Nutrient Profiles of Korean-Americans, Non-Hispanic Whites and Blacks With and Without Hypertension in the United States

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Purpose We compared the nutrient profiles of hypertensive Korean-Americans, non-Hispanic Whites and Blacks with those of normotensive Korean-Americans, Whites, and Blacks.

Methods This study was a cross-sectional comparative design of nutrient profiles among three ethnic groups. Korean-Americans were interviewed at Korean-American health clinics and churches in Chicago and data were collected by the 24-hour dietary recall method. Age- and sex-matched data of non-Hispanic Whites and Blacks were selected from the Third National Health and Nutrition Examination Survey for comparison. Descriptive statistics, one way ANOVA with post hoc test, and the propensity score matching method within each hypertensive and normotensive group were used for data analysis. Subjects included 102 subjects with hypertension (Korean-Americans, n = 37; Whites, n = 37; Blacks, n = 28), and 149 subjects without hypertension (Korean-Americans, n = 55; Whites, n = 55; Blacks, n = 39) for final statistical analyses.

Results Significant differences in nutrient profiles among the three groups were as follows. In both hypertensive and normotensive groups, Korean-Americans consumed less energy from fat and saturated fatty acids and more energy from carbohydrates than did Whites and Blacks. All three ethnic groups exceeded the dietary reference intakes of sodium, but did not meet those of calcium and potassium.

Conclusion The findings suggest that protein may be needed to replace excessive carbohydrate intake in Korean-Americans and to replace fat intake in Whites and Blacks. Health professionals need to emphasize the importance of increasing calcium and potassium intake and decreasing sodium intake in their nutrition education for these ethnic groups to help prevent and control hypertension. [Asian Nursing Research 2008;2(3):141–149]

Key Words diet, ethnic groups, hypertension

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INTRODUCTION

The United States (U.S.) has received a rapidly increasing number of immigrants in recent decades (U.S. Census Bureau, 2000). The Korean-American population, which is the fifth largest Asian ethnic group, has dramatically grown since the first immigration to the U.S. in 1903 (Sohn, 2004) and now numbers more than 1,000,000, accounting for 0.4% of the total U.S. population (U.S. Census Bureau, 2000, 2003).

Hypertension is associated with immigrants from non-Western countries to the U.S. (Steffen, Smith, Larson, & Butler, 2006). Many empirical studies show that immigrants are at greater risk of heart disease, including hypertension, than their counterparts in their countries of origin (Burt et al., 1995; Jee, Appel, Suh, Whelton, & Kin, 1998; Satia-Abouta & Neuhauser, 2002). One explanation for this is dietary change associated with immigration. Some immigrants adopted a healthy diet, while others adopted an unhealthy diet, such as increasing their consumption of fast food, fats, and soft drinks (Lockyear, 2004). A study reported a higher prevalence of hypertension in Korean-Americans living in Maryland (35% of men and 30% of women) than in other Americans (24.2% of men and 22.2% of women) (Kim, Kim, Juon, & Hill, 2000), and their counterparts in Korea (28.9% of men and 15.9% of women) (Jee et al.). The prevalence of hypertension increased to 71% in Korean-Americans aged at least 60 years (Kim, Juon, Hill, Post, & Kim, 2001). The ethnic difference in diet consumption and nutrient profiles resulted in ethnic disparities in hypertension and raised awareness of the need for hypertension prevention and control in Korean-Americans.

Hypertension is a major risk factor for cardiovascular disease and is associated with diet (Gariballa, 2000; U.S. Department of Health and Human Services, 2000). Diet is clearly an important component of lifestyle modification to prevent and treat hypertension (Chobanian et al., 2003). For instance, a diet that includes low calorie intake, and low intake of sodium, cholesterol, fat, and saturated fatty acids (SFA), combined with high potassium and calcium intake is known to be an effective nutrition strategy to reduce blood pressure (Appel et al., 1997; Appel et al., 2005; Sacks et al., 2001). In spite of the new nutritional approach considering multiple nutrients together rather than a single nutrient for blood pressure management (Karpapanen, Karpapanen, & Mervaala, 2005), there is a lack of empirical data on nutrient profiles associated with hypertension in Korean-Americans.

Some studies have dealt with dietary differences in various ethnic populations in the U.S. For example, African-Americans consumed more sodium than other ethnic groups, but less potassium and calcium (Hajjar & Kotchen, 2003), and Blacks and Hispanics were more likely to fry foods than Whites (Gans, Burkholer, Risica, & Lasater, 2003). African-American women consumed more calories than Caucasian, Chinese, Hispanic or Japanese women, while the energy-adjusted total fat intake of Chinese women was at least 10% lower than that of all other ethnic groups (Huang et al., 2002). However, no study has been published comparing nutrients associated with hypertension among Korean-Americans and the two major ethnic groups in the U.S. (i.e., 70% Whites and 12.7% Blacks) (U.S. Census Bureau, 2000).

This study aimed to fill the knowledge gap that exists in nutrient profiles of hypertensive Korean-Americans, non-Hispanic Whites and Blacks, and normotensive Korean-Americans, non-Hispanic Whites and Blacks. We reasoned that differences in diets among the three ethnic groups (Center for Disease Control, 2004; Kim, Ahn, Chon, Bowen, & Khan, 2003; Kim et al., 2000) could lead to differences in the nutrient profiles of these ethnic groups, and that the knowledge gained from the study would help health professionals develop a culturally responsive nutrition plan and education program for each group.

METHODS

Subjects

A convenience sample of 71 hypertensive and 98 normotensive Korean-Americans was collected in two university hospital-affiliated clinics and two Korean churches in the Chicago metropolitan district, from May 2003 to June 2004. Korean-Americans included
in the study were aged 40–70 years, had lived in the
U.S. for more than 5 years, and spoke Korean as their
primary language at home. Hypertensive Korean-
Americans had been diagnosed with hypertension
by a physician more than 1 year prior to the start of
the study. A stratified random sample of 100 non-
Hispanic Whites and 100 Blacks in each hyperten-
sive and normotensive group was obtained from
5,447 age- and sex-matched subjects (aged 40–70
years) in the Third National Health and Nutrition
Examination Survey (NHANES III), 1988–1994 data
set file. Both hypertensive Whites and Blacks were
diagnosed by medical doctors, and the majority of
individuals in all three groups were taking medica-
tion or had been told by their health care provider
to take prescribed medication.

Because income, education, and body mass index
(BMI) are important variables that influence nutri-
ent profiles (Block, Rosenberger, & Patterson, 1988;
Chobanian et al., 2003; Lv & Cason, 2004), and
because there were significant differences in these
variables among the three ethnic groups, the propen-
sity score (PS) matching method was used to control
selection bias. The PS matching method involves
matching a similar PS of each subject in the treatment
group (Korean-Americans) and the control group
(i.e., Whites and Blacks) by balancing the individual’s
covariates in the two groups (Rosenbaum & Rubin,
1983). The PS is defined as the conditional pro-
bability of belonging to the treatment group. PS
matching was done in each hypertensive and nor-
motensive group. This resulted in 102 subjects with
hypertension (Korean-Americans, \( n = 37 \); Whites, \( n =
37 \); Blacks, \( n = 28 \)), and 149 subjects without hyper-
tension (Korean-Americans, \( n = 55 \); Whites, \( n = 55 \);
Blacks, \( n = 39 \)) for final statistical analyses.

**Results**

**Comparing general characteristics among ethnic groups**

A total of 251 subjects were analyzed after PS match-
ing (Table 1). All three groups contained slightly
higher percentages of women. In the hypertensive groups, 40.6% of Korean-Americans, 43.2% of Whites and 32.1% of Blacks in the sample were college educated. There were more Blacks (64.3%) who had a low income than Korean-Americans (59.5%) and Whites (43.2%), but this was not statistically significant. The average age was 60.0 years, 59.3 years, and 60.1 years for Korean-Americans, Whites, and Blacks, respectively. Korean-Americans had a higher mean BMI (27.3 kg/m²) than Whites (26.2 kg/m²) and Blacks (25.3 kg/m²), but this was not statistically significant.

In normotensive groups, 60% of Korean-Americans, 65.5% of Whites and 56.4% of Blacks in the sample were college educated. About 10% of each group had a low income. The average age was 52.6 years in Korean-Americans, 51.2 years in Whites and 53.5 years in Blacks. The BMI of each group was around 25 kg/m².

### Comparing nutrient profiles among ethnic groups with hypertension

Nutrient profiles among the three ethnic groups are shown in Table 2. In the hypertensive groups, Korean-Americans consumed the least energy from fat and SFA and consumed the most energy from carbohydrates among the three ethnic groups ($p<.05$). Whites and Blacks had similar proportions of energy from these three macronutrients. The three ethnic groups with hypertension showed no differences in cholesterol intake. Whites had higher calcium consumption than Korean-Americans or Blacks. There were no significant differences in sodium intake among the ethnic groups. Hypertensive Korean-Americans had the lowest potassium intake among the three ethnic groups. Potassium consumption among the three ethnic groups was 39.8–55.4% of dietary reference intakes (DRIs), while sodium consumption was 183.9–200.6% of DRIs (Food and Nutrition Board, 2000).
<table>
<thead>
<tr>
<th></th>
<th>Hypertensive</th>
<th>Normotensive</th>
<th>p</th>
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<tbody>
<tr>
<td></td>
<td>Korean-</td>
<td>Whites</td>
<td>Blacks</td>
</tr>
<tr>
<td></td>
<td>Americans</td>
<td>(n = 37)</td>
<td>(n = 28)</td>
</tr>
<tr>
<td>Calories (kcal)</td>
<td>1,457.8 ± 528.0</td>
<td>1,772.4 ± 666.9</td>
<td>1,532.9 ± 765.5</td>
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<tr>
<td>Calories (% of RDA)</td>
<td>68.0 ± 24.3</td>
<td>81.0 ± 25.3</td>
<td>72.0 ± 31.7</td>
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<tr>
<td>Energy from fat (%)</td>
<td>20.6 ± 8.3</td>
<td>32.2 ± 10.7</td>
<td>29.9 ± 10.6</td>
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<tr>
<td>Energy from SFA (%)</td>
<td>2.9 ± 2.9</td>
<td>10.9 ± 4.8</td>
<td>9.5 ± 4.1</td>
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<tr>
<td>Energy from carbo (%)</td>
<td>64.3 ± 10.9</td>
<td>49.6 ± 12.5</td>
<td>47.4 ± 11.0</td>
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<td>Energy from protein (%)</td>
<td>15.1 ± 4.0</td>
<td>14.9 ± 5.2</td>
<td>17.7 ± 5.8</td>
</tr>
<tr>
<td>Protein (g)</td>
<td>55.7 ± 26.9</td>
<td>65.2 ± 30.4</td>
<td>66.6 ± 36.4</td>
</tr>
<tr>
<td>Protein (% of DRI)</td>
<td>111.8 ± 53.2</td>
<td>127.7 ± 54.3</td>
<td>133.7 ± 72.7</td>
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<td>Cholesterol (mg/dL)</td>
<td>237.4 ± 226.8</td>
<td>218.8 ± 167.8</td>
<td>226.0 ± 157.8</td>
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<td>Calcium (mg/dL)</td>
<td>411.3 ± 247.9</td>
<td>632.2 ± 405.2</td>
<td>407.0 ± 264.2</td>
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<td>Calcium (% of DRI)</td>
<td>36.4 ± 22.6</td>
<td>55.2 ± 37.5</td>
<td>35.1 ± 23.3</td>
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<td>Sodium (mg/dL)</td>
<td>3,009.2 ± 1,838.0</td>
<td>2,759.2 ± 1,421.8</td>
<td>2,859.2 ± 1,719.3</td>
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<tr>
<td>Sodium (% of DRI)</td>
<td>200.6 ± 122.5</td>
<td>183.9 ± 94.8</td>
<td>190.6 ± 114.6</td>
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<tr>
<td>Potassium (mg/dL)</td>
<td>1,870.3 ± 716.4</td>
<td>2,604.8 ± 973.2</td>
<td>2,216.5 ± 1,194.0</td>
</tr>
<tr>
<td>Potassium (% of DRI)</td>
<td>39.8 ± 15.2</td>
<td>55.4 ± 20.7</td>
<td>47.2 ± 25.4</td>
</tr>
</tbody>
</table>

**Note.** Values are mean ± SD. *p < .05 among ethnic groups; †p < .01 among ethnic groups. 1 = result of Duncan test: Korean-Americans < Blacks, Whites; 2 = result of Duncan test: Blacks, Whites < Korean-Americans; 3 = result of Duncan test: Korean-Americans < Whites; 4 = result of Duncan test: Korean-Americans, Blacks < Whites. RDA = recommended daily allowance; SFA = saturated fatty acid; carbo = carbohydrates; DRI = dietary reference intake.
Comparing nutrient profiles among ethnic groups without hypertension

In normotensive groups, ethnic differences in these nutrients were similar to those seen in the hypertensive groups, except that Korean-Americans consumed fewer calories than Whites. Energy from protein and cholesterol was similar among the three ethnic groups, while Korean-Americans and Blacks consumed less potassium than Whites. Potassium consumption by the three ethnic groups was 46.6–60.2% of DRIs, while sodium consumption was 193.4–240.5% of DRIs (Food and Nutrition Board, 2000).

Comparing nutrient profiles according to hypertension status

Since PS matching was done in each hypertensive and normotensive group, the three ethnic groups with hypertension \( (n = 102) \) were matched homogeneously and the three ethnic groups without hypertension \( (n = 149) \) were also homogeneous. However, hypertensive groups were not matched with normotensive groups homogeneously, so in each ethnic group the mean age, mean BMI and income level of the hypertensive and normotensive groups showed a statistically significant difference (i.e., the hypertensive group was older, had a higher BMI, and was poorer than the normotensive group in each ethnic group). For this reason, comparing nutrient profiles according to hypertensive status was not reliable, so the results of this analysis are not included.

DISCUSSION

We examined nutrient profiles of hypertensive Korean-Americans, non-Hispanic Whites and Blacks and normotensive Korean-Americans, non-Hispanic Whites and Blacks in the U.S.

All ethnic groups needed to replace one of their macronutrients according to the findings of the Omni Heart Study (Appel et al., 2005) in which participants were 164 adults with pre-hypertension or stage 1 hypertension. A protein diet group and an unsaturated fat diet group both showed reductions in blood pressure 6 weeks after the start of the experiment in the Omni Heart Study. Korean-Americans in our study showed a higher proportion of carbohydrate intake (61.5% vs. 48%) and a lower proportion of protein intake (15.9% vs. 25%) than the members of the protein diet group in the Omni Heart Study. This suggests that Korean-Americans need to increase their protein intake and reduce the percentage of energy taken in from carbohydrates in order to lower blood pressure. Whites and Blacks in our study showed similar percentages of energy intake from carbohydrates (48% vs. Whites 48.3%, Blacks 46.6%), but higher percentages of energy intake from fat (27% vs. Whites 33.9%, Blacks 33.5%) and SFA (6% vs. Whites 11.5%, Blacks 11.9%) compared to the unsaturated fat diet group in the Omni Heart Study. On the other hand, compared with the protein group in the Omni Heart Study, the Whites and Blacks in our study consumed a lower proportion of protein (25% vs. Whites 15.0%, Blacks 16.2%). This comparison suggests that Whites and Blacks might benefit from reducing fat and increasing protein from vegetables in their diet to lower blood pressure.

Although the three ethnic groups showed no differences in cholesterol intake among those with and without hypertension, Korean-Americans may have a lower risk of developing high cholesterol levels than Whites and Blacks. Researchers reported a positive correlation between the percentage of calories from fat and serum cholesterol levels (Stallones, 1983) and an inverse association between carbohydrates and serum cholesterol (Sonnenberg, Posters, Belanger, Adrienne, & D’Agostino, 1992), which has a direct association with blood pressure (Castelli & Anderson, 1986). In other words, because Korean-Americans received fewer calories from fat and consumed higher amounts of carbohydrates than Whites and Blacks, Korean-Americans were less likely to be at risk of hypertension than Whites and Blacks.

Higher-income households consumed more calcium than lower-income households in NHANES III data (Briefel & Johnson, 2004). Although income level was controlled and was not significantly different among the three ethnic groups in our study, the
fact that Whites showed higher calcium consumption than Korean-Americans or Blacks might have been due to Whites having a higher income than Korean-Americans or Blacks.

All three ethnic groups consumed almost twice as much sodium as recommended by the DRIs (1,500 mg/day), which exceeded the tolerable upper limits of intake of 2,300 mg/day (Food and Nutrition Board, 2000). As found in an earlier meta-analysis, sodium reduction plays a key role in regulating blood pressure (Lv & Cason, 2004), and high sodium contributes to increased cardiovascular risk (Sacks et al., 2001). Low calcium intake and high sodium intake in Korean-Americans are consistent with previous findings in elderly Korean-Americans (Cross, Kim, Yu, Chen, & Kim, 2002) and pose a high risk for hypertension.

Hypertensive Korean-Americans showed the lowest potassium intake among the three ethnic groups, and normotensive Korean-Americans showed significantly lower consumption than did normotensive Whites. However, all three ethnic groups failed to meet the DRIs for potassium (Food and Nutrition Board, 2000). In earlier studies, high dietary intake of potassium and potassium supplementation were associated with blood pressure reduction and decreased risk of stroke (Ascherio et al., 1998; Hajjar, Grim, George, & Kotchen, 2001; Whelton et al., 1997). In fact, hypertensive Korean-Americans had lower consumption of potassium-rich vegetables and a lower total potassium intake than Native Koreans (NKs) (Kim, Lee, Ahn, Bowen, & Lee, 2007), supporting, in part, a higher prevalence of hypertension among Korean-Americans compared with their NK counterparts (Kim et al., 2000). Therefore, it is worth considering potassium as an important nutrient in diet planning and education of hypertensive Korean-Americans. However, one should assess overall diet rather than a single nutrient in isolation when measuring the impact of diet on blood pressure. The favorable effect of combined nutrients, such as low sodium, high potassium and high calcium, outweighs the effect of a single nutrient, such as low sodium or high potassium, on blood pressure (Karppanen et al., 2005).

Twenty-four-hour recall evaluates food intake in 1 day, and it may not accurately reflect the participants’ usual diet which is influenced by day-to-day variation. However, this method has been used commonly in many studies (Bazzano et al., 2001; Hajjar & Kotchen, 2003; Park, Paik, Skinner, Spindler, & Park, 2004) and has been shown to be reliable (Edens & Knous, 1999; Nelson, 1997). Speed and ease of administration, as well as the reasonable cost, are advantages of this method. Because only a small amount of information is required for each interview, compliance is usually good. Twenty-four-hour recall is appropriate for studies where group means will be compared (Nelson). Hence, only group means were used in this study. In studies with a small number of participants, the group mean estimate may be unstable, and findings should be interpreted with caution. Our sample size became small ($n = 102$ out of 271 in the hypertensive group, and $n = 149$ out of 298 in the normotensive group) after PS matching; however, homogeneity of the groups provides credence to the findings.

Statistically significant differences in the demographic profiles of the ethnic groups led us to use the PS matching method, and this helped us to interpret the results more rigorously. Earlier studies with a small sample size failed to control for the confounding variables (Huang et al., 2002; Karppanen et al., 2005). The use of the PS matching method allowed us to control confounding variables somewhat. However, comparing nutrient profiles between the hypertensive group and the normotensive group was not reliable because the hypertensive group did not match with the normotensive group as there were different general characteristics according to hypertensive status in each ethnic group.

Another limitation of this study was the use of different data sets, in which data for Korean-Americans were generated from face-to-face interviews in 2003 and data for Whites and Blacks were collected from the NHANES III data set from 1988–1994. This difference might reflect changes in diet pattern with changes in time, but by comparing with matched data the size of this difference may be reduced.
CONCLUSION

The findings provide useful information on the ethnic differences in nutrient profiles and important nutrients associated with hypertension specific to Korean-Americans, Whites, and Blacks. The high proportion of carbohydrate intake in Korean-Americans and the high proportion of fat intake in Whites and Blacks need to be replaced with vegetable proteins. All three ethnic groups need to increase calcium and potassium intake and decrease sodium intake, and Korean-Americans need these changes the most. The nutrient profiles of ethnic groups should be considered when nutrition education programs are planned for the prevention and control of hypertension.

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REFERENCES


