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Effect of educational intervention on knowledge of breast self-examination among senior secondary school female adolescents in Ogun State, Nigeria: A quasi-experimental design

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Abstract
Objective: This study assessed the effect of educational intervention on knowledge of breast self-examination among senior secondary school female adolescents in Ogun State, Nigeria.
Method: A Two-group pre-test-post-test quasi-experimental design was employed involving 200 female adolescents; researcher-led (RL,65), Abeokuta South, peer-led (PL,67) and Yewa South (CG, 68). Breast self-examination training was conducted in experimental groups for four (4) weeks. A structured questionnaire with Cronbach alpha coefficients of 0.725 was used to collect data at pre-intervention(P0), 2-week post-intervention(P1) and 6-week post-intervention(P2). Data were analysed on the IBM SPSS, using descriptive (frequency, percentage, mean and standard deviation) and inferential statistics (t-test) at a 0.05 significance level.
Results: At pre-intervention (P0), results revealed that most participants had moderate knowledge, RL (69%). PL (62.7%) and CG (76.5%). Post-intervention results at P1 and P2 indicated improved knowledge, RL= (73.8%,80%), and PL = (57.8%,71.4%), while CG remained moderate (76.5%, 61.8%). Significant differences were identified between P0 and P1 for BSE knowledge mean score in RL (3.9 $t_{(64)} = 8.8$, $p < 0.001$), and PL (1.3 $t_{(66)} = 2.46$, $p = .017$). Significant differences were also found between P0 and P2 in RL ($t_{(64)=}$ -7.53; p> 0.001), and PL ($t_{(62)=}$ -4.91; p<0.001), Cohen's *d* effect size were -0.93 (-1.22 to -0.63) and -0.62 (-0.88 to -0.34) for RL and PL respectively.
Conclusion: Educational intervention improved BSE knowledge among female adolescents, and RL approach was more effective. It is recommended that healthcare professionals teach BSE to female adolescents as part of health promotion activities in school health programmes.

Keywords: Breast self-examination, Educational intervention, Female adolescents, Knowledge level, Ogun State, Peer-led, Researcher-led

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Plain English Summary
Breast cancer is the most prevalent form of cancer, causing high rates of illness and death in women. Breast cancer affects women of all ages in every country across the globe, and half of all cases occur in women who have no known risk factors. Early detection would aid in reducing the morbidity and mortality rate of breast cancer. Breast self-examination is one recommended, easy and simple way females can use to examine their breasts for early detection of breast lumps or any other abnormality. Educational intervention on breast self-examination is advocated to improve the knowledge level of breast self-examination, which was also demonstrated in our study.

