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Research Article

Association of Family Composition and Metabolic Syndrome in Korean Adults Aged over 45 Years Old

Young-Ju Kim, RN, ACNP, PhD *

College of Nursing, Sungshin Women's University, Seoul, South Korea

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SUMMARY

Purpose: This study investigated the relationship between family composition and the prevalence of metabolic syndrome by gender in Korean adults aged 45 years and older.
Methods: The sample consisted of 11,291 participants in the Korea National Health and Nutrition Examination Survey from 2010 to 2012. We used complex sample analyses, including strata, cluster, and sample weighting, to allow generalization to the Korean population. Complex samples crosstabs and chi-square tests were conducted to compare the percentage of sociodemographic characteristics to the prevalence of metabolic syndrome and its components by gender and family composition. Next, a complex sample logistic regression was performed to examine the association between family composition and the prevalence of metabolic syndrome by gender.
Results: The percentage of adults living alone was 5.6% for men and 13.9% for women. Slightly more women (14.0%) than men (10.1%) reported living with three generations. The percentage of metabolic syndrome in Korean adults aged 45 years and older was 53.2% for men and 35.7% for women. For women, we found that living with one or three generations was significantly associated with a higher risk of metabolic syndrome, blood pressure, and triglyceride abnormality after adjusting for age, education, household income, smoking, physical activity, and body mass index, when compared to living alone. No significant relationships were found for men.
Conclusions: A national strategy, tailored on gender and family composition, needs to be developed in order to prevent the increase of metabolic syndrome in Korean women over middle age.

Introduction

Metabolic syndrome (MetS) is a global public health problem that increases the risk of death caused by cardiovascular disease and diabetes. In 2012, cardiovascular disease, cerebrovascular disease, and diabetes were the second, third, and forth leading causes of death, respectively, in Korean adults [1]. Globally, the prevalence of MetS ranges from 8.0% to 24.0% in men and from 7.0% to 46.0% in women [2]. However, the prevalence of MetS in Koreans aged 30 years and older inclines toward the higher end of the range (31.9% for men, 25.6% for women, and 28.8% combined) [3].

Various sociodemographic factors, such as older age, low household income, low educational attainment, unemployment, family history, and ethnicity have been associated with developing MetS [4–9]. Lifestyle behaviors, such as smoking, heavy alcohol consumption, physical inactivity, and a high carbohydrate intake [5,6,10–12] in addition to a higher body mass index, predominant central obesity, insulin resistance, and postmenopausal status [5,13,14] have also been associated with an increased risk of developing MetS.

To our knowledge, there are no studies investigating the role of family composition regarding the prevalence of MetS despite evidence suggesting that living arrangement affects health, mortality, and dietary quality [15–18]. For example, studies have shown that adults, middle-aged and older, who either lived alone or with someone other than a spouse tended to have poorer dietary quality [18], and an increased mortality risk [17] than adults living with a spouse. Furthermore, Umberson [19] reported that mortality was lower for people who were married and had children, especially young children. Living with other family members has been shown to promote compliance with group norms, encourage beneficial health practices, and reduce stress through emotional reassurance [16].

* Correspondence to: Young-Ju Kim, RN, ACNP, PhD, College of Nursing, Sungshin Women's University, 147 Mia-dong, Kangbuk-gu, Seoul, 142-732, South Korea.
E-mail address: yjkim727@sungshin.ac.kr

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However, little attention has been given to women who have multiple roles and responsibilities for family caregiving. Women who not only serve as the primary caregiver to their parent or parent-in-law, but simultaneously are married and have children at home are often referred to as women in the middle [20]. The roles these women occupy compete for their time and energy and that the responsibilities of their multiple roles make these women especially vulnerable to stress. An accumulation of stress across multiple roles was related to poorer well-being [20]. On the contrary, multiple roles may provide individuals with role privileges and personal enrichment [21]. Of key concern are the stressors such men and women encounter in these multiple roles and how these positive and negative experiences are related to their health status.

