
Strengthening Food Quality Using Nurse-Led Training Among Handlers and Pupils in Schools

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ABSTRACT: *The study examined the effectiveness of nurse-led training on food quality among primary school pupils and food handlers in Ogun State. The study adopted a quasi-experimental design incorporating pre-test and post-test non-randomised control group. Using multistage sampling procedure to select 500 pupils and food handlers, the researcher embarked on random assignment of the Schools to each of the treatment groups. Food Quality Questionnaire (FQQ) was constructed and validated by the researcher to gather relevant data on food quality. A treatment package whose contents were developed validated using the Delphi approach, was prepared by the researcher to serve as a guide for research assistants administering the treatment. Descriptive statistics was used to answer research questions while the hypotheses, were analysed using Analysis of Covariance (ANCOVA). Significant difference was observed among the pre- and post-test mean score differences of pupils and handlers in different treatment and certification groups as well as in different types of schools on food quality ($F_{3, 483} = 73.090$; $p < .000$). It was recommended among others that the Federal and State Ministries of Education should adopt behaviour-ingrained professional methodologies/treatments to prosecute and enhance food quality in schools, especially at the primary level, rather than the passive routine food/school inspection arrangements presently prevalent in schools.*

KEYWORDS: food quality, nurse-led training, handlers, pupils

INTRODUCTION

According to WHO (2019), 'each year worldwide, unsafe food causes 600 million cases of foodborne diseases and 420 000 deaths' with 30% of these deaths being among children under 5 years of age. Africa has highest morbidity and mortality due to foodborne diseases with more than 91 million people related illnesses and 137 000 deaths each year while diarrhoeal diseases are responsible for 70% of food-borne diseases in the region. WHO (2022) estimated that, over 200,000 deaths occur annually in Nigeria as a result of foodborne pathogens. Sodimu and Asonye (2021) reported the scenario of food-borne illnesses in Abeokuta South, Ogun State where environmental health officers lamented the unabated upsurge of cases.

One problem which stems from this situation is that children who have limited chance of determining their food options stand the risk of consuming foods whose quality are compromised. In primary schools, learners who do not bring their foods from home are sometimes, at the mercy of food vendors (Ogum-Alangea et al., 2021), and in a situation when such handlers of food are not taught, quality of what is offered and taken cannot be guaranteed (Okojie & Isah, 2014).

From the consumers' point of view, food quality entails all the characteristics of a food substance like colour, texture, taste, known constituents, preparatory methods, environment, packaging, taste and sometimes, cost that all combine to make potential consumers willing to pay for and consume the food item in question (Petrescu et al., 2020). Although in strict technical terms, food safety is a subset of food quality, that is, food can only be of quality after passing the safety criteria (Savov & Kouzmanov, 2009) but to the producer, food quality is predominantly determined by consumers' preferences or perception of what quality should entail, and next by conformity to food law, standards or other rules (Lásztity, 2009). It is observed that the prevalence of consumers' preferences and perception in the determination of food quality cannot adequately guarantee food safety in real terms.

The study carried out by Raji et al., (2021) reported that the qualification of food handlers is grossly low and inadequate for them to be proficient, knowledgeable and compliant to food quality standards, and this might be the reason for the high spate of food borne diseases in Nigeria. The researchers thus recommended training options for unqualified handlers of food. Leslie et al., (2021) observed a similar trend in public primary schools in Ikenne, Ogun State, where it was documented that the possession of food handling knowledge in relation to food safety did not amount to improved practices.

It is in this view that this present study seeks to conduct and test the effectiveness of nurse-led training on food quality among primary school pupils and food handlers. The study specifically:

1. assessed the pre- and post-test mean score differences of pupils and handlers in different treatment groups on food quality;
2. assessed the pre- and post-test mean score differences of pupils and handlers in private and public schools on food quality; and
3. assessed the pre- and post-test mean score differences of pupils and handlers in certified and uncertified handlers' groups on food quality;

Research Questions

1. What are the pre- and post-test mean score differences of pupils and handlers in different treatment groups on food quality?
2. What are the pre- and post-test mean score differences of pupils and handlers in private and public schools on food quality?
3. What are the pre- and post-test mean score differences of pupils and handlers in certified and uncertified handlers' groups on food quality?

Research Hypotheses

H₀1: There is no significant difference among the pre- and post-test mean score differences of pupils and handlers in different treatment groups on food quality.

