sodium content. If one product did not have a matching type in other brands, it was excluded from the sample. The data was collected two times in the same stores initially and again after an interval of two months. Data collection started in November 2012 and was completed in January 2013.

Data Analysis

Microsoft Excel was used to analyze the data for sodium content of the sample products. Descriptive statistics including the mean and standard deviation were conducted on the data. In addition, frequency of sodium levels was analyzed. An independent samples t-test and ANOVA were used to assess statistically significant differences in the sodium content of each brand.

Limitations

The study had some limitations. First, the results of study were not easy to generalize due to a small sample size. Product (brand) availability and preference could vary depending on the region. The study collected samples only in the Menomonie and Minneapolis areas, so the data

might have some problems being generalized to a wider population. Another limitation of this study was the product comparison. For example, even though Campbell and Progresso labeled the product 'vegetable beef soup', the ingredients were different so it was difficult to compare similar types of soup from different brands. The last limitation was that the study collected data only in the winter season. Product availability and preference could differ depending on season, which could lead to different results.

Chapter IV: Results

Canned Soup

Twenty two canned soups were sampled. The samples were either the Campbell (*n*=7) or the Progresso (n=7) brands. Low-sodium versions of canned soups were also obtained from the Campbell (n=4) or Progresso (n=4) brands. Most of Campbell's regular soups contained more than 850 mg/serving of sodium, whereas Progresso's regular soup contained 690 mg/serving of sodium (see Table 1). A serving size for both these brands was one half cup. All of the Campbell's low sodium soup samples contained 410 mg/serving of sodium while three of Progresso's low sodium soup contained more than 460 mg/serving of sodium.

Table 1

Frequency of Sodium Content in Two Brands of Regular and Low Sodium Soup

	Frequency			Frequency	
Sodium in regular version (mg)	Campbell	Progresso	Low-sodium version (mg)	Campbell	Progresso
< 600	0	0	< 400	0	0
600 ~ 650	2	1	400 ~ 420	4	0
650 ~ 700	0	5	420 ~ 440	0	0
700 ~ 750	0	0	440 ~ 460	0	1
750 ~ 800	0	0	460 ~ 480	0	3
800 ~ 850	0	1	480 ~ 500	0	0
850 ~ 900	5	0			

Table 2 indicates the sodium content of each soup sample. The soup types and sodium content of the Campbell and Progresso brands included beef barley soup (890mg, 690mg), beef & vegetable soup (890mg, 690mg), chicken noodle soup (890mg, 690mg), chicken with rice soup (610mg, 640mg), cream of mushroom soup (870mg, 830mg), vegetable soup (890mg, 670mg), and minestrone soup (650mg, 690mg) respectively. Among the samples, four types of

low sodium soup with the Campbell's brand had a matching soup in the Progresso brand. The soups of the sodium content included beef & vegetable soup (410mg, 480mg), chicken noodle soup (410mg, 470mg), vegetable soup (410mg, 450mg), and minestrone soup (410mg, 470mg).

Table 2

Sodium Content of the Regular and Low Sodium Versions of Soup from Campbell and Progresso

	Campbell (mg/one half cup)	Progresso (mg/one half cup)
Regular		
Beef barley soup	890	690
Beef & vegetable soup	890	690
Chicken noodle soup	890	690
Chicken with rice soup	610	640
Cream of mushroom soup	870	830
Vegetable soup	890	670
Minestrone soup	650	690
Low sodium		
Beef & vegetable soup	410	480
Chicken noodle soup	410	470
Vegetable soup	410	450
Minestrone soup	410	470

The average sodium content of Campbell's regular soup samples (812.9 mg/serving) was significantly higher than Progresso's samples (700 mg/serving) when compared by a t-test (p = 0.02). However, the average sodium content of Progresso's low sodium versions (467.5 mg/serving) was significantly higher than Campbell's low sodium versions (410 mg/serving) (p = 0.001) (see Table 3).

