Original Article

The Effects of Chronic Exposure to Aircraft Noise on the Prevalence of Hypertension

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Exposure to environmental noise has been suggested to increase the prevalence of hypertension. The present study investigated whether or not chronic exposure to military aircraft noise is related to an increased prevalence of hypertension. The study population consisted of 137 subjects (mean age 60±14 years) who lived within 5 km of a helicopter airbase and 486 subjects (58±16 years) living within 5 km of a fighter-jet airbase. A control group consisted of 252 subjects (58±16 years) not exposed to aircraft noise. Overall, the subjects exposed to military aircraft noise had a higher prevalence of hypertension than those in the control group (*p*=0.037). However, whereas those exposed to helicopter noise had a higher prevalence than the control group (*p*=0.020), those exposed to fighter-jet noise did not (*p*=0.094). The prevalence of known hypertension in the helicopter group was higher than in the control group (*p*=0.024). The prevalence odds ratio for hypertension adjusted for age, gender, body mass index, current smoking, alcohol intake, diabetes, and regular exercise was 1.62 (95% confidence interval [95% CI], 1.02–2.59) for the subjects exposed to helicopter noise, and 1.23 (95% CI, 0.87–1.74) for those exposed to fighter-jet noise. In conclusion, the results of the present study suggest that chronic exposure to military aircraft noise may be associated with hypertension. The difference in the effects between helicopter and fighter-jet noise implies that different kinds of noise will have different influences on the prevalence of hypertension. (*Hypertens Res* 2008; 31: 641–647)

***Key Words*: hypertension, aircraft noise, military aircraft**

Introduction

Exposure to environmental noise has been suggested to cause a variety of physiological and psychological disturbances, such as sleep disturbance, annoyance (*1*), and ischemic heart disease (*2*, *3*). Many investigators have evaluated the association between environmental noise exposure and hypertension, and have suggested that traffic and occupational noise could elevate blood pressure and the risk of developing hypertension (*4*–*7*).

A few studies have revealed some relationships between aircraft noise and hypertension (*8*–*10*). A meta-analysis showed a significant association between hypertension and both occupational and air traffic noise exposure (*11*). However, the subjects in most of the prior studies were living near civilian airports. Only two studies in the literature have investigated subjects living near military airbases, and their results contradicted each other (*12*, *13*). Although several studies have suggested positive associations, there has been no conclusive evidence of an association between aircraft noise exposure and hypertension.

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Table 1. Clinical and Demographic Findings of Subjects

	Control	Helicopter	Fighter jet	*p* value*		
				Control *vs.* Helicopter *vs.* Fighter jet	Control *vs.* Helicopter	Control *vs.* Fighter jet
n	252	137	486			
Age (years)	58±1	60±1	58±1	0.270	0.156	0.995
$L_{Aeq,8h}$, dB(A)	53–54	71–72	68–82			
L_{max}, dB(A)	88–89	114–116	105–115			
Sex, *n* (%)						
Male	100 (39.7)	65 (47.4)	223(45.9)	0.200	0.139	0.107
Female	152 (60.3)	72 (52.5)	263(54.1)			
Occupation, *n* (%)						
Farmers	139 (55.2)	70 (51.1)	292 (60.1)	0.125	0.443	0.198
Non-farmers	113 (44.8)	67 (48.9)	194 (39.9)			
Education, *n* (%)						
None	29 (12)	18 (13)	72 (15)			
Elementary school	90 (36)	58 (42)	183 (38)			
Middle school	46 (18)	19 (14)	77 (16)	0.826†	0.591†	0.622†
High school	59 (23)	30 (22)	108 (22)			
College or more	28 (11)	12 (9)	46 (9)			
Smokers, *n* (%)	60 (23.8)	50 (36.5)	141 (29.0)	0.031	0.008	0.133
Drinking, *n* (%)	99 (39.6)	50 (36.5)	199 (41.6)	0.542	0.548	0.597
Regular exercise, *n* (%)	31 (12.3)	24 (17.5)	71 (14.6)	0.368	0.368	0.389
Body mass index, kg/m^2	23.6±0.2	24.1±0.3	24.4 ±0.2	0.006	0.097	0.001
HR, bpm	61±1	61±1	63±1	0.023	0.989	0.016
Fasting glucose, mg/dL	94±1	98±2	95±1	0.253	0.148	0.893
Total cholesterol, mg/dL	190±2	186±3	189±2	0.330	0.160	0.854
TG, mg/dL	135±5	165±16	157±5	0.017	0.013	0.014
HDL cholesterol, mg/dL	53±1	51±1	52±1	0.167	0.074	0.148
LDL cholesterol, mg/dL	111±2	104±3	108±2	0.191	0.067	0.372
Diabetes mellitus, *n* (%)	18 (7.1)	18 (13.1)	58 (11.9)	0.089	0.055	0.044
Angina pectoris, *n* (%)	3 (1.2)	3 (2.2)	8 (1.6)	0.749	0.445	0.628
Myocardial infarction, *n* (%)	4 (1.6)	2 (1.5)	4 (0.8)	0.606	0.922	0.342
Arrhythmia, *n* (%)	0 (0.0)	1 (0.7)	4 (0.8)	0.359	0.174	0.149
Heart failure, *n* (%)	3 (1.2)	1 (0.7)	1 (0.2)	0.234	0.667	0.084

