



■ Article ■

Longitudinal Mediating Effect of Depression in the Relationship between Alcohol Dependence and Suicidal Ideation in Women

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Abstract

This study examined the longitudinal mediating effect of depression on the relationship between alcohol dependence and suicidal ideation in women, analyzing the data of 4,211 in the four-year survey (2014–2017) of the Korea Welfare Panel (KOWEPS) using an autoregressive cross-lagged model (ARCLM). The results were as follows: (1) alcohol dependence, depression, and suicidal ideation in women at the previous time point had stable and continuous significant effects on alcohol dependence, depression, and suicidal ideation, respectively, at a later time point. (2) Women's alcohol dependence at the previous time point had a statistically significant effect on depression at the later time point, and depression at the previous time point had a static effect on suicidal ideation at the later time point. (3) Depression completely mediated the relationship between women's alcohol dependence at the previous time point and suicidal ideation at the later time point. Thus, the higher the woman's alcohol dependence at the previous time point, the higher the depression, and the higher the depression at the previous time point, the more suicidal ideation experienced at the later time point. This study provides empirical data on the pathway of female alcoholics to suicide by verifying the longitudinal mediating effect of depression on the relationship between alcohol dependence and suicidal ideation in women through ARCLM.

■ **Keywords** : women, alcohol dependence, depression, suicidal ideation, longitudinal mediating effect

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Introduction

As the number of female drinkers increases, societal concerns about female alcoholics also increase. According to the National Health and Nutrition Survey, high-risk drinking among women aged 19 years and older increased 2.5 times from 3.4% in 2005 to 8.4% in 2018 (Korea Disease Control and Prevention Agency, 2020). According to the National Health Insurance Service, a total of 74,915 patients were treated for alcohol use disorder in 2019. Although the 57,958 men were more than three times the number of women, the number of male alcohol use disorders is decreasing annually, while the number of female alcohol use disorders is increasing annually, from 15,279 in 2015 to 16,957 in 2019 (Korea Ministry of Health and Welfare, 2021).

An alcoholic is a person who impairs his or her physical, mental, and social functioning by continuously drinking too much alcohol beyond its social use (Min, 2015). Their excessive drinking is chronic and displays relapses, negatively affecting their daily lives and causing a variety of problems (Ministry of Health and Welfare, 2016). Although many different problems arise from drinking, alcohol consumption has been consistently reported as a major risk factor for depression and suicide (Sher, 2006; Wagner, 1997).

Several studies have reported a significant correlation between suicidal ideation, suicide attempts, and alcohol (Osgood & Manetta, 2002; Roy, 2003). Alcohol use disorder (AUD), including dependence, is associated with suicidal behavior (Conner & Ilgen, 2016); specifically, alcoholism is associated with suicidal ideation and attempts, as well as completed suicide (see meta-analysis of Darvishi et al., 2015). Similarly, people who abused or were dependent on alcohol were approximately 10 times more likely to die by suicide than those who did not exhibit symptoms of alcohol abuse and dependence (Wilcox et al., 2004). In Korea, the suicide attempt rate of alcoholics is 10 times higher than that of general adults (Yoon, 2011), and alcoholics are 2.9 times more likely to have specific suicide plans than the general population (Sohn et al.,

2009).

The suicide rate among Korean women is one of the highest among the OECD countries (D. Moon & Chung, 2018). The suicide mortality rate is twice as high for men; however, a higher suicide mortality rate for men does not indicate that women are relatively safe from suicide, because suicidal ideation and nonfatal self-harm are also higher in women (Freeman et al., 2017; Miranda-Mendizabal et al., 2019; J. Moon et al., 2021). In addition, the suicide mortality rate among female alcoholics is high. Roerecke and Rehm (2014) found that the standardized rate of suicide deaths associated with AUD was approximately twice as high for women as for men. The higher risk of suicide in women with AUD than in men with AUD indicates that women have a higher susceptibility to alcohol effects than do those without AUD (Hommer et al., 2001; Nolen-Hoeksema, 2004). Women who display alcohol dependence in Korean society experience greater social stigma than men (Khan et al., 2013), and because they receive more social criticism than men, they do not show alcohol dependence, which leads to chronic alcohol dependence (Song & Kang, 2018). In addition, women have a telescoping effect of alcohol dependence due to their different physical sensitivities than men; therefore, the process of reaching alcohol dependence is more compressive in women than in men (Bong & Lee, 2011). These results raise the need to examine the problem of suicide in alcohol-dependent women.