Table 3

Comparison of the Mean Sodium Content of Regular and Low Sodium Versions of Two Brands of Soup by t-Test

	Campbell (mg/one half cup)	Progresso (mg/one half cup)	sig
Regular Soup	812.9	700	0.02
	(125.7)	(60.3)	
Low Sodium Soup	410	467.5	0.001
	(0)	(12.6)	

Overall results for the sodium content of regular canned soup indicated that Campbell's products contained more sodium than Progresso's products. Also, Campbell's soups showed wider variations in sodium content depending on type of soup than did the Progresso brands (see Figure 1).

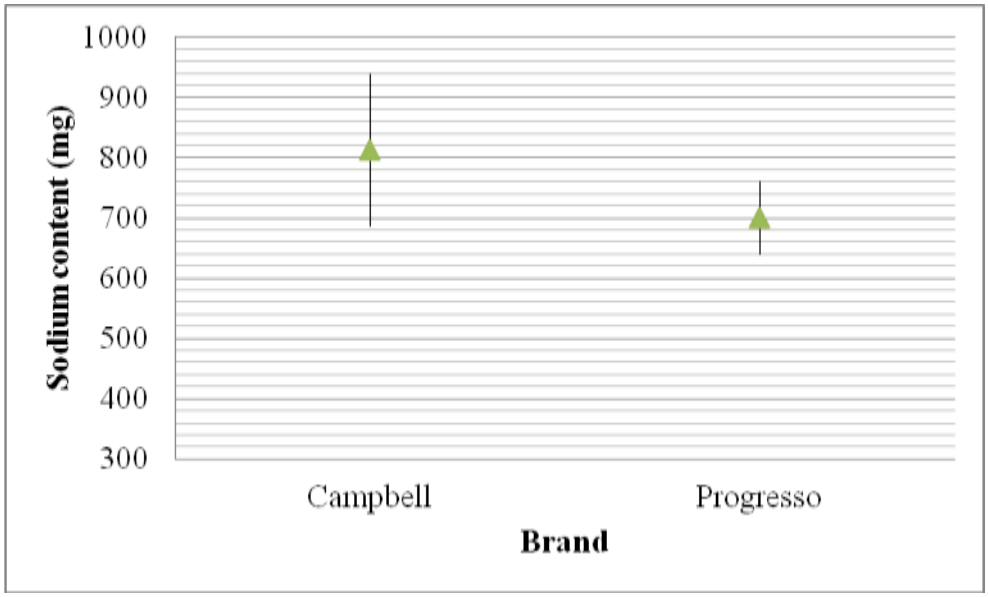

*Figure 1***.** Mean of sodium content of regular soup sold by Campbell and Progresso

In the case of the low sodium versions of canned soup, Progresso's products contained more sodium than did Campbell. All Campbell's low sodium soup samples showed a fixed sodium

content (410 mg/serving), and Progresso's samples showed variations in sodium content depending on the type of soup (see Figure 2).

