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Impact of intervention on knowledge and risk factors of coronary heart disease among teachers in Sokoto, Nigeria

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Although coronary heart disease (CHD) is the most common cause of death in the developed countries, tremendous decline attributable to interventions causing reductions in population risk factors has been recorded in death rates from CHD in them in the past two decades. This study aimed to assess the impact of intervention on the knowledge and prevalence of risk factors of CHD among teachers in Sokoto. A quasi experimental study was conducted among 216 secondary school teachers selected by multistage sampling technique from April to July 2012. Anthropometric measurements, blood pressure measurement, and estimation of fasting blood sugar and cholesterol were done for the participants, together with questionnaire administration. The proportion of participants with good knowledge of CHD was low while the prevalence of the risk factors of CHD was high in both groups at baseline. At post-intervention, there was statistically significant increase in the proportion of participants with good knowledge of CHD and statistically significant reduction in the prevalence of its risk factors mainly in the intervention group. Behavioral change communication and health promotion activities to enhance smoking cessation, regular moderate exercise, healthy diet, and reduce alcohol use, should be put in place in homes and workplaces.

Key words: Coronary heart disease, risk factors, knowledge, prevalence, intervention.

INTRODUCTION

Coronary heart disease (CHD) is defined as impairment of heart function due to inadequate blood flow to it compared to its needs, caused by obstructive changes in the coronary circulation to the heart. Evidence of increased risk of CHD and other clinical manifestations of cardiovascular disease (CVD) with the presence of specific risk factors has been documented in previous epidemiological studies such as the Framingham heart study, the Standford three-community study and the multiple risk factors intervention trial (Park, 2009). CHD is one of the most common clinical manifestations of cardiovascular disease (American Heart Association (AHA), 2000). The development of CVD is promoted by major risk factors such as hypercholesterolaemia, hypertension, diabetes mellitus and smoking. These risk factors are independently associated with CVD risk and are common among adults both in the developed and developing countries. The identification of these major risk factors and the implementation of control strategies (e.g. community education and targeting of high risk

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individuals) have contributed to the fall in CVD mortality rates observed in industrialized nations (Ford et al., 2007). The high burden of CVD in the developing countries are attributable to the increasing incidence of atherosclerotic diseases, perhaps due to urbanization and higher risk factor levels (such as obesity, diabetes mellitus, hypercholesterolaemia and hypertension), the relatively early age at which they manifest, the large sizes of the population, and the high proportion of individuals who are young adults or middle-aged in these countries (Yusuf et al., 2001).

It is estimated that the elderly population will increase globally (over 80% during the next 25 years), with a large share of this rise in the developing world, because of expanding populations. Increased longevity due to improved social and economic conditions associated with lifestyle changes in the direction of a rich diet and sedentary habits, is believed to be one of the main contributors to the incremental trend in CVD in the last century (Dominguez et al., 2006).

CHD is the most common cause of death in the developed countries, and has now become a problem of public health importance in the developing countries including Nigeria. In the UK, it caused almost one in five deaths in 2003. However, death rates from CHD in the UK have halved in the past two decades. Most of this decline (58%) has been attributed to interventions causing reductions in population risk factors (Unal et al., 2004). In most industrialized countries in which declines in mortality from CHD have been carefully examined, reductions in major risk factors have contributed to the declines at about the same level as specific medical treatments and interventions for CHD. A study by Ford et al. (2007) recently showed that, about 44% of the decline in US deaths due to CHD from 1980 through 2000 was attributable to reductions in major risk factors, and approximately 47% to evidence-based medical treatments.

Knowledge is an important pre-requisite for implementing the various preventive strategies for CHD. For behavioral change to occur, an individual must be aware of the potential negative consequences of his or her current actions. The Health-Belief-Model (HBM), suggests that a person must feel susceptible to the disease in order to change his or her behavior (Jones et al., 2006). Knowledge of the risk factors of the disease is essential for a person to make an informed decision about engaging in or continuing certain behaviors that may increase disease risk, such as smoking, not exercising or consuming high fat foods (Homko et al., 2008). It has been reported that improving cardiac related knowledge to further healthy lifestyle is the best preventive strategy against CHD (Nidal et al., 2010). In studies by Holiman et al. (2006) and Alm-Roijer et al. (2006) it was reported that, knowledge of risk factors of CHD improves adherence to advice on lifestyle changes and medication.

The prevalence of CHD in the Nigerian population is unknown, even though reports from several hospital based studies show that CHD is uncommon and does not contribute significantly to morbidity and mortality from cardiovascular diseases in Nigeria, with CHD constituting 1 in 20,000 to 1 in 13,500 medical admissions over a period of 10 to 15 years at the University College Hospital, Ibadan and the Lagos University Teaching Hospital, Lagos respectively; available evidence shows an increase in the incidence of the disease in the country over the last four decades (Nwaneli, 2010).

Also, recent reports show a high prevalence of the risk factors of CHD in Nigeria. In 2008, the prevalence of hypertension in Nigeria was estimated at 42.8%, diabetes mellitus was estimated at 8.5%, obesity was estimated at 6.5%, raised cholesterol was estimated at 16.1%, current daily smoking of tobacco was estimated at 4.6%, while the cardiovascular diseases (CVDs) accounted for an estimated 12% of all deaths in Nigeria (World Health Organization (WHO), 2011).

A cross sectional survey of knowledge and prevalence of risk factors of CHD among teachers in Calabar, Nigeria reported poor knowledge and high prevalence of the risk factors of the disease (Ansa et al., 2007). The school is an institution for socialization, knowledge and health promoting behaviors acquired by teachers, in addition to preventing them from developing CHD would be passed to their students. The students being young adults are at a critical transition period in their lives, it is believed that behavior patterns and trajectories established now will influence their health for a lifetime and also that of the next generation when they grow up and become parents (Tsigos et al., 2008).