It is also noteworthy that women are more vulnerable to depression than men, which is a major risk factor for suicide (Piccinelli & Wilkinson, 2000). A recent Korean study that analyzed the differences between men and women in the level of depression in adults also found that women were twice as likely to experience depression and prevalent depressive disorders as men (Jeon, 2014). Women who are vulnerable to depression experience depression as they experience frustration and hurt in the process of becoming dependent on alcohol, repeating the vicious cycle of avoiding these problems and drinking alcohol to forget their suffering (Ihn et al., 2003). In addition, the risk of suicide is 3.16 times greater in depressed patients when alcohol dependence is comorbid, and the num-

ber of suicide attempts, fatality of suicide attempts, and thoughts of suicide are significantly higher in depressed patients who have suffered from alcoholism than among those who do not (Sher et al., 2005), and alcohol dependence and depression lead to suicidal thoughts and suicide attempts. These results suggest that women are more susceptible to the effects of alcohol and to depression, and alcohol-dependent women may thus be more likely to commit suicide due to depression.

The Present Study

This study aimed to establish a model of the relationship between alcohol dependence, depression, and suicide based on the studies described above and to statistically verify this model. In particular, researchers (S. B. Lee et al., 2010; Nolen-Hoeksema, 2004; Piccinelli & Wilkinson, 2000; Roerecke & Rehm, 2014) have found that anxiety, depression, and suicide attempts among alcoholics were higher than among men, which was tested to confirm the seriousness of the problem of alcohol dependence in women. Studies (Sher, 2006; Song & Kang, 2018) of alcoholism and suicide that have been conducted using hospital data, including data on alcoholics and psychiatric patients, frequently report the comorbidity of depression and alcoholism, but as the group of patients admitted to the hospital may have a wider variety of illnesses than the general population, the correlation between depression and alcoholism in the general population may be overestimated, making it difficult to generalize the results obtained from hospital data to the general population (Kim et al., 2005; Swendsen & Merikangas, 2000).

To overcome the limitations of previous studies, this study aimed to establish and verify the relationship between alcohol problems, depression, and suicidal ideation among women in general and to establish and verify the relationship between female alcohol problems mediating depression and suicidal ideation using survey data from the general population. However, analysis of the causal relationships between these variables is limited by the use of cross-sectional data. Therefore, this

study aimed to determine whether women's alcohol dependence, depression, and suicidal ideation remain stable over time through a longitudinal analysis of longitudinal data, and whether a causal relationship between women's alcohol dependence on depression and suicidal ideation is established over time. Therefore, this study aimed to examine the longitudinal mediating effect of depression on the relationship between alcoholism and suicidal ideation in women by analyzing the relationship between variables in detail using longitudinal data of the 4th year, as tracked from 2014 to 2017, of the Korea Welfare Panel Data.

Method

Data and Participants

We used data from the Korean Welfare Panel Study (KOWEPS). The Korea Welfare Panel constructed longitudinal data by extracting samples from 90% of the 2005 population census. The survey was conducted face-to-face with trained investigators visiting households using computers. This study used data from the 9th survey in 2014 to the 12th survey in 2017. Data from 4,211 women aged 20 years or older who responded to all waves (9th to 12th) were analyzed. The missing values for all variables were minimized using regression imputation.

Measurement of the Study Variables

1) Alcohol Use Disorder: The Korean Welfare Panel Survey asks questions about problematic drinking and alcohol dependence using the AUDIT (Alcohol Use Disorder Identification Test; Babor et al., 2001) scale. The AUDIT scale, which has been reported as having adequate sensitivity and specificity, is a self-reported alcohol abuse and dependence assessment scale used in many studies. The AUDIT scale consists of 10 questions measuring three areas: the frequency and amount of drinking experienced by the individual over the past year, symptoms of alcohol dependence, and problems related to drinking (3 questions about harmful

drinking, 3 questions about alcohol dependence, and four questions about hazardous drinking; E. Choi, 2006), scored on a 5-point scale ranging from *not at all* (0 points) to *almost every day* (4 points), where a higher total score means that there is a risk of a drinking problem and the likelihood of drinking behavior is high. The reliability is indicated by Cronbach's alpha values of .813 for the 9th, .812 for the 10th, .809 for the 11th, and .805 for the 12th survey.

2) Depression: The Korean Welfare Panel Survey uses the short form of Radloff's (1977) CES-D Scale (Center for Epidemiological Studies-Depression Scale) to measure depression. The questionnaire consists of 11 questions about feelings and behaviors related to depression over the past week from the time of the survey. For each question, the responses *extremely rare*, *sometimes*, *often*, and *most of the time* may be scored with 0, 1, 2, or 3, respectively. The reliability (Cronbach's alpha) was .823 for the 9th, .860 for the 10th, .866 for the 11th, and .865 for the 12th survey.

