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Analysis of The Contributing Factors of Jeju-Do's High Obesity Prevalence in South Korea

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ABSTRACT

Obesity, particularly in children and adolescents, is a leading cause of chronic disease throughout life. This study aims to identify the factors that are associated with the highest obesity prevalence among Korean children and adolescents in Jeju-do. This study analysed a total of 483,034 data records from student health examinations conducted by the Ministry of Education of the Republic of Korea between 2017 and 2022, suing descriptive statistics and chi-square tests in R version 4.3.1[1]. In Jeju-do, the normal students consumed soft drink and fast food three or more times per week, watched TV, played games or used the internet for more than 2 hours per day, thought about running away, had no one to talk to about their problems, and worried about family issues more frequently than students in other regions. The obese students in Jeju-do had a statistically significant higher intake of instant noodles and fast food compared to those in other regions. Comparing normal and obese elementary students in Jeju-do, the obese group had a significantly higher intake of unhealthy foods such as instant noodles, soft drink, and fast food compared to the normal group. Jeju-do's middle and high school students had similar characteristics to the obese population in other regions. Jeju-do's students have unique factors associated with obesity compared to students in other regions. The study highlights the correlation between obesity and unhealthy mental states among study subjects in South Korea. Future adolescent health policies should address this issue in greater depth.

Introduction

Obesity and overweight are conditions characterised by the accumulation of excessive amounts of body fat, which can negatively impact health. According to recent global statistics, the number of obese individuals has nearly tripled since 1975. In 2016, over 1.9 billion adults aged 18 and older were overweight, with over 650 million of them being obese. Additionally, more than 340 million children and adolescents aged 5-19 were overweight or obese[2].

Internationally agreed thresholds for defining underweight, normal weight, overweight, and obesity in adults are based on body-mass index (BMI). However, in children, growth is affected by age, gender, pubertal status, and race/ethnicity, making classification challenging[3]. Childhood obesity can lead to serious consequences, such as hypertension, dyslipidemia, insulin resistance/diabetes, fatty liver disease, and psychosocial complications[4]. Reducing childhood obesity rates is recognised as a significant step towards creating a healthier society.

The Ministry of Education of the Republic of Korea conducted a student health examination for elementary, middle, and high school students every year in accordance with the School Health Act and the School Health Inspection Rules. The examination aims to identify the health status of students, including measurements of height and weight to calculate obesity, physical development status, vaccination and medical history, diet and hygiene, physical activity, school and home life, use of television, internet, and pornography, and social and mental health. Based on the survey results, the obesity prevalence among Korean adolescents has been

steadily increasing over time. Notably, Jeju-do - the biggest island located in South Korea - has consistently reported a higher obesity prevalence compared to other provinces. Further investigation is necessary to determine the underlying reasons for this trend.

Materials and Methods

The study analysed data from 483,034 students aged 6-18 years who underwent student health examinations in elementary, middle, and high schools in the Republic of Korea over a five-year period from 2017 to 2022 (excluding 2020)[5]. U.S. Centers for Disease Control and Prevention (US CDC) defines, in children ages 2 to 19, BMI greater than or equal to 95th percentile as obese[6].

The students' BMI values were used to determine their weight status based on the 2017 Pediatric Growth Charts in South Korea. Students with a BMI above the 85th percentile and below the 95th percentile for their age were classified as overweight, while those with a BMI above the 95th percentile for their age were classified as obese. Individuals whose weight for age falls below the 5th percentile were classified as underweight, while the rest were classified as normal. Out of the 483,034 students surveyed, 186,864 were elementary school students, and 296,170 were middle and high school students.

Of the questions examined in the student health examination, seven questions related to eating habits, five questions related to exercise and lifestyle habits, and six questions related to mental health that may contribute to obesity were extracted from the student health exam. The eating habit questions asked whether instant noodle, soft drink, and fast food were consumed three or more times per week, whether meat, fruits, and vegetables were consumed three or more times per week, and whether breakfast was skipped. The consumption of instant noodle, soft drink, and fast food more than three times a week, as well as skipping breakfast, were categorised as unhealthy eating habits, while the remaining habits were considered healthy. The questionnaire included questions about exercise and lifestyle habits. For elementary students, the questions asked whether they exercised three or more times per week, slept less than seven hours per day, watched 2 or more hours of television per day, and played games or used the internet for 2 or more hours per day. For middle and high school students, the questions asked whether they exercised for 30 minutes or more per day, three or more times per week, and whether they slept less than seven hours per day, played games or used the internet for 2 or more hours per day. The mental health questions asked, including whether the individual was bullied, had thoughts of running away, had someone to talk to about their problems (for middle/high school students), worried about problems at home, had family support (for elementary school students), and felt helpless (for elementary school students).

All subjects were divided into those residing in Jeju-do with highest obesity rate and those residing in other regions to check the distribution of gender, height, weight, BMI, and the selected answer to each question above. The study divided subjects into the normal weight group (hereinafter NWG) and the obese group (hereinafter OG), and within NWG and OG, the subjects were categorised into Jeju-do and other regions to analyse the distribution of results for questions. In addition, the subjects in Jeju-do were divided into elementary school students and middle/high school students, and the results of each question were divided into NWG and OG.

The data was analysed using descriptive statistics and chi-square tests in the R version 4.3.1 (R Foundation for Statistical Computing, Vienna, Austria)[1].

Results

The survey showed that the obesity rate for the total population was 16.25%. Among the 17 provinces in South Korea, Jeju-do had the highest obesity rate at 19.8%, while Sejong had the lowest at 13.5%, followed by

Gyeonggi at 14.6%, and Seoul at 14.8%. To investigate the reasons for the high obesity rate in Jeju-do, the participants were divided into two groups: those from Jeju-do and those from the rest of Korea. The groups were further categorised by age, specifically elementary school students and middle/high school students, to determine if there were any differences in distribution. The distribution of gender, height, weight, BMI, and responses to selected questions were analysed.

The BMI of students in Jeju-do was higher than that of students in other regions. Specifically, elementary students in Jeju-do had an average BMI of 19.0 ± 3.8 kg/m^2, compared to 18.6 ± 3.6 kg/m^2 for elementary students in other regions. Similarly, middle and high school students in Jeju-do had an average BMI of 22.6 ± 4.4 kg/m^2, compared to 22.1 ± 4.1 kg/m^2 for middle and high school students in other regions. Some differences were observed between students in Jeju-do and those in other regions regarding their eating habits, exercise and lifestyle habits, and mental health. Compared to other regions, elementary school students in Jeju-do consumed less fruit and more meat and vegetables. Additionally, they were more likely to spend over 2 hours per day watching TV, playing games or using the internet. Compared to students in other regions, middle and high school students in Jeju-do consume more instant noodles, soft drinks, and fast food, and less fruit. They also spent more time playing games or using the internet for 2 hours per day, have a higher tendency to having the thought to runaway, not having someone to talk to, and worry more about problems at home. In contrast, they were more likely to eat meat and vegetables and exercise for 30 minutes or more per day than students in other regions. Students in Jeju-do were less likely to sleep less than 7 hours per day compared to students in other regions (refer to Table 1).

Table 1. Distribution of basic information and responses between Jeju and other regions

		Jeju		Others	
		Elementary (n=6,665, %)	Middle-High (n=11,544, %)	Elementary (n=180,199, %)	Middle-High (n=284,626, %)
Sex	Male	52.4	49.7	51.3	50.6
	Female	47.6	50.3	48.7	49.4
Anthropo-morphic Character-istcs (mean ± SD)	Hight (cm)	136.3 ± 12.2	164.2 ± 8.4	137.0 ± 12.2	165.1 ± 8.4
	Weight (kg)	36.2 ± 12.1	61.4 ± 14.5	35.8 ± 11.8	60.6 ± 14.0
	BMI (kg/m^2)	19.0 ± 3.8	22.6 ± 4.4	18.6 ± 3.6	22.1 ± 4.1
Eating habits	Instant noodle intake rate ≧3 times/wk	5.1	14.1	5.1	13.1
	Soft drink rate ≧3 times/wk	19.9	42.5	20.0	41.0
	Fast food intake rate ≧3 times/wk	4.3	10.1	3.9	9.0
	Skipped breakfast rate	16.2	35.2	15.7	34.9
	Meat intake rate≧3 times/wk	67.9	74.8	56.2	65.3
	Fruit intake rate ≧3 times/wk	69.2	56.5	71.7	58.9

		Jeju		Others	
		Elementary (n=6,665, %)	Middle-High (n=11,544, %)	Elementary (n=180,199, %)	Middle-High (n=284,626, %)
	Vegetable intake rate ≧3 times/wk	66.8	62.9	63.9	61.7
Exercise & Lifestyle habits	Exercise rate≧3 times/wk (elementary)	59.2		59.1	
	Exercise 30 minutes a day ≧3 times/wk (middle/high)		33.5		29.8
	Sleeping time < 7 hr/day	10.3	64.8	11.1	70.2
	Watching TV ≧ 2 hr/day (elementary)	39.7		33.2	
	Playing game or internet ≧ 2 hr/day	37.2	53.9	33.9	50.9
Mental health	Bullying experience within 1 year	3.3	1.9	3.5	2.0
	Runaway thought	5.4	5.7	5.0	3.9
	Without someone to talk (middle/high)		18.1		16.4
	Worried about problems at home		10.6		9.5
	No family support (elementary)	11.7		11.0	
	Feeling helpless (elementary)	3.4		3.3	

A cross-sectional analysis was conducted by dividing the total records into NWG and OG and categorising them based on their location, either in Jeju-do or other regions. Statistically significant differences were found in the following items: only the rate of skipping breakfast (26.8% vs 30.6%, p<0.001) was statistically significant among the unhealthy eating habits in OG. All three healthy eating habits were statistically significantly higher in NWG compared to OG. In regard to exercise and lifestyle, OG had a statistically significant higher percentage of individuals who slept less than 7 hours per day (50.0% vs 46.7%, p<0.001), watched more than 2 hours of TV per day (elementary) (39.8% vs 31.7%, p<0.001), and played games or used the internet for more than 2 hours per day (51.0% vs 42.1%, p<0.001). In regards to mental health, OG had statistically significantly higher rates of bullying (2.5% vs 3.1%, p<0.001), runaway thoughts (4.4% vs 5.4%, p<0.001), having no one to talk to about problems (middle/high) (16.1% vs 17. 9%, p<0.001), worrying about problems at home (9.1% vs 11.3%, p<0.001), having no family support (elementary) (10.9% vs 12.0%, p<0.001), and feeling helpless (elementary) (3.1% vs 4.3%, p<0.001) compared to NWG (Table 2).

Table 2. Cross-sectional analysis of factors that may contribute to obesity between NWG and OG and between Jeju and Others

		NWG (n=324,166)			OG (n=78,473)			OG vs. NWG
		Jeju (n=11,623, %)	Others (n=312,543, %)	p-value	Jeju (n= 3,601, %)	Others (n=74,872, %)	p-value	p-value
Eating habits	Instant noodle intake rate ≧3 times/wk	10.9	10.3	0.058	11.2	8.9	<0.001	<0.001
	Soft drink rate ≧3 times/wk	33.9	32.9	0.027	34.5	33.0	0.079	0.325
	Fast food intake rate ≧3 times/wk	7.6	7.1	0.04	8.8	6.9	<0.001	0.444
	Skipped breakfast rate	27.1	26.7	0.354	31.0	30.6	0.627	<0.001
	Meat intake rate≧3 times/wk	73.0	62.3	<0.001	71.5	60.1	<0.001	<0.001
	Fruit intake rate ≧3 times/wk	62.8	65.1	<0.001	57.0	59.1	0.014	<0.001
	Vegetable intake rate ≧3 times/wk	64.9	62.7	<0.001	63.1	61.8	0.119	<0.001
Exercise & Life-style habits	Exercise rate≧3 times/wk (elemen-tary)	60.1	59.3	0.266	57.8	59.5	0.259	0.739
	Exercise 30 minutes a day ≧3 times/wk (middle/high)	34.6	29.9	<0.001	31.6	31.0	0.544	<0.001
	Sleeping time < 7 hr/day	43.1	46.7	<0.001	48.8	50.0	0.16	<0.001
	Watching TV ≧ 2 hr/day (elementary)	37.9	31.5	<0.001	44.9	39.5	0.003	<0.001
	Playing game or in-ternet ≧ 2 hr/day	45.8	42.0	<0.001	51.3	50.9	0.742	<0.001
Mental health	Bullying experience within 1 year	2.3	2.5	0.273	2.8	3.1	0.434	<0.001
	Runaway thought	5.3	4.4	<0.001	6.4	5.3	0.043	<0.001
	Without someone to talk (middle/high)	17.2	16.1	0.011	20.3	17.7	0.002	<0.001
	Worried about prob-lems at home	9.9	9.1	0.033	12.0	11.3	0.311	<0.001
	No family support (elementary)	11.6	10.9	0.139	13.4	11.9	0.146	<0.001
	Feeling helpless (el-ementary)	3.2	3.1	0.617	4.1	4.3	0.81	<0.001

Among NWG, students in Jeju-do were found to have a statistically significant higher likelihood of consuming soft drink three or more times per week (33.9% vs 32.9%, p=0.027) and fast food three or more

times per week (7.6% vs 7.1%, p=0.04) compared to students in other regions. The frequency of eating fruit three or more times a week was statistically significantly lower than in other regions (62.8% vs 65.1%, p<0.001). The percentage of elementary students watching TV for 2 or more hours per day was higher in Jeju-do compared to other regions (37.9% vs 31.5%, p<0.001). Similarly, the rate of playing games or using the internet for more than 2 hours a day was also higher in Jeju-do (45.8% vs 42.0%, p<0.001). NWG in Jeju-do exhibited a higher rate of having runaway thought (5.3% vs 4.4%, p<0.001), a higher rate of having no one to talk to about problems during middle/high school (17.2% vs 16.1%, p=0.011), and a higher rate of worrying about problems at home (9.9% vs 9.1%, p=0.033) compared to those in other regions.

Compared to obese adolescents in other regions, obese adolescents in Jeju-do were significantly more likely to consume instant noodle three or more times per week (11.2% vs 8.9%, p<0.001) and fast food three or more times per week (8.8% vs 6.9%, p<0.001). Their consumption of fruit three or more times per week was significantly lower than that of obese adolescents in other regions (57.0% vs 59.1%, p=0.014). The study showed that the rates of watching TV for more than 2 hours per day among elementary students were higher in Jeju (44.9%) compared to other regions (39.5%) (p=0.003). The rate of runaway thoughts was also higher in Jeju's obese group (6.4%) compared to other regions (5.3%) (p=0.043). Middle/high school students in Jeju's obese group reported having no one to talk to about problems more frequently (20.3%) than those in other regions (17.7%) (p=0.002). Table 2 provides further details.

To investigate whether the high rate of obesity in Jeju-do varies by age, analyses were conducted on students dividing elementary and middle/high schools. Our findings indicate that middle and high school students exhibit a significant increase in unhealthy eating habits, such as consuming instant noodle, soft drink, and fast food more than three times a week, and skipping breakfast (p<0.001), compared to elementary school students. Middle and high school students experienced a significant increase of more than five times in the percentage of sleeping less than 7 hours per day, and a significant increase in the prevalence of playing games or internet for more than 2 hours per day, from around 30% to more than 50% (p<0.001). The transition from elementary to middle school resulted in a significant increase in the rate of these questions' results, while the difference between middle and high school students was relatively small in comparison.

Elementary school students in Jeju-do were divided into NWG and OG. The results showed that OG was significantly more likely to consume instant noodle three or more times per week (7.0% vs 4.7%, p=0.002), drink soft drink three or more times per week (22.9% vs 19.1%, p=0.004), and eat fast food three or more times per week (6.2% vs 3.9%, p=0.001) than NWG. OG had a slightly higher prevalence of skipping breakfast compared to NWG, but the difference was not statistically significant (15.9% vs 18.0%, p=0.084). NWG had statistically significantly better healthy eating habits than OG. OG had a significantly higher likelihood of sleeping less than 7 hours per day (9.6% vs 13.7%, p<0.001), watching more than 2 hours of TV per day (37.9% vs 44.9%, p=0.001), and playing more than 2 hours of games or using the internet per day (34.6% vs 45.9%, p<0.001). However, there was no statistically significant difference between NWG and OG on the mental health questionnaires (Table 3).

When analysing middle and high school students in Jeju-do, the prevalence of skipping breakfast was statistically significantly higher in OG (37.7%) than in NWG (34.1%) (p=0.002). NWG had a higher prevalence of exercising for 30 minutes or more per day, three or more times per week (34.6% vs 31.6%, p=0.01), while OG had a statistically significant higher rate of sleeping less than 7 hours per day (67.3% vs 64.0%, p=0.005). In the mental health questions, the rate of individuals who reported having no one to talk to about problems was higher in the middle/high OG compared to NWG (17.2% vs 20.3%, p=0.001). Similarly, the rate of individuals who reported worrying about problems at home was also higher in the middle/high OG compared to NWG (9.9% vs 12.0%, p=0.005) (see Table 3).

Table 3. Cross-sectional analysis of factors that may contribute to obesity between elementary students and middle/high students in Jeju-do

		Elementary in Jeju-do			Middle/High in Jeju-do			Ele.OG vs. Mid/HiOG
		NWG (n=4,332 ,%)	OG (n=1,220 ,%)	p-value	NWG (n=7,301 ,%)	OG (n=2,381 ,%)	p-value	p-value
Eating habits	Instant noodle intake rate ≧3 times/wk	4.7	7.0	0.002	14.7	13.5	0.18	<0.001
	Soft drink rate ≧3 times/wk	19.1	22.9	0.004	43.1	40.6	0.04	<0.001
	Fast food intake rate ≧3 times/wk	3.9	6.2	0.001	9.9	10.2	0.634	<0.001
	Skipped breakfast rate	15.9	18.0	0.084	34.1	37.7	0.002	<0.001
	Meat intake rate≧3 times/wk	69.2	65.9	0.03	75.4	74.4	0.359	<0.001
	Fruit intake rate ≧3 times/wk	71.2	63.3	<0.001	57.5	53.6	0.002	<0.001
	Vegetable intake rate ≧3 times/wk	68.5	61.9	<0.001	62.7	63.8	0.369	0.287
Exercise & Lifestyle habits	Exercise rate≧3 times/wk (elementary)	60.1	57.8	0.155				
	Exercise 30 minutes a day ≧3 times/wk (middle/high)				34.6	31.6	0.01	
	Sleeping time < 7 hr/day	9.6	13.7	<0.001	64.0	67.3	0.005	<0.001
	Watching TV ≧ 2 hr/day (elementary)	37.9	44.9	0.001				
	Playing game or internet ≧ 2 hr/day	34.6	45.9	<0.001	53.0	54.9	0.278	<0.001
Mental health	Bullying experience within 1 year	3.0	3.8	0.259	1.8	2.3	0.167	0.031
	Runaway thought	5.2	6.4	0.137	5.5	6.4	0.355	1
	Without someone to talk (middle/high)				17.2	20.3	0.001	

		Elementary in Jeju-do			Middle/High in Jeju-do			Ele.OG vs. Mid/HiOG
		NWG (n=4,332 ,%)	OG (n=1,220 ,%)	p-value	NWG (n=7,301 ,%)	OG (n=2,381 ,%)	p-value	p-value
	Worried about problems at home				9.9	12.0	0.005	
	No family support (elementary)	11.6	13.4	0.112				
	Feeling helpless (elementary)	3.2	4.1	0.158				

Discussion

Kang's study[7] reported that the prevalence of obesity among adolescents in Jeju-do was 9.9% in 2002, which increased to 16.7% in 2014. In 2022, the obesity rate was confirmed to be 19.8%5. The objective of this study was to analyse various factors contributing to the continuously increasing obesity rate among adolescents in Jeju-do over the past 20 years to 2022. Raw data from student health examinations conducted by the Ministry of Education every year from 2017 to 2022 (except 2020) was used for this purpose. Over the five-year period, the mean BMI of the surveyed subjects was 19.2 ± 2.5 kg/m^2 in NWG and 27.5 ± 3.7 kg/m^2 in OG. These results are consistent with Jee and Kim's study[8] on obesity, which used the 2011 Youth Health Behavior Online Survey and found mean BMIs of 19.95 kg/m^2 in NWG and 26.81 kg/m^2 in OG. The obesity rate among the surveyed subjects increased slightly over a five-year period, from 14.55% in 2017 to 15.08% in 2018 and 15.83% in 2019. It is assumed that no student health examinations were conducted in 2020 due to COVID-19, and raw data for that year was not available. The obesity rate among children and adolescents was 18.80% in 2021 and decreased to 16.85% in 2022. The decrease in 2022 may be attributed to the resumption of normal school life after the COVID-19 pandemic. However, the rate is still higher than in previous years ($p<0.001$).

From over 100 questions included in the student health examination, 18 factors that are known to be associated with obesity were selected. To determine the correlation between these 18 factors and obesity, NWG and OG were compared. The data showed that skipping breakfast was associated with obesity and was a major factor in increasing the risk of overweight/obesity, as confirmed by Yong Fu[9] and Giovana Longo-Silva[10]. Although Shin et al.[11] and Ahmad Syayqy et al.[12] reported a significant correlation between frequent instant noodle consumption and obesity, this study found a higher rate of instant noodle consumption (more than three times a week) in NWG compared to OG, which is consistent with the findings of Jee and Kim[8].

Regarding exercise and lifestyle habits, a study by Waszak et al.[13] found that increased physical activity is effective for weight loss in obese and overweight children. However, it is worth noting that the amount of exercises per week in this study was higher in OG than in NWG. Additionally, the study found significant associations between obesity and sleeping less than 7 hours per day, watching more than 2 hours of TV per day, and playing more than 2 hours of games or using the internet per day (Table 2). Sood et al.[14] confirmed that sleep disruption or lack of sleep can increase the risk of obesity. Li et al. [15] demonstrated that children who spend more than two hours in front of screens are more likely to be obese.

Beltran-Garrayo et al. [16] found that childhood obesity and mental health disorders in adolescence often coexist. Obese children have a 7.15-fold increased risk of mental disorders in adolescence compared to normal-weight children. These data showed that OG had a higher rate of identification in all six questions related to mental health compared to NWG. This suggests a strong association between obesity and mental disorders such as depression, as confirmed by Kosowski et al.[17]

Cross-sectional analysis of NWG and OG revealed that 10 unhealthy behaviours, including skipping breakfast, sleeping less than 7 hours per day, watching TV for more than 2 hours per day, playing games or using the internet for more than 2 hours per day, experiencing bullying, thinking of running away, having no one to talk to about problems, worrying about problems at home, having no family support, and feeling helpless, as well as 3 healthy behaviours, namely meat, fruit, and vegetable consumption, were significantly associated with obesity (refer to Table 2). Among NWG, students in Jeju-do consumed soft drink and fast food three or more times per week, watched TV and play games or internet for more than 2 hours per day, thought about running away from home, had no one to talk to about their problems, and worried about family issues more frequently than students in other regions. Notably, students in Jeju-do consumed meat and vegetables three or more times per week and exercised for 30 minutes or more per day three or more times per week at a statistically significant higher rate than students in other regions. Among OG, Jeju-do adolescents had a statistically significant higher intake of instant noodle and fast food compared to those in other provinces. Additionally, the proportion of meat intake was significantly higher in Jeju-do adolescents than in other provinces. Based on the similarities observed in Table 2 between OG and NWG, it was determined that instant noodle and fast food consumption significantly contribute to adolescent obesity in Jeju-do, as shown in Table 2.

In Jeju-do, students in NWG exhibit better eating and lifestyle habits than students in other regions, while students in OG appear to have worse eating and lifestyle habits than students in other regions. This suggests that students in Jeju-do who maintain good eating and lifestyle habits are better managed, while those who do not have good habits are not as well managed as students in other regions.

To identify the factors associated with the high obesity rate in Jeju-do more precisely, analyses were conducted according to the age of subjects. The study conducted among middle and high school students in Jeju-do revealed a significant increase in the rate of unhealthy eating habits such as instant noodle, soft drink, and fast food, as well as skipping breakfast ($p<0.001$). There was a decrease in the rate of eating fruit more than three times a week ($p<0.001$). The study also showed significant increases in the rate of sleeping less than 7 hours per day and playing games or internet for more than 2 hours per day ($p<0.001$). According to the data, middle and high school students consumed meat three or more times per week more frequently than elementary school students ($p<0.001$). Middle and high school students experienced less bullying experience compared to elementary school students ($p=0.031$). A comparison was made between OG and NWG of elementary school students in Jeju-do. The study showed that OG had significantly higher intake of unhealthy food such as instant noodle, soft drink, and fast food compared to NWG. This feature was not identified in the factor analysis of OG in the overall study population (refer to Table 2). Therefore, it can be considered a unique characteristic of obesity among elementary school students in Jeju-do (refer to Table 3). When comparing only middle and high school students in Jeju-do, the study found that skipping breakfast, exercising for more than 30 minutes a day, sleeping less than 7 hours per day, not having someone to talk to about problems, and worrying about problems at home were identified as the associated factors of obesity in OG (Table 3). These results were consistent with the factor analysis conducted on the total population (Table 2).

After comparing the eating and lifestyle habits of elementary school students with those of middle and high school students in Jeju-do, a rapid deterioration in the latter group was identified. Therefore, urgent action is required to educate not only the students but also their parents and guardians at home. It is believed that home education may be neglected because children may feel that they have matured to a certain degree when they enter middle and high school. However, as obesity during adolescence can have a significant impact on adult health, it is necessary to provide intensive management to educate and correct eating and lifestyle habits at home. Since the difference between elementary and middle school students is greater than the difference between middle and high school students, it is important to focus on the transition from elementary to middle school and middle school period. This is a critical time for management to educate both students and parents/guardians. Based on the observed data, the factors associated with obesity in Jeju-do elementary school children may differ from those found nationwide. Therefore, efforts to reduce obesity in Jeju-do elementary

school students through healthcare policies that are specific to them may effectively decrease the rate of adolescent obesity in Jeju-do.

This study utilised raw data from the Ministry of Education's student health examination. It is important to note that this examination is a self-reported survey, which may result in some inaccuracies. Additionally, it is not specifically designed to measure obesity, which may limit its usefulness in this regard. However, we consider the results of this study to be highly reliable due to the large sample size of over 480,000 raw data surveyed over five years.

As a result of the ongoing efforts to improve dietary habits to combat obesity, many children and adolescents in South Korea have become more aware of the need to improve their eating behaviours. However, the study revealed that students in Jeju-do need to improve their eating habits. Recent studies have reported a correlation between obesity and unhealthy mental states. The correlation is clearly evident in the results of these surveys and future adolescent health policies should address this issue in depth.

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