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The Moderating Effect of Mental Health on the Relationship Between Cardiovascular Disease Awareness and Health Behaviors of Middle-Aged Korean Chinese Workers With Cardiovascular Risk Factors in Korea

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Abstract

Introduction: Cardiovascular disease (CVD) remains a leading cause of death in China and Korea, yet little is known about in Korean Chinese workers. The purpose of the study was to investigate the effects of CVD awareness and mental health on health behaviors and evaluate the moderating effect of mental health on the relationship between CVD awareness and health behaviors among Korean Chinese workers. **Method:** We used a cross-sectional design and convenience sampling of participants from Seoul in December 2021. Data were analyzed using descriptive statistics, Pearson's correlation coefficient, independent *t* tests, and hierarchical multiple regression analysis. **Results:** CVD awareness, mental health, and health behaviors were relatively low and mental health showed a moderating effect on the relationship between the two variables. **Discussion:** Understanding relationships between CVD awareness, socioculturally mediated health behaviors, and mental health issues is critical to CVD prevention among participants; moreover, mental health should be specifically assessed and targeted for improvement.

Keywords

cardiovascular disease, risk factors, awareness, mental health, health behaviors

Introduction

In China and Korea, cardiovascular disease (CVD) remains a leading cause of death in both rural and urban areas (The Writing Committee of the Report on Cardiovascular Health and Diseases in China, 2022; Statistics Korea, 2021a). The number of Chinese nationals of Korean descent or Korean Chinese workers residing in Korea for economic reasons has increased continuously since 2012. Korean Chinese workers account for as many as 31.8% of the approximately 2.04 million foreigners residing in Korea (Ministry of Justice, 2021; Statistics Korea, 2021b). Most Korean Chinese workers in Korea are engaged in low-quality, unstable jobs such as simple labor; earn lower wages than most Korean workers; and live in areas with poor living conditions (C. W. Lee et al., 2017), putting them at greater risk of adverse health outcomes such as CVD. Among the approximately 640,000 Korean Chinese workers, more than half are at the age when the risk of CVD increases. Specifically, more than 70% are 40 years of age or older (Statistics Korea, 2021b). This is concerning as more than 43.2% of the total deaths due to disease among all workers in Korea, in 2019, including foreign workers, were attributed to CVD (Korean Occupational Safety and Health Agency, 2021). Accordingly, it is urgent to develop a CVD prevention education strategy that considers sociocultural factors for middle-aged Korean Chinese workers living in Korea.

Healthy lifestyles and behaviors are critical for preventing or decreasing the risk of CVD. Awareness and the ability to recognize CVD risk factors are prerequisites for active participation in health-promoting activities (Hwang & Park, 2016). A study of Canadian workers found that decreased awareness of CVD risk was associated with lower levels of health behaviors (Josephine et al., 2016). Although middle-aged Korean Chinese workers hope to lead a healthy life

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while working in Korea, there are insufficient health promotion programs designed for foreigners (Chae & Kim, 2020). For migrant workers, access to health information regarding the prevention of CVD that can be easily applied in daily life is limited (H. K. Lee et al., 2016). Although living in China, the Korean Chinese did not speak Korean in China. Thus, language barriers contribute to difficulties in obtaining information about medical programs and services while working in Korea (H. K. Lee et al., 2013). Published reports indicate that when health problems occur, these workers obtain health information from Chinese websites, friends, or family members in China (K. Jin et al., 2020). Most Chinese people have strong cultural beliefs, such as controlling their own destiny and making their own decisions regarding starting and stopping medications (King-Shier et al., 2018). In addition, they do not have the time to visit the hospital and often do not undergo medical examinations because of the burden of medical costs (H. K. Lee et al., 2013), which impedes the early detection and management of diseases (H. K. Lee et al., 2016).

Major modifiable risk factors for CVD include obesity, hypertension, diabetes, dyslipidemia, tobacco use, and lack of exercise (Arnett et al., 2019). Effective management of CVD risk factors typically requires a combination of health interventions such as lifestyle improvement and potential, drug therapy (Arnett et al., 2019). Among adults with hypertension and dyslipidemia, those who practiced healthy eating habits and exercised regularly for 12 months had a lower risk of CVD than those who did not (O'Connor et al., 2020). However, most Korean Chinese workers in Korea work more than 10 hr a day, are limited to 2 days off a month (H. K. Lee et al., 2013), and cannot easily exercise on their days off due to fatigue (H. K. Lee et al., 2016). Also, compared with Korean workers, Korean Chinese workers have limited ability to engage in healthy behaviors due to social economic factors and a lack of resources such as available health practical programs (S. J. Lee & Chung, 2013). Therefore, encouraging middle-aged Korean Chinese workers to engage in healthy behaviors is an important strategy to reduce CVD risk and the long-term burden of the disease (H. K. Lee et al., 2016).

