

Self-Assessment by School Foodservice Directors on Their Equipment and Sanitary Procedures, Related to Four Alternative Management Systems*

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ABSTRACT

In Korea, the school foodservice program has been expanding rapidly in recent years, partly as a result of increased government support. With the growth in the number of schools offering foodservice programs, food safety and sanitation concerns have been increasing. To assist with program improvement, a situation analysis was carried out, with the focus on equipment and sanitary management of school foodservice programs under four different management systems. A questionnaire was mailed to the foodservice directors of 234 randomly selected schools which included elementary, middle and high schools at the national level. Among them, one hundred and sixty-five responses reasonably completed were used for the analysis. This study classified each school's foodservice management into one of four types: independent-conventional, independent-commissary, contract-conventional, and contract-delivery. The results show that the monitoring of employees' health and personal hygiene, and employees' sanitary education was well conducted, but that the sanitary education of the voluntary parent workers was largely ignored. Eighty-six percent of the schools had their drinking water tested for sanitation, and the results showed that more effort is needed in careful management of drinking water in order to prevent foodborne illnesses and bacillary dysentery. In general, contract management showed lower scores in foodservice equipment and their efficiency, compared with independent management. A relatively high number of schools on the contract-delivery management system employed nurses and teachers instead of dietitians as foodservice directors. The adoption of the HACCP (Hazard Analysis Critical Control Point) system was lowest in contract-conventional and contract-delivery management systems, and highest in elementary schools using the independent-conventional system.

KEY WORDS: school foodservice, contract foodservice, independent foodservice, foodservice equipment, sanitation.

INTRODUCTION

A school foodservice program was initiated in 1953 with the donation of cereals by UNICEF (United Nation's Infant and Children Education Fund) and other organizations in order to assist children afflicted by the Korean War. This program has been gradually expanded¹⁾ such that by December 2000, foodservice programs were offered in 99.9% of elementary schools (5,286 out of 5,292) and 88.1% of the children (3,554,890 out of 4,035,240) benefited from the program. 1,853 high schools (94.7%) offer the program. Only 56.6% of middle schools offer

the program, and a nationwide program expansion is planned by the end of the year 2002.²⁾

To facilitate further expansion in the national school foodservice program, the Korean government revised the relevant law in December 1996, allowing for contracted foodservice management. It became possible for contractors to either prepare food utilizing foodservice equipment in schools or to deliver the food which had been prepared/processed/packaged outside schools and which could be partially heated or reheated upon delivery.^{3,4)} In 2001 the situation analysis carried out by the Education Human Resources Section showed that 69.1% of the schools had the independent foodservice management system, while 30.9% had contract management. In the case of independent foodservice management, 75.8% had the conventional service where each school was managing its own foodservice, and 24.2% had the commissary system where more than one school were sharing the foodservice

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management. In schools with the contract foodservice system, 74.9% had a conventional system where contractors prepared food on school premises, while 25.1% had a delivery system.²⁾

With the expansion of foodservices, increased concerns over school food safety, sanitation, and the quality of foods served to students have led to calls for strengthening the system.⁷⁾ The Education Human Resources Section posts in its home page the names of the schools which had incidences of food poisoning. In general, the incidences of food poisoning in contract management, compared to independent management, was 7.9 times higher in 1998, 6.5 times in 1999, and 3.3 times in 2000.⁸⁾ Thus, the Education Human Resources Section, after consulting experts in food safety, published the guidelines for school foodservice sanitation, based on the HACCP (Hazard Analysis Critical Control Point) system. Only a small number of progressive schools have adopted the recommendation and are practicing the HACCP at present. The goal of the school foodservice program, as described in the school foodservice law, is to encourage the development of healthy minds and bodies of students as well as to contribute to the improvement of dietary behavior.¹⁰⁾ Korean children are often under the extreme stress of schoolwork and entrance examinations, as well as the psychological stress of adolescence. Consequently, serious health problems such as growth retardation, obesity, and early onset of degenerative diseases in children, are emerging; these could be partly attributed to frequent missing of meals, irregular meal times, and overeating, so school foodservice is becoming particularly important.¹²⁾¹³⁾ School foodservice should consider the food preferences of the children, provide balanced meals, and prevent food poisoning with good sanitation practice. Proper and efficient foodservice equipment, as well as thorough sanitation management in the work place and of the employees, are essential. Given that very few studies have been carried out in the area, and that there is an urgent need for comparative data on independent and contract foodservices, the present study was conducted to survey the situation systematically and to provide basic data to help reduce food poisoning in schools. The overall aim of the study is to support improvements in the general standard of school foodservice.

