SODIUM INTAKE OF SPECIAL POPULATIONS IN THE HEALTHY AGING IN NEIGHBORHOODS OF DIVERSITY ACROSS THE LIFE SPAN (HANDLS) STUDY

by

Julie Clymer

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Approved: ____
Nancy Cotugna, DrPH, RD, LDN
Professor in charge of thesis on behalf of the Advisory Committee

Approved: ____
P. Michael Peterson, Ed.D.
Chair of the Department of Behavioral Health and Nutrition

Approved: ____
Kathleen S. Matt, Ph.D.
Dean of the College of Health Sciences

Approved: ____
Charles G. Riordan, Ph.D.
Vice Provost for Graduate and Professional Education

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ABSTRACT

Introduction: Hypertension (HTN) strikes 33.6% of Americans contributing to half of all cardiovascular disease leading to heart disease and strokes often resulting in disability and death**.** The *Dietary Guidelines for Americans, 2010* recommends a 1500 mg/day sodium restriction for the special population groups (those with hypertension, diabetes, or chronic renal disease, African Americans, and those 51 years and older) which comprise 50% of the American population. Americans typically consume 3400 mg sodium daily. The purpose of this study was to analyze the sodium intake of participants of the HANDLS study who were in the three The *Dietary Guidelines for Americans, 2010* identified categories. Additionally, major dietary sources of sodium for each group were determined, and dietary intakes were compared with the sodium recommendations.

Methods: The sample consists of 2,156 socioeconomically diverse African American and White participants, aged 30-64 years, from Baltimore area participating in the HANDLS study. Utilizing HANDLS study baseline data, sodium intake from two 24-hour recalls was analyzed. Variables analyzed included age, race, HTN status, and sodium calculated from United States Department of Agriculture Food and Nutrient Database for Dietary Studies. All statistical analyses were carried out using the SAS statistical analysis computer package. A regression analysis was also conducted to determine if there were significant differences on energy, sodium, potassium magnesium from the independent variables. There were three regressions for each of the four dependent variables (energy, sodium, potassium and magnesium). The independent variables were age group (<51 years vs. ≥51 years), race, and HTN. There were five regressions for each of the dependent variables. A Stata analysis containing all the comparisons between Weekend and Weekday was also conducted.

Results: None of the groups met the recommended daily 1500 mg sodium restriction. The mean daily sodium consumption for the total sample was 1594 mg/1000 kcal daily or 3188 mg for a reference 2000 kcal diet. Analysis showed a range of 1586-1608 mg sodium/1000 kcal consumed, and the mean daily energy intake showed a range of 1968-2366 kcal. Highest sources of sodium included cold cuts, beef dishes, yeast breads, pasta dishes, chicken dishes, salty snacks, sandwiches, and cheese.

Conclusion: The *Dietary Guidelines for Americans, 2010* recommendations for sodium intake may be unrealistic for the special populations.

Chapter 1

INTRODUCTION

Hypertension (HTN), commonly known as high blood pressure, can have catastrophic outcomes for many Americans. HTN strikes 33.6% of Americans which then contributes to half of all cardiovascular disease leading to heart disease and strokes often resulting in disability and death (1, 2). Cardiovascular disease is the number one cause of death (34.3% of all deaths), and separately, heart disease is the first cause of death and strokes are the third cause of death in the United States (1). Sixty-nine percent of people suffering their first myocardial infarction, and 77% of victims having their first stroke have high blood pressure $\geq$140/90 mm Hg. According to the *Heart Disease and Stroke Statistics 2010 Update*, death rates due to HTN are increasing and the total indirect and direct healthcare costs related to HTN were $76.6 billion for the year 2010 (1). HTN also promotes development of renal disease and blindness (3). HTN is especially problematic for certain population groups such as African Americans (AA), the middle-aged and the elderly (4).

To manage HTN, limiting consumption of sodium by limiting salt intake is an important intervention as there is a positive correlation between salt intake and increases in blood pressure (2). Sodium is an element that is unstable and corrosive in the pure form, however, when combined with the element chlorine, it becomes the stable, ingestible sodium chloride, or table salt, which is a useful food preservative and flavor enhancer (5, 6). Sodium comprises 40% of the content of sodium chloride (7).

The *Dietary Guidelines* (DG*) for Americans, 2010* recommends limiting sodium to 1500 mg daily for special population groups (those with hypertension, diabetes, or chronic renal disease, AAs, and those 51 years and older) which actually comprises ~50% of the population for those $\geq$2 years (4). A small amount of sodium (180 mg) is normally required for the human body to retain extracellular fluid volume and serum osmolality (6). The Dietary Reference Intakes (DRI) recommendation for Adequate Intake (AI) for sodium is a maximum of 1500 mg daily (7). This recommendation was reached to replace sodium losses incurred from perspiration resulting from recommended physical activity. The DG sets the sodium limit for 1500 mg daily for special population groups, and 2300 mg daily for the rest of the American population (4). However, Americans typically consume higher sodium diets of 3400 mg sodium daily, due to having high intakes of processed foods related to frequent eating out of the home and consumption of packaged meals and salty snack foods (4, 8).

Chapter 2

LITERATURE REVIEW

2.1 Hypertension and Sodium Intake

According to the National Institutes of Health (NIH), HTN is defined as a systolic blood pressure of ≥140 mm Hg or a diastolic blood pressure of ≥90 mm Hg (3). Cardiovascular disease risk is increased as systolic and diastolic blood pressure increases (3). Optimum systolic blood pressure is ≤115 mm Hg and an optimum diastolic blood pressure is ≤75 mm Hg (2, 9, 10). It is thought that sodium increases blood volume in the arteries, hence increasing blood pressure, and the increased pressure makes the heart work harder hence promoting cardiovascular disease (11).

Research has shown a positive relationship between salt intake and blood pressure and decreasing intake of salt improves blood pressure (12, 13). There have been more than 50 randomized trials conducted on the effect of sodium increasing blood pressure (14). Law et al (15) performed an analysis of observational data among populations from different communities including 47,000 people and found that a reduction in sodium by 2300 mg over 24 hours showed a 10 mm Hg decrease in systolic blood pressure and an average 5 mm Hg decrease in diastolic blood pressure in 60-69 year olds. This study found that the higher the blood pressure, the greater the decrease in systolic blood pressure for the same decrease in sodium intake, especially for older participants. He et al (9) conducted a meta-analysis of salt restriction trials and found that the more salt intake was restricted, the more blood pressures improved. The authors estimated that there would be a 33% decrease in stroke, 25% reduction in ischemic heart disease and 25% decline in heart failure if salt intake is reduced from 10-12 g salt to 5-6 g salt daily (translates to a reduction from 4.0-4.8 g sodium daily to 2-2.4 g sodium daily). This study suggested that decreasing salt intake improved arterial elasticity, and therefore, improved blood pressure. The INTERSALT Study was a worldwide epidemiologic study of 10,000 people (12). The researchers also found that higher sodium intakes caused higher blood pressures.

The Dietary Approaches to Stop Hypertension (DASH)-Sodium study showed large blood pressure decreases with the 1500 mg sodium restriction along with the DASH diet (see Appendix A for the DASH diet) (16). The researchers showed that reducing the sodium intake from the high level (3.3 g sodium) to the low level (1.5 g sodium) reduced systolic pressure in the participants. Systolic pressure was decreased by 6.7 mm Hg overall in the low-sodium treatment group without the DASH component. With the DASH component and sodium restriction, normotensive volunteers had a 7.1 mm Hg systolic reduction, whereas, the hypertensive volunteers had an 11.5 mm Hg reduction the same treatment. These changes were reported as significant, and reported to lower blood pressures as effectively as that of a single-drug hypertensive therapy

The Trial of Nonpharmacologic Intervention in the Elderly (TONE) study included 975 men and women aged 60-80 years old with HTN receiving a single antihypertensive medication (17). The participants were randomized into 6 groups: obese receiving no treatment; obese treated with a sodium restriction; obese receiving a sodium restriction and a weight-loss diet; obese with a weight-loss diet without a sodium restriction; non-obese with no treatment; and non-obese treated with a sodium restriction. The participants were weaned off their antihypertensive medications, and the researchers found that the mean systolic and diastolic blood pressure readings were significantly lower in all the intervention groups than the untreated groups.

2.2 AAs and Blood Pressure

AAs tend to have higher rates of HTN, higher severity of HTN complications, develop high blood pressure at younger ages than other racial groups, and have greater salt sensitivity (3). Franco and Oparil (6) defined salt sensitivity as “the tendency for blood pressure to fall during salt reduction and rise during salt repletion/supplements.” Weinberger (18) devised a protocol for testing for salt sensitivity. Test subjects were provided with intravenous saline infusions and then given a sodium-reduced diet and three doses of oral furosemide. The subjects who had an average decrease in mean arterial pressure (average pressure of systolic and dystolic) of 10 mm Hg or greater after sodium and volume depletion were deemed “salt sensitive.” Those subjects having a decrease of 5 mm Hg or less were classified as “salt resistant.” People who are salt sensitive may be hypertensive or normotensive, and adverse health effects are still seen in salt-sensitive normotensives. (6). Theories for causes of salt sensitivity include a less-responsive renin-angiotensin system (RAS, blunted secretion of atrial natriuretic peptide, and primary arterial baroreceptor failure. People who tend to be salt sensitive are AAs, people older than 45 years, and people with hypertension (6, 18).

High blood pressure affects >43% of the AA population verses 28% of the white population (1). AAs are more likely to have strokes than whites and more likely to die from strokes than whites (1.3 times and 1.8 respectively), and this population is at higher risk for dying from heart disease than the white population (1.5 times greater) (1). Roughly half of heart disease can be attributed to hypertension in this population (19). Studies have shown that AA children younger than 10 years of age have higher blood pressures than white children of the same age, providing longer time for complications to develop (20). Some theories about why AAs may have higher rates of HTN include higher rates of obesity, lower consumption of potassium, more sedentary lifestyles, less access to health care, and more stress-related psychosocial issues (19). Research has not consistently shown that AAs consume sodium in different amounts than other races; however, this group may consume less potassium and calcium than other groups. There is also evidence that the RAS in AAs contributes to high blood pressure due to decreased plasma renin levels which leads to lower sodium excretion (21). Another study by Choi et al (22) suggested that young AAs' autonomic nervous systems showed the same impairment as older white subjects, suggesting a premature aging of the system which leads to high blood pressure. Severity of renal disease and stroke are likely higher in this population also due to the higher rates of diabetes in this group (1).

2.3 The Middle-aged and The Elderly and Blood Pressure

Blood pressure typically starts increasing after age 35 and continues to rise as artery elasticity declines (23, 24). High blood pressure prevalence also increases with age: Fifty percent of people in their sixties have HTN, and 75% of people >70 years have HTN (1). People who reach 55 years of age who have not yet developed high blood pressure still have a 90% chance of developing HTN during their lifetime (25). People older than 65 years have a higher risk of cardiovascular occurrences due to high blood pressure than those aged 35 to 64 because of decreased arterial flexibility (24).