Engaging in healthy behaviors is more challenging in the presence of mental health issues, especially among middle-aged and older adults. Mental health conditions such as depression, anxiety, and stress directly affect CVD risk and health behaviors, including exercise and tobacco cessation (Batelaan et al., 2016; Case et al., 2018; E. R. Jun et al., 2019; Osborne et al., 2020). Unlike Chinese culture, which expresses dissatisfaction and proactively resolves unfair situations, Korean culture emphasizes the restraint of individual impulses and control of expression (Han & Ryu, 2018). Korean Chinese workers experience a great amount of stress owing to their foreign status, unfair compensation, discrimination, neglect by Korean employers, and low job security (H. K. Lee et al., 2013). Nevertheless, they preferred to take care of their self or seek help informally from family and friends rather than use professional mental health services (Chao et al., 2020; Tieu & Konnert, 2014). In addition, healthy behaviors are less frequent among people with higher levels of stress and anxiety (Jin & Song, 2016; Otto et al., 2016). This suggests it is essential for clinicians to consider the degree and role of Korean Chinese workers' mental health status, pertinent cultural factors, and traditional risk factors when planning educational interventions to prevent CVD among this population. For example, a study targeting Korean and Chinese workers (Shin et al., 2020) found that stress had a mediating effect on health behaviors. Specifically, focusing on weight was shown to decrease health behaviors by increasing stress. It is expected that mental health issues such as stress may moderate the strength of health behaviors when added to CVD awareness in the Korean Chinese workers. However, we found no studies exploring this effect.

Therefore, the purpose of the study was to investigate the effects of CVD awareness and mental health on health behaviors and evaluate the moderating effect of mental health on the relationship between CVD awareness and health behaviors among Korean Chinese workers.

Method

Study Design, Sample, and Setting

This was a cross-sectional descriptive study using convenience sampling and snowball techniques. Participants were recruited from two areas in Seoul with a large population of Korean Chinese workers (Y. S. Kim & Yim, 2018).

Participants were recruited after being introduced by members of the Korean Chinese Workers' Federation. The Korean Chinese Workers Federation is a nonprofit private organization founded by the Chinese in 2006, which engages in various activities such as volunteering and socializing (Y. S. Kim & Yim, 2018). Specific selection criteria were Korean Chinese workers who lived in Korea for more than 1 year, were age 40 to 64 years, employed, able to communicate in Korean or Chinese, and understand the purpose of the study.

Participants were included if they had one or more CVD risk factors, including hypertension, diabetes mellitus, dyslipidemia, obesity (body mass index [BMI] $\geq$ 25), smoking, or a family history of CVD. As the overall goal was primary prevention, individuals with a history of CVD, such as myocardial infarction or stroke, were excluded. Also, participants with cognitive impairment, such as dementia, and those with a medical diagnosis of bipolar disorder, panic disorder, or schizophrenia were excluded.

Sample size was estimated using G*power program 3.1.9 isomg an input alpha at .05, power of .80, an effect size of 0.171 calculated based on previous research (Kong et al., 2016), and the number of predictors at 13 for a linear

multiple regression analysis. The minimum sample size required for this study was 116. However, a projected attrition rate of 15% resulted in a calculated sample size of 137 people.

Measurements

General Demographics. Demographics were collected using a form developed specifically for this study. Data elements consisted of sex, age, marital status, educational background, monthly income, living with family, length of living away with family, length of stay, and CVD knowledge acquisition experience. Cardiovascular risk factors included a total of 16 items suggested by the American Heart Association: hypertension, diabetes, dyslipidemia, obesity (BMI $\geq$ 25), smoking, or family history of CVD (Arnett et al., 2019). In addition, the participants' waist–height ratios were calculated, and their waist circumference was measured directly by the researcher.

CVD Awareness, Knowledge, and Attitudes

Knowledge of CVD Symptoms. The United States Centers for Disease Control and Prevention's (2009) Behavioral Risk Factor Surveillance System Questionnaire was translated by the Korea Centers for Disease Control and Prevention in collaboration with professors from nine university hospitals nationwide and modified for use in Korea (Chonnam National University Hospital Regional Cardiocerebrovascular Center, 2010). The tool consists of 12 items (one reverse item for each symptom), including six items for heart attack symptoms and six items for stroke symptoms. The responses to each question were scored on a 5-point Likert-type scale, and the total score ranged from a minimum of 6 to a maximum of 30, with higher scores indicating a greater level of knowledge about CVD symptoms. The reliability of the tool at the time of development was Cronbach's α = .83, and the reliability in this study was Cronbach's α = .73. On a 5-point Likert-type scale, knowledge was regarded as correct if the participant responded *strongly agree* or *agree* and incorrect if the participant answered *disagree*, *strongly disagree*, or *don't know*. Negative items were scored in the opposite manner.

