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John Henryism Active Coping, Blood Pressure, Arterial Stiffness in Korean Americans

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Abstract

Objective: The study was conducted to test the John Henryism Active Coping (JHAC) hypothesis by examining the main and interaction effects of socioeconomic status (SES) and JHAC on cardiovascular risk (measured by blood pressure and arterial stiffness) in Korean Americans (KAs).

Methods: The sample was 102 KAs (aged 21–60 years). Measures include age, gender, body mass index, smoking, SES, JHAC (measured by the 12-item JHAC Scale), BP, and Arterial stiffness (AS). Data was analyzed with two way factorial ANOVA by SAS 9.2.

Results: Systolic BP (SBP) and Diastolic BP (DBP) were significantly higher in the low education group. The interaction effect of education and JHAC on SBP was significant, indicating that the education effect on SBP was greater in the low JHAC group. The main effect of education on AS was not significant. However, the JHAC had a significant main effect on AS, showing that the group with low JHAC score had higher AS than the group with high JHAC. The interaction between education and JHAC on AS was also significant, thus the effect of JHAC on AS was greater in the low education group.

Conclusion: The inverse relationship between education and cardiovascular measures was more severe in the low JHAC group, contrary to JHAC hypothesis. Furthermore, AS, an important biomarker of cardiovascular disease, was predicted by JHAC, but not by education. The findings suggest that JHAC may have beneficial effects on cardiovascular health in KAs.

Keywords

John Henryism Active Coping; Social Economic Status; Blood Pressure; Arterial Stiffness; Korean Americans (in order of relevance)

Introduction

High blood pressure is an important risk factor for cardiovascular disease which is a leading cause of death in modern society [1]. Although the associations among blood pressure and its personal and environmental risks are often highly complex, many population-based longitudinal studies have clearly demonstrated that blood pressure (BP) is inversely related to socioeconomic status (SES) [2–4]. Despite the challenges of measuring SES accurately [5, 6], education is considered a more consistent and stable measure of SES than either income or occupation [2, 4, 7–9].

Certain coping styles are considered to alter the relationships between health and its risk factors, exerting either positive or detrimental effects on health. The concept of John Henryism active coping has been used to explain cardiovascular disparity in African Americans. John Henryism active coping is defined as a strong behavioral predisposition to cope with psychosocial environmental stressors in an active, determined, and hard-working manner [10, 11]. According to the John Henryism hypothesis, the inverse association between BP and SES is more severe for individuals who have high John Henryism active coping than those who have less John Henryism active coping [12].

While several studies supported the John Henryism hypothesis in both Black and White Americans [13, 14], no studies have examined this phenomenon with physiological measures and in Asian Americans or more specifically Korean Americans. Korean Americans are the fifth largest Asian population in U.S. [15]. According to 2010 national data, Korean Americans have the highest uninsured rate (31%) and least median house hold income among all Asian American and Pacific Islander subgroups [16]. Despite scarcity of studies on Korean Americans' health, one study showed a high prevalence of hypertension in Korean Americans [17]. Korean Americans also have high levels of psychological stress from adjusting to American culture and environment [18–20].

Given the reported data on socioeconomic status, hypertension, and the high levels of stress of Korean Americans, it is important to examine how John Henryism active coping factors into the relationship of SES and cardiovascular health in Korean Americans. Large-artery stiffness has been not only considered an independent predictor of progression to hypertension [21], but also identified as an significant marker of cardiovascular morbidity and mortality [22, 23]; [24]. Therefore, the purpose of this study was to examine how John Henryism active coping, alone and in combination with SES, influence cardiovascular risk (measured by BP and arterial stiffness) in Korean Americans.