2.4 Why Control HTN with Diet and Not Medication?

There has been interest in controlling blood pressure with sodium restriction rather than antihypertensive medications due to concerns over cost and risks associated with antihypertensive medications (17). Medication costs can be as high as $134 monthly, and certain medications do not have generics (26). Patients are often prescribed numerous medications for

HTN and would likely be on medications for other chronic diseases and are at risk for polypharmacy. Many antihypertensives have undesirable side effects such as drowsiness or lightheadedness which could contribute to falls in the elderly. Other side effects such as frequent urination from loop diuretics could lead to non-compliance. Another risk for certain antihypertensives is dehydration which can lead to hospitalization for acute renal failure. Some antihypertensives such as angiotensin-converting enzyme (ACE) inhibitors and angiotensin II receptor blockers are contraindicated during later pregnancy due to risk to the fetus (27). Taylor et al (28) found an increased risk for incident diabetes with beta-adrenergic blockers and thiazide diuretics. There are no side effects associated with a 1500 mg sodium-restricted diet.

There are several classes of blood pressure medicines: Alpha-adrenergic blockers, beta-adrenergic blockers, diuretics, calcium channel blockers, and ACE Inhibitors (29). Alpha-adrenergic blockers and beta-adrenergic blockers reduce blood pressure by inhibiting the sympathetic nervous system. They block impulse transmission at receptor sites. Alpha-adrenergic blockers work on the peripheral vasculature to cause vasodilation, and beta-adrenergic blockers reduce cardiac output. Diuretics reduce plasma volume by removing sodium. Calcium channel blockers obstruct calcium ion passage across heart muscle membranes and vascular smooth muscle cells and dilate coronary and periphery arteries resulting in decreased heart force contraction and heart workload. ACE-inhibitors block binding of angiotensin II to its receptor and prevent vasoconstriction (29).

2.5 Why the 1500 mg Sodium Limit?

The Centers for Disease Control and Prevention (CDC) made the recommendation of limiting sodium intake to 1500 mg daily based on the current AI of 1500 mg for sodium in the United States to meet estimated sodium losses in perspiration for those in increased temperatures or physical activity (4, 30). The DASH-Sodium study also showed that a 1500 mg sodium restriction along with the DASH diet showed the same large reductions in blood pressures that would be seen produced by antihypertensive medications (13).

2.6 Research on Sources of Sodium in American Diet

Seventy-seven percent of the American sodium intake is from food processing and restaurant foods (4). Foods consumed outside of the home provide 34% of the sodium intake of Americans (31). Many restaurant meals are very high in sodium. The USDA nutrient data base showed that some restaurant food items such as beef and cheese nachos provide 1780 mg sodium per serving or 600 mg sodium per cup, and other foods such as the Hardee's® Monster Thickburger® provides 1350 mg of sodium per serving (32). This data base showed that canned baked beans provides 1100 mg sodium per cup, and some frozen dinners such as the Swanson® Hungry Man Classic Fried Chicken provide about 1900 mg sodium per package. Many foods commonly consumed by Americans also provide a large percentage of sodium in the diet as Table 1 below illustrates. One study analyzing 6419 foods between 1994 and 1996 found that the top foods consumed that contributed the most for sodium intake were yeast breads (10.7%), cheese (5.5%), and ham (3.4%) (33). A later study reported by the CDC showed that the top foods contributing to sodium intake was still yeast bread, but the percentage had decreased (from 10.7% to 7.4%) (33, 34). Cold cuts were increased in ranking (5.1%) in the later study, but the cheese contribution had decreased (5.5% to 3.8%) (33, 34).

Table 1. Major Sources of Sodium in the American diet: A Side-by-side comparison of Two Studies

Sodium Consumption 1994-1996 (33)	% of Total Dietary Sodium	Sodium Consumption 2007-2008 (34)	% of Total Dietary Sodium
Yeast Bread	10.7	Yeast Breads	7.4
Cheese	5.5	Cold cuts	5.1
Ham	3.4	Pizza	4.9
Salad Dressings/mayonnaise	3.2	Poultry	4.5
Cakes/cookies/quick breads/doughnuts	3.1	Soups	4.3
Beef	3.0	Sandwiches	4.0
Milk	2.6	Cheese	3.8
Cold cuts (except ham)	2.6	Pasta mixed dishes	3.3
Ready-to eat cereal	2.5	Meat Mixed Dishes	3.2
Condiments/other sauces	2.5	Savory Snacks	3.1

2.7 Other Studies on the Special Population Groups

In 2009, The CDC conducted an analysis of the National Health and Nutrition Examination Survey (NHANES) for these special population groups for the years 1999-2006 to determine what percentage of the American population of those $\geq$20 years these groups comprised. The study found that these groups collectively made up 69% of the American population for whom the 1500 mg sodium restriction daily was recommended (35).

2.8 Controversy Regarding Sodium and HTN

Not everyone agrees that sodium needs to be limited. The Salt Institute is an industry trade association, and its website stated "The Salt Institute is a North American based non-profit trade association dedicated to advancing the many benefits of salt, particularly to ensure winter roadway safety, quality water and healthy nutrition." The Salt Institute stated in a letter written to the United States Department of Agriculture (USDA) and Department of Health and Human Services that the sodium recommendations made in the DG were "based on inadequate medical and scientific evidence" (36). The letter further indicated that the flawed information would cause great harm to the public and the salt producers. The letter also discussed research that found harm due to activation of the RAS when sodium was reduced. The RAS is activated when sodium intake is inadequate, however, when this system is chronically elevated, risks for chronic diseases such as diabetes, cardiovascular diseases are also increased. The authors stated that the RAS is activated when sodium intake is reduced to less than 3450 mg daily.

The Salt Institute letter (36) cited a Cochrane review disputing low-sodium diets' safety (Cochrane Reviews are reviews of research and are "internationally recognized as the highest standard in evidence-based health care" per its website. The reviews are maintained in a database called the Cochrane Library, maintained by the Cochrane Collaboration) (37). Taylor et al's Cochrane Review (38) found that among seven studies, one of which included subjects with heart failure, salt reduction did not show compelling evidence for reducing mortality or morbidity for those with HTN or those without HTN. Additionally, there was an increase in mortality for people with heart failure. Taylor et al (38) indicated that larger studies were needed for a longer time period, however, other researchers MacGregor and He (39) in a refuting article stated it would be unethical to subject participants to a higher sodium diet over a period of years.

Additionally, MacGregor and He (39) re-analyzed the same studies but omitted one group which was comprised of people with heart-failure, and the new results did show strong evidence that salt reduction decreased morbidity and mortality in CVD. These researchers said that the heart failure group was on very high diuretic therapy causing sodium and fluid depletion, and salt reduction diets would not normally be recommended for this group. However, per the previous studies cited earlier in this paper, most experts agree that sodium restriction is beneficial.

The Salt Institute also cited an NHANES study that showed a relationship of higher mortality and sodium reduction diets (36, 40). However a limitation of the study included no urinary sodium excretions collections to validate the self-reported diet intakes. The Salt Institute also cited issues with hyponatremia in the elderly leading to confusion and falls, but hyponatremia can also be caused by excessive fluid intake, not necessarily low sodium intake (36).

Despite these concerns, most experts recommend a low-sodium diet as discussed in the previous studies in this literature review. The American Heart Association (AHA) produced an AHA Presidential Advisory report delineating the evidence as discussed earlier in this paper supporting a 1500 mg sodium restriction for “all populations” (41, 42). The AHA’s goal is to reduce deaths from strokes by 20% by reducing blood pressure via reduced sodium intake. This report noted that processed foods provide 77% of sodium in diet and that eating out increased 200% from 1977 to 1995. This advisory stated that cooperation of food manufacturers is necessary to help reduce sodium intakes, and they have already been successful in the United Kingdom in reducing sodium intake by 10% population-wide.

2.9 Potassium and Magnesium for Regulation of Blood pressure

Potassium and magnesium are also minerals that are important for the regulation of blood pressure. Potassium works against the effects of sodium on blood pressure, and the recommended AI intake for potassium for adults is 4700 mg daily (4). Diet sources of potassium include fruits, vegetables, meats and dairy. Magnesium is also recommended in the DASH diet plan. The Recommended Dietary Allowance (RDA) for females aged 19-30 years is 310 mg daily and for females $\geq$30 years is 320 mg daily (4). The RDA for magnesium for males aged 19-30 years is 400 mg daily and for males $\geq$30 years is 420 mg daily. Food sources of magnesium include fruits, vegetables, lean meats, poultry, and fish, and nuts, seeds, and legumes.

2.10 Statement of the Research Topic

Sodium intakes of special populations as defined by the DG (Individuals with hypertension, AAs, and individuals who are 51 years of age and older).

2.11 Statement of the Research Question

- What are the sodium intakes of these special populations among the participants of the *Healthy Aging in Neighborhoods of Diversity across the Life Span* (HANDLS) study?
- What are the groups' major sources of sodium?
- How do their intakes compare with the recommendations for sodium?
- How do their intakes compare with the recommendations for potassium and magnesium?

2.12 Research Purpose

The purpose of this study is to estimate the sodium intake of these special populations of individuals with hypertension, AAs, and middle-aged and older adults.

2.13 Hypothesis of Study

Individuals in the special population groups are exceeding the DG recommendations of sodium limit of 1500 mg daily.

Chapter 3

METHODS

3.1 The HANDLS Study

This study is a secondary analysis of original data of the Healthy Aging in Neighborhoods of Diversity across the Life Span (HANDLS) study. The HANDLS study is being conducted by the National Institutes on Aging of the National Institutes of Health. This 20-year prospective, multi-disciplinary, longitudinal study gathered variables from 3,721 African Americans and Whites aged 30-64 in the Baltimore area (43). The purpose of the HANDLS study is to investigate the effects of racial and socioeconomic differences on the participants' cerebrovascular and cardiovascular health over time. The HANDLS baseline study commenced 2004 and ended March 2009.

The HANDLS study is to be conducted over three Waves, however, for the purpose of this thesis, the data analyzed were obtained during the Wave 1 phase. The Wave 1 phase included recruitment within defined neighborhoods in the city of Baltimore. The first interview was conducted in the participant's home and the second was conducted in the mobile research vehicle. The information that was utilized in my study included age, racial identification of AA or White, identification of HTN by participant report, physical examination, and/or antihypertensive prescription, and two 24-hour dietary recalls.

3.2 Study Population

The study sample included 2,156 people because only participants with two dietary interviews were included, but four were later dropped from analysis due to missing HTN data in the final analysis. Data from the HANDLS study were analyzed for the total group, and three non-overlapping risk groups (defined by the NHANES analysis), as well as a fourth group including everyone else not qualifying for the one of the at risk groups. The groups studied included "All adults ≥51 years old without HTN," "All adults ≥51 years old without HTN," "AAs <51 years without HTN," and "White adults <51 years without HTN." The participants were identified as having HTN by an overall HTN dichotomous variable based on blood pressure readings, prescriptions, and self report.

