






A Mixed-Methods Exploration of Implementation of a Healthy School Canteen Program after a Year Intervention

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Abstract

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BACKGROUND: The previous studies have shown that adolescents prefer less healthy food and their eating habits will affect their nutritional status in adulthood and old age. School canteen is a part of food retailing and provisioning that influence the diet quality of the adolescents. Healthy school canteen intervention is recommended as one of the public health strategies in supporting the development of healthy diet behavior.

AIM: The objectives of the study were to evaluate the effects of a healthy school canteen intervention program among middle school children.

METHODS: A mixed-methods research design including focus group interviews for teachers and principal, observation on school canteen, a survey for food handlers, and food testing for hazardous chemicals. Thematic analysis of focus group data and descriptive analyses of survey data were conducted. Four schools were selected as intervention groups and four schools as positive control groups. Data collection phase took place between April 22 and May 2, 2019.

RESULTS: Only one school out of eight schools that had written commitment and a food safety team. In intervention school 50% of food handlers use personal protective equipment and 25% of food handlers received training. In the positive control group, none of the food handlers used personal protective equipment and they had not received any training. Food handlers in the positive control group have a higher rate of correct answers. Only 2 out of 4 schools in the intervention group had nutritious foods available in the canteen and 3 out of 4 schools in the positive control group. None of the school canteens were found positive for metanil yellow. Higher positive findings for Rhodamin B, Formaldehyde, and Borax (33.3%, 60.0%, and 33.3%, respectively) in the control group compared to the control group (28.6%, 27.3%, and 28.6%, respectively).

CONCLUSIONS: Intervention groups have been slightly more successful in creating healthy school canteens, as they had a slightly better total score in the observation sheet compared to the schools from the positive control group. Collaboration with another stakeholder such as Primary Health Center can be thought of as a solution to train food handlers about healthy practice while handling the food.

Introduction

In 2017, there were over 14 million adolescents aged 15–19 years old who were attending school, representing about 5% of the population in Indonesia [1]. Adolescence is a critical period for both physical and cognitive development; proper nutrition during that time is critical to both. The results of improper nutrition in teens can have effects that last for a lifetime. Adolescents in Indonesia suffer from the triple burden of malnutrition: Undernutrition, overweight, and micronutrient deficiencies [2].

Since many of the adolescents are still attending school, it is reasonable to start using a school-based intervention for health and nutrition promotion. The previous studies showed that eating habits in adolescents will affect their nutritional status in adulthood and old age. However, many of them are not aware of the risk and often

still skip meals and eating imbalance food [3]. School is not only a place for studying but also an alternative source for students to buy food since they spend most of their time in school. School canteen is a part of food retailing and provisioning that influence the diet quality of the adolescents. Food retailing and provisioning are not only about what food is available but also about the nutrition, safety, price, convenience, and promotion of food [4].

Regarding the dining room, a number of schools in Indonesia do not have a canteen and many schools have low standard quality canteens. Provision of unhealthy and unsafe food and beverages can encourage the number of morbidities among students, which can influence the decline of academic performance and finally can negatively impact the reputation of the school [5]. Since adolescents make impulsive decision making, nutrition education alone is not enough to change their behavior. Although they have received education about balanced food and healthy food choices, adolescents

do not necessarily do so immediately. They are heavily influenced by the environment. Students' eating behavior most probably impacted merely by the presence of tempting smells or display of unhealthy foods. They often care about taste and convenience besides anything else [6]. Thus, the supply of food in school is particularly crucial for adolescents to contribute to successful health and nutrition promotion.

The supply of healthy food starts from the food sellers and handlers who are health and nutrition conscious. School canteens face challenges on the nutrition and safety of food. Therefore, food sellers and food handlers play a crucial role in reducing the likelihood of contamination of the food that they prepare. In other words, the food handlers should improve their knowledge and practice about personal hygiene and safe food service to minimize food contamination. In addition, the food sellers should have the knowledge about what foods are nutritious, where to get them, and how to prepare the foods to be more nutritious [7].

Schools are regarded as an effective setting to create a generation of well-mannered students. It is also a setting for students to apply their knowledge on nutrition. If students have a habit of consuming healthy food at an early age, it is more likely to carry on to the next stage in life. Thus, school-based nutrition program may contribute in solving in the nutritional problem in the community since students may also act as agents of change at home and community [8].

The success of school-based nutrition intervention relies on the demand from the students because students have the purchasing power in this setting. The previous studies have shown that students preferred less healthy food and they found that it was difficult to make nutritious foods that match students' preferences [9]. Therefore, it is important to raise awareness about nutrition among adolescents for example through nutrition education.

Nutrition Goes to School (NGTS) is one of the flagship programs in Southeast Asia Ministry of Education Organization Regional Center for Food and Nutrition (SEAMEO RECFON) [10]. To implement health and nutrition promotion in adolescents, SEAMEO RECFON had conducted NGTS program from April 2018 to April 2019 in Malang district, East Java. After a year of intervention, SEAMEO RECFON conducted a study to evaluate the school canteen as part of NGTS program which provides the supply of food for the adolescents at school.

the local situation in Malang district regarding healthy school canteen. In depth interviews were conducted to collect the data from school principals. Group interviews with the teachers were also conducted to explore the information in depth. The researchers also observed the school commitment related with healthy canteen, human resources, facilities and utilities, and food quality. In terms of food safety, the researchers performed food testing for hazardous chemicals to assess the safety of food being sold in school. In addition, the quantitative approach was used for a validation study for a food handler questionnaire to quantify their knowledge level about a healthy school canteen. The thematic analysis of the interview data was driven by key concepts previously identified in the observation checklist following the guide for healthy school canteen, that is, (1) commitment and management, (2) building and facilities, (3) human resources, and (4) food quality [10], [11].