H₀2: There is no significant difference between the pre- and post-test mean score differences of pupils and handlers in private and public schools on food quality;

H₀3: There is no significant difference between the pre- and post-test mean score differences of pupils and handlers in certified and uncertified handlers' groups on food quality;

RESEARCH METHODS

The pre-test and post-test non-randomized control group were included in this study's quasi experimental design. All Primary 5 pupils and food handlers in all public and government-approved private primary schools in Ogun State, Nigeria, are included in this study. This is because Primary 5 pupils have already spent a significant amount of time in the primary school, allowing researchers to easily examine the subjects' educated evaluations of food as a crucial pre variable of the study. The fact that these pupils still have one more year to go gives the researcher plenty of time to follow up if necessary.

Except for those whose pupils had not yet reached Primary 5, all public and government-approved primary schools in Ogun State participated in the survey. To take part in the study, a school must be both government-approved and in possession of at least one food vendor/handler. The study's sample was chosen using a Multistage sampling procedure. To begin, each of Ogun State's four blocs—Remo, Ijebu, Yewa, and Egba—was treated as a cluster using the cluster sampling technique. The second stage involved dividing each of the four clusters from Stage 1 into public and government-approved private schools using a stratified random sampling technique, resulting

in each cluster having two strata. In total, there will be 8 strata, with 4 housing public elementary schools and the other 4 housing private institutions sanctioned by the government. The final step required selecting 2 schools from each of the eight strata that had been created using a random sampling technique. Eight private and eight public schools are implied by this. The next step was the random assignment of the Schools in each cluster to each of the 4 treatment groups, allowing only the intact class with Primary 5 pupils and food handlers in each school to participate in the study.

Food Quality Questionnaire (FQQ) was developed by the researcher. It is a Likert-type questionnaire purposefully designed to gather continuous data on the salient constructs of food quality. It consists of sections A and B. Section A is on personal information about pupils and food handlers in with respect to age, school type, gender and whether they are pupil or food handler in the school. Section B consists of 20 items on food quality. Proper application of Lawshe's formula was done in this study by giving the instrument to five experts in the field to rate the appropriateness of each of the items in the instrument, after which Lawshe's formula was used in each case to determine the Content Validity Index (CVI) of the instrument.

To determine the reliability of the instruments, a pilot study conducted using 30 subjects similar to, but not present in the real samples that will be engaged later in the study. Using SPSS version 23, the Cronbach Alpha values was computed for FQQ and figure obtained was 0.888 which showed that the instrument was sufficiently reliable.

At the first week of the research, the research instrument, FQQ was administered on participating handlers and pupils to obtain the pre-test measure while at the eight week into the research, the same instrument was readministered to take post-test measures. Nurses, Health and allied Officers were trained by the researcher and they will serve as Research Assistants for administering the treatment packages, and for collecting relevant data. Descriptive statistics like mean and standard deviation were used to answer research questions while all the hypotheses, were analysed using Analysis of Covariance (ANCOVA).

Research Question 1: What are the pre- and post-test mean score differences of pupils and handlers in different treatment groups on food quality?

Table 1: Descriptive Statistics of the Pre- and Post-Test Mean Scores on Food Quality of Participants in the Treatment and the Control Groups

Treatment	N		Post-Test	Pre-Test	Difference
Nurse-Led Training	95	Mean	63.9789	44	19.9789
		Std. Deviation	5.6756	10.2064	
Safety Compliance Monitoring	153	Mean	56.9216	48.4575	8.4641
		Std. Deviation	11.4963	14.1379	
Nurse-Led Training & Safety Compliance Monitoring	126	Mean	67.1429	42.4365	24.7063
		Std. Deviation	7.9203	14.8962	
Control	126	Mean	45.6587	50.1032	-4.4444
		Std. Deviation	10.4101	5.8663	
Total	500	Mean	58	46.508	11.492
		Std. Deviation	12.4866	12.4309	

Table 1 above showed that, the posttest-pretest mean difference in participants' scores on food quality was 11.492 while the order was 24.7063, 19.9789, 8.4641 and -4.4444 for participants in the nurse-led & safety compliance monitoring, nurse-led, safety compliance monitoring and control groups respectively. This implied that, except for the control group, participants' mean scores on food quality improved after receiving treatment. The order of improvement was nurse-led & safety compliance monitoring (24.7063), nurse-led (19.9789) and safety compliance monitoring (8.4641).