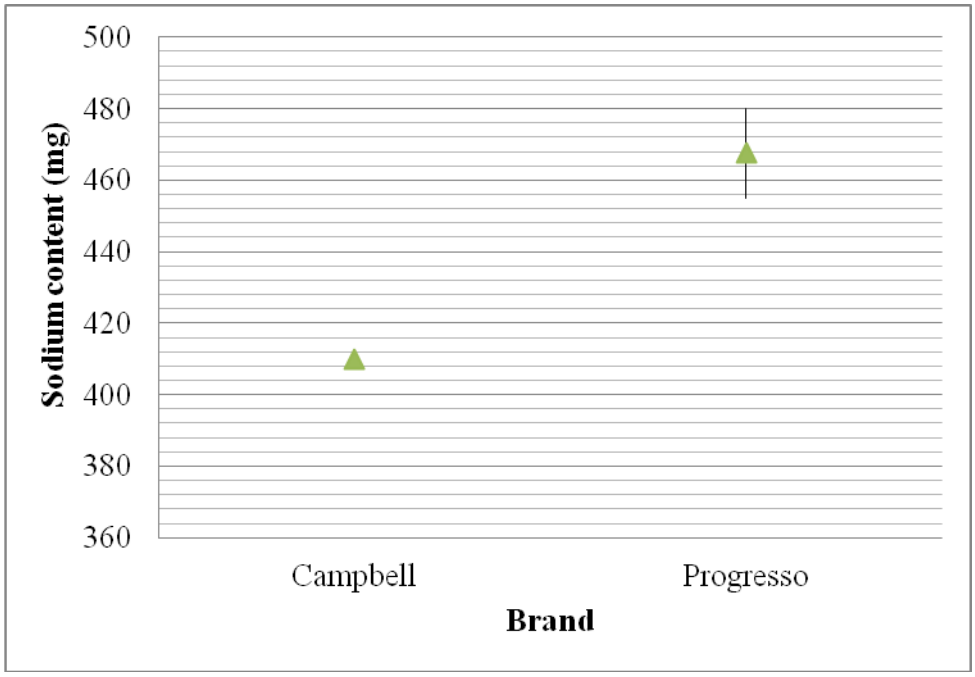

*Figure 2***.** Mean of sodium content of low sodium soup sold by Campbell and Progresso

Processed Meat - Smoked Sausage

Twelve smoked sausage samples were analyzed. The brands sampled included Johnsonville (n = 4), Hillshire (n = 4), and Shurfresh (n = 4). Table 4 indicates the sodium content of each sausage sample by brand. The sausage types and sodium content per sausage of the Johnsonville, Hillshire, and Shurfresh brands included chicken (870mg, 640mg, 530mg), beef (630mg, 640mg, 640mg), pork (760mg, 580mg, 580mg), and turkey (710mg, 500mg, 500mg) respectively.

Table 4

Sodium Content of the Smoked Sausage of Johnsonville, Hillshire, and Shurfresh Brands

	Johnsonville (mg/sausage)	Hillshire (mg/sausage)	Shurfresh (mg/sausage)
Chicken sausage	870	640	530
Beef sausage	630	640	640
Pork sausage	760	580	580
Turkey sausage	710	500	500

The average sodium content of Johnsonville's sausage sample (742.5 mg/serving) was significantly higher when analyzed by ANOVA than Hillshire and Shurfresh ($p = 0.02$) (see Table 5). The sausage samples of Hillshire and Shurfresh (590 and 562.5 mg/serving) contained a similar sodium content.

Table 5

Comparison of the Mean Sodium Content of Smoked Sausage of Three Brands by ANOVA

	Johnsville (mg/sausage)	Hillshire (mg/sausage)	Shurfresh (mg/sausage)	sig
Smoked Sausage	742.5	590	562.5	0.02
	(100.5)	(66.3)	(61.3)	

Overall results for the sodium content of smoked sausage indicated that Johnsonville sausage samples contained the highest average sodium with wide variations depending on type of meat used in the sausage while Shurfresh's samples contained the lowest average sodium content but was not different significantly from the Hillshire brand (see Figure 3).