Previous studies in Nigeria primarily examined the prevalence of the risk factors of CHD; despite the high prevalence reported in several studies, there is a dearth of literature on interventions targeted at the risk factors of the disease in the country. This study aimed to assess the impact of intervention on the knowledge and prevalence of risk factors of CHD among teachers in Sokoto.

METHODOLOGY

Study design and population

The study was quasi experimental in design, with pre- and post-test design as in the model described by Fisher et al. (1991) among secondary school teachers in Sokoto metropolis, the capital of Sokoto state, in North Western Nigeria, from April to July 2012. The metropolitan city of Sokoto lies between longitude $05°11^1$ to $13°03^1$ East and latitude $13°00^1$ to $13°06^1$ North and covers an area of 60.33 km^2. Those eligible for the study were teachers that had worked for up to one year in the teaching profession, pregnant women and those with physical limitations that hinder or prevent exercise were excluded.

The minimum sample size was estimated at 98, and adjusted to 108 to compensate for non-response (with an anticipated 95% response rate) using the formula for comparison of proportions in independent groups (Ibrahim, 2009).

$$n = \frac{2(Z_\alpha + Z_\beta)^2 P(1 - P)}{D^2}$$

The level of significance was set at 5% ($\alpha = 0.05$), and a power of 80%, where n = minimum sample size per group, Z_α = two-sided percentage point of the normal distribution corresponding to the required significance level ($\alpha = 0.05$) = 1.96, Z_β = one-sided percentage point of the normal distribution corresponding to 100% – the power (that is, 100% – 80% = 20% = 0.20) = 0.84, P = mean proportion of factor under study (knowledge of obesity as a risk factor for CHD = 41.6%) observed at baseline in a previous study (Ansa et al., 2007) and the projected proportion post-intervention based on the proposed hypothesis of 20% increase = (41.6% + 61.6%)/2 = 51.6% = 0.52, D = difference between the proportions = 61.6% - 41.6% = 20% = 0.20.

The eligible participants were selected by multistage sampling technique. At the first stage, out of the 4 Local Government Areas (LGAs) in the metropolis, 2 were randomly allocated by balloting into intervention group LGAs and 2 into control group LGAs. In the two intervention group LGAs, 4 of 16 schools and 2 of 7 schools were selected as study centers; while in the two control group LGAs, 5 of 18 schools and 1 of 4 schools were selected as study centers. At the second stage, selection of study participants in each of the selected secondary schools was done by systematic sampling technique using the staff list in the schools to constitute the sampling frame. Proportionate allocation (based on staff population) was applied in the selection of study participants in the selected schools.

Data collection at pre-intervention phase

The methods of data collection comprised of personal interview, physical and biochemical assessments. A standardized semi-structured, interviewer-administered questionnaire was used to obtain information on the socio-demographic characteristics of the study participants, awareness of CHD and its risk factors and behavioral measurements. The questions on awareness of CHD risk factors were adapted from the American Heart Association's questionnaire that was used for a national survey on knowledge of heart disease among women (Mosca et al., 2004). The questions on behavioural measurements were adapted from the WHO STEPS Instrument for chronic diseases risk factors surveillance that was used for a national survey on health behaviour monitor among Nigerian adult population (Nigeria Heart Foundation (NHF) and Federal Ministry of Health (FMoH), 2003). The instruments were pre-tested in a pilot study among 7 bankers and 10 teachers in one of the banks and schools not selected for the study, the necessary adjustment was effected based on the observations made during the pre-test.

Weight was measured with shoes off to the nearest 0.5 kg using a Seca optimal scale; it was validated with a standard weight and corrected for zero error, the pre- and post-intervention measurements were taken by the same research assistant, to prevent inter-observers' error.

Height was measured without shoes to the nearest 0.5 cm using a stadiometer. Blood pressure was measured using a sphygmomanometer (Dekamet MG3, England) and stethoscope (Littman quality) with all tight clothing and other similar materials removed from the arm and in the sitting position. The first measurement was taken after the participant had rested for at least 10 min in a sitting position with the arm rested on a table such that the middle of the forearm was about the level of the heart. The second measurement was taken at the end of the interview; the mean of the 2 readings was used in the analysis to prevent error due to subject variation. Also the pre-intervention and post-intervention measurements were taken by the same research assistant to prevent inter-observers' error.

Acucheck glucometer was used for blood sugar analysis; capillary whole blood was obtained from the participants early in the morning after an overnight fast. Rayto RT-9200 semi-auto chemistry analyzer (spectrophotometer) was used for analysis of fasting serum total cholesterol.

Intervention phase

The components of the intervention comprised of health communication, moderate exercise schedule and dietary control.

The health communication aspect was to make the participants have a clear understanding of the symptoms and signs, risk factors and prevention of CHD and the anticipated effectiveness of the proposed intervention. It consisted of a lecture session (reinforced with wall mounted information, posters and handbills), held jointly for the intervention group participants. It was held after the collection of baseline data, the lecture on CHD lasted 40 min, while 20 min was given for questions and answers. This was followed by fortnightly discussion sessions in each of the schools. The discussion sessions lasted 30 min per session, they were held during the morning break period in the schools (from 10.00 to 10.30 am). A roster of the discussion days (Mondays, Wednesdays and Fridays) was made and circulated to the participants in the six schools in the intervention group. A group leader was appointed by the participants in each of the schools to facilitate prompt and adequate communication with the participants, and also ensure effective co-ordination of the activities in the respective study centers. The discussion sessions enabled reinforcement of the information communicated at the lecture session and provided an avenue for feedback from the participants on compliance with the moderate scheduled exercise. Complaints were also entertained and addressed as appropriate; those with problems requiring medical attention were referred to the physicians. A telephone line (GSM) was also dedicated for communicating with the participants, especially for complaints that require immediate attention, the GSM numbers of the participants were registered with the identification numbers issued to them during registration at the stage of enrolment into the study.

