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Original Research Article

Impact of food hygiene and safety training on knowledge, attitude, and practices of food hygiene and safety practices among food handlers in boarding schools of Embu County, Kenya

Rosaline W. Kaugi*, John G. Kariuki, Alfred O. Odongo, Maureen J. Koech, Harrison C. Njoroge

School of Public Health, Mount Kenya University, Nairobi, Kenya

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***Correspondence:**
Dr. Rosaline W. Kaugi,
E-mail: kauginjiru11@gmail.com

ABSTRACT

Background: The reduction of foodborne illnesses depends on the adoption and evaluation of effective food handling procedures in the food service industry. The purpose of the study was to evaluate the impact of food hygiene and safety training on the knowledge, attitudes, and practices of food handlers in boarding schools in Embu County, Kenya.
Methods: A longitudinal nonequivalent quasi-experimental survey design was utilized. A sample size of 198 study respondents was generated, Magnani formula was used. Multistage sampling was applied to select the study participants. STATA version 17 was employed for data analysis.
Results: The knowledge score changed from 71% at baseline to 90% at the end line compared to the control arm which did not significantly change. Attitude score changed from 71% at baseline to 89% at endline compared to the control arm which did not significantly change (64% to 63%). This corresponds to a DID change of 19 percent increase in the attitudes scores ($p<0.001$). Lastly, practices score changed from 63% at baseline to 93% at endline. This corresponded to a 34 percentage point increase in the practice scores ($p<0.001$).
Conclusions: Overall, Knowledge, attitude and practices were low at baseline than at the endline survey. Statistically, the study revealed that knowledge, attitude, and practices were associated with adherence to food safety and hygiene standards. The Government through the Ministries of health and education should consider training of food handlers on food safety and hygiene for improved knowledge, attitude, and practices.

Keywords: Food handlers, Food safety knowledge, Attitude and practices

INTRODUCTION

Foodborne diseases are an intensifying global public health problem with momentous morbidity and mortality even in regions with already existing modernized food safety systems.[1] Food obliges as a source of various pathogens and an excellent vehicle by which many pathogens can reach a suitable colonization site in a new host.[2] According to the world health organization (WHO), illnesses brought on by eating tainted food impact millions of people each year, especially in impoverished nations.[3] Children and other vulnerable populations, such as pregnant women, the sick, and the elderly, are the main groups affected by these diseases.[4]

According to a report by WHO, In Africa, foodborne diseases are becoming a menace due to poor hygienic food handling methods, the absence of advanced infrastructure, and poor understanding. This has been fueled by weak regulatory systems, inadequate financial resources, inappropriate handling and sanitation practices, and a lack of sufficient food laws.[5] Data obtained in developing nations in Africa revealed, that 70% of diarrhea cases have been associated with foodborne routes which are increasing day by day in Africa.[6] About 75% of foodborne illness outbreaks are associated with insufficient safe food handling practices by concerned food handlers in established food outlets.[7] It has been noted that food handlers have a significant role in ensuring strict observance of food safety principles in the entire process of food production.[8]

Food safety in learning institutions is capital-intensive when it comes to hiring, developing, and retaining.[9,10] The required human resources and also procuring the appropriate food safety equipment. The adequacy and reliability of the institution's financing system are therefore likely to determine its food safety outcomes.[11] It has been known that private institutions obtain their funds from student fees and whereas public institutions obtain their funds primarily from the government. The difference in the source of these funds is likely to influence the outcome of food safety in the concerned institutions.[12]A study conducted in East Africa in the context of Covid-19 revealed, that food handlers and inspectors focused more on covid 19 mitigation and less on food safety compliance. In Kenya, although food handlers were required to get tested for COVID-19, further checks to assess adherence to other food safety requirements were reportedly missing. [11] As a result, unscrupulous people took advantage of the few inadequate personnel available thereby engaging in food safety irregularities which has caused a rise in foodborne illness in the region. [11] Food handlers who operate in cooking facilities in the port must handle food appropriately to avoid food contamination. The purpose of this study was to evaluate the impact of food hygiene and safety training on knowledge, attitude, and practices of food hygiene and safety practices among food handlers in boarding schools of Embu in relation to compliance to food safety and hygiene standards.