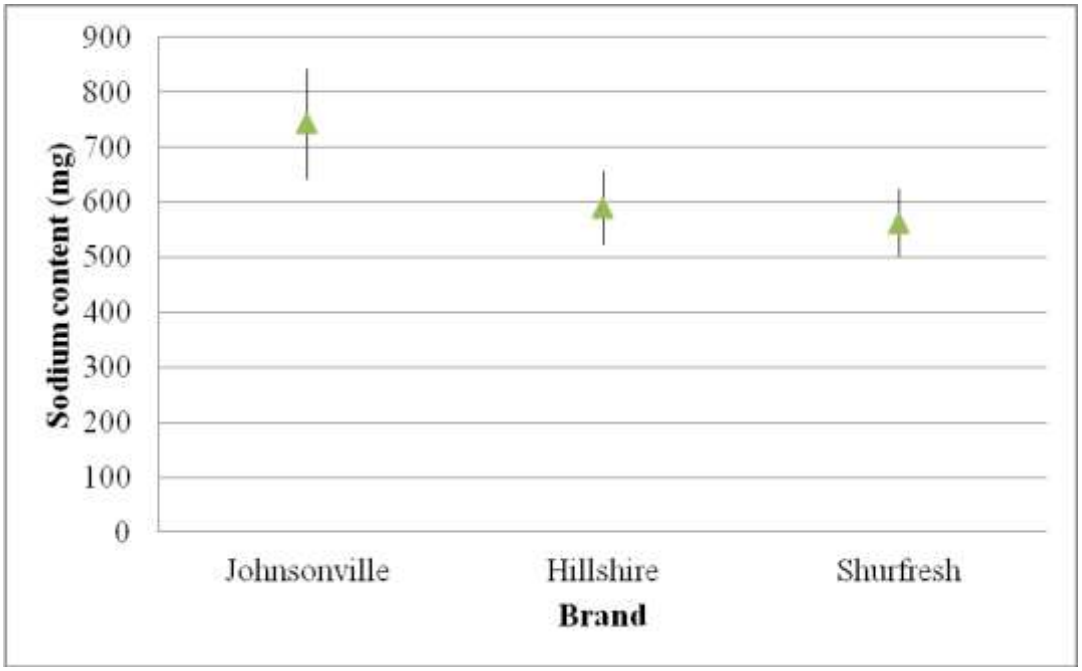

Figure 3. Mean of sodium content of smoked sausage sold by Johnsonville, Hillshire, and Shurfresh

Processed Meat - Hot Dogs

Eight hot dog samples were analyzed. The brands sampled included Oscar Mayer (n = 4), and Farmland (n = 4). Table 6 indicates the sodium content of each hot dog sample by brand. The hot dog types and sodium content of Oscar Mayer and Farmland brands included original (680mg, 370mg), beef frank (470mg, 610mg), black angus frank (370mg, 530mg), and Jalapeno cheese (480mg, 350mg) respectively. A serving size was considered one hot dog.

Table 6

Sodium Content of the Hot Dogs by Oscar Mayer and Farmland

	Oscar Mayer (mg/hot dog)	Farmland (mg/hot dog)
Orignal	680	370
Beef franks	470	610
Black angus franks	370	530
Jalapeno cheese	480	350

The average sodium content, as analyzed by t-test, of Oscar Mayer's hot dog sample (500mg/serving) was higher than Farmland (465 mg/serving) but it was not significant ($p = 0.39$) (see Table 7).

Table 7

Comparison of the Mean Sodium Content of Hot Dogs of Two Brands by t-Test

	Oscar Mayer (mg/hot dog)	Farmland (mg/hot dog)	sig
Hot Dogs	500	465	0.39
	(129.9)	(125.8)	

Pasta Sauce

Twenty one pasta sauces were sampled. The brands sampled included Classico (n=7), Newman's Own (n=7), and Prego (n=7). Sodium content of the Classico's pasta sauces were evenly distributed between 350 ~ 500 mg/serving. A serving size of pasta sauce was one half cup. Most of the Prego's samples contained a similar amount of sodium regardless of sauce type (450 ~ 500 mg/serving). Newman's Own pasta sauces contained higher amounts of sodium than the other two brands. Three types of Newman's Own samples contained more than 600 mg/serving of sodium content (see Table 8).

Table 8

Frequency of Sodium Content in Three Brands of Pasta Sauce

	Frequency		
Sodium Content (mg)	Classico	Newman's Own	Prego
< 350	1	0	0
350 ~ 400	2	0	0
400 ~ 450	2	0	2
450 ~ 500	2	2	5
500 ~ 550	0	2	0
550 ~ 600	0	0	0
> 600	0	3	0

Table 9 indicates the sodium content of each pasta sauce sample by brand. The sauce types and sodium content of Classico, Newman's Own, and Prego brands included marinara (460mg, 460mg, 480mg), roasted garlic (320mg, 480mg, 460mg), Italian sausage (440mg, 630mg, 480mg), mushroom (450mg, 520mg, 480mg), tomato & basil (400mg, 520mg, 420mg), cheese (480mg, 610mg, 430mg), and herb (400mg, 660mg, 460mg) respectively.