Moderate scheduled exercise sessions were held 5 days in a week (Mondays to Fridays), comprising of any, or a combination of the following exercises; brisk walking, bicycling, playing football or basketball, running, jogging, swimming and playing tennis or squash. Each exercise session lasted for a minimum of 30 min but not longer than 1 h. Each participant was issued an exercise log book for keeping records of the exercise sessions observed, so as to monitor compliance (since the exercise sessions were held at convenient locations chosen by the participants themselves, in view of religious and socio-cultural factors).

A nutritionist was recruited to coordinate the dietary control aspect of the study, dietary patterns were recommended for the participants (Graffagnino et al., 2006). They were instructed to reduce their calorie intake by reducing the serving size of their meal by between a quarter to half, avoid snacks and fruit juice, and also to desist from taking heavy meals late at night. They were also instructed to replace high calorie foods with vegetables, fruits, whole grains and legumes. Demonstrations were held (during the discussion sessions) on how to measure the serving sizes of the common locally available food items, planning of meals and the appropriate food serving sizes to achieve reduction in calorie intake of about 500 to 1,000 kcal/day less than the usual intake. A weight loss of 1 to 2 pounds (0.45 to 0.91 kg) per week was anticipated.

Data collection at post-intervention phase

Data was collected again at post-intervention (in the intervention

group) and at the end of the study (in the control group). This was done after the completion of the 3 months period of scheduled exercise (5 times in a week), and fortnightly group discussion sessions in the intervention group. The same instruments of data collection used at baseline were used. After the post-intervention data collection, the same intervention offered to the intervention group was also offered to the control group for the benefit of the participants.

Three medical officers, two nurses and three laboratory scientists assisted in data collection after pre-training on the objectives, selection of participants and use of survey instruments. Ethical permission to carry out the study was obtained from the Ethical committee of the Usmanu Danfodiyo University Teaching Hospital Sokoto. Permission to carry out the study in the schools was sought and obtained from Sokoto State Ministry of Education and Ministry of Science and Technology. Informed written consent was obtained from the participants before data collection.

Operational definition of terms

Body mass index (BMI) was calculated as weight (kg) divided by height^2 (m^2) and was used as marker for overweight and obesity (Tsigos et al., 2008). Underweight was defined as BMI less than 18.5 kg/m^2, normal weight was defined as BMI of 18.5 to 24.9 kg/m^2, overweight was defined as BMI of 25.0 to 29.9 kg/m^2, while obesity was defined as BMI of 30.0 kg/m^2 and above. Diabetes mellitus was defined using the World Health Organization criteria (WHO, 1999) as fasting plasma whole glucose ≥6.1 mmol/l (110 mg/dl). Hypercholesterolaemia was defined using the American Heart Association criteria (AHA, 2002) as fasting serum total cholesterol (Tc) ≥5.2 mmol/l (200 mg/dl). Hypertension was defined using the World Health Organization and International Society of Hypertension criteria (WHO and ISH, 2003) as systolic blood pressure (SBP) ≥140 mmHg and/or diastolic blood pressure (DBP) ≥90 mmHg or both or self reported antihypertensive medication during the past 1 week.

Data analysis

Data collation and sorting was done manually. Computer data processing was done using the Statistical Package for Social Sciences (SPSS) version 17 computer statistical software package. Frequency runs were done for further editing and cleansing of the e-data. Frequency distribution tables were constructed; cross tabulations were done to examine relationship between categorical variables. Knowledge of symptoms and signs of CHD was scored on a 9 item scale, while 7 item scales were used for scoring knowledge of risk factors and prevention of CHD. Correct response was scored one and incorrect response or none- response was scored zero. Respondent scoring less than 50% was considered to have poor knowledge while scores of 50% and above were graded as having good knowledge. The independent student's t-test was used for comparison of mean differences between the two groups at pre-intervention. Comparison of the post-intervention data in the two groups was done in order to demonstrate the effect of the intervention program. The Chi-square test was used to compare differences between proportions while the paired student's t-test was used for comparison of mean differences. All statistical analysis was set at 5% level of significance (that is, $p \leq 0.05$).

RESULTS

A total of 216 participants, comprising of 108 participants in the intervention group and 108 participants in the control group, participated in the study at the pre-intervention stage. At the post-intervention stage of data collection, there were 200 participants, comprising of 101 participants in the intervention group and 99 participants in the control group; thus giving an attrition rate of 6.5 and 8.3% for the intervention group and control group, respectively. Most of the participants in both the intervention group (38.0%) and control group (39.8%) were in the 30 to 39 years age group. Majority of the participants in both the intervention group (58.3%), and control group (60.2%), were males. Islam was the predominant religion among the participants in both groups; 63.0 and 69.4% of the participants in the intervention and control groups, respectively, were Muslims. Majority of the participants in both the intervention group (68.5%) and control group (67.6%), had university education, only a few of the participants in both groups graduated from either the college of education or polytechnic. There was no statistically significant difference between the two groups in any of the socio-demographic variables as shown in Table 1.

Impact of intervention on participants' knowledge of symptoms and signs of CHD

The impact of intervention on the knowledge of symptoms and signs of CHD that was assessed at pre-intervention is shown in Table 2. The proportion of participants with good knowledge of the signs and symptoms of CHD increased tremendously among the intervention group participants from 34 (31.5%) of the 108 participants at the pre-intervention stage to 81 (80.2%) of the 101 participants at the post-intervention stage and the difference was statistically significant (χ^2 = 50.052, $p < 0.001$). Among the control group participants, there was a slight increase in the proportion of participants with good knowledge of the symptoms and signs of CHD from 28 (25.9%) of the 108 participants at the beginning of study to 28 (28.3%) of the 99 participants at the end of study, but the difference was not statistically significant (χ^2 = 0.145, $p = 0.703$). Whereas, there was tremendous and statistically significant ($p < 0.001$) increase in the proportion of participants that knew the various symptoms and signs of CHD at the post-intervention stage compared to the pre-intervention stage among the intervention group participants, no statistically significant increase in knowledge of any of the symptoms and signs of CHD was observed at the end of study compared to the beginning of study among the control group participants (p values ranged from 0.596 to 0.994).