Attitude Regarding the Prevention of CVD. This questionnaire was based on nine items identified as healthy lifestyle factors for prevention of CVD by the Korea Ministry of Health and Welfare (2008) in collaboration with eight academic societies interested in CVD. Each question was scored on a 5-point Likert-type scale, with a total score ranging from a minimum of 6 to a maximum of 30, with a higher score indicating a better attitude toward CVD prevention. The reliability of the tool at the time of development was Cronbach's α = .89 (Korea Ministry of Health and Welfare, 2008), and the reliability in this study was Cronbach's α = .84.

Mental Health. Mental health was assessed using the Korean version of the Depression Anxiety Stress Scale (DASS-21), a simplified form of the DASS scale (Lovibond & Lovibond, 1995). The subdomain is a 21-item 4-point Likert-type scale consisting of seven items to assess stress, seven items to assess anxiety, and seven items to assess depression. Depression items were answered as not at all (0 points), slightly or sometimes (1 point), quite or often (2 points), and frequently (3 points), with a minimum of 0 points and maximum of 63 points, with higher scores indicating poorer mental health. The depression status was classified as "no depression" for scores of 9 or less, "mild depression" for scores from 10 to 13, and "severe depression" at scores of 14 or higher. Anxiety scores also were allocated into one of three categories (7 points or less, 8 to 9 points, and 10 points or more), as were stress scores (14 points or less, 15 to 18 points, and 19 points or more). In a preliminary study validating the tool for use with the general public, the Cronbach's alpha values for depression, anxiety, and stress were .88, .82 and .90, respectively (Henry & Crawford, 2005); those in this study were .89, .84, and .91, respectively.

Health Behaviors for CVD Prevention. Health behaviors for CVD prevention were measured using the tool E. Y. Kim and Hwang (2011) used with bus drivers. We modified the tool based on H. J. Park's (2008) tool developed to measure the health behaviors of industry workers for CVD prevention. The resulting questionnaire consisted of 18 items in six subdomains of smoking, drinking, exercise, eating habits, stress, and health checkup. Each item response was scored on a 5-point Likert-type scale ranging from 1 point for a *strongly disagree* response to 5 points for *strongly agree*. Scores ranged from a minimum of 18 to a maximum of 90, with higher scores indicating better performance in CVD prevention behavior. The reliability of the tool was .73 in the Park's study, .77 in Kim and Hwang's study, and .76 in this study.

Data Collection

The study was approved by the Institutional Review Board (IRB) of H University (HYUIRB-202111-001-2) for the Protection of Human Participants. Data were collected from November 10 to December 19, 2021. The researcher relied on key informants to help screen potential participants prior before enrollment in the study. Key informants included Korean Chinese Workers' Federation members. They introduced about 30 Korean Chinese workers registered with the federation who met the selection and exclusion criteria for this study. After contacting the workers in advance, the researcher visited their workplaces and residences personally, explained the purpose and design of the study, and distributed questionnaires to the individuals who volunteered to participate. In addition, the researcher provided questionnaires regarding CVD risk factors, diseases under the

umbrella of CVD, and psychiatric diseases before conducting the survey to assess eligibility. The researcher completed the questionnaire through one-on-one personal interviews. In the next step, snowball sampling was conducted, such that those who completed the survey introduced other participants who met the selection criteria for the study. The time required to complete all study questionnaires was approximately 20 min. The completed questionnaires were individually sealed in paper bags to protect the confidentiality of personal information.

Statistical Analyses

Data were analyzed using IBM SPSS Version 26.0 software. Descriptive statistics were used to analyze all study variables. The normality of the variables was tested using the Kolmogorov–Smirnov test method and the Scheffé test as the post hoc test. Correlations between participants' CVD awareness, mental health, and health behaviors were analyzed using Pearson's correlation coefficient. A hierarchical multiple regression analysis was performed to investigate the effect of CVD awareness and mental health on health behaviors and the moderating effect of mental health on the relationship between these two variables. First, the significance of the effect of the independent variable on the dependent variable was assessed, followed by the significance of the moderator variable on the dependent variable. In the third step, the significance of the interaction term between the independent variable and the moderator variable was confirmed. To minimize multicollinearity, the independent variable and the control variable were respectively mean-centered, and the two variables were multiplied to create an interaction term. Reliability of the tool was calculated using Cronbach's alpha value.