The groups were originally determined per the definitions set by the CDC as of 2009 recommending limiting sodium to 1500 mg daily for the special population groups (those with hypertension, AAs, and those 40 years and older) which comprised 70% of the population for those ≥ 20 years old, however since this study commenced, the new guidelines changed the age to 51 years and older and added in diabetes and renal disease to the parameters (4, 35). For this study, diabetes and renal disease was not included, but the age was increased.

3.3 Nutrition Information

Nutrition information was obtained from two 24-hour recall dietary interviews. The 24-hour recalls were administered by trained interviewers utilizing the USDA's Automatic Multiple Pass Method which includes measurement illustrations to facilitate estimations of food quantity consumed. The first dietary recall was obtained during the household interview, and the second was obtained in the medical research vehicle. Only participants who completed both interviews were included in the study.

Estimates of total calories consumed, sodium intake, potassium intake and magnesium intake were conducted using the USDA Food and Nutrient Database for Dietary Studies (Version 3.0, 2008; Beltsville, MD: Agricultural Research Service. Food Surveys Research Group) (FNDDS). The FNDDS is a food database that calculates nutrients on the amounts reported. Each food is assigned an 8-digit code and is organized into nine basic food groups and then into subgroups per the food coding scheme. There are over 6,900 foods in this database, and for the purpose of this study, a tool from another thesis was utilized which had the further categorized the foods into 60 groups (Table 2) based on fat and sugar content (44). Two of these groups, yeast and baby foods, were excluded from the analysis because no participant reported consumption of these items.

Table 2. 60 Food Groups Used for Analysis (44)

Group number	Food Group	Group number	Food Group
1	Refined bread/grains	31	Low-fat and fat-free dairy desserts
2	100% whole wheat breads/grains	32	Lean meats
3	Whole grain cooked and high fiber cereals	33	Red meats with fat
4	Pasta	34	Chicken/turkey no added fat
5	Rice	35	Chicken/poultry with added fat
6	Cooked cereals	36	Fin fish no fat
7	Ready to eat cereals	37	Fin fish with added fat
8	Salty snacks	38	Shellfish
9	Reduced fat snacks	39	Sandwich
10	Cakes, donuts, pastries	40	Sausage/bacon/luncheon meats
11	Diet cookies, cakes	41	Meat dishes
13	Fruit	42	Soups
12	*Baby food-omitted*	43	Diet frozen meat meals
14	Citrus fruit	44	Eggs and Egg dishes
15	Berries	45	Legumes
16	Dried fruit	46	Pizza
17	Fruit desserts	47	Coffee
18	Dark green vegetable	48	Sweetened beverages
19	Orange vegetables	49	Diet drinks
20	Starchy vegetables	50	Alcoholic beverages
21	Other vegetables	51	Sugar
22	Regular milk	52	Sugar sub
23	Reduced fat and fat-free milk	53	Candy
24	Natural cheese	54	Animal fats
25	Reduced fat and fat-free natural cheese	55	Vegetable fats
26	Processed cheese	56	Reduced salad dressings
27	Reduced fat and processed natural cheese	57	Nuts and nut butters
28	Regular dairy products	58	Protein powders
29	Low-fat dairy products	59	*Yeast--omitted*
30	Dairy desserts, regular	60	Condiments

3.4 Statistical Analysis

All statistical analyses were carried out using the SAS statistical analysis computer package [9.2 (TS1M0), 2002-2008: SAS Institute Inc, Cary, NC]. The FNDDS and SAS were used to determine if the four population groups were meeting the DG recommended intake levels for sodium, AIs for potassium, and RDAs for magnesium. Means and medians for sodium, potassium, and magnesium in milligrams (mg) per 1,000 Kilocalorie (hereafter, referred to as kcal) were calculated for the four population groups, as well as the mean calorie intake for each of the four groups. The HANDLS sample is stratified and clustered, and includes sampling weights to correct for the clustering and stratification. The clusters were constructed from adjacent census tracts. Twelve of theses clusters were selected at random into the sample. Stratification variables are age (7 five-year bands between 30 and 64), sex, race, and poverty status (43). Analyses were conducted with SAS survey procedures, proc surveyfreq, proc surveymeans, and proc surveyreg, including a cluster statement, a strata statement and a weight statement.

The data were also analyzed to determine what the top 50 contributors for sodium were for the four population groups. First, the percentage of sodium contributed by each of the 58 food groups was calculated for the total population of the sample. The food groups were then reviewed and aggregated where appropriate to better match the groups studied in the National Cancer Institute study "Sources of Sodium Among the US Population (2005-2006)" (45). The top five food groups were identified by percentage of sodium contributed for the total and each of the four population groups. Then the top five eight-digit food code contributors were established for the total and the four population groups. The listing of the top 50 foods is not in rank order of percentage of sodium.

The SAS surveyreg procedure was used to test for mean differences between AAs and Whites, between young (<51) and old (≥51) and between those with and without HTN. Two sets of regressions were run for each dependent variable: One with each independent variable (race, age, HTN) as the single regressor and one with all three independent variables plus two variables indicating whether the day-one and day-two intake assessments were done on the weekend. Statistical tests titled adjusted means reported below were based on the regression containing all the regressors simultaneously. A *p*-value of 0.05 is considered to be statistically significant.

Lastly, a Stata analysis (1985-2011; Statacorp, College Station, TX) was conducted for all comparisons between Weekend and Weekday intakes in the dependent variables, total calories, sodium intake, potassium intake and magnesium intake. In addition, regressions including simultaneous entry of all four regressors (the independent variables age group, race, HTN, and weekend) were compared between Weekend and Weekday samples. The Stata procedure regress was used for these analyses. Results for each of the days were stored and compared using the test statement a for cross-equation statistical tests.

Chapter 4

RESULTS

4.1 Characteristics of the Participants

The study sample was 2,156 people because only participants with 2 dietary interviews were included. There were 909 Whites and 1,247 AAs. Of the participants, 1,235 were above 125% poverty guideline and 921 were below the 125% poverty guideline (four were missing due to missing data). In this population, 698 did not complete high school, 711 had a high school diploma or General Equivalency Diploma (GED), 446 had some college, 51 had an Associate's degree, 135 had a Bachelor's degree, 42 had a Master's degree, and 20 had a professional or technical degree. Fifty-one cases are missing education data. In the following groups, there were 973 participants in the "all with HTN" group (4 were excluded due to missing HTN status), 317 participants were in the "all ≥51 with no HTN" group, 483 participants were in the "AAs >51 years with no HTN" group, and 379 participants were in the "Whites <51 years with no HTN" group. The participants assigned to the special groups comprised 82% of the total sample studied.

4.2 Data Findings for Sodium

None of the five groups' mean or median sodium daily intakes met the daily 1500 mg sodium restriction (Table 3). The mean daily sodium consumption for the total sample was 1594 mg/1000 kcal daily or 3188 mg for a reference 2000 kcal diet. Excluding salt at the table, the mean daily sodium intake range was 1585-1607 mg/1000 kcal for a mean kcal intake range of 1968-2366 kcal daily (Table 3). The median daily intakes range was 1524-1586 mg/1000 kcal.

Among the groups, the "Whites <51 years with no HTN "group consumed the highest mean (1608 mg) and highest median (1586 mg) mg sodium/1000 kcal consumed.

Table 3. Sodium Intakes for the Five Groups Studied

Group	N	Mean mg Sodium/ 1000 kcal ± SE	Mean Energy, Kcal ± SE	Median mg Sodium/ 1000 kcal	Median Energy, Kcal
Total Sample	2156[a]	1594 ± 12.54	2110 ± 48.34	1553	1828
All with HTN	973	1589 ± 20.20	1976 ± 54.50	1555	1759
All ≥51 years with no HTN	317	1603 ± 38.19	1968 ± 92.59	1537	1731
AAs <51 years with no HTN	483	1586 ± 26.13	2366 ± 116.75	1524	1960
Whites <51 years with no HTN	379	1608 ± 25.34	2143 ± 79.85	1586	2035

[a]HTN status is missing in four cases.

For the total sample, approximately 66% of sodium intake came from foods in the following 10 categories: Cold cuts, sausage, franks, ribs, beef and beef dishes, yeast breads, pasta and pasta dishes, chicken and chicken dishes, salty snacks, sandwiches, regular cheese, starchy vegetables, and egg and egg dishes (Table 4). The three categories providing the most sodium for all groups in different rankings were the cold cuts, sausage, franks, and ribs group, the yeast breads groups, and the beef and beef dish groups (Table 4 and Figures 1-5 in Appendix B). In general, for all five groups, the same categories were present in different rankings, with the exception of starchy vegetables joining the rankings for the total sample and the "AAs <51years with no HTN" group and "All with HTN" group, grain based desserts for the "All ≥51 years with no HTN” group and the “All with HTN” group, and pizza and other vegetables groupings for the “Whites <51 years with no HTN “group.

Table 4. Top Ten Sodium Contributing Food Groups for the Five Groups Studied

Total Sample	% of total sodium intake	All with HTN	% of total sodium intake	All ≥51 years with no HTN	% of total sodium intake	AAs <51years with no HTN	% of total sodium intake	Whites <51 years with no HTN	% of total sodium intake
Cold cuts, sausage, franks, ribs	12.38%	Beef & beef dishes	11.16%	Cold cuts, sausage, franks, ribs	15.35%	Cold cuts, sausage, franks, ribs	14.44%	Beef & beef dishes	10.78%
Beef & beef dishes	10.80%	Cold cuts, sausage, franks, ribs	11.02%	Yeast breads	10.78%	Beef & beef dishes	11.36%	Yeast breads	10.43%
Yeast breads	10.70%	Yeast breads	10.99%	Beef & beef dishes	8.62%	Yeast breads	10.52%	Cold cuts, sausage, franks, ribs	9.79%
Pasta &pasta dishes	6.11%	Pasta &pasta dishes	6.55%	Pasta &pasta dishes	5.13%	Chicken & Chicken mixed dishes	6.57%	Pizza	6.40%
Salty snacks	4.40%	Salty snacks	4.39%	Salty snacks	4.25%	Sandwiches	4.74%	Sandwiches	4.57%
Sandwiches	4.17%	Starchy vegetables	4.18%	Eggs & egg dishes	4.09%	Salty snacks	4.57%	Salty snacks	4.31%
Regular cheese	4.06%	Sandwiches	3.82%	Chicken &chicken mixed dishes	3.97%	Regular cheese	4.50%	Regular cheese	4.05%
Starchy vegetables	3.81%	Eggs & egg dishes	3.76%	Grain based desserts	3.85%	Eggs & egg dishes	4.45%	Other vegetables	3.52%
Eggs & egg dishes	3.74%	Grain based desserts	3.70%	Sandwiches	3.32%	Starchy vegetables	4.06%	Chicken &chicken mixed dishes	3.18%

The most commonly consumed foods consumed in the cold cuts, sausage, franks, and ribs group were deli meats (specifically sliced ham for all five groups), pork bacon for all five groups, and frankfurters for all five groups (Table 5). All five groups also specified other deli meats such as turkey as high contributors. The beef and beef dishes group was actually a collapsed group consisting of lean meats, red meat, seafood, meat dishes (including chicken missed dishes and Hispanic dishes), and frozen meals that may have other non-beef meats included (Table 6). For the beef and beef dishes group, tuna salad was actually a top contributor for all groups with the exception of the "Whites <51 years with no HTN" group. Chile con carne was a top contributor for the total sample, "All ≥51 years with no HTN," and "Whites <51 years with no HTN" groups. For an expanded list of the top fifty food contributors of sodium for each of the five groups review Figures 6-10 in Appendix C. For the yeast bread group, all five groups had white bread and soft white rolls included as part of the top five contributors (Table 7).