Impact of intervention on participants' knowledge of risk factors of CHD

Among the intervention group participants an appreciable and statistically significant increase was recorded in both the proportion of participants with good knowledge of the risk factors of CHD from 49 (45.4%) of the 108 participants

Table 1. Socio-demographic profile of participants.

Variable	Intervention group [N=108 (%)]	Control group [N=108 (%)]	p- value
Age groups (years)			
20 - 29	36 (33.3)	35 (32.4)	
30 - 39	41 (38.0)	43 (39.8)	$\chi^2 = 0.215$
40 - 49	24 (22.2)	22 (20.4)	p = 0.975
50 - 59	7 (6.5)	8 (7.4)	
Sex			
Male	63 (58.3)	65 (60.2)	$\chi^2 = 0.077$
Female	45 (41.7)	43 (39.8)	p = 0.445
Marital status			
Single	32 (29.6)	44 (40.7)	$\chi^2 = 2.923$
Married	76 (70.4)	64 (59.3)	p = 0.058
Religion			
Islam	68 (63.0)	75 (69.4)	$\chi^2 = 1.014$
Christianity	40 (37.0)	33 (30.6)	p = 0.194
Educational status			
College of education	17 (15.7)	21 (19.4)	
Polytechnic	17 (15.7)	14 (13.0)	$\chi^2 = 0.718$
University	74 (68.5)	73 (67.6)	p = 0.698

Table 2. Impact of intervention on participants' knowledge of symptoms and signs of CHD.

Variable	Response	Intervention group		Control group	
		Pre-intervention [N= 108 (%)]	Post-intervention [N= 101 (%)]	Beginning of study [N=108 (%)]	End of study [N= 99 (%)]
Knowledge grading					
Good knowledge	-	34 (31.5)	81 (80.2)*	28 (25.9)	28 (28.3)
Poor knowledge	-	74 (68.5)	20 (19.8)	80 (74.1)	71 (71.7)
Symptoms and signs of CHD					
Chest pain after doing some work but goes after rest	Yes	33 (30.6)	78 (75.2)*****	30 (27.8)	28 (28.3)
	No	7 (6.5)	3 (3.0)	8 (7.4)	7 (7.1)
	Don't know	68 (63.0)	22 (21.8)	70 (64.8)	64 (64.6)
Chest pain that radiates to neck, shoulder and arm	Yes	28 (25.9)	83 (87.4)*****	31 (28.7)	33 (33.3)
	No	7 (6.5)	7 (7.1)	5 (4.6)	4 (4.0)
	Don't know	73 (67.6)	5 (5.3)	72 (66.7)	62 (62.6)
Chest tightness or shortness of breath after doing some work	Yes	40 (37.0)	72 (71.3)*****	34 (31.5)	33 (33.3)
	No	9 (8.3)	5 (5.0)	10 (9.3)	7 (7.1)
	Don't know	59 (54.6)	24 (23.8)	64 (59.3)	59 (59.6)
Feeling of tiredness quickly, after a little work or even without doing any work	Yes	30 (27.8)	68 (67.3)*****	28 (25.9)	29 (29.3)
	No	12 (11.1)	4 (4.0)	9 (8.3)	5 (5.1)
	Don't know	66 (61.1)	29 (28.7)	71 (65.7)	65 (65.7)
Sudden death	Yes	44 (40.7)	85 (84.2)*****	35 (32.4)	36 (36.4)
	No	4 (3.7)	3 (3.0)	7 (6.5)	4 (4.0)
	Don't know	60 (55.6)	13 (12.9)	66 (61.1)	59 (59.6)

*****Statistically significant ($p < 0.05$)

Table 3. Impact of intervention on participants' knowledge of risk factors of CHD.

Variable	Response	Intervention group		Control group	
		Pre-intervention [N= 108 (%)]	Post-intervention [N= 101 (%)]	Beginning of study [N=108 (%)]	End of study [N= 99 (%)]
Knowledge grading					
Good knowledge	-	49 (45.4)	98 (97.0)*	45 (41.7)	48 (48.5)
Poor knowledge	-	59 (54.6)	3 (3.0)	63 (58.3)	51 (51.5)
Risk factors of CHD					
As age increases	Yes	37 (34.3)	76 (75.2)*	36 (33.3)	32 (32.3)
	No	8 (7.4)	12 (11.9)	15 (13.9)	14 (14.1)
	Don't know	63 (58.3)	13 (12.9)	57 (52.8)	53 (53.5)
Lack of physical activity	Yes	41 (38.0)	90 (89.1)*	36 (33.3)	34 (34.3)
	No	8 (7.4)	4 (4.0)	14 (13.0)	18 (18.2)
	Don't know	59 (54.6)	7 (6.9)	58 (53.7)	47 (47.5)
Overweight/Obesity	Yes	43 (39.8)	92 (91.1)*	48 (44.4)	49 (49.5)
	No	7 (6.5)	5 (5.0)	7 (6.5)	7 (7.1)
	Don't know	58 (53.7)	4 (4.0)	53 (49.1)	43 (43.4)
Smoking tobacco (cigarette)	Yes	42 (38.9)	89 (88.1)*	46 (42.6)	45 (45.5)
	No	8 (7.4)	6 (5.9)	7 (6.5)	4 (4.0)
	Don't know	58 (53.7)	6 (5.9)	55 (50.9)	50 (50.5)
Hypertension	Yes	49 (45.4)	91 (90.1)*	43 (39.8)	62 (62.6)*
	No	7 (6.5)	5 (5.0)	9 (8.3)	5 (5.1)
	Don't know	52 (48.1)	5 (5.0)	56 (51.9)	32 (32.3)
Diabetes mellitus	Yes	38 (35.2)	92 (91.1)*	37 (34.3)	66 (66.7)*
	No	10 (9.3)	4 (4.0)	7 (6.5)	10 (10.1)
	Don't know	60 (55.6)	5 (5.0)	64 (59.3)	23 (23.2)
Eating foods containing too much fat	Yes	40 (37.0)	84 (83.2)*	45 (41.7)	52 (52.5)
	No	9 (8.3)	5 (5.0)	7 (6.5)	4 (4.0)
	Don't know	59 (54.6	12 (11.9)	56 (51.9)	43 (43.4)

*Statistically significant ($p < 0.05$).

participants at the pre-intervention stage to 98 (97.0%) of the 101 participants at the post-intervention stage (χ^2 = 66.754, $p < 0.001$), and the proportion of participants that knew all the risk factors of CHD.