Methods

Subjects and Setting

A total of 102 male and female Korean Americans aged 21–60 years were recruited for the study from the Triangle area of North Carolina (NC). NC experienced a 30.71% growth in its Asian population from 2000 to 2006, and Koreans are one of the fastest growing groups of Asian immigrants in the U.S. [15]. For this study, only people who were born in Korea and have lived in the U.S. for at least 1 year were recruited. Certain people were excluded

from the study based upon pre-established criteria. For example, children were excluded because the parameters for arterial stiffness were not sufficiently standardized in children and the relationship between coping and hypertension in children is unknown. Because arterial stiffness progressively increases with age, and isolated systolic hypertension affects 50% of people over age 60 [25], only adults 21 to 60 years of age were recruited. Since the device measuring arterial stiffness (SphygmoCor) requires a regularly occurring pulse wave and normal electrocardiogram (ECG) to derive its measures, people with irregular cardiac rhythms were also excluded. Those who take medications that may affect BP and those with known cardiac conditions or vascular conditions that may affect the measures of arterial stiffness were also excluded.

Measures

The study measured the psychological factor of John Henryism Active Coping, physiological responses (arterial stiffness and BP), demographic factors (age, gender, SES measured by education and household income) and control factors (body mass index and smoking).

John Henryism active coping.—Chronic active coping was measured by the John Henryism Active Coping Scale (JHAC12) [10]. This 12-item scale measures the behavioral predisposition to cope actively and persistently with difficult psychosocial stressors and barriers. According to James et al. (1987), the scale consists of three themes: a commitment to hard work, a determination to achieve one's goals, and efficacious mental and physical tenacity. The 5-point Likert scale ranges from 1 (completely false) to 5 (completely true). The total John Henryism score is derived by summing the numerical values for all 12 items; thus, possible scores range from 12 to 60 with higher scores indicating greater active coping. The Cronbach's alpha of .73 to .76 have been reported by Barksdale et al. (2013), Haritatos et al. (2007), and Fernander, et al. (2005). Several authors stated there is no published study that has reported test-retest reliability of this scale [26, 27]. In this study, the internal consistency of JHAC12 was Cronbach's alpha of .79 and the test – retest reliability was r of .61.

Blood Pressure.—Blood pressure (BP) is a measure of the force applied to the walls of the arteries as the heart pumps blood through the body. BP is determined by both the force and amount of blood pumped, as well as the size and flexibility of the arteries. Brachial BP was measured using WelchAllyn Vital Signs Monitor 300 Series. Since incorrect cuff size causes error in BP measurement [28], the mid-section circumference of the dominant upper arm was measured with a tape, and the proper sized cuff was selected according to the upper arm circumference. The bladder of the cuff should encircle at least 80% of the arm. The cuff was placed over the bare arm to maximize reliability of the measures. The artery marker on the cuff was placed over the brachial artery and the cuff was applied snugly allowing no more than two fingers underneath. The arm was kept at the level of the heart without movement and the patient was not spoken to and asked not to speak during the BP measurement [29]. Using the automated BP monitoring device, BP was measured in the dominant arm twice with 2 minutes rest between measures [28]. The mean of the 2 BP measurements served as baseline BP and was entered into SphygmoCor software.

Arterial stiffness.—Since pulse wave travels faster in stiffer arteries, determining pulse wave velocity (PWV) is generally accepted as the most simple, noninvasive, and reproducible method to measure arterial stiffness [30]. PWV can be determined by the distance the pulse travels between two arterial sites (D) divided by pulse transit time (t); thus, PWV equals $D(\text{meters}) / t(\text{seconds})$ [31]. Carotid-femoral PWV (C-F PWV) is considered the ‘gold-standard’ measure of arterial stiffness because it measures PWV of aorto-iliac pathway [31], which buffer BP most [32]. In this study, arterial stiffness was determined by measuring CF PWV using the SphygmoCor system (AtCor medical). Carotid and femoral wave forms were obtained by a tonometer placed on the carotid and femoral sites. The transit time of the pulse wave from the left ventricle to the carotid artery ($t1$) and the transit time of the pulse wave from the left ventricle to the femoral artery ($t2$) were calculated by the system software on the basis of ECG. The distance from the suprasternal notch to the carotid artery site ($d\text{-carotid}$) and the distance from the suprasternal notch to the femoral artery site ($d\text{-femoral}$) were measured by a tape measure. PWV is the distance difference ($d\text{-femoral} - d\text{-carotid}$) divided by the time difference ($t2 - t1$) [33].