Table 5. Cold Cuts Top Five Sodium Food Contributors for the Five Groups Studied

Ranking in % Sodium	Total Sample	All with HTN	All ≥51 years with no HTN	AAs <51years with no HTN	Whites <51 years with no HTN
1	Ham, sliced, prepackaged or deli, luncheon meat	Ham, sliced, prepackaged or deli, luncheon meat	Ham, sliced, prepackaged or deli, luncheon meat	Ham, sliced, prepackaged or deli, luncheon meat	Ham, sliced, prepackaged or deli, luncheon meat
2	Frankfurter or hot dog, beef	Frankfurter or hot dog, beef	Frankfurter or hot dog, beef	Frankfurter or hot dog, beef	Chicken or turkey loaf, prepackaged or deli, luncheon meat
3	Pork bacon, NS as to fresh, smoked or cured, cooked	Pork bacon, NS as to fresh, smoked or cured, cooked	Beef sausage, smoked	Pork bacon, NS as to fresh, smoked or cured, cooked	Frankfurter or hot dog, beef
4	Chicken or turkey loaf, prepackaged or deli, luncheon meat	Ham and pork, luncheon meat, chopped, minced, pressed, spiced, canned	Ham and pork, luncheon meat, chopped, minced, pressed, spiced, canned	Turkey or chicken breast, prepackaged or deli, luncheon meat	Turkey or chicken breast, prepackaged or deli, luncheon meat
5	Turkey or chicken breast, prepackaged or deli, luncheon meat	Chicken or turkey loaf, prepackaged or deli, luncheon meat	Pork bacon, NS as to fresh, smoked or cured, cooked	Pork sausage, fresh, bulk, patty or link, cooked	Pork bacon, NS as to fresh, smoked or cured, cooked

Table 6. Beef & Beef Dishes Top Five Sodium Contributors for the Five Groups Studied

Ranking in % Sodium	Total Sample	All with HTN	All ≥51 years with no HTN	AAs <51years with no HTN	Whites <51 years with no HTN
1	Tuna salad	tuna salad	lemon chicken, Chinese style	tuna salad	Deer bologna
2	Ham, smoked or cured, cooked, lean only eaten	Ham, smoked or cured, cooked, lean only eaten	Tuna salad	Crab cake	Chili con carne with beans
3	Crab cake	Ham, smoked or cured, cooked, NS as to fat eaten	Steak, NS as to type of meat, cooked, NS as to fat eaten	Pork chop, broiled or baked, lean only eaten	Chicken curry
4	Chili con carne with beans	Crab cake	Chili con carne with beans	Corned beef, cooked, lean only eaten	Ground beef or patty, cooked, NS as to percent lean (
5	Ham, smoked or cured, cooked, NS as to fat eaten	Salisbury steak with gravy (mixture)	Taco or tostada with beef, cheese and lettuce	Chicken or turkey a la king with vegetables, cream, white, or soup-based sauce	Beef jerky

Table 7. Yeast Breads Top Five Sodium Contributors for the Five Groups Studied

Ranking in % Sodium	Total Sample	All with HTN	All ≥51 years with no HTN	AAs <51 years with no HTN	Whites <51 years with no HTN
1	Bread, white	Bread, white	Bread, white	Bread, white	Bread, white
2	Roll, white, soft	Bread, wheat or cracked wheat	Pancakes, plain	Pancakes, plain	Roll, white, soft
3	Bread, wheat or cracked wheat	Roll, white, soft	Roll, hoagie, submarine	Roll, white, soft	Bagel
4	Pancakes, plain	Biscuit, baking powder or buttermilk type, commercially baked	Roll, white, soft	Roll, white, hard	Roll, hoagie, submarine
5	Bread, white, toasted	Bread, white, toasted	Bread, white, toasted	French toast, plain	Waffle, plain

4.3 Data Findings for Potassium and Magnesium

Although not part of the original study research questions, potassium and magnesium were also analyzed as points of interest. None of the five groups' mean or median potassium intakes met the 4700 mg potassium recommendation based on a reference 2000 kcal daily diet (Table 8). The mean daily intake range was 1035-1168 mg potassium/1000 kcal for a mean kcal intake range of 1968-2366 kcal daily. The median daily intakes range was 1002-1239 mg potassium/1000 kcal. Among the five groups, the "AAs < 51 years with no HTN" group had the lowest mean (1035 mg) and lowest median (1002 mg) mg potassium/1000 kcal intake.

Table 8. Potassium Intakes for the Five Groups Studied

Group	N	Mean mg Potassium/ 1000 kcal ± SE	Mean Energy, kcal ± SE	Median mg Potassium/ 1000 kcal	Median Energy, kcal
Total Sample	2156 [a]	1168 ± 14.27	2110 ± 48.34	1105	1828
All with HTN	973	1169 ± 20.32	1976 ± 54.50	1122	1759
All ≥51 years with no HTN	317	1311 ± 35.46	1968 ± 92.59	1225	1731
AAs <51 years with no HTN	483	1035 ± 24.88	2366 ± 116.8	1002	1960
Whites <51 years with no HTN	379	1256 ± 29.73	2143 ± 79.85	1239	2035

[a]HTN status is missing in four cases.

None of the five groups' mean or median magnesium intakes met the 310-420 mg magnesium recommendations based on sex and age based on a reference 2000 kcal daily diet (Table 9). The daily mean intake ranged 113-142 mg magnesium/1000 kcal mean kcal intake range of 1968-2366 kcal daily. The median daily intake range was 106-130 mg magnesium/1000 kcal. Among the five groups, the "AAs <51 years with no HTN" group, had the lowest daily mean (113 mg) and lowest median (106 mg) mg magnesium/1000 kcal intake.

Table 9. Magnesium Intakes for the Five Groups Studied

Group	N	Mean mg Magnesium/ 1000 kcal ± SE	Mean Energy, kcal ± SE	Median mg Magnesium/ 1000 kcal	Median Energy, kcal
Total Sample	2156 [a]	128 ± 1.82	2110 ± 48.34	116	1828
All with HTN	973	129 ± 2.53	1976 ± 54.50	120	1759
All ≥51 years with no HTN	317	137 ± 4.32	1968 ± 92.59	126	1731
AAs <51 years with no HTN	483	113 ± 1.95	2366 ± 116.8	106	1960
Whites <51 years with no HTN	379	142 ± 4.53	2143 ± 79.85	130	2035

[a]HTN status is missing in four cases.

4.4 Testing for Significance of Data

The data were also analyzed for significance of the independent variables of age group, race, and HTN status effect on the means of energy, sodium, potassium, and magnesium. There was no significant effect of any of the independent variables on sodium intakes on the unadjusted or adjusted means (see Table 10 and Appendix D). However, there were some significant effects of some of the independent variables on the unadjusted and adjusted means for energy, potassium, and magnesium. The unadjusted means refer to means in each category of an independent variable without control for any other variable; whereas the adjusted means refer to comparisons between each category of the independent variable with control for all the other independent variables.

The effect of age group on the unadjusted mean energy intake was significant (Pr > F = 0.0002) showing that the younger age group consumes mean of 338 kcals more daily than the older group (Table 10). The effect of HTN status was also significant on unadjusted mean energy intake (Pr > F = 0.0036), showing that those without the HTN diagnosis (dx) consumed 230 kcals more daily than those with the HTN dx. When all of the independent variables were compared together in a regression, the adjusted mean for the age groups was still significant (Pr > F =<0.0020). The adjusted mean energy for the "30-51 yrs" group was 2206 kcal daily, and the adjusted mean energy intake for the "51 or older group" was 1934 kcal daily, showing that the younger group consumes a mean of 272 kcal more daily.

The effect of age group on the unadjusted mean potassium intake was significant (Pr > F = <0.0001) showing that the older age group consumed an unadjusted mean of 128 mg more potassium/1000 kcal daily than the younger group (Table 10). The effect of race was also significant on unadjusted mean potassium intake (Pr > F = <0.0001), showing that Whites consumed a mean of 189 mg more potassium/1000 kcal daily than the AA group. There was no significance shown with the other independent variables. When all of the independent variables were compared together in a regression, the adjusted mean mg potassium/1000 kcal for age groups was still significant (Pr > F =<0.0001). The adjusted mean mg potassium/1000 kcal for the "30-51 yrs" group was 1122 mg potassium/1000 kcal daily, and the adjusted mean potassium intake for the "51 or older group" was 1255 mg potassium/1000 kcal daily, showing that the older group consumes a mean of 133 mg potassium/1000 kcal more daily.

Race was still significant as well on the effect of the adjusted mean mg potassium/1000 kcal (Pr > F = <0.0001). The adjusted mean mg potassium/1000 kcal for the White group was 1288 mg potassium/1000 kcal daily, and the adjusted mean energy intake for the AA group was 1102 mg potassium/1000 kcal daily, showing that the White group consumed a mean of 186 mg potassium/1000 kcal more daily than the AA group.

The effect of age group on the unadjusted mean magnesium intake was significant (Pr > F = <0.0049) showing that the older age group consumed an unadjusted mean of 9 mg more magnesium/1000 kcal daily than the younger group (Table 10). The effect of race was also significant on unadjusted mean magnesium intake (Pr > F = <0.0001), showing that Whites consumed a mean of 23 mg more magnesium/1000 kcal daily than the AA group. There was no significance shown with the other independent variables for the unadjusted means. When all of the independent variables were compared together in a regression, the adjusted mean magnesium/1000 kcal for age groups was still significant (Pr > F = <0.0085). The adjusted mean mg magnesium/1000 kcal for the "30-51 yrs" group was 125 mg magnesium/1000 kcal daily, and the adjusted mean energy intake for the "51 or older group" was 134 mg magnesium/1000 kcal daily, showing that the older group consumes a mean of 9 mg magnesium/1000 kcal more daily than the younger group

Race was still significant as well on the effect of the adjusted mean mg magnesium/1000 kcal (Pr > F = <0.0001). The adjusted mean mg magnesium/1000 kcal for the White group was 143 mg magnesium/1000 kcal daily, and the adjusted mean energy intake for the AA group was 120 mg magnesium/1000 kcal daily, showing that the White group consumed a mean of 23 mg magnesium/1000 kcal more daily than the AA group.

The Stata analysis showed no significant differences between Weekend and Weekday for energy, sodium, potassium or magnesium intakes (Table 11 and Appendix E).