METHODS

Study design, location and population

This research employed a longitudinal nonequivalent quasi-experimental survey design study. The research was conducted at Embu County in Kenya among food handlers from December 2022 to May 2023. The research location was in boarding schools both primary and secondary. The study population was food handlers in both boarding primary and Secondary schools in Embu County who met inclusion criteria and would consent to participate in the study.

Sample size determination

The population used was obtained from 27 boarding schools in Embu County (15 primary public, 3 primary private, 8 secondary public, and 1 secondary private). Nonetheless, the samples selected were 196 food handlers working in the various primary and secondary boarding schools of Embu County. For an impact study, the Magnani formula has been suggested to be the best to estimate the sample size. As a result, 198 study respondents were recruited in this study by use of the formula. Since the research was an impact study, the 198 study respondents recruited were divided by 2 for the intervention and control arms of the study, which was 99 for each arm of the study.

Sampling technique

This research used Multistage sampling and purposive sampling techniques, Embu County was purposefully selected since there has been an increased incidence of food-borne illness related to non-compliance to food hygiene and safety practices. For instance, during the years 2017 and 2019, there was foodborne outbreaks which resulted to 3 fatalities and 46 cases.

Data collection tools and procedures

A structured interviewer-administered questionnaire was designed based on different studies conducted globally. The tool was distributed into 4 parts: socio-demographics, knowledge, attitude, and hygiene practices. The statements on KAP were adapted from the WHO's Five Keys to Safer Food guidebook for food handlers. Respondents' knowledge about proper food handling practices was assessed using a set of thirty-three questions on a five-point Likert scale ranging from 0 (lowest) to 4 (highest).

The composite score for each respondent was generated by obtaining the average of the responses from all the questions. The mean score for each indicator was interpreted from 0 (lowest) to 4 (highest) knowledge for that specific indicator. Pertaining attitudes among respondents towards food handling practices was assessed using a set of seven questions on a five-point Likert scale ranging from 0 (lowest) to 4 (highest). The composite score for each respondent was generated by obtaining the average of the responses from all the questions. The mean score for each indicator was interpreted from 0 (lowest) to 4 (highest) knowledge for that specific indicator. The final component of this study was the participant's practices when handling food. Participants were asked to respond yes (coded 1) or no (coded 0) to a series of twelve questions. A composite score was obtained by summing up the responses from all the nine indicators for each respondent. Figure fourteen shows the summary of the changes in the overall knowledge percentage score between the baseline and end line based on the difference in difference analysis.

Table 1: Demographic information.

Parameters	Baseline, N (%)			Endline, N (%)		
	Total	Control	Intervention	Total	Control	Intervention
Sex						
Female	81 (40.9)	57 (57.6)	24 (24.2)	77 (40.1)	54 (56.3)	23 (24.0)
Male	117 (59.1)	42 (42.4)	75 (75.8)	115 (59.9)	42 (43.8)	73 (76.0)
Marital status						
Single	35 (17.7)	15 (15.2)	20 (20.2)	32 (16.7)	14 (14.6)	18 (18.8)
Married	157 (79.3)	78 (78.8)	79 (79.8)	154 (80.2)	76 (79.2)	78 (81.3)
Divorced/widowed/separated	6 (3)	6 (6)	0 (0)	6 (3.1)	6 (6.2)	0 (0)
Education level						
No formal education	3 (1.5)	3 (3)	0 (0)	3 (1.6)	3 (3.1)	0 (0)
Primary	107 (54)	61 (61.6)	46 (46.5)	104 (54.2)	60 (62.5)	44 (45.8)
Secondary	67 (33.8)	28 (28.3)	39 (39.4)	64 (33.3)	26 (27.1)	38 (39.6)
Vocational/tertiary	21 (10.6)	7 (7.1)	14 (14.1)	21 (10.9)	7 (7.3)	14 (14.6)
Ever had a food safety training program	72 (36.4)	33 (33.3)	39 (39.4)	127 (66.1)	31 (32.3)	96 (100.0)
Age (years)						
21-30	31 (15.7)	14 (14.1)	17 (17.2)	30 (15.6)	14 (14.6)	16 (16.7)
31-40	53 (26.8)	27 (27.3)	26 (26.3)	52 (27.1)	27 (28.1)	25 (26)
41-50	73 (36.9)	39 (39.4)	34 (34.3)	70 (36.5)	36 (37.5)	34 (35.4)
51-60	36 (18.2)	15 (15.2)	21 (21.2)	35 (18.2)	15 (15.6)	20 (20.8)
61-70	5 (2.5)	4 (4)	1 (1)	5 (2.6)	4 (4.2)	1 (1)
Work experience (years)						
1-9	117 (59.1)	60 (60.6)	57 (57.6)	114 (59.4)	58 (60.4)	56 (58.3)
10-19	51 (25.8)	27 (27.3)	24 (24.2)	49 (25.5)	26 (27.1)	23 (24)
20-29	23 (11.6)	10 (10.1)	13 (13.1)	23 (12)	10 (10.4)	13 (13.5)
30-39	5 (2.5)	1 (1)	4 (4)	4 (2.1)	1 (1)	3 (3.1)
40+	2 (1)	1 (1)	1 (1)	2 (1)	1 (1)	1 (1)
Monthly income (KES)						
0-10,000	119 (60.1)	80 (80.8)	39 (39.4)	115 (59.9)	78 (81.3)	37 (38.5)
10,000-20,000	73 (36.9)	18 (18.2)	55 (55.6)	72 (37.5)	18 (18.8)	54 (56.3)
20,000+	6 (3)	1 (1)	5 (5.1)	5 (2.6)	0 (0)	5 (5.2)