MATERIALS AND METHODS

1. Subjects and questionnaire

The schools providing school foodservice in all major ci-

ties (Seoul, Busan, Daegu, Incheon, and Daejeon) and in farming/fishing areas (Kyoung-gi, Kang-won, Chung-Buk, Chung-Nam, Jeon-Buk, Jeon-Nam, Kyoung-Buk, Kyoung-Nam, and Jeju) were studied. A total of 234 schools, comprising 96 elementary schools, 72 middle schools and 66 high schools, were randomly selected. The schools were further classified into the four foodservice management types: independent-conventional, independent-commissary, contract-conventional, and contract-delivery. The questionnaire was sent to the school foodservice directors with a return envelope and postage. The questionnaire solicited information on the general characteristics of foodservice directors, average meal price, efficiency/satisfaction/ placement of foodservice equipment and facilities, sanitation management, etc. Follow-up telephone calls were made to school foodservice directors, to improve the response rate. One hundred and seventy-four schools returned the questionnaire (74.5%), and the responses from 165 schools were finally used for this study because of relatively incomplete responses by 13 schools.

2. Statistical treatment

The SPSS 10.0 program was used for data analysis. Frequency, percentages, means and standard deviations were used to describe the general characteristics of the schools surveyed. The χ^2 -test was used to test the similarity between school foodservice programs, and ANOVA was used to find out differences between the elementary/middle/high schools, and between the four different management types used. Statistical significance was analyzed by using the Turkey test and the S.N.K. (Student-Newman-Keuls).

RESULTS

1. General characteristics

The schools surveyed were divided into elementary/middle/high schools, and further into the four different foodservice management types. Among the 73 elementary schools studied, 46 schools (63.0%) used independent-conventional (IC) management, and 26 schools (35.6%) used independent-commissary (ICM) management. Among the middle schools surveyed, contract management was adopted by 44.7% of the schools (15.8% contract-conventional (CC) and 28.9% contract-delivery (CD)), and independent management was used by 55.2% of the schools (28.9% independent-conventional (IC) and 26.3% independent-commissary (ICM)). Among the high schools, 57.3% had a contract system (CC: 27.7% ; CD: 29.6%) and 42.6% had

an independent system (IC: 29.6% ; ICM: 13.0%). It appears that more than half of the middle/high schools used a contract type of management. In contract to service management situations, the final decision-makers in choosing the contractor were mainly the principals (50% in middle schools and 46.2% in high schools), school management committees (50% of the middle schools and 30.8% of the high schools), and school trustees or parents associations (13% of all schools). The criteria for deciding the contractor mainly consisted of their experience in school foodservice, the presence of dietitians, the number of participating students, and financial status and size of the firm.

Regarding the age of dietitians, 64.8% of the dietitians were in their 20's and mid-30's. Dietitians' education level was: 26.1% graduated from technical colleges, 60% from universities, and 4.2% with a master's degree. 87.6% of the dietitians working at elementary schools had worked in school foodservice for more than 5 years, but 48.4% of the dietitians working at middle/high schools worked

less than 5 years on the job (Table 1). It appears that the dietitians at elementary school had more school foodservice experience.

In contract-delivery management cases, 75% of the contractors managed less than 5 school foodservices, and one or more dietitians managed multiple school foodservices (55.6% had one, 16.7% had two, and 27.8% had three or more full-time dietitians). The foodservice directors at schools using contract-delivery were dietitians (25%), school nurses (53.6%), and teachers (10.7%). In particular, a majority of foodservice directors at schools using contract-delivery management were nurses (72.7% in middle schools and 53.8% in high schools) and teachers (9.1% in middle schools and 15.4% in high schools). Thus, more training is needed for these foodservice directors in program management and food sanitation.