Demographic factors and Control factors.—Age, Gender, SES (income and education), and smoking were self-reported. To calculate BMI (kg/m^2), height (m) and weight (kg) were measured with a portable stadiometer manufactured by Accu-Hite and with an electronic scale manufactured by Pen Scale, respectively.

Procedures

Measures of arterial stiffness are known to have a circadian pattern and to be maximal in the morning [34, 35], therefore, all data were collected in the same time period of day between 7 and 11am. All subjects abstained from consuming coffee, smoking, and eating for 3 hours and from drinking alcohol for 10 hours before data collection [31].

To minimize distractions, the subjects completed the scales in a quiet room. Participants then rested at least 10 minutes in the recumbent position, and BP was measured twice in the supine position. After measuring BP, electrodes were attached to the subject’s chest. Pulse wave velocity (PWV) was obtained at the carotid and femoral arterial sites by a well-trained investigator. To ensure privacy, the investigator used a clean blanket to cover the groin site so that only a small area of the femoral region was exposed for the tonometer placement.

Data Analysis

All statistical analysis was performed with SAS 9.2 software. Descriptive analysis was obtained by mean and percentage. In bivariate correlation analysis, income and smoking were not related to either JHAC scores nor to any of cardiovascular measures, thus, further analysis did not include these variables. In order to make the analysis method consistent with the first study that examined the JHAC hypothesis [4], the means of education and JHAC scores (mean 42.04 and median 42.00) were used to divide subjects into two levels of education (low education for community college graduate or less, and high education for university graduate or higher) and two levels of JHAC scores (low for equal to or less than 42 and high for greater than 42). The main effects of education and JHAC on cardiovascular measures (blood pressure and arterial stiffness) were tested by two way factorial ANOVA

using Type III sum of squares. The interaction effect of education and JHAC scores were further examined by contrasts, controlling for age, gender, and BMI that were significantly related to blood pressure and arterial stiffness. A value of $P < .05$ was considered statistically significant.

Results

The study sample included 102 participants (60% women) with a mean age (SD) of 39.64 (9.89) years. 69 participants (67.65%) reported education at the university graduate or higher while 33 participants (32.35%) graduated from community college or had lower levels of education. 65.7% of sample earned a yearly household income less than \$49,999. Table 1 displays the characteristics of the overall sample and of the two subgroups by education and John Henryism Active Coping score. The mean score of JHAC was 42.04 (SD: 5.68) and it was normally distributed with $-.59$ skewness and $.87$ kurtosis. The bivariate correlation results showed that among age, gender, education, income, BMI, and smoking, only education was significantly related to JHAC ($r = .297$, $p = .003$).

The results showed that the main effect of education on SBP was significant ($F = 4.82$, $p = 0.031$), such that SBP was significantly higher for the group with low education. The main effect of JHAC on SBP was non-significant ($F = 0.95$, $p = 0.331$). However, the interaction effect of education and JHAC was significant ($F = 5.60$, $p = 0.019$), indicating that the education effect was greater in the group of low JHAC than in the group of high JHAC.

Education also had a significant main effect on DBP ($F = 6.80$, $p = 0.011$), indicating that the low education group had higher DBP than the high education group. However, the main effect of JHAC and the interaction of education and JHAC on DBP were not significant ($F = 1.62$, $p = 0.207$ and $F = 2.62$, $p = 0.109$).

Interestingly, a two-factor ANOVA yielded a non-significant main effect of education on PWV ($F = 0.22$, $p = 0.641$). However, the JHAC score had a significant main effect on PWV ($F = 5.50$, $p = 0.021$), showing that the group with low JHAC score had higher PWV than the group with high JHAC.

Furthermore, the interaction between education and JHAC was also significant ($F = 5.85$, $p = 0.018$), so that the effect of JHAC on PWV was greater in the group with low education.

The results of additional analysis on the interaction effect sliced by two education groups and two JHAC group are demonstrated in figure 1 and 2. In the low JHAC group, the participants with low education had significantly higher SBP and PWV than those with high education ($p = .0004$ and $p = .024$, respectively). Likewise, in the low education group, the participants with low JHAC score had significantly higher SBP and PWV than those with high JHAC ($p = .049$ and $p = .006$, respectively).