Respondents and settings

This study was conducted as a part of an intervention program with a title NGTS to improve health and nutritional status, Physical Endurance, and Cognitive Function on Adolescents in Malang District, East Java by SEAMEO RECFON. The study area was limited to six sub districts in Malang. There were four schools as intervention groups and four schools as control groups. SEAMEO RECFON develops the NGTS framework using the DePPIS approach. As shown in the framework, NGTS program aims to achieve AWESOME (Active, Well-nourished, and Smart Of ME) school children through four approaches and processes [10] Figure 1.

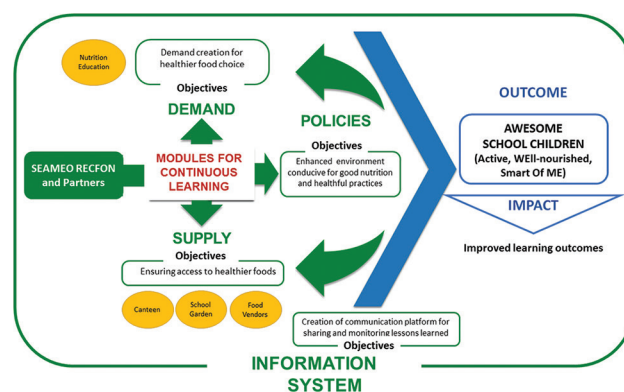


Figure 1: DePPIS Framework [10]

Methods

Study design

This study used a mixed method design. Researchers did a qualitative approach to understand

Demand

Creating the school children's demand for choosing healthier foods by providing training and capacity building to staff from Nutrition Academy, universities, and health workers as our partners to train school teachers and education personnel.

Supply

Securing access to supplies of safer, varied and nutritious foods and water at school (by improving canteen, food vendors, school gardens, and partnering with food companies on fortified foods).

Policy

Ensuring workable school policies for the implementation of good nutritional practices (by convening simultaneous consultative meetings with school decision makers and stakeholders).

Information system

Establishing a functioning information system (by enhancing partnership on communication and monitoring/evaluation that are technology based). SEAMEO RECFON carried out a baseline study in April 2018 and designed an intervention based on the results. Since then, schools in the intervention group had received nutrition education training for teachers, development of a healthy school canteen and school garden in the past year. SEAMEO RECFON also assisted with the information system to monitor progress and advocated for adopting the NGTS Program into the school policy. On the other hand, the schools in the control group received nutrition education training for teachers and school-related booklets from SEAMEO RECFON.

Sample size calculation and sample procedure

Sample size needed to be calculated was for the purpose of pretesting questionnaires on the knowledge of food handlers. Inclusion criteria for food handlers were the person who directly engages in the handling of food in school canteen, literate, available at the collection data time, and sign the informed consent. While the exclusion criteria were the illiterate respondent. We used the recommended default sample size of 30 participants for the pre-test of questionnaires. Although the recommended default is 30 participants, we were unable to get all of them. Instead, we collected 27 sets of responses from eight schools due to the limited human resources at the school canteen. They were all suitable and eligible to participate in the study.

The rest of the study was done using a qualitative method. The schools, including the principals are purposely selected based on the school's participation in the baseline survey of NGTS. Teachers are purposely selected based on the participation of training for teachers held by SEAMEO RECFON and collaboration with SEMEO BIOTROP.

Variable indicator matrix

Variable indicator matrix in this study is shown in Table 1 below.

Table 1: Variable indicator matrix

Variable	Indicator	Method	Reference
Healthy school canteen	Total score of healthy school canteen indicator sheet	Observation	Februhartanty, 2018
Commitment and management	Total score of pillars 1 healthy school canteen indicator sheet Recognition from principal/ teachers	Observation, school principal in-depth interview, teacher group interview	Februhartanty, 2018
Human resource	Total score of pillars 2 healthy school canteen indicator sheet Involvement of teachers and parents	Observation, school principal in-depth interview, teacher group interview	Februhartanty, 2018
Facilities and utilities	Total score of pillars 3 healthy school canteen indicator sheet	Observation, school principal in-depth interview, teacher group interview	Februhartanty, 2018
Quality of food	Total score of pillars 4 healthy school canteen indicator sheet Negative result from chemical food testing	Observation, chemical food testing	Februhartanty, 2018
Food handler knowledge	Total score of food handler knowledge questionnaire	Self-administered questionnaire	Februhartanty, 2018

Operational definition

Operational definition for this study divided into several terms as presented in Table 2.