Data are expressed as mean±SEM. HR, heart rate; TG, triglyceride; HDL, high density lipoprotein; LDL, low density lipoprotein. *Three *p* values for all groups and two noise groups with a reference of the control group achieved by a univariate general linear model or a simple logistic regression model. †*p* values by χ^2 test.

Different military aircraft produce different noises with different characteristics, such as variable intensity and duration. These characteristics may also be different from those of civilian aircraft. As well, the characteristic noise from fighter-jet aircraft is obviously different from that of helicopters. Previous studies have not evaluated such differences.

The present study evaluated whether or not chronic exposure to noise from military aircraft is related to the increased prevalence of hypertension, and whether or not the effects differ between military helicopter noise and fighter-jet noise.

Methods

Subjects

Six rural communities within 5 km of a fighter-jet airbase and two rural communities within 5 km of a military helicopter airbase were selected as the exposed areas. As a control group, residents in three rural communities at least 10 km away from the airbases were selected. Residents over the age of 18 years were enrolled. In the exposed areas, 692 subjects (317 men, mean age±SD: 57±16 years) from 1,152 residents (550 men, 57±15 years) participated. In the exposed areas,

Table 2. Prevalence of Hypertension

Prevalence of HT	Control	Helicopter	Fighter jet	*p* value*		
				Control *vs.* Helicopter *vs.* Fighter jet	Control *vs.* Helicopter	Control *vs.* Fighter jet
Total, % (*n*)	41.7 (105)	54.0 (74)	48.1 (234)	0.054	0.020	0.094
Sex, % (*n*)						
Male	43.0 (43)	52.3 (34)	42.2 (94)	0.338	0.242	0.887
Female	40.8 (62)	55.6 (40)	53.2 (140)	0.029	0.039	0.015
Age groups, % (*n*)						
<40 years	5.9 (2)	54.5 (6)	20.3 (15)	0.006	0.002	0.074
40–49 years	20.7 (6)	28.6 (6)	33.3 (23)	0.454	0.520	0.211
50–59 years	37.7 (23)	30.8 (8)	41.1 (36)	0.614	0.536	0.653
60–69 years	51.6 (32)	66.7 (26)	58.1 (75)	0.327	0.136	0.395
≥70 years	63.6 (42)	70.0 (28)	66.9 (85)	0.789	0.502	0.647
Known HT, % (*n*)	21.0 (53)	31.4 (43)	27.3 (132)	0.060	0.024	0.065

HT, hypertension. *Three *p* values for all groups and two noise groups with a reference of the control group achieved by a simple logistic regression model.

150 subjects (53%) among 282 residents (135 men, 58±14 years) lived around a helicopter airbase, and 542 subjects (62%) among 870 residents (414 men, 56±15 years) lived near a fighter-jet airbase. In the control areas, 259 subjects (46%) among 558 subjects (240 men, 56±15 years) participated. After the exclusion of subjects who had lived in these locations for less than 10 years, 137 subjects near a helicopter airbase were analyzed (65 men, 60±14 years, helicopter group), as were 486 subjects near a fighter-jet airbase (223 men, 58±16 years, fighter-jet group) and 252 subjects in the control areas (100 men, 58±16 years, control group).