The cost of school meals was not significantly different between the types of foodservice management (Table 2). The cost of meals in elementary schools tended to be lower compared to middle/high schools, because the government and local administration pay labor costs at elementary schools. The cost of meals tended to be higher in schools under contract service management in addition, costs appeared to be higher in high schools than in middle schools regardless of management type.

Table 1. General characteristics of the dietitians employed in school foodservice programs

Types of institution	Elementary school	Middle school (n = 38)	High school (n = 51)
Total in sample (n)			
Age in years			
< 25	0	3 (7.9)	7 (13.7)
25 - 30	14 (19.2)	5 (13.2)	10 (19.6)
30 - 34	41 (56.2)	19 (50.0)	18 (35.3)
35 - 39	8 (11.0)	5 (13.2)	5 (9.8)
> 40	8 (11.0)	6 (15.8)	11 (11.2)
Education level			
Junior college	13 (18.1)	10 (27.8)	20 (39.2)
University	52 (72.2)	22 (66.1)	25 (49.0)
Masters	2 (2.8)	3 (8.3)	2 (3.9)
Others	4 (5.6)	1 (2.8)	4 (7.8)
Work experience in school foodservice (years)			
< 5	8 (11.3)	8 (21.1)	24 (44.4)
5 - 10	52 (72.2)	13 (34.2)	11 (21.6)
11 - 15	7 (9.6)	0	0
> 15	5 (6.8)	1 (2.8)	4 (7.8)

2. Foodservice facilities and equipment

Table 3 shows that the cost of foodservice equipment is mainly borne by parents and central government/local

Table 2. Meal prices in won at schools under four different management types (Mean \pm standard deviation)

Types of institution (Number in sample)	Elementary school (67)	Middle school (30)	High school (42)
Contract-conventional	-	1910.0 \pm 84	1961.4 \pm 72
Contract-delivery	1300.0	2070.0 \pm 140	2175.0 \pm 158
Independent-conventional	1325.8 \pm 164	1799.0 \pm 157	1877.3 \pm 110
Independent-commissary	1330.5 \pm 314	1700.0 \pm 297	1785.7 \pm 89

Table 3. Contributors of foodservice facilities and equipment, by management system¹⁾

Variables	Contract-conventional (n = 21)			Contract-delivery (n = 12)			Independent-conventional (n = 73)			Independent-commissary (n = 43)		
	E*	M*	H*	E	M	H	E	M	H	E	M	H
School founder	0 (0)	0 (6)	3(20.0) (15)	0 (1)	0 (5)	0 (6)	7(15.3) (46)	0 (11)	2(12.5) (16)	2(7.6) (26)	1(10.0) (10)	1(14.3) (7)
Parents	0 (0)	2(33.3) (6)	1(6.6) (15)	0 (1)	3(60.0) (5)	4(66.7) (6)	18(39.1) (46)	5(45.5) (11)	8(50.0) (16)	14(53.8) (26)	7(70.0) (10)	3(42.9) (7)
Government/local government	0 (0)	3(50.0) (6)	2(13.3) (15)	1 (1)	0 (5)	0 (6)	30(65.2) (46)	5(45.5) (11)	8(50.0) (16)	19(73.1) (26)	4(40.0) (10)	5(71.4) (7)
Other	0 (0)	2(33.3) (6)	9(60.0) (15)	0 (1)	2(40.0) (5)	2(33.3) (6)	1 (46)	2(18.2) (11)	1(6.3) (16)	0 (26)	1(10.0) (10)	0 (7)

¹⁾ Multiple answers are allowed

*E: Elementary school, M: Middle school, H: High school

governments. But in some schools under the independent conventional and commissary management systems, the school founders paid for the equipment. Under contract management, a significant proportion of the contractors paid for the equipment.