Table 2: Operational definition

Term	Definition	Reference
Healthy school canteen	A unit of school activity that benefit to health and can provide nutritious, hygienic and safe meals or snack to consumed by students and other school member	Februhartanty, 2018
Commitment and management	Strong authority in the canteen management to ensure the achievement of healthy canteen goals	Februhartanty, 2018
Human resource	A person in the school canteen who prepare, process, and serve the food or drink for consumer	Februhartanty, 2018
Facilities and utilities	Everything that can be used as a tool or can be support the system in achieving purpose and goal of healthy school canteen	Indonesia Dictionary (KBBI)
Quality of food	A multi-faceted phenomenon including intrinsic (product safety and health, sensory properties and shelf life, reliability and convenience) as well as extrinsic factors (production system characteristics, and environmental aspects)	Luning <i>et al.</i> , 2002
Food contaminant	Chemical substance (Rhodamin B, metanil yellow, formaldehyde, and borax) that can cause any corrupted/harm in the food	Australian Institute of Food Safety, 2019
Food handler	A person in the school canteen who directly engages in the handling of food, or who handles surface likely to come into contact with food	Government of Western Australia Department of Health, 2019
Food handler knowledge	Facts, information, and skills acquired by food handler through experience or education or practical understanding	Government of Western Australia Department of Health, 2019
Selling experience	Amount of time (month/year) that a person has spent to sell/cook food in the school canteen	Utami, 2013
Hazardous food	Food that is natural or manmade and is in a form capable of supporting the rapid and progressive growth of infectious and toxin-producing microorganisms	Institute of agriculture The University of Tennessee, 2019

Instrument

Instruments used for data collection including questionnaire, voice recorder, and chemical hazard

tester kit for food samples. There were two types of questionnaires, first questionnaire was to assess demographic data among canteen sellers, including age, sex, education, selling duration in the school canteen (in month or year), and food safety training. Second questionnaire was to observe the healthy school canteen that contained 29 indicators. Voice recorder was used to record the in-depth interviews with school principals and group interviews among teachers.

Chemical hazard tester kit was used to assess the dangerous food additives and preservatives such as Rhodamin B, Methanyl Yellow, Borax, and Formaldehyde found in the food sold at the school canteen. Tester kit including the reagent, mortar, baker glass, Aquadest, test tube, spoon, plastic clip, and food scale.

Data collection procedure

Preparation phase

Preparation phase was conducted within 2 weeks, including instrument reconstruction, equipment preparation, and procurement of the logistics. In-depth interview and group interview list of questions were reconstructed from baseline questionnaire. Researchers added a new questionnaire for food handlers which consist of several statements to assess the knowledge to be pre-tested. The statements in the food handler questionnaire were constructed based on 29 indicators of healthy canteen. Besides, a food safety testing kit and the reagents were also prepared to assess the safety of food being sold at school.

Data collection phase

Data collection phase took place between April 22 and May 2, 2019. Data collection consisted of several different methods. The qualitative portion of the study used group interviews among teachers and in-depth interviews with school principals. Interview to the principal and teachers were done in the same day. Researchers asked all participants to sign an informed consent sheet before the interview began and asked permission to record the interview. The note takers also used 29 indicators of school canteen observation sheet to collect data in terms of healthy school canteen, and analyze it using "present, not present, or irrelevant" responses. In addition, sample of food sold in the canteen of each school was collected based on the suspected food list. Assigned observer stored the food at cooling box to keep it safe until the testing time.

On the other hand, a quantitative study using self-administered food handler questionnaires was used to explore the knowledge of food handlers about healthy school canteens. Note taker asked about the respondent's agreement through the food handler's informed consent before spreading the questionnaire. Completed questionnaires were collected to be analyzed further.

Data analysis phase

Data collected from the interview session (notes and recording file) were collected in one Microsoft Excel 2013 online database. Note taker classified the answers based on 4 pillars of Healthy School Canteen, so at the end of data collection day, researchers can compare answer differences among those eight schools, intervention, and positive control group.

The completed food handler questionnaire was analyzed using biserial analysis in Microsoft Excel 2013 to find out the valid statement to assess the food handler knowledge. Then, comparison between intervention and positive control group was analyzed. To analyze food samples sold in the canteen of each school were tested for hazardous chemicals including Rhodamin B, Methanyl Yellow, Borax, and Formaldehyde, data from observation sheets and food testing were compared.

Ethical consideration

This action research had ethical clearance from ethics committee Faculty of Medicine, Indonesia University with permit number 355/UN2.F1/ETIK/2018 on April 23, 2018, and has been extended until April 22, 2020.

Before the in-depth interviews with school principal, teacher's group interview, and also answering knowledge questionnaire by food handler, all informants and participants signed written-informed consent informing that they could withdraw from the study at any time without sanction, the participation of the study was on a voluntary basis, and they are also informed that all data will be treated confidentially and used only for study purposes.

Results

Characteristics of the informants

There were 27 food handlers involved in this study. Characteristics of the informants are presented in Table 3.

Table 3: Characteristics of the food handlers

Characteristics	Intervention group, n (%)	Positive control group, n (%)
Gender		
Female	13 (93)	11 (85)
Male	1 (7)	2 (15)
Age (years)		
≤43	8 (57)	5 (38)
>43	6 (43)	8 (62)
Education		
Low	7 (50)	7 (54)
High	7 (50)	6 (45)
Selling experience (year)		
<1	1 (7)	1 (8)
>1	13 (93)	12 (92)

Of the 27 informants participating in the study, the total of female food handlers was much more than male for both intervention and positive control groups. In terms of education, the informants are divided into balance distributions for both groups; 50:50 for the intervention group, and 54:45 for the positive control group. Majority, the informants have long experience in selling food in the school canteen, only persons who sell <1 year in each group.

Characteristics of the principals and teachers are presented in Table 4. From 35 informants participated in the study, the total of teachers and principals was higher in the intervention group (n = 21) than the positive control group (n = 14). In terms of the number of school principals, the informants from the positive control group had higher numbers than the intervention group.