The participants were asked to voluntarily participate in the study through written informed consent and confidentiality of the study participants was ensured by not indicating any form of identification like the name of the participant. Since the KAP had an impact after training, it was also given to the control group after the research exercise to ensure they also benefited from the intervention.

Statistical analysis

The data collected from food handlers were converted to frequency and percentage. STATA version 17 was used in data analysis. To evaluate the impact of the study, the difference-in-difference (DID) impact evaluation method was used (Fredriksson & Oliveira, 2019). For compliance with knowledge, attitudes and practices, composite scores were computed by summing the responses on each of the variables used to measure that specific item. The percentage score for each individual was computed by dividing the summative score by the total expected score for that item.

RESULTS

Demographic data

As shown in (Table 1) Male participants were the majority at both baseline (overall=59%, intervention= 76%, control=42%) and endline (overall=60%, intervention=76%, control=43%).

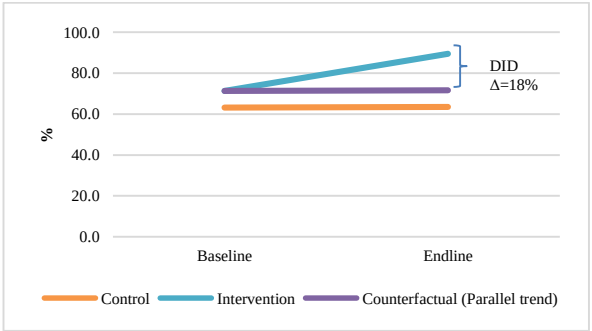

Figure 1: Effect of the intervention on overall knowledge score on food safety measures accounting for the parallel trend assumption of the DID analysis.

Table 2: Participants knowledge of personal hygiene measures.