Table 10. Comparisons of Unadjusted Means and Adjusted for the Dependent Variables

	Energy in kcal				Mean mg Sodium/ 1000 kcal				Mean mg Potassium/ 1000 kcal				Mean mg Magnesium/ 1000 kcal			
	Unadjusted		Adjusted [a]		Unadjusted		Adjusted		Unadjusted		Adjusted		Unadjusted		Adjusted	
Independent Variables	Mean	Pr > |t|	Mean	Pr > |t|	Mean	Pr > |t|	Mean	Pr > |t|	Mean	Pr > |t|	Mean	Pr > |t|	Mean	Pr > |t|	Mean	Pr > |t|
30-51 years	2226	**0.0002**	2206	**0.0020**	1596	0.8872	1594	0.9184	1124	**<0.0001**	1122	**<0.0001**	125	**0.0049**	125	**0.0085**
51 or older	1888		1934		1592		1591		1252		1255		134		134	
White	2108	0.9708	2107	0.9281	1615	0.2013	1612	0.2856	1290	**<0.0001**	1288	**<0.0001**	143	**<0.0001**	143	**<0.0001**
AA	2111		2114		1583		1583		1101		1102		120		120	
HTN-yes	1976	**0.0036**	2038	0.1053	1589	0.7691	1591	0.9032	1169	0.9320	1164	0.8009	129	0.6832	129	0.5076
HTN-no	2206		2163		1596		1595		1167		1171		127		127	

[a]The variables of age group, race, and HTN status, and weekend were controlled for the adjusted means.

Table 11. Stata analysis for Weekend and Weekday Comparisons

Independent Variables	Energy in kcal p-level	Mean mg Sodium/ 1000 kcal p-level	Mean mg Potassium/ 1000 kcal p-level	Mean mg Magnesium/ 1000 kcal p-level
Age group	0.5564	0.2260	0.3920	0.9060
Race	0.2429	0.0997	0.9118	0.4059
HTN	0.7579	0.6471	0.9978	0.5612
Weekend	0.1523	0.5860	0.6633	0.9788

Chapter 5

DISCUSSION

The data from this study add to our knowledge of sodium intake, especially in this current climate of proposed policy changes in regards to limiting sodium in food products by food manufacturers. None of the groups studied met the guidelines for intakes for sodium, potassium, or magnesium which would assist in improving blood pressure. Many of the foods consumed were indeed processed foods which are known for being high in sodium, and lowering the sodium in processed food would likely help lower sodium intakes.

The Food and Nutrition Board's Committee on Strategies to Reduce Sodium Intake was assembled per the request of Congress to determine strategies for reducing sodium intake in the American population (46). In 2010, the report "Strategies to Reduce Sodium Intakes in the United States" was published and strategies proposed included that the Food and Drug Administration (FDA) mandate national standards for foods' sodium content, and the committee recommended voluntary sodium reduction in foods by the food manufacturers. Additionally there is the National Salt Reduction Initiative (NSRI) that is working with some food manufacturers to voluntarily reduce sodium in their products by 25% over 5 years (47). However, manufacturers are not keen on reducing sodium in their foods. The Association of Bakers recently made a comment that when manufactures had reduced sodium in their products, sales decreased, and one spokesperson stated that inactivity and dietary fat contribute more to heart disease than higher sodium intake (48). Consumer rejection of the lower-sodium products may be related to an innate preference for salt, and a recent report indicated that salt preference develops in infants and young children (49). The report indicated that exposure to salt at an early age via salty starches such as cereals and crackers help develops the preference for salt. The researchers found that at 6 months, this preference can be developed (49).

The mean daily sodium consumption for the total sample was 1594 mg/1000 kcal daily or 3188 mg for a reference 2000 kcal diet. This finding is similar to a recent finding by the CDC that the mean daily sodium consumption was 3266 mg (34). This study was conducted among 7227 participants aged ≥2 years in the What We Eat in America, National and Nutrition Examination Survey, 2007-2008. In that study, the top contributor was bread and rolls (7.4%), followed by cold cuts/cured meats (5.1%), and pizza (4.9%) In another study conducted by the National Cancer Institute, the researchers also found that yeast breads were the top contributor (7%), followed by chicken and chicken mixed dishes (6.8%) and pizza (6.3%) (8).

In my study, however, the highest contributor was cold cuts, sausage, franks and ribs (12%), and yeast breads ranked third in contributions (11%) after the beef and beef dish group (11%) (Figure 1 in Appendix B). Possible reasons for a higher intake of these foods than in other studies include having low-income participants. In this study, 921 participants out of 2156 were below the 125% poverty guideline, and many of the foods such as cold cuts, hotdogs, tuna fish, and white bread are less expensive and easy to obtain in low-income neighborhoods (Table 6 in Appendix C).

The low-sodium restriction of 1500 mg daily may not be feasible as this study and other studies have shown participants' mean sodium intakes of >3000 mg daily. An additional feasibility study also stated that the researchers used nutrition databases to determine that in order to meet the 1500 mg sodium restriction, then meeting adequacy standards for 27 nutrients would be more difficult (50). This study stated that the low guidelines should be viewed as "aspirational" because a large change in diet would be necessary to meet the 1500 mg sodium limit as processed foods provide 77% of sodium in diet and that eating out has increased 200% from 1977 to 1995 (31, 50). The only way individuals in this country will be able to reduce sodium intake is with the cooperation of the food and restaurant industry, however, it is possible as evidenced by the United Kingdom salt reduction campaign where they have reduced sodium intake by 10% population-wide (41).

Chapter 6

CONCLUSION

A high-sodium diet can contribute to high blood pressure leading to cardiovascular disease, renal disease, and blindness. This study extends previous findings about sodium intake by reporting that excessive sodium intake characterizes a sample of residents in a comparatively low-income area with a diverse population profile are not limiting their sodium intake nor consuming adequate intakes of potassium and magnesium in order to help regulate blood pressure. It is not feasible to only counsel individuals to limit their sodium to 1500 mg daily in the face of the abundance of prepared foods and with fast food restaurants plentifully available. Having the cooperation of food manufacturers to voluntarily reduce sodium as well as educating the public will be necessary.

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Appendix A

DASH DIET GUIDELINES

Table A12. DASH Diet Guidelines[a] (42)

Food Item	Daily Recommended Servings
Sodium	Limit to 1500 mg
Grains	6-8
Low-fat Dairy	2-3 for most people/3-4 for people >50 years
Vegetables	4-5
Fruits	4-5
Meats	6 oz or less
Nuts, seeds, and legumes	4-5
Fats and oils	2-3
Sweets and oils	5 or less

[a]The DASH diet helps lower blood pressure by decreasing intake of sodium, cholesterol, added sugars and total fat and increasing intake of potassium, magnesium, fiber, and calcium.