Background
Breast self-examination is a simple and effective way to detect any early signs of breast lumps or changes that may lead to breast cancer. Breast self-examination (BSE) involves palpating the breasts at regular intervals, using the three middle fingers to check for the breast's normal appearance and detect any breast pain, lumps, nipple discharge, and changes in shape or size. Breast self-examination, when performed regularly at the right time using the right techniques, would help in the early detection of breast lumps and any other abnormality and has also proven to be useful in reducing the risk of late breast cancer diagnosis (1, 2, 3).
Breast cancer was the most diagnosed cancer globally in 2020 among women (4), accounting for 2,261,419 new cases, making it a total of 24.5% of all cancers. In Africa, breast cancer was the most common in females, accounting for 186,590 (29.5%) new cases and the most common cause of death (85,787, 12.1%). In sub-Saharan Africa, breast cancer was ranked the highest in females, accounting for 129,415 (27.3%) new cases and also the most common cause of death (64,234, 12.3%). Likewise, in Nigeria, the authors mentioned that breast cancer ranked as the most common cancer, with 26,320 (37%) new cases, 11,564 deaths (16.4%) and a 5-year prevalence of 52,562 across all ages. In line with this, a new Global Breast Cancer Initiative Framework (GBCIF) was released by (5), to save 2.5 million lives from breast cancer by 2040, which could be accomplished by adopting the pillars of health promotion for early detection and timely diagnosis, which should focus on early detection programmes for breast cancer. Breast self-examination has been recommended as a means for early detection of a breast lump or any other breast abnormality.
In addition, in the past, breast cancer was seen as a middle-aged disease (6). However, recent statistics, as stated by (7) and observed admissions at the hospitals have shown that the trend has moved to younger adults and even adolescents, increasing the morbidity and mortality rate of breast cancer. Also, in a retrospective analysis of breast cancer in adolescents and young adult females in Nigeria (7), breast cancer was by far the most common cancer, constituting 50% of all cancers and 51% (2798 of 5469) of all breast cancer cases.
According to a recent study (8), females who have a high level of knowledge of breast self-examination are three times more likely to perform BSE compared to females with low levels of knowledge. However, female adolescents lack good knowledge of breast self-examination, resulting in late detection of breast lumps and consequent late diagnosis of breast cancer (9). To improve knowledge of BSE, there is a need for an educational intervention on breast self-examination among female adolescents because good knowledge of BSE will enhance their performance in BSE as they grow into adulthood (10, 11). Good knowledge of breast self-examination entails a consistent look-and-feel procedure carried out by a female at regular intervals within her menstrual cycle to identify any abnormality.
Recent studies on the knowledge of breast self-examination reveal low knowledge levels and this is evidenced by the results from studies conducted by (12), which revealed 31(33%) had adequate knowledge of performing Breast Self-Examination; (13) revealed more than half of the participants (55.3%) had poor knowledge of BSE; (14), revealed only 4.2% showed adequate knowledge about BSEs, while only 26.5% knew that a BSE has to be completed each month; (15), revealed only 37.8% had heard about BSE before, 25.2% knew BSE, and only 17.2% had done it (16); few know when to commence (43.1%), the right frequency (31.5%), or the right timing (24.6%). This was also evident as low knowledge levels of BSE were found in an integrative review by (17). The researcher alludes that it is important to improve the knowledge of BSE to reduce the high rate of morbidity and mortality arising from breast cancer. This study utilised two (2) approaches (researcher-led and peer-led) for the educational intervention to determine which approach was the best in increasing the knowledge level of BSE.
Hence, this study utilised an educational intervention to improve the knowledge of breast

self-examination among senior secondary school female adolescents in Ogun State.

Research question
What is the pre-intervention (P0), 2-week post-intervention (P1) and 6-week post-intervention (P2) knowledge level of Breast Self-examination among senior secondary school female adolescents in the researcher-led, peer-led, and control groups?
Hypotheses
$H_0$1: There is no significant difference between the knowledge mean score of pre-intervention (P0) and 2-week post-intervention (P1) of Breast Self-examination among senior secondary school female adolescents in the researcher-led group and peer-led group.
$H_0$2: There is no significant difference in BSE knowledge between the researcher-led and peer-led approaches at pre-intervention (P0) and post-intervention 2 (P2).

Methods
Study Area
The study was conducted in Ogun State, one of the states in the South-West region of Nigeria. According to Encyclopedia Britannica, Ogun State was created on 3 February 1976 from the former Western State. Ogun State borders Lagos State to the south, Oyo State and Osun State to the north, Ondo State to the east, and the Republic of Benin to the west. Ogun State is divided into three senatorial districts: Ogun Central, Ogun East and Ogun West, consisting of twenty local government areas.

Study Population
The study population for this study was female adolescents enrolled in senior secondary schools in the selected Local Government Areas of Ogun State. The students were those within the age range of 10 and 19 years from the selected schools in Ogun Central, Ogun East and Ogun West.

Study Design
The research was a quasi-experimental study, carried out in 4 phases-pre-intervention (P0), intervention, post-intervention 1 (P1) and post-intervention 2 (P2) phases.