Parameters	Control (%)		Intervention (%)		DID	
	Base Line (n=99)	Endline (n=96)	Baseline (n=99)	End Line (n=96)	Change	P value
Washing hands before work reduce the risk of contamination	80.0	77.5	85.0	95.0	12.5	0.045
Using gloves when handling food reduces risk of contamination	60.0	55.0	62.5	87.5	30.0	<0.001
Proper cleaning with detergents on utensils reduces the risk of contamination	80.0	75.0	82.5	95.0	17.5	0.009
Eating and drinking at the workplace increases the risk of food contamination	47.5	42.5	65.0	90.0	30.0	<0.001
Food prepared in advance increases the risk of food contamination	47.5	50.0	50.0	80.0	27.5	0.012
Frequent reheating of cooked foods can contribute to food contamination	52.5	50.0	65.0	95.0	32.5	<0.001
Washing utensils with detergent leaves them free of contamination	77.5	72.5	82.5	95.0	17.5	0.014
Children, healthy adults, pregnant women, and older individuals are at risk of food poisoning	62.5	67.5	75.0	92.5	12.5	0.035
Typhoid fever can be transmitted through food	67.5	62.5	82.5	97.5	20.0	0.022
HIV can't be transmitted through food	80.0	75.0	72.5	87.5	20.0	0.008
Bloody diarrhea can be transmitted through food	65.0	65.0	77.5	95.0	17.5	0.023
Cholera is among the foodborne disease	72.5	75.0	80.0	90.0	7.5	0.089
Swollen cans may contain the micro-organisms and germs	60.0	67.5	62.5	87.5	17.5	0.021
microbes are no the skin, nose, and mouth of healthy food handlers	60.0	62.5	75.0	90.0	12.5	0.031
Clean water is not the same as safe/treated water	52.5	50.0	47.5	72.5	27.5	<0.001
Freezing does not kills all the bacteria that may cause foodborne diseases	60.0	62.5	47.5	82.5	32.5	<0.001
Contaminated foods do not always have change in colour, odour, or taste	30.0	32.5	32.5	62.5	27.5	0.001
During infectious disease of the skin, it is necessary to take leave from work	75.0	75.0	87.5	90.0	2.5	0.567
The health status of workers should be evaluated before being employed	77.5	77.5	85.0	87.5	2.5	0.613
Abortion in pregnant women can be induced by foodborne diseases	37.5	40.0	57.5	87.5	27.5	0.001
Well cooked foods are free from contamination	77.5	72.5	87.5	90.0	7.5	0.089
Proper hand hygiene can prevent food borne diseases	77.5	75.0	85.0	90.0	7.5	0.091
Storage of food with detergents in the same room is NOT recommended	65.0	70.0	67.5	82.5	10.0	0.056
Raw and cooked foods should be stored separately to reduce the risk of food contamination	75.0	72.5	77.5	87.5	12.5	0.043
It is necessary to check the temperature of refrigerators/freezers periodically	65.0	65.0	77.5	87.5	10.0	0.061
The health status of workers should be evaluated before employment	77.5	82.5	80.0	90.0	5.0	0.132

Continued.

Parameters	Control (%)		Intervention (%)		DID	
	Base Line (n=99)	Endline (n=96)	Baseline (n=99)	End Line (n=96)	Change	P value
Abortion in pregnant women can be induced by foodborne diseases	37.5	40.0	57.5	87.5	27.5	0.001
Well cooked foods are free from contamination	77.5	72.5	87.5	90.0	7.5	0.089
Proper hand hygiene can prevent food borne diseases	77.5	75.0	85.0	90.0	7.5	0.091
Storage of food with detergents in the same room is NOT recommended	65.0	70.0	67.5	82.5	10.0	0.056
Raw and cooked foods should be stored separately to reduce the risk of food contamination	75.0	72.5	77.5	87.5	12.5	0.043
It is necessary to check the temperature of refrigerators/freezers periodically	65.0	65.0	77.5	87.5	10.0	0.061
The health status of workers should be evaluated before employment	77.5	82.5	80.0	90.0	5.0	0.132
Beards and uncovered hair could contaminate food with germs	65.0	62.5	80.0	97.5	20.0	0.011
Long and painted fingernails could contaminate food	75.0	67.5	82.5	97.5	22.5	0.008
Food handlers can be a source of foodborne diseases	70.0	70.0	80.0	97.5	17.5	0.007
Eggs should not be washed immediately after supply	60.0	60.0	50.0	80.0	30.0	<0.001
Kitchen towels can be a source of food contamination	65.0	62.5	77.5	95.0	20.0	0.008
Knives and cutting boards should be properly cleaned to prevent cross-contamination	77.5	80.0	82.5	95.0	10.0	0.062
Food handlers who have cuts on their hands should not touch foods without gloves	75.0	77.5	82.5	95.0	10.0	0.061

The majority of participants were married (79%) and was evenly distributed between control and intervention arms at both time points. A considerable majority of the participants (54% both baseline and endline) had attained only primary education as their highest level of academic achievement with only a third (33%) having completed secondary education.

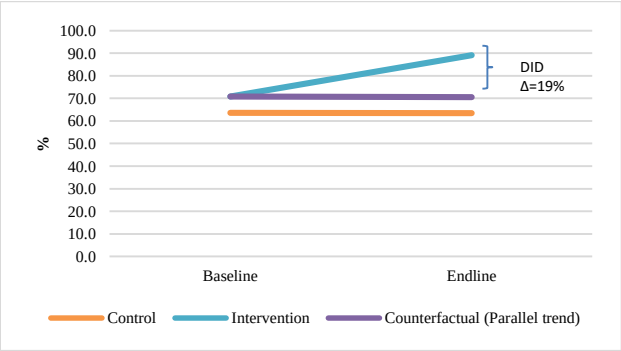

Figure 2: Effect of the intervention on the overall score of attitudes toward food safety practices accounting for the parallel trend assumption of the DID analysis.

