Original Article

Comparison of fast food consumption and dietary guideline practices for children and adolescents by clustering of fast food outlets around schools in the Gyeonggi area of Korea

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Objectives: This study investigated the distribution density of fast food outlets around schools, and the relationship between dietary health of children and adolescents and the density of fast food outlets in Korea. **Methods**: A distribution map of fast food outlets was drawn by collecting information on 401 locations of 16 brands within a 15-minute walk (800 meter) of 342 elementary and secondary schools in Suwon, Hwaseong and Osan. A questionnaire was used to gather data on the dietary life of 243 sixth and eighth grade students at eight schools. Schools in the upper 20% and lower 20% of the fast food outlet distribution were classified as high-density and low-density groups, respectively. The practice rate of dietary guidelines published by the Health and Welfare Ministry and the fast food consumption pattern of children and adolescents from low and high density groups were determined. **Results**: The number of schools with a fast food outlet within 200 meters or in the Green Food Zone around its location was 48 of 189 (25.4%) in Suwon and 14 of 153 (9.2%) in Hwaseong and Osan. Students in the low-density group visited fast food outlets less often than those in the high-density group (*p*<0.01). Dietary guideline practice scores for children did not show a significant difference between the two groups. **Conclusion**: The distribution map of fast food outlets within 200 meters of schools was useful for identifying the effectiveness of the Green Food Zone Act and nutrition education programs.

Key Words: distribution map, fast food outlets, fast food consumption, dietary guideline practices, Green Food Zone

INTRODUCTION

With the rapid change of culture, economic status and lifestyle, the number of international and domestic fast food restaurants has increased in Korea. The consumption rate in this sector has increased steadily, with 12% of middle school students purchasing fast food three times or more a week in 2013, compared with 11.2% in 2010.[1,2] Most adolescents visit fast food outlets for convenience and ease of access and to socialize with friends. This tendency is more common in urban (metropolitan) areas.[3] However, many studies have reported that frequent consumption of fast food could lead to nutritional imbalance and give rise to a high risk of chronic disease due to its characteristically high calorie, high fat, low mineral or low fibre content.[1,4] Further, strong flavours in fast foods prompt repeat sales. Children indulge in the taste and form poor dietary habits.[5,6]

Eating habits, formed in early childhood and significantly influenced in adolescence, are known to play an important role in maintaining health for a lifetime. In Korea, many students in middle school and upper grades of elementary school attend afterschool programs or participate in personal extra-curricular activities, spending extended time outside the home. Adolescents of single-parent families or dual-income families without a house-

helper frequently use fast food from a kiosk, street vendor or fast food outlet as a meal, which affects the quality of dietary life.[7]

In 2003, the Ministry of Health, Welfare and Family Affairs suggested healthy dietary life goals for the people and published guidelines that characteristically reflect the life cycle of infants and adolescents.[8] In 2008 and 2010, "the Dietary Guidelines for Koreans (DGK)" were revised to promote a proper dietary life and foster specific practices for health.

In conjunction, "The Comprehensive Plans for Children's Food Safety" were prepared at the government level and published by the Food and Drug Administration of Korea (KFDA) in 2007 in an attempt to reduce nutrition imbalance and create a safe food environment for children. Enacted as the Special Act on Children's Die-

tary Life Safety Management (SACDLSM) in 2008[9] and enforced from 8 December, 2012,[10] its purpose is to contribute to and promote children's health by regulating requirements and provisions for safe and nutritious foods and proper dietary habits among adolescents. Article 5, Chapter 2 designates a Green Food Zone (GFZ) for the protection of children, where safe and sanitary food must be sold within a 200-meter radius of schools. In the GFZ, high-calorie and low nutrition foods deemed unhealthy by standards set by the KFDA commissionaire are prohibited. It includes 23 food items, such as snack foods, frozen desserts, chocolate, gimbap, sandwiches, bread products, ice cream, hamburgers and pizza. A secondary plan from the Children's Dietary Life Safety Management from 2013 to 2015 is expected to add 7 other food items: ramen, tteokbokki (rice cake seasoned with spice and sweet sauce), skewered food, eomuk (fish paste), fried foods, mandu and hotdogs.[10]

To ensure children's food safety and foster a healthy eating environment near schools, an authorized watchdog group consisting of exclusively charged officials and parents of schoolchildren carries out inspections of food sold within a 200-meter radius from schools. The group checks for quality in terms of shelf life, labelling and hygiene standards. Only establishments certified by the KFDA as not selling high-calorie and low nutrition foods in a safe and sanitary facility can be classified as "best practice" and operate within 200 meters of a school.

The question, however, is whether legislation has been effective in improving the dietary life of students in Korea, as most studies focus on fast food consumption patterns and dietary habits of students.[11-14] A limited number of international studies[15,16] have investigated the relationship between density of food outlets and dietary life practices. In Korea, no research has been conducted to identify whether the GFZ is effective. Further, there is no research to assess the effectiveness of the SACDLSM by drawing a distribution map of fast food outlets around schools.

This study examined the impact of density of fast food outlets around schools on healthy dietary practices of students. We investigated the distribution of fast food outlets within 15 minutes walking distance from schools and within the GFZ. Further, this study examined the dietary life of elementary and middle school students, including fast food consumption patterns and practice of dietary guidelines according to density of fast food restaurants around schools in Suwon, Hwasung and Osan.

METHODS
Mapping fast food outlet distribution around schools
Elementary, middle and high schools in the Suwon and Hwaseong/Osan public school districts were sampled. Districts were selected using a convenience sampling method, in that cooperation was easily secured and locations are adjacent to each other in the south-western part of Gyeonggi Province. In Suwon, there were 93 elementary, 55 middle and 41 high schools of 189 schools. In Hwaseong and Osan, there were 89 elementary, 38 middle and 26 high schools of 153 schools.

Zones of 200 meters, 400 meters and 800 meters radius around schools were used for mapping locations of fast

food restaurants and schools.[17] The 200-meter radius coincided with the regulated distance of the GFZ in which fast-food outlets must comply with food safety requirements stipulated by the SACDLSM. The 400-meter and 800-meter parameters were based on estimates of 7 and 15 minutes walking distance, respectively. To create locational patterns, addresses of fast food restaurants and schools were entered into mygeopostion.com and Google open API (Air Position Indicator) to assign longitude and latitude. Fast food outlets included 401 units of 16 brands that offer menu items such as hamburgers, pizza, fried chicken, doughnuts and sandwiches. The 16 brands and number of locations were: Lotteria (17), McDonald's (5), Burger King (4), Pizza Hut (8), Domino's Pizza (9), Mister Pizza (9), Pizza School (23), 59 Rice Pizza (21), KFC (5), BBQ Chicken (38), BHC Chicken (15), Gyochon Chicken (21), Nene Chicken (20), Pericana Chicken (27), Dunkin' Donuts (18) and Issac Toast (24).

Participants
Student data were collected from schools in the upper 20% and lower 20% of the fast food outlet distribution classified as high-density and low-density groups, respectively. The high density group had 8 to 12 fast food outlets within 15 minutes walking distance of a school. The low-density group had one or zero fast food outlets. There were 59 sixth-grade students and 62 eighth-grade students in the low-density and high-density groups of Suwon schools and 60 sixth-grade and 62 eighth-grade students in low-density and high-density groups of Hwaseong/Osan schools. Surveys were conducted from 17 to 25 of September 2012, collecting data from a total of 243 (119 sixth graders and 124 eighth graders) of 255 questionnaires. The study was approved by the institution review board of the Dankook University, Yongin, in Korea (registration number 2014-08-006).

Practice of dietary guidelines
The DGK for children and adolescents were used to assess healthful dietary practices. The guidelines include 5 dimensions for children and 6 dimensions for adolescents, accompanied by 3 to 4 practices for eachdimensions.[18]

The questionnaire for children asked how well he/she followed the five dietary guidelines: Eat a variety of foods, daily; Be active and eat moderately; Eat on time and use less salt; Select safe and smart snacks; and Dine with family, with manners. The questionnaire for adolescents asked how well he/she followed six dietary guidelines: Eat a variety of foods from each category, daily; Eat foods with less salt and grease; Eat appropriately with knowledge of a healthy weight; Drink less beverages except water; Do not skip eating or overeat; and Choose sanitary foods. Participants were asked to rate practice of dietary guidelines on a 5-point Likert-scale from "completely agree (5) to completely disagree (1)".

General profiles and fast food consumption behaviour
Data were collected on general characteristics (height, weight, gender, grade and residence area). To understand fast food consumption patterns, respondents were asked about related behaviours such as companions and purpose and frequency of visits to fast food outlets.

Statistical analysis
All statistical analyses were performed using the SPSS program (Statistical Package for the Social Science, version 18.0, IBM Inc., USA). Frequency, proportion, mean and standard deviation were calculated according to survey categories. A Chi-square test and t-test were used to determine the significance of difference between variables, with $p<0.05$ considered statistically significant.[19]

RESULTS
Distribution of fast food outlets around schools
Table 1 presents the number of schools with fast food outlets within 200, 400 and 800 meters of location in Suwon, Hwaseong and Osan. The number of schools with fast food outlets within 200meters was 48 of 189 (25.4%) schools in Suwon and 14 of 153 (9.2%) schools in Hwaseong/Osan. A total of 99 schools (52%) in Suwon and 46 (30%) in Hwaseong/Osan had fast food outlets within a 400-meter radius. The number of schools with at least one fast food outlet within 800 meters was 152 of 189 (80%) in Suwon and 97 of 153 (63%) in Hwaseong/Osan.

The average number of fast food outlets located within 200meters of a school, also known as GFZ, was 1.33 in Suwon and 1.35 in Hwaseong/Osan. The number of fast food outlets and locations within 200, 400 and 800 meters of schools in Suwon was significantly greater than Hwaseong/Osan ($p<0.05$). Fast food restaurants tended to be more clustered around schools in Suwon than Hwaseong/Osan.

Distribution map for school indicating fast food outlet density
Figure 1 shows the location of schools and fast food outlets in Suwon and Hwaseong/Osan according to distance. A "0" in a gray box indicates that there were no fast food outlets within an 800-meter radius of a school; a "1" for schools with at least one fast food outlet within a 200-meter radius, a "2" for schools with at least one fast food restaurant within a 400-meter radius, and a "3" for schools with at least one fast food outlet within a 800-meter radius. Green circles mark the location of fast food outlets within a 15-minute walk from a school.

The area and population of Suwon are 121 km² and 1,120,885, 689 km² and 522,612 for Hwaseong, and 42.8 km² and 185,314 for Osan, respectively. Although the area of Hwaseong and Osan was 6 times larger than

Suwon, the population of Suwon was 1.6 times greater than Hwaseong and Osan. The locations of fast food outlets and schools were evenly distributed in Suwon (Figure 1a), and densely aggregated in Osan and Dongtan in the Hwaseong/Osan districts (Figure 1b). Suwon showed a higher density and wider dispersion of fast food outlets than Hwaseong.

Food consumption patterns between high and low density areas of fast food outlets
A survey was conducted with 243 sixth-grade and eighth-grade students at eight schools selected as low density and high density in Suwon and Hwaseong/Osan. Schools were classified into low-density or high-density groups according to distribution of fast food restaurants. The low-density schools included the lowest 20% of Suwon and Hwaseong/Osan schools with one or zero fast food outlets in an 800-meter radius. The high-density group included the top 20% of schools with 8 to 12 fast food outlets in an 800-meter radius or within a 15-minute walking distance.

Differences in height and body weight of sixth and eighth graders were not apparent between low-density and high-density schools in Suwon and Hwaseong/Osan. Of elementary students, those in the high-density group were taller (154 cm for boys, 155 cm for girls) than those in the low-density group (151 cm for boys, 153 cm for girls), showing a significant difference ($p<0.05$). The weights of boys in both groups were similar. Of middle school students, boys in the high-density group were taller (168 cm) and heavier (55.2 kg) than the low-density group ($p<0.05$). The heights and weights of female middle school students were similar.

Fast food consumption patterns according distribution of fast food outlets around schools are represented in Table 2. In responses to the question of the purpose for eating fast food, 61.3% of respondents ate fast food as a snack, especially on weekends and holidays. When dining out at fast food outlets, students ate with friends (42%) or family (51.9%) and rarely alone (10%), showing that there is a significant difference ($p<0.05$) in fast food consumption. On motive for purchasing fast food, 'taste of food' (49.8%) ranked highest, followed by 'convenience' (27.2%) and 'quick service' (10.7%). On frequency of consumption, the low-density group ate fast food 3.73 times per month and the high-density group 5.11 times a month. The high-density group ate fast food more often

Table 1. Number of schools with fast food outlets and average number of outlets by distances

	Suwon (n=189)[†]			Hwaseong/Osan (n=153)[‡]		
	Within 200 m	Within 400 m	Within 800 m	Within 200 m	Within 400 m	Within 800 m
Number of schools with fast food outlets[§]	48 (25.4)	99 (52.4)	152 (80.4)	14 (9.2)	46 (30.1)	97 (63.4)
Average number of fast food outlets[¶]	1.33±0.66	1.76±1.08	3.54±1.88	1.35±0.74	1.47±0.69	3.02±2.06

[†]Participating schools in Suwon had 93 elementary schools, 55 middle schools and 41 high schools.
[‡]Participating schools in Hwaseong and Osan had 89 elementary schools, 38 middle schools and 26 high schools.
[§]Data were indicate number (percentage) of schools with a fast food outlet within 0~200 m, within 0~400 m, and within 0~800 m.
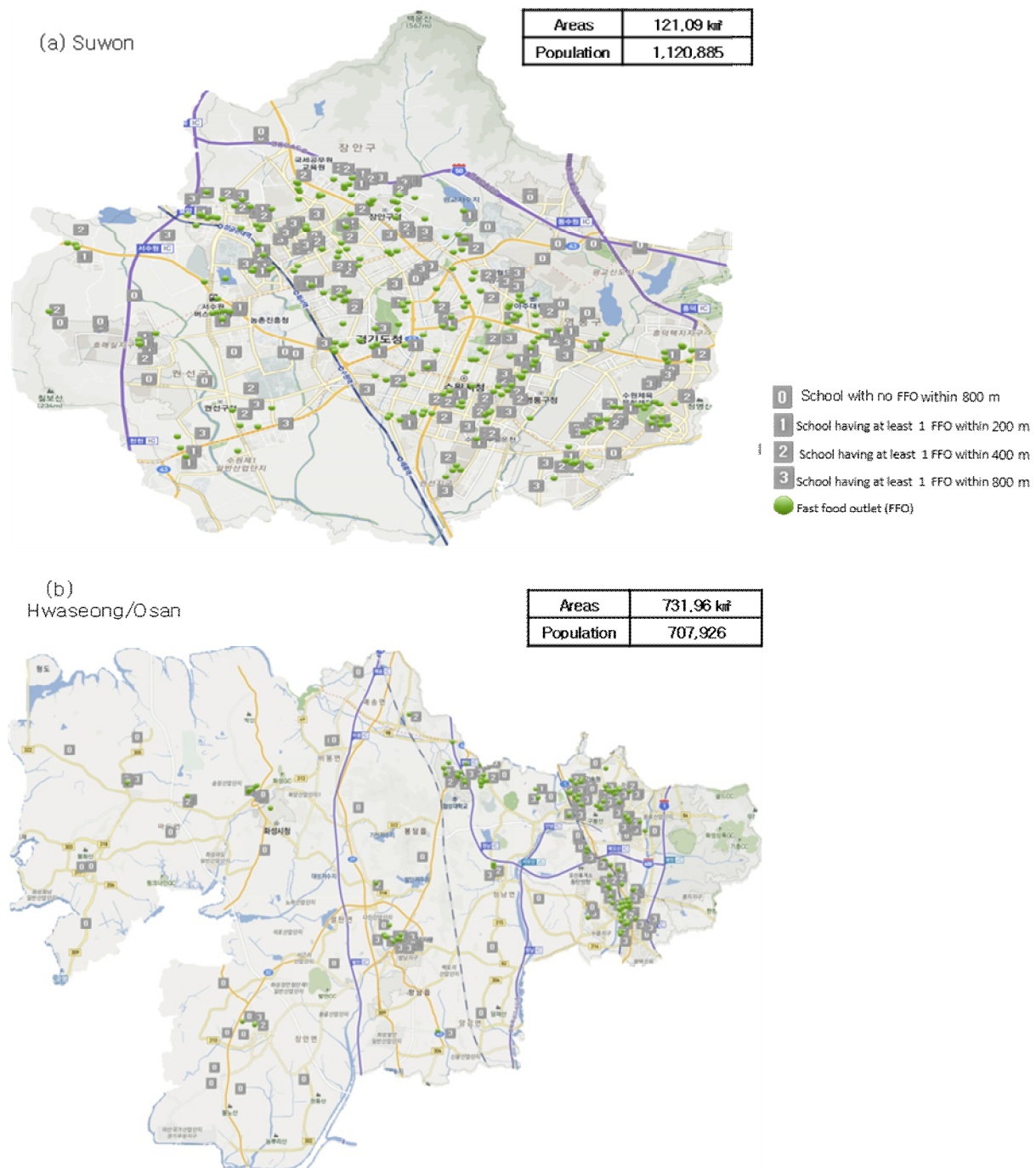[¶]Data are presented as mean and standard deviation.

| Areas | 121,09 k㎡ |
| Population | 1,120,885 |

| Areas | 731,96 k㎡ |
| Population | 707,926 |

Legend:
0 School with no FFO within 800 m
1 School having at least 1 FFO within 200 m
2 School having at least 1 FFO within 400 m
3 School having at least 1 FFO within 800 m
● Fast food outlet (FFO)

(a) Suwon

(b) Hwaseong/Osan

Figure 1. Distribution of fast food outlets within a 15 minute walk of schools in (a) Suwon and (b) in Hwaseong/Osan

than the low-density group, which was a statistically significant difference ($p<0.01$). Consumption frequency by region showed that residents of Suwon ate fast food 5.47 times a month and Hwaseong/Osan residents 3.45 times per month (data not shown). There was a significant difference in consumption frequency between the two cities ($p<0.001$).

Practice of dietary guidelines between high and low density groups
In comparing low-density and high-density groups, there was no significant difference between scores on the practice of dietary life guidelines for children ($p>0.05$) (Table 3). Students agreed most often with 'dine with families', which had the highest score, followed by 'do not skip

breakfast' and 'serve food on a plate, eat moderately and do not waste food'. 'Eat less sweets/carbonated drinks and fast food' scored 3.31, the second lowest of all 10 guidelines.

Dietary guidelines for adolescents (Table 3) were followed more often by the high-density group, with a statistically difference from the low-density group ($p<0.05$). 'Do not follow a severe diet' ($p<0.05$), 'do not skip breakfast' ($p<0.001$) and 'drink less carbonated and sugar-sweetened beverages' ($p<0.05$) scored highest. 'Eat less fried and fast food' at 3.55 for the high-density group was significantly higher than 3.14 for the low-density group ($p<0.001$).

Table 2. Fast food consumption patterns according to distribution of fast food outlets n (%)

		Low-density[‡] (n=115)	High-density[§] (n=128)	Total (n=234)	x^2-value
Purchasing purpose	For snack	71 (61.7)	78 (60.9)	149 (61.3)	0.706
	For meal	35 (30.4)	43 (33.6)	78 (32.1)	
	Etc.	9 (7.8)	7 (5.5)	16 (6.6)	
Companion	Alone	3 (2.6)	7 (5.5)	10 (4.1)	11.6[**]
	Friends	59 (51.3)	43 (33.6)	102 (42.0)	
	Family	53 (46.1)	73 (57.0)	126 (51.9)	
	Etc.	0 (0.0)	5 (3.9)	5 (2.1)	
Visit frequency per month[†]		3.73±2.88	5.11±4.43	4.46±0.69	-2.84[**]
Purchasing motives	Convenience	35 (30.4)	31 (24.2)	66 (27.2)	2.19
	Quick service	10 (8.7)	16 (12.5)	26 (10.7)	
	Good place with friends	9 (7.8)	10 (7.8)	19 (7.8)	
	Taste of food	55 (47.8)	66 (51.6)	121 (49.8)	
	Advertisement	3 (2.6)	3 (2.3)	6 (2.5)	
	Trying new menu	3 (2.6)	2 (1.6)	5 (2.1)	

[*]$p<0.05$, [**]$p<0.01$, [***]$p<0.001$.
[†]Data are presented as mean and standard devistion.
[‡]Low density group includes schools with one or zero fast food outlets in a 800-meter radius of location.
[§]High density group include schools with more than 8 fast food outlets in a 800-meter radius of location.

Table 3. Practice of dietary life guidelines for children and adolescents according to distribution of fast food outlets

Guidelines	Low-density	High-density	Total	t-value
Children[†]				
Eat variety of vegetables	3.56±0.96[§¶]	3.69±0.80	3.63±0.88	0.665
Drink two cups of milk daily	3.51±1.31	3.44±1.31	3.47±1.31	0.093
Exercise 1 hour daily	3.35±1.08	3.50±1.07	3.43±1.07	0.575
Eat meals and snack regularly	3.44±1.02	3.65±0.83	3.55±0.93	1.48
Do not skip breakfast	3.93±1.19	3.92±1.26	3.92±1.22	0.002
Eat less salty/sweet/greasy food	3.16±0.92	3.39±0.95	3.28±0.94	1.78
Eat less sweets/carbonated drinks/fast food	3.19±1.13	3.42±1.05	3.31±1.09	1.29
Know junk foods from healthy food and try not to eat	3.58±1.12	3.48±1.10	3.53±1.10	0.219
Dine with family	4.02±1.13	4.15±0.79	4.08±0.96	0.521
Serve food on a plate, eat moderately and do not waste	3.61±1.05	3.82±0.86	3.72±0.96	1.42
Subtotal	35.4±6.47	36.4±6.05	35.9±6.25	0.921
Adolescents[‡]				
Eat variety of vegetables, fish and meat	3.71±0.77	3.88±0.92	3.80±0.86	1.25
Drink two cups of milk daily	3.03±1.23	3.47±1.23	3.27±1.24	3.87
Eat less salty food and soup	3.12±0.84	3.33±0.85	3.23±0.85	1.96
Eat less fried and fast food	3.14±0.76	3.55±0.75	3.35±0.78	9.03[***]
Do physical activity for 1 hour daily	3.10±1.07	3.35±1.09	3.23±1.08	1.59
Do not follow a severe diet	3.84±0.99	4.24±0.79	4.06±0.90	6.22[*]
Drink water frequently & sufficiently	3.72±0.85	4.02±0.85	3.88±0.86	3.60
Drink less carbonated and sugar-sweetened beverages	3.22±0.88	3.59±0.89	3.42±0.90	5.28[*]
Do not skip breakfast	3.67±1.25	4.36±0.94	4.04±1.14	12.3[***]
Do not overeat	3.17±0.94	3.33±0.98	3.26±0.96	0.864
Do not eat unhealthy foods	3.24±1.16	3.47±1.07	3.36±1.11	1.30
Verify nutritional facts and expiration date	3.72±1.21	3.83±0.92	3.78±1.06	0.324
Subtotal	40.7±5.57	44.4±4.91	42.7±5.53	15.6[***]

[*]$p<0.05$, [***]$p<0.001$.
[†]Number of children was 57 in low density and 62 in high density.
[‡]Number of adolescents was 62 in low density and 62 in high density.
[§]Data are presented as mean and standard devistion.
[¶] Score of data used a 5-point Likert scale: 1 completely disagree; 2 disagree; 3 so-so; 4 agree; 5 completely agree.

DISCUSSION

The fast food industry increasingly counts children and adolescents among its major consumers, with each passing decade. Consumption of high-calorie low-nutrient foods from fast food outlets is closely related to the rise of childhood obesity and related diseases. In this study, we attempted to identify the distribution of fast food outlets around schools and investigate whether students with more exposure and easier access to a high density of fast food outlets had poorer dietary habits than students with less exposure and access.

The average number of fast food outlets within 200 meters of a school was 1.35 in Suwon and 1.33 in Hwaseong/Osan. The average number within 400 meters of a school was 1.76 in Suwon and 1.47 in Hwaseong/Osan, and the average number within 800 meters of a school was 3.54 in Suwon and 3.02 in Hwaseong/Osan. A study from Austin et al[17] in Chicago reported that the number of fast food outlets was 0.9 on average, ranging from 0 to 33 within 400 meters of a school; and 3.1 on average, ranging from 0 to 85 within 800 meters of a school. A lower number of fast food outlets around schools in Korea may be the result of GFZ policies, which restrict the kind of food sold to children and adolescents. However, there is room for improvement.

Studies have suggested that environmental factors such as income inequality, level of commercialization and neighborhood food environment (density of fast food outlets) are correlated with the epidemic of childhood obesity.[15,17,20-22] We found 80% of schools in Suwon and 63% of schools in Hwaseong/Osan had at least one fast food outlet within 800 meters. Considering that Suwon is more populated and commercialized than Hwaseong/Osan, it is consistent with the Austin et al's study.[17] They found that highly and moderately commercialized areas of Chicago had more fast food restaurants clustered within 1.5 km of schools compared to areas with low commercialization. In contrast, a study suggested a strong relationship between socioeconomic status and the density of fast food outlets. People living in poor areas were exposed to fast food outlets 2.5 times more than those in wealthier neighborhoods.[21] Another study showed that the concentration of fast food outlets around a school was higher in areas where median annual household income was $43,700 or greater.[17] Our study did not examine economic status in the low-density and high-density groups. Therefore, it was not possible to determine whether there was a correlation between density of fast food outlets and level of household income.

The present study found that fast food brands distributed around schools were BBQ Chicken (38 locations), Pericana Chicken (27), Issac Toast (24), Pizza School (23), Gyochon Chicken (21), and 59 Rice Pizza (21), which are popular with children and medium-sized franchise outlets based in Seoul, Korea. A limited number of international fast food brand franchises operated around schools in Suwon and Hwaseong, including Dunkin' Donuts (18 locations), Lotteria (17), Domino's (9), Pizza Hut (8), McDonald's (5) and KFC (5).

The most preferred fast food among students was chicken, followed by hamburgers and pizza. This result was similar to Her et al[13] and Kim.[14] Her et al[13] suggested

a positive correlation between intake frequency and preference of fast foods in Busan, Korea, where adolescents most frequently ate and preferred dukbokki, chicken and mandu. Kim[14] reported that adolescents were inclined to eat fast food as a snack, with chicken, pizza and hamburgers among favourites and good taste listed as the top reason for consumption. Regular or frequent consumers of fast food said that they felt more drowsy or cold in hands and feet than non-consumers. The study recommended that adolescents be aware of frequent fast food consumption leading to an unbalanced diet and undesirable food habits.[14]

This study found no significant differences in dietary habits between children of low-density and high-density groups. Contrary to our expectations, dietary guideline practices among adolescents in the high-density group were sounder than those in the low-density group. This finding may be attributed to many reasons.

First, public health and education in schools have been given more attention. Article 13, Chapter 4 of the SACDLSM in Korea[10] suggests that children be provided with education on food safety and nutrition. It also prescribes that education and public relations campaigns be customized according to characteristics of the audience, level of health status and perception on health to help children adopt a healthy and proper diet. Continuous and repetitive educations for children and adolescents by a nutrition teacher has been implemented at schools with the goal of changing poor dietary habits to good and healthy dietary practices.[23] An analysis on nutritional education in elementary schools found that formation of proper dietary practices for students, correction of students' unbalanced diets, dining etiquette, relationship between favourite foods and nutrition, and physical development and nutrition are main themes.[24] Reinforced nutrition polices and education, especially in urban areas with a higher density of fast food outlets and higher awareness among children's parents, may have led students to make more informed choices about fast foods and follow better dietary practices.

Second, parental style may have influenced children's nutritional choices or dietary practices. Studies have reported that parenting style had a moderating effect on specific parental child-feeding practices and weight control.[25-28] Examining associations between parental feeding styles, snack intake and weight, it was found that instrumental or emotional feeding has a negative effect on children's snacking behaviours, and encouragement, overt control and covert control give rise to less energy-dense snacking and fewer sugar-sweetened beverages.[25]

Third, socioeconomic status was found to be linked with parental style and parental education, and may affect the dietary practices of children and adolescents.[27] In general, districts with a higher density of fast food outlets may have higher economic status and higher income. However, children and adolescents can easily form healthy dietary practices under the right parental style, despite being surrounded by a higher density of fast food outlets. This result was consistent with a previous study, indicating that the mean score of dietary guideline index for children and adolescents (DGI-CA) in Australia was associated with lower energy intake and sugar intake, and

socio-economic level.[27]

Density of fast food outlets around schools is an important public health consideration, as it may represent a detrimental influence on the school neighbourhood food environment. Research suggested that a healthy school food environment requires fast food outlets be located a minimum distance from schools, be limited in number around schools, and be limited in proximity to each other. Ashe et al[29] discussed the importance of local government policy to protect public health by restricting availability of nutritionally deficient foods. It found that land use policy is a useful tool for monitoring public health by lessening the negative effects of retail stores on community health. However, more research is needed to determine whether such regulations are successful in reducing the negative effects of other types of retail outlets.

There were limitations of this study. First, the sample size is relatively small and regions were restricted to three districts in the Gyeonggi area. Therefore, interpretations and conclusions should be drawn with caution. Second, parental feeding style and economic status of subjects were not identified, as the questionnaire was only administered to children and adolescents, not parents. Future studies are warranted to include the effects of parental feeding style, economic status and effect of parental style on dietary practices of students in areas with a higher and lower density of fast food outlets.

Despite limitations, our study found that the average number of fast food outlets ranged from 1.3 to 1.5 within 200 meters of a school and from 3.0 to 3.5 within 800 meters. To the best of our knowledge, this is the first study in Korea to identify fast food outlets around schools and create a distribution map. In addition, we found evidence that suggests government regulations and laws have been effective in fostering a school environment suitable for promoting student health. It is recommended that students exposed to a high density of fast food outlets be provided with a more active education on the selection of foods and formation of proper dietary habits at school and at home. If schools and families unite to provide systematic life education and food guidelines to children and adolescents, the next generation can build and lead lives with healthful dietary habits.

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Original Article

Comparison of fast food consumption and dietary guideline practices for children and adolescents by clustering of fast food outlets around schools in the Gyeonggi area of Korea

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通过聚类分析韩国京畿道地区学校周围的快餐店来比较儿童青少年快餐的消费和膳食指南实践

目的：本研究调查了学校周围快餐店的分布密度，分析了韩国儿童青少年的饮食健康与快餐店密度之间的关系。**方法**：通过收集 Suwon、Hwaseong 和 Osan 的 342 所小学和中学周围步行 15 分钟范围内（800 米）的 16 个品牌快餐店的 401 个位置信息，绘出了快餐店的分布图。采用问卷收集了八所学校 243 名六年级和八年级学生的饮食生活数据。在快餐店分布密度的上 20%和下 20%的学校分别被定义为高密度组和低密度组。确定了高、低密度组儿童青少年快餐消费模式与卫生和福利部发布的膳食指南的实践率。**结果**：200 米以内有快餐店或其周围的绿色食品区有快餐店的学校，Suwon 有 48（共有学校 189 所，占 25.4%）所，Hwaseong 和 Osan 有 14 所（共有学校 153 所，占 9.2%）。低密度组的学生去快餐店的频率低于高密度组（*p*<0.01）。孩子的膳食指南实践得分两组之间无显著性差异。**结论**：学校 200 米范围内快餐店的分布图有助于识别绿色食品区和营养教育计划的有效性。

关键词：分布图、快餐店、快餐消费、膳食指南实践、绿色食品区