To collect information, we provided each subject with a self-administered questionnaire on personal characteristics, education, living situation, occupation, regular exercise, smoking, sleep disturbance, alcohol intake, medication use, and history of cardiovascular disease or of diabetes. For smoking, subjects were classified as either current smokers or nonsmokers. For alcohol intake, subjects were classified as either drinkers or nondrinkers. A previous diagnosis of hypertension and the current use of medication for cardiovascular disease including hypertension were confirmed from the medical records of hospitals and clinics that the subjects visited. Subjects who performed physical exercise more than 40 min per day and 4 or more days per week were defined as regular exercisers. Body mass index (BMI) was calculated from the measured body weight and height (weight [kg]/height^2 [m^2]). Fasting blood glucose, total cholesterol, triglyceride (TG), high-density lipoprotein (HDL) cholesterol, and low-density lipoprotein (LDL) cholesterol were measured after at least 8 h of overnight fasting. Diabetes mellitus was defined as a history of diabetes mellitus and/or the use of blood glucose–lowering medications and/or a fasting plasma glucose level ≥126 mg/dL (*14*). The study was performed according to the principles of the Declaration of Helsinki. The study protocol was approved by the Institutional Research Ethics Committee of Dankook University Hospital, and all participants gave written informed consent.

Measurements of Blood Pressure

Blood pressure was measured with an automatic device (HEM-907, Omron Healthcare, Kyoto, Japan) (*15*). All subjects were asked to refrain from caffeine, alcohol, and smoking during the previous 12 h. Before blood pressure measurement, the subjects were seated comfortably with the arm supported and positioned at the level of the heart on the examination table for at least 5 min. Blood pressure from each arm was measured three times at 5-min intervals. An average from two close readings was calculated. The averaged blood pressures from both arms were compared, and the higher value was used for analysis. Hypertension was defined as a systolic blood pressure (SBP)≥140 mmHg or a diastolic blood pressure (DBP)≥90 mmHg, a previous diagnosis of hypertension, or the current use of antihypertensive medications (*16*).

Measurement of Noise Levels

Noise levels were measured by a cumulative noise dosimeter (Spark 706/703 Noise Dosimeter, Larson Davis, Depew, USA). Eight sites from the exposed areas and two sites from the control areas were selected for the measurement of noise levels. To avoid the effects of structures on the measurement of noise, open areas not obstructed by woods or houses were selected. The dosimeters were placed 1.5 m above a concrete ground surface. To avoid the effects of wind, noise was measured only when the wind velocity was below 5 m/s. Noise was measured during the daytime (between 10:00 AM and 6:00 PM). The 8-h average A–weighted equivalent sound

Table 3. Level of Blood Pressure in Subjects Not Taking Antihypertensive or Cardiovascular Medications

	Control	Helicopter	Fighter jet	*p* value*		
				Control *vs.* Helicopter *vs.* Fighter jet	Control *vs.* Helicopter	Control *vs.* Fighter jet
n	201	101	368			
Sex, *n* (%)						
Male	83 (41.3)	52 (51.5)	185 (50.3)	0.088	0.093	0.040
Female	118 (58.7)	49 (48.5)	183 (49.7)			
Age, years	55±1	58±1	55±1	0.220	0.175	0.782
SBP, mmHg	129±1	135±2	132±1	0.013 (0.039†)	0.005 (0.019†)	0.093 (0.090†)
DBP, mmHg	77±1	80±1	79±1	0.042 (0.081†)	0.041 (0.074†)	0.026 (0.064†)
Male						
SBP, mmHg	132±2	137±3	132±1	0.211	0.183	0.904
DBP, mmHg	79±1	81±2	81±1	0.390	0.295	0.187
Female						
SBP, mmHg	127±2	134±3	131±1	0.057	0.025	0.081
DBP, mmHg	76±1	78±2	77±1	0.205	0.128	0.157

Data are expressed as mean±SEM. SBP, systolic blood pressure; DBP, diastolic blood pressure. *Three *p* values for all groups and two noise groups with a reference of the control group achieved by a univariate general linear model for age, SBP, and DBP, and by a logistic regression model for sex. †Age and sex adjusted *p* values.

pressure level ($L_{Aeq,8h}$) (dB(A)) and the maximum sound pressure level (L_{max}) (dB(A)) were automatically calculated.