Appendix B

SOURCES OF SODIUM IN THE DIET FOR EACH GROUP STUDIED

Figure B1. Sources of Sodium in the Diets of the Total Sample

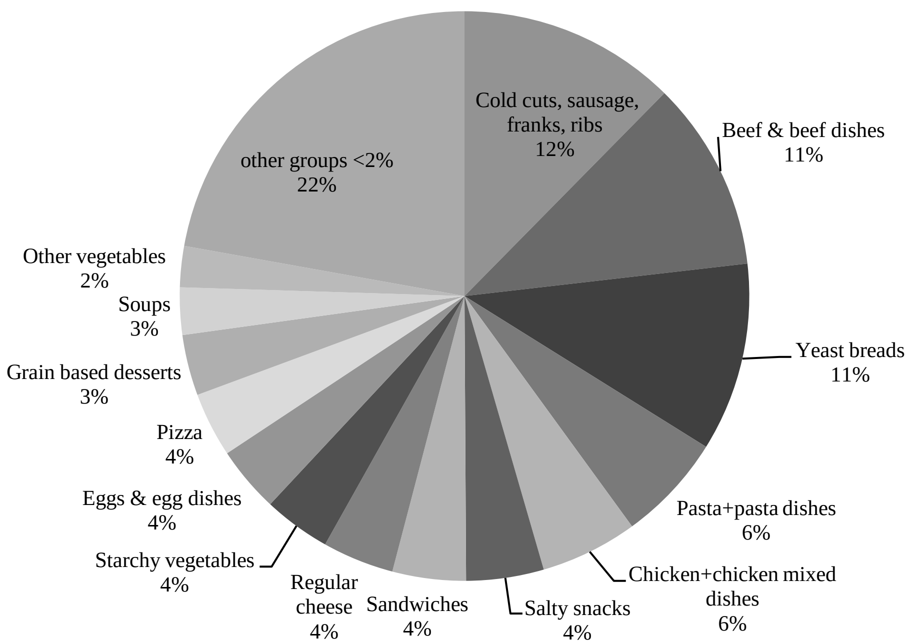


Figure B2. Sources of Sodium in the Diets of All with HTN

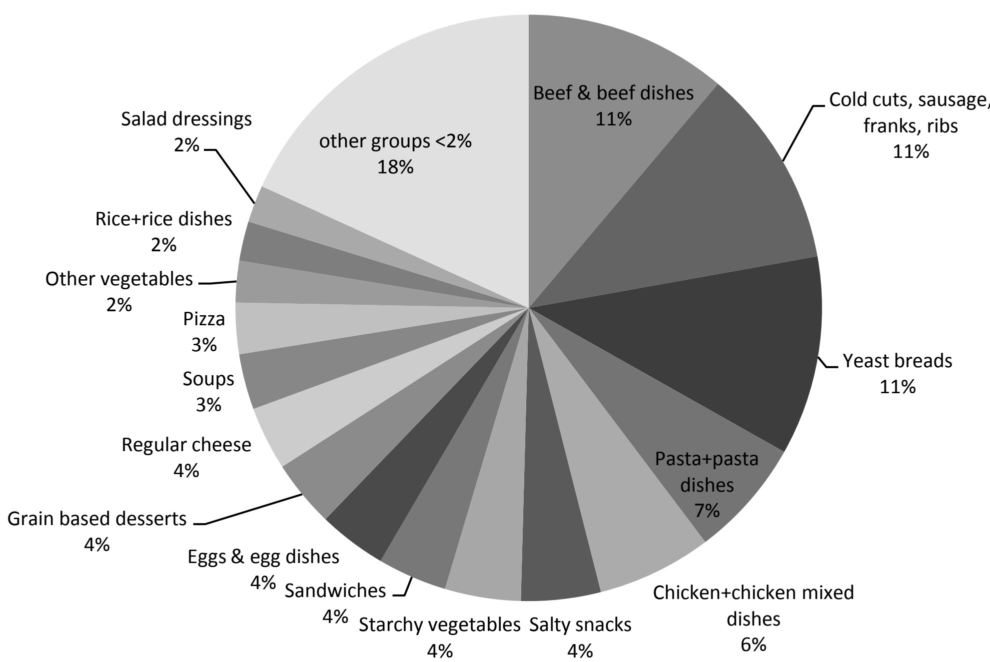


Figure B3. Sources of Sodium in the Diets of All ≥51 years with no HTN

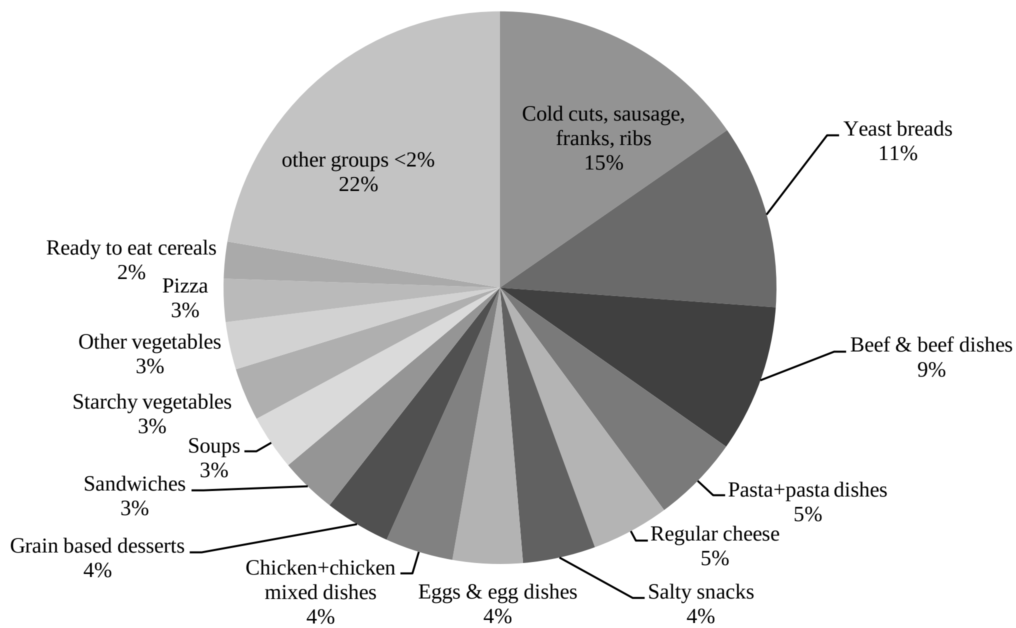


Figure B4. Sources of Sodium in the Diets of AAs <51 years with no HTN

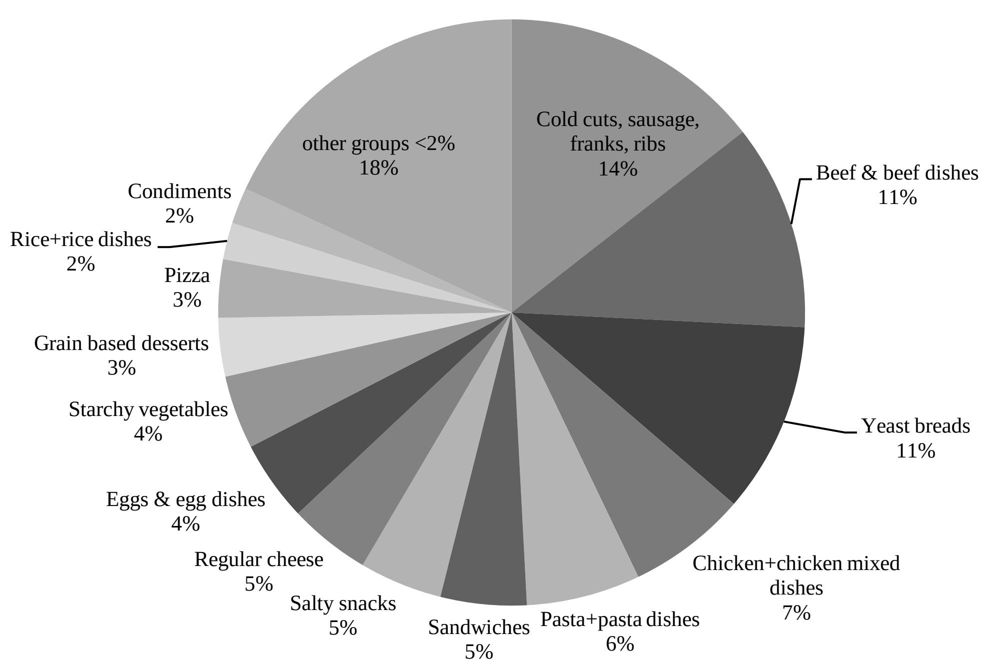
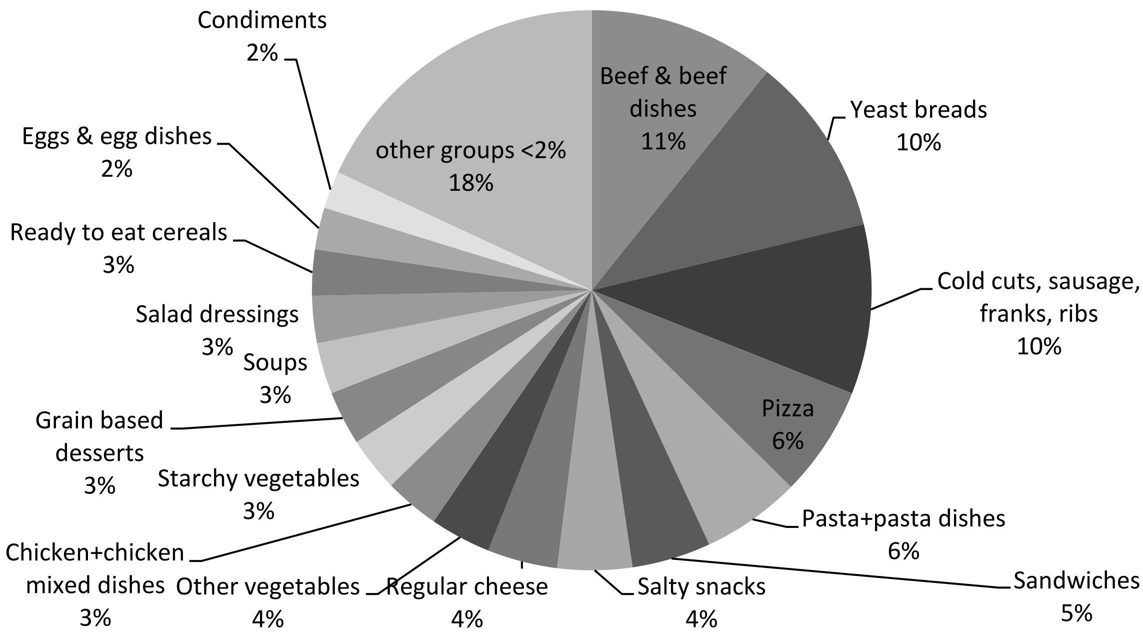


Figure B5. Sources of Sodium in the Diets of Whites <51 years with no HTN



Appendix C

TOP 50 SODIUM CONTRIBUTING FOODS FOR THE FIVE GROUPS STUDIED

Figure C6. Top 50 Sodium Contributing Foods for Total Sample [a]

1	Ham, sliced, prepackaged or deli, luncheon meat
2	Frankfurter or hot dog, beef
3	Pork bacon, NS as to fresh, smoked or cured, cooked
4	Chicken or turkey loaf, prepackaged or deli, luncheon meat
5	Turkey or chicken breast, prepackaged or deli, luncheon meat
6	Tuna salad
7	Ham, smoked or cured, cooked, lean only eaten
8	Crab cake
9	Chili con carne with beans
10	Ham, smoked or cured, cooked, NS as to fat eaten
11	Bread, white
12	Roll, white, soft
13	Bread, wheat or cracked wheat
14	Pancakes, plain
15	Bread, white, toasted
16	Spaghetti with tomato sauce and meatballs or spaghetti with meat sauce
17	Macaroni or noodles with cheese
18	Macaroni or noodles with cheese, made from dry mix
19	Pasta with tomato sauce and meat or meatballs, canned
20	Lasagna with meat
21	Chicken, breast, coated, baked or fried, prepared with skin, skin/coating eaten
22	Chicken, wing, coated, baked or fried, prepared with skin, skin/coating eaten
23	Chicken patty, fillet, or tenders, breaded, cooked
24	Chicken, drumstick, coated, baked or fried, prepared with skin, skin/coating eaten
25	Chicken nuggets
26	White potato, chips
27	Pretzels, hard
28	Salty snacks, corn or cornmeal base, corn puffs and twists; corn-cheese puffs and twists
29	Cracker, cheese
30	Popcorn, popped in oil, buttered
31	Double cheeseburger (2 patties), with tomato and/or catsup, on bun
32	Cold cut submarine sandwich, with cheese, lettuce, tomato, and spread
33	Steak and cheese submarine sandwich, with lettuce and tomato
34	Chicken patty sandwich, with lettuce and spread
35	Cheeseburger with tomato and/or catsup, on bun
36	Cheese, processed, American or Cheddar type
37	Cheese, natural, Cheddar or American type C
38	Cheese spread, American or Cheddar cheese base
39	Cheese, NFS
40	Cheese, Provolone
41	White potato, French fries, from frozen, deep fried

42	Potato salad with egg
43	White potato, home fries
44	Corn, yellow, cooked, from canned, fat not added in cooking
45	Potato salad
46	Egg omelet or scrambled egg, with cheese
47	Eggs, whole, fried
48	Egg omelet or scrambled egg, fat added in cooking
49	Egg, Benedict
50	Eggs, whole, boiled

[a]These foods are not in rank order of content of sodium. The top five foods from the top ten groups were collected for this list.

Figure C7. Top 50 Sodium Contributing Foods for All with HTN[a]

1	Tuna salad
2	Ham, smoked or cured, cooked, lean only eaten
3	Ham, smoked or cured, cooked, NS as to fat eaten
4	Crab cake
5	Salisbury steak with gravy (mixture)
6	Ham, sliced, prepackaged or deli, luncheon meat
7	Frankfurter or hot dog, beef
8	Pork bacon, NS as to fresh, smoked or cured, cooked
9	Ham and pork, luncheon meat, chopped, minced, pressed, spiced, canned
10	Chicken or turkey loaf, prepackaged or deli, luncheon meat
11	Bread, white
12	Bread, wheat or cracked wheat
13	Roll, white, soft
14	Biscuit, baking powder or buttermilk type, commercially baked
15	Bread, white, toasted
16	Spaghetti with tomato sauce and meatballs or spaghetti with meat sauce
17	Macaroni or noodles with cheese
18	Macaroni or pasta salad
19	Pancakes, plain
20	Lasagna with meat
21	Chicken, breast, coated, baked or fried, prepared with skin, skin/coating eaten
22	Chicken, wing, coated, baked or fried, prepared with skin, skin/coating eaten
23	Chicken, drumstick, coated, baked or fried, prepared with skin, skin/coating eaten
24	Chicken, thigh, coated, baked or fried, prepared with skin, skin/coating eaten
25	Chicken patty, fillet, or tenders, breaded, cooked
26	White potato, chips
27	Cracker, cheese
28	Salty snacks, corn or cornmeal base, corn puffs and twists; corn-cheese puffs and twists
29	Pretzels, hard
30	Popcorn, popped in oil, buttered
31	Potato salad with egg
32	White potato, french fries, from frozen, deep fried
33	White potato, home fries
34	Corn, yellow, cooked, from canned, fat not added in cooking
35	Potato salad
36	Cold cut submarine sandwich, with cheese, lettuce, tomato, and spread
37	Double cheeseburger (2 patties), with tomato and/or catsup, on bun
38	Chicken fillet (breaded, fried) sandwich
39	Double bacon cheeseburger (2 patties, 1/4 lb meat each), on bun
40	Cheeseburger, with mayonnaise or salad dressing, on bun
41	Egg, whole, fried

42	Egg omelet or scrambled egg, with cheese
43	Egg omelet or scrambled egg, fat added in cooking
44	Egg, Benedict
45	Egg, cheese, and steak on bagel
46	Doughnut, cake type
47	Muffin, fruit and/or nuts
48	Cake, yellow, with icing, made from home recipe or purchased ready-to-eat
49	Cake, cupcake, not chocolate, with icing or filling
50	Cake, chocolate, devil's food, or fudge, with icing, coating, or filling,

[a]These foods are not in rank order of content of sodium. The top five foods from the top ten groups were collected for this list.