Discussion

This study demonstrated that the low education group had higher BP than the high education group, which is consistent with past studies. However, the effect of JHAC on the relationship

between education and SBP was contrary to the findings of James et al [10, 11], showing that the inverse relationship between education and SBP was more prominent in the group with low JHAC not in the group with high JHAC. This result was significant after adjusting for age, gender and BMI, which are important confounding factors of SBP, presenting that JHAC may have positive and protective effect on SBP in this group of Korean Americans.

Another interesting finding is that arterial stiffness as measured by C-F PWV was not different in low and high education groups, however, arterial stiffness was higher in the low JHAC group than the high JHAC group after adjusting for age, gender, and BMI. Furthermore, in the low education group, the low JHAC group had significantly higher PWV than the high JHAC group. Also in the low JHAC group, the low education group had significantly higher arterial stiffness than the high education group, showing that the cases accompanied by low education and low JHAC have highest arterial stiffness in this Korean American sample. These results further support the important effect of JHAC on cardiovascular health in Korean Americans because of increasing emphasis that has been placed on the role of arterial stiffness in the development of cardiovascular diseases.

Arterial stiffness has been implicated in pathophysiological processes of cardiovascular diseases [21, 36]. When the heart pumps blood, a pulse wave flows throughout arteries and the pulse wave flows back when it meets the arterial walls [37]. Therefore, the pressure wave is summed with the reflected wave [38]. When the walls of arteries are elastic, the reflected wave is present during diastole, therefore, it does not increase SBP but help blood flow in the coronary system [39]. However, when the arteries are stiff, the reflected wave flows back faster and appear in late systole, increasing SBP and left ventricular load [40]. Indeed, arterial stiffness has been identified not only as an independent predictor of hypertension but also as an important clinical marker of CVD [22, 23], [24].

This study is the first to report the effect of JHAC on arterial stiffness, and the results demonstrate that, in this group of Korean Americans, JHAC appeared to exert a beneficial impact on cardiovascular health, particularly in the low education group. Whereas the majority of studies showed detrimental effects of JHAC on low SES African Americans, some studies previously reported the positive effect of JHAC on self-reported health behaviors [41] and self-reported physical health [42]. For example, one study on 146 Black Americans reported that patients with low levels of education and low levels of JHAC had higher nicotine dependence scores than any other groups of education and JHAC [26]. A study with 894 White, Black, and Hispanic Americans reported that only Whites with low JHAC and low SES were significantly related to worse oral health. Another study that examines JHAC in 318 self-identified Chinese and Indian immigrants with high socioeconomic status reported that higher JHAC predicted better self-rated health and physical functioning, and fewer somatic symptoms [27]. Although these studies included no physiological measure, they showed that JHAC is beneficial to health in people with both low SES and high SES. It is questionable whether or not this sample of Korean Americans can be presented as high socioeconomic immigrants. According to a population-based study with 1,344,267 Korean Americans, 49.8% of participants had a bachelor's or higher degree, and the median household income of that population was \$53, 887 [16]. This sample of 102 Korean Americans had higher educational levels but low household income compared with

the national data. Nevertheless, this sample of Korean Americans may have low social resources and lack of psychosocial support due to their immigration status.

The observation that the JHAC hypothesis does not appear to be supported in Asian immigrants may be explained by certain emotions that are accompanied by or followed after ones' use of the JHAC style. The emotional states caused by stressful encounter changes over time, depending on the coping strategy used [43] and those emotions may play a mediating role between coping and physiological health. Previous studies showed that there were difference in the relationship of JHAC and emotions between African Americans and Asian Americans. For example, one study on 758 (mainly African-Americans) indicated that JHAC was negatively associated with happiness [44]. On the other hand, a study on 318 Asian Americans reported that JHAC was significantly related to less perceived stress, and the perceived stress played a mediating role between JHAC and self-reported physical health [27]. It is known that laughter and happiness induce beneficial effect on cardiovascular function [45, 46], whereas negative emotions such as stress emotions have adverse effect on BP [47, 48]. Therefore, conflicting results on the relationship between JHAC and cardiovascular measure may be because JHAC leads to different emotions which have different impacts on cardiovascular function in different populations. It is not clear whether these different results are from 'racial difference of physical response to high-effort coping' or from 'cultural difference of emotional response to this type of coping'. Simultaneous examinations of JHAC and emotions in multiethnic groups will advance our understanding of JHAC and its benefit to alleviate cardiovascular disparities in minority groups.

