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INFECTION PREVENTION AND CONTROL PRACTICE: COMPLIANCE AMONG HEALTHCARE WORKERS IN NIGERIA DURING COVID-19

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Received: 19/3/2024; accepted for publication 21/8/2024

ABSTRACT

Background: The COVID-19 infection has become a global pandemic and received attention worldwide with varying consequences of death or ill-health among Health Care Workers (HCWs). As a result of COVID-19, infection prevention and control (IPC) practices have been identified to play a concrete role in combating the spread of COVID-19 globally. Infection prevention and control (IPC) programs that are well-planned and carefully implemented have been shown to reduce illness, reduce hospital stays, prevent death, and save money.

Aim: This study aimed to investigate compliance with IPC practice among HCWs in Nigeria.

Methods: The study adopted a cross-sectional design that used a self-administered paper-based questionnaire. Seventy-eight (78) HCWs workers from different disciplines in different healthcare centres participated across Nigeria. A convenience sampling technique was used. Descriptive statistics of percentages and descriptive statistics were used to present the results.

Results: more than half of the participants 44 (56.4%), were medical doctors with the majority of respondents' ages ranging between 25 and 34 years. All the respondents indicated 100% compliance with handwashing practices during the period of COVID-19. Only 65 (83.2%) wear surgical/N95 masks during patient contact while 51 (65.3%) ensure the maintenance of social/physical distancing during working hours.

Conclusion: This study revealed that the HCWs in Nigeria have a relatively good compliance rate to IPC practice indicating they are better positioned to combat outbreaks.

Keywords: *Infection Prevention and Control (IPC), Practice, Compliance, COVID-19*

INTRODUCTION

The COVID-19 infection has become a global pandemic and received attention worldwide[1,2]. The pandemic caused by COVID-19 has spread to virtually all countries globally with exponential growth among developed and developing countries[2]. There has also been a steady increase in the number of healthcare workers (HCWs) deaths globally. Worldwide, the workplace is responsible for about 40% of infections among Healthcare Workers, and Healthcare settings present an easy location for HCWs to contract and transmit SARS-Cov-2[3]. To this end, infection prevention and control (IPC) practices have been identified to play a concrete role in combatting the spread of COVID-19 globally[2]. Adherence to IPC practices plays a pivotal role in HCWs' safety with an extended effect on patient protection and also the care environment[4]. The IPC was recognized as one of the many actions to be taken by countries in their preparedness and readiness towards mitigating the spread of SARS-CoV-2 thereby reducing the mortality and morbidity of COVID-19 among the population[2]. As many people were hospitalized, IPC practices played a pivotal role in combatting the spread of SARS-CoV-2 in the healthcare setting and among HCWs[5]. The provision of high-quality healthcare is significantly impacted by the health of healthcare professionals during the COVID-19 pandemic. In addition, HCWs are highly susceptible to SARS-CoV-2 and could easily be a target for onward transmission of COVID-19[6]. The work of Pappas et al.[7] explained that high infection rates among HCWs had mental and social effects such as discrimination, depression, stigmatization, loss, and anxiety.

Worldwide, the precautionary measures to stop the COVID-19 virus from spreading which included social /physical distancing, the practice of hand hygiene, and the use of medical masks and personal protective equipment (PPE) have been successfully implemented[8]. The WHO designated the COVID-19 pandemic as a public health emergency of international concern in January 2020 and thereafter outlined public health measures to combat its spread and to guide countries in their plans and strategies[9,10,11]. Thus, IPC was recognized as a pivotal measure taken by countries globally and locally in response to the pandemic[2]. Considering the significance and high burden of communicable diseases such as the annual outbreak of Lassa fever, an outbreak of Ebola in 2014, and the re-occurrence of monkeypox since 2017, these events have better positioned and equipped Nigeria with the needed experience in preparation and response to outbreaks[10,12]. IPC has been given priority as it is important in the strengthening of various health systems and response to outbreaks. Nigeria's experiences with previous outbreaks have led to the development of protocols and training of staff on IPC practices, with IPC structures, policies, programmes, and guidelines in place[11].

Given the lack of critical care beds in many areas of Africa, death rates among African healthcare workers who contract COVID-19 may be high[12]. The present threat of COVID-19 affects both the healthcare workers especially those on the frontline and also their family members[13]. Increased risk of COVID-19 among healthcare workers such as nurses, medical doctors, physiotherapists, and dentists may be associated with factors such as proximity to patients[14]. Additionally, due to their greater aerosol volume generation, some procedures, such as non-invasive ventilation, high-flow nasal cannula, and bag-mask ventilation, have been linked to an increased risk of COVID-19 infection[15]. Infection prevention and control (IPC) programmes that are well-planned and carefully implemented have been shown to reduce illness, reduce hospital stays, prevent death, and save money[16]. This study aimed to survey compliance with IPC practice among HCWs in Nigeria.