Table 4: Characteristics of the principals and teachers

Characteristics	Intervention group, n (%)	Positive control group, n (%)
Gender		
Female	13 (62)	5 (36)
Male	8 (38)	9 (64)
Job position		
Principal	2 (10)	4 (29)
Vice principal	2 (10)	0 (0)
Public relation	0	2 (14)
Sports teacher	1 (4)	0
Biology teacher	3 (14)	1 (7)
Counselor	2 (10)	1 (7)
Others	11 (52)	6 (43)

Pillar 1: Commitment and Management

There are two indicators contributing to good management and commitment in a healthy school canteen. They are the availability of written commitment from the school-to-school canteen and the establishment of a healthy school team.

On the other hand, data collected through the observation shows that 1 school from the intervention group had implemented both indicators of pillar 1 (commitment and management). When the researchers did an in-depth interview with the principal, he stated that the school is going to do canteen management reformation this year. The principal assigned a canteen coordinator who will prepare and manage food to be cooked every day, and the menus will be adjusted to health standards and student preference. Canteen monitoring will be monitored through CCTV.

The other schools in the intervention group did not have a written commitment established by the principal. However, stakeholders such as the teachers had recognized the importance of commitment to establish a healthy school canteen.

“There should be a commitment from us as well to establish a healthy school canteen, especially about providing the snacks. And then, [the school] should pay attention to the human resources, that is the food sellers.” (Teacher X, Intervention School).

On the contrary, the stakeholders in the control group had a different point of view. They were

concerned about the feasibility of the NGTS program in terms of time and financial ability of the school.

“In my opinion, the [possibility of] NGTS program could be implemented, realistically [speaking], is [only] about 40% even with a slow curve, except if the program is directly embedded in the national curriculum. The teaching plan that SEAMEO proposed to be implemented at the school level has a small opportunity because school will always prioritize more important [things]. While the nutrition program, so far, we do not know much. Moreover, if the nutrition program needs funding from school.” (Teacher Y, Control School).

Besides, at least 25% of the schools in the intervention group had a written commitment on food safety and established a school food safety team. On the other hand, none of the schools in the control group had a written commitment for food safety or a team for monitoring food safety at school. The result for Pillar 1 as presented in Table 5 below.

Table 5: Observation of indicators in pillar 1

Number	Indicator	Intervention group (n = 4)			Positive control group (n = 4)		
		Yes, n (%)	No, n (%)	Irrelevant, n (%)	Yes, n (%)	No, n (%)	Irrelevant, n (%)
Pillar 1	Commitment and management						
1	A written commitment from the school to improve food safety in school canteen is established	1 (25)	3 (75)	0	0	4 (100)	0
2	Food safety team to monitor food being sold at the school canteen is established	1 (25)	3 (75)	0	0	4 (100)	0

Pillar 2: Human resources

Food handler practice

From the school canteen observation, in intervention schools 50% of food handlers use personal protective equipment and 25% of food handlers received training on hygiene, sanitation, and food safety from school in 2018. While in the control group, none of the food handlers used personal protective equipment. In fact, they had not received any training on hygiene, sanitation, and food safety. We can see the result for Pillar 2 in Table 6.

Food handler questionnaire

The food handler questionnaire was validated using reliability and validity test. The result for this test was listed in Table 7.

Out of the 25 statements in the food handler questionnaire, 13 statements had r-p.bis >0.381 which were then included to assess the food handlers'

Table 6: Observation of indicators in pillar 2

Number	Indicator	Intervention group (n = 4)			Positive control group (n = 4)		
		Yes, n (%)	No, n (%)	Irrelevant, n (%)	Yes, n (%)	No, n (%)	Irrelevant, n (%)
Pillar 2	Human Resource						
3	Food handlers use PPE, for example, gloves, mask, and hair nets	2 (50)	2 (50)	0	1 (25)	3 (75)	0
4	Food handlers maintain a high degree of personal hygiene (clothes and hands) and health condition (not suffering from influenza infection or cough), do not have open wounds, and do not use too many jewelry	4 (100)	0	0	4 (100)	0	0
5	Food handlers have received training on hygiene, sanitation, and food safety	1 (25)	3 (75)	0	0	4 (100)	0

PPE: Personal protective equipment.

knowledge. We received 14 responses from the schools in the intervention group and 13 responses from the schools in the control group. In Table 7, it is shown that the food handlers in the control group have a higher rate of correct answers in 11 out of the 13 validated statements. In other words, the food handlers from schools in the intervention group had poorer knowledge on healthy school canteens than the food handlers in the control group.

The differences were in the hand washing knowledge as well as room and utensils sanitation. Based on the hand washing knowledge (statement 10), 84.6% respondents in the positive control group had the correct answer, while in the intervention group 64.3% respondents had the correct answer. Similar results also showed in the room and utensil sanitation knowledge (statement 17 and 18), 92.3% respondents in the positive control group had the correct answer, while in the intervention group 64.3% respondents had the correct answer. Another statement related to food packaging knowledge (statement 19) showed that 100% respondents in the positive control group had the correct answer and 85.7% respondents in the intervention group correctly answered the statement.