Sample size
The sample size for this study was determined by using Daniel's formula, and a prevalence rate as found by (18) was used in calculating the sample size. A sample size of 200 was used for the study.

$$n = \frac{Z^2 P(1-P)}{d^2}$$

Where:
n = sample size
Z = Statistic for the level of confidence (for the level of confidence of 95%, the Z value is 1.96)
p = Prevalence: (Ibrahim et al., 2022, found a prevalence of 13.7%). Therefore, (P is 0.137)
d = Precision (d is considered 0.05 to produce good precision and a smaller error of estimate).

$$n = \frac{Z^2 P(1-P)}{d^2}$$
$$n = \frac{(1.96)^2 (0.137)\ (1- 0.137)}{(0.05)^2}$$
$$n = \frac{3.8416\ (0.137)\ (0.863)}{0.0025}$$
$$n = \frac{3.8416\ (0.1182)}{0.0025}$$
$$n = \frac{0.4541}{0.0025}$$
n=181.64
n= 182
10% attrition rate=10% of 182= 18
Sample size= 182 + 18 = 200

Sampling technique
A multi-stage sampling technique was used to select female adolescents for researcher-led, peer-led, and control groups from senior secondary schools in the selected three Local Government Areas in Ogun State
The local government areas (LGAs) in Ogun state are grouped into three (3), that is the senatorial zones as, Ogun Central, Ogun East and Ogun West. Numbers were assigned to each Local Government Area/district to give room for an unbiased selection. One (1) LGA was selected from each senatorial zone/district, making it a total of three (3) LGAs. The selection was done by simple random sampling through paper balloting. The three (3) Local Government Areas (LGAs) selected are Ikenne LGA, Abeokuta South LGA, and Yewa South LGA. Balloting was done to pick one (1) LGA for experimental group 1 intervention, experimental group 2 intervention and the control group, while developed criteria (school with the highest population in the selected LGA) were used to select the schools to participate in the study. From the three (3) LGAs, the list of public secondary schools was obtained from the Ministry of Education. The school with the highest population in each LGA was chosen. The three (3) schools selected for the study were Mayflower School (Senior), Ikenne, Baptist Girls College, and Itolu Community High School. A proportionate sampling technique was used in selecting the participants from the three (3) senior secondary school classes (SS 1, SS2, SS3).

A systematic sampling technique was employed in the selection of students from each class. Every n^{th} (20th) student on the list of classes was selected and approached for participation. Table 1 below explains how many students were selected per level and class.

Table 1: Calculated proportion for the selected secondary schools per class

S/N	LGA	Name of School	Population	Proportion	Sample size
1.	Ikenne	Mayflower School, Ikenne	SS1=331	331/4016 x 200	17
			SS2=490	490/4016 x 200	24
			SS3=485	485/4016 x 200	24
2.	Abeokuta South	Baptist Girls' College School	SS1=465	465/4016 x 200	23
			SS2=539	539/4016 x 200	27
			SS3=338	338/4016 x 200	17
3.	Yewa South	Itolu Community High School, Ilaro	SS1=554	554/4016 x 200	27
			SS2=501	501/4016 x 200	25
			SS3=313	313/4016 x 200	16
				TOTAL=	200

Inclusion Criteria
The female students in the senior secondary school in the chosen schools in Ogun State. The female students who are fully registered in the selected schools. Female students who consent to participate in the study, and also those whose parents consent to the participation in the study.

Exclusion Criteria
The female students whose parents do not approve of their participation, and those who are sick at the point of recruitment for participation.

Pre-intervention Phase
A team, including the research assistants (nurses with BNSc.), was constituted. Three (3) peer-leaders/educators were identified and trained.
Selection of peer educators
The selection of peer educators took place during the pre-intervention stage (P0), which involved all the participants from the selected school in Abeokuta South. The participants from the peer-led group who performed better during the demonstration of breast self-examination using the dummy and those who had better knowledge of breast self-examination were chosen, trained and evaluated to make sure they were well-equipped to carry out the training for their peers. Three (3) peer-educators were selected, representing the best from each class level (one student from senior secondary (SS 1, SS 2 and SS 3).
This training was a 3-day training, and they were exposed to the purposes of the research, the method to employ for data collection and data administration. Baseline data were collected for this study and were used as a reference for the effectiveness of the intervention on knowledge of breast self-examination. Data was collected from female adolescents across the three schools using the same instrument of data collection.