A smaller proportion of 1 in every 9 (~11%), possessed tertiary education qualifications.

In terms of age, the majority of participants fell within the 31 to 50-years-old range and a considerably big proportion (59%) had accumulated 1 to 10 years of work experience. Regarding their monthly earnings, the majority of food handlers earned less than KES 20,000 monthly. Overall, on average, the two study arms were evenly balanced in terms of their socio-demographic characteristics.

Knowledge, attitudes, and practices (KAP)

This research aimed at determining the knowledge, attitude, and practices among food handlers in boarding schools of Embu County, Keny on food hygiene and safety practices.

The study sought to gather information about food handlers' knowledge of proper food handling practices, their attitudes toward food safety, and the actual practices they implement to ensure food safety and hygiene.

Knowledge on hygiene measures and proper food handling

The (Figure 1) shows the summary of the changes in the overall knowledge percentage score between baseline and end-line based on the difference in difference analysis. Results showed that in the intervention arm, knowledge score changed from 71% at baseline to 90% at end line compared to the control arm which did not significantly change (remained at 63% between baseline and end line). This corresponds to an 18 percentage points increase in the knowledge of respondents (p<0.001) as presented in (Table 2).

Table 3: Attitudes towards food safety and hygiene practices

Parameters	Control (%)		Intervention (%)		DID	
	BL (n=99)	EL (n=96)	BL (n=99)	EL (n=96)	Change	P value
Food from the fridge can be warmed and returned back to the fridge	50.0	52.5	50.0	85.0	32.5	<0.001
The best way to remove ice from a frozen chicken is in a bowl of cold water	42.5	42.5	57.5	85.0	27.5	<0.001
Wearing masks is an important practice to reduce the risk of food contamination	57.5	60.0	72.5	87.5	12.5	0.012
Wearing gloves is an important practice to reduce the risk of food contamination	50.0	50.0	67.5	87.5	20.0	0.009
Wearing protective clothing is an important practice to reduce the risk of food	70.0	72.5	77.5	92.5	12.5	0.012
Safe food handling is an important part of my job responsibilities	87.5	85.0	85.0	92.5	10.0	0.020
Learning more about food safety through training courses is important to me	87.5	82.5	85.0	92.5	12.5	0.013

As shown in (Table 2) significant changes were observed in twenty-four of the thirty-three indicators measured. Specifically, highest knowledge changes (>20%) were observed in the following indicators: using gloves when handling food reduced risk of contamination (Control: 60% to 55%, Intervention: 63% to 88%, DID change=30%, p<0.001); eating and drinking at the workplace increased the risk of food contamination (Control: 48% to 43%.

Intervention: 65% to 90%, DID change=30%, p<0.001); freezing does not always kill all the bacteria that may cause foodborne diseases (Control: 60% to 63%, Intervention: 48% to 83%, DID change=33%, p<0.001); eggs should not be washed immediately after supply (Control: 60% to 60%.

Intervention: 78% to 95%, DID change=30%, p<0.001); abortion in pregnant women can be induced by foodborne diseases (Control: 38% to 40%, Intervention: 58% to 88%, DID change=28%, p=0.001); contaminated foods do not always have some change in colour, odour, or taste (Control: 30% to 33%, Intervention: 33% to 63%, DID change=28%, p=0.001); and clean water is not always the same as safe/treated water (Control: 53% to 50%, Intervention: 48% to 73%, DID change=28%, p<0.001). Others included knowledge that typhoid fever can be transmitted through food (Control: 68% to 63%, Intervention: 83% to 98%, DID change=20%, p=0.022); and HIV can't be transmitted through food (Control: 80% to 75%, Intervention: 73% to 88%, DID change=20%, p=0.008) (Table 2).

Attitudes towards food safety and hygiene practices

The (Figure 2) below shows the summary of the changes in the overall attitude percentage score between baseline and end-line based on the difference in difference analysis. Results show that in the intervention arm, attitudes score changed from 71% at baseline to 89% at end-line compared to the control arm which did not significantly change (64% to 63%). This corresponded to a 19 percentage points increase in the attitudes scores (p<0.001) as given in (Table 3).

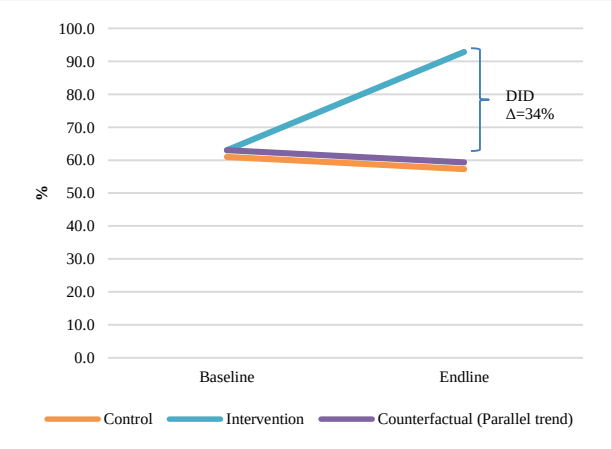

Figure 3: Effect of the intervention on the overall score of practices of handling food accounting for the parallel trend assumption of the DID analysis.

Table 3 presents the findings from each of the questions. Attitude was measured using a set of thirteen questions. Significant changes were observed in all the variables used to measure attitudes.

Table 4: Practices towards food safety and hygiene practices.

Parameters	Control (%)		Intervention (%)		DID	
	BL (n=99)	EL (n=96)	BL (n=99)	EL (n=96)	Change	P value
Does the food handler use (different) utensil to prepare raw and cooked food products or to cut raw vegetable and fresh meat and poultry	40.0	30.0	40.0	90.0	60.0	<0.001
Does the food handler (DO NOT) have unhygienic behaviour like blowing their nose or coughing and continuing to prepare food cooking in unclean premises, wiping hands with apron	10.0	20.0	10.0	90.0	70.0	<0.001
Does the food handler wash their hands in clean water each time before handling, preparing and serving food?	80.0	80.0	90.0	100.0	10.0	<0.001
Does the food handler handle food hygienically	80.0	70.0	90.0	100.0	20.0	<0.001
Does the food handler use gloves during the distribution of unpackaged foods?	10.0	10.0	10.0	80.0	70.0	<0.001
Does the food handler wear a mask when you distribute uncovered food?	20.0	30.0	10.0	80.0	60.0	<0.001
Does the food handler (DOES NOT) eat or drink in the kitchen?	50.0	50.0	60.0	80.0	20.0	<0.001
Does the food (NOT) handler prepare a meal in advance (i.e., from one shift to another)?	60.0	70.0	60.0	90.0	20.0	<0.001
Does the food handler properly clean the food storage area before storing new products?	100.0	90.0	100.0	100.0	10.0	0.013
Does the food handler use soap/detergent when washing utensils (plates, mugs, and spoons)	100.0	90.0	100.0	100.0	10.0	0.017
Does the food handler check the expiry date of foods at the time of delivery?	90.0	90.0	90.0	100.0	10.0	0.023

Specifically, the highest attitude changes (>20%) were observed in the following indicators: food from the fridge can be warmed and returned back to the fridge (Control: 50% to 53%, Intervention: 50% to 85%, DID change=33%, p<0.001); the best way to remove ice from a frozen chicken is in a bowl of cold water (Control: 43% to 43%, Intervention: 73% to 88%, DID change=28%, p<0.001) and wearing gloves is an important practice to reduce the risk of food contamination (Control: 50% to 50%, Intervention: 68% to 88%, DID change=20%, p=0.009). As given in the same table, other observed changes included attitudes towards wearing masks as an important practice to reduce the risk of food contamination (Control: 58% to 60%, Intervention: 73% to 88%, DID change=13%, p=0.012), wearing protective clothing is an important practice to reduce the risk of food (Control: 70% to 73%, Intervention: 78% to 93%, DID change=13%, p=0.012), learning more about food safety through training courses being important to the food handler (Control: 88% to 83%, Intervention: 85% to 93%, DID change=13%, p=0.013) and safe food handling is an important part of the food handlers job responsibilities (Control: 88% to 85%, Intervention: 85% to 93%, DID change=10%, p=0.020.

