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Associations between depressed mood with negative health behaviors of Koreans during the COVID-19 pandemic

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COVID-19 유행 기간 동안 한국인의 우울한 기분과 부정적인 건강 행동 사이의 연관성

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Abstract The objective of this study was to assess the association of changes in behaviors and depressed mood during the COVID-19 pandemic in Korea. A cross-sectional internet-based survey was conducted, using proportional samples of Korean adults and a logistic regression model was used to assess the association. As a result, negative changes of daily sitting or lying down time, daily walking time, smoking, and alcohol consumption were associated with being more depressed during the COVID-19 pandemic [odds ratios (ORs): 2.23 (95% CI=1.77-2.81), 2.04 (95% CI=1.63-2.56), 2.84 (95% CI=1.51-5.36), and 1.82 (95% CI=1.26-2.63), respectively]. This indicates that strategies to promote positive health behaviors change (increased activities and decreased consumption of smoking and alcohol) could help address psychological distress during the COVID-19 pandemic.

Key Words : COVID-19, Pandemics, depressed mood, Health behavior, Mental health

요 약 본 연구의 목적은 한국에서 COVID-19 유행 기간 동안 건강 행동 변화와 우울한 기분의 연관성을 평가하는 것이다. 한국 성인의 비례표본을 이용하여 인터넷 기반 단면 설문조사를 실시하였고, 로지스틱 회귀모형을 이용하여 연관성을 평가하였다. 그 결과, COVID-19 유행 기간 동안 앉거나 눕는 시간, 걷는 시간, 흡연 및 음주의 부정적인 변화는 우울한 기분으로의 변화와 관련이 있었다 [교차비(OR): 2.23(95% CI=1.77-2.81), 2.04(95% CI=1.63-2.56), 2.84(95% CI=1.51-5.36) 및 1.82(95% CI=1.26-2.63)]. COVID-19 유행기간 동안 긍정적인 건강 변화(활동 증가, 흡연 및 알코올 감소)를 증진시키기 위한 전략은 정신적 스트레스 경감에 도움이 될 수 있다.

주제어 : COVID-19, 전세계적 유행병, 우울한 기분, 건강 행동, 정신건강

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1. Introduction

Since the first case of COVID-19 was detected in Wuhan City, Hubei Province of China, in December 2019, it continues to spread across the world causing serious health implications and death [1-3]. Apart from the direct impact of COVID-19, it also caused indirect impacts such as determinants of mental health through loss of livelihoods, restrictions on social activities, and isolation. Moreover, several studies report that major economic crises are commonly accompanied by mental health concerns such as depression, anxiety disorders, substance abuse, suicidal tendencies, and Post Traumatic Stress Disorder (PTSD) [4-6].

The COVID-19 Mental Disorders Collaborators reported that the pandemic caused a 27.6% increase in the global prevalence of major depressive disorder in 2020 [7]. In Korea, several studies show that the proportion of individuals suffering from depression increased by 18.8% - 36.75% after the pandemic began [8-11].

Previous studies suggest that risk factors associated with depression and depressive symptoms include health behaviors such as smoking, excessive alcohol consumption, physical inactivity, unhealthy diet, sleep deprivation; low income, unemployment, low social support, and perceived stress are other determinants [12-21].

Pandemic measures such as social distancing and restrictions on social activities may also lead to negative changes in health behaviors such as smoking, alcohol consumption, and physical activity. Some studies on Korean samples reported that health behaviors had not changed significantly from before the pandemic, while others reported negative changes in smoking and physical activity and positive changes in alcohol consumption [22-26].

Research has explored the association between health behaviors and psychological suffering extensively, and findings indicate that the association between lifestyle behaviors and depression, anxiety, and stress is variable and depends on the nature of behavior being studied [27-30].

Several studies conducted on American, Australian, and Vietnamese populations post-pandemic found adverse health behaviors to be associated with depression [31-35]; however, there is a lack of such studies in Korea. As there is expectation of a prolonged pandemic and subsequent psychological distress, we aimed to examine the association of negative health behaviors with depressed mood in Koreans during COVID-19.

2. Materials and Methods

2.1 Study design and study sample

A cross-sectional study was conducted from 27 October 2020 to 1 November 2020. An online survey was used to recruit Korean adults aged 20 to 69 years who had voluntarily participated in a panel of Embrain (Online Survey company). Participation in the study was voluntary and anonymous. The sampling method used was proportional random allocation based on self-weighting effects considering geographical location, age, and sex. Number of respondents that completed the survey was 1,500.

2.2 Survey questionnaire

Survey questions were developed to investigate changes in the general health level of the public regarding smoking, alcohol consumption, exercise, and social variables before and after the COVID-19 outbreak [36].

Demographic characteristics included age, gender, residential area, marital status, educational

Table 1. Sample characteristics according to depressed mood since the COVID-19 pandemic

		N(%) (n=1500)	Depressed mood		*p*-value
			Yes.(n=835)	No.(n=665)	
Gender	Male	768(51.2)	371(44.4)	397(59.7)	<.0001
	Female	732(48.8)	464(55.6)	268(40.3)	
Marital status	Married	811(54.1)	458(54.9)	353(53.1)	0.5285
	Single	689(45.9)	377(45.2)	312(46.9)	
Age	20~29	330(22.0)	182(21.8)	148(22.3)	0.7329
	30~39	340(22.7)	194(23.2)	146(22.0)	
	40~49	407(27.1)	232(27.8)	175(26.3)	
	50~	423(28.2)	227(27.2)	196(29.5)	
Residential area	Metropolitan area	800(53.3)	491(58.8)	309(46.5)	<.0001
	Non-metropolitan area	700(46.7)	344(41.2)	356(53.5)	
Age of the first child	Under 13	241(27.8)	137(28.4)	104(27.2)	0.9844
	14~19	141(16.3)	78(16.2)	63(16.5)	
	20 over	381(44.0)	211(43.7)	170(44.4)	
	No child	103(11.9)	57(11.8)	46(12.0)	
Religion	Yes.	701(46.7)	393(47.1)	308(46.3)	0.8125
	No.	799(53.3)	442(52.9)	357(53.7)	
Education	High school	264(17.6)	135(16.2)	129(19.4)	0.2598
	University	1038(69.2)	589(70.5)	449(67.5)	
	Graduate school	198(13.2)	111(13.3)	87(13.1)	
Smoking	Smoker	425(28.3)	227(27.2)	198(29.8)	0.4011
	Ex-smoker	151(10.1)	81(9.7)	70(10.5)	
	Non-smoker	924(61.6)	527(63.1)	397(59.7)	
Alcohol	Drinker	1046(70.0)	608(72.8)	438(65.9)	0.0007
	Ex-drinker	258(17.2)	142(17.0)	116(17.4)	
	Non-drinker	196(13.1)	85(10.2)	111(16.7)	
Exercise	Yes.	489(32.6)	260(31.1)	229(34.4)	0.1941
	No.	1011(67.4)	575(68.9)	436(65.6)	
Heath behavior change since COVID-19 pandemic					
Sitting or lying down time	Negative change[3]	520(34.7)	361(43.2)	159(23.9)	<.0001
	No change & positive change	980(65.3)	474(56.8)	506(76.1)	
Walking day per week	Negative change[4]	576(38.4)	392(47.0)	184(27.7)	<.0001
	No change & positive change	924(61.6)	443(53.1)	481(72.3)	
Amount of smoking[1]	Negative change[3]	58(10.1)	43(14.0)	15(5.6)	0.0014
	No change & positive change	518(89.9)	265(86.0)	253(94.4)	
Amount of alcohol consumption[2]	Negative change[3]	160(12.3)	113(15.1)	47(8.5)	0.0005
	No change & positive change	1144(87.7)	637(84.9)	507(91.5)	

[1] Cigarette per day multiplied by the frequency per month among smokers and ex-smokers
[2] Glass per day multiplied by the frequency per month among drinkers and ex-drinkers
[3] Increased by more than 10%.
[4] Decreased by more than 10%.

attainment, religion, age of the first child, and current health behaviors such as smoking, alcohol consumption, and exercise.

Depressed mood was assessed using the item "I feel depressed compared to before the COVID-19 pandemic." Responses were scored between 1 (not at all) and 7 (very much). Those with scores above 5 (slightly) were considered as having "depressed mood."

Health behaviors were assessed using four parameters that compared activities before the pandemic to the recent month before the survey:

Table 2. Associations between depressed mood and negative changes of health behavior since the COVID-19 pandemic

		Depressed mood	
		Crude model	Adjusted model[5]
All subjects			
Daily sitting or lying down time	No change/positive change	1	1
	Negative change[3]	2.42 (1.94, 3.03)	2.23 (1.77, 2.81)
Walking day per week	No change/positive change	1	1
	Negative change[4]	2.31 (1.86, 2.88)	2.04 (1.63, 2.56)
Amount of smoking[1]	No change/positive change	1	1
	Negative change[3]	2.74 (1.48, 5.05)	2.84 (1.51, 5.36)
Amount of alcohol consumption[2]	No change/positive change	1	1
	Negative change[3]	1.91 (1.34, 2.74)	1.82 (1.26, 2.63)
Men			
Daily sitting or lying down time	No change/positive change	1	1
	Negative change[3]	2.70 (1.96, 3.73)	2.64 (1.90, 3.67)
Walking day per week	No change/positive change	1	1
	Negative change[4]	2.47 (1.80, 3.40)	2.43 (1.76, 3.35)
Amount of smoking[1]	No change/positive change	1	1
	Negative change[3]	2.62 (1.34, 5.13)	2.89 (1.45, 5.74)
Amount of alcohol consumption[2]	No change/positive change	1	1
	Negative change[3]	1.89 (1.16, 3.09)	1.83 (1.12, 3.00)
Women			
Daily sitting or lying down time	No change/positive change	1	1
	Negative change[3]	1.98 (1.44, 2.72)	1.86 (1.34, 2.57)
Walking day per week	No change/positive change	1	1
	Negative change[4]	1.86 (1.37, 2.53)	1.70 (1.24, 2.33)
Amount of smoking[1]	No change/positive change	1	1
	Negative change[3]	2.64 (0.54, 12.86)	2.54 (0.50, 12.94)
Amount of alcohol consumption[2]	No change/positive change	1	1
	Negative change[3]	1.86 (1.08, 3.21)	1.65 (0.94, 2.89)

[1] Cigarette per day multiplied by the frequency per month among smokers and ex-smokers
[2] Glass per day multiplied by the frequency per month among drinkers and ex-drinkers
[3] Increased by more than 10%
[4] Decreased by more than 10%
[5] Adjusted for gender, age, marital status, residential area, and alcohol consumption. For alcohol consumption, adjusted for gender, age, marital status, and residential area

1) hours and minutes spent per day (on average) on sitting or lying down; 2) days spent per week (on average) walking for more than 30 minutes; 3) average daily amount of smoking and the frequency per month; 4) days per month and glasses per day (on average) of drinking alcohol. Total amount of smoking per month was calculated as the number of cigarettes smoked per day multiplied by the frequency per month. Total amount of alcohol consumption per month was calculated as the number of glasses consumed per day multiplied by the frequency per month. Health behaviors that showed adverse changes of more than 10% compared to that before COVID-19 were defined as 'negative changes'.

2.3 Statistical analyses

General characteristics were assessed by Chi-square test. A logistic regression model was used to assess the association between depressed mood and negative changes of health behaviors.

SAS v9.4 software was used for the analysis and all p-values were tow-sided and considered significant if less than 0.05.

3. Result

Table 1 represents demographic and health behavior characteristics of the sample. More than half (n = 835, 55.7%) of the participants had depressed mood post the COVID-19 outbreak. The results indicate an increased ratio of women than men (n = 464, 55.6%, p-value < 0.0001), people living in a metropolitan area than in a non-metropolitan area (n = 491, 58.8%, p-value < 0.0001), and drinkers than ex-drinkers and non-drinkers (n = 608, 72.8%, p-value = 0.0007) to have significantly depressed mood. Moreover, negative changes were found in health behaviors, including increased sitting or lying down time (34.7%), decreased walking (38.4%), increased smoking (10.1%), and increased alcohol consumption (12.3%) (Fig. 1).

The depressed mood group constituted a significantly higher percentage of individuals with negative changes in all health behaviors after the pandemic as compared to the not depressed group (increased sitting or lying down time: n = 361, 43.2%, p-value < 0.0001, decreased walking time: n = 392, 47.0%, p-value < 0.0001, increased smoking: n = 43, 14.0%, p-value = 0.0014, and increased alcohol consumption: n = 113, 15.1%, p-value = 0.0005). The percentage of married males with significantly depressed mood was higher than that of unmarried ones (married: n = 211, 56.9%, p-value = 0.0445), which varied from the data on females (married: n = 247, 53.2%, p-value = 0.1852).

Associations between post-pandemic depressed mood and negative changes in health behaviors are outlined in Table 2. Participants who reported a negative change in health behavior had a significantly higher probability of being depressed after the pandemic (sitting or lying down time: adjusted OR = 2.23, 95% CI = 1.77 - 2.81; walking time: adjusted OR = 2.04, 95% CI = 1.63 - 2.56; smoking: adjusted OR = 2.84, 95% CI = 1.51 - 5.36; alcohol consumption: adjusted OR = 1.82, 95% CI =1.26 - 2.63). Furthermore, the odds ratio for men compared to women were slightly higher for all four health behaviors.

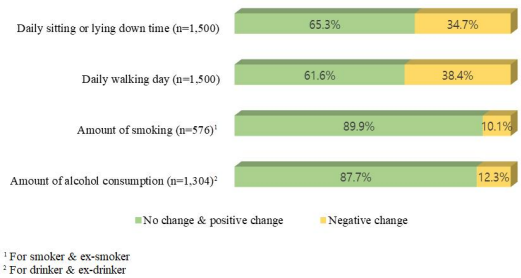

Fig. 1. Proportion of those showing changes in health behavior since the COVID-19 pandemic

4. Discussion

The present study demonstrated that over half the participants were more depressed after the COVID-19 pandemic than before. This varies from previous studies which reported the prevalence of depression in Koreans as 18.8% - 36.75% and globally as 27.6% post-pandemic [7-11]. The disparity in results could be because the current study investigates 'subjective depressed mood' as compared to 'depression' investigated in earlier studies.

Percentage of those who had negative changes in sitting or lying down time (34.7%) and walking time (38.4%) was similar to results of previous studies. In a study with Australian adults, almost half (48.9%) of the respondents reported a negative change (reduction) in physical activity since the onset of the pandemic [31]. A survey conducted in the UK showed that the proportion of respondents with negative behavior changes after lockdown was 40% for exercise, 34% for

being physically active, and 73% for time spent sitting down [37]. The decrease in time for daily sitting or lying down and walking may be a consequence of social restrictions arising from social distancing, working or studying from home, and constraints on outdoor facilities. Nevertheless, considering the benefits of physical movement for depressed mood, a strategy to promote physical activities is essential.

According to our data, 14% of the participants reported negative changes in smoking which is similar to other findings such as in Australia, where this percentage was 7% [31]. Since smokers are more prone to respiratory tract infections, a study in China examined the association between smoking and COVID-19 and found that smoking is linked to a poor prognosis of COVID-19 [38,39]. Although further research is needed in this area, it is important to initiate health promotion measures aimed at informing the public about the risks of smoking during COVID-19.

In an Australian study, almost 25% of respondents reported a negative change in alcohol use since the onset of COVID-19 [31]. Additionally, in the UK, 17% and in Canada, 12% of the participants also reported increased alcohol consumption [40,41]. Similarly, these negative changes were found in 12% of the respondents of our study. Research suggests that the increase in consumption may help deal with psychological stress during the pandemic [32]. A concurrent health strategy may be to inform and educate the population of the risks associated with increased drinking during the pandemic.

Results of the present study indicate that after the pandemic, negative changes in health behaviors were significantly associated with depression consistent with previous reports [31-33,42]. In an Australian cross-sectional study, participants who reported negative changes in physical activity, smoking, and alcohol consumption were more prone to depression. In addition, several previous studies have reported that an increase in sedentary behaviors during the lockdown is associated with adverse changes in physical and mental health [43-45], which is consistent with our results.

The strengths of the current study include a relatively large sample of Korean adults with a good representation of males and females. Moreover, participants were recruited using the proportional method which can obtain a self-weighting effect through a comparative analysis of a city's/province's population. Second, it was possible to observe the changes that occurred in the early, restrictive period of the pandemic in Korea, since our study was conducted 10 months after the outbreak. Finally, to the best of our knowledge, this is the first such study to report associations between health behaviors and depressed mood in Korean adults during COVID-19.

A key limitation of this study was that data was self-reported, potentially introducing self-reporting and recall bias into these findings. Second, epidemiologic causality cannot be inferred due to the cross-sectional design of the study. Third, the identification for depressed mood was based on self-report questionnaires and not clinical diagnoses. Thus, it should be noted that utilizing different definitions might lead to different effect size and results. Last, because the questionnaire does not cover all physical aspects (e.g., Metabolic equivalents (METs) measurement), we could not measure the complete physical routine. However, variables of sitting or lying down time and walking time were good proxies for sedentary behaviors during the brief lockdown [34,35,46,47].

In conclusion, negative changes in daily sitting or lying down time, daily walking time, smoking, and alcohol consumption are

associated with being more depressed during the COVID-19 pandemic.

Once the pandemic shifts to an endemic phenomenon, psychological distress is expected to be a critical issue in Korea. Thus, strategies to promote positive health behaviours change (increased activities and decreased consumption of smoking and alcohol) could help address psychological distress during the COVID-19 pandemic. Further investigation into positive health change could play a role in coping with other major distress events such as COVID-19.

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