3) Suicidal ideation: The Korean Welfare Panel Survey asks whether the respondent has ever thought about committing suicide or considered a specific method for committing suicide during the past year as of the survey date. These questions were used to assess suicidal ideation.

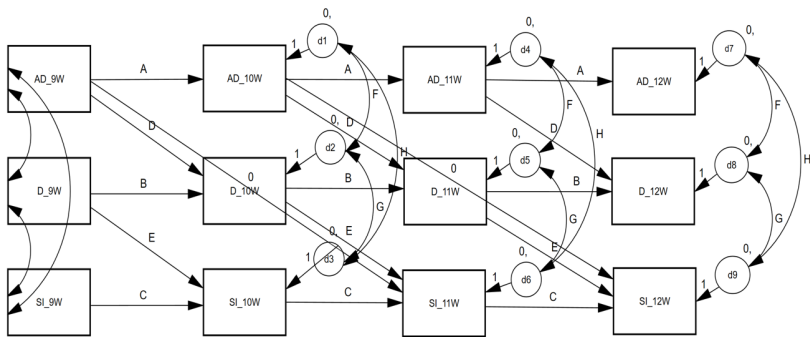
Analysis

First, before examining the research model (Fig. 1), we obtained descriptive statistics and correlations to ensure that the key variables—alcohol dependence, depression, and suicidal ideation—met the basic conditions for structural equation modeling. Second, an autoregressive cross-lagged model (ARCLM; Sher et al., 1996) was used to determine associations between time points t and $t + 1$ among alcohol dependence, depression, and suicidal ideation. The criteria for goodness-of-fit in this study referenced RMSEA (good: ≤ 0.08 , acceptable: $\leq .1$; Browne & Cudeck, 1993) and TLI and CFI (values $> .90$ were interpreted as indicating good fit; Bentler, 1990; Tucker & Lewis, 1973). Third, the longi-

tudinal mediating effect of depression was assessed to determine whether alcohol dependence affected suicidal ideation through depression (Park & Lee, 2013). Bootstrapping was performed to verify the mediating effect (Shrout & Bolger, 2002). If the 95% confidence interval of the estimate obtained through bootstrapping does not contain zero, it can be interpreted that the indirect effect is statistically significant at the significance level of .05. Statistical calculations were conducted using IBM SPSS (v22) and AMOS (v26).

Figure 1.

The Research Model



Note: AD, alcohol dependence; D, depressive symptoms; SI, suicidal ideation; W, wave.

Results

Descriptive Statistics and Correlation Coefficients

Table 1 lists the correlation coefficients and descriptive statistics of the variables used in the analysis. The correlation coefficients showed a significant association between alcohol dependence, depression, and suicidal ideation. These results indicated that it would be appropriate to test the causal relationships among the variables. The variables satisfied the conditions for normal distribution (skewness ± 3 , kurtosis ± 10 or small magnitude; Kline, 2005); thus, goodness-of-fit of the model was verified using maximum likelihood estimation.

Table 1.
Correlations and Descriptive Statistics

	1)	2)	3)	4)	5)	6)	7)	8)	9)	10)	11)
1) AD_9W	1										
2) AD_10W	.297***	1									
3) AD_11W	.299***	.293***	1								
4) AD_12W	.256***	.274***	.368***	1							
5) D_9W	.069**	.200***	.046**	.060**	1						
6) D_10W	.058**	.051**	.164***	.071*	.342***	1					
7) D_11W	.037*	.051**	.060**	.159**	.318**	.373**	1				
8) D_12W	.044*	.059**	.055**	.066**	.309***	.347***	.372***	1			
9) SI_9W	.025*	.144***	.033*	.033*	.304***	.172***	.170***	.163***	1		
10) SI_10W	.013	.024	.064**	.019	.165***	.327***	.133***	.142***	.192***	1	
11) SI_11W	.028	.011	.035*	.053**	.120***	.148***	.308***	.166***	.118***	.156***	1
12) SI_12W	.048**	.018	.013	.032*	.091***	.133***	.132***	.266***	.099***	.132***	.161***

* $p < .05$, ** $p < .01$, *** $p < .001$

Note: AD, alcohol dependence; D, depressive symptoms; SI, suicidal ideation; W, wave.

ARCL Modeling Results

Longitudinal relationships between alcohol dependence, depression, and suicidal ideation were tested by fitting the autoregressive cross-lagged model at four time points. First, a partial mediation model that fixed the direct path between the 12th suicidal ideation measurement and the 9th assessment of alcohol dependence was compared with the fully mediated model. Although both the fully and partially mediated models had good fit, the fully mediated model had better fit (TLI = .909, CFI = .938, RMSEA = .046) than the partially mediated model (TLI = .907, CFI = .938, RMSEA = .047). Therefore, a fully mediated model that fixed the coefficient of the direct path between the 9th assessment of alcohol dependence and the 12th assessment of suicidal ideation to zero was the more appropriate model. Thus, following the principle of parsimony, we adopted a relatively concise, fully mediated model as the final study model (Kline, 2011).

The path coefficients (Table 2) were significant for each autoregressive coefficient from measurement time point t to $t + 1$ at all time intervals

for alcohol dependence (9th wave → 10th wave: $\beta = .258, p < .001$; 10th wave → 11th wave: $\beta = .298, p < .001$; 11th wave → 12th wave: $\beta = .284, p < .001$), depression (9th wave → 10th wave: $\beta = .328, p < .001$; 10th wave → 11th wave: $\beta = .312, p < .001$; 11th wave → 12th wave: $\beta = .317, p < .001$), and suicidal ideation (9th wave → 10th wave: $\beta = .132, p < .001$; 10th wave → 11th wave: $\beta = .118, p < .001$; 11th wave → 12th wave: $\beta = .120, p < .001$). The cross-lagged coefficients between alcohol dependence and depression were significant for 9th wave alcohol dependence → 10th wave depression ($\beta = .032, p < .01$), 10th wave alcohol dependence → 11th wave depression ($\beta = .035, p < .01$), and 11th wave alcohol dependence → 12th wave depression ($\beta = .034, p < .01$). With respect to the cross-lagged coefficients between depression and suicidal ideation, significance was found for 9th wave depression → 10th wave suicidal ideation ($\beta = .099, p < .001$), 10th wave depression → 11th wave suicidal ideation ($\beta = .104, p < .001$), and 11th wave depression → 12th wave suicidal ideation ($\beta = .117, p < .001$).

Table 2.

Results of the Autoregressive Cross-Lagged Model

	B	S.E.	β		
			9w→ 10w	10w→ 11w	11w→ 12w
AD → AD autoregressive coefficient	.288***	.007	.258	.298	.284
D → D autoregressive coefficient	.319***	.007		.312	.317
SI → SI autoregressive coefficient	.109***	.006	.132	.118	.120
AD → D cross-lagged coefficient	.078**	.016	.032	.035	.034
D → SI cross-lagged coefficient	.004***	.000	.099	.104	.117
AD → SI cross-lagged coefficient	-	-	-	-	-

** $p < .01$, *** $p < .001$

Note: AD, alcohol dependence; D, depressive symptoms; SI, suicidal ideation; W, wave.

This study examined the mediation effect of the autoregressive cross-lagged model using Shrout and Bolger’s (2002) bootstrap method. The relationship between alcohol dependence at the 9th wave measurement and suicidal ideation at the 11th wave measurement was significant ($\beta = .009, p < .01$) and did not include 0 (95% confidence interval for

depression: .004–.016). Also, the relationship between alcohol dependence at the 10th wave measurement and suicidal ideation at the 12th wave measurement was significant ($\beta = .007, p < .01$) and did not include 0 (95% confidence interval for depression: .003–.013). This indicates that the greater the alcohol dependence, the higher the depression, and that a high level of depression increased suicidal ideation.

Discussion

In order to prevent female suicide in a situation where it is increasing, this study focused on the influence of factor related to drinking among various risk factors on suicide. Specifically, we sought to verify the mediating effect of depression on the relationship between alcohol dependence and suicidal thoughts. For this purpose, this study used longitudinal data collected over four years from the Korean Welfare Panel data tracked from 2014 to 2017 and analyzed the relationships between variables using the ARCLM method, a longitudinal analysis method. The results of this study are discussed in connection with those of previous related studies.

First, women's alcohol dependence, depression, and suicidal thoughts at a previous time point had stable and continuously significant effects on alcohol dependence, depression, and suicidal thoughts at a later time point. This result supports a previous study that showed that alcohol use disorder has a relatively high recurrence rate compared to other chronic diseases because it is addictive (Bagnardi et al., 2015), and a previous study that showed that depression was stable over time (Hong & Hwang, 2015). These results also support those of Yoo (2018), who found a stable effect on the autoregressive coefficient of suicidal thoughts.

Second, the results of this study showed that women's alcohol dependence at a previous time increased their depression at a later time. This result is based on previous research showing that in the process of becoming dependent on alcohol, people experience depression by repeating the vicious cycle of drinking to avoid these problems and forget

pain (Ihn et al., 2003). This also supports previous research results (Boden & Fergusson, 2011; B. Choi et al., 2010; H. Lee & Roh, 2011) showing that negative emotions, such as depression, are caused by drinking problems. In the same context as these previous studies, this study identifies the causal direction in which drinking problems affect depression, and shows that drinking problems can cause depressive problems or deepen depression in women. These results suggest that alcohol dependence in women can cause psychological maladaptive problems such as depression; therefore, for women vulnerable to depression, drinking problems should be addressed together to deal with depressive problems.

The results also showed that women's depression at a previous time increased their suicidal thoughts at a later time. These results are consistent with Tomori and Zalar (2000), who reported that high school students who attempted suicide showed a higher level of depression than a comparison group that did not attempt suicide and that depression was a psychological factor affecting suicide among alcoholics (Sher et al., 2005). The results of this study, which showed that depression affects suicide-related factors, suggest that active intervention is needed to address the depressive problems of women, who are much more vulnerable to depression, to prevent them from leading to suicidal thoughts and behaviors.

Third, depression fully mediated the relationship between alcohol dependence at a previous time point and suicidal thoughts at a later time point. This indicates that the higher the alcohol dependence at a previous time point, the higher the depression, and the higher the depression at a previous time point, the more suicidal thoughts at a later time point. Previous research has reported that among suicide attempters, a history of alcohol use disorder is associated with more frequent and more fatal suicide attempts (Rizk et al., 2021). Our study shows that depression mediates the relationship between the two variables, rather than alcohol use disorder having a direct effect on suicide. This is consistent with Sher et al. (2005), who found that when depressed patients suffer from alcohol dependence, the risk of suicide increases by 3.16 times compared

to non-depressed patients, and that depressed patients who have suffered from alcohol dependence have a higher risk of suicide than those who do not (the number of attempts, fatality of suicide attempts, and suicidal thoughts were significantly higher). By showing the longitudinal mediating effect of depression, in which depression mediates women's drinking problems and suicidal thoughts, this study confirms that women's alcohol dependence problems increase their depression over time, and that heightened suicidal thoughts increase over time.

Considering that suicidal thoughts are an indicator that predicts suicide attempts and leads to suicidal behaviors (Chung & Han, 2020; Lim & Kim, 2020; Nock et al., 2008), it is important to explore the factors influencing suicidal thoughts in women. This study showed the seriousness of women's drinking problems by showing that women's alcohol use disorder can have a significant impact on psychological emotions and thoughts, such as depression and suicidal thoughts. Previous studies reported that women tend not to reveal their alcohol dependence and have the characteristics of chronic alcohol dependence (Song & Kang, 2018), and because they have different physical sensitivities than men, they develop alcohol dependence faster than men; thus, alcohol dependence can cause serious problems (Bong & Lee, 2011). This study is significant in that it reveals the seriousness of the alcohol problem by showing that women's chronic and repeated drinking causes chronic mental illnesses such as alcohol abuse and alcohol dependence, which can act as major risk factors for suicide.

Based on these results, practical ways to prevent female suicide are as follows: First, programs are needed for female alcohol-dependent individuals to prevent suicide. To this end, efforts are needed to create a space that alcohol-dependent women can easily visit, help them connect with various treatment institutions in the community, and encourage them to actively utilize self-help groups. Second, in social welfare practice, research is needed on programs and preventive approaches to prevent and treat female-centered drinking problems as well as male-centered drinking problem programs and treatment approaches. Third, in health

promotion education and health problem prevention management for problem drinkers, not only physical aspects but also emotional and mental aspects, including depression management, should be provided. Considering the differences in problem drinking and depression rates between men and women, a differentiated approach may be needed.

Despite its research significance and implications, this study has several limitations. First, it targeted women aged > 20 years. Although it encompassed the characteristics of adult women, its research limitations made it difficult to identify these characteristics by age group. In particular, as drinking problems and suicide rates show characteristics by age group, it is necessary to confirm the relationship between the variables that influence drinking problems and suicidal thoughts by mediating depression by age group. Second, this study focused only on suicidal thoughts because of the very low response rates for suicide attempts and suicidal behavior. Suicidal ideation is an indicator that predicts suicidal behavior and is a continuous thought process that leads to suicide attempts (Nock et al., 2008). However, future research should include analyses of drinking problems and depression, which are separately linked to suicide attempts and behavior.

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