Table 9

Sodium Content of the Pasta Sauce by Classico, Newman's Own, and Prego

	Classico (mg/one half cup)	Newman's Own (mg/one half cup)	Prego (mg/one half cup)
Marinara	460	460	480
Roasted garlic	320	480	460
Italian sausage	440	630	480
Mushroom	450	520	480
Tomato & basil	400	520	420
Cheese	480	610	430
Herb	400	660	460

The average sodium content of Classico's pasta sauce sample as analyzed by ANOVA (421.4 mg/serving) was significantly lower than Newman's Own and Prego ($p = 0.001$). Newman's Own pasta sauce samples contained significantly higher sodium (554.3 mg/serving) than other two brands ($p = 0.001$). Prego's samples had a moderate level of sodium content (458.6 mg/serving) (see Table 10).

Table 10

Comparison of the Mean Sodium Content of Pasta Sauce of Three Brands by ANOVA

	Classico (mg/one half cup)	Newman's Own (mg/one half cup)	Prego (mg/one half cup)	sig
Pasta Sauce	421.4	554.3	458.6	0.001
	(53.7)	(78.3)	(24.8)	

Overall results for the sodium content of pasta sauce indicated that the pasta sauce samples from Newman's Own contained the highest average sodium with wide variations depending on the type of sauce while Classico's samples contained the lowest average sodium. Prego's pasta sauce samples indicated moderate sodium content with the least variation among sauce types (see Figure 4).

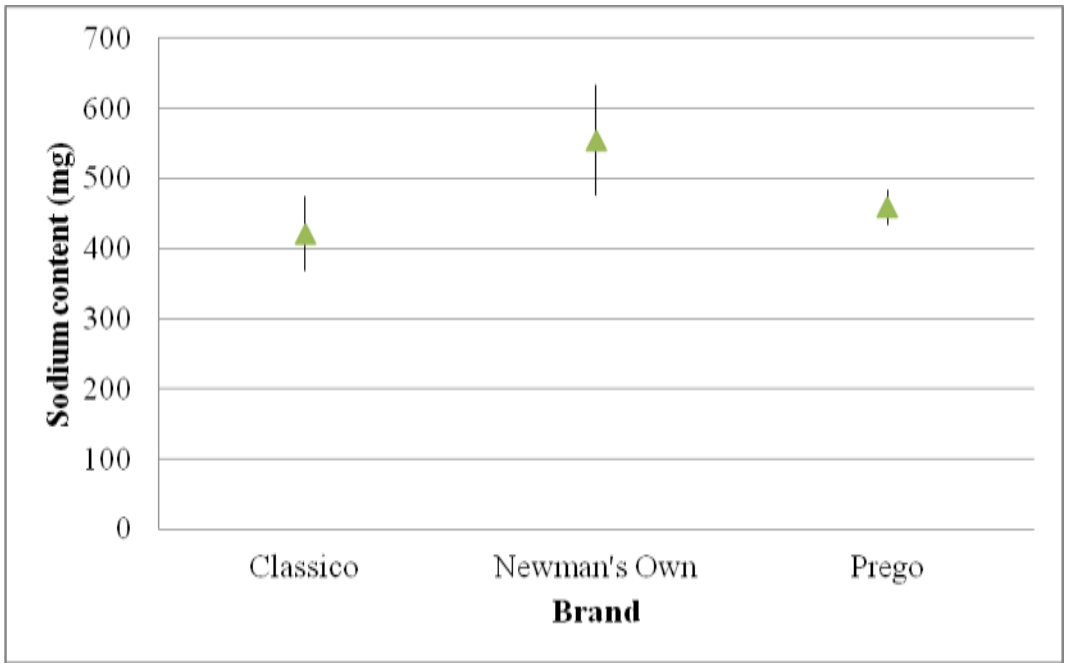

Figure 4. Mean of sodium content of pasta sauce sold by Classico, Newman's Own, and Prego

The significance of the sodium content as reflected in these results will be discussed in chapter 5.