It is widely recognized that gender shapes life experiences, and that even in similar roles men and women may encounter different patterns of opportunities and constraints [21]. Because changes in living arrangements are more prevalent for women (because women are more likely to be widowed as they age) than men [15], it is important to consider gender differences when examining the impact of living arrangements on health. Previous studies [5,13,22,23] demonstrated that Korean men tend to have a higher prevalence of MetS than Korean women do from young age ($\geq$ 20 years) to middle age ($<$ 50 years). The peak age of MetS in Korean men was 40 years old through 49 years old, and the prevalence decreased with aging [22]. However, Korean women have a higher prevalence than Korean men do above the age of 50 years [5,13,22,23].

The purpose of this study was to examine whether family composition was associated with the risk of MetS in Korean adults aged 45 years and older according to gender. The findings from this study would provide critical information with regard to how role experiences according to various family composition contribute to Korean adults' health in terms of MetS and its components.

Methods

Study design

A secondary analysis of existing cross-sectional data was used to investigate the association between family composition and the prevalence of MetS in Korean adults aged 45 years and older.

Data source

Data were derived from the Korea National Health and Nutrition Examination Survey (KNHANES) conducted by the Korea Centers for Disease Control and Prevention (KCDC) from 2010 to 2012. The KNHANES consists of three main questionnaires: the Health Interview Survey (HIS), the Nutrition Survey, and the Health Examination Survey. The HIS provides information on living arrangement, health status, and health-related behaviors as well as sociodemographic data. The Nutrition Survey provides daily food intake and the Health Examination Survey consists of data about height, weight, blood pressure, blood glucose, waist circumference, triglyceride levels, high-density lipoprotein cholesterol levels, body mass index (BMI), and past medical history.

Study sample

Data were collected from 25,534 participants who responded to the HIS questionnaire. The sample for this analysis, however, was restricted to 11,810 adults aged 45 and older. An additional 262 participants with a history of cancer and 257 participants with a white blood cell count $\leq$ 10,000 cells/μL were excluded from the sample. Thus, the final analytic sample consisted of 11,291 adults (4,843 men and 6,448 women).

Ethical considerations

The KNHANES VI-3 data sources are publicly available and participant information provided by the KCDC is nonidentifiable. Only de-identified data was used for this analysis. The data set was downloaded from the KCDC website (http://knhanes.cdc.go.kr) free of charge. The study was approved by the Institutional Review Boards of the Sungshin Women's University (sswuirb 2013-034).

Measures

Sociodemographic characteristics

The sociodemographic variables measured included age, marital status, education, household income, alcohol use, smoking, perceived level of stress, physical activity, and BMI. Marital status was collapsed into three categories: married, not married, and divorced/widowed. Level of education was collapsed into four categories: elementary school or lower, middle school, high school, and college/post-graduate. Monthly average household income was collapsed into four categories (as recommended by the KCDC): lower, middle-lower, middle-upper, and upper. The frequency of alcohol use was collapsed into three categories: less than once a week, twice or three times a week, and more than four times a week. Smoking status was collapsed into three categories: nonsmoker, ex-smoker, and current smoker. Perceived level of stress was assessed by one item “How much do you usually perceive stress?” and the original response was collected with four scales. However, it was dichotomized as low and high levels due to insufficient responses for both extreme scales. Physical activity was assessed by asking the number of days per week spent participating in moderate physical activity (defined as walking for more than 30 minutes a day). Responses were then collapsed into three categories: less than 1 day a week, 2–3 days a week, and more than 4 days a week.

Metabolic syndrome

Based on the revised National Cholesterol Education Program's Adult Treatment Panel III [24], MetS is defined as the presence of three or more of the following five criteria: (a) waist circumference $\geq$ 90 cm in men or $\geq$ 85 cm in women (using the Korean abdominal obesity criterion), (b) fasting blood glucose $\geq$ 100 mg/dL, (c) systolic blood pressure $\geq$ 130 mmHg or diastolic blood pressure $\geq$ 85 mmHg, (d) high-density lipoprotein cholesterol $<$ 40 mg/dL in men or $<$ 50 mg/dL in women, and (e) triglyceride $\geq$ 150 mg/dL. It should be noted that the same criteria for assessing cardiovascular risk via waist circumference in a Western population could not be used for a Korean population because Koreans have a lower waist circumference than most Western populations [25]. Therefore, this study used modified criteria for abdominal obesity recommended by the Korean Society for Obesity. In addition, participants who reported currently taking medications for hypertension, diabetes, or dyslipidemia were classified as having a MetS-related disease or abnormality.