Results

Demographics and Cardiovascular Risk Factors

A total of 137 participants completed the questionnaires, 132 of which were used for the final data analysis. Five questionnaires on which the respective respondent consistently answered *strongly disagree* or *don't know* were discarded because the researcher determined that the reliability of these questionnaires was relatively low. The average age of the participants was 53.3 ± 6.3 years, and 54.5% were women. Smoking (44.7%) was the most common CVD risk factor, followed by family history (42.4%), hypertension (28%), hyperlipidemia (21.2%), and diabetes (16.7%). Most of the participants (59.8%) had a BMI ≥ 25 kg/m^2, and the mean waist-to-height ratio (WHtR) was >0.50 in 41.7% of men and >0.50 in 21.8% of women. Almost one third of the participants (31.8%) responded that they had no experience with acquiring knowledge regarding CVD (Table 1).

CVD Awareness, Mental Health, and Health Behaviors of Participants

CVD awareness was low moderate, with an average of 66.79 ± 8.86 points out of 105 points. Moderate depression (24.2%) and moderate anxiety (12.5%) were the most common mental health conditions. The average score for health behaviors was 50.23 ± 7.65 of 90 points, and the lowest score among the subdomains was preventive health checkup with an average of 5.98 ± 2.86 points. See Table 2 for further details.

CVD Awareness, Mental Health, and Health Behaviors According to General Characteristics

Living with family and obesity were significantly associated with CVD awareness, mental health, and health behaviors ($p < .05$). Monthly income ($F = 3.75$, $p = .026$) and strength exercise ($t = 3.16$, $p = .002$) were significantly associated with CVD awareness and mental health, respectively. Sex ($t = -2.12$, $p = .036$), length of living away with family ($t = 3.00$, $p = .003$), and smoking ($t = -2.21$, $p = .029$) were significantly associated with health behaviors (Table 3).

Correlation Among CVD Awareness, Mental Health and Health Behaviors

Health behaviors were positively correlated with CVD awareness ($r = .44$, $p < .001$) and negatively correlated with mental health ($r = -.45$, $p < .001$). In addition, CVD awareness negatively correlated with mental health ($r = -.35$, $p < .001$) (Table 4).

The Effects of CVD Awareness and Mental Health on Health Behaviors and the Moderating Effect of Mental Health on the Relationship Between These Two Variables

To test the moderating effect of mental health on the relationship between CVD awareness and health behaviors, mean centering of variables was performed to remove multicollinearity between interaction of the independent and moderator variables. In Step 1, analyzing CVD awareness while controlling for general characteristics of sex, living with family, length of living away with family, smoking, and obesity, 24% of the variance was explained by Model 1 ($F = 7.87$, $p < .001$), and CVD awareness had a significant effect ($\beta = 0.39$, $p < .001$). After adding mental health to Model 2 as a modulating variable, mental health had a significant effect on health behaviors ($\beta = -0.29$, $p < .001$), and the explanatory power of the model increased significantly compared with Step 1 at 31% ($F = 9.40$, $p < .001$). Next, when the interaction variables between CVD awareness and mental

Table 1. General Characteristics of the Participants and Their Cardiovascular Risk Factors (N = 132).

Characteristics	Categories	*n* (%)	*M* ± *SD*
Age			53.33 ± 6.31
Sex	Men	60 (45.5)	
	Women	72 (54.5)	
Marital status	Unmarried	85 (64.4)	
	Married/divorced/bereaved	47 (35.6)	
Education	Elementary school/middle school	44 (33.4)	
	High school/college	88 (66.7)	
Monthly income (10,000 won)	<200	38 (28.8)	
	200–299	80 (60.6)	
	≥300	14 (10.6)	
Job type	Restaurant service	65 (49.2)	
	Factory worker	34 (25.8)	
	Self-employment/office worker/facility caregiver	33 (9.8)	
living with family	No	106 (80.3)	
Length of living apart (year)			5.16 ± 3.75
Length of stay (year)			6.80 ± 3.20
Cardiovascular risk factors[a]			2.19 ± 1.13
	Hypertension	37 (28.0)	
	Diabetes	22 (16.7)	
	Hyperlipidemia	28 (21.2)	
	CVD family history	56 (42.4)	
	Current smoking	59 (44.7)	
	Obesity (BMI ≥ 25)	79 (59.8)	24.27 ± 2.74
WHtR	Men > 0.50	55 (41.7)	0.49 ± 0.04
	Women > 0.52	29 (21.8)	
Aerobic exercise	<2 times/week	91 (68.9)	
Strength exercise	<2 times/week	109 (82.5)	
CVD knowledge acquisition experience[a]	None	34 (31.8)	

Note. CVD = cardiovascular disease; BMI = body mass index (kg/m^2); WHtR= waist-to-height ratio.
[a]Multiple responses.

health were additionally input in Model 3, these variables explained 33% of health behaviors, a significant increase compared with the model used at Step 2 ($F = 9.00, p < .001$). Mental health was found to have a moderating effect on the relationship between CVD awareness and health behaviors (Table 5) (Figure 1).