Figure C8. Top 50 Sodium Contributing Foods for: All $\geq$51 Years with no HTN[a]

1	Ham, sliced, prepackaged or deli, luncheon meat
2	Frankfurter or hot dog, beef
3	Beef sausage, smoked
4	Ham and pork, luncheon meat, chopped, minced, pressed, spiced, canned
5	Pork bacon, NS as to fresh, smoked or cured, cooked
6	Bread, white
7	Pancakes, plain
8	Roll, hoagie, submarine
9	Roll, white, soft
10	Bread, white, toasted
11	Lemon chicken, Chinese style
12	Tuna salad
13	Steak, NS as to type of meat, cooked, NS as to fat eaten
14	Chili con carne with beans
15	Taco or tostada with beef, cheese and lettuce
16	Spaghetti with tomato sauce and meatballs or spaghetti with meat sauce or
17	Pasta with tomato sauce and meat or meatballs, canned
18	Macaroni or noodles with cheese
19	Spaghetti with tomato sauce, meatless
20	Macaroni and cheese with egg
21	Cheese, processed, American or Cheddar type
22	Cheese, natural, Cheddar or American type C
23	Cheese, Cheddar or American type, NS as to natural or processed
24	Cheese, NFS
25	Cheese, Feta
26	White potato, chips
27	Pretzels, hard
28	Popcorn, popped in oil, buttered
29	Cracker, sandwich-type, peanut butter filled
30	Cracker, snack
31	Egg omelet or scrambled egg, with cheese
32	Egg, whole, fried
33	Egg omelet or scrambled egg, fat added in cooking
34	Egg, cheese, and ham on English muffin
35	Egg omelet or scrambled egg, fat not added in cooking
36	Chicken, breast, coated, baked or fried, prepared with skin, skin/coating eaten
37	Chicken, wing, coated, baked or fried, prepared with skin, skin/coating eaten
38	Chicken patty, fillet, or tenders, breaded, cooked
39	Chicken nuggets
40	Chicken, breast, roasted, broiled, or baked, skin not eaten
41	Cookie, oatmeal, with raisins

42	Cookie, gingersnaps
43	Muffin, fruit and/or nuts
44	Doughnut, cake type
45	Crackers, graham
46	Cold cut submarine sandwich, with cheese, lettuce, tomato, and spread
47	Cheeseburger with tomato and/or catsup, on bun
48	Hamburger, with tomato and/or catsup, on bun
49	Steak and cheese submarine sandwich, plain, on roll
50	Double cheeseburger (2 patties), with mayonnaise or salad dressing, on double-decker bun

[a]These foods are not in rank order of content of sodium. The top five foods from the top ten groups were collected for this list.

Figure C9. Top 50 Sodium Contributing Foods for AAs <51 Years with no HTN[a]

1	Ham, sliced, prepackaged or deli, luncheon meat
2	Frankfurter or hot dog, beef
3	Pork bacon, NS as to fresh, smoked or cured, cooked
4	Turkey or chicken breast, prepackaged or deli, luncheon meat
5	Pork sausage, fresh, bulk, patty or link, cooked
6	tuna salad
7	Crab cake
8	Pork chop, broiled or baked, lean only eaten
9	Corned beef, cooked, lean only eaten
10	Chicken or turkey a la king with vegetables
11	Bread, white
12	Pancakes, plain
13	Roll, white, soft
14	Roll, white, hard
15	French toast, plain
16	Chicken, wing, coated, baked or fried, prepared with skin, skin/coating eaten
17	Chicken, breast, coated, baked or fried, prepared with skin, skin/coating eaten
18	Chicken patty, fillet, or tenders, breaded, cooked
19	Chicken, thigh, coated, baked or fried, prepared with skin, skin/coating eaten
20	Chicken nuggets
21	Spaghetti with tomato sauce and meatballs or spaghetti with meat sauce
22	Macaroni or noodles with cheese, made from dry mix
23	Macaroni or noodles with cheese
24	Macaroni and cheese with egg
25	Spaghetti with tomato sauce, meatless
26	Double cheeseburger (2 patties), with tomato and/or catsup, on bun
27	Cold cut submarine sandwich, with cheese, lettuce, tomato, and spread
28	Steak and cheese submarine sandwich, with lettuce and tomato
29	Cold cut submarine sandwich, with cheese, lettuce, tomato, and spread
30	Bacon cheeseburger, 1/4 lb meat, with mayonnaise or salad dressing, and tomato and/or catsup, on bun
31	White potato, chips
32	Cracker, sandwich-type, cheese-filled
33	Salty snacks, corn or cornmeal base, corn puffs and twists; corn-cheese puffs and twists
34	Pretzels, hard
35	Popcorn, popped in oil, buttered
36	Cheese, processed, American or Cheddar type
37	Cheese, natural, Cheddar or American type C
38	Cheese, NFS
39	Cheese spread, American or Cheddar cheese base
40	Cheese, Cheddar or American type, NS as to natural or processed
41	Egg omelet or scrambled egg, with cheese

42	Egg, whole, fried
43	Egg omelet or scrambled egg, fat added in cooking
44	Egg, Benedict
45	Egg omelet or scrambled egg, with ham or bacon
46	White potato, French fries, from frozen, deep fried
47	White potato, home fries
48	Potato salad with egg
49	Potato salad
50	White potato, hash brown, from frozen

[a]These foods are not in rank order of content of sodium. The top five foods from the top ten groups were collected for this list.

Figure C10. Top 50 Sodium Contributing Foods for Whites <51 Years with no HTN[a]

1	Deer bologna
2	Chili con carne with beans
3	Chicken curry
4	Ground beef or patty, cooked, NS as to percent lean (formerly NS as to regular, lean, or extra lean)
5	Beef jerky
6	Bread, white
7	Roll, white, soft
8	Bagel
9	Roll, hoagie, submarine
10	Waffle, plain
11	Ham, sliced, prepackaged or deli, luncheon meat
12	Chicken or turkey loaf, prepackaged or deli, luncheon meat
13	Frankfurter or hot dog, beef
14	Turkey or chicken breast, prepackaged or deli, luncheon meat
15	Pork bacon, NS as to fresh, smoked or cured, cooked
16	pizza with meat, thin crust
17	Pizza, cheese, thick crust
18	pizza with meat and vegetables, thin crust
19	Pizza with meat and vegetables, thick crust
20	Pizza, cheese, thin crust
21	Spaghetti with tomato sauce and meatballs or spaghetti with meat sauce
22	Lasagna with meat
23	Macaroni or noodles with cheese, made from dry mix
24	Ravioli, cheese-filled with tomato sauce
25	Macaroni or noodles with cheese and beef
26	Steak and cheese submarine sandwich, with lettuce and tomato
27	Frankfurter or hot dog, with catsup and/or mustard, on bun
28	Cheeseburger, 1/4 lb meat, with tomato and/or catsup, on bun
29	Double cheeseburger (2 patties), with mayonnaise or salad dressing, on double-decker bun
30	Reuben sandwich (corned beef sandwich with sauerkraut and cheese), with spread
31	Pretzels, hard
32	White potato, chips
33	Salty snacks, corn or cornmeal base, tortilla chips
34	Pretzels, soft
35	Popcorn, popped in oil, buttered
36	Cheese, processed, American or Cheddar type
37	Cheese, Provolone
38	Cheese, natural, Cheddar or American type C
39	Cheese, Cheddar or American type, NS as to natural or processed
40	Cheese, Feta
41	Spaghetti sauce, meatless

42	Olives, NFS
43	Pickles, NS as to vegetable
44	Cucumber pickles, dill
45	Beans, string, green, cooked, NS as to form, with mushroom sauce
46	Chicken, breast, roasted, broiled, or baked, skin not eaten
47	Chicken, breast, coated, baked or fried, prepared with skin, skin/coating eaten
48	Chicken patty, fillet, or tenders, breaded, cooked
49	Chicken nuggets
50	Chicken, breast, roasted, broiled, or baked, skin eaten

[a]These foods are not in rank order of content of sodium. The top five foods from the top ten groups were collected for this list.

Appendix D

LINEAR REGRESSION ANALYSIS RESULTS

Regression Analysis for Dependent Variable Energy

Data Summary

Number of Observations	2152[a]
Sum of Weights	2146.7
Weighted Mean of Energy	2111.8
Weighted Sum of Energy	4533423.2

Tests of Model Effects

Effect	DF	F Value	Pr > F
Model	5	6.45	<.0001
Intercept	1	763.30	<.0001
Agegroup	1	9.66	0.0020
Race	1	0.01	0.9281
HTN	1	2.64	0.1053
Weekend_1	1	6.94	0.0087
weekend_d2	1	8.16	0.0045

Estimated Regression Coefficients

Parameter	Estimate	Standard error	Pr > /t/
Intercept	2074.80187	75.0983453	<.0001
agegrp	-272.03678	87.5054134	0.0020
Race	7.59315	84.0694877	0.9281
HTN	-125.82638	77.5088891	0.1053
Weekend_	193.89111	73.5878612	0.0087
weekday	248.39326	86.9704110	0.0045

Adjusted Means-Dependent Variable Energy

Obs	Adjusted mean energy	Agegrp	Race	Htn	Day1	Day2
1	2205.89	30 -51 yrs	0.645	0.41	0.510725	0.315836
2	1933.85	51 or older	0.645	0.41	0.510725	0.315836
3	2107.18	0.345	White	0.41	0.510725	0.315836
4	2114.77	0.345	AA	0.41	0.510725	0.315836
5	2163.36	0.345	0.645	No	0.510725	0.315836
6	2037.54	0.345	0.645	yes	0.510725	0.315836
7	2013.05	0.345	0.645	0.41	Week day	0.315836
8	2206.94	0.345	0.645	0.41	weekend	0.315836
9	2033.62	0.345	0.645	0.41	0.510725	weekday
10	2282.02	0.345	0.645	0.41	0.510725	weekend