Height, weight, waist circumference, and a blood sample were taken and analyzed using standardized techniques and calibrated equipment. Brachial systolic and diastolic blood pressure readings were taken from the seated position after 5 minutes of rest at 30-second intervals. The average of three readings was used. For lipid and glucose assays, a fasting blood sample was drawn from the participant's arm. Detailed descriptions of the anthropometric, venipuncture, and blood pressure measurement procedures can be found in the Guidelines for Use of KNHANES IV Raw Data and the Final Report of KNHANES IV sampling frame [26].

Table 1 *Sociodemographic Characteristics of Participants by Gender and Family Composition.*

Characteristics	Men, % or $M \pm SD$						Women, % or $M \pm SD$					
	All	Living alone	Living with 1 generation	Living with 2 generations	Living with 3 generations	p	All	Living alone	Living with 1 generation	Living with 2 generations	Living with 3 generations	p
	$n = 4{,}564$	$n = 255$	$n = 1{,}741$	$n = 2{,}109$	$n = 459$		$n = 6{,}178$	$n = 858$	$n = 1{,}846$	$n = 2{,}607$	$n = 867$	
Age (yr)						< .001						< .001
45–49	23.7	21.8	5.1	33.6	22.5		20.4	5.6	9.9	31.3	13.2	
50–59	38.8	36.8	27.2	44.8	38.8		35.2	13.6	33.5	42.7	28.4	
60–69	21.6	20.6	33.2	15.9	21.3		21.1	20.6	33.9	14.1	23.6	
≥ 70	15.9	20.8	34.5	5.8	17.4		23.3	60.2	22.7	11.9	34.8	
Marital status						< .001						< .001
Not married	0.7	7.6	0.3	0.4	0.4		0.3	0.5	0.3	0.2	0.1	
Married	91.5	26.1	99.0	94.5	87.6		71.8	6.0	98.2	78.2	54.9	
Divorced/widowed	7.8	66.4	0.7	5.1	12.0		27.9	93.5	1.5	21.6	45.1	
Education						< .001						< .001
< Elementary school	24.7	30.9	37.1	18.0	24.4		49.0	76.3	57.5	35.7	59.6	
Middle school	18.2	15.4	19.5	17.6	20.0		17.1	9.8	19.4	18.0	15.6	
High school	33.3	38.4	29.6	34.6	33.1		24.3	9.5	17.1	32.7	19.1	
≥ College	23.8	15.4	13.9	29.9	22.5		9.6	4.3	6.1	13.6	5.7	
Household income						< .001						< .001
Upper	28.8	19.3	19.6	34.7	26.8		23.6	4.6	17.2	30.4	26.6	
Middle-upper	25.0	13.4	17.9	28.9	28.8		21.8	5.3	15.5	27.2	26.9	
Middle-lower	25.4	23.9	27.3	24.2	28.9		26.2	15.7	29.3	25.9	30.3	
Lower	20.8	43.4	35.3	12.2	15.5		28.4	74.4	37.9	16.5	16.1	
Frequency of alcohol drinking						.077						.056
≤ 1 time a week	56.6	57.3	57.4	56.0	56.9		92.8	91.5	92.5	92.7	95.0	
2–3 times a week	24.4	21.9	20.8	26.4	24.6		5.0	4.6	4.9	5.3	4.1	
≥ 4 times a week	19.0	20.8	21.8	17.6	18.4		2.2	3.9	2.6	2.0	0.9	
Smoking status						< .001						< .001
Nonsmoker	15.7	11.5	15.7	16.7	12.9		91.5	84.0	94.2	92.3	89.8	
Ex-smoker	46.7	39.8	51.8	45.0	46.2		3.7	6.6	3.5	3.1	4.3	
Current smoker	37.6	48.6	32.5	38.3	40.9		4.8	9.4	2.3	4.6	5.9	
Perceived level of stress						.064						.513
Low	80.4	82.5	83.2	78.6	81.6		72.8	74.2	74.0	72.5	70.8	
High	19.6	18.5	16.8	21.4	18.4		27.2	25.8	26.0	27.5	29.2	
Physical activity						.028						.007
≤ 1 time a week	70.5	72.6	73.8	68.2	72.3		75.7	81.6	73.9	75.0	77.1	
2–3 times a week	16.0	13.5	12.4	18.1	15.9		12.0	8.9	12.2	13.1	9.8	
≥ 4 times a week	13.5	13.8	13.8	13.6	11.9		12.3	9.5	13.9	11.9	13.1	
Body mass index (kg/m^2)	23.89 ± 0.12	23.45 ± 0.19	23.61 ± 0.09	24.10 ± 0.08	23.77 ± 0.15	<.001	24.16 ± 0.13	24.08 ± 0.16	24.35 ± 0.10	24.01 ± 0.09	24.41 ± 0.16	.033