Discussion

Findings from our study evaluating the relationships between CVD awareness, mental health, and health behaviors indicated a lower awareness of CVD than that reported by Y. H. Park and Jang (2018). Specifically, awareness of typical symptoms, such as chest pain was high, but awareness of jaw, shoulder, or arm pain was low. This suggests that the participants lacked knowledge about symptoms associated with cardiac pain other than typical chest pain. Because they have CVD risk factors, education regarding associated and atypical symptoms is necessary to recognize and respond quickly when symptoms of a heart attack occur.

Our participants were familiar with the stroke symptoms of "sudden numbness or weakness on one side of the body," but the recognition of changes in speech or vision was low. This was similar to the findings of other studies with Chinese (C. Lee et al., 2021) and Korean (K. A. Kim & Hwang, 2016) participants. This can be attributed to limited access to CVD prevention information that can be easily used by Korean Chinese workers with language barriers and limited leisure time (H. K. Lee et al., 2013, 2016). Furthermore, 33.4% of the participants in this study had not completed middle school and 31.8% had no experience in acquiring knowledge related to CVD despite having CVD risk factors. Thus, we predicted that their knowledge about stroke symptoms would be low. Heart attack or stroke can have devastating consequences if the symptoms are not recognized, as the "golden time" from symptom onset to hospitalization determines prognosis. Therefore, it is necessary to educate Korean Chinese workers with risk factors on how to improve their lifestyle to prevent CVD, identify acute heart attack and stroke symptoms, and respond accordingly. Considering the language barriers

Table 2. CVD Awareness, Mental Health, and Health Behaviors of Participants (N = 132).

CVD awareness	*n* (%) or *M* ± *SD*	Actual range	Possible range	Correct answer *n* (%)
Knowledge of symptom	37.61 ± 5.91	24–52	12–60	
Heart attack (six items)	18.21 ± 3.66	10–27	6–30	39 (29.5)
Jaw, neck, or back pain				36 (27.2)
Weakness, dizzy, and blurred see				98 (74.3)
Chest pain				34 (25.7)
Arm or shoulder pain				61 (45.2)
Shortness of breath				
Stroke (six items)			6–30	
Sudden slurred speech				66 (50.0)
Sudden numbness or weakness on one side of the body				96 (72.8)
Sudden trouble seeing in one or both eyes				51 (37.1)
Sudden trouble walking, dizziness	19.39 ± 4.00	9–30		71 (55.3)
Sudden severe headache				78 (59.1)
Attitude regarding prevention of CVD	29.18 ± 6.10	18–44	9–45	
Total	66.79 ± 8.86	45–91	21–105	
Mental health depression (seven items)	7.76 ± 3.80	0–15	0–21	
Mild	15 (11.4)			
Moderate	32 (24.2)			
Severe	5 (3.8)			
Anxiety (seven items)	6.28 ± 3.16	0–14	0–21	
Mild	13 (9.8)			
Moderate	23 (17.5)			
Severe	6 (4.5)			
Stress (seven items)	11.43 ± 3.53	1–19	0–21	
Mild	30 (22.7)			
Moderate	19 (14.4)			
Severe	5 (3.8)			
Total	25.47 ± 9.22	2–45	0–63	
Health behaviors	50.23 ± 7.65	36–71	18–90	

Note. CVD = cardiovascular disease.

and characteristics of busy middle-aged Korean Chinese workers, it is necessary to develop a website or application providing CVD prevention information in Chinese that can be easily used in the workplace or community regardless of educational levels.

The degree of participants' mental health, including depression, anxiety, and stress, was worse than that reported in other studies with similar populations (D. K. Jun, 2019; D. K. Jun et al., 2018). These results may be related to the fact that most participants lived alone, away from their families in China, and worked long hours in restaurants and factories with low job security and autonomy. In addition, the monthly income of most of our participants was 2.99 million won or less, about US$2,231.43, which is lower than the average monthly income of Korean workers in general (Statistics Korea, 2021c). Furthermore, Chinese cultural values, such as "filial piety" and "family relations," and the role of the family in health care are very important (K. Jin et al., 2020). However, most participants in this study lived alone and away from their Chinese families for years. Therefore, we recommend that mental health issues of foreign workers in Korea, particularly Korean Chinese workers, should be included in all relevant national health care policies. Existing programs can be modified to fit the needs of Korean Chinese workers. For example, counseling services for work-related or mental health problems could leverage the social networking platform WeChat, which is used by 97% of the Chinese population (Zhang et al., 2017).