Table 4 shows the evaluation of foodservice facilities and equipment by the school foodservice directors, ac-

Table 4. Evaluation of foodservice facilities and equipment, by food-service system¹⁾

Variables	Elementary school	Middle school	High school
Contract-conventional			
Efficiency	0	3.33 ± 0.52 ²⁾	2.87 ± 0.83
Satisfaction	0	3.17 ± 0.41	2.73 ± 0.96
Lay-out	0	2.83 ± 0.75	2.27 ± 0.80
Contract-delivery			
Efficiency	3.0 ± 0	2.0 ± 1.29	1.90 ± 0.99 ^{a)}
Satisfaction	3.0 ± 0	2.17 ± 1.33 ^{a3)}	2.20 ± 0.79
Lay-out	4.0 ± 0	1.71 ± 0.95 ^{a)}	2.10 ± 0.88
Independent-conventional			
Efficiency	3.23 ± 0.05	3.09 ± 0.83	3.07 ± 1.06 ^{b)}
Satisfaction	3.33 ± 1.01	3.27 ± 1.01	3.00 ± 0.93
Lay-out	3.02 ± 0.88	2.90 ± 0.74 ^{b)}	2.75 ± 1.06
Independent-commissary			
Efficiency	3.23 ± 1.18	3.44 ± 0.88	3.29 ± 0.79 ^{b)}
Satisfaction	3.15 ± 1.16	3.70 ± 1.16 ^{b)}	3.29 ± 0.76
Lay-out	3.41 ± 1.28	3.00 ± 1.00 ^{b)}	2.71 ± 1.38

1) Strongly agree: 5 pts, Agree: 4 pts, Fair: 3 pts, Not agree: 2 pts, Strongly not agree: 1 pts

2) Mean ± S.D.

3) Values with different superscripts (a,b) are significantly different (SNK test, $p < 0.05$)

ording to the types of management. In middle schools facilities and equipment satisfaction shows significant different between contract-delivery and independent-commissary systems ($p < 0.05$).

In independent-conventional management, the elementary schools tended to have higher scores than middle/high schools, and high schools had the lowest score in food service facilities and equipment.

Regarding the layout of the foodservice facilities and equipment, middle schools with a contract system, had a significantly lower score than the middle schools with independent systems ($p < 0.05$). Among the high schools, efficiency of facility and equipment seemed to be lower under a contract system than under an independent system ($p < 0.05$).

Foodservice directors in middle schools reported a higher level of satisfaction with the independent-commissary system than with contract-delivery, regarding efficiency and contents of foodservice facilities and equipment ($p < 0.05$). High schools under independent-commissary management had high scores in efficiency, and a high level of satisfaction in terms of contents and layouts.

3. Sanitation practices

Tables 5, 6, and 7 show the results for the sanitary education and practice of foodservice workers in elementary/middle/high schools. It appears that the submission of employee health screening, annual health screening, and

Table 5. Foodservice sanitary practices in Elementary schools (n = 74)

Variables	CD (n = 1)	IC (n = 46)	ICM (n = 27)
Employee health screening is submitted	100	93.5	92.6
Medical examination for employees scheduled annually	100	100	100
Sanitary education for employees	100	100	100
Sanitary education for parent workers	0	30.4	22.2
Convenient location of hand washing equipment in kitchen area	100	84.8	74.1
Check personal hygiene and uniform	100	100	100
Adequate locker for employees is provided	100	82.6	77.8
Adequate sanitary foot plate is provided	100	97.8	85.2
Separate use and storage of cutting boards and knives	100	100	88.9
Food production is conducted at least 60 cm above the floor	100	84.8	81.5
Separate storage of unwashed and pre-prepared foods	100	87.0	77.8
Separate sinks are used for different food types	0	56.5	40.7
Use refrigerator to thaw meats	0	30.4	22.2
Use meat freezer	0	13.0	37.0
Proper temperatures are maintained for cooked foods (cold foods- $< 10^{\circ}\text{C}$, hot foods- $> 60^{\circ}\text{C}$)	0	32.6	22.2
Provide proper containers (refrigerated or warm) for cooked-food transportation	0	19.6	48.1
Maintain food temperatures for distribution	0	32.6	40.7
Distribution is concluded within two hours of cooking	100	93.5	100
Recording the food temperatures when checking the accuracy of tray	0	71.7	59.3
Keep sample foods	100	100	100
Regular monitoring of temperatures of refrigerator and freezer	100	100	85.2