Pillar 3: Facilities and utilities

Based on the observation result in Table 8, the school canteens in the intervention group were better in terms of ventilation and lighting, food storage facility, and providing running water and soap appropriately for washing utensils in the sink. Besides, at least 1 school from the intervention group had provided enough water and soap by the toilets accessible from the canteen area while other schools had not done so. Another

Table 7: Knowledge of Food Handlers from 13 validated statements (n = 27)

No.	Statements	Correct Answer n (%)		r-p.bis	Sig.
		Intervention Group (n = 14)	Positive Control Group (n = 13)		
<i>Pillar 2: Human Resources</i>					
1.	In my opinion, it is enough to wash aprons once a week	12 (85.7)	12 (92.3)	0.54*	1.000
2.	In my opinion, the open wound on the seller will affect the quality of the food	13 (92.9)	11 (84.6)	0.43*	0.596
3.	In my opinion, a seller who is coughing will not spread the disease through the food he sells	10 (71.4)	9 (69.2)	0.52*	1.000
<i>Pillar 3: Facilities and Utilities</i>					
4.	In my opinion, a cooking area can also be used as a place to serve food for sale	9 (64.3)	11 (84.6)	0.61*	0.385
5.	In my opinion, a well-maintained kitchen is characterized by a non-slip floor	7 (50.0)	12 (92.3)	0.52*	0.033*
6.	In my opinion, washing your hands after defecating and urinating is sufficient with running water	9 (64.3)	11 (84.6)	0.68*	0.385
7.	In my opinion, washing utensils is sufficient by using running water	7 (50.0)	7 (53.8)	0.40*	1.000
8.	In my opinion, bottles of cleaning fluid with illegible labels risk being confused with food ingredients	12 (85.7)	13 (100)	0.43*	0.481
9.	In my opinion, non-label insecticide can be used in the kitchen to prevent insects from getting into the food	9 (64.3)	12 (92.3)	0.84*	0.165
10.	In my opinion, wet cutlery can be used immediately without drying it first	9 (64.3)	12 (92.3)	0.84*	0.165
11.	In my opinion, Styrofoam and plastic crackle are safe containers or packaging for serving and storing hot food	12 (85.7)	13 (100)	0.59*	0.481
12.	In my opinion, food tongs can be used to prevent the spread of bacteria on the hands of consumers and the hands of sellers	13 (92.9)	13 (100)	0.52*	1.000
<i>Pillar 4: Quality of Food</i>					
13.	In my opinion, instant noodles with eggs for breakfast are enough to fulfill my nutrition	11 (78.6)	12 (92.3)	0.57*	0.596
Average Score (%)		73.1	87.6		

*Sig. 2 tailed with alpha=5 %

point from the observation was 2 schools from the intervention group had clean dining areas and enough space while in the control group none of the school canteens had clean dining areas and enough space. However, the school canteen in the intervention group was rather lacking in terms of appropriate floor and wall condition, presence of insects in snack food, and fewer food handlers were using food tongs or gloves to avoid contamination. In some cases, the space of the school is limited. There were only 2 schools from the intervention group that had clean and spacious dining areas while other schools did not have them.

Pillar 4: Quality of food

Researchers assessed the food safety practice in this study by examining food samples for 4 main hazardous chemicals, namely, Rhodamine B, Metanil yellow, Formaldehyde, and Borax. Summary of the result is presented in Table 9.

Table 8: Observation of indicators in Pillar 3

Number	Indicator	Intervention group (n = 4)			Positive control group (n = 4)		
		Yes, n (%)	No, n (%)	Irrelevant, n (%)	Yes, n (%)	No, n (%)	Irrelevant, n (%)
Pillar 3	Facilities and utilities						
6	A permanent school canteen building	3 (75)	1 (25)	0	3 (75)	1 (25)	0
7	Canteen layout is appropriate for its function to prevent contamination	3 (75)	1 (25)	0	3 (75)	1 (25)	0
8	Nonabsorbent, flat, and dry floor surface	3 (75)	1 (25)	0	4 (100)	0	0
9	Smooth, nonabsorbent, and easy-to-clean wall surface	2 (50)	2 (50)	0	3 (75)	1 (25)	0
10	Good ventilation to ensure air circulation for removing steam, gas, odor, and dust in the room	3 (75)	1 (25)	0	1 (25)	3 (75)	0
11	Good lighting to assist during food processing and room cleaning	4 (100)	0	0	1 (25)	3 (75)	0
12	Sufficient clean water supply	4 (100)	0	0	4 (100)	0	0
13	Wastewater flows smoothly; sewage system is a closed system and working well; drain is made of waterproof material	4 (100)	0	0	4 (100)	0	0
14	Toilets available with sufficient clean water and soap	1 (25)	3 (75)	0	0	4 (100)	0
15	Closed trash bins are available and waste is disposed regularly	2 (50)	2 (50)	0	1 (25)	3 (75)	0
16	Hand washing stations are provided with sufficient clean running water and soap	1 (25)	3 (75)	0	2 (50)	2 (50)	0
17	Sinks for washing utensils are provided with sufficient clean running water and soap	4 (100)	0	0	3 (75)	1 (25)	0
18	Cleaning equipment are available (broom, mop, brush, and cleaning material)	2 (50)	2 (50)	0	3 (75)	1 (25)	0
19	Insects at risk of contaminating snack food (e.g., flies, cockroaches, rats, cats, etc.) are absent	1 (25)	3 (75)	0	3 (75)	1 (25)	0
20	There are efforts for keeping foods/drinks away from pests and insects	2 (50)	2 (50)	0	3 (75)	1 (25)	0
21	Clean and spacious kitchen area with a range hood	1 (25)	3 (75)	0	1 (25)	3 (75)	0
22	Clean and spacious dining area	2 (50)	1 (25)	1 (25)	0	4 (100)	0
23	Proper washing, drying, and storage of utensils	3 (75)	1 (25)	0	3 (75)	1 (25)	0
24	Using food grade containers or packaging (not Styrofoam, plastic)	2 (50)	2 (50)	0	2 (50)	2 (50)	0
25	Well-functioning food storage facility (refrigerator, freezer)	4 (100)	0	0	3 (75)	1 (25)	0
26	Using food tong or gloves to avoid contamination	2 (50)	2 (50)	0	3 (75)	1 (25)	0
27	Cooked foods are served in sealed containers	1 (25)	3 (75)	0	1 (25)	3 (75)	0