Among the control group participants, even though there was statistically significant increase in the proportion of participants that knew diabetes mellitus and hypertension as risk factors of CHD from 37 (34.3%) to 66 (66.7%), and 43 (39.8%) to 62 (62.6%), respectively, the marginal increase in the proportion of participants with good knowledge of the risk factors of CHD from 45 (41.7%) of the 108 participants at the beginning of study to 48 (48.5%) of the 99 participants at the end of study was not statistically significant ($p = 0.325$) as shown in Table 3.

Impact of intervention on participants' knowledge of CHD prevention

The impact of intervention on the knowledge of CHD prevention that was assessed at pre-intervention is shown in Table 4. A statistically significant increase (χ^2 = 44.053, $p < 0.001$) was observed in both the proportion of participants with good knowledge of prevention of CHD among the intervention group participants from 51 (47.2%) of the 108 participants at the pre-intervention stage to 91 (90.1%) of the 101 participants at the post-intervention stage, and the proportion of participants that knew the ways of preventing the risk factors of CHD ($p < 0.001$).

Among the control group participants, although there

Table 4. Impact of intervention on participants' knowledge of CHD prevention.

Variable	Response	Intervention group		Control group	
		Pre-intervention [N= 108 (%)]	Post-intervention [N= 101 (%)]	Beginning of study [N=108 (%)]	End of study [N= 99 (%)]
Knowledge grading					
Good knowledge		51 (47.2)	91 (90.1)*	46 (42.6)	48 (48.5)
Poor knowledge		57 (52.8)	10 (9.9)	62 (57.4)	51 (51.5)
Prevention of CHD					
Engage in regular physical exercise	Yes	49 (45.4)	84 (83.2)*****	46 (42.6)	49 (49.5)
	No	8 (7.4)	6 (5.9)	6 (5.6)	8 (8.1)
	Don't know	51 (47.2)	11 (10.9)	56 (51.9)	42 (42.4)
Lose weight	Yes	46 (42.6)	83 (82.2)*****	43 (39.8)	51 (51.5)
	No	6 (5.6)	13 (12.9)	7 (6.5)	9 (9.1)
	Don't know	56 (51.9)	5 (5.0)	58 (53.7)	39 (39.4)
Avoid or quit smoking	Yes	48 (44.4)	81 (80.2)*****	45 (41.7)	44 (44.4)
	No	14 (13.0)	14 (13.9)	16 (14.8)	20 (20.2)
	Don't know	46 (42.6)	6 (5.9)	47 (43.5)	35 (35.4)
Ensure appropriate treatment of hypertension	Yes	41 (38.0)	86 (85.1)*****	43 (39.8)	60 (60.6)*****
	No	20 (18.5)	11 (10.9)	15 (13.9)	12 (12.1)
	Don't know	47 (43.5)	4 (4.0)	50 (46.3)	27 (27.3)
Ensure appropriate treatment of diabetes mellitus	Yes	45 (41.7)	85 (84.2)*****	48 (44.4)	65 (65.7)*****
	No	9 (8.3)	10 (9.9)	5 (4.6)	7 (7.1)
	Don't know	54 (50.0)	6 (5.9)	55 (50.9)	27 (27.3)
Reduce consumption of fatty foods	Yes	47 (43.5)	73 (72.3)*****	49 (45.4)	47 (47.5)
	No	5 (4.6)	13 (12.9)	11 (10.2)	14 (14.1)
	Don't know	56 (51.9)	15 (14.9)	48 (44.4)	38 (38.4)
Eat fruits and vegetables regularly	Yes	43 (39.8)	70 (69.3)*****	45 (41.7)	43 (43.4)
	No	10 (9.3)	9 (8.9)	6 (5.6)	9 (9.1)
	Don't know	55 (50.9)	22 (21.8)	57 (52.8)	47 (47.5)

*****Statistically significant ($p < 0.05$).

was statistically significant increase (p values range from 0.002 to 0.008) in the proportion of participants that knew ensuring appropriate treatment for hypertension and diabetes mellitus as ways of preventing CHD from 43 (39.8%) to 60 (60.6%) and 48 (44.4%) to 65 (65.7%), respectively, the marginal increase observed in the proportion of participants with good knowledge of CHD prevention from 46 (42.6%) of the 108 participants at the beginning of study to 48 (48.5%) of the 99 participants at the end of study was not statistically significant (χ^2 = 0.723, p = 0.395).

Impact of intervention on the prevalence of hypertension, diabetes mellitus and hypercholesterolaemia among participants

Among the intervention group participants, a statistically significant decrease in the systolic blood pressure at the post-intervention stage compared to the pre-intervention stage was recorded (Mean decrease = 2.87 mmHg, standard deviation (SD) = 9.20); t = 3.136, p = 0.002. The decrease recorded in the diastolic blood pressure was also statistically significant (Mean decrease = 1.49 mmHg, SD = 5.90); t = 2.531, p = 0.013. Among the control group participants, there was no statistically significant reduction at the end of the study compared to the beginning of the study in the systolic blood pressure (Mean decrease = 0.30 mmHg, SD = 2.24); t = 1.347, p = 0.181. Similarly, the decrease recorded in the diastolic blood pressure was not statistically significant (Mean decrease = 0.26 mmHg, SD = 1.50); t = 1.747, p = 0.084. A statistically significant decrease in the prevalence of hypertension was recorded at the post-intervention stage compared to the pre-intervention stage among the intervention group participants from 29.6 to 17.8% (χ^2 =

Table 5. Impact of intervention on the prevalence of hypertension, diabetes mellitus and hypercholesterolaemia among participants.