Health behavior scores of the participants in this study, while low, were similar to that of other published studies involving middle-aged office workers with CVD risk factors in Korea (Kang & Hwang, 2018; E. J. Kim & Hwang, 2019). Almost half of our participants were currently smoking and more than half were obese. Smoking is a culturally accepted practice in China and serves as a conduit for social interaction (Ding & Hovell, 2012). Similarly, white rice and flour are the main staple foods in China. Adhering to dietary recommendations that limit carbohydrate intake presents a major sociocultural challenge for Chinese diabetic patients (Chesla et al., 2009). In addition, Chinese people tend to

Table 3. CVD Awareness, Mental Health, and Health Behaviors According to General Characteristics (N = 132).

Characteristics	Categories	CVD awareness			Mental health			Health behaviors		
		M ± *SD*	*t*/*F*	*p*	*M* ± *SD*	*t*/*F*	*p*	*M* ± *SD*	*t*/*F*	*p*
Sex	Men	66.35 ± 9.04	−0.62	.575	36.80 ± 8.91	1.52	.131	51.03 ± 8.19	−2.12	.036
	Women	67.22 ± 8.72			24.36 ± 9.38			53.72 ± 7.17		
Age	40–54 years	66.09 ± 8.75	−1.11	.268	25.79 ± 8.94	0.463	.644	50.16 ± 7.24	−0.01	.995
	55–65 years	67.82 ± 8.95			25.04 ± 9.65			50.00 ± 8.36		
Marital status	Unmarried	67.29 ± 13.52	0.21	.891	23.57 ± 10.29	−0.81	.417	51.29 ± 8.73	0.55	.586
	Married/divorced/bereaved	66.77 ± 8.20			25.69 ± 9.10			50.10 ± 7.55		
Education	<Middle school	66.77 ± 7.97	−0.05	.959	24.66 ± 9.37	−0.71	.477	50.68 ± 7.99	0.48	.631
	High school/college	66.85 ± 9.29			25.88 ± 9.17			50.00 ± 7.52		
Monthly income (10,000 W)	<200	65.79 ± 8.28	3.75	.026	26.26 ± 10.05	0.34	.714	48.63 ± 7.19	1.82	.167
	200–299	66.28 ± 8.89			25.36 ± 8.66			50.50 ± 8.09		
	≥300	72.79 ± 8.36			23.93 ± 10.42			53.00 ± 5.45		
living with family	Yes	71.08 ± 9.28	−2.81	.006	21.85 ± 11.33	2.27	.025	55.35 ± 8.55	−4.02	<.001
	No	65.78 ± 8.45			26.36 ± 8.45			48.97 ± 6.90		
Length of living away with family	<4 years	68.27 ± 9.42	1.44	.151	24.10 ± 11.20	−1.31	.191	54.76 ± 8.19	3.00	.003
	≥4 years	65.98 ± 8.43			26.28 ± 7.78			48.73 ± 6.94		
Comorbidity[a]	Yes	67.51 ± 8.91	0.63	.532	24.39 ± 8.39	−1.23	.222	50.70 ± 7.77	0.61	.545
	No	66.54 ± 8.64			26.38 ± 9.81			49.88 ± 7.65		
CVD Family history	Yes	67.86 ± 9.34	1.15	.252	25.09 ± 10.24	−0.41	.686	50.21 ± 7.07	−0.02	.987
	No	66.07 ± 8.44			25.75 ± 8.44			50.24 ± 8.11		
Smoking	Current smoker	65.34 ± 8.53	−1.75	.082	26.85 ± 8.46	1.55	.123	48.61 ± 7.79	−2.21	.029
	None/EX smoker	68.03 ± 8.97			24.36 ± 9.70			51.53 ± 7.34		
Obesity (BMI)	<25 kg/m^2	68.71 ± 9.10	3.08	.003	24.03 ± 8.85	−2.23	.027	51.34 ± 7.10	2.07	.041
	≥25kg/m^2	64.02 ± 7.71			27.62 ± 9.42			48.57 ± 7.33		
Aerobic Exercise	<2 times/week	66.15 ± 8.88	1.30	.195	25.00 ± 9.41	0.87	.385	50.32 ± 7.45	−0.20	.839
	≥2 times/week	68.32 ± 8.68			26.51 ± 8.81			50.02 ± 8.18		
Strength Exercise	<2 times/week	66.20 ± 8.44	−1.78	.078	26.60 ± 8.50	3.16	.002	49.84 ± 7.16	−1.26	.309
	≥2 times/week	69.78 ± 10.23			20.13 ± 10.73			52.04 ± 9.63		

Note. CVD = cardiovascular disease; BMI = body mass index.
[a]Comorbidity: hypertension, diabetes, hyperlipidemia.

Table 4. Correlation Among CVD Awareness, Mental Health and Health Behaviors (N = 132).