Practices towards food safety and hygiene practices

As highlighted in (Figure 3) below, the results of this research showed that in the intervention arm, the practices score changed from 63% at baseline to 93% at the end line compared to the control arm which changed (61% to 57%). This corresponds to a 34 percentage points increase in the practice scores (p<0.001) as provided in (Table 4).

DISCUSSION

This study's primary objective was to determine knowledge, attitude, and practices of food hygiene and safety practices among food handlers in boarding schools of Embu County, Kenya. In this study, understanding of food safety and hygiene practices among food handlers considerably increased in the intervention arm compared to the control group. These results concur with various studies done on knowledge which entails to the ability to acquire, retain and utilize information hence education and training are prerequisites of knowledge. According to a study conducted in Ghana, it revealed that the level of knowledge on food hygiene and safety practices was satisfactory after intervention treatment.[13] The results of another previously done study on food handlers in

boarding schools showed that participants' pre-intervention understanding of food safety and cleanliness was low, but that knowledge later improved in both the intervention and control groups to 98.5% and 100%, respectively. At baseline, both intervention and control groups had poor knowledge of transmission and prevention of foodborne illnesses with only 46.2% of the respondents had knowledge on proper hand washing before cooking at pre-intervention while about 40.9% had knowledge of keeping short and clean nails .[14]

In agreement with this recent study, another study conducted in Malaysia among food handlers in boarding schools discovered that 50% of food handlers lacked knowledge of the proper steps involved in hand washing[15]. Additionally, respondents reported preparing food three hours before serving time without keeping the food warm in baths and uncovered so as to allow the food pathogens to multiply. Furthermore, in relation to equipment hygiene, where a lack of information was noted, the findings of this recent study concur with those of. [15] Findings from the study done by[16] reported insufficient knowledge on proper handwashing with soap resulted in food contamination which is the case in this recent research. This research findings disagree with the findings of a study conducted in North Dayi District, Ghana, which revealed good knowledge of food safety among food handlers at baseline research.[17] This research also aimed at evaluating food handlers' attitudes following educational training. Our study results concur with the results of a study on food safety and sanitation among food handlers in Kenya's high school kitchen which reported that 63% of the respondents agreed that a food handler could prepare food even with an injury provided that the wound is covered properly. This study also reported a low percentage (35%) of respondents who felt the need to wear protective attire while preparing and serving food. Further, Concerning food contamination, 36% of them agreed that ready-to-eat food could be prepared on the same cutting board as raw meat. [18]

According to a study by, [19] contaminated food always has a bad odor and a spoiled taste indicating that most food handlers do not perceive the risks that come with contaminated food.[16] Study also revealed the adoption of positive attitudes towards ensuring food safety. These results were similar to this current research end-line results in the intervention arm. Regarding the last objective on this research on practices, Similar to the results of this research for baseline data, Poor practices on food hygiene and safety were reported among food handlers by.[20] According to,[14] handwashing is a key practice in preventing cross-contamination, when the practice of washing hands with soap and water after nose-blowing, handling waste, and visiting the toilet was assessed, no respondents reported always washing hands with soap and water. The study also found the poor practice of jewelry removal when handling food and low levels of reporting illnesses to authority among most respondents. Afrizal's study findings were in the same line with the current research results following the intervention. Some of the projected study limitations were; Attrition bias because the study was longitudinal, it was minimized by recruiting additional respondents (10% of the total sample size), Selection bias because there was no randomization to either intervention or control group that would make it difficult to conclude the causal association between intervention and the outcome. The bias was minimized by collecting baseline and end line measurements. Lastly, detection bias could occur between the intervention and control group, it was minimized by masking the assessors.

CONCLUSION

Results show that in the intervention arm, knowledge score changed from 71% at baseline to 90% at end line compared to the control arm which did not significantly change (remained at 63% between baseline and end line). Results show that in the intervention arm, the attitudes score changed from 71% at baseline to 89% at the end line compared to the control arm which did not significantly change (64% to 63%). Results show that in the intervention arm, the practice score changed from 63% at baseline to 93% at the end line compared to the control arm which changed (61% to 57%). Statistically, the study revealed that knowledge, attitude, and practices were associated with adherence to food safety and hygiene standards.

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