CC: Contract-conventional, CD: Contract-delivery, IC: Independent-conventional, ICM: Independent-commissary

sanitary education are carried out in more than 90% of all schools regardless of their management types. But sanitary education for parent workers is carried out in only 30.4% and 22.2% of the elementary schools using independent-conventional and independent-commissary ma-

agement, respectively. In middle/high schools, less than 40% of the contract and independent management conducted sanitation education for parents.

Regarding facilities and sanitary equipment, hand-washing equipment was present in most facilities, but contract

Table 6. Foodservice sanitary practices in middle schools (n = 31)

Variables	CC (n = 6)	CD (n = 7)	IC (n = 10)	ICM (n = 8)
Employee health screening is submitted	100	85.7	100	87.5
Medical examination for employees scheduled annually	100	100	100	100
Sanitary education for employees	100	100	100	100
Sanitary education for parent workers	33.3	28.6	30.0	0
Convenient location of hand washing equipment in kitchen area	83.5	85.7	80.0	62.5
Check personal hygiene and uniform	100	100	100	100
Adequate locker for employees is provided	83.3	71.4	80.0	50.0
Adequate sanitary foot plate is provided	66.7	71.4	100	100
Separate use and storage of cutting boards and knives	100	100	90.0	100
Food production is conducted at least 60cm above the floor	100	100	60.6	75.0
Separate storage of unwashed and pre-prepared foods	100	100	80.0	75.0
Separate sinks are used for different food types	66.7	71.4	50.0	62.5
Use refrigerator to thaw meats	66.7	57.1	20.0	25.0
Use meat freezer	50.0	42.9	20.0	0
Proper temperatures are maintained for cooked foods (cold foods- < 10°C, hot foods- > 60°C)	66.7	100	30.0	87.5
Provide proper containers (refrigerated or warm) for cooked-food transportation	50.0	100	10.0	25.0
Maintain food temperatures for distribution	83.3	71.4	30.0	37.5
Distribution is concluded within two hours of cooking	83.3	71.4	100	100
Recording the food temperatures when checking the accuracy of tray	83.5	28.6	80.0	50.0
Keep sample foods	100	100	100	100
Regular monitoring of temperatures of refrigerator and freezer	100	85.7	100	87.5

CC: Contract-conventional, CD: Contract-delivery, IC: Independent-conventional, ICM: Independent-commissary

Table 7. Foodservice sanitary practices in High schools (n = 47)

Variables (N)	CC (15)	CD (9)	IC (16)	ICM (7)
Employee health screening is submitted	86.7	88.9	87.5	71.4
Medical examination for employees scheduled annually	100	100	100	100
Sanitary education for employees	100	88.9	93.8	100
Sanitary education for parent workers	33.3	22.2	12.5	0
Convenient location of hand washing equipment in kitchen area	80.0	88.9	75.0	57.1
Check personal hygiene and uniform	93.3	100	100	100
Adequate locker for employees is provided	86.7	88.9	81.3	57.1
Adequate sanitary foot plate is provided	73.3	88.9	81.3	85.7
Separate use and storage of cutting boards and knives	93.3	100	93.8	100
Food production is conducted at least 60 cm above the floor	86.7	88.9	93.8	71.4
Separate storage of unwashed and pre-prepared foods	100	88.9	87.5	85.7
Separate sinks are used for different food types	86.7	77.8	68.8	28.6
Use refrigerator to thaw meats	93.3	88.9	50.0	57.1
Use meat freezer	46.7	66.7	43.8	28.6
Proper temperatures are maintained for cooked foods (cold foods- < 10°C, hot foods- > 60°C)	60.0	100	56.3	42.9
Provide proper containers (refrigerated or warm) for cooked-food transportation	28.6	77.8	25.0	14.3
Maintain food temperatures for distribution	73.3	88.9	31.3	42.9
Distribution is concluded within two hours of cooking	100	100	100	85.7
Recording the food temperatures when checking the accuracy of tray	80.0	33.3	75.0	57.1
Keep sample foods	100	100	100	85.7
Regular monitoring of temperatures of refrigerator and freezer	100	100	93.8	71.4