MATERIALS AND METHODS

Study tool and data collection

A cross-sectional study was undertaken among healthcare workers in Nigeria. Ethical approval was also sought and obtained. A self-administered survey questionnaire was distributed via WhatsApp as a Google form link. The study was explained to the respondents through the attached statements on the Google form and consent was sought and obtained. The study recruited those who were willing to participate by distributing the links to the google form to various WhatsApp Healthcare Groups the researchers belonged. All the respondents were asked to fill out a questionnaire on "IPC practices following COVID-19 and barriers to compliance with the IPC practices among Healthcare workers" by Jamie[17] which was adapted and utilized. Section 1 collected participants' socio-demographic data and their practice of handwashing before and during the period of COVID-19 as well as the availability of guidelines or protocols for caring for patients with COVID-19. Section 2 describes their level of compliance with IPC practices such as hand hygiene, face mask use, and physical and social distancing following COVID-19. The section consists of 13 questions that examined hand hygiene immediately on arrival at the workplace, before donning gloves, after taking them off, after touching blood, body fluids, or secretions,

before making contact with patients, between patients, after making contact with patients without gloves, before a procedure, after a procedure, after a day at work, and while wearing a surgical/N95 mask while treating patients, maintaining social and physical distance during patient contact, and lastly maintaining social/physical distance during working hours with colleagues. Data was downloaded from the google form data collection platform via Microsoft Excel and All statistical analyses were conducted using the SPSS package version 25.

RESULTS

A total of seventy-eight healthcare workers from different disciplines in different healthcare centres were recruited into the study. The majority of the respondents 47 (60.3%) were women, and the majority (85.9%) of the respondents were between the ages of 25 and 34. A total of fifty-three (69.2%) respondents had between one to five years of practice and a total of 17 (21.8%) had between six to ten years of practice. Most of the respondents work in government and private hospitals with an equal percentage of 37 (47.4%) respondents while 4 (5.1%) of respondents work for non-governmental organizations (NGOs). Most of the respondents 44 (56.4%) were medical doctors, 17 (21.8%) were physiotherapists, and 4 (5.1%) were nurses. The majority of the respondents (46.2%) work in the Federal Capital Territory. All the respondents indicated they practiced hand washing during the period of COVID-19 while 65 (83.3%) respondents surveyed said that hand washing was a component of the organizational culture before the advent of COVID-19. During the period of COVID-19, a total of 61 (78.2%) of respondents indicated the presence of a COVID-19 guideline or protocol. See Table 1

Fifteen (19.2%) of respondents indicated that they do not perform hand hygiene at work on arrival. Forty-nine (62.8%) of respondents showed that they practice hand hygiene before donning gloves. All the respondents indicated they promptly practice hand hygiene after the removal of gloves and after touching blood, body fluids, or any type of bodily secretions. Sixteen (20.5%) respondents indicated that they do not perform hand hygiene before contact with patients. Seventy (89.8%) respondents reported that they perform hand hygiene before touching each patient. All the respondents indicated they do practice hand hygiene after contact with a patient. All respondents perform hand hygiene after a procedure, and seventy respondents (89.7%) said they do so before a procedure. After the close of work, seventy-seven (98.7%) of the respondents showed that they perform hand hygiene. Fifteen (16.6%) of the respondents do not wear medical face masks during patient contact. Twelve (15.4%) indicated that they maintain social/physical distancing while treating patients. Fifty-one (65.3%) respondents showed that they do maintain social/physical distancing during working hours with colleagues. See Table 2.

Table 1: Respondents' Socio-demographic characteristics

	Variable	Frequency	Percentage (%)
Gender	Male	31	39.7
	Female		60.3
Age	< 25	3	3.8
	25 – 34	7	9.0
	≥ 45	1	1.3
Years of practice	< 1	3	3.8
	1 – 5	54	69.2
	6 – 10	17	21.8
	> 10	4	5.1
Profession	Medical Doctors	44	56.4
	Nurses/midwives	4	4.1
	Physiotherapists	17	21.8
	Laboratory scientists	5	6.4
	Radiographers	1	1.3
	Orthotist	2	2.6
	Pharmacist	2	2.6
	Ortho technologist	1	1.3
	Public health	1	1.3
	Prosthetist	1	1.3
Area of practice	Private Hospital	37	47.4
	Governmental Hospital	37	47.4
	Non-governmental	4	5.1
Do you practice hand washing during COVID-19	Yes	78	100
	No	0	0
Do you have a guideline or protocol for caring for patients with COVID-19	Yes	61	78.2
	No	17	21.8
Do you practice hand washing in your facility before the advent of COVID-19	Yes	65	83.3
	No	13	16.7