Chapter V: Discussion

This study examined the sodium content of processed foods selected from three grocery stores in Menomonie and Minneapolis. The processed food categories included canned soup, processed meat (smoked sausage and hot dogs), and pasta sauce. Two to three different brands of each category were collected for comparison. Products, which did not have a matching type in other brands, were excluded from the sample. The contents of this chapter will include a discussion of the limitations, conclusions, and recommendations.

Limitations

As mentioned previously, limitations of this study included a small sample size, limited sampling location, seasonality of the study and finding products with similar ingredients. Processed food samples were used in the study only if a matching type food could be located in other brands; therefore the sample size was decreased. The small sample size makes it difficult to generalize the results. The samples were collected from limited areas, Menomonie and Minneapolis. Product (brand) availability or preference could vary depending on the region (Ten all-American soups, 1987). This would also make it difficult to generalize the results to a wider population. Another limitation was that data were collected only during the winter months. As availability of products can vary from season to season, the data collected may not be a complete representation of the entire year. The final limitation was the product comparison. This study compared the same type of product samples among brands. However, even though two canned soup samples were labeled the same with ‘chicken noodle soup’, the ingredients may not necessary be similar between the brands. Therefore, it was hard to compare perfectly matched samples with identical ingredients.

Conclusions

Among the three categories of samples, only the canned soup category had an option of a low sodium version. Regular Campbell soups contained more sodium than Progresso. Therefore Progresso soups may be better for sodium reduction diet ($p = 0.02$). These results may suggest that consumers should choose canned soup by brand because overall the types of Progresso soup samples contained lower sodium than Campbell's. However, the opposite was found for the low sodium version soups because the average sodium content of Campbell's was significantly lower than Progresso ($p = 0.001$). Therefore, consumers should be careful when they choose low sodium canned soup by reading the label carefully.

In case of smoked sausage samples, the difference in sodium was clear. Overall types of Johnsonville sausages contained significantly higher sodium than Hillshire and Shurfresh ($p = 0.02$). Therefore, consumers can choose smoked sausage by brand to control sodium intake. The sodium content of hot dogs varied depending on brand. The original hot dog with the highest sodium content was the Oscar Mayer brand; the lowest amount of sodium was found in Farmland samples. However, the average sodium content of Oscar Mayer and Farmland was not significantly different ($p = 0.39$). This result suggests that consumers need to read the nutrition label depending on the type of hot dog if they want to account for the sodium content. In addition, the serving size of sausages and hot dogs varied slightly depending on the brand, so future research will need to consider this serving size difference for more accurate comparsions.

The average sodium content of Classico pasta sauces was significantly lower than Newman's Own and Prego. Even though each brand had some low sodium version pasta sauces, this study did not use those because they had no matching type in other brands. For example, Classcio had low sodium marinara sauce but Prego had only low sodium Italian sausage sauce,

so a comparison was not possible. This result may suggest that consumers should choose pasta sauce by both brand and the sodium label because the low sodium pasta sauce could be available in several brands.

Finally, sodium reduction requires the consumers' effort. Consumers should have some knowledge about processed food selection as well as how to read labels for sodium content. The results of this study support the need to improve consumer's knowledge on processed foods. Consumers should be advised to eat processed foods in moderation because almost every processed food in the market contains high sodium. However, consumers eat processed foods regularly because of many reasons such as convenience or taste. Sodium reduction from processed foods can reduce consumers' health issues due to high sodium intake. Therefore, constant research will be needed in the future for improvement in consumer health.

Recommendations

As many types and brands of processed foods are consumed in the United States, a larger sample size of processed foods may be needed to generalize sodium content data. This research study examined only a small number of products from a limited sampling location. Therefore it is recommended to use a larger sample size of processed foods from various sampling locations in the future studies.

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