CC: Contract-conventional, CD: Contract-delivery, IC: Independent-conventional, ICM: Independent-commissary

managements tended to have more facilities than independent management (more than 80%). One hundred per cent of the schools carried out inspections of employees' personal hygiene and attire. 94.3%, 84.5%, and 82.2% of the elementary, middle, high schools, respectively, provided a sanitary footboard, and these values were lower for contract management compared to independent management.

The separation of knives and chopping boards for different foods was made in more than 90% of the schools. Food preparation conducted at least 60 cm above the floor, and separate storage of pre-prepared foods and raw foods, were satisfactory regardless of management types and schools. Refrigerators were used for thawing meats in 30.4% of the elementary schools using independent-conventional management, 22.2% of the elementary schools using independent-commissary operations, 20% of middle schools under independent-conventional, 25% of middle schools under independent-commissary, 50% of high schools under independent-conventional, and 57.1% of high schools under independent-commissary. On the other hand, meats were thawed in refrigerators in 66.7% of middle schools under contract-conventional and 57.1% of middle schools under contract-delivery; the equivalent values for high schools were 93.3% of contract-conventional and 88.9% of contract-delivery. Overall, contract management was better than independent management at adhering to the sanitary practice of thawing meat in refrigerators. It appears that contract management generally kept to the sanitation rules better than independent management. However, 43% of contract-delivery management in middle schools did not defrost meat in the refrigerator, and this would be a potential cause of food-borne illness.

Storage of cooked foods at proper temperatures was practiced less under independent management, compared to contract management; the results for independent management were as follows: 32.6% and 22.2% of elementary schools under independent-conventional and independent-commissary management; 30.0% and 87.5% of middle schools under independent-conventional and independent-commissary management; 56.3% and 42.9% of high schools under independent-conventional and independent-commissary management. High schools scored higher than middle schools, and middle schools scored higher than elementary schools; this would be attributed to the older children's outspoken temperature preference.

88.9% of the contract-delivery operations provided proper containers for warm and cold foods to assist transportation of cooked food. Maintaining proper temperatures during servings was achieved in 32.6% of elementary schools under independent-conventional management, 40.7% of elementary schools under independent-commissary management, 30% of middle schools under independent-conventional management, 37.5% of middle schools under independent-commissary management, 31.3% of high schools under independent-conventional management, and 42.9% of high schools under independent-commissary management. Compared to independent management, contract management operations put more effort into maintaining the temperature of food at serving; contract management results were: 83.3% of middle schools under contract-conventional, 71.1% of middle schools under contract delivery, 73.3% of high schools under contract-conventional and 88.9% of high schools under contract delivery. It is a common practice for caterers to deliver the food at proper temperatures. Food was served within 2 hours of cooking and 100% of the schools surveyed

Table 8. Sanitary practices for drinking water and HACCP

Variables	N(%)											
	Contact-conventional (21)			Contract-delivery (12)			Independent-conventional (73)			Independent-commissary (43)		
	E* (0)	M* (5)	H* (13)	E (1)	M (7)	H (9)	E (43)	M (10)	H (16)	E (27)	M (8)	H (7)
Sanitary examination of drinking water												
Performed	0	5(100)	13(100)	1	6(86)	6(67)	38(88)	6(60)	12(75)	26(96)	6(75)	6(86)
Not perform	0	0	0	0	1	3(33)	5(12)	4(40)	4	1	2	1(14)
Drinking water												
Self-developed underground water	0	1	0	0	3(43)	1(11)	1(2)	0	3	9(33)	4(50)	1(14)
Cooperated underground water	0	1	0	0	0	1(11)	1(2)	1(10)	0	0	0	0
Tap water	0	4(67)	15(100)	1	4(57)	7(78)	44(96)	9(90)	13(81)	18(67)	4(50)	6(86)
HACCP practice												
Perform	0	5(84)	11(73)	4(57)		6(67)	44(96)	8(80)	14(88)	21(78)	7(88)	6(86)
Not perform	0	1	4	3(43)		3(33)	2(4.7)	1	2(12)	6	1	1