Based on the results above, it is shown that the schools in the intervention group were worse than the schools in the control group in terms of food safety. None of the school canteens were found positive for metanil yellow in their food samples. However, the schools in the intervention group were found to have higher positive findings for Rhodamin B, Formaldehyde, and Borax; 33.3%, 60.0%, and 33.3%, respectively, compared to 28.6%, 27.3%, and 28.6% in the control group.

On the other hand, based on the NGTS observation sheet, the note taker suspected only 2 out of 4 schools in the intervention group to have hazardous chemicals in the food being sold in the canteen. While in the control group, the note taker suspected 3 out of 4 school canteens to have hazardous chemicals. In terms of nutritional content of the food being sold in the school canteen, the food included commercial packaged food products, home industry pre-packaged snacks, and homemade food cooked at the canteen area. Researchers also assessed the practice of food handlers at the schools in providing nutritious foods containing vitamins, minerals, protein, and fiber. Based on our observation

as seen in Table 10, only 2 out of 4 schools in the intervention group had nutritious foods available in the canteen while there are 3 out of 4 schools in the positive control group who do so.

Other findings

Through interviews with the principals, we found that 2 out of 4 principals in the intervention group were new. While in the positive control group, we had a similar finding that 2 out of 4 principals were new to the position. One of the schools from the positive control group even had separate buildings. Thus, the school can provide only one small canteen out of the two buildings due to limited space.

“Nutrition program related to the canteen is not yet established, because the school has limited space. The number of students that reach approximately 500 people, [the school] has only one canteen with a limited size. So, the school cannot limit the place that students buy snacks from. Therefore, many students buy snacks from food street vendors.” (Principal, Positive Control School).

Table 9: Food testing result

School group	Testing method	Food sample	Total sample, n (%)	Positive finding, n (%)	Positive food sample
Intervention	Rhodamin B	Sausage, red dried noodles, tomato sauce, tempura	6 (100)	2 (33.3)	Sausage, tomato sauce
	Metanil yellow	Macaroni, yellow noodles, yellow dried noodles, yellow mambo ice, ginger acid drink	7 (100)	0	-
	Formaldehyde	Fried chicken, tofu sausage, tempura, crispy tofu, intestine	10 (100)	6 (60.0)	Fried chicken, sausage, tempura, crispy tofu, intestine
	Borax	Sausage, tempura, meatball, yellow noodles, tofu, rice cake	9 (100)	3 (33.3)	Sausage, tempura, meatball
Positive Control	Rhodamin B	Tomato sauce, red macaroni, red dried chips, red dried tofu, red dried meatball	7 (100)	2 (28.6)	Tomato sauce, red dried tofu
	Metanil yellow	Yellow noodles, yellow chips, taro chips	4 (100)	0	-
	Formaldehyde	Tofu, fried chicken, black grass jelly, tempura, intestine, yellow noodles, meatball, fried tofu	11 (100)	3 (27.3)	Tempura, intestine, fried tofu
	Borax	Meatball, yellow noodles, rice cake, fried tofu	7	2 (28.6)	Meatball

Table 10: Observation of indicators in pillar 4

Number	Indicator	Intervention group (n = 4)			Positive control group (n = 4)		
		Yes, n (%)	No, n (%)	Irrelevant, n (%)	Yes, n (%)	No, n (%)	Irrelevant, n (%)
Pillar 4	Quality of food						
28	Hazardous chemical substances, for example, formalin, borax, textile dyes are expected to be absent in foods	2 (50)	2 (50)	0	1 (25)	3 (75)	0
29	Nutrient rich foods available (vitamin, mineral, protein)	2 (50)	2 (50)	0	3 (75)	1 (25)	0

In a different case, there was one school without any homemade food sellers on the day the researchers visited the school because it was a holiday for the school. Therefore, the researchers could not collect the food sample and analyze the homemade food cooked from that school.

Summary of NGTS pillars

From the in-depth interview and group interview, we summarize the finding from both groups as present in Table 11.

Discussion

It appears that, overall, the participating schools in the intervention group have been slightly more successful in creating healthy school canteens, as they had a slightly better total score in the NGTS observation sheet compared to the schools from the positive control group. In addition, the healthy school canteen and present findings are in line to achieve the overall goal of NGTS by improving access to the supply of safer and nutritious food at school. Despite the positive findings, there are contradictions between the commitment and its implementation assessed through food handler knowledge, food handler practices, and quality of food they provided in the canteen.

Pillar 1: Commitment and management

Most schools involved in the study did not have a written commitment and a team for monitoring food safety at school regardless of the fact that they have received the intervention on healthy school canteen or not. Half of the principals being interviewed were new which may have an impact on their commitment to a healthy school canteen. Some of them were not familiar with the NGTS program and admitted to not having arranged any canteen program yet for this year. While, the previous studies have shown that the role of principal is crucial in the establishment of a healthy school canteen. School with good leadership can cope

Table 11: Summary of nutrition goes to school pillars between intervention and positive control group

NGTS Pillar	Indicators	Intervention schools	Positive control school
Pillar 1	Commitment	Strong - "There must also be a commitment from us for a healthy canteen, especially the provision of snacks. Then have to pay attention to human resources, namely food vendors" (Teacher X, intervention school)	Weakness - "In my opinion, the NGTS program has a realistic chance of being implemented by 40%, even then on a slow curve, unless this program is directly part of the national curriculum. There is little chance of the teaching plan that SEAMEO proposes to be implemented at the school level, because schools will always prioritize what is more important. As for the nutrition program, we are not very familiar with it so far. Especially if the nutrition program also requires funds from schools" (Teacher Y, positive control school)
Pillar 2	Canteen management Teacher involvement Parents involvement	Can be managed by school itself Present Not found yet	Separated from school management Present There is a plan - "Socialization to parents has been planned, considering that students bring food supplies from what their parents prepared. So that parents feel they must have a sufficient knowledge base to provide a healthy diet for their children" (Teacher B, positive control school)
Pillar 3	Awareness on facilities and utilities	Good - "There are 29 indicators that must be met, one of which must be the facilities first building, room conditions, walls, floors, and the location of the canteen itself should ideally be separated, so that ventilation is better maintained, without disturbing learning process" (Teacher X, intervention school)	Canteen is not in the top priority due to the space of the school is limited (Two different teachers from positive control group)
Pillar 4	Teachers' willingness	Good-teachers recommend students to buy healthy food while break time, and do a routine nutritional status checking in UKS	Good - "The results of the training are likely to be realized. For the school canteen must follow the provisions or procedures. Those who sell must meet the requirements. The food must be free from preservatives, flavorings, replaced with more nutritious foods" (Teacher R, positive control school)

SEAMO: Southeast Asian Ministers of Education Organization, NGTS: Nutrition goes to school.

with their environment and utilize resources effectively to achieve their goal, which is a healthy canteen [12].

Results from teachers' group interview and in-depth interview with the principal showed us that schools from the intervention group had recognized the importance of commitment in creating a healthy school canteen. Yet, when the researchers do a triangulation method by comparing it with their food handlers' knowledge assessed through a food handler questionnaire, the results showed otherwise. The food handlers from the intervention group received lower scores than the positive control group [13].

Moreover, the schools in the intervention group also received poorer results when the researchers analyzed the quality of food samples from their canteen. Sample testing for Rhodamine B, formaldehyde, and borax revealed that "positive findings" were found in more samples from the schools in the intervention group. Since the schools in this group already had a

high commitment towards healthy school canteen, there is a possibility of other factors that lead to poorer quality of food. The influence from the demand side is considered as one of the possibilities for the condition, since demand can force supply to some extent [13]. However, triangulation with the students as the demand in a school setting was beyond the scope of our study.

Pillar 2: Human resource

Food handlers have important roles in determining the quality of food. A worldwide report showed that the majority of foodborne disease resulted from the improper food handling, such as the use of unhygienic food container and unhygienic practice of food handler [14]. It is almost impossible for any food producer, including a school canteen to guarantee, the food is pathogen free. Thus, those who prepare or handle food at school canteen need to understand and be empowered to improve their food safety skills. Food handler knowledge about food safety and personal hygiene become one of the factors that can improve practice on food safety [15].

Comparison between intervention and positive control group showed that food handlers from the schools in the intervention group had lower knowledge, poorer food handler practice, and also provided poorer quality of food. Poor knowledge among food handlers in the intervention group was relevant with the observation report. It was alarming to find that handwashing and sanitation of cooking and eating utensils were still issues in the school canteens. Besides that, there was more food that contained chemical hazards from the schools in the intervention group. It confirms the importance of knowledge among food handlers in school canteens to keep the quality of food as well as their practice toward food safety. This is consistent with the finding from Tan *et al.* revealed that hygiene knowledge had a positive relationship with self-reported practices of food handlers at primary schools in Malaysia [16].

Although policies were in place (1 school in the intervention group), the food sellers were still reluctant to sell more nutritious food. Many of them had knowledge about the influence of food processing on the nutritional content of food as well as identifying food groups for certain sources of nutrients. However, many of the food handlers still had misconceptions about what a balanced meal looks like, not only from the intervention group but also from the positive control group. In short, many of the food handlers had a relatively good knowledge on nutrition but they still had misjudgments for applying the nutrition knowledge. Hence, once the school principal makes a healthy canteen policy, it is important to spread the information to food handlers, students, teachers, and also parents and all the stakeholders to collaborate in making such rules implemented and sustained [17].

Considering the findings earlier about the human resources involved in the establishment of

a healthy canteen, there was still a gap between the principals, teachers, food sellers, and food handlers in the canteen. After a written commitment to establish a healthy school canteen is in place, it is necessary to assist the food sellers and food handlers to provide safe and nutritious food. In a bigger intervention in Australia, the program provided the school canteen with supplementary tools and resources such as a guideline for planning, pricing, and creating an online product database. Canteen product database was created in the form of a website to give examples of products that comply with healthy canteen policy [18]. It is crucial to create an easier approach for the food sellers to follow the policy and therefore help make the program successful.

Pillar 3: Facilities and utilities

Observations resulting from intervention and positive control comparison indicated that schools from the intervention group had better facilities and utilities to implement healthier school canteens. When the researchers interviewed principal and teachers for triangulation, the barriers faced by the positive control group were noticeable.

Regarding the healthy school canteen observation sheet, the schools had to comply with a spacious area of the canteen. However, none of the school canteens in the positive control group had a clean and spacious dining area. For some positive control schools, this challenge cannot be solved easily. Studies in the past also showed that many schools in the US could not comply with the dietary guidelines for school meals from the Department of Agriculture in terms of kitchen space and equipment. The study concluded the lack of standardized space and equipment in the canteen's kitchen inhibited the school from providing appealing food yet nutritious to the students [19]. Thus, it will be difficult to implement a holistic healthy school canteen program without emphasizing the significance of standardized kitchen space and equipment.

Beside the size of the space for the canteen, the teachers and principals from the positive control group were concerned in terms of funding. The fact that the NGTS program suggested schools use their own funding to sustain the program revealed that the schools were hesitant because nutrition is generally not a priority at school. Thus, it will take a long period of time to collect financial sources to run the program. This is consistent with the findings from Li, 2018 revealed that key barriers in implementing healthy canteen include cost, poor communication between employees and management, individual emphasis on taste over healthfulness, and preference [20].

In addition, the stakeholders, especially teachers, were concerned that the NGTS program will take precious teaching time for them and learning time for the students. Since the teachers perceived time as

a barrier, it implied that they did not see the healthy canteen program to be beneficial for their students' performance in school. Some of the teachers were unable to realize the connection between nutrition and the academic performance of students. Similar with the finding by Holthe *et al.* these barriers related to the time conflict, lack of funding, and inadequate standardized canteen space contributed as significant factors restricting the school ability to successfully implement healthy school canteen as part of NGTS program [21].

Pillar 4: Quality of food

Good quality of food is one factor that can ensure food will not cause harm when people consume it. In this case, the school has to be able to guarantee that the school canteen provides food with good quality to be served to the students.

Researchers' observation using naked eye on the food quality was inaccurate compared to the food testing finding. Items that the researchers did not expect to contain harmful chemical substances, it turned out that they were found "positive." Difference of sensitivity and validity level between naked eye and chemical testing is one of the possible reasons. Chemical testing is required because when additional substances (e.g., formaldehyde and borax) are mixed with the food ingredient, they cannot be assessed visually using naked eye [22]. Furthermore, the difference of observers for each school is also considered as the limitation of the study. There is possible inconsistency in appraising each indicator on quality of food. It would be better to have one person assigned to observe each canteen that we visited. Many studies identify that good quality of food can also be achieved by regular training and education for food handler on microbiological food hazard, personal hygiene, and cross contamination [23].

Strength and limitation of the study

This study was conducted to evaluate the effectiveness of the healthy school canteen portion of the NGTS program. The author realized there were strengths and limitations from this study.

Strength

This study assessed healthy school canteen by using a mix method of quantitative and qualitative approach. Quantitative data on the canteen observational sheet are supported by principal, teacher, and student interview data. Researchers also do triangulation to the information obtained from interviews. Based on these activities, researchers can be sure that the data are valid to depict the real situation of healthy school canteens among eight schools in Malang District, East Java.

Limitation

Aside from the study design and method, there were some limitations on this study. Minimum requirement of the respondent cannot be afforded by the end of the data collection period. Researchers only got 27 food handlers instead of 30 to test the questionnaire validity that makes our confidence about the finding slightly decreased. Moreover, interobserver reliability while doing observation also needs to be considered as a limitation, because we only can set one person to do it for each school due to the limitation of human resource that we have. While, ideally, more observers can help to reduce interobserver bias.

Conclusions

Within a year, the NGTS program had created a positive impact in the healthy canteen of the intervention group compared to the positive control group, particularly in the establishment of written commitment for healthy school canteen and establishment of a team for monitoring food safety at school. Overall, the schools in the intervention group had a higher score based on the healthy canteen indicators from the NGTS program. However, there are still gaps in human resources especially in the food handlers' practice, improper use of facilities and utilities, and low quality of food.

Commitment and management pillar witness an opposite trend between intervention and positive control groups. High commitment indicated in the intervention schools. In addition, food handler practices toward food safety and condition of facilities and utilities still do not meet the standard. In terms of quality of food, there are some findings on hazardous substances in the food served to the children.

Recommendation

Finding of this study revealed that food handlers' knowledge on hygiene and sanitation practice is lacking for both intervention and control groups, since the score for this section is the lowest among others. Collaboration with another stakeholder such as Primary Health Center can be thought of as a solution to train food handlers about healthy practice while handling the food.

More research is necessary to identify barriers and opportunities that apply for the 4 pillars of healthy school canteen; not only the implementation but also monitoring the program. In addition, since the scope of our study was limited to the supply side, it would

be beneficial to expand it to investigate the demand side; that is the students. Exploring the factors influencing student's food choices at school from their own perspective could show a bigger picture of the healthy school canteen portion of NGTS program. Parents involvement in supporting the NGTS program is seen as one of potential approaches to improve the effectiveness of program implementation, since parents are acknowledged as the first and foremost educators for their children. Parents' aspiration and expectation toward their children will help participation of the children at school.

Besides, it might be interesting to investigate the larger community's health and nutritional status as well as their socioeconomic status. For example, it will be advantageous to explore the status at the level of sub districts where the schools are located. Future research studying the impact on the larger community between schools in the intervention group and the control group could equip SEAMEO RECFON with new insights to motivate other schools to enroll in the NGTS program. Not only that, the outcome will provide evidence for the government and possibly private stakeholders to support the schools who enroll in the NGTS program.

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