Family composition

The HIS collected information regarding the total number of persons living in a household as well as their relationship to each other. This information was collapsed into four family compositions: living alone, living with one generation [the survey respondent and a spouse, sibling(s), or relative(s)], living with two generations [respondent/married couple with parent(s) or children], and living with three generations [respondent/married couple and parent(s) as well as children].

Data analysis

The KNHANES IV-3 data was collected using stratified cluster sampling. We used a complex sample analysis, including strata, cluster, and sample weighting, to allow generalization to the Korean population at large. All data were split and analyzed separately by gender. A preliminary descriptive analysis was conducted to examine the distribution of the variables. Complex sample analyses for crosstabs, chi-square tests, and general linear model were then conducted to compare the percentage or mean of sociodemographic characteristics to the prevalence of MetS and its components by gender and family composition. Next, a complex sample logistic regression was performed to examine the association between family composition and the prevalence of MetS according to gender. The goodness of fit for models was evaluated by using Nagelkerke R^2. Finally, variables that were found significant at a p less than .05 in the bivariate analyses were entered in the multiple logistic regression model. All analyses were carried out using SPSS Statistics version 21 (SPSS Inc., Chicago, IL, USA).

Results

Sociodemographic characteristics by gender and family composition

The percentage of male participants with MetS was 48.2%, 54.2%, 56.4%, and 51.9% (for age ranges of 45–49 years, 50–59 years, 60–69 years, and ≥ 70 years, respectively). In female participants, the prevalence of MetS was 14.8%, 26.9%, 47.4%, and 52.1%, respectively.

Adults living alone was 255 (5.6%) for men and 858 (13.9%) for women. Slightly more women than men reported living with three generations [867 (14.0%) and 459 (10.1%), respectively]. Similarly, women who were divorced/widowed were more likely to report living with three generations than divorced/widowed men were (45.1% and 12.0%, respectively).

Men living alone were more likely to have a lower average household income and to smoke compared to those in other family composition groups. Women living alone were more likely to have a lower education level, a lower income, and to be current smokers compared to those in other groups. Although it was not statistically significant, women living with three generations perceived a higher level of stress when compared to that of men and women in other groups (Table 1).

Prevalence of MetS by gender and family composition

Table 2 summarizes the percentage of participants who presented with a MetS and its components by gender and family composition. The overall prevalence of MetS in Korean adults aged 45 years and older was 53.2% for men and 35.7% for women. With the exception of hypertension, there were no significant differences in the prevalence of MetS and its related abnormalities for men. Women living alone had a significantly higher prevalence of MetS and all of its components whereas women living with two generations had a significantly lower proportion.

Association of family composition and metabolic syndrome

The complex sample logistic regression models for the association of family composition with the prevalence of MetS and its components are shown in Tables 3 and 4 according to gender. All odds ratios (ORs) were adjusted for age, level of education, marital status, household income, smoking status, physical activity, and BMI.

