ORIGINAL ARTICLE

A STUDY ON THE COMPARISON OF THE ALTERATION OF BODY MASS INDEX (BMI) DURING THE COVID-19 PANDEMIC AMONG THE FILIPINO AND SOUTH KOREAN POPULATION FOR FUTURE HEALTH RISK ASSESSMENT

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ABSTRACT

The Philippines and South Korea are among countries still dealing with the COVID-19 disease pandemic (2022) with varying approaches such as frequent lockdowns and work from home leading to restricted movement and sedentariness. Hence, it is of interest to compare the Filipinos and Korean populations in terms of alterations in body mass index based on lifestyle factors such as gender, age, smoking, drinking, physical activities, COVID-19 history, and other reported health problems during the pandemic. Using Google survey, data from Filipinos and South Koreans were matched, based on each factor using the two-sample z-tests and one-way analyses of variance for BMI and two-tailed tests of population proportion for the number of respondents was done. Results showed that before and during the pandemic, Filipinos had statistically significant higher mean BMI in most factors, which may be due to differences in lifestyle, pandemic management, and stricter lockdown implementations by the government. A greater number of Filipinos suffered severe COVID-19 symptoms which may be associated with higher BMI and vaccination conflicts. A statistically significant increase in the cases of mental disorders ($p = 0.0003$) and the higher mean BMI of Filipinos with mental disorders than South Koreans ($p = 0.0053$) were notable during the pandemic. Thus, association between mental disorders and high BMI needs further investigation. The results warrant immediate intervention measures by stakeholders to deal with health situations arising from higher BMI and mental disorders in the Philippines and the lowering of BMI at unhealthy levels in the South Korea population.

Keywords: *Body mass index, COVID-19 pandemic, heart diseases, mental disorders, Philippines, smoking, South Korea*

INTRODUCTION

The coronavirus disease 2019 (COVID-19) caused a pandemic[1] that required lockdowns, leading to sedentariness[2]. There is a risk of weight gain during the pandemic[3] and obesity may worsen COVID-19 outcomes by lessening lung capacity[4]. The study focused on lifestyle factors that can affect COVID-19[5], i.e., smoking, drinking, physical activity, and other health problems. The Philippines and South Korea are still dealing with the outbreak as of June 2022. One (1) in four (4) Filipinos had anxiety and one (1) in six (6) had depression[6]. Education was disrupted, some household heads became unemployed, and those who retained employment had income decrease or no payment[7]. South Korea efficiently responded to the outbreak[8]. Appropriate measures were implemented and were reported to be under a stable quarantine policy in terms of fatality and recovery rate compared to the Philippines[9]. The Philippines and South Korea both had a high number of cases at the start of the rapid overflowing transmission of the virus, but the difference in the response was massive. Previous studies highlighted the effect of response inequalities between the two countries[10] and compared dietary habits of other countries in relation to COVID-19, which pointed to availability of food accounting for the vulnerability of the population[11]. In this study, the response to the pandemic of a more developed country and a less developed one was further delved into by comparing the lifestyle of the citizens, taking into account lifestyle factors (gender, age, smoking, drinking, physical activities, COVID-19 history, and other reported health problems during the pandemic), as these are greatly affected by the strategies their countries had adopted. However, decline in physical activity, quality of life, and mental health were observed among Koreans as well[12]. With limited evidence on the BMI of Filipinos and South Koreans, the study focused on these countries. The differences between before and during the pandemic and between Filipinos and South Koreans were analyzed; thus, it was assumed that the pandemic is ongoing. With these, the study highlighted the effects of each country's quarantine measures on its citizens' overall health. These should be recognized to improve the response to future occurrences similar to COVID-19 pandemic and prepare for the overall anticipated decline in the health status of the populations.

METHODS

Survey

Surveys were conducted in a questionnaire form via Google Forms filled out by the respondents; to accommodate difficulties in answering online

(respondents ≥60 years old), surveys were available as hard copies. The questionnaire was prepared in English for Filipinos and Hangul for South Koreans. For each respondent, the survey was designed to access information from two (2) time periods (before and during the COVID-19 pandemic until April 2022) and on demographics (gender, age group), anthropometric traits (weight, height), and lifestyle factors (cigarette stick consumption, drinking history, physical activities, COVID-19 history, other health problems).

Data Gathering

Respondents were recruited via convenience sampling. A respondent must be ≥18 years old, a Filipino residing in the Philippines or a South Korean residing in South Korea. 570 responses were collected from the Philippines which became 564 because six (6) were <18 years old. 113 responses were collected from South Korea. Prior to the anonymous survey, respondents were informed of the terms of the Data Privacy Act of 2012 and its Implementing Rules and Regulations in the Philippines.

Data Analysis

Microsoft Excel with PHStat was used. Two-sample z-tests were conducted for mean BMI of gender, age group, cigarette stick consumption, drinking history, physical activity hours, COVID-19 severity, and other health problems. One-way analysis of variance (ANOVA) was conducted for the mean BMI of gender and age group. Two-tailed tests of proportion were conducted for the number of respondents based on COVID-19 severity, and other health problems. Each test had a 95% confidence interval.

RESULTS

Philippines

The Philippines revealed more females (59.75%) who significantly had lower mean BMI before (p = 0.0077) and during (p = 0.0001) the pandemic (Table 1). The age group 18-30 years old had the most respondents (70.92%); their mean BMI was significantly different from other groups (p = 0.0000). Non-smokers increased from before (89.36%) to during (93.97%) the pandemic; other subcategories decreased. There were mostly non-drinkers (53.55%) during the pandemic. Most spent 1-10 hours of physical activities before (69.86%) and during (72.52%) the pandemic. Respondents who were COVID-19-positive had mild symptoms (71.76%); the highest mean BMI before the pandemic had severe symptoms. Filipinos mostly had no existing health problems before (71.63%) but decreased during (65.07%) the pandemic. The common health problem was high cholesterol, cardiovascular diseases (CVD), or hypertension (HPN) before (8.87%) and during (10.46%) the pandemic. For these factors, the mean BMI differences were insignificant. There were significant differences in the number of Filipinos who tested positive (15.60%) and never tested positive (84.40%) for COVID-19 (p = 0.0000) (Table 3), who had no other health problems (p = 0.0178), and who had mental health disorders (p = 0.0003) (Table 4).

South Korea

South Korea revealed more females (79.65%) who significantly had lower mean BMI than males and sexual and gender minorities (SGM) before (p = 0.0008) and during (p = 0.0057) the pandemic (Table 1). The age group 18-30 years old had the most respondents (71.68%), although statistically insignificant before (p = 0.1570) and during (p = 0.1995) the pandemic. The respondents were mostly non-smokers before (70.80%) which increased during (87.99%) the pandemic; there was a decrease in smokers who consume 8-49 sticks (12.39% to 11.50%) and ≥50 sticks (15.93% to 10.62%). Most were active drinkers (71.68%). Most spent 1-10 hours of physical activities before (76.99%) and during (80.53%) the pandemic. Mild COVID-19 was the common occurrence (84.21%); there were no moderate or severe cases. South Koreans mostly had no existing health problems before (63.72%) but decreased during (58.41%) the pandemic. The most common health problem was mental disorders before (18.5%) and during (23.01%) the pandemic. For these factors, the mean BMI differences from before to during the pandemic were statistically insignificant except asthmatic respondents (p = 0.0010). The findings were statistically insignificant on COVID-19 history (Table 3) and health problems (Table 4).

Comparison between Filipinos and South Koreans

The mean BMI of Filipinos was generally higher than South Koreans in all factors except among respondents with high cholesterol, CVD, or HPN and in respondents with other health problems before the pandemic (Table 1). Table 2 shows that the mean BMIs of Filipinos and South Koreans were significantly different in females across all age groups; 0 and 8-49 sticks consumed weekly before the pandemic, 0 and ≥50 sticks consumed weekly during the pandemic; all drinker subcategories; 0 and 1-10 physical activity hours; asymptomatic and mild COVID-19 cases; and no health problems, allergies, mental disorders during the pandemic, and asthma. The factors wherein the mean BMI of Filipinos were lower than South Koreans were statistically insignificant. There were also significant differences between Filipinos and South Koreans regarding the number of respondents who tested positive for COVID-19 and moderate cases (Table 3).

Table 1a. BMI of Filipinos (PH) and South Koreans (SK) before (B) and during (D) the pandemic

FACTORS	n (%)		Mean BMI		p-value	
	B	D	B	D	B	D
Gender						
PH: Male	227 (40.25%)		24.03	24.85	0.0855	
Female	337 (59.75%)		22.86	23.20	0.3708	
	p-value		0.0077*	0.0001*		
SK: Male	21 (18.58%)		23.37	23.54	0.8688	
Female	90 (79.65%)		20.60	20.88	0.5255	
SGM (1 non-binary, 1 queer)	2 (1.77%)		18.55	19.58	0.6811	
	p-value		0.0008*	0.0057*		
Age Group (years old)						
PH: 18-30	400 (70.92%)		22.27	22.91	0.0000*	0.0000*
31-45	69 (12.23%)		25.83	25.94		
46-60	76 (13.48%)		25.95	26.33		
61-90	19 (3.37%)		26.11	26.39		
SK: 18-30	81 (71.68%)		20.66	21.02	0.1570	0.1995
31-45	7 (6.19%)		21.93	21.97		
46-60	23 (20.35%)		22.21[b]	22.17		
61-90	2 (1.77%)		22.36	22.98		
Cigarette Consumption (sticks/week)						
PH: 0	504 (89.36%)	530 (93.97%)	23.20	23.78	-	-
1-7	25 (4.43%)	15 (2.66%)	22.64	22.65	-	-
8-49	29 (5.14%)	15 (2.66%)	24.37	24.56	-	-
≥50	6 (1.06%)	4 (0.71%)	28.75	30.38	-	-
SK: 0	80 (70.80%)	87 (76.99%)	20.80	21.27	-	-
1-7	1 (0.88%)	1 (0.88%)	20.45	21.22	-	-
8-49	14 (12.39%)	13 (11.50%)	21.21	22.22	-	-
≥50	18 (15.93%)	12 (10.62%)	22.27[b]	20.97	-	-
Drinking History						
PH: Non-drinker	302 (53.55%)		23.08	23.65	0.1634	
Non-active	45 (7.98%)		24.40	24.70	0.8382	
Active	217 (38.48%)		23.32	23.82	0.2493	
SK: Non-drinker	19 (16.81%)		21.30	21.45	0.8735	
Non-active	13 (11.50%)		21.27	21.33	0.9679	
Active	81 (71.68%)		21.00	21.33	0.5107	
Physical Activity (hours/week)						
PH: 0	101 (17.91%)	101 (17.91%)	23.84[b]	23.70	-	-
1-10	394 (69.86%)	409 (72.52%)	23.34	23.88	-	-
11-20	48 (8.51%)	40 (7.09%)	22.19	23.43	-	-
≥21	21 (3.72%)	14 (2.48%)	22.23	24.12	-	-
SK: 0	17 (15.04%)	17 (15.04%)	21.11[b]	20.48	-	-
1-10	87 (76.99%)	91 (80.53%)	21.07	21.43	-	-
11-20	9 (7.96%)	5 (4.42%)	21.08	22.82	-	-
≥21	0 (0.00%)	0 (0.00%)	-	-	-	-
COVID-19 Severity						
PH: Asymptomatic	14 (16.47%)		27.08	28.25	-	-
Mild	61 (71.76%)		23.68	24.20	-	-
Moderate	6 (7.06%)		23.98[b]	23.90	-	-
Severe	4 (4.71%)		27.43[b]	26.77	-	-
SK: Asymptomatic	9 (15.79%)		21.09	21.52	-	-
Mild	48 (84.21%)		21.28	21.38	-	-
Moderate	0 (0.00%)		-	-	-	-
Severe	0 (0.00%)		-	-	-	-

Table 1b. BMI of Filipinos (PH) and South Koreans (SK) before (B) and during (D) the pandemic

Health Problems					
PH: None	404 (71.63%)	367 (65.07%)	22.92	23.56	0.0562
High cholesterol, CVD, HPN	50 (8.87%)	59 (10.46%)	26.18[ab]	25.93	0.8319
Allergies	38 (6.74%)	43 (7.62%)	21.96	23.10	0.2567
Mental disorders	27 (4.79%)	59 (10.46%)	21.95	23.06	0.4484
Asthma	27 (4.79%)	28 (4.96%)	23.73	24.26	0.7095
Diabetes, high blood sugar	24 (4.26%)	28 (4.96%)	28.88[b]	27.76	0.5072
Others	25 (4.43%)	29 (5.14%)	24.11[a]	24.13	0.9903
SK: None	72 (63.72%)	66 (58.41%)	21.03	21.39	0.5048
High cholesterol, CVD, HPN	6 (5.31%)	6 (5.31%)	26.74[b]	25.83	0.6620
Allergies	15 (13.27%)	19 (16.81%)	19.83	20.57	0.2134
Mental disorders	21 (18.58%)	26 (23.01%)	20.37	20.61	0.7737
Asthma	2 (1.77%)	3 (2.65%)	20.57[b]	19.21	0.0010*
Diabetes, high blood sugar	4 (3.54%)	4 (3.54%)	23.79[b]	23.66	0.9704
Others	3 (2.65%)	4 (3.54%)	24.32[b]	22.68	2.0791

[a] *BMI is lower than South Korean counterpart*
[b] *BMI decreased from before to during the pandemic*
** Significant at p < 0.05*

Table 2. Comparison of mean BMI between Filipinos and South Koreans as represented with p-values before (B) and during (D) the pandemic.

FACTORS	p-value	
	B	D
Gender		
Male	0.4347	0.0836
Female	0.0000*	0.0000*
Other	-	-
Age Group (years old)		
18-30	0.0001*	0.0000*
31-45	0.0017*	0.0004*
46-60	0.0000*	0.0000*
61-90	0.0132*	0.0167*
Cigarette Consumption (sticks/week)		
0	0.0000*	0.0000*
1-7	-	-
8-49	0.0435*	0.1337
≥50	0.0642	0.0400*
Drinking History		
Non-drinker	0.0103*	0.0037*
Non-active	0.0395*	0.0193*
Active	0.0000*	0.0000*
Physical Activity (hours/week)		
0	0.0011*	0.0000*
1-10	0.0000*	0.0000*
11-20	0.2553	0.5338
≥21	-	-
COVID-19 Severity		
Asymptomatic	0.0004*	0.0000*
Mild	0.0023*	0.0001*
Moderate	-	-
Severe	-	-
Health Problems		
None	0.0000*	0.0000*
High cholesterol, CVD, HPN	0.7497	0.9509
Allergies	0.0117*	0.0017*
Mental disorders	0.2718	0.0053*
Asthma	0.0007*	0.0000*
Diabetes, high blood sugar	0.0874	0.1021
Others	0.9478	0.3461

** Significant at p < 0.05*

Table 3: COVID-19 history before (B) and during (D) the pandemic

COVID-19 History	n (%)		p-value
	Philippines	South Korea	
COVID-19 Result			
Tested positive	88 (15.60%)	57 (50.44%)	0.0000*
Never tested positive	476 (84.40%)	56 (49.56%)	0.0000*
p-value	0.0000*	0.8966	
COVID-19 Severity			
Asymptomatic	14 (16.47%)	9 (15.79%)	0.9124
Mild	61 (71.76%)	48 (84.21%)	0.0854
Moderate	6 (7.06%)	0 (0.00%)	0.0404*
Severe	4 (4.71%)	0 (0.00%)	0.0969

** Significant at p < 0.05*

Table 4: Health problems before (B) and during (D) the pandemic

Health Problems	n (%)		p-value
	B	D	
Philippines			
None	404 (71.63%)	367 (65.07%)	0.0178*
High cholesterol, CVD, HPN	50 (8.87%)	59 (10.46%)	0.3628
Allergies	38 (6.74%)	43 (7.62%)	0.5619
Mental disorders	27 (4.79%)	59 (10.46%)	0.0003*
Asthma	27 (4.79%)	28 (4.96%)	0.8887
Diabetes, high blood sugar	24 (4.26%)	28 (4.96%)	0.5687
Others	25 (4.43%)	29 (5.14%)	0.5755
South Korea			
None	72 (63.72%)	66 (58.41%)	0.4122
High cholesterol, CVD, HPN	6 (5.31%)	6 (5.31%)	1.0000
Allergies	15 (13.27%)	19 (16.81%)	0.4593
Mental disorders	21 (18.58%)	26 (23.01%)	0.4122
Asthma	2 (1.77%)	3 (2.65%)	0.6527
Diabetes, high blood sugar	4 (3.54%)	4 (3.54%)	1.0000
Others	3 (2.65%)	4 (3.54%)	0.7039

** Significant at p < 0.05*

DISCUSSION

Gender

The ratios of males to females in Filipinos (1:1.48) and South Koreans (4.29:1) do not reflect the national ratios (1.02:1)[13] and (1:1)[14], respectively, which may be due to limitations of convenience sampling. No data was available on SGM but it is known that weight discrimination and stigma is a common experience among sexual minorities[15]. Increases in weight were also found in China, Saudi Arabia, and United States[16], which was also believed to be due to sedentariness[17]. Females' lower mean BMI in this study may be due to body image concerns[18]; women are likely to be discriminated against regarding weight[19]. Males are likely to have hypertension[20], a disease linked to higher BMI[21] and is the most common health problem among Filipinos in this study. Filipino women are concerned with body image satisfaction, i.e., those with lower BMI were more satisfied with their body image[22]; nonetheless, South Koreans reported lower mean BMI than Filipinos—South Korean society had a strong preference for thinness due to weight-based bias[19].

Age Group

Older individuals are more susceptible to diseases[23] due to falls, and sensory, cognitive, and physiological changes[24]. The body undergoes changes with aging—metabolism is stable at around 20-60 years old but declines thereafter[25]. Physical inactivity leading to lower energy expenditure is more common in older people[26]. Changes in muscle and fat mass are linked to aging wherein muscle mass decreases while fat mass increases with aging[27].

Smoking

The public information on COVID-19 stated that it affects respiratory tract[28]; this may be a reason for the decrease in the number of smokers. The fear of the disease may have caused people to take better care of their respiratory systems with hopes to avoid complications if they contract COVID-19. The decrease in the number of active smokers during the pandemic may be related to the Philippines advocating for smoking cessation and disseminating information on the ill-effects of cigarettes[29]. The number of active smokers decreasing can be attributed to the South Korean government's response on tobacco consumption

and national smoking cessation during the pandemic[30].

Drinking

This study revealed that alcohol consumption increased during the pandemic. Despite the Philippines having experienced liquor bans a number of times, these implementations did not deprive the citizens of access to alcoholic beverages. In South Korea, no liquor ban was implemented except for online sales of liquor which was then lifted[31]. Other studies found that alcohol consumption increase was due to stress, anxiety, distractions, and feeling safer or as if they were outside[32]; however, for those whose alcohol consumption decreased was due to the lack of access to alcoholic drinks, less money, free time, and interest, and an attempt to a healthier lifestyle. In relation to this, it has been reported that excessive alcohol consumption may result in the weakening of the immune system; given the pandemic, this may cause the person to be more susceptible in acquiring COVID-19[33].

Physical Activities

Physical exercise plays a role in maintaining health[34]. Inactivity may cause a development of comorbidities like diabetes, hypertension, and heart conditions, increasing susceptibility in acquiring the virus[35]; age, lack or excess of food intake, and types of diet may also influence the development of comorbidities. Despite the closing of fitness centers in compliance with lockdown guidelines, it was proven otherwise in the data as there was an increase of respondents who became more active. A decrease in physical activities in those with 11-20 and ≥21 hours among Filipinos and 1-10 hours among South Koreans may be influenced by having insufficient time, longer work hours, lack of access to equipment, space or place, social support, mental health, and other health-related problems[36], which may also apply to the physically inactive during both time periods. The increase in mean BMI during the pandemic despite being physically active, however, may be influenced by the specific number of hours. The type of workout and diet may also be considered.

COVID-19 History

South Korea was one of the first countries to experience the COVID-19 outbreak[37] before being categorized as a global pandemic[38]. This could have contributed to more than half of the South Korean respondents testing positive. The disparity in vaccine distribution especially because vaccination can dampen severity and slow the spread of COVID-19[39] could have played a role in how there is no South Korean who experienced the two worst severities. By June 2022, 63.9% of Filipinos and 86.2% of South Koreans were fully vaccinated[40]. South Korea was able to procure 194 million doses of COVID-19 vaccines by August 2021[41]. They also consistently accommodated those who needed healthcare access[11]. In the Philippines, there were conflicts on vaccine brands—the president opted for a brand from the United States but the national government procured mostly Sinovac[42]. This did not help in gaining the trust of Filipinos whose vaccine hesitancy has been worsening due to the DengVaxia issue that occurred years prior[43]. The mean BMI differences among COVID-19 severities may be attributed to loss of taste and appetite—common experiences among people with COVID-19[44-45]. Symptoms may last after the infection, i.e., 'long COVID', which is more common to those with severe COVID-19[46]. Dysfunction of taste or smell are experienced even after COVID-19 infection, wherein some participants reported weight loss[47-48].

Health Problems

Being overweight or obese are related to chronic diseases[49]. Filipinos with mental disorders significantly increased during the pandemic; the prevalence of anxiety and depression during the pandemic increased worldwide[50]. The negative mental health issues on Filipino university students that the pandemic caused were due to the fear of getting infected and financial difficulties[51]. The increased mean BMI of Filipinos with mental issues may be related to intake of medications—the commonly prescribed medications are selective serotonin reuptake inhibitors (SSRIs)[52] with weight gain as a prevalent side effect[53] that is amplified by unhealthy lifestyles like sedentariness[54]. Moreover, the increase in the mean BMI may be attributed to the symptoms of anxiety and depression such as inactivity or overeating[55-56], or paradoxically, weight gain through sedentariness could have led to vulnerability. Obesity heightens the chances of getting depression and anxiety since vascular and metabolic dysfunctions work as risk factors[57]. Bidirectional association between mental disorders and obesity was also reported[58-59]. An increase in the mean BMI of Filipinos who do not have any underlying health condition has been observed as well, which may be attributed to restricted movement[17, 60]. The statistically significant decrease in the mean BMI of asthmatic South Koreans may be related to the previous findings on how weight control may improve the treatment of asthma in people with obesity[61]; nonetheless, decline in BMI may also be linked to factors like physical activities or diets.

Comparison of BMI between Filipinos and South Koreans

The mean BMI of Filipinos was generally higher. Reports on distorted body images that South Koreans perceive with the social pressure for thinness[62] along with unhealthy weight loss diets[63], it is one of the countries with the highest prevalence of eating disorders[64] and lowest obesity rate[65]. In the older COVID 19 patients, BMI bordering underweight was associated with

an increased risk of death in South Korea[66]. In terms of lifestyles, the gap in lifestyles between South Koreans and Filipinos due to the disparities in government regulations on COVID-19 could have resulted in a higher BMI and higher incidences of mental disorders in Filipinos during the pandemic. South Korea is said to have a better response to the COVID-19 outbreak than other countries[11], wherein they were able to accommodate those who needed healthcare access. Additionally, no national lockdowns or shutdown measures were implemented[67]. In contrast, the Philippines' measures was described to be 'militaristic' with one of the strictest and longest lockdowns worldwide[68]; it included stringent limitations on mobility of individuals[69] especially the elderly, which heightened the hurdles for proper medical care[70]. Thus, the strict implementation against COVID-19 in the Philippines could have resulted in heavier mental tolls and poorer access to the healthcare systems compared to South Korea, and consequently reported higher mean BMI and incidence of ailments.

Limitations

The lower sample size of South Koreans than Filipinos was due to reluctance of the former to reveal information regarding their health status. Convenience sampling and availability of respondents could have also led to variations in the number of respondents.

CONCLUSIONS

Filipinos had higher mean BMI during the COVID-19 pandemic than South Koreans, which possibly made them more susceptible to health problems including COVID-19. There were statistically significant differences in the mean BMI between Filipinos and South Koreans in almost all the subcategories per factor, which may be attributed to the differences in lifestyle and government approach to healthcare pre-, during, and post-COVID-19. Thus, the health sectors of national governments should actively improve based on informed choices regarding persistent promotion of healthy lifestyles, effective dissemination of health information, and proper management of outbreaks, which must all be prioritized for the wellbeing of people especially during a pandemic.

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Competing interests

There are no competing interests to declare.

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