*E: Elementary schools, M: Middle schools, H: High schools

kept sample foods.

Sanitary tests of drinking water (Table 8) were performed in almost all schools (except for 5 elementary, 3 middle, and 3 high schools). Performing sanitary tests of drinking water is an important preventive measure against food-borne illness and bacillary dysentery. The adoption rate of HACCP was low in contract-conventional and contract-delivery systems, and was the highest in the elementary schools under independent-conventional management.

DISCUSSION AND RECOMMENDATIONS

There are two major types of foodservice management in Korea: independent foodservice and contract foodservice management. Independent foodservice is further divided into conventional cooking and commissary cooking, and contract foodservice into conventional cooking and delivery (*dosirack*). The present study investigated the efficiency of the facilities/equipment and of sanitation management in the school foodservices according to their management types and according to type of institution (elementary, middle and high schools). In general, the contract service type resulted in a lower score in equipment and efficiency, compared to the independent type. This is probably due to a less satisfactory work environment for the managers, and lower satisfaction of the children who receive the precooked food. In addition, the general lack of professional dietitians in the schools with contract services could be linked with the lower levels of satisfaction.

There was no significant difference in the facilities and sanitation management between independent and contract management types. Health management and sanitation education of employees were satisfactory, which is similar to the finding by Chun¹⁵⁾ who reported that 73.8% of the foodservice employees in elementary schools had satisfactory training in sanitation. However, many parents who take turns in helping out with the foodservice are not trained in sanitation. Only 30% of the elementary schools, where the parents play a particularly active role in foodservice, gave the parents sanitation education. Thus, it is urgent to train the parents who are involved in foodservice. Other sanitation measures such as individual worker's sanitation, adequate provision of foot plates, separate use of knives and chopping boards, and separate storage of raw and prepared food, were well practiced both in independent and contract management types. But the use of refrigerators in defrosting meats, and of separate refrigerators for meats, was low in independent

management systems, compared to contract management. In addition, 38% of contract deliveries did not meet the sanitary regulations: this delivery of precooked food to schools under improper conditions would increase the danger for food poisoning.

The sanitary testing of the drinking water was done in 86% of the schools surveyed, and it should be emphasized that the regular test of drinking water is imperative in preventing food poisoning and bacillary infection. The adoption of HACCP was low under contract management, while it was at a 96% level in elementary schools under independent-conventional management.

On the basis of the present findings, the following suggestions are made:

First, financial support is needed for improving school foodservice facilities for sanitary and efficient work.

Second, stricter criteria for selection, and a continuous assessment and supervision of contract management, is needed as the satisfaction score tended to be lower in contract management compared to independent management.

Third, professional dietitians who have a good background in nutrition and sanitation should be in charge of foodservice programs at school. At present, many schools do not have professional dietitians in charge of the program. The school food program is an efficient means for providing nutrition education to children who tend to have eating problems and to be overweight. A national body to oversee the school foodservice program needs to be set up; this would be responsible for providing nutrition education program, ensuring efficient management of foodservices, standardization of portion sizes and nutrients in school meals, consultation on management, technical support, evaluation of school foodservice, and resolution of food safety issues.

Four, inspection of sanitation measures and enforcing sanitation education for foodservice employees (as well as for the parent workers) need to be carried out for improvement of sanitation in school foodservices. School foodservices need program support by the professionals who could provide sanitation education programs systematically and develop audiovisual programs for easy and efficient education of the food workers.

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