Table 2 *Prevalence of Metabolic Syndrome and its Components by Gender and Family Composition.*

Components	Men, %						Women, %					
	All	Living alone	Living with 1 generation	Living with 2 generations	Living with 3 generations	p	All	Living alone	Living with 1 generation	Living with 2 generations	Living with 3 generations	p
	n = 4,564	n = 255	n = 1,741	n = 2,109	n = 459		n = 6,178	n = 858	n = 1846	n = 2607	n = 867	
Fasting blood glucose (mg/dL)						.109						< .001
< 110	55.9	50.5	52.9	57.5	58.0		61.6	57.2	65.3	70.5	63.3	
≥ 110	44.1	49.5	47.1	42.5	42.0		38.4	42.8	34.7	29.5	36.7	
HDL cholesterol (mg/dL)						.889						< .001
≥ 40 (men) or 50 (women)	41.3	42.6	42.2	40.7	41.6		58.6	53.9	53.1	63.2	55.1	
< 40 (men) or 50 (women)	58.7	57.4	57.8	59.3	58.4		41.4	46.1	46.9	36.8	44.9	
SBP ≥ 130 or DBP ≥ 85 mmHg						.005						< .001
No	41.7	40.2	36.8	44.5	41.1		46.7	31.4	41.3	55.2	38.1	
Yes	58.3	59.8	63.2	55.5	58.9		53.3	68.6	58.7	44.8	61.9	
Triglyceride (mg/dL)						.116						< .001
< 150	54.4	50.7	58.1	53.6	51.4		61.8	57.3	57.2	66.6	55.5	
≥ 150	45.6	49.3	41.9	46.4	48.6		38.2	42.7	42.8	33.4	44.5	
Waist circumference (cm)						.841						< .001
< 90 (men) or 85 (women)	48.3	46.7	47.7	49.1	47.0		65.9	59.2	61.4	71.4	60.8	
≥ 90 (men) or 85 (women)	51.7	53.3	52.3	50.9	53.0		34.1	40.8	38.6	28.6	39.2	
Metabolic syndrome						.396						< .001
No	46.8	45.1	44.4	48.1	47.1		64.3	52.2	58.0	72.3	55.1	
Yes	53.2	54.9	55.6	51.9	52.9		35.7	47.8	42.0	27.7	44.9	

Note. DBP = diastolic blood pressure; HDL = high-density lipoprotein; SBP = systolic blood pressure.

Table 3 *Complex Sample Logistic Regression for Metabolic Syndrome and its Components in Men.*

Family composition	Fasting sugar abnormality	HDL-cholesterol abnormality	Blood pressure abnormality	Triglyceride abnormality	Abdominal obesity	Metabolic syndrome
	Odds ratio[a] (95% confidence interval)					
Living alone	1.00	1.00	1.00	1.00	1.00	1.00
Living with 1 generation	0.86 (0.53–1.42)	1.16 (0.71–1.91)	1.62 (0.99–2.61)	1.07 (0.65–1.75)	0.68 (0.36–1.29)	1.22 (0.66–2.22)
Living with 2 generations	0.84 (0.52–1.35)	1.22 (0.76–1.95)	1.49 (0.94–2.34)	0.98 (0.59–1.61)	0.62 (0.32–1.19)	1.05 (0.58–1.89)
Living with 3 generations	0.73 (0.44–1.21)	1.19 (0.72–1.97)	1.46 (0.89–2.39)	1.12 (0.68–1.85)	0.73 (0.36–1.49)	1.06 (0.57–1.97)

Notes. HDL = high-density lipoprotein.
[a] Odds ratio were adjusted for age, education, marital status, household income, smoking status, physical activity, and body mass index.

There were no statistically significant relationships between family composition and prevalence of MetS and its components in men (Table 3). The ORs for high fasting blood glucose and abdominal obesity tended to decrease in men living with one or more generations compared to men living alone. The values of Nagelkerke R^2 for goodness of fit ranged from .330 to .620.

The higher ORs for MetS and all of its components were observed in women living with one or more generations than that in women living alone. Although women living alone had a higher prevalence of MetS and its components in bivariate analyses, a multivariate regression model adjusted for possible covariates produced different results. Women who lived with one or three generations showed a significantly higher risk for MetS, blood pressure abnormalities, and triglyceride abnormalities than women living alone in the multivariate regression model. Also, women who lived with one generation showed a significantly higher risk for abdominal obesity than women living alone (Table 4). The values of Nagelkerke R^2 for goodness of fit ranged from .264 to .643.