In conclusion, this study tested the JHAC hypothesis in Korean Americans, and further examined the interaction of JHAC and education on arterial stiffness as well as blood pressure. The results demonstrate that the inverse relationship between education and cardiovascular measures are more prominent in the low JHAC group, contrary to previous studies. Furthermore, arterial stiffness, an important biomarker of cardiovascular disease, was predicted by JHAC but not by education, showing the subjects with low JHAC had significantly higher arterial stiffness. This phenomenon was also more obvious in the subjects with low education. The findings suggest that the traditional JHAC hypothesis may not accurately reflect life experiences of some Korean Americans, suggesting that JHAC may exert beneficial effect on cardiovascular health in this under representative group. In order to develop JHAC as a tool to intervene in health, further studies are recommended to identify factors that lead to conflicting results among different cultures and ethnicities, and to resolve the pathway by which JHAC affect blood pressure and arterial stiffness.

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Figure1.
The interaction effect between Education and JHAC on SBP (Adjusted for age, gender, and body mass index)

Figure2.

The interaction effect between Education and JHAC on PWV (Adjusted for age, gender, and body mass index)

Table 1.

Descriptive Statistics of all participants and subgroups by JHAC Scores and Education Status

	All (N=102)	Low Education (N=33)	High Education (N=69)	Low JHAC (N=55)	High JHAC (N=47)
Age	39.64 ± 9.89	43.79 ± 8.36	37.65 ± 10.01	40.49 ± 8.99	38.64 ± 10.88
BMI	23.59 ± 3.26	24.43 ± 3.20	23.19 ± 3.23	23.24 ± 3.15	24.00 ± 3.37
SBP(mmHg)	119.70 ± 14.91	126.12 ± 16.41	116.64 ± 13.21	120.22 ± 14.92	119.11 ± 15.06
DBP(mmHg)	71.92 ± 9.27	76.58 ± 8.44	69.69 ± 8.88	72.93 ± 9.38	70.74 ± 9.11
PWV (m/s)	6.99 ± 1.13	7.49 ± 1.06	6.76 ± 1.10	7.17 ± 1.19	6.79 ± 1.05
JHAC	42.04 ± 5.68	39.64 ± 6.26	43.19 ± 5.04	5.51	6.01

Values are mean ± SD, SBP: Systolic blood pressure, DBP: Diastolic blood pressure, PWV:Pulse wave velocity

Table 2.

Effects of Education and JH alone and in combination on Cardiovascular Measures

	SBP (F=6.97, p=<.0001)		DBP(F=10.22, p=<.0001)		PWV (F=14.42, p=<.0001)	
	F	P	F	P	F	P
Education	7.64	0.0068	9.28	0.0030	1.08	0.3020
JHAC	0.00	0.9902	0.44	0.5092	2.11	0.1497
Age	1.77	0.1867	9.73	0.0024	44.24	<.0001
Gender	12.50	0.0006	15.91	0.0001	0.14	0.7137
BMI	3.01	0.0862	0.86	0.3565	4.88	0.0295
	SBP (F=7.02, p=<.0001)		DBP(F=9.10, p=<.0001)		PWV(F=13.6, p=<.0001)	
	F	P	F	P	F	P
Education	4.82	0.031	6.80	0.011	0.22	0.641
JHAC	0.95	0.331	1.62	0.207	5.50	0.021
Education * JHAC	5.60	0.019	2.62	0.109	5.85	0.018
Age	2.15	0.146	10.34	0.002	47.86	<.0001
Gender	14.11	0.0003	16.92	<.0001	0.27	0.602
BMI	2.44	0.122	0.62	0.432	4.18	0.044