Research Question 2: What are the pre- and post-test mean score differences of pupils and handlers in private and public schools on food quality?

Table 2: Descriptive Statistics of the Pre- and Post-Test Mean Scores on Food Quality of Participants in Public and Private Schools

School Type	N		Post-Test	Pre-Test	Difference
Public	252	Mean	56.5238	47.1627	9.3611
		Std. Deviation	12.9358	13.7708	
Private	248	Mean	59.5	45.8427	13.6573
		Std. Deviation	11.8516	10.8901	
Total	500	Mean	58	46.508	11.492
		Std. Deviation	12.4866	12.4309	

Results in Table 2 revealed that, the overall difference between the post test and pretest mean scores of participants on food quality was 11.492. However, the mean difference recorded by participants in private schools (13.6573) was higher than the mean difference of public school participants (9.3611). This showed that, the mean food quality posttest scores outweigh mean food quality pretest scores in both private and public schools with private schools having higher mean difference than public schools.

Research Question 3: What are the pre- and post-test mean score differences of pupils and handlers in certified and uncertified handlers' groups on food quality?

Table 3: Descriptive Statistics of the Post-Test Mean Scores on Food Quality of Participants in Certified and Uncertified Handlers' Groups

Certification	N		Post Test	Pre Test	Difference
Uncertified	210	Mean	50.4429	51.4	-0.9571
		Std. Deviation	10.9562	12.0681	
Certified	290	Mean	63.4724	42.9655	20.5069
		Std. Deviation	10.5286	11.4677	
Total	500	Mean	58	46.508	11.492
		Std. Deviation	12.4866	12.4309	

Table 3 above showed that, the mean difference, the overall mean difference between the scores of participants on food quality was 11.492. The mean difference between posttest and pretest mean scores on food quality for participants in the certified group was 20.5069 while it was negative for participants in the uncertified handlers' group (-0.9571). This revealed that, the mean food quality posttest score outweighed the mean food quality pretest score for participants in the certified handlers' group while the reverse was the case for uncertified handlers' group

Test of Hypotheses

H₀₁: There is no significant difference among the pre- and post-test mean score differences of pupils and handlers in different treatment groups on food quality

Table 4: N-way Analysis of Covariance for Observed Difference between the Pretest-Posttest-Mean Scores on Food Quality for Participants in Different Treatment Groups, School Types and Certification Profile

Source	Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power ^b
Corrected Model	63817.264 ^a	16	3988.579	137.756	.000	.820	2204.099	1.000
Intercept	1713.568	1	1713.568	59.183	.000	.109	59.183	1.000
Food Quality Pretest	3477.044	1	3477.044	120.089	.000	.199	120.089	1.000
Treatment	14126.308	3	4708.769	162.630	.000	.503	487.890	1.000
Handlers' Certification	4784.835	1	4784.835	165.257	.000	.255	165.257	1.000
Type of School	1488.921	1	1488.921	51.424	.000	.096	51.424	1.000
Treatment * Handlers' Certification	2781.345	3	927.115	32.020	.000	.166	96.061	1.000
Treatment * Type of School	4744.954	3	1581.651	54.627	.000	.253	163.880	1.000
Handlers' Certification * Type of School	491.982	1	491.982	16.992	.000	.034	16.992	.984
Treatment * Handlers' Certification * Type of School	6348.721	3	2116.240	73.090	.000	.312	219.270	1.000
Error	13984.736	483	28.954					
Total	1759802.000	500						
Corrected Total	77802.000	499						

Table 4 showed that, the calculated F-value of 162.630 was due to the difference among the treatment groups. This value is statistically significant since it is greater than the critical value of 2.6234 given at 3 and 483 degrees of freedom, and at 0.05 level of significance. Therefore, hypothesis two which stated that, 'There is no significant difference among the pre- and post-test mean score differences of pupils and handlers in different treatment groups on food quality was rejected. Based on this which corroborated the calculated p-value in Table 18 being less than .05, it was concluded that, 'There is significant difference among the pre- and post-test mean score differences of pupils and handlers in different treatment groups on food quality ($F_{3, 483}=162.630$; $p < .05$)'. To determine which of the treatment groups were significantly different from other(s) after adjusting for the pretest scores, Pairwise Comparison was carried out as shown in Tables 5 and 6 below:

Table 5: Estimates of Posttest Food Quality Means in Treatment and Control Groups after Adjusting for Covariate

Treatment	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Nurse-Led Training	66.031 ^a	.841	64.379	67.683
Safety Compliance Monitoring	52.997 ^a	.610	51.798	54.196
Nurse-Led Training and Safety Compliance Monitoring	52.280 ^a	1.043	50.232	54.329
Control	42.421 ^a	.675	41.094	43.748

Table 6: Pairwise Comparisons for the Difference between Posttest Food Quality Means of Participants in Different Treatment and Control Groups after Adjusting for Covariate

(i) Treatment	(j) Treatment	mean difference (i-j)	std. error	sig. ^b	95% confidence interval for difference ^b	
					lower bound	upper bound
Nurse-Led Training	Safety Compliance Monitoring	13.034*	1.062	.000	10.948	15.120
	Nurse-Led Training and Safety Compliance Monitoring	13.751*	1.390	.000	11.021	16.482
	Control	23.610*	1.097	.000	21.455	25.765
Safety Compliance Monitoring	Nurse-Led Training	-13.034*	1.062	.000	-15.120	-10.948
	Nurse-Led Training and Safety Compliance Monitoring	.717	1.038	.490	-1.322	2.756
	Control	10.576*	.848	.000	8.910	12.241
Nurse-Led Training and Safety Compliance Monitoring	Nurse-Led Training	-13.751*	1.390	.000	-16.482	-11.021
	Safety Compliance Monitoring	-.717	1.038	.490	-2.756	1.322
	Control	9.859*	1.108	.000	7.681	12.037
Control	Nurse-Led Training	-23.610*	1.097	.000	-25.765	-21.455
	Safety Compliance Monitoring	-10.576*	.848	.000	-12.241	-8.910
	Nurse-Led Training and Safety Compliance Monitoring	-9.859*	1.108	.000	-12.037	-7.681

Table 5 above showed that, the estimated posttest food quality mean for the nurse-led training group is the highest in the group, higher than the food quality mean for each of safety compliance monitoring and combined nurse-led training & safety compliance monitoring and quite higher than what obtains in the control group. However, the pairwise comparison in Table 6 revealed that, the posttest food quality mean in the control group is significantly lower than the one in any of the treatment groups while the posttest food quality for participants in the nurse-led training group mean is significantly different from the food quality means for participants in safety compliance

and combined nurse-led & safety compliance groups that are not significantly different from each other but significantly different from the food quality posttest mean in the control group. This implied that, each of the treatments (nurse-led training, safety compliance monitoring and combined nurse-led training & safety compliance monitoring significantly increased food quality while this was not the case in the control group.

H₀2: There is no significant difference between the pre- and post-test mean score differences of pupils and handlers in private and public schools on food quality.

To determine whether this observed difference was of statistical significance, ANCOVA was carried out as shown in Table 5 above affirming that, there is significant difference between the pre- and post-test mean score differences of pupils and handlers in private and public schools on food quality ($F_{1, 483}=51.424$; $p<.05$).

H₀3: There is no significant difference between the pre- and post-test mean score differences of pupils and handlers in certified and uncertified handlers' groups on food quality ANCOVA was carried out as shown in Table 4 above to determine the significance of the observed difference. According to Table 18, there is significant difference between the pre- and post-test mean score differences of participants on food safety in uncertified and certified handlers group ($F_{1, 483}=165.257$; $p<.05$).

DISCUSSION OF FINDINGS

Analysis of research question one which showed that, except for the control group, participants' mean scores on food quality improved after receiving treatment is in support of already documented research evidences by Grenier and Wynn (2018) that through the application of their experience in nutrition, a group of nurses in Chicago, set what can be called a world model public nutrition and health template by designing an intervention which did not only fight food insecurity but which is impressively instrumental to improving the quality and safety of food delivered to the public. Thus, by dwelling on a similar model of using nurses to train and monitor handlers and pupils in the real content, method, practice, belief and general culture of food and feeding, it was unsurprising to document a change in the positive/right measure of food quality.

The analysis of research question two which revealed that, the mean food quality posttest scores outweigh mean food quality pretest scores in both private and public schools with private schools having higher mean difference than public schools is also explainable in tandem with previous research positions. Laska et al. (2019) revealed that treatments such as the ones adopted in this study, bring tremendous improvement to food quality, especially with respect to staple foods. These authors emphasized that, when such treatment is backed by commensurate legislation, total

food quality is not far from being achieved, and it is of course not out of place that, training and monitoring appear to make the needed change in this wise.

A finding similar to the one above is that emanating from research question three which has found the mean food quality posttest score outweighing the mean food quality pretest score for participants in the certified handlers' group while the reverse was the case for uncertified handlers' group. This inference can be likened to that from the previous work by Raji et al. (2021) where it was reported that the qualification of food handlers is grossly low and inadequate for them to be proficient, knowledgeable and compliant to food quality standards. As this might be the reason for the high spate of food borne diseases in Nigeria, the current report has provided a further empirical impetus for why it important for all handlers of food in the public sphere to possess requisite certifications

Hypothesis one revealed that, there is significant difference among the pre- and post-test mean score differences of pupils and handlers in different treatment groups on food quality, and this is without dispute as it is well supported by previous research findings. Corroboratively, based on empirical facts, authors and researchers have previously recommended that training and safety performance monitoring are effective measures to ensuring food safety among food handlers in public primary schools (Leslie et al., 2021; Raji et al., 2021). Also well grounded in sound empirical background are other outcomes from the test of this hypothesis which revealed that, the posttest food quality mean in the control group is significantly lower than the one in any of the treatment groups while the posttest food quality for participants in the nurse-led training group mean is significantly different from the food quality means for participants in safety compliance and combined nurse-led & safety compliance groups that are not significantly different from each other but significantly different from the food quality posttest mean in the control group with the implication that, each of the treatments (nurse-led training, safety compliance monitoring and combined nurse-led training & safety compliance monitoring significantly increased food quality while this was not the case in the control group.

Sodimu and Asonye (2021) affirmed the foregoing observation when they held that, for any training on food handling to bring desirable traits to consumers, such must be nurse-led as against the erstwhile norm of mere accreditation of food handlers by Government. This is because as affirmed in previous studies, repeated exposure to healthful foods, enjoyable social meals, and enhancement of the cognitive qualities (e.g. thoughts or ideas) of healthful foods portend great pleasure and happiness for children, which is a spring to construction of healthy food decisions (Haines et al., 2019). As further shown, in the short or long run, promotion of eating pleasure is intricately linked to healthy nutrition, and thus, enhancing the quality of food consumed by whatever means is a sure way to promoting healthy living.

The study found with respect to hypothesis two that, there is significant difference between the pre- and post-test mean score differences of pupils and handlers in private and public schools on food quality, and this outcome has previously been suggested by previous research. For example, as recounted in research hypothesis three, Oldroyd et al (2020), Prescott et al. (2019) and Young et al. (2020) showed earlier that, type of school is an implicit predictor of food safety and quality characteristics. However, that, the pre- and post-test mean score difference of private school participants on food quality was higher than the mean difference for public schools was a direct opposite to what was obtained for food safety in public and private schools. Although the obvious socio-economic disparity between private and public school learners in favour of private schools suggest higher food quality traits for private school pupils but that has not been previously revealed in empirical research. Thus, more empirical research is needed to empirical unravel the magnitude and direction of these pretest-posttest mean differences in food quality (as well as food safety) in private and public schools.

Results obtained from test of hypothesis three showed that, there is significant difference between the pre- and post-test mean score differences of participants on food quality in uncertified and certified handlers group, with the pre- and post-test mean score difference of participants in certified handlers' group on food quality was higher than the mean difference for uncertified handlers' group. This result followed the pattern substantiated by hypothesis five. As previous researches like DiMaria-Ghalili et al (2014) and Perry et al (2015) indicated, the place of nutritional education as a necessity to improved handling of public food.

CONCLUSION

The study concluded that the pretest-posttest mean differences were observed on food quality for participants in different treatment groups was to suggest that, different treatment groups might have different food quality characteristics. That test of relevant hypothesis affirmed that, there is significant difference among the pre- and post-test mean score differences of pupils and handlers in different treatment groups on food quality implied that, behaviour-modifying treatments would have a significant effect on food quality.

Recommendations

The following recommendations were made

1. The Federal and State Ministries of Education should adopt behaviour-ingrained professional methodologies/treatments to prosecute and enhance food quality in schools, especially at the primary level, rather than the passive routine food/school inspection arrangements presently prevalent in schools.
2. The State Governments should collaborate with the Federal Government to extend and enhance the Home Grown Feeding Programme to higher or all classes in the public primary school to improve the quality of food eaten by children in public primary schools.

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