Discussion

The prevalence of MetS in Korean participants aged 45 years and older increased with age. As seen in findings, the prevalence in men plateaued during the middle years of life and did not change in subsequent years. However, the prevalence in women increased sharply in the decade between 50 and 59 years of age and again between 60 and 69 years of age. Gender differences in the prevalence of MetS after the age of 50 years may be related to the higher prevalence of abdominal obesity and prominent weight gain associated with menopause in women [5]. Natural menopause is associated with increased central adiposity, and central adiposity is a contributing factor for prevalence of MetS [22]. In a study by Kim et al [13], the mean BMI of premenopausal and postmenopausal women was similar, but a large waist circumference was significantly associated with postmenopausal status after adjusting for age. Therefore, a prevention program for MetS will be needed for premenopausal women due to its considerably increased prevalence over 50 years of age.

We did not find any evidence to suggest that family composition had an influence on the risk of MetS for Korean men. However, Korean men living alone tended to be at a higher risk for having an abnormal fasting blood sugar and abdominal obesity than men living with one or more generations, while men living with three generations had a slightly lower prevalence of MetS than men living alone. Our findings are consistent with health-related outcomes from previous studies, which show that older men who lived alone had a slightly higher risk of mortality than those who were married [15]. In addition, men living alone were less likely to have breakfast and more likely to perceive a high level of stress than those living with family or others [27]. Several studies suggested that support from spouse was a key factor in maintaining physical health habits and psychological health of older people, especially for older men [27–31].

Very interestingly, Korean women living with one or more generations had a higher risk for MetS, blood pressure, and triglyceride level compared to women living alone. In this sample, women living with one or three generations were more likely to be in the middle age range of 50–59 years. This indicates that living with other family members may cause many stressful situations to middle-aged women. We found in this study that Korean women living with three generations were caring for an average of five household persons including their spouse, their or the spouse's parent(s), and unmarried children. Furthermore, some of them were in charge of caring for family members even though they were divorced or widowed. There is growing evidence to suggest that older women who live with multiple household members are at a disadvantage regarding their social contacts, mental health, physical and functional health, dietary intake, and survival in comparison to those who live alone [15]. It is possible that this is because women living with three generations retain the role of homemaker and caregiver even if they are no longer physically able to complete the tasks, which can have negative effects on their health. Furthermore, women living with three generations may be less likely to use health services or to participate in social activities or interactions outside home. In fact, it is reported that Korean wives who worked in the home had a 1.6 times higher risk of MetS than those who worked outside of the home [3]. Women who were in

Table 4 *Complex Sample Logistic Regression for Metabolic Syndrome and its Components in Women.*

Family composition	Fasting sugar abnormality	HDL-cholesterol abnormality	Blood pressure abnormality	Triglyceride abnormality	Abdominal obesity	Metabolic syndrome
	Odds ratio[a] (95% confidence interval)					
Living alone	1.00	1.00	1.00	1.00	1.00	1.00
Living with 1 generation	1.13 (0.82–1.57)	1.25 (0.92–1.69)	1.39 (1.02–1.89)*	1.53 (1.13–2.08)*	1.53 (1.03–2.28)*	1.67 (1.19–2.34)*
Living with 2 generations	1.15 (0.85–1.59)	1.02 (0.76–1.35)	1.31 (0.98–1.74)	1.27 (0.91–1.65)	1.14 (0.79–1.65)	1.24 (0.91–1.69)
Living with 3 generations	1.09 (0.81–1.47)	1.11 (0.81–1.53)	1.37 (1.00–1.88)*	1.39 (1.01–1.92)*	1.17 (0.79–1.74)	1.58 (1.11–2.23)*

Notes. HDL = high-density lipoprotein.
*$p \leq .05$.
[a] Odds ratio were adjusted for age, education, marital status, household income, smoking status, physical activity, and body mass index.

multiple-member households were less likely to exercise regularly, to sleep well, and to have regular health examinations [28,29]. It may be that these women concentrate on caring for family members and do not have time to take care of themselves. For example, one study found that women in multiple-member households spent an average of 2 hours and 47 minutes a day on meal preparation or doing housework, whereas single women spent an average of 48 minutes [32]. Park et al [33] reported that fatigue in middle-aged women increased with a higher number of family members than did in those with lower numbers of family members. They found a significant positive relationship between fatigue and total hours of housework. Furthermore, if a woman lives with and provides care to a spouse or parent who is seriously ill, there may be further negative consequences for her own health [17].