Intervention Phase
Administration of the educational intervention was done (educational intervention on breast self-examination). The participants were using the training module as prepared by the researcher, which covered lessons on breast cancer, breast self-examination, all that to look out for during breast self-examination and then the teaching and demonstration of breast self-examination using a dummy. A BSE pamphlet designed for the study was given to the participants during the intervention phase. The BSE pamphlet had pictures and also served as a reference material for the female adolescents who participated in the study.
The peer educators also used the same training manual and the same BSE pamphlet, just as the researchers used for the other group.
The educational intervention took place during break periods, one (1) hour for 3 days a week for 4 weeks.

Post-intervention Phase
The post-intervention data were collected from the female adolescents at two points, 2 weeks post-intervention (P1) and 6 weeks post-intervention (P2) for the experimental groups. The data collected was used to determine the effectiveness of the intervention on the knowledge of breast self-examination. The data collected was used to measure the outcome of the intervention and determine its sustainability within the period. The data was used to determine if there was a sustained change in the female adolescents' knowledge of breast self-examination.

Research instrument and data Collection
The questionnaire was developed by the researcher using information gathered from the literature review was used to elicit data from the participants. Section A of the instrument elicited information on socio-demographic characteristics, while Section B was on BSE knowledge.
The instrument assessed participants' knowledge of breast self-examination using twenty-nine dichotomous questions of True/False, measured on a 29-point rating scale. For negatively constructed questions, "True" was scored zero (0) and "False" was scored one (1), while for positively constructed questions, "True" was scored one (1) and "False" was scored zero (0). The maximum/highest score for correct responses for the knowledge of BSE is 29. The knowledge score was rated as:
Less than (< 50%), 1-14 questions = Poor knowledge
50-75%, 15-21 questions = Moderate knowledge
Above (>75%), 22-29 questions = Good knowledge
The same instrument was administered at baseline (pre-intervention, P0), 2 weeks post-intervention (P1) and at 6 weeks post-intervention (P2). The validity of the instrument was ensured by review of experts in Nursing and the research subject for face, content, and construct validity. Corrections/alterations were made based on expert guidance. The Cronbach's Alpha coefficient of 0.725 was obtained for instrument reliability. The questionnaire was pretested among 20 senior secondary school female adolescents in Ilishan-Remo.

Data management and management
The data for this study were collated, entered, coded, and analysed using the IBM statistical package for the social sciences (SPSS)Version 23. Descriptive statistics (frequency distribution tables, percentages, mean and standard deviation) were used to analyse the socio-demographic characteristics of the participants and research questions. Inferential statistics, t-test, and Cohen's *d* effect size were used for the hypotheses. All the hypotheses were tested at the 0.05 level of significance.

Results
Table 2 shows the socio-demographic characteristics of the respondents. The result indicates that the mean age for the RL group was 15yrs±1.10; PL group 15yrs±1.18, while the CG had a mean age of 16yrs±1.5.

Table 2: Baseline Socio-Demographic Characteristics of Respondents (n=200)

VARIABLES	OPTIONS	RL		PL		CONTROL	
		F	%	F	%	F	%
nAge	12-15years	56	86.2	51	76.1	33	48.5
	16-19years	9	13.8	16	23.9	35	51.5
	Mean age	15yrs±1.10		15yrs±1.18		16yrs±1.5	
	Total	65	100	67	100	68	100
Class	SS1	17	26.2	24	35.8	27	39.7
	SS2	25	38.5	25	38.8	25	36.8
	SS3	23	25.4	16	23.5	16	23.5
	Total	65	100	67	100	68	100

Table 3 revealed the level of BSE knowledge at the pre-, post-intervention 1 and post-intervention 2 among senior secondary school female adolescents in the RL, PL and Control groups.
For the RL group, the result revealed that the majority of the participants had moderate knowledge of BSE, 45 (69.2%) at PO, good knowledge of BSE, 48 (73.8%) at P1, and good knowledge of BSE, 52 (80%) at P2.
For the PL group, the result revealed that the majority of the participants had moderate knowledge of BSE, 42 (62.7%) at P0, good knowledge of BSE, 37 (57.8%) at P1, and good knowledge of BSE, 46 (71.4%) at P2.
For the control group, the result revealed that majority of the participants had moderate knowledge of BSE, 52 (76.5%) at P0, moderate knowledge of BSE, a moderate knowledge of BSE, 52 (76.5%) at P1, and moderate knowledge of BSE, 42 (61.8%) at P2.
The result revealed an improvement in the level of respondents' knowledge of BSE at P1 and P2 post-intervention in the researcher-led and peer-led groups.