Variable	Measure	Intervention group		Control group	
		Pre-intervention [N= 108 (%)]	Post-intervention [N= 101 (%)]	Beginning of study [N = 108]	End of study [N = 99]
Blood pressure (mmHg)					
Systolic BP	Mean systolic BP Decrease in mean systolic BP	115.84 ± 18.73 2.87 ± 9.20*	112.97 ± 16.74	113.64±16.33 0.30 ± 2.24	113.33 ± 15.32
Diastolic BP (DBP)	Mean diastolic BP Decrease in mean diastolic BP	78.02 ± 11.54 1.49 ± 5.90*	76.54 ± 9.72	77.88 ±13.56 0.26 ± 1.50	77.62 ± 11.33
BP status					
Normal BP	-	76 (70.4)	83 (82,2)	84 (77.8)	80 (80.8)
Hypertensive	-	32 (29.6)	18 (17.8)*	24 (22.2)	19 (19.2)
Fasting blood sugar (mg/dl)	Mean fasting blood sugar Decrease in mean fasting blood sugar	85.13 ± 43.71 6.69 ± 10.38*	78.44 ± 18.67	85.48 ± 33.98 1.80 ± 9.10	83.68 ± 23.92
Blood sugar status					
Normal	-	97 (89.8)	98 (97.0)	95 (88.0)	91 (92.9)
Diabetic	-	11 (10.2)	3 (3.0)*	13 (12.0)	7 (7.1)
Fasting blood cholesterol (mg/dl)	Mean fasting blood cholesterol Decrease in mean fasting blood cholesterol	185.23 ± 31.68 12.71 ± 19.54*	172.52 ± 24.92	183.76 ± 38.16 5.17 ± 13.42*	178.59 ± 36.50
Blood cholesterol status					
Normal	-	11 (10.2)	32 (31.7)	12 (11.1)	18 (18.2)
Borderline high	-	65 (60.2)	55 (54.5)	62 (57.4)	57 (57.6)
High	-	32 (29.6)	14 (13.9)*	34 (31.5)	24 (24.7)

*Statistically significant ($p < 0.05$).

3.998, p = 0.046). The decrease recorded in the prevalence of hypertension at the end of study compared to the beginning of study among the control group participants from 22.2 to 19.2% was not statistically significant ($\chi^2 = 0.288$, p = 0.591).

A statistically significant reduction in the fasting blood sugar was recorded among the intervention group participants (Mean decrease = 6.69 mg/dl, SD = 10.38); t = 6.530, $p < 0.001$. There was also a statistically significant decrease in the prevalence of diabetes mellitus among them from 10.2% at pre-intervention to 3.0% at post-intervention ($\chi^2 = 4.347$, p = 0.037). The decrease recorded in the fasting blood sugar level of the control group participants at the end of study compared to the beginning of study was not statistically significant (Mean decrease = 1.80 mg/dl, SD = 9.10); t = 1.967, p = 0.052. The decrease recorded in the prevalence of diabetes mellitus among the control group participants from 12.0% at the beginning of study to 7.1% at the end

Table 6. Impact of intervention on participants' lifestyle and prevalence of overweight and obesity.

Variable	Response/Measure	Intervention group		Control group	
		Pre-intervention [N= 108 (%)]	Post-intervention [N= 101 (%)]	Beginning of study [N = 108]	End of study [N = 99]
Engage in moderate leisure exercise	Yes	49 (45.4)	90 (89.1)*	61 (56.5)	65 (66.3)
	No	59 (54.6)	11 (10.9)	47 (43.5)	33 (33.7)
Physical activity status	Active	85 (78.7)	94 (93.1)	100 (92.6)	97 (98.0)
	Inactive	23 (21.3)	7 (6.9)*	8 (7.4)	2 (2.0)
Currently smoke cigarette	Yes	4 (3.7)	3 (3.0)*	6 (5.6)	5 (5.1)
	No	104 (96.3)	98 (97.0)	103 (94.4)	94 (94.9)
Eat fatty foods	Yes	74 (68.5)	32 (31.7)*	78 (72.2)	70 (70.7)
	No	34 (31.5)	68 (68.3)	30 (27.8)	29 (29.3)
Drank alcohol in the past 30 days	Yes	11 (10.2)	3 (3.0)*	11 (10.2)	8 (8.1)
	No	97 (89.8)	98 (97.0)	97 (89.8)	91 (91.9)
Weight (kg)	Mean weight	68.65 ± 17.62		72.72 ± 12.28	
	Decrease in mean weight	1.01 ± 2.61*	67.64 ± 16.55	nil	73.33 ± 12.11
	Increase in mean weight	nil		0.61 ± 3.08	
Weight category					
Underweight/normal weight	-	63 (58.3)	61 (60.4)	60 (55.6)	55 (56.1)
Overweight	-	31 (28.7)	29 (28.7)	21 (19.4)	18 (18.4)
Obese	-	14 (13.0)	11 (10.9)	27 (25.0)	25 (25.5)

*Statistically significant ($p < 0.05$).

end of study was also not statistically significant (χ^2 = 0.236, p = 1.404).

Among the intervention group participants, a statistically significant decrease in the fasting blood cholesterol at the post-intervention stage compared to the pre-intervention stage was recorded (Mean decrease = 12.71 mg/dl, SD = 19.54); t = 6.540, $p < 0.001$. A statistically significant decrease in the prevalence of hypercholesterolaemia was recorded from 29.6% at pre-intervention to 13.9% at post-intervention (χ^2 = 17.818, $p < 0.001$). Among the control group participants, a statistically significant decrease at the end of study compared to the beginning of study in the fasting blood cholesterol level was also recorded (Mean decrease = 5.17 mg/dl, SD = 13.42); t = 3.834, $p < 0.001$. The decrease recorded in the prevalence of hypercholesterolaemia from 31.5% at the beginning of study to 24.7% at the end of study was not statistically significant (χ^2 = 2.748, p = 0.253) as shown in Table 5.