[a]HTN status is missing in four cases

Regression Analysis for Dependent Variable Sodium mg per 1000 kcal

Data Summary

Number of Observations	2152[a]
Sum of Weights	2146.7
Weighted Mean of Energy	1593.2
Weighted Sum of Energy	3420147.5

Tests of Model Effects

Effect	DF	F Value	Pr > F
Model	5	0.69	0.6276
Intercept	1	3523.13	<.0001
Agegroup	1	0.01	0.9184
Race	1	1.14	0.2856
HTN	1	0.01	0.9032
weekend	1	0.85	0.3572
weekday	1	0.23	0.6323

Estimated Regression Coefficients

Parameter	Estimate	Standard error	Pr > /t/
Intercept	1631.83131	27.4922949	<.0001
agegrp	-3.09948	30.2365352	0.9184
Race	-28.99190	27.1139412	0.2856
HTN	-3.71924	30.5660913	0.9032
weekend	-25.78964	27.9785570	0.3572
weekday	-13.19897	27.5617782	0.6323

Adjusted Means for Dependent Variable Sodium mg per 1000 kcal

Obs	Adjusted mean energy	Agegrp	Race	Htn	Day1	Day2
1	1594.27	30 to 51 yrs	0.645	0.41	0.510725	0.315836
2	1591.17	51 or older	0.645	0.41	0.510725	0.315836
3	1611.91	0.345	White	0.41	0.510725	0.315836
4	1582.91	0.345	AA	0.41	0.510725	0.315836
5	1594.71	0.345	0.645	No	0.510725	0.315836
6	1590.99	0.345	0.645	Yes	0.510725	0.315836
7	1606.37	0.345	0.645	0.41	Week day	0.315836
8	1580.58	0.345	0.645	0.41	Weekend	0.315836
9	1597.37	0.345	0.645	0.41	0.510725	Week day
10	1584.17	0.345	0.645	0.41	0.510725	Weekend

[a]HTN status is missing in four cases

Regression Analysis for Dependent Variable Potassium mg per 1000 kcal

Data Summary

Number of Observations	2152[a]
Sum of Weights	2146.7
Weighted Mean of Energy	1168.2
Weighted Sum of Energy	2507794.5

Tests of Model Effects

Effect	DF	F Value	Pr > F
Model	5	21.69	<.0001
Intercept	1	2639.66	<.0001
Agegroup	1	22.56	<.0001
Race	1	0.06	<.0001
HTN	1	2.64	0.8009
Weekend_1	1	0.05	0.8187
weekend_d2	1	0.03	0.8566

Estimated Regression Coefficients

Parameter	Estimate	Standard error	Pr > /t/
Intercept	1240.92097	24.1529268	<.0001
agegrp	133.02297	28.0043707	<.0001
Race	-186.10755	23.1304627	<.0001
HTN	-6.98026	27.6597804	0.8009
Weekend_1	5.19860	22.6660899	0.8187
Weekend-d2	4.46724	24.7057910	0.8566

Adjusted Means for Dependent Variable Potassium mg per 1000 kcal

Obs	Adjusted mean energy	Agegrp	Race	Htn	Day1	Day2
1	1122.04	30 -51 yrs	0.645	0.41	0.510725	0.315836
2	1255.06	≥51 yrs	0.645	0.41	0.510725	0.315836
3	1288.02	0.345	White	0.41	0.510725	0.315836
4	1101.91	0.345	AA	0.41	0.510725	0.315836
5	1170.76	0.345	0.645	No	0.510725	0.315836
6	1163.78	0.345	0.645	Yes	0.510725	0.315836
7	1165.26	0.345	0.645	0.41	Week day	0.315836
8	1170.45	0.345	0.645	0.41	weekend	0.315836
9	1166.50	0.345	0.645	0.41	0.510725	weekday
10	1170.97	0.345	0.645	0.41	0.510725	weekend

[a]HTN status is missing in four cases

Regression Analysis for Dependent Variable Magnesium mg per 1000 kcal

Data Summary

Number of Observations	2152[a]
Sum of Weights	2146.7
Weighted Mean of Energy	127.92952
Weighted Sum of Energy	274624.5

Tests of Model Effects

Effect	DF	F Value	Pr > F
Model	5	13.47	<.0001
Intercept	1	1481.96	<.0001
Agegroup	1	7.00	0.0085
Race	1	45.33	<.0001
HTN	1	0.44	0.5076
Weekend_1	1	0.14	0.7090
weekend_d2	1	0.25	0.6163

Estimated Regression Coefficients

Parameter	Estimate	Standard error	Pr > /t/
Intercept	138.726324	3.60363322	<.0001
agegrp	9.407658	3.55603535	0.0085
Race	-23.080728	3.42804592	<.0001
HTN	2.036042	3.07064819	0.5076
Weekend_1	1.036038	2.77453036	0.7090
Weekend-d2	-1.677232	3.34500277	0.6163

Adjusted Means for Dependent Variable Magnesium mg per 1000kcal

Obs	Adjusted mean energy	Agegrp	Race	Htn	Day1	Day2
1	124.661	30 -51 yrs	0.645	0.41	0.510725	0.315836
2	134.068	≥51 yrs	0.645	0.41	0.510725	0.315836
3	142.800	0.345	White	0.41	0.510725	0.315836
4	119.719	0.345	AA	0.41	0.510725	0.315836
5	127.075	0.345	0.645	No	0.510725	0.315836
6	129.111	0.345	0.645	Yes	0.510725	0.315836
7	127.376	0.345	0.645	0.41	Week day	0.315836
8	128.412	0.345	0.645	0.41d	weekend	0.315836
9	128.435	0.345	0.645	0.41	0.510725	weekday
10	126.757	0.345	0.645	0.41	0.510725	weekend

[a]HTN status is missing in four cases

Appendix E

STATA ANALYSIS FOR WEEKEND AND WEEKDAY COMPARISIONS

Independent variables: all
Dependent variable: energy

Energy: Day 1 Regression Stats

	coeff	std_err	t-value	p-value
agegrp	-309.5063	111.4532	-2.7770	0.0057
race	-35.6677	111.9993	-0.3185	0.7503
HTN	-145.6260	101.0706	-1.4408	0.1504
weekend_d1	206.5998	103.0858	2.0042	0.0457
Intercept	2235.1714	93.6238	23.8740	0.0000

energy: Day 2 Regression Stats

	coeff	std_err	t-value	p-value
agegrp	-248.9202	90.4314	-2.7526	0.0062
race	73.9066	80.3461	0.9199	0.3582
HTN	-117.4086	79.2677	-1.4812	0.1393
weekend_d2	383.1147	86.7227	4.4177	0.0000
Intercept	2037.5689	72.3922	28.1462	0.0000

energy: Difference: day 1 - day 2 Regression Coefficients

	coeff_diff	std_err	t-value	p-value
agegrp	-60.5861	102.9113	-0.5887	0.5564
race	-109.5743	93.6955	-1.1695	0.2429
HTN	-28.2174	91.4920	-0.3084	0.7579
weekend	-176.5149	123.0766	-1.4342	0.1523
Intercept	197.6025	87.4405	2.2599	0.0243

****
Independent variables all
Dependent variable: sodium

Sodium: Day 1 Regression Stats

	coeff	std_err	t-value	p-value
agegrp	35.2173	39.7033	0.8870	0.3756
race	-60.7945	36.3262	-1.6736	0.0950
HTN	10.8263	47.5001	0.2279	0.8198
weekend_d1	-47.3601	36.7014	-1.2904	0.1976
Intercept	1632.1944	29.3007	55.7050	0.0000

Sodium: Day 2 Regression Stats

	coeff	std_err	t-value	p-value
agegrp	-39.0348	46.5709	-0.8382	0.4024
race	24.8451	39.5632	0.6280	0.5304
HTN	-15.6746	39.9863	-0.3920	0.6953
weekend_d2	-77.2027	38.7415	-1.9928	0.0469
Intercept	1660.4408	36.0401	46.0721	0.0000

Sodium: Difference: day 1 - day 2 Regression Coefficients

	coeff_diff	std_err	t-value	p-value
agegrp	74.2521	61.2390	1.2125	0.2260
race	-85.6397	51.9100	-1.6498	0.0997
HTN	26.5009	57.8541	0.4581	0.6471
weekend	29.8426	54.7504	0.5451	0.5860
Intercept	-28.2464	40.4601	-0.6981	0.4855

Independent variables: all
Dependent variable: potassium

potassium: Day 1 Regression Stats

	coeff	std_err	t-value	p-value
agegrp	149.9300	37.1600	4.0347	0.0001
race	-193.1874	29.7893	-6.4851	0.0000
HTN	-3.3588	34.1574	-0.0983	0.9217
weekend_d1	11.3564	26.7212	0.4250	0.6711
Intercept	1244.3685	30.5329	40.7550	0.0000

potassium: Day 2 Regression Stats

	coeff	std_err	t-value	p-value
agegrp	118.8166	30.0773	3.9504	0.0001
race	-189.4587	29.7368	-6.3712	0.0000
HTN	-3.2666	31.5549	-0.1035	0.9176
weekend_d2	-7.0183	31.1985	-0.2250	0.8221
Intercept	1283.7118	27.7332	46.2879	0.0000

potassium: Difference: day 1 - day 2 Regression Coefficients

	coeff_diff	std_err	t-value	p-value
agegrp	31.1134	36.3084	0.8569	0.3920
race	-3.7287	33.6374	-0.1109	0.9118
HTN	-0.0922	34.1484	-0.0027	0.9978
weekend	18.3746	42.1733	0.4357	0.6633
Intercept	-39.3433	30.4147	-1.2936	0.1965

****

Independent variables: all
Dependent variable: magnesium

magnesium: Day 1 Regression Stats

	coeff	std_err	t-value	p-value
agegrp	9.9884	4.2772	2.3352	0.0200
race	-21.3682	4.0779	-5.2400	0.0000
HTN	0.8124	3.8039	0.2136	0.8310
weekend_d1	-1.6884	3.4008	-0.4965	0.6198
Intercept	140.6167	4.3314	32.4646	0.0000

magnesium: Day 2 Regression Stats

	coeff	std_err	t-value	p-value
agegrp	9.5686	3.8058	2.5142	0.0123
race	-24.2683	3.8847	-6.2472	0.0000
HTN	3.0047	3.2941	0.9121	0.3622
weekend_d2	-1.8383	3.9000	-0.4714	0.6376
Intercept	141.9249	4.2315	33.5403	0.0000

magnesium: Difference: day 1 - day 2 Regression Coefficients

	coeff_diff	std_err	t-value	p-value
agegrp	0.4198	3.5526	0.1182	0.9060
race	2.9002	3.4860	0.8319	0.4059
HTN	-2.1923	3.7698	-0.5816	0.5612
weekend	0.1499	5.6305	0.0266	0.9788
Intercept	-1.3082	4.1266	-0.3170	0.7514