Table 3: Level of knowledge at pre-intervention, post-intervention 1 and post-intervention 2 on Breast Self-examination among senior secondary school female adolescents in the researcher-led group, peer-led group and control group

Groups	Knowledge Level	Pre-test (P0)		Post-test (P1)		Post-test2(P2)	
		F	%	F	%	F	%
Experimental group 1	1-14 (poor)	5	7.7		-	1	1.5
	15-21(Moderate)	45	69.2	17	26.2	12	18.5
	22-29 (Good)	15	23.1	48	73.8	52	80.0
	Total	65	100	65	100	65	100
	Mean score (SD)	19.2(±3.5)		23.0(±2.4)		23.6(±2.9)	
Experimental group 2	1-14 (poor)	-	-	-	-	1	1.6
	15-21 (Moderate)	42	62.7	27	42.2	17	27.0
	22-29 (Good)	25	37.3	37	57.8	46	71.4
	Total	67	100	64	100	64	100
	Mean score (SD)	20.4(±2.6)		21.7(±3.7)		23.1(±3.4)	
Control group	1-14 (poor)	9	13.2	9	13.2	17	25.0
	15-21 (Moderate)	52	76.5	52	76.5	42	61.8
	22-29 (Good)	7	10.3	7	10.3	9	13.2
	Total	68	100	68	100	68	100
	Mean score (SD)	18.4(±2.75)		18.41(±2.75)		17.6(±3.5)	
Experimental group's mean score (knowledge level)		19.8±3.1 (Moderate)		22.4±3.2 (Good)		23.4±3.2 (Good)	

Table 4 shows the result of hypothesis 1 postulated in this study. The result indicates a significant difference between pre-intervention (P0) and post-intervention 1 (P1) on the knowledge mean score towards breast self-examination in the RL group. This is justified by the p-value, which is less than the critical value of 0.05 (p = <0.05). The result revealed differences in mean scores in the RL (19.2±3.46 to 23.1±2.38) and PL (20.4±2.6 to 21.7±3.67) groups at P0 and P1.

This result further indicates a significant mean difference in knowledge of breast self-examination between pre- and post-intervention 1 in the RL group (Mean diff. = 3.9; $t_{(64)}$ = 8.8, p = .000). From the PL group the result showed a significant mean difference in knowledge towards breast self-examination between pre- and post-intervention 1, with (Mean diff. = 1.3; $t_{(66)}$ =2.46, p = .017). Therefore, the observed difference in knowledge mean score between pre- and post-intervention 1 in the two experimental groups must have been as the result of the intervention. Hence, the null hypothesis was hereby rejected by this finding.

Table 4: T-test analysis showing knowledge mean score between pre (P0) and post-intervention 1(P1) test, Knowledge on Breast Self-examination among senior secondary school female adolescents in the researcher-led and peer-led groups.

	Test	N	Mean ± SD	Mean difference	Std error mean	t. value (df)	P	Dec.
Experimental 1	Pre-test (P0)		19.2±3.46		0.44	8.8		Sig.
	Post-test 1 (P1)	65	23.1±2.38	3.9		{64}	0.000	
Experimental 2	Pre-test (P0)	67	20.4±2.6	1.3	0.52	2.46	0.017	Sig.
	Post-test 1(P1)		21.7±3.67			{66}		