Impact of intervention on participants' lifestyle and prevalence of overweight and obesity

The impact of intervention on participants' lifestyle and the prevalence of overweight and obesity at post-intervention compared to pre-intervention is shown in Table 6. The proportion of participants that routinely engage in moderate leisure exercise increased among the intervention group participants from 49 (45.4%) of the 108 participants at the pre-intervention stage, to 90 (89.1%) of the 101 participants at the post-intervention stage, and the increase was found to be statistically significant (χ^2 = 44.824, $p < 0.001$). There was a statistically significant decrease in the proportion of participants that do not routinely engage in any form of physical activity (sedentary lifestyle) from 23 (21.3%) of the 108 participants at pre-intervention to 7 (6.9%) of the 101 participants at post-intervention (χ^2 = 8.761, p = 0.003). Among the control group participants, the slight increase that was observed in the proportion of participants that routinely engage in moderate leisure exercise, from 61 (56.5%) of the 108 participants at the beginning of study to 65 (66.3%) of the 99 participants at the end of study, was not statistically significant (χ^2 = 2.096, p = 0.148). The decrease that was recorded in the proportion of participants that do not routinely engage in any form of physical activity from 8 (7.4%) of the 108 participants at the beginning of study to 2 (2.0%) of the 99 participants at

the end of study was also not statistically significant (χ^2 = 3.261, p = 0.071).

The proportion of participants that currently smoke cigarette decreased from 4 (3.7%) of the 108 participants at pre-intervention to 3 (3.0%) of the 101 participants at post-intervention, among the intervention group participants, but the difference was not statistically significant (χ^2 = 0.087, p = 0.768). Similarly, the decrease recorded in the proportion of participants that currently smoke cigarette among the control group participants from 6 (5.6%) of the 108 participants at the beginning of study to 5 (5.1%) of the 99 participants at the end of study was not statistically significant (χ^2 = 0.026, p = 0.871).

Among the intervention group participants, there was a statistically significant decrease in the proportion of participants that eat fatty foods from 74 (68.5%) of the 108 participants at pre-intervention to 32 (31.7%) of the 101 participants at post-intervention (χ^2 = 28.332, p < 0.001). Among the control group participants, the slight decrease in the proportion of participants that eat fatty foods from 78 (72.2%) of the 108 participants at the beginning of study to 70 (70.7%) of the 99 participants at the end of study was not statistically significant (χ^2 = 0.050, p = 0.808).

Among the intervention group participants, there was a statistically significant decrease in the proportion of participants that drank alcohol in the past 30 days, from 11 (10.2%) of the 108 participants at pre-intervention to 3 (3.0%) of the 101 participants at post-intervention (χ^2 = 4.347, p = 0.037). Among the control group participants, the decrease in the proportion of participants that drank alcohol in the past 30 days, from 11 (10.2%) of the 108 participants at the beginning of study to 8 (8.1%) of the 99 participants at the end of study was not statistically significant (χ^2 = 0.274, p = 0.600).

The intervention group participants recorded a statistically significant reduction in mean weight from 68.65 kg at the pre-intervention stage to 67.64 kg at the post-intervention stage (Mean weight loss = 1.01 kg, SD = 2.61); t = 3.895, p < 0.001. The proportion of participants with overweight remained constant at 28.7% both at pre-intervention and post-intervention, while the proportion of obese participants decreased from 14 (13.0%) of the 108 participants at pre-intervention to 11 (10.9%) of the 101 participants at post-intervention, but the difference was not statistically significant (χ^2 = 0.225, p = 0.894). Among the control group participants, no reduction in mean weight was recorded, the mean weight increased from 72.73 kg at the beginning of study to 73.33 kg at the end of study, but the increase was not statistically significant (Mean weight increase = 0.61 kg, SD = 3.08); t = 1.965, p = 0.053. The proportion of participants with overweight decreased from 21 (19.4%) of the 108 participants at the beginning of study, to 18 (18.4%) of the 99 participants at the end of study, while the proportion of obese participants increased marginally from 27 (25.0%) of the 108 participants at the beginning of study to 25 (25.5%) of the 99 participants at the end of study, and the difference recorded was not statistically significant (χ^2 = 0.040, p = 0.980).

Among the female participants in the intervention group, a slight decrease was recorded in the proportion of participants that reported use of oral contraceptives in the past 1 month from 6 (13.3%) of the 45 participants at pre-intervention to 5 (12.5%) of the 40 participants at post-intervention. The decrease recorded was not statistically significant (χ^2 = 0.013, p = 0.909).

A marginal increase was recorded in the proportion of participants that reported use of oral contraceptives in the past 1 month among the female participants in the control group, from 4 (9.3%) of the 43 participants at the beginning of study to 4 (9.5%) of the 42 participants at the end of study. The increase was also not statistically significant (χ^2 = 0.001, p = 0.972).

