

*Original Research*

# Health Perceptions of Korean and Japanese Adolescents During the Prolonged COVID-19 Pandemic: An Importance Performance Analysis

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Submitted: 28 June 2022 Revised: 29 July 2022 Accepted: 8 August 2022 Published: 11 November 2022

## Abstract

**Background:** This study compares and analyzes the importance and performance of Korean and Japanese adolescents' health awareness in the long COVID-19 pandemic situation. **Methods:** A frequency analysis was conducted on data collected from 1341 Korean and Japanese adolescents in September 2021 through online and offline surveys to confirm their characteristics (reliability was verified through Cronbach's  $\alpha$ ). A paired sample test was conducted to analyze health awareness differences and performance of each variable between Korean and Japanese middle-school students and between male and female participants, substantiated by importance-performance analysis (IPA). **Results:** First, Korean adolescents perceived importance for all factors of health perception greater as compared to their Japanese counterparts. Second, performance differences between Korean and Japanese adolescents were especially significant in hygiene management, disease management and physical activity. Third, in Quadrant 4 of the IPA matrix, there were similarities and differences in a particular factor of health perception between Korean and Japanese adolescents. On this basis, we proposed measures emphasizing the importance of health, to enhance Korean and Japanese adolescents' performance. **Conclusions:** It is important for national government, public education institutions, and families to couple a therapeutic approach with a preventive and management approach that encourages periodic exercise, desirable diet, and adequate sleep when exploring measures to maintain and promote adolescents' health.

**Keywords:** importance-performance analysis; COVID-19; health perceptions; Korean; Japanese; adolescents

## 1. Introduction

The onset of the coronavirus disease 2019 (COVID-19) in November 2019 and the consequent use of face masks and social distancing practices have significantly disrupted life as we know it [1]. Social distancing practices and a contactless way of life have been some of the key consequences of this changing world [1]. Experts predict the impossibility of returning to the pre-COVID-19 life even after the eradication of the virus [1]. It is anticipated that this contactless way of life will persist even post COVID-19.

Sedentary time increased, and physical activity reduced during the COVID-19 pandemic [2,3]. Concerns about elevated sedentary time raised before the pandemic have intensified during the outbreak. Such lifestyle changes have increased the percentage of the obese [4]. Countries struck by COVID-19 report several psychological problems, including depression and anxiety [3].

These problems are not confined to the adult population but rage across adolescents as well [5,6]. Schools—where Korean adolescents spend most of their day—have

focused on anti-COVID-19 measures to halt the virus's spread [4]. Indoor exercise facilities actively utilized by adolescents before the pandemic have closed. Other potential channels that could spread the virus, movement within schools and extracurricular sports activities (e.g., school sports clubs, afterschool sports, time fillers, Saturday sports day activity) have also been controlled [7]. Adolescents engage less in voluntary outdoor activities, as they fear contracting COVID-19. With controlled physical activities within and outside the school, adolescent health problems have emerged [8]. Educational authorities are sensitively reacting to these societal issues pertaining to academics and childcare. They focus on measures to run curricular physical education (PE) classes amid environmental changes provoked by the COVID-19 pandemic, such as online classes [9]. Educational interests in comprehensive issues of adolescent health and physical activity are minimal.



The situation is similar in Japan. The percentage of Japanese schools that implemented temporary closure of specific grade levels and classes in response to the prevalent COVID-19 cases was still high at 13.8% as of February 9, 2022, and 8.5% as of March 9, 2022 [10]. Amidst such conditions, 31.5% of elementary schools provided safe home exercise guides [10]. The percentages of schools providing exercise guidance decrease with advancing grade levels: 36.0% among elementary schools, 25.1% among middle schools, and 21.1% among high schools [10]. However, reduced physical activities have been reported across a range of age groups [11]. Concerns have been raised about the decline in children's physical fitness [10], polarization of exercise habits [12,13], decrease in physical activity and life satisfaction among college students [11,14], and the decline of physical activity in the elderly [15].

Previous studies on adolescents' health during the COVID-19 pandemic examined adolescents' mental health, and most reported a deterioration in adolescent mental health during the pandemic. The COVID-19 pandemic elevated depression, anxiety, social isolation, maladaptation, stress, and physical health deterioration among adolescents [5,14–19]. Further, the prevalence of obesity has risen [20], and physical activities markedly declined among adolescents during the pandemic [21–23]. Many countries ordered the closure of indoor and outdoor sports facilities, such as swimming pools, playgrounds, and gyms [20]. Such measures limited adolescents' physical activities and induced their social isolation [24]. Adolescent health-related quality of life (HRQoL) has reduced [25] with their lifestyle [5,26,27]. These can be attributed to the closure of schools, the primary place of physical activity among adolescents, or restrictions of physical activities within schools even after their reopening [28,29]. In their importance-performance analysis (IPA) of health perceptions among Korean adolescents during the COVID-19 pandemic, Lee, So, and Youn [5] discovered disparities between therapeutic and preventive health factors. A follow-up study analyzed health perception differences according to the types of virtual Physical Education classes in transitioning from Physical Education classes to online classes [6].

The necessity to verify whether these study findings are unique to Korean adolescents or are universally evident across all adolescent populations has been highlighted. First, we aim to conduct a follow-up study comparing these study findings with those of Japanese adolescents, since Japan features a similar school education system. In addition, the questionnaire has been reorganized and a new analysis method applied to compensate for the IPA results used by Lee, So, and Youn [5] and Yoo, Han, Youn, and Jung [6], collected only in one specific dead quadrant. We seek to develop a questionnaire that addresses this issue for our use. Previous studies also played a small part in revealing the differences between male and female participants. This study plans to analyze health perceptions of

students continuing their academic endeavors even during a global pandemic and present some alternatives. This study differs from previous literature in that it suggests alternatives while observing the development, spread, and settling phases of the COVID-19 pandemic and tracking adolescents' health awareness. Our study will shed light on the importance of adolescents' health perceptions during the prolonged COVID-19 pandemic and discover alternative educational measures for actively addressing the health management problems affecting adolescents.

The objective of this study is to conduct an empirical analysis by applying a modified IPA technique that divides Korean and Japanese adolescents' health perceptions during the COVID-19 pandemic into six domains: mental health management, disease management, physical activity management, sleep management, diet management, and hygiene management. The specific research questions are as follows: First, we ascertain differences in the importance and performance of health perception between Korean and Japanese adolescents. Second, differences in importance and performance of health perception between male and female adolescents are ascertained. Finally, we examine differences in the importance-performance matrix between Korean and Japanese, male and female adolescents.

## 2. Materials and Methods

### 2.1 Participants

The study population comprised Korean and Japanese adolescents who took a PE class during the 2021 pandemic. A total of 1341 adolescents from two middle schoolers in Seoul, Korea (A, B) and two middle schools in Tokyo, Japan (C, D) were chosen as participants using convenience sampling, a nonprobability sampling method, from September to October 2021 (participants aged 13–15). Online (Google forms) and offline questionnaires were administered. Informed consent was obtained from all participants involved in the study. The results of the study participants are shown in Table 1.

**Table 1. Participants' demographic characteristics.**

Characteristic	Category	Number (n)	Percentage (%)
Gender	Male	617	46.0
	Female	724	54.0
Nationality	Korea (Seoul)	676	50.4
	Japan (Tokyo)	665	49.6
Total		1341	100.0

### 2.2 Instruments

Instruments used in previous studies deemed appropriate for use were employed here. Participants' demographics were set to gender and nationality, both assessed as nominal variables. The Health Perception Scale devel-

high  ↑  importance  ↓  low	B Section (Quadrant II)	A Section (Quadrant I)
	Concentrate here	Keep up the good work
	High important Low Performance	High important High Performance
	C Section (Quadrant III)	D Section (Quadrant IV)
	Lower priority	Possible overkill
	Low important Low Performance	Low important High Performance
	low ← performance → high	

Fig. 1. Importance – Performance Matrix [32].

oped by Ware [30] and validated by Lee, So, and Youn [5]; and Yoo, Han, Youn, and Jung [6] was modified for use. Sub-variables were divided into six categories: mental health management, disease management, physical activity management, sleep management, eating habits management, and hygiene health management. They were assessed on a 5-point Likert rating scale with “strong yes” (5 points), “yes” (4 points), “normal” (3 points), “no” (2 points), and “not at all” (1 point). Each score was calculated independently. We used the IPA questionnaire in our study. IPA is an analysis method that evaluates importance and achievement to accurately pursue research goals, and it is used in various studies on educational program evaluation [31].

The IPA method was first used by Martilla and James [32] in the 1970s. IPA is used for customer satisfaction surveys in the marketing field. Recently, the judgment of its application and results has become concise and clear, so it is used in various studies such as those evaluating educational and experiential programs.

As it uses the average value of importance and satisfaction, the IPA method is not statistically complicated and has the advantage of being able to draw results quickly and easily. First, the importance-performance is measured. Second, the measured values are displayed on the X and Y axes’ coordinates of each of the four quadrants. Third, the implications are assigned based on the distribution of measured values in each section. The contents of the PA matrix are presented in Fig. 1 (Ref. [32]).

In this way, the IPA method helps in effective improvement and development by confirming the problem’s priority or improvement direction through the survey results [31,33]. The IPA method includes both traditional and modified techniques. Traditional IPA methods only concentrate on specific segments [34]. An alternative IPA survey was used to supplement this. This alternative IPA uses relative importance, making it possible to reflect perceptual changes to prevent problems concentrated in the second and third quadrants [34,35]. Therefore, the revised method was used

to obtain more accurate and reasonable results by supplementing the existing IPA method and its result problems.

### 2.3 Reliability of Instruments

We tested reliability using Cronbach’s  $\alpha$  based on the criteria where a value of 0.80 or higher indicated good reliability, whereas 0.6 or lower implied low internal consistency [36]. Accordingly, a health perception sub-variable for Korean and Japanese adolescents was found to lie between 0.702 and 0.940.

This can be evaluated as high internal consistency because Cronbach’s  $\alpha$  was 0.7, or higher than the standard of 0.6 [37]. A Cronbach’s  $\alpha$  of 0.7 to 0.95 was also recognized as a confidence tolerance range [38]. The reliability of the item was judged to be high, and was used in this study. The reliability of verification results is shown in Table 2.

Table 2. Reliability analysis.

Variable		Cronbach’s $\alpha$
Mental health management	Importance	0.880
	Performance	0.876
Disease management	Importance	0.796
	Performance	0.702
Physical activity management	Importance	0.879
	Performance	0.840
Sleep management	Importance	0.864
	Performance	0.793
Diet management	Importance	0.851
	Performance	0.743
Hygiene management	Importance	0.940
	Performance	0.884

### 2.4 Procedure and Data Collection

We collected data between June and October 2021 through online (Google forms) and offline questionnaires

**Table 3. Importance and performance comparisons between Korean and Japanese adolescent.**

Variable		Korea		Japan		T	p
		M	SD	M	SD		
Mental health management	Importance	4.57	0.51	4.30	0.75	7.550***	0.000
	Performance	4.02	0.73	3.92	0.85	3.032**	0.002
Disease management	Importance	4.58	0.53	4.37	0.74	5.992***	0.000
	Performance	4.23	0.66	4.17	0.78	3.375**	0.001
Physical activity management	Importance	4.23	0.74	4.06	0.88	4.045***	0.000
	Performance	3.52	1.02	3.36	1.09	3.370**	0.001
Sleep management	Importance	4.46	0.63	4.31	0.81	3.934***	0.000
	Performance	3.58	0.95	3.59	0.95	0.763	0.446
Diet management	Importance	4.40	0.68	4.28	0.85	2.973**	0.003
	Performance	3.79	0.88	3.90	0.89	-1.283	0.200
Hygiene management	Importance	4.69	0.46	4.47	0.72	6.484***	0.000
	Performance	4.42	0.54	4.24	0.71	5.339***	0.000

\*\*\* $p < 0.001$ , \*\* $p < 0.01$ , \* $p < 0.05$ .

from Korean and Japanese adolescents. A pilot test was conducted on 300 Korean and 300 Japanese adolescents from June 1 to 30, 2021. The main questionnaire was administered between September and October 2021 to 1,433 (742 Korean, 691 Japanese) students. After excluding 7 questionnaires for missing responses and 85 questionnaires with unsuitable responses, a total of 1341 questionnaires were included in the analysis. Collected data were analyzed using the SPSS 18.0 software (IBM Corp., Armonk, NY, USA), from November 3 to 16, 2021. First, we analyzed participants' demographic characteristics with frequency analysis. Second, we assessed the instrument's reliability using Cronbach's  $\alpha$ . Third, we conducted a paired sample test comparing the average value of each result to analyze differences in the degree of health awareness between Korean and Japanese middle-school students as well as the degree of importance and execution for each variable.

Finally, to verify each variable's importance and execution, a modified IPA was conducted [33] from December 1 to 10, 2021. Results of the traditional IPA indicated that the attributes of importance and achievement were not mutually independent, which could lead to misinterpretation [32,39,40]. In contrast, modified IPA can prevent the problem of concentrating attributes on quadrants I and III of the traditional method, reducing errors and yielding more accurate results [34]. The data collection analysis and text writing were translated into Korean, Japanese, and English for a cross-review by both Korean and Japanese authors.

### 3. Results

#### 3.1 Importance and Performance Comparisons of Korea and Japan

First, a paired samples  $t$ -test was performed to compare perceived importance between Korean and Japanese adolescents, and statistically significant differences in the perceived importance for all variables were noticed. Sec-

ond, a paired samples  $t$ -test to examine differences in performance between Korean and Japanese adolescents. There were statistically significant differences in health perception between the two countries for mental health, disease management, physical activity, and hygiene management, but not for sleep management and diet management. The results are shown in Table 3.

#### 3.2 Importance and Performance Comparisons between Gender

First, we performed a paired samples  $t$ -test to compare perceived importance between male and female adolescents. Statistically significant differences in the importance of gender were found only in physical activity. Second, we performed a paired samples  $t$ -test to examine differences in the performance between male and female adolescents. A statistically significant difference between the performance of both genders in physical activity, sleep management, meal management, and systemic health was noticed. However, hygiene and disease management did not show a statistically significant difference. The results are shown in Table 4.

#### 3.3 IPA for both Countries and Genders

First, we generated the IPA matrix for Korean adolescents with the mean importance score of 4.49 and mean performance score of 3.93 as the reference values. The IPA matrix for Japanese adolescents was generated with the mean importance score of 4.30 and mean performance score of 3.86 as the reference values. The results are displayed in Table 5 and Fig. 2.

Second, we generated the IPA matrix for male adolescents with a mean importance score of 4.42 and a mean performance score of 4.01 as the reference values. The IPA matrix for female adolescents was generated with the mean importance score of 4.38 and mean performance score of

**Table 4. Importance and performance comparisons between male and female adolescents.**

Variable		Male		Female		t	p
		M	SD	M	SD		
Mental health management	Importance	4.45	0.66	4.42	0.65	0.753	0.452
	Performance	4.05	0.79	3.93	0.78	2.622**	0.009
Disease management	Importance	4.49	0.65	4.47	0.65	0.657	0.511
	Performance	4.28	0.69	4.21	0.73	1.789	0.074
Physical activity management	Importance	4.20	0.82	4.11	0.80	2.092*	0.037
	Performance	3.63	1.05	3.32	1.04	5.394***	0.000
Sleep management	Importance	4.42	0.73	4.37	0.71	1.154	0.249
	Performance	3.82	0.92	3.43	0.92	7.839***	0.000
Diet management	Importance	4.37	0.76	4.32	0.76	1.128	0.260
	Performance	3.95	0.90	3.80	0.85	3.297**	0.001
Hygiene management	Importance	4.56	0.60	4.59	0.62	-1.020	0.308
	Performance	4.31	0.65	4.34	0.64	-0.866	0.386

\*\*\* $p < 0.001$ , \*\* $p < 0.01$ , \* $p < 0.05$ .

**Table 5. Health perception factor distribution in Korean and Japanese, male and female adolescents.**

Category	Criteria	Group	Factor distribution	
Quadrant I (Concentrate here)	Importance↑, Performance↑	Country	Korea Japan	hygiene management, disease management, mental health management hygiene management, disease management, mental health management
		Gender	Male Female	hygiene management, disease management, mental health management hygiene management, disease management, mental health management
	Importance↑, Performance↓	Country	Korea Japan	none sleep management
		Gender	Male Female	none none
Quadrant III (Low priority)	Importance↓, Performance↓	Country	Korea Japan	physical activity management, sleep management, diet management physical activity management
		Gender	Male Female	physical activity management, sleep management, diet management physical activity management, sleep management, diet management
	Importance↓, Performance↑	Country	Korea Japan	none diet
		Gender	Male Female	none none

3.84 as the reference values. The results are displayed in Table 5 and Fig. 3.

First, hygiene management, disease management, and mental health management were placed in quadrant I—indicating high importance and performance—among Korean and Japanese adolescents. Adolescent male and female students also had a high degree of importance and implementation in both the factors of “hygiene”, “disease management”, and “mental health”. Second, none of the variables were placed in quadrant II among Korean adolescents. However, sleep management was placed in this quadrant among Japanese adolescents, indicating high importance and low performance in sleep management. Adolescent males and females were found to have no corresponding factors in common. Third, physical activity management, sleep management, and diet management were in quadrant

III—indicating low importance and performance—among Korean adolescents. Among Japanese adolescents, only physical activity management was linked to low importance and performance. Adolescent male and female students commonly showed low importance and performance in the factors of “physical activity”, “sleep management”, and “eating habits”. Fourth, none of the variables were placed in quadrant IV among Korean adolescents. Nevertheless, diet management was placed in this quadrant among Japanese adolescents indicating low importance and high performance in diet management. Adolescent male and female students were found to have no common corresponding factors.

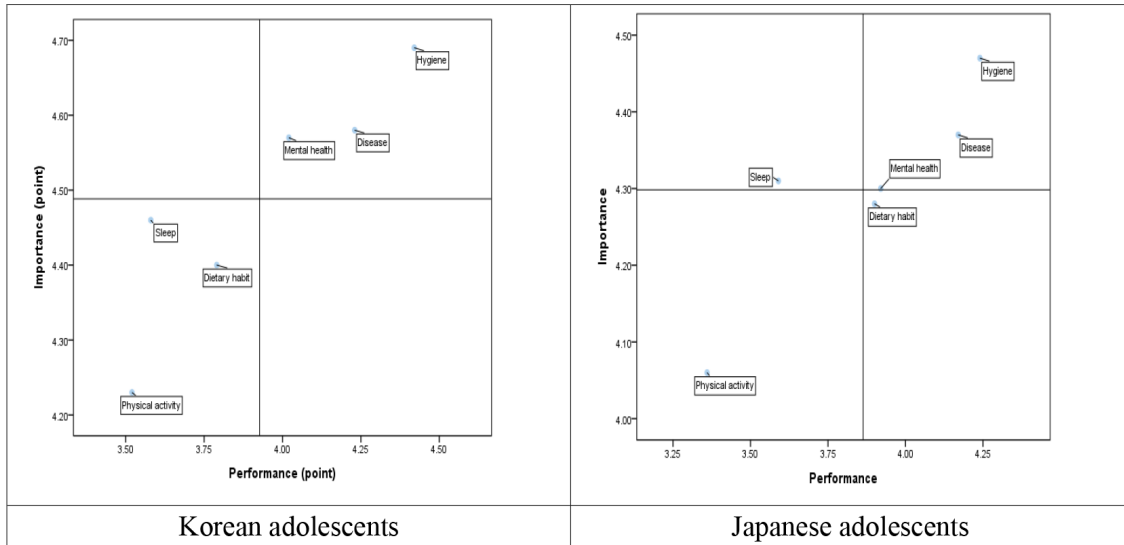


Fig. 2. IPA Matrix – Factors (countries).

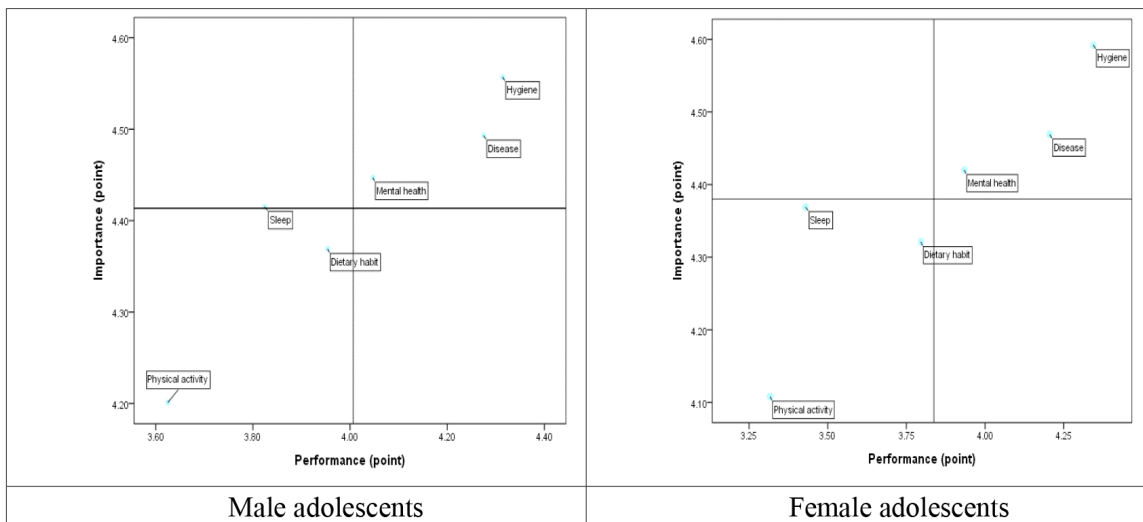


Fig. 3. IPA Matrix – Factors (gender).

#### 4. Discussion

This study analyzed the perceived importance and performance of health-related factors during the COVID-19 pandemic among Korean and Japanese adolescents using the IPA. It discussed its major findings considering previously published research.

First, Korean adolescents perceived all health-related factors as compared to their Japanese counterparts. Specifically, its importance for each population markedly differed for categories of “mental health”, “hygiene management”, “disease management”, “physical activity”, and “sleep management”.

Such differences are evident in the health levels and health-promoting policies of the two countries. Japan boasts the best global health and health achievement, while Korea is not included in the top 30 countries for these in-

dices [41]. We can conclude that Japan has achieved a high level of health, where individuals have managed their own health, facilitated by the implementation of national health-promotion policies since the 1970s. Another key reason underlying this achievement is that Japanese schools impart knowledge about disease prevention, including infections through PE and health education classes, from elementary school to high school [42–44]. In Korea, national health-promotion policies implemented in the 2000s are still being actively enforced [45]. Therefore, Korean adolescents, more exposed to Korean versions of health-promotion projects led by both national and local governments and schools, perceive the importance of health. Conversely, Japan currently promotes individual health management, evidenced by the fact that a mandatory lockdown was never enforced in Japan during the COVID-19 pan-

demic despite school closure orders. Japanese adolescents are thus less exposed to health-promoting policies, as compared to their Korean counterparts, probably contributing to their relatively low perceived health importance.

Korean adolescents showed higher performance in four health domains, while performance did not differ in two domains for either population. Performance in “hygiene management”, “disease management”, and “physical activity” significantly differed between the two populations.

National and local government-led anti-COVID-19 measures—the K anti-infection system—including school closure and conversion to online courses, have enhanced Korean adolescents’ hygiene management and disease management [45]. The Japanese Ministry of Education, Culture, Sports, Science and Technology actively publishes reference materials dealing with prevalent infections, and adolescents actively engage in independent hygiene management or disease management [46,47]. Japan provided many PE and club activities in schools before the COVID-19 pandemic through which students engaged in adequate physical activity [41,48,49]. In Korea, since 2010, schools have implemented several activities through PE, sports clubs, sports leagues, afterschool activities, and Saturday sports [45]. The COVID-19 pandemic hit both countries at a crucial time, with schools implementing distancing, no physical contact policies, and limited PE classes, in response to the pandemic. Japanese adolescents’ physical activities seem more influenced by such measures.

Second, male adolescents attach more importance to the “physical activity” factor than female adolescents. This was confirmed even before advent of the COVID-19 pandemic [50]. It is believed that this preference for physical activity among boys more than girls continues through the pandemic. Male adolescents showed higher practical performance for factors of “sleep management”, “physical activity”, “meal management”, and “mental health” than female adolescents, and there were no perceived differences in “hygiene” and “disease management” factors. We can interpret “sanitation management”, “disease management”, and the actual ability of both men and women to implement them, as successful anti-epidemic policies of the governments, municipalities, and school sites for both countries. There was no significant difference between male and female adolescents [10]. With the low ability of female adolescents to implement “sleep management”, “physical activity”, “meal management”, and “mental health”, developing and applying various educational programs to solve these problems is necessary. Regarding female adolescents’ “physical activity” factors, which are relatively low as compared to male adolescents in both importance and implementation, the program takes into account the emotions of female adolescents determined by the COVID-19 pandemic situation [51] and implements various program strategies [52] to overcome prejudice.

Third, similarities and differences in the distribution of four quadrants in the IPA matrix for health perception between Korean and Japanese, as well as male and female adolescents, were noticed. Quadrant I (keep up the good work) indicated high importance and performance, and “hygiene management”, “disease management”, and “mental health” were placed in this quadrant for both countries and genders. The importance and performance of “hygiene management” and “disease management” seem to be products of both Korean and Japanese governments’ anti-infection measures and anti-infection school education. Such public organization-led anti-infection measures instilled the importance of routine hygiene and disease management in adolescents of both countries. Our results suggest that adolescents translate this into actual practice. Studies also mention COVID-19 blues, depression, and helplessness among adolescents [16,53,54]. People feel lonely, experiencing depression and anxiety because of social isolation [55]. This study identified mental health problems previously unexamined, because of Korean and Japanese special educational and college admission systems. Prior to the COVID-19 pandemic, adolescents in both countries suffered from intense academic stress due to fierce competition to gain admission to eminent colleges [56]. Consequently, both countries had high the adolescent suicide rates [57]. Since the occurrence of COVID-19 however, rates of stress, suicidal ideation, suicidal planning, and suicide attempts have declined as compared to the pre-COVID-19 period [8]. Adverse mental health factors affecting adolescents seem to have diminished partly owing to social distancing and the use of offline, online classes during the COVID-19 pandemic. Results show that amid the prolonged pandemic, adolescents from both countries and genders show promising progress in “hygiene management”, “disease management”, and “mental health”. Thus, a positive acceptance of the current situation is necessary to maintain and improve the status quo. This requires educational programs that involve appropriate adolescent interactions with experts and parents [8].

Quadrant II factors indicate high importance but low performance, and factors in this quadrant call for urgent improvement. None of the health-related factors for Korean male and female adolescents belonged in this quadrant. However, “sleep management” was placed in this quadrant for Japanese adolescents. Japanese adolescents have been reported to sleep longer during the COVID-19 pandemic [58], indicating poor sleep quality (e.g., regularity, deep sleep) [37]. Actively promoting sleep management, including sleep quality, is as essential as imparting its importance to adolescents amid the extended pandemic.

Quadrant III factors (low priority) indicates low importance and performance and do not require more improvement beyond the current level. For Korean male and female adolescents, physical activity, sleep management, and diet, had low importance and performance. For

Japanese adolescents, only physical activity was placed in this quadrant.

The problems of diet and sleep among Korean adolescents are attributable to the irregularity of in-person school days and online classes during the COVID-19 pandemic. Students enjoy regular, nutritionally balanced meals when going to school; they however have difficulty consuming meals regularly or enjoying nutritionally balanced meals during online learning. They often skip breakfast, lunch, or eat hurriedly due to short lunchtime [59,60]. Students also enjoy late-night snacks, and even physically attending school, eat quickly or inadequately to prevent contracting COVID-19. The increased rate of junk food consumption is a critical cause of diet-induced health problems. Adolescents' consumption of junk foods such as carbonated drinks, fast food, and ramen, leads to poorly balanced diets of vegetables, fruits, milk. This impairs health, both directly and indirectly, causing stress, depression, and poor self-evaluations of health [61]. Our results that adolescents showed low perceived importance and performance regarding diet management could be due to the COVID-19 pandemic hindering the formation of diet values [62].

Frequent online classes, exposure to digital media and a smartphone-centered lifestyle caused by restrictions in daily living and physical activities adversely affect their sleep [5,40]. These results are in line with pre-COVID-19 reports of adolescent health negligence [63]. They suggest that while adolescents perceive the importance of COVID-19 prevention and treatment since the pandemic outbreak, they lack interest in practicing routine behaviors to maintain and promote their health, including sleep and diet management. Education about diet, sleep management, and physical activity should be coupled with interventions that promote these activities. These could prove useful for Korean adolescents amid the prolonged pandemic.

Notably, adolescents from both countries, of both genders showed the lowest importance and performance for physical activity. Scholars worldwide have warned that extended suspension of face-to-face education and outdoor activities during the COVID-19 pandemic exposes students to risks such as obesity, diabetes mellitus, and hypertension [64–66]. Activity-focused PE classes offered in Korean and Japanese schools have been replaced by hybrid (online + offline) PE classes because of the pandemic. Club and school programs involving sports and physical activities have been restricted [9,67]. Inadequate engagement in various extracurricular and leisure activities could also have contributed to the low perception of importance and practice of physical activity. Adolescents gained bodyweight faster during school breaks than during school semesters, even before the COVID-19 pandemic [62]. While school classes are currently conducted in a hybrid format, in terms of the amount of physical activity, the pandemic situation is like an extension of the summer break for students. Prior to the pandemic, students could engage in considerable phys-

ical activity by commuting to school and back, and participating in various activities, including PE classes [38,67].

Physical activity is key to a healthy lifestyle, and has evidence-based effects on improvement of physical health (e.g., obesity, physical fitness), mental health (e.g., anxiety, depression, happiness), social life, and lifestyle [68,69]. Further, physical activity contributes to individuals' health not only during adolescence but throughout their lives [70]. A sedentary lifestyle undermines human life, evidenced by it being the fourth leading cause of death. Physical activity contributed to mental well-being even during the COVID-19 pandemic [3], and is a non-invasive, cost-effective means of protecting one's body from viruses by boosting the immune system [4]. Physical activity programs should be systematically designed to involve moderate- to vigorous-intensity exercise instead of simply lengthening the duration of physical activity. A longitudinal study conducted on Japanese adolescents found a significant association between sports club participation during adolescence and reduced mortality risk from cardiovascular disease in adulthood [71]. In Korea, both PE programs and music-incorporated PE programs have been developed to promote adolescent health [72]. Other countries too currently run school-based moderate- to vigorous-intensity physical activity programs for adolescents. Some prime examples are "TAKE 10!" in the United States, the "Schools on the Move" in Finland, and "Smart Moves" in Australia [67]. Several European countries such as France, Germany, and Ireland also provide students with opportunities to participate in diverse moderate- to vigorous-intensity physical activity programs through school PE classes and afterschool programs [73].

It is important to expand opportunities for student participation in systematic moderate- to vigorous-intensity physical activity to promote ideal physical growth and immunity in Korean and Japanese adolescents. Amidst the prolonged COVID-19 pandemic, designing and implementing programs that comprise educational and practice-promoting aspects and consider all health-related factors are essential. This is in opposition to comparing the ranking or levels of diet, sleep management, and physical activity between Korean and Japanese adolescent populations.

Quadrant IV (possible overkill) indicates low importance but high performance and its factors are perceived to be less important than others but practiced more than necessary. Although none of the health-related factors present in this quadrant for Korean male and female adolescents, "diet" was placed in this quadrant for Japanese adolescents. It is highly likely that Japanese adolescents do not perceive diet to be as important as other health-related factors because Japanese culture features enjoyment of small portions of food [41,74]. As Japan has a well-developed school meal system, adolescents demonstrate high performance in natural diet management [71]. In other words, Japanese people have extremely positive values toward diet culture. It is



therefore important to educate Japanese adolescents about the importance of diet and the values of the good eating culture of their country. This will help adolescents practice their current eating culture more effectively and foster a healthier eating culture.

## 5. Conclusions

Our study presents data on the relationship between perceived importance and performance of health-related factors among Korean and Japanese adolescents, their strategic priorities, as well as health perception disparities between the two groups. These will help evaluate school PE education during the COVID-19 pandemic and design future curricula. Our findings will also provide public and private educational institutions valuable foundational data, to plan and enforce health education, in preparation for the post-COVID-19 era.

It is important for national, government, and public education institutions, and families to couple a therapeutic approach with a preventive and management approach, one that encourages periodic exercise, desirable diet, and adequate sleep while exploring measures to maintain and promote adolescent health. First, the national government, local governments, and schools should continue promoting and educating adolescents in hygiene management, disease management, and mental health management from a therapeutic perspective, to maintain the status quo. Special efforts are also required from both schools and families to manage diet, sleep, and physical activity in both countries, from a preventive perspective.

Physical activity was identified as the most vulnerable health-related factor for Korean and Japanese adolescents, calling for the development of various remote PE programs and efforts to facilitate PE activities during in-person sessions. School curricula must be modified to promote physical activity by promoting in-person PE classes, sports clubs, afterschool sports activities, school sports club leagues, and Saturday sports. To this end, the Office of Education, schools, relevant organizations, teachers, and parents must make the necessary efforts to improve school curricula.

Subsequent studies should expand this sample to more countries, local- and school-grade groups, and comparatively analyze their results with our findings. In-depth interviews, observations, and document analyses are needed to enable a broader and deeper interpretation of IPA results for students and teachers. A mixed methods methodology should be utilized towards more dynamic, persuasive findings and implications.

## Author Contributions

H-SY, E-JL, C-MK, and YO designed and conducted the research study. H-SY, E-JL, SR, CM, C-MK, and YO collected and analyzed the data. H-SY, E-JL, C-MK, and YO interpreted the data. E-JL, CM, C-MK, and YO drafted

the manuscript. H-SY, E-JL, CM, and YO revised the manuscript's content. All authors read and approved the final manuscript.

## Ethics Approval and Consent to Participate

This study was conducted according to the guidelines of the Declaration of Helsinki and approved by the Institutional Review Board (or Ethics Committee) of Wonkwang University in Korea (WKIRB-202009-SB-053) and the Nippon Science University (IRB) (NSSUIRB-021-H083). Informed consent was obtained from all participants.

## Acknowledgment

Not applicable.

## Funding

This paper was supported by Wonkwang University in 2022.

## Conflict of Interest

The authors declare no conflict of interest.

## References

- [1] Woods JA, Hutchinson NT, Powers SK, Roberts WO, Gomez-Cabrera MC, Radak Z, *et al.* The COVID-19 pandemic and physical activity. *Sports Medicine and Health Science.* 2020; 2: 55–64.
- [2] Chen P, Mao L, Nassis GP, Harmer P, Ainsworth BE, Li F. Coronavirus disease (COVID-19): the need to maintain regular physical activity while taking precautions. *Journal of Sport and Health Science.* 2020; 9: 103–104.
- [3] Maugeri G, Castrogiovanni P, Battaglia G, Pippi R, D'Agata V, Palma A, *et al.* The impact of physical activity on psychological health during Covid-19 pandemic in Italy. *Heliyon.* 2020; 6: e04315.
- [4] Rundle AG, Park Y, Herbstman JB, Kinsey EW, Wang YC. COVID-19–Related School Closings and Risk of Weight Gain among Children. *Obesity.* 2020; 28: 1008–1009.
- [5] Lee SM, So WY, Youn HS. Importance-performance analysis of health perception among Korean adolescents during the COVID-19 pandemic. *International Journal of Environmental Research and Public Health.* 2021; 18: 1280.
- [6] Yoo JI, Han JK, Youn HS, Jung JH. Comparison of health awareness in South Korean middle school students according to type of online physical education classes during the COVID-19 pandemic. *International Journal of Environmental Research and Public Health.* 2021; 18: 7937.
- [7] Lee G. The necessity of youth physical activity and role and task of school physical education in COVID 19. *Korean Journal of Sport Pedagogy.* 2021; 28: 175–198.
- [8] Lee JH, Kwon M. Health behavior changes in Korean adolescents before and during the COVID-19 pandemic: secondary data analysis of the 2019–2020 youth health risk behavior web-based survey. *Journal of Korean Society of School Health.* 2021; 34: 179.
- [9] Lee EJ, Zea SJ, Youn HS. Exploring the difficulties and strategies of practicing online classes experienced by high school veteran physical education teachers in the corona19 pandemic. *Journal of Korean Association for Learner-centered Curriculum and Instruction.* 2020; 20: 339–362.

- [10] Nagano K, Kikuchi S, Nakamura K. Comparison of physical fitness and athletic ability of elementary school students pre- post the epidemic of new coronavirus infection. *Proceedings of the Japanese Society of Physical Education, Sports and Health*. 2021; 71: 117. (In Japanese)
- [11] Hoshino S, Sugawa M. Impact of physical fitness and QOL due to student corona damage. *Proceedings of the Japanese Society of Physical Education, Sports and Health*. 2021; 71: 36.
- [12] National Center for Child Health and Development. Results of questionnaire for COVID-19 and children. National Center for Child Health and Development: Tokyo, Japan. 2021. Available at: [https://www.ncchd.go.jp/center/activity/covid19\\_kodomo/e-port/CxC1\\_finalrepo\\_20210306revised.pdf](https://www.ncchd.go.jp/center/activity/covid19_kodomo/e-port/CxC1_finalrepo_20210306revised.pdf) (Accessed: 24 August 2021).
- [13] The National Network of Physical and Mental Health in Japanese Children. Results of emergency survey for body and soul in children. 2021. Available at: <http://kodomonokaradatokokoro.com/images/20210119.pdf> (Accessed: 24 August 2021).
- [14] Moriyama M, Yuki A. Changes in physical activity among university students after the lifting of the COVID-19 emergency declaration issued in April 2020. *Japanese Journal of Physical Fitness and Sports Medicine*. 2021; 70: 257–268.
- [15] Nakai Y, Tomioka K, Taniguchi Y, Takenaka T, Makizako H. Changes in Physical Activity Levels between before and during the COVID-19 Outbreak of Older Community-dwelling Adults: a Survey of Older Adults who Participated in Exercise Programs. *Journal of Physical Therapy Science*. 2021; 36: 35–40.
- [16] Ezpeleta L, Navarro JB, de la Osa N, Trepal E, Penelo E. Life conditions during COVID-19 lockdown and mental health in Spanish adolescents. *International Journal of Environmental Research and Public Health*. 2020; 17: 7327.
- [17] Jones EA, Mitra AK, Bhuiyan AR. Impact of COVID-19 on mental health in adolescents: a systematic review. *International Journal of Environmental Research and Public Health*. 2021; 18: 2470.
- [18] Meherali S, Punjani N, Louie-Poon S, Abdul Rahim K, Das JK, Salam RA, *et al*. Mental health of children and adolescents amidst COVID-19 and past pandemics: A rapid systematic review. *International Journal of Environmental Research and Public Health*. 2021; 18: 3432.
- [19] Nearchou F, Flinn C, Niland R, Subramaniam SS, Hennessy E. Exploring the impact of COVID-19 on mental health outcomes in children and adolescents: A systematic review. *International Journal of Environmental Research and Public Health*. 2020; 17: 8479.
- [20] O’Sullivan K, Clark S, McGrane A, Rock N, Burke L, Boyle N, *et al*. A qualitative study of child and adolescent mental health during the COVID-19 pandemic in Ireland. *International Journal of Environmental Research and Public Health*. 2021; 18: 1062.
- [21] Golberstein E, Wen H, Miller BF. Coronavirus Disease 2019 (COVID-19) and Mental Health for Children and Adolescents. *JAMA Pediatrics*. 2020; 174: 819–820.
- [22] Pietrabissa G, Volpi C, Bottacchi M, Bertuzzi V, Usubini AG, Löffler-Stastka H, *et al*. The impact of social isolation during the COVID-19 pandemic on physical and mental health: the lived experience of adolescents with obesity and their caregivers. *International Journal of Environmental Research and Public Health*. 2021; 18: 3026.
- [23] Lee DJ, So WY, Lee SM. The relationship between Korean adolescents’ sports participation, internal health locus of control, and wellness during COVID-19. *International Journal of Environmental Research and Public Health*. 2021; 18: 2950.
- [24] Bronikowska M, Krzysztozek J, Łopatka M, Ludwiczak M, Pluta B. Comparison of physical activity levels in youths before and during a pandemic lockdown. *International Journal of Environmental Research and Public Health*. 2021; 18: 5139.
- [25] Sekulic D, Blazevic M, Gilic B, Kvesic I, Zenic N. Prospective analysis of levels and correlates of physical activity during COVID-19 pandemic and imposed rules of social distancing: gender specific study among adolescents from Southern Croatia. *Sustainability*. 2020; 12: 4072.
- [26] Lashua B, Johnson CW, Parry DC. Leisure in the Time of Coronavirus: a Rapid Response Special Issue. *Leisure Sciences*. 2021; 43: 6–11.
- [27] Nobari H, Fashi M, Eskandari A, Villafaina S, Murillo-García Á, Pérez-Gómez J. Effect of COVID-19 on health-related quality of life in adolescents and children: a systematic review. *International Journal of Environmental Research and Public Health*. 2021; 18: 4563.
- [28] Mastorci F, Bastiani L, Trivellini G, Doveri C, Casu A, Pozzi M, *et al*. Well-being perception during COVID-19 pandemic in healthy adolescents: from the avatar study. *International Journal of Environmental Research and Public Health*. 2021; 18: 6388.
- [29] Jang JY. Relationships of Adolescents’ Stress and Psychological State by Gender and Physical Activity Level during the early COVID19 crisis. *The Korean Journal of Growth and Development*. 2021; 29: 181–187.
- [30] Margaritis I, Houdart S, El Ouadrhiri Y, Bigard X, Vuillemin A, Duché P. How to deal with COVID-19 epidemic-related lockdown physical inactivity and sedentary increase in youth? Adaptation of Anses’ benchmarks. *Archives of Public Health*. 2020; 78: 52.
- [31] Ware JE. Health perception questionnaire instruments for measuring nursing practice and other care variables (pp. 158–161). DHEW Publication: Hyatts-ville, MD, USA. 1979.
- [32] Martilla JA, James JC. Importance-Performance Analysis. *Journal of Marketing*. 1977; 41: 77–79.
- [33] Deng W. Using a revised importance–performance analysis approach: the case of Taiwanese hot springs tourism. *Tourism Management*. 2007; 28: 1274–1284.
- [34] Oh M, Ryu J. Comparison between traditional IPA and revised IPA: an attractiveness evaluation of Incheon Chinatown. *International Journal of Tourism and Hospitality Research*. 2016; 30: 129–142.
- [35] Vacha-Haase T, Kogan LR, Thompson B. Sample compositions and variabilities in published studies versus those in test 563 manuals: Validity of score reliability inductions. *Educational and Psychological Measurement*. 2000; 60: 509–522.
- [36] Nunnally J, Bernstein L. *Psychometric theory* (pp. 565). McGraw-Hill Higher, INC: New York. 1994.
- [37] Weaver B, Maxwell H. Exploratory factor analysis and reliability analysis with missing data: A simple method for SPSS users. *The Quantitative Methods for Psychology*. 2014; 10: 143–152.
- [38] DeVellis R. *Scale development: theory and applications: theory and application* (pp. 568). Sage: Thousand Okas, CA. 2003.
- [39] Matzler K, Bailom F, Hinterhuber HH, Renzl B, Pichler J. The asymmetric relationship between attribute-level performance & overall customer satisfaction: a reconsideration of the importance–performance analysis. *Industrial Marketing Management*. 2004; 33: 271–277.
- [40] Deng W, Kuo Y, Chen W. Revised importance–performance analysis: three-factor theory and benchmarking. *The Service Industries Journal*. 2008; 28: 37–51.
- [41] Chon S. The Effects of Perceived social supports on Loneliness and SNS addiction in Adolescents amid Covid-19 Pandemic. *Journal of Future Oriented Youth Society*. 2021; 18: 119–146.
- [42] Nippon Sport Science University Noi Laboratory Notice. Annual report of physical and mental health among the children 2021. Year. Available at: <http://kodomonokaradatokokoro.com/hakusho/hakusho.html> (Accessed: 14 December 2021).
- [43] Nippon Sport Science University Noi Laboratory Notice. “Urgent investigation on children’s bodies” result report.

2021. Available at: <http://kodomonokaradatokokoro.com/image/s/20210119.pdf> (Accessed: 30 January 2021).
- [44] Japan Sports Agency. 2021 year National physical fitness, athletic ability, exercise habits, etc. 2021. Available at: [https://www.mext.go.jp/sports/content/20211221-spt\\_sseisaku02-000019583\\_1.pdf](https://www.mext.go.jp/sports/content/20211221-spt_sseisaku02-000019583_1.pdf) (Accessed: 14 April 2022).
- [45] Kim J, Kang S, Kim KK, Yoo S. Value and direction of Health Promotion in Korea: a content analysis of Health Plan 2020. *Korean Journal of Health Education and Promotion*. 2021; 38: 42021.
- [46] Ministry of Education, Culture, Sports, Science, and Technology, Japan (MEXT). Hygiene management manual for new Coronavirus infectious diseases in schools “new lifestyle in schools”. 2022. Available at: [https://www.mext.go.jp/content/20220404-mxt\\_kouhou01-000004520\\_01.pdf](https://www.mext.go.jp/content/20220404-mxt_kouhou01-000004520_01.pdf) (Accessed: 4 April 2022).
- [47] Ministry of Education, Culture, Sports, Science, and Technology, Japan (MEXT). Curriculum guidelines for Japanese elementary schools: family edition. 2017. Available at: [https://www.google.co.kr/url?sa=t&source=web&rct=j&url=https://www.mext.go.jp/component/a\\_menu/education/micro\\_detail/\\_icsFiles/afieldfile/2019/03/18/1387017\\_009.pdf&ved=2ahUKEwiq4rOtmdbD3AhVjHJKYKHYc7DZ4QFnoECA4QAQ&usq=AOvVaw0373V441MolvSJDGiN2oil](https://www.google.co.kr/url?sa=t&source=web&rct=j&url=https://www.mext.go.jp/component/a_menu/education/micro_detail/_icsFiles/afieldfile/2019/03/18/1387017_009.pdf&ved=2ahUKEwiq4rOtmdbD3AhVjHJKYKHYc7DZ4QFnoECA4QAQ&usq=AOvVaw0373V441MolvSJDGiN2oil) (Accessed: 18 March 2019).
- [48] Ministry of Education, Culture, Sports, Science, and Technology, Japan (MEXT). Japanese junior high school learning guidance guidelines (2017 notification). 2017. Available at: [https://www.mext.go.jp/content/1413522\\_002.pdf](https://www.mext.go.jp/content/1413522_002.pdf) (Accessed: 14 April 2022).
- [49] Ministry of Education, Culture, Sports, Science, and Technology, Japan (MEXT). Japanese high school learning guidance guidelines (notification in 2018). 2018. Available at: [https://www.mext.go.jp/content/1384661\\_6\\_1\\_3.pdf](https://www.mext.go.jp/content/1384661_6_1_3.pdf) (Accessed: 14 April 2022).
- [50] Bae SS, Kim GS, Won YS, Cho MH. An analysis of females and males’ perception, experiences and needs toward elementary physical education classes. *Korean Journal of Sport Pedagogy*. 2005; 12: 114–138.
- [51] Kim YH. EMOTION Strategy for Female Students’ Active Participation in Physical Activity. *The Journal of Curriculum Evaluation*. 2010; 13: 133–156.
- [52] Kang MO, Koo MH. Prejudice and Teaching Strategies for Girls in Physical Education Classes of Middle and High School Physical Education Teachers. *Korean Journal of Sport Pedagogy*. 2019; 17: 39–48.
- [53] Sher L. The impact of the COVID-19 pandemic on suicide rates. *QJM: an International Journal of Medicine*. 2020; 113: 707–712.
- [54] Loades ME, Chatburn E, Higson-Sweeney N, Reynolds S, Shafran R, Brigden A, *et al*. Rapid Systematic Review: the Impact of Social Isolation and Loneliness on the Mental Health of Children and Adolescents in the Context of COVID-19. *Journal of the American Academy of Child and Adolescent Psychiatry*. 2020; 59: 1218–1239.e3.
- [55] Calati R, Ferrari C, Brittner M, Oasi O, Olié E, Carvalho AF, *et al*. Suicidal thoughts and behaviors and social isolation: a narrative review of the literature. *Journal of Affective Disorders*. 2019; 245: 653–667.
- [56] Kim HS, Kim HS. Risk Factors for Suicide Attempts among Korean Adolescents. *Child Psychiatry and Human Development*. 2008; 39: 221–235.
- [57] Roh B, Jung EH, Hong HJ. A Comparative Study of Suicide Rates among 10–19-Year-Olds in 29 OECD Countries. *Psychiatry Investigation*. 2018; 15: 376–383.
- [58] Ministry of Education, Culture, Sports, Science, and Technology, Japan (MEXT). Survey on learning guidance, etc., during temporary holidays because of new coronavirus infection. 2022. Available at: [https://www.mext.go.jp/content/20220317-mxt\\_kyoiku02-000006590\\_01.pdf](https://www.mext.go.jp/content/20220317-mxt_kyoiku02-000006590_01.pdf) (Accessed: 17 March 2022).
- [59] Antunes R, Frontini R, Amaro N, Salvador R, Matos R, Mourouço P, *et al*. Exploring lifestyle habits, physical activity, anxiety and basic psychological needs in a sample of Portuguese adults during COVID-19. *International Journal of Environmental Research and Public Health*. 2020; 17: 4360.
- [60] Di Renzo L, Gualtieri P, Pivari F, Soldati L, Attinà A, Cinelli G, *et al*. Eating habits and lifestyle changes during COVID-19 lockdown: an Italian survey. *Journal of Translational Medicine*. 2020; 18: 229.
- [61] Arya G, Mishra S. Effect of junk food & beverages on Adolescent’s health. *IOSR Journal of Nursing and Health Science*. 2013; 1: 26–32.
- [62] Kang HJ. The status quo and prospect of university entrance exam in Japan. *Korean Journal of the Japan Education*. 2018; 23: 51–73.
- [63] Shin J, Park HY, Kim JL, Lee JJ, Lee H, Lee SH, *et al*. Psychiatric Morbidity of Survivors one Year after the Outbreak of Middle East Respiratory Syndrome in Korea, 2015. *Journal of Korean Neuropsychiatric Association*. 2019; 58: 245–251.
- [64] Kosaka Y. Parental perception of the relationship between stress responses and the changes in lifestyle habits of elementary school students during a temporary leave of absence for COVID-19. *The Japanese Journal of Psychology*. 2021; 92: 408–416.
- [65] Suzuki T. Situation of socio-emotional (non-cognitive) abilities of children and students under the epidemic of new coronavirus infection: literature survey on the early stage of the epidemic. From the perspective of the possibility of using the product development research team research report. National institute for educational policy research. 2021. Available at: [https://www.nier.go.jp/04\\_kenkyu\\_annai/pdf3/2021\\_hattatsu\\_a.pdf](https://www.nier.go.jp/04_kenkyu_annai/pdf3/2021_hattatsu_a.pdf) (Accessed: 3 November 2021).
- [66] Kim M. A Study on the Relationship between Health and Physical Fitness and School Life of Children. *The Korean Journal of Growth and Development*. 2020; 28: 55–63.
- [67] Choi S, Choi M. Focus Group Interview(FGI) Study on ‘K-Edu’ Experienced by School Teachers in COVID-19. *Journal of the Korean Entertainment Industry Association*. 2021; 15: 179–189.
- [68] Lee EJ, So WY, Youn HS, Kim JY. Effects of school-based physical activity programs on health-related physical fitness of Korean adolescents: A preliminary study. *International Journal of Environmental Research and Public Health*. 2021; 18: 2976.
- [69] Henchoz K, Cavalli S, Girardin M. Health perception and health status in advanced old age: a paradox of association. *Journal of Aging Studies*. 2008; 22: 282–290.
- [70] Holder K, Reddy PH. The COVID-19 effect on the immune system and mitochondrial dynamics in diabetes, obesity, and dementia. *The Neuroscientist*. 2021; 27: 331–339.
- [71] Gero K, Iso H, Kitamura A, Yamagishi K, Yatsuya H, Tamakoshi A. Cardiovascular disease mortality in relation to physical activity during adolescence and adulthood in Japan: does school-based sport club participation matter? *Preventive Medicine*. 2018; 113: 102–108.
- [72] Jeong HC, Lee EJ, Youn HS, So WY. Development and Implementation of a “Music Beeps” Program to Promote Physical Fitness in Adolescents. *International Journal of Environmental Research and Public Health*. 2020; 17: 6148.
- [73] Bailey R. Physical Education and Sport in Schools: a Review of Benefits and Outcomes. *Journal of School Health*. 2006; 76: 397–401.
- [74] Rozin P, Fischler C, Imada S, Sarubin A, Wrzesniewski A. Attitudes to food and the role of food in life in the U.S.A., Japan, Flemish Belgium and France: possible implications for the diet-health debate. *Appetite*. 1999; 33: 163–180.