Statistical Analysis

Descriptive data are presented as mean±SEM or frequency and percentages in parentheses, as appropriate. For the univariate assessment of the differences among the three groups, we used a general linear model for continuous variables, such as age, BMI, heart rate, fasting glucose, total cholesterol, TG, HDL cholesterol, LDL cholesterol, and systolic and diastolic blood pressure, or a simple logistic regression for binary variables such as sex, occupation, smoking, drinking, regular exercise, diabetes mellitus, angina pectoris, myocardial infarction, arrhythmia, and hypertension. A *p* value for the comparison of all groups and two *p* values for the comparison of the two exposed groups with the control group as a reference were displayed. Differences in SBP and DBP were analyzed by a general linear model with and without age and gender adjustments.

The prevalence odds ratio and 95% confidence intervals (95% CI) for hypertension were evaluated by multiple logistic regression analysis, with adjustment for age, sex, BMI, diabetes, smoking, alcohol intake, and regular exercise. A value of $p<0.05$ was considered significant. Statistical analysis was performed using SPSS statistical software (version 13; SPSS, Chicago, USA).

Results

The mean age of 150 participants (70 men) exposed to helicopter noise was 59±14 years (mean age±SD), and the mean age of 542 participants (247 men) exposed to fighter-jet noise was 56±16 years. In the control areas, the mean age of 259 participants (105 men) was 57±17 years. There were 132 nonparticipants (65 men) in the areas exposed to helicopter noise, and their mean age was 56±13 years. The mean age and sex ratio of nonparticipants were not different from those of the participants ($p=0.056$ and 0.666, respectively). In the areas exposed to fighter-jet noise, 328 subjects (168 men) were nonparticipants, and their mean age was 57±13 years. They did not differ from participants in mean age or sex ratio ($p=0.672$ and 0.106, respectively). In the control areas, there were 299 nonparticipants (135 men) in the control areas, and their mean age was 55±14 years. They did not differ from participants in mean age or sex ratio ($p=0.488$ and 0.273, respectively).

Table 1 shows the demographic and clinical findings of the enrolled subjects. There were no significant differences among the groups with respect to mean age, gender, alcohol intake, regular exercise, fasting glucose level, total cholesterol level, diabetes, angina, myocardial infarction, or heart failure. The helicopter group had more current smokers than the control group ($p=0.008$). The fighter-jet group had a significantly higher BMI ($p=0.001$), resting heart rate ($p=0.016$), and frequency of diabetes mellitus ($p=0.044$) than the control group. Measured $L_{Aeq,8h}$ of the control areas were 53 and 54 dB(A) and L_{max} were 88 and 89 dB(A). $L_{Aeq,8h}$ of areas exposed to helicopter noise were 71 and 72 dB(A), and L_{max} were 114 and 116 dB(A). $L_{Aeq,8h}$ of areas exposed to fighter-jet noise were 68, 74, 78, 79, 80, and 82 dB(A), while L_{max} were 105, 107, 108, 109, 110, and 115 dB(A).

Table 4. Level of Blood Pressure in Subjects without Hypertension

	Control	Helicopter	Fighter jet	*p* value		
				Control *vs.* Helicopter *vs.* Fighter jet	Control *vs.* Helicopter	Control *vs.* Fighter jet
n	147	63	252			
Sex, *n* (%)						
Male	57 (38.8)	31 (49.2)	129 (51.2)	0.053	0.160	0.016
Female	90 (61.2)	32 (50.8)	123 (48.8)			
Age, years	52±1	56±2	52.8±1.0	0.187	0.067	0.678
SBP, mmHg	120±1	123±1	122±1	0.047 (0.169†)	0.029 (0.089†)	0.053 (0.138†)
DBP, mmHg	73±1	74±1	75±1	0.045 (0.094†)	0.425 (0.413†)	0.013 (0.033†)
Male						
SBP, mmHg	124±1	123±2	124±1	0.939	0.755	0.992
DBP, mmHg	74±1	74±2	76.0±1	0.206	0.884	0.137
Female						
SBP, mmHg	117±1	124±2	120±1	0.014	0.005	0.073
DBP, mmHg	72±1	73±1	73±1	0.312	0.319	0.148

Data are expressed as mean±SEM. SBP, systolic blood pressure; DBP, diastolic blood pressure. *Three *p* values for all groups and two noise groups with a reference of the control group achieved by a univariate general linear model for age, SBP, and DBP, and by a logistic regression model for sex. †Age and sex adjusted *p* values.