DISCUSSION

The intervention group participants recorded statistically significant increase in the proportion of participants with good knowledge of symptoms and signs, risk factors and prevention of CHD at post-intervention compared to pre-intervention; but such a uniform pattern was not observed among the control group participants. Whereas, there was statistically significant (p < 0.001) increase in the proportion of participants that knew the various symptoms and signs, risk factors and prevention of CHD at post-intervention compared to pre-intervention, among the intervention group participants, such a uniform pattern was not observed among the control group participants. However, a statistically significant increase in the proportion of participants that knew diabetes mellitus (p < 0.001) and hypertension (p = 0.005) as risk factors of CHD was recorded at the end of study compared to the beginning of study among the control group participants. A statistically significant increase was also recorded in the proportion of participants that knew appropriate treatment of diabetes (p = 0.002) and hypertension (p = 0.008) as prevention for CHD at the end of study compared to the beginning of study among the control group participants. This could be due to the fact that the study being a screening test, generated awareness about the disease among the control group participants. In addition, participants with abnormal test results among the control group, particularly those that were referred to physicians for treatment, probably obtained information about the risk factors and prevention of the disease from the hospital and other sources, considering the fact that an abnormal test result could have influenced their perception of vulnerability to the disease. The findings in this study are in concordance with the findings in a study by Huang et al. (2002) that reported improvement in health promotion knowledge and behaviors following a health promotion education program among the elderly in the community, and another study by Kirk-Kirk-Gardner and

Steven, (2003) that reported improved knowledge and reduced risk behaviors in a community based program on heart health promotion among healthy adults over a period of 3 months, it has also revealed that education programs are effective in improving health promotion knowledge and behaviors.

The statistically significant increases recorded in the proportion of participants with good knowledge of hypertension and diabetes mellitus in both the intervention and control groups in this study unequivocally demonstrates the potential of a screening interventional program like this in generating awareness about these diseases in the general population. This is of immense public health significance as it elucidates the implications of the non-inclusion of screening for hypertension and diabetes mellitus in the periodic Nigeria Demographic and Health Surveys (NDHS), despite the high prevalence of the diseases in the country (National Population Commission (NPC) and ICF Macro, 2009).

The statistically significant decrease that was recorded in the prevalence of hypertension among the intervention group participants from 29.6% at pre-intervention down to 17.8% at post-intervention ($p = 0.046$) was probably due to the medications the participants with hypertension that were referred to the physicians received and improved compliance with their medications following the health communication aspect of the intervention. The findings in this study are similar to those in a study by Steven et al. (2001) that reported significant reductions in blood pressure after multifaceted physical activity interventions among men and women aged 30 to 54 years in 6 months.

Similarly, a statistically significant decrease ($p = 0.037$) was observed in the prevalence of diabetes mellitus at the post-intervention stage compared to the pre-intervention stage among the intervention group participants in contrast to the control group participants. This is in concordance with the findings in a study by Castaneda et al. (2002) that reported reduced plasma glycosylated hemoglobin, increased muscle glycogen and reduction in the dose of prescribed diabetic medications among intervention group participants in a randomized controlled trial of resistance exercise training to improve glycemic control in older adults with type 2 diabetes. Interventions incorporating physical activity, diet, or a combination of both have been documented to reduce progression to diabetes and reverse existing diabetes (Greaves et al., 2011).

A statistically significant decrease ($p < 0.001$) was also observed in the prevalence of hypercholesterolemia at the post-intervention stage compared to the pre-intervention stage among the intervention group participants in contrast to the control group participants. Similar to the findings in this study, Metz et al. (2000) also reported significant decreases in total cholesterol and triglycerides levels with diet interventions among persons with hypertension and dyslipidaemia.

A statistically significant reduction (p values range from < 0.001 to 0.037) in CHD related lifestyles such as physical inactivity, alcohol ingestion and consumption of fatty foods was recorded among the intervention group participants in contrast to the control group participants in this study. The slight decrease recorded in the proportion of participants that currently smoke cigarette, and the female participants that reported use of oral contraceptives in the past 1 month at the post-intervention stage compared to the pre-intervention stage, in both groups, could be due to the low prevalence of these CHD related lifestyles among them. The behavioral change observed among the intervention group participants compared to the control group participants in this study, supports the submissions of previous studies (Bayne-Smith et al., 2004; Eshar et al., 2010; Homko et al., 2006) on the significance of knowledge of modifiable risk factors of CHD as a key component of behavioral change decision making, in addition to providing cues for action.

A statistically significant ($p < 0.001$) reduction in mean weight was recorded among the intervention group participants, at the post-intervention stage compared to the pre-intervention stage, with a mean weight reduction of 1.0 kg in 3 months. No weight reduction was recorded among the control group participants, but the slight increase in mean weight (mean weight gain of 0.6 kg) that was recorded at the end of study compared to the beginning of study among the control group participants was not statistically significant ($p = 0.053$). The findings in this study agree with the findings in a primary care intervention program among obese adults with CHD risk factors by Read et al. (2004) that reported a statistically significant mean weight reduction of 3.1 kg over the same period of 3 months. The higher mean weight reduction recorded in the study among the obese adults could be due to the fact that the exercise sessions were held jointly in the health facilities, thus making ascertainment of compliance more feasible; in contrast to the situation in this study whereby the participants observed the exercise sessions individually at home due to the challenges posed by religious and socio-cultural factors. This highlights the need for further research in developing intervention programs compatible with religious and socio-cultural background across Nigeria.

Conclusion

Poor baseline knowledge of CHD and high prevalence of its risk factors among teachers in Sokoto was demonstrated in this study. Intervention made significant impact in improving knowledge of CHD and reducing the prevalence of its risk factors among the intervention group participants. Behavioral change communication and health promotion activities to enhance smoking cessation, regular moderate exercise, healthy diet, and reduce alcohol use, should be put in place in homes and workplaces.

LIMITATIONS TO THE STUDY

The study involved collection of blood samples for biochemical analysis and measurement of blood pressure and anthropometry, it was therefore more of a multi-phasic screening test. The results were communicated to the participants as demanded by them, and those with abnormal results that require treatment were referred to the physicians. Those with abnormal test results (especially those that were referred to the physicians) among the control group participants could seek for information about the disease from the healthcare providers and other sources. Those that were referred to the physicians could receive counseling on CHD related behavioral modifications in the course of their treatment. These could distort the pattern of knowledge, CHD related risk behavior, and prevalence of CHD risk factors among the control group participants. The exercise sessions were observed individually at home due to the challenges posed by religious and socio-cultural factors, ascertainment of compliance was therefore difficult.

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