	CVD awareness	Mental health	Health behaviors
	r (*p*)	*r* (*p*)	*r* (*p*)
CVD awareness			.44 (<.001)
Mental health	− .35 (<.001)		
Health behaviors		− .45 (<.001)	

Note. CVD = cardiovascular disease.

Table 5. The Effects of CVD Awareness and Mental Health on Health Behaviors and the Moderating Effect of Mental Health On the Relationship Between These Two Variables (N = 132).

Variables	*B*	*SE*	ß	*t*	*p*	VIF
Model 1						
(Constant)	44.18	4.92		8.98	<.001	
Sex (ref: Men)	2.04	1.58	0.13	1.30	.198	1.83
Living with family (ref: Yes)	2.81	2.12	0.15	1.32	.188	2.11
Length of living away with family (ref: ≥4 years)	−0.26	0.22	−0.13	−1.18	.241	1.97
Smoking (ref: None/EX smoker)	0.34	1.49	0.02	0.23	.818	1.63
Obesity (ref: ≥25 kg/m^2)	0.23	1.37	0.01	0.16	.870	1.34
CVD awareness	2.95	0.63	0.39	4.69	<.001	1.16
			R^2 = .27, adjusted R^2 = .24, F = 7.87 (p < .001)			
Model 2						
(Constant)	44.88	4.69		9.56	<.001	
Sex (ref: Men)	1.73	1.51	0.11	1.15	.254	1.84
Living with family (ref: Yes)	2.31	2.03	0.12	1.14	.257	2.12
Length of living away with family (ref: ≥4 years)	−0.2	0.21	−0.12	−1.15	.254	1.97
Smoking (ref: None/EX smoker)	0.29	1.42	0.02	0.21	.836	1.63
Obesity (ref: ≥25 kg/m^2)	0.49	1.31	0.03	0.38	.706	1.34
CVD awareness	2.24	0.63	0.29	3.57	.001	1.28
Mental health	−2.24	0.61	−0.29	−3.71	<.001	1.19
			R^2 = .35, adjusted R^2 = .31, F = 9.40 (p < .001)			
Model 3						
(Constant)	45.28	4.63		9.77	<.001	
Sex (ref: Men)	2.01	1.49	0.13	1.35	.181	1.85
Living with family (ref: Yes)	1.93	2.01	0.10	0.96	.338	2.14
Length of living away with family (ref: ≥4 years)	−0.29	0.21	−0.14	−1.40	.163	2.00
Smoking (ref: None/EX smoker)	0.25	1.40	0.02	0.18	.857	1.63
Obesity (ref: ≥25kg/m^2)	0.70	1.29	0.05	0.54	.588	1.35
CVD awareness	2.57	0.64	0.34	4.02	<.001	1.36
Mental health	−2.58	0.62	−0.34	−4.18	<.001	1.27
CVD Awareness × Mental Health	0.99	0.47	0.17	2.09	.039	1.23
			R^2 = .37, adjusted R^2 = .33, F = 9.00 (p < .001)			

Note. VIF = variance inflation factors; CVD = cardiovascular disease.

believe that rest is better than exercise when diagnosed with hypertension or diabetes (Davidson et al., 2011). Moreover, in a study of middle-aged Korean Chinese female workers, despite being provided with health-related knowledge, participants were unable to put it into practice because of a lack of understanding of medical terms and health information (H. K. Lee et al., 2016). Education focusing on the importance of exercise, tobacco cessation, healthy weight, and healthy dietary choices that incorporate culturally appropriate recommendations is urgently required. Furthermore, educational efforts should include a clear explanation of the relationship between risk factors and CVD in an appropriate format, to facilitate healthy behaviors and improve the CVD risk profile of Korean Chinese workers in Korea.

In this study, CVD awareness, mental health, obesity, and health behaviors were all lower in participants living alone and away from their families than in those living together,