Table 2: Infection prevention and control practices (Hand hygiene, Face mask use, and Physical/social distancing) following covid-19 outbreak

Variable	Frequency	Percentage
Hand Hygiene Immediately on arrival at work	63	80.7
Hand Hygiene Before putting on gloves	49	62.9
Hand Hygiene after removing gloves	77	98.7
Hand Hygiene After touching blood, body fluids, secretions	78	100
Hand Hygiene Before contact with patients	62	79.5
Hand Hygiene Between Patients	70	89.8
Hand Hygiene After contact with patients without gloves	78	100
Hand Hygiene Before a procedure	70	89.7
Hand Hygiene After a procedure	78	100
Hand Hygiene After a day's work	77	98.7
Wearing of surgical/N95 mask during patient contact	65	83.2
Maintaining Social/physical distancing during patient contact	66	84.6
Maintaining Social/physical distancing during working hours with colleagues	51	65.3

DISCUSSION

This study assessed the compliance of HCWs to IPC practice during the earlier phase of the COVID-19 pandemic in Nigeria. HCWs are more likely to contract COVID-19. Hand hygiene has been proven as a fundamental principle in IPC practices worldwide and an integral part of patient safety programmes[18]. This study reveals that there was high compliance with the practice of hand hygiene among the HCWs before the advent of COVID-19. This might be a result of exposure of the HCWs to IPC practices from previous outbreaks such as the Ebola virus and the recurrent outbreak of Lassa fever from where hand hygiene practice has been shown as an effective strategy in breaking the transmission of the virus. This is different from the study done by Pepple and Akpan[19] where only about 30% of the general population were still adherent to safety precautions such as hand wash and the use of hand sanitizers post-Ebola (Pre COVID-19). In addition, in the study done by Martins and Osiyemi[20] among HCWs in a teaching hospital in Nigeria, the majority (80.0%) of the respondents were not compliant with hand hygiene practices for infection control post-Ebola (Pre COVID-19).

The COVID-19 pandemic ushered in several IPC practices such as hand hygiene, face mask use, social/physical distancing, among others. These non-pharmacological interventions (Wearing face masks, practicing good hand hygiene, physical/social distancing) are very crucial in the fight against COVID-19[21]. To stop the spread of COVID-19, the Nigeria Centre for Disease Control (NCDC) advised practicing good hand hygiene, particularly at the point of care, which is the intersection of the patient, the healthcare provider, and the care or treatment that involves contact with the patient or their surroundings[22]. During the early phase of COVID-19, our study showed majority of the respondents had a high compliance rate with hand hygiene practices. The result is similar to the study done by Esther et al.[23] where there was 100% compliance with hand hygiene practices. The reason might be because of the novel nature of the SARS-COV-2 and the high infectious rate and death rate associated with the virus, this now resulted in a high hand hygiene compliance rate among the HCWs.

From this study, HCWs were found to be highly compliant with the use of face masks in the prevention of COVID-19 during patient contact. This might be a product of correct IPC training that has been part of the healthcare practice in Nigeria and also the availability of PPEs within the healthcare system knowing the important role face mask use plays in curbing the transmission of COVID-19. In the study done in Ethiopia by Tekalegn et al.[24], it was revealed that the compliance level of HCWs regarding the use of face masks in the prevention of COVID-19 was very low which was attributed to poor or inadequate training. In another study done in Nigeria by Babatola et al.[25], barely half of the population sampled had good practices of face mask use which was associated with two-thirds of the population having erroneous beliefs about face shields and one-third of the population sampled having poor knowledge with the need for training and retaining of HCWs[25]. According to World Health Organization recommendation, all HCWs and caregivers working in clinical areas and COVID-19 community transmission should wear face masks to protect themselves as well as their patients from COVID-19 infection[26]. Correct and adequate training has been associated with the proper use of face masks among HCWS. In the study done by Tekalegn et al.[24], HCWs were 2.2 times more likely to correctly use a face mask. In addition, HCWs working in COVID-19 treatment centres were

2.6 times more likely to properly use their face masks compared to the HCWs working in non-COVID-19 dedicated hospitals.

Physical distancing also known as social distancing has been shown as one of the widely recognized effective ways to decrease viral transmission[27] with 2 meters (6 feet) