

An Analysis of Meal Hygiene Management Status of Children's Foodservice Facilities in Anyang Area - Regarding the Change in the Number of Visits due to COVID-19 -

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Abstract

In order to prevent mass infection of food poisoning in children, children's foodservice facilities should always thoroughly manage the hygiene and safety of meals. In this study, the hygiene management levels of daycare centers and kindergartens were compared according to the characteristics of foodservice facilities for four years from 2018, and the effect of the number of visits on the meal hygiene management scores analyzed. The facilities were divided into a small-scale and the group foodservice facilities and was divided into the Sprout group and the Fruit group according to the meal hygiene management level. As a result, the meal hygiene management of the Fruit group was generally better than that of the Sprout group, and the meal hygiene management scores in the second half of each year increased compared to the first half of the year. In addition, it was confirmed that the meal hygiene management scores in 2020, when the number of visits to foodservice facilities decreased due to COVID-19, was the worst compared to other years, and the decrease in the number of visits could affect the level of hygiene management. In conclusion, meal hygiene management of children's foodservice facilities should be applied differently depending on the characteristics of the facilities. Moreover, the number of visits and the hygiene management scores correlated, so it is considered that the appropriate number of visits should be maintained to improve the meal hygiene management level. However, in situations where it is necessary to prevent the spread of mass infectious diseases such as COVID-19, other active measures to replace visits should be proposed.

Keywords: Center for Children's Foodservice Management, Children, COVID-19, Foodservice Facilities, Meal Hygiene Management

1. INTRODUCTION

Thorough food hygiene and safety management in institutional foodservice is an essential factor. Food poisoning in institutional foodservice can lead to large-scale group food poisoning accidents in which many patients are caused by one contamination [1]. Therefore, it is important not only to pay attention to management to prevent transmission after occurrence, but also to prevent occurrence. The cause of food poisoning was the

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consumption of unsanitary foods and inappropriate food storage in developing countries [2, 3]. However, even in developed countries, it occurs due to many causes such as negligent in hygienic management in food preparation and storage [3], changes in dietary habit [4], increase of using of institutional foodservice, and climate changes due to global warming [5].

Food poisoning is steadily occurring every year in Korea [6]. According to data onto the number of food poisoning cases by causative substance from 2018 to 2021, provided by the Ministry of Food and Drug Safety, the most common cause was by Norovirus in 218 cases, followed by 129 cases of pathogenic *Escherichia coli*, 97 cases of protozoa, and 90 cases of *Salmonella* [7]. Food poisoning is caused by negligence in managing food hygiene such as inadequate storage methods, insufficient heating cooking, and cross-contamination [8]. Therefore, knowledge, attitude, and practice for hygiene management can be important factors that can reduce the incidence of food poisoning [9].

Children's foodservice facilities, such as daycare centers and kindergartens, should prevent food poisoning more thoroughly. Because children's immune systems are not properly completed, so the health risks caused by food poisoning are more severe than adults [10]. Nevertheless, the management of children's foodservice facilities is not properly observed. According to the press release of 'hygiene inspection at kindergartens and cafeterias nationwide' conducted in July 2020, 953 facilities were found to be unsanitary, including non-preserved food storage, expiration fate, non-health checkup of food manager [11]. These inappropriate meal hygiene management problems can cause group food poisoning in children's foodservice facilities. In relation to this, according to the current status of food poisoning at kindergartens in Gyeonggi Province provided by the Gyeonggido-Icheon Office of Education, four cases occurred each in 2019 and 2020 [12].

Accordingly, the Ministry of Food and Drug Safety established the Center for Children's Foodservice Management and dispatched dietitian to children's foodservice facilities that are difficult to manage systematically, showing positive effects of managing meal hygiene [13, 14]. The number of visits to institutions for meal hygiene management of children's foodservice facilities is determined in accordance with the guidelines on the Ministry of Food and Drug Safety [15]. The grade is divided according to the children's foodservice facilities, and as compared with the standard score, if the score is low in the previous year, it belongs to the Sprout group, and if high, it belongs to the Fruits group. And the Sprout group is supposed to visit six times and the Fruit group is four times. The reason why the Sprout group has more visits is to manage hygiene more thoroughly by intensively managing institutions with low scores. However, in order to prevent the spread of COVID-19, which has become serious since 2020, the number of visits temporarily has been reduced to four times in Sprout group and three times in Fruits group. This change in the number of visits may affect the meal hygiene management of children's foodservice facilities, and in similarly research, Park [16] reported the necessary for continuous visits for hygiene management. However, research on COVID-19 and meal hygiene reported until recently is a topic on the necessity of education for safe school meal service [17], and there is no research in children's foodservice facilities.

Therefore, this study compared the meal hygiene management scores from 2018 to 2021 to analyze whether a temporary decrease in the number of visits due to COVID-19 influenced the meal hygiene management of children's foodservice facilities. Through this, it was intended to confirm the importance of constant visit management of children's foodservice facilities for safe meal hygiene, such as preventing food poisoning.

2. RESEARCH METHODS

2.1 Research Subjects

This study was conducted children's foodservice facilities registered on Center for Children's Foodservice

Management in Anyang from January 2018 to December 2021. Institutions were classified into the small-scale foodservice facilities and group foodservice facilities according to the Food Sanitation Act [18]. And based on the guidelines on Ministry of Food and Drug Safety's Center for Children's Foodservice Management [15], they were divided into the Sprout group if the previous year's meal hygiene management's score was lower than the standard and the Fruit group if they were high. Therefore, as shown in Table 1, the number of the Sprout and Fruit groups in the small-scale foodservice facilities were 19 and 12 in 2018, 13 and 18 in 2019, 16 and 16 in 2020, and 19 and 12 in 2021. In the case of group foodservice facilities, the number of the Sprout and Fruit groups was 28 and 47 in 2018, 20 and 55 in 2019, 32 and 32 in 2020, and 32 and 43 in 2021, respectively.

Table 1. Number of children's foodservice facilities and visits in present study

Year	Small-scale foodservice facilities			Group foodservice facilities		
	Sprout Group	Fruit Group	Total	Sprout Group	Fruit Group	Total
Number of children's foodservice facilities						
2018	19	12	31	28	47	75
2019	13	18	31	20	55	75
2020	16	15	31	32	43	75
2021	19	12	31	32	43	75
Total	67	57	124	112	188	300
Number of visits						
2018	114	48	162	168	188	356
2019	78	72	150	120	220	340
2020	64	45	109	128	129	257
2021	114	48	162	192	172	364
Total	370	213	583	608	709	1,317

2.2 Contents of Meal Hygiene Management and Number of Visits

The contents of each facility's meal hygiene management and the annual number of visits were setting based on the guidelines on Ministry of Food and Drug Safety's Center for Children's Foodservice Management [15]. It consists of 'environment such as facilities', 'personal hygiene', 'raw material use', 'process management', and 'other matters'. The meal hygiene management score was calculated as perfect score of 100.

The annual number of visits are different to the Sprout and Fruit groups. In the case of 2018, 2019, and 2021, the number of visits to the Sprout and Fruit groups was 6 and 4 times a year. However, in 2020, for prevent the spread of COVID-19, the number of visits was limited to 4 for the Sprout group and 3 for the Fruit group.

Table 1 is represented of the number of visits to children's foodservice facilities. In the small-scale foodservice facilities, the number of visits to the Sprout and Fruit groups was 114 and 48 in 2018, 78 and 72 in 2019, 64 and 45 in 2020, and 114 and 48 in 2021, respectively. The total number of visits by year were the highest in 2018 and 2021, followed by 2019 and 2020. And in 2021, the visit's number was at least 41 and up to 53 less than other three years.

In the group foodservice facilities, the number of visits to the Sprout and Fruit groups was 168 and 188 in 2018, 120 and 220 in 2019, 128 and 129 in 2020, and 192 and 172 in 2021, respectively. The number of visits to 2021 was the largest, followed by 2018, 2019, and 2020. In 2020, it was at least 83 and up to 107 less than other three years.

2.3 Data Analysis

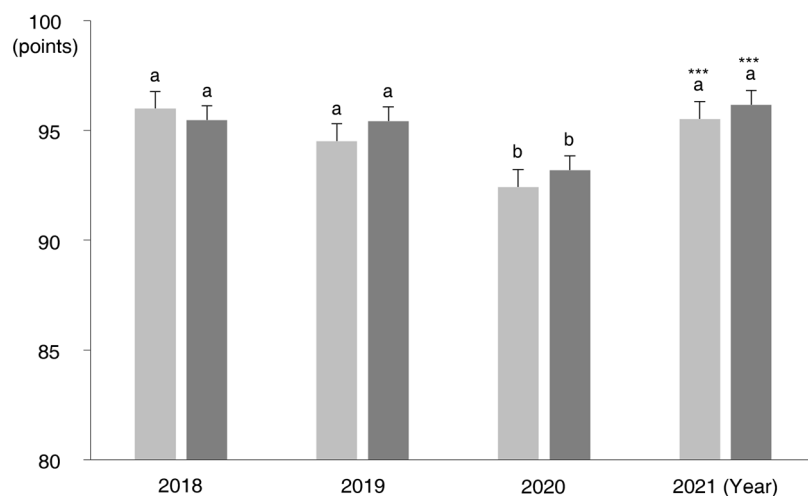
Statistical analysis of data used the SPSS version 18.0 (IBM Corp., Armonk, NY, USA). For comparison of score of 2018, 2019, 2020 and 2021 years was conducted by one-way analysis of variance (ANOVA) followed by post hoc Duncan's multiple comparisons test. An independent samples t-test was used to compare the difference between score of the Sprout and Fruit groups, and the first and second half of the year. Pearson correlation analysis was conducted on the correlation between the number of visits and score. For all results, a p-value <0.05 was considered as statistically significant.

3. RESULTS AND DISCUSSION

As a result of comparing the annual meal hygiene management scores of 2018 (small-scale, 95.99 ± 0.37 ; group, 95.46 ± 0.30), 2019 (small-scale, 94.51 ± 0.48 ; group, 95.43 ± 0.30), 2020 (small-scale, 92.42 ± 0.73 ; group, 93.18 ± 0.46), and 2021 (small-scale, 95.51 ± 0.50 ; group, 96.16 ± 0.38), both small-scale and group foodservice facilities had significantly the lowest meal hygiene scores for 2020 (Figure 1; $p < 0.001$).

These results were the difference in the number of visits, not the result of the difference in the number of facilities, as the total number of facilities over the four years was always the same. As shown in table 1, the number of visits in 2020 was significantly lower than in other three years.

It is known that education and management is effective to repeatedly conduct more than once [19]. What is noteworthy in our results is that the number of visits in 2020 is not one-time, but only one or two fewer times than other years, but the score has been significantly lowered. In addition, as the number of visits increased again the following year, the score increased to the previous level. From this, it could be expected that the meal hygiene management effect would decrease if the visit management was not performed more than a certain number of times. And it is speculated that food manager has neglected the hygiene management of meals as the reason for the reduction in score is that dietitian visited less than before.



Light gray bar, small-scale foodservice facilities; Dark gray bar, group foodservice facilities. Values are expressed as means \pm standard error. Significant differences among four years were analyzed by one-way ANOVA followed by post hoc Duncan's multiple comparisons test. *** $p < 0.001$

Figure 1. Annual meal hygiene management scores comparison in the small-scale and group foodservice facilities

In order to make the results of Figure 1 more detailed, the results of comparative analysis of the meal hygiene management score by dividing them into the Sprout and Fruit groups and the first and the second half of the year are shown in Table 2 and 3. The reason for dividing into the first and the second half the year was to examine the effectiveness of repetitive management for each year, and it was confirmed whether the score in the second was better than in the first half the year. The number of visits in the first and the second half of the year is the same in all groups, except the number of visits in the Fruit group in the second half of the 2020 is decreasing than that in the first half of the year.

Table 2. Meal hygiene management scores comparison of the first and second half of the year in the small-scale foodservice facilities

	Classification	Sprout Group (n) ¹⁾	Fruit Group (n)	p-value ²⁾
2018	First	94.54 ± 0.75 (57) ^{a,4)}	95.50 ± 0.82 (24)	0.454
	Second	96.93 ± 0.54 (57) ^a	97.67 ± 0.72 (24)	0.442
	p-value	0.011 ³⁾	0.053	
2019	First	91.67 ± 1.06 (39) ^a	94.83 ± 0.71 (36)	0.017
	Second	94.49 ± 1.02 (39) ^{ab}	97.28 ± 0.72 (36)	0.031
	p-value	0.060	0.018	
2020	First	88.34 ± 1.47 (32) ^b	94.27 ± 1.07 (30)	0.002
	Second	92.06 ± 1.34 (32) ^b	98.20 ± 0.84 (15)	0.0001
	p-value	0.066	0.006	
2021	First	92.77 ± 0.93 (57) ^{a**}	96.17 ± 1.30 (24)	0.044
	Second	96.68 ± 0.77 (57) ^{a**}	98.58 ± 0.49 (24)	0.041
	p-value	0.002	0.091	

First, the first half of the year; Second, the second half of the year.

¹⁾ Values are expressed as means ± standard error. The number in parentheses present the number of visits.

²⁾ Significant differences between Lower and Upper grade group were analyzed by independent samples t-test.

³⁾ Significant differences between the first and the second half of the year were analyzed by independent samples t-test.

⁴⁾ Significant differences among four years were analyzed by one-way ANOVA followed by post hoc Duncan's multiple comparisons test. The superscript letters correspond to significance in comparisons between groups. **p<0.01

As shown in Table 2, when comparing the differences between grades in the first and second half of the year in small-scale foodservice facilities, the score of the Fruit group was higher than that of the Sprout group in 2019 (the first of the year, p=0.017; the second of the year, p=0.031), 2020 (the first of the year, p=0.002; the second of the year, p=0.0001), and 2021 (the first of the year, p=0.044; the second of the year, p=0.041). There was no statistical significance in 2018, but the Fruit group tended to be higher than the Sprout group. We speculated that these results are because, the criterion for dividing the Sprout and Fruit groups was initially classified into the Sprout group if it was lower than the criterion for the previous year's meal hygiene management score and the Fruit group if it was high. Therefore, the Sprout group may less manage than the Fruit group, so the Sprout group score was expected to be lower in the results of this study.

This could also be observed in the group foodservice facilities (Table 3). Except for the second half of the 2021, the Fruit group always scored higher than Sprout group. In 2018, the score of the Fruit group was higher than that in the Sprout group of both the first (p=0.0001) and the second (p=0.0001) half of the year. In both 2019 and 2020, the Fruit group's score was higher than that in the Sprout group in the first (p=0.0001 in both year) and the second (p=0.0001 in both year) half of the year. And in 2021, the Fruit group scored higher than

that in the Sprout group in the first half of the year ($p=0.0001$). These results are similar with Lee [20], who said that the Fruit grade is less visited than the Sprout grade, but the level of hygiene management is higher. Also, Cheon *et al.* [21] reported that the number of visits to foodservice facilities that need to be improved should be increased to derive improvement effects. These differences between grades in our study show that there are a possibility that more meal hygiene management problems may occur in the Sprout group, so more detailed management of the Sprout group is required.

Table 3. Meal hygiene management scores comparison of the first and second half of the year in the group foodservice facilities

Classification		Sprout Group (n) ¹⁾	Fruit Group (n)	p-value ²⁾
2018	First	90.77 ± 0.75 (84) ^{ab, 4)}	97.18 ± 0.34 (94) ^{ab}	0.0001
	Second	94.45 ± 0.61 (84) ^a	98.84 ± 0.25 (94)	0.0001
	p-value	0.0001 ³⁾	0.0001	
2019	First	90.97 ± 0.95 (60) ^{ab}	96.58 ± 0.40 (110) ^a	0.0001
	Second	93.13 ± 0.74 (60) ^{ab}	97.97 ± 0.32 (110)	0.0001
	p-value	0.074	0.007	
2020	First	88.91 ± 1.23 (64) ^a	94.36 ± 0.49 (86) ^c	0.0001
	Second	92.48 ± 0.88 (64) ^b	98.23 ± 0.49 (43)	0.0001
	p-value	0.020	0.0001	
2021	First	93.35 ± 0.65 (96) ^{b**}	97.92 ± 0.45 (86) ^{b***}	0.0001
	Second	96.68 ± 0.49 (96) ^{c***}	96.95 ± 1.21 (86)	0.826
	p-value	0.0001	0.454	

First, the first half of the year; Second, the second half of the year.

¹⁾ Values are expressed as means ± standard error. The number in parentheses present the number of visits.

²⁾ Significant differences between Lower and Upper grade group were analyzed by independent samples t-test.

³⁾ Significant differences between the first and the second half of the year were analyzed by independent samples t-test.

⁴⁾ Significant differences among four years were analyzed by one-way ANOVA followed by post hoc Duncan's multiple comparisons test. The superscript letters correspond to significance in comparisons between groups. ** $p<0.01$, *** $p<0.001$

When comparing the scores of the first and the second half of the year in the small-scale foodservice facilities, the Sprout group's score rose in 2018 ($p=0.011$) and 2021 ($p=0.002$), and the Fruit group's score rose in 2019 ($p=0.018$) and 2020 ($p=0.006$), in the second half of the year. There was no statistical significance for the rest of the year of the two graded groups, but the scores were higher in the second than in the first half of the year. Similar results were shown in the group foodservice facilities. In the Sprout group, the score rose in 2018 ($p=0.0001$), 2020 ($p=0.020$), and 2021 ($p=0.0001$), and in the Fruit groups, the score rose in 2018 ($p=0.0001$), 2019 ($p=0.007$) and 2020 ($p=0.0001$), in the second half of the year. These results reflect the importance of continuous care of meal hygiene management. In this study, the number of visits in the first and second half of the year was always the same, except when the number of visits in the second half of 2020 in the Fruit group was half of the first half of the year. In other words, the reason why the number of visits is the same and the score in the second half of the year is higher may expecte to be the result of repeated and accumulated visit management. The necessity for continuous meal hygiene management of children's foodservice facilities has been emphasized. Systematic and continuous hygiene education and guide of foodservice facilities will

contribute to the increase of meal hygiene knowledge and improvement of meal hygiene management performance of food manager [22]. In addition, Lee [23] reported that the longer the education period, the more continuous improvement effect could appear. Through this, it can be said that in order to improve the meal hygiene management of children's foodservice facilities, continuous visit management is necessary every year.

Table 4. Correlation between the number of visits and score in the Sprout and Fruit groups

		Score			
		Sprout Group	p-value	Fruit Group	p-value
The number of visits	Small-scale foodservice facilities	0.251	0.0001	0.088	0.201
	Group foodservice facilities	0.158	0.0001	0.138	0.0001

As a result of comparing scores by grade for 4 years, in the case of the Sprout groups in the small-scale foodservice facilities, both the first and second half of the year was differed. The score in the first half of the 2020 was lower than in other three years ($p < 0.01$), and the score in the second half of the 2020 was lower than in 2018 and 2021 ($p < 0.01$). In the group foodservice facilities, the score in the first half of the 2020 was lower than in 2021 ($p < 0.01$), and the score in the second half of the 2020 was lower than in 2018 and 2021 ($p < 0.001$). In the Fruit group, there was no difference in four years in the small-scale foodservice facilities, though the score for the first half of 2020 was the lowest than other 3 years in the group foodservice facilities ($p < 0.001$). As such, the scores in 2020 were statistically lower in the first and second half of the year than in other years.

The reason for this low score in 2020 can be seen as a decrease in the number of visits due to COVID-19, and the correlation can be seen in Table 4. Table 4 is showed the correlation between the number of visits to children's foodservice facilities and meal hygiene management score. In the small-scale foodservice facilities, there was a positive correlation between the number of visits and score in the Sprout group ($r = 0.251$, $p = 0.0001$) whereas there was no relationship between the Fruit group. In the group foodservice facilities, both Sprout and ($r = 0.158$, $p = 0.0001$) Fruit ($r = 0.138$, $p = 0.0001$) groups showed a positive correlation, with the higher the number of visits, the higher the score. From these results, it was found that if the number of visits to the children's foodservice facilities is small, the meal hygiene management score of the facility may be lowered. After all, the number of visits to children's foodservice facilities was small in 2020, so the score for that year was lower than that of other years.

4. CONCLUSION

In this study, we checked whether the meal hygiene management of daycare centers and kindergartens was affected by the number of visits by dietitian. As a result of comparing and analyzing the annual meal hygiene management scores for four years from 2018, the level of meal hygiene management differed in the Sprout and Fruit groups. In the small-scale and group foodservice facilities, the score of the Fruit group was generally higher than that of the Sprout group, so the Fruit group was better managed than the Sprout group. In addition, when comparing the scores in the first half and the second half of the year, most of the scores increased in the second half from the first half, showing that continuous education can lead to improved meal hygiene management.

Moreover, it has been confirmed that meal hygiene management is not being properly managed in 2020, when the number of visits by dietitians was temporarily small due to COVID-19. The number of food poisoning cases in 2020 rather decreased due to thorough personal hygiene [24]. However, the management of other items of meal hygiene management other than personal hygiene, such as facility management, cross-contamination etc., may be neglected due to a decrease in the number of visits, so there is still concern about food poisoning.

In conclusion, since the level of meal hygiene management in children's foodservice facilities varies depending on the scale and the management grade, the management method should vary depending on the characteristics of the facility. In addition, it is carefully suggested that the number of visits should not be reduced to prevent food poisoning in children's meal facilities. However, it will be difficult to maintain the number of visits in special situations where there is concern about the spread of mass infectious diseases such as COVID-19. Therefore, another feasible active method of meal hygiene management other than visits is prepared, and even if the number of visits decreases, continuous management is required so that meal hygiene management is not neglected.

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