Women living with one generation may have a different family dynamic when compared to women living with three generations. We found that 98.0% of women or men living with one generation in this study were living with spouse only. As mentioned above, spousal support has a positive effect on health of men in married couple. However, it may not be as effective as men for women in a couple. A study reported that 40.7% of women living with retired husband responded that their health status was worse during the 2 years after the husband's retirement [34]. Although women living with their husband have only one household member, they have still lots of routine housework and feel stress if there is no help with household chores from their husband. Only 21.0% of middle-aged women exercised regularly and 49.0% of them had diseases such as gastritis, hypertension, arthritis, and so on [35]. More surprisingly, the methods that they tried for relieving stress were enduring their life situation. A community-based stress management program targeting middle-aged women living with multiple household members should be developed and disseminated.

Another possible explanation for an increased risk of MetS in women living with spouse is free of raising children. The responsibility arising from raising children promotes positive health behaviors and inhibits negative health behaviors [30]. Umberson [19] found that married couples with children, especially young children living at home, had a lower mortality rate than childless couples. Compared to childless couples, married couples with children experienced enduring responsibilities and a sense of belonging that reduced the likelihood of engaging in undesirable health behaviors. Women who have been relieved from raising children may not have sense of meaning or obligation to increase good health behaviors. This was supported by findings from the current study that women living with two generations (husband and unmarried children) had no significant increased risk of MetS compared to women living with one or three generations. However, it is less clear if older children living at home impart the same advantage [16]. The constant care of older children may increase stress and therefore threaten a woman's health. It is likely that the family provides both positive and negative interactions that have both positive and negative outcomes on health. In other words, while the family often provides instrumental as well as emotional support that can have positive outcomes, family relations are obligatory and can cause stress leading to negative outcomes [36,37]. For example, although psychological measures of well-being among widowed women were positively associated with social engagement and morale, they were unrelated to instrumental support provided by family members [38].

The increased risk of MetS in women living with spouse can be explained by the idea that shared environmental factors contribute to the development of MetS. Lee et al [9] found that couples who had been married longer, had a higher OR for MetS than couples who had been married for a shorter time [9]. This could be because couples tend to be exposed to more common environmental factors the longer they have been married, thereby putting them at risk of developing MetS.

This study has several limitations. The use of a large, population-based dataset is an important strength for this study; however, the cross-sectional nature of the data limits casual inference. Furthermore, although participation in the study was relatively high, there is a potential for selection bias since participants with missing values were excluded and it may be that those individuals are more likely to have risk factors associated with MetS. The KNHANES database used in this study was developed between 2010 and 2012, Thus, the reported prevalence rates may differ from those in the current Korean population. The dietary factors that might influence components of MetS were not analyzed in this study. In addition, menopausal status was a risk factor for the prevalence of MetS in women. However, it was not considered as a covariate in this study due to lack of data. Future studies are warranted to investigate how eating habits differ according to family composition and control the effect of menopause on MetS in women. Cohort studies are also needed to examine whether changes in marital status and family composition have acute effects on the risk of MetS and to examine the relationship of family dynamics and health problems according to family composition. For example, one can study if a stressful family event such as spousal death or divorce has an impact on the prevalence of MetS and other health problems.

Despite the limitations, this study is the first study investigating the relationship of family composition and prevalence of MetS using a large population-based data. Many studies have focused on health of people who are living alone as single family is on the rise sharply. These findings suggest that multiple roles in middle-aged women should be examined in terms of role quality and not simply in terms of role occupancy. This study showed a critical point, that is, the number of family members living together and the relations between them should be considered in developing a public health promotion program for middle-aged women such as stress management and outside physical activity.

Conclusion

The number of elderly individuals with MetS has been rapidly increasing. MetS is affected by marital status, the number of family members living in the home, spousal interaction, and family dynamics. A national strategy, tailored on gender and family composition, needs to be developed in order to prevent the increase of MetS in the Korean population. More MetS screening or programs that encourage physical activity outside the home are needed for women who live with one or more generations.

Conflicts of interest

The author declared no conflict of interest.

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