A paired t-test was conducted to determine if the mean differences observed in the female adolescents' BSE knowledge due to the intervention were statistically significant between pre-intervention and post-intervention 2. As shown in Table 5 below, the intervention had a statistically significant effect on the female adolescents' BSE knowledge between P0 and P2 in the RL ($t_{(64)=}$ -7.53; p> 0.001), in the PL ($t_{(62)=}$ -4.91; p<0.001). However, in the control group, a negative statistically significant difference in the mean BSE knowledge score ($t_{(67)=}$ 1.68; p<0.097) was observed. This negative significance was observed because there was a decrease in BSE knowledge at P2. The result revealed that the RL approach had a larger effect size (ES) of -0.93 (-1.22 to -0.63) between P0 and P2. However, the results show that the RL and PL interventions had statistically significant changes in the female adolescents' BSE

knowledge. Therefore, based on these values, the null hypothesis is rejected.

Table 5: Paired T-test analysis showing the difference in BSE knowledge between the researcher-led and peer-led approaches at post-intervention (P0) and post-intervention 2 (P2)

Variable	Groups	Mean Diff	SD	df	T	ES (95% CI)	p-value
BSE knowledge	Researcher-led	-4.48	4.79	64	-7.53	-0.93 (-1.22 to -0.63)	0.001
	Peer-led	-2.71	4.38	62	-4.91	-0.62(-0.88 to -0.34)	0.001
	Control	0.78	0.46	67	1.68	0.20(-0.37 to 0.44)	0.097

Significant at < 0.05

Discussion

Findings from the study revealed that the participants of the researcher-led group (RL) had a mean age of 15 (±1.10), and the peer-led group (PL)=15 (±1.18). This result corroborates the findings of the study by other authors (18), who observed that the mean age of the respondents was 15.5±1.11 years, supported by others (19) who showed that the mean age of respondents was 15.64 ± 1.33 years. These results were found to be similar because the studies were conducted among senior secondary schools.

The result showed that the majority of the respondents had moderate knowledge towards BSE, at baseline, (45, 69.2%, 42 (62.7% and 52 (76.5%), for the RL, PL and the control groups, respectively. These results indicate a positive increase in respondents' knowledge to good knowledge on Breast Self-examination after the intervention programme in the two experimental groups after 2 weeks and 6 weeks as: (RL, 48(73.8%) to 52 (80%) and PL, 37(57.8%) to 46 (71.4%). This reflects a positive influence on the respondents' knowledge in the 2-week and 6-week post-intervention.

This result corroborates a study by (19) among adolescent female secondary school students in Delta State, who showed an increase in BPAM knowledge after intervention from 5.20±2.28 to 21.56±1.85 (t=29.44, p<0.05), and an increase in BPAME knowledge from 7.03±1.13 to 21.73±1.26 (t=31.77, p<0.05). Similarly (20), found an increase in knowledge levels of BSE of the respondents, before the education programme, showing that only 25.4% of the participants had a good knowledge of how to conduct a BSE, which increased to 56.8% post-education, while others reported an improvement in knowledge of breast self-examination and screening (from 9.8% to 22.2%; p<0.001) after the intervention among females in Ghanaian high schools (21). In the same line, scholars studying the impacts of educational interventions on the enhancement of knowledge on breast self-examination, disclosed that in the pre-test, 4 (13.3%) had poor knowledge, while 26 (86.7%) had good knowledge in the post-test (22). Similarly, a study among women in Majengo Health Centre, Moshi Municipality, Kilimanjaro Region, Tanzania, showed that 31(33%) had adequate knowledge of performing Breast Self-Examination after intervention programmes (12). These results were found to be similar because the studies were based on a quasi-experimental research design.

This result was against the outcome of the study, among 20 to 49-year-old women in Butwal sub-metropolitan Rupandehi, who revealed that more than half of the participants (55.3%) had poor knowledge of BSE (13). Similarly, a study among young women in South-West Ethiopia (23) also revealed that BSE was unknown to more than 80% of the study participants, and another study showed that 21 (70%) participants had poor knowledge, while 9 (30%) had good knowledge (22). These outcomes may have differed from previous studies due to technological change, which might have prompted most of the participants in this technological era to undergo some form of learning or training on BSE either through social media or social gatherings before intervention.