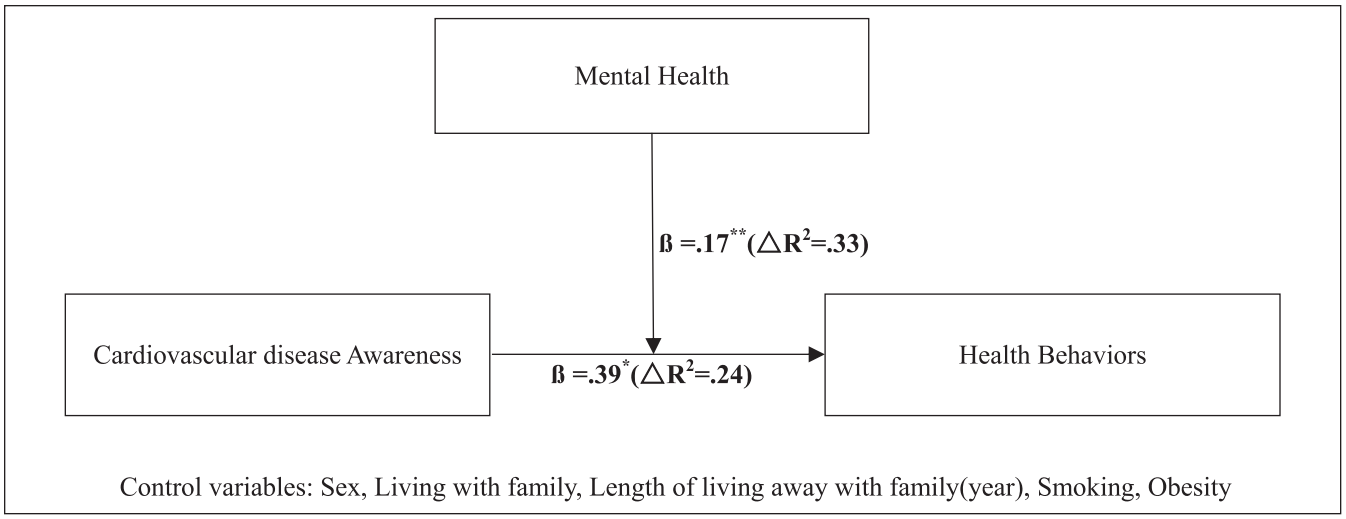

Figure 1. Moderating Effect of Mental Health on the Relationship Between Cardiovascular Disease Awareness and Health Behaviors. *$p < .05$. **$p < .01$.

supporting the importance of family presence in CVD prevention efforts (K. A. Kim & Hwang, 2016). Further in-depth research is necessary to identify the specific obstacles faced by middle-aged Korean Chinese workers with CVD risk factors who live alone and to identify possible culturally acceptable interventions.

In our study, as mental health scores increased, health behaviors increased. This was similar to reported findings among taxi drivers, in whom depression also associated with less frequent health-promoting behaviors (Jung & Kim, 2020). We also found that the effects of CVD awareness on health behaviors were moderated by mental health, supporting the observation that depression, anxiety, and stress negatively affect health-promoting behaviors (Chang & Park, 2021; Jung & Kim, 2020). Therefore, it is important to raise awareness among the government and related organizations of the rude treatment and discriminatory practices experienced by Korean Chinese workers and to establish reasonable regulations to create a work environment that can minimize the risk of depression, anxiety, and stress.

Nursing Implications

Nursing researchers and clinicians should continue to conduct research on the cardiovascular and mental health of Korean Chinese workers and implement relevant findings into practice. Engaging in such research can also prompt the creation of an official online community focused on increasing awareness of the specific health needs of this population and encourage networking, communication, and collaboration among stakeholders. Local health center nurses should advocate organizational guidelines for screening and management of foreign workers for CVD and mental health risk factors, inform individuals and business owners of the results, and provide education to improve awareness and adoption of health behaviors for both employers and employees.

Strengths and Limitations

This is one of the few studies exploring CVD risk factors, health behaviors, and mental health among Korean Chinese workers living in Korea. Our results added to the limited understanding of the interactions between these factors, validating the importance of mental health in reducing CVD risk and improving CVD risk factor awareness and health behaviors.

However, this study had several limitations. First, because data collection was conducted in two areas located in Seoul, where many Korean Chinese workers are concentrated, the generalizability of the results to all Korean Chinese middle-aged workers residing in Korea is limited. Therefore, caution should be exercised when interpreting these results. Second, the results should be interpreted carefully because the research variables were measured using a self-report questionnaire and questions exploring sociocultural influences were not included. Third, the explanatory power of the variables in the final model of this study was low, which might be related to the absence of variables such as monthly income, exercise, diet, and drinking, which did not significantly affect health behaviors in the univariate analysis. Further research using larger samples is needed to confirm these results.

Conclusion

CVD awareness, health behaviors, and mental health of Korean Chinese workers in Korea in this study were relatively low compared with the results of similar studies with

other Korean populations. The importance of the relationship between CVD awareness and health behaviors and the moderating effects of mental health on that relationship was identified. More research is needed to verify these results in larger populations of Korean Chinese and other immigrant workers in Korea. In addition, qualitative studies that can promote an in-depth understanding of all factors influencing CVD awareness, mental health, and health behaviors of Korean Chinese workers for CVD prevention are needed to inform culturally appropriate, evidence-based policies and validated intervention programs.

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Declaration of Conflicting Interests

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Ethical Statement

Before proceeding with this study, the study design was approved by the Institutional Bioethics Committee (IRB) of H University (HYUIRB-202111-001). Data were collected after obtaining written informed consent from the participants. The informed consent forms explained that participants could withdraw from the study at any time without penalty. Anonymity and confidentiality were maintained throughout the study.

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