The prevalence of hypertension was marginally higher in the exposed groups than in the control group (Table 2, $p=0.054$). A comparison of the exposed subjects (helicopter group and fighter-jet group combined) to the control group showed a significantly higher prevalence of hypertension in the exposed subjects (49.4% *vs*. 41.7%, respectively, $p=0.037$) (not shown in table). When compared to the control group, the helicopter group showed a significantly higher prevalence of hypertension ($p=0.020$), whereas the fighter-jet group did not ($p=0.094$). While the prevalence of hypertension in the male subjects did not differ among the three groups, female subjects in the exposed groups showed a significantly higher prevalence of hypertension than that of the control group ($p=0.029$). Stratified analysis by age group showed that subjects under 40 years of age in the helicopter group had a significantly higher prevalence of hypertension that control subjects under 40 ($p=0.002$). However, in the fighter-jet group, the prevalence of hypertension was not higher than in the control group ($p=0.074$). The prevalence of known hypertension in the helicopter group was significantly higher than that in the control group ($p=0.024$). The prevalence of known hypertension in the fighter-jet group was not different than that in the control group ($p=0.065$).

Analysis of the subjects who did not take antihypertensive or other cardiovascular medications (Table 3) showed a higher SBP in the exposed groups than the control group after adjustment for age and gender ($p=0.039$). The DBP of the exposed groups did not differ from that of the control group after adjustment for age and gender ($p=0.081$). The SBP of the helicopter group was significantly higher than that of the control group ($p=0.019$). The SBP of the fighter-jet group and the DBP of the helicopter and fighter-jet groups were not statistically different from the SBP and DBP of the control group after adjustment for age and gender. Female subjects in the helicopter group had higher SBP than those in the control group; however, this was not the case for males. An analysis of the subjects without hypertension showed higher SBP in the helicopter group and higher DBP in the fighter-jet group than in the control group (Table 4). After age and gender adjustment, only DBP in the fighter-jet group was significantly different from that in the control group ($p=0.033$). The female subjects in the helicopter group had significantly higher SBP than the control group ($p=0.005$). Although the differences were not significant ($p>0.05$), the prevalence of pre-hypertension in subjects without hypertension was highest in the helicopter group (63%), followed by the fighter-jet group (59%) and the control group (53%) (not shown in Table).

Table 5 shows the prevalence odds ratio for hypertension by the multiple logistic regression model after adjustment for age, gender, BMI, current smoking, alcohol intake, diabetes, and exercise. Subjects in the helicopter group had 1.62 times (95% CI, 1.02–2.59) higher risk for hypertension than subjects in the control group. The risk for hypertension in the fighter-jet group was not significantly higher than in the control group.

In an analysis of subjects who had lived for more than 5 years near a helicopter airbase ($n=146$), a fighter-jet airbase ($n=511$), or a control area ($n=253$), the prevalence odds ratios for hypertension were 1.44 (95% CI 0.92–2.25) in the subjects exposed to helicopter noise and 1.25 (95% CI 0.89–1.75) in the subjects exposed to fighter-jet noise.

Table 5. Adjusted Odds Ratio (OR) and 95% Confidence Interval (CI) for Risk of Hypertension, Achieved by Multiple Logistic Regression Analysis

Variables	OR	95% CI
Noise groups		
Fighter jet	1.23	0.87–1.74
Helicopter	1.62	1.02–2.59
Age	1.06	1.05–1.07
Sex	1.06	0.71–1.56
Body mass index	1.19	1.13–1.25
Diabetes mellitus	1.22	0.75–1.99
Smoking	0.66	0.44–0.98
Alcohol intake	1.57	1.09–2.27
Regular exercise	0.74	0.48–1.16

Discussion

The present study showed that the subjects exposed to helicopter noise had a significantly higher prevalence of hypertension than the unexposed control group. Chronic exposure to environmental noise has been suggested to increase the risk of ischemic heart disease (*2*, *3*) and the prevalence of hypertension (*4–12*). Although the influence of aircraft noise exposure on the prevalence of hypertension is inconclusive, many previous studies performed to evaluate the effects of noise from civilian airplanes showed weak positive associations with an increased prevalence of hypertension. The effect of military aircraft on the prevalence of hypertension is controversial. Matsui *et al*. reported a dose-response relationship between blood pressure and noise exposure around a military airfield in Okinawa, Japan (*12*). However, a survey performed by Pulles *et al*. showed no significant association between noise level and blood pressure (*13*). The intensity and length of noise exposure seem to be important factors in the increased prevalence of hypertension (*4*, *9*). Both of these factors vary depending on the type of aircraft. Thus, we can assume that different types of environmental noise may have different effects on the prevalence of hypertension. Most previous studies did not evaluate noise variations based on different noise sources. Another possible consideration is the cumulative effects of exposure to aircraft noise. However, it is not possible to calculate the cumulative effects of long-term aircraft noise exposure. In addition, other sources, such as traffic noise and occupational noise, may influence the prevalence of hypertension. In the present study, the distributions of gender and occupation did not differ among the groups. The influences of traffic and workplace noise would not be expected to differ among the groups. Thus, in the present study, the major determinant for the increased prevalence of hypertension among the environmental noises may have been aircraft noise, particularly that from helicopters. The intensity and length of noise exposure from a helicopter airbases may have been different from those of the fighter-jet airbases. Although a source-specific difference in the risk of cardiovascular disease by environmental noise exposure was suggested (*17*), no other study has evaluated whether or not exposure to noise from helicopters differs from exposure to that from fighter jets in their influence on the prevalence of hypertension. The present study is the first to evaluate different influences by different types of aircraft noise on the prevalence of hypertension. Our results suggest that different aircraft types may have different influences on the prevalence of hypertension.

The stratified analysis showed a higher prevalence of hypertension in the female subjects of the helicopter and fighter-jet groups than in the control groups. Although the prevalence of hypertension in male subjects in the helicopter group was higher than that in the control group, the difference was not statistically significant. The prevalence of hypertension in male subjects from the fighter-jet group was similar to that in the control group. While the majority of female subjects in the present study did not work outside of the home, many of the male subjects had work sites that were distant from the airbases and therefore not exposed to aircraft noise (data not shown). Thus, it could be postulated that the high prevalence of hypertension in female subjects may be due to the difference in exposure duration, though the present study did not measure the exact duration of aircraft noise exposure.

We observed a high prevalence of hypertension in subjects under the age of 40 in the exposed groups. This finding is different from the results of previous reports (*9*, *18*). Age is an important factor for hypertension in the general population (*19*, *20*). The prevalence of hypertension increases with age. Aging can mask the effect of noise exposure on the development of hypertension. Thus, it is plausible that when subjects are young, the effect of age on the development of hypertension is weak and the influence of aircraft noise may be stronger. However, the small study population and cross-sectional design require confirmation by further investigations.

There is no clear definition for the duration of exposure to determine the chronicity of noise exposure. Among the previous studies of the effects of environmental noise on health, Bluhm *et al*. reported a stronger association between noise and hypertension among those who had lived at their residence for more than 10 years (*4*). Babisch *et al*. also reported significantly increased risk of myocardial infarction for men who had lived in the studied area for at least 10 years (*21*). In the present study, subjects who had lived for more than 10 years in the studied areas showed a significant association between aircraft noise exposure and increased prevalence of hypertension. However, the association was not significant when the same analysis was performed for subjects who had lived more than 5 years. This result suggests that the duration of exposure to aircraft noise may be an important factor, but further studies are needed for confirmation.

The present study has the following limitations. First, the design was cross-sectional and with a relatively small population. A small increase can result in a statistically significant difference. To confirm the association between aircraft noise exposure and hypertension, long-term follow-up studies with a larger study population are needed. Second, the level of noise may be an important determinant for the prevalence of hypertension. Subjects who were exposed to higher levels of average energy or maximum noise levels have been shown to have a higher prevalence of hypertension (*4*, *9*). To calculate an accurate noise load, noise maps and noise models are needed. When the present study was performed, there was no noise map near the studied area. However, the present study was not designed to evaluate the dose-response relationship of aircraft noise exposure on the prevalence of hypertension. The noise levels in the present study were measured at representative areas, and $L_{Aeq,8h}$ and L_{max} near the helicopter and fighter-jet airbases were found to be higher than in the control areas. Third, the prevalence of hypertension in the present study was higher than that reported for the general Korean population (*22*, *23*). The mean age of the subjects included in the present study was different from that of the prior reports. However, the age-specific prevalence of hypertension was similar. In the present study, blood pressure was measured with a semi-automatic electronic device to prevent inter-observer differences. The validity of the device has been established previously (*15*).

In conclusion, the results of the present study suggest that chronic exposure to aircraft noise may increase the prevalence of hypertension. Although further investigations are needed, the different effects between helicopter noise and fighter-jet noise on the prevalence of hypertension implies that different types of aircraft may have different influences on the prevalence of hypertension.

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