Educational intervention modules have proven to influence knowledge levels of breast self-examination after an intervention programme. In a study to assess the knowledge of breast self-examination to determine the impact of educational intervention among young females, using a quasi-experimental study method with 30 participants, in the pretest, 21 (70%) participants had poor knowledge and 9 (30%) had good knowledge. In the post-test, 4 (13.3%) had poor knowledge, while 26 (86.7%) had good knowledge (24).

Peer education has also been proven to be an effective approach to improving breast self-examination knowledge. A study among female Nigerian adolescents revealed that pre-peer training, 906(67.8%) students knew about BSE, and significantly more students, 1134(94.7%), knew about BSE after peer training (25).

Furthermore, findings from hypothesis 1 showed there is a significant difference between pre-

intervention (P0) and post-intervention 1 (P1) on knowledge mean score towards breast self-examination in the RL group (19.2±3.46) and (23.1±2.38), and the PL group (20.4±2.6) and (21.7±3.67) at pre-intervention and post-intervention 1. This shows that the knowledge level at pre-intervention and post-intervention 1 is not the same as a result of the educational intervention. This can be attributed to educational intervention by researchers and peer educators.

Findings from hypothesis 2 revealed a statistically significant difference between pre-intervention and post-intervention 2. the intervention had statistically significant effect on the female adolescents' BSE knowledge between P0 and P2 in the RL ($t_{(64)=}$ -7.53; p> 0.001), in the PL ($t_{(62)=}$ -4.91; p<0.001). The result revealed that the RL approach had a larger effect size (ES) of -0.93 (-1.22 to -0.63) between P0 and P2. The findings of this study are in tandem with another study that found a statistically significant difference between the BSE knowledge levels of nursing students, their levels before education, and those detected immediately after and one month after education (26). There was a significant difference among the students' pre- and post-knowledge at t (558) = 14.49, p = 0.01. In the same line, scholars revealed a significant difference between pre-test and post-test knowledge scores, which were 10.07; p<0.05 among female teachers at selected high schools in Goa (27). This study is consistent with the results of others, who found knowledge mean score of breast self-examination improved after intervention (1.57 ± 1.86 vs. 3.94 ± 0.93; $p < 0.001$) (11). However, the result of the study by Aluh et al, aimed to assess the effect of a clinical lecture on knowledge and practice of BSE among student pharmacists, the result revealed that no statistically significant differences (p<0.05) were found between the mean knowledge (2.00±0.93 and 1.92±0.65) in the pre and post samples of the study (28).

Conclusion and recommendation

The knowledge level of breast self-examination was moderate at pre-intervention but improved significantly to good knowledge at post-intervention in the researcher-led and peer-led groups. The study concludes that the educational intervention improved knowledge of breast self-examination among senior secondary school female adolescents in the intervention groups. This implies that educational interventions, training workshops and seminars must be ongoing to ensure that female adolescents are informed about the crucial messages to improve and sustain good knowledge of breast self-examination.

List of Abbreviations

BSE: Breast self-examination
BUHREC: Babcock University Health Research and Ethics Committee
CG: Control Group
IBM: International Business Machine
LGA: Local Government Area
PL: Peer-led group
RL: Researcher-led group
SPSS: Statistical Package for Social Sciences

Declarations

Ethics approval and consent to participate

Ethical clearance has been sought from Babcock University Health Research and Ethical Committee (BUHREC/703/23) and Ogun State Health Research Ethics Committee (OGHREC) to conduct the study (OGHREC/467/155). A letter of introduction and permission to collect data was obtained from the Dean, School of Nursing, Babcock University and taken to the principals in charge of each school selected for the research study. Verbal and written informed consent were obtained from the participants, while only written consent was obtained from the parents of the participants. Anonymity and confidentiality were also maintained throughout the study.

Consent for publication

The authors herewith transfer all copyright ownership to the journal if this work is accepted and published by the journal.

Availability of data

Data for this work are available from the authors and may be presented on request.

Conflict of interest

No conflict of interest is declared by the authors.

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Authors Contributions

ACE conceived the research idea and collected data, ONA supervised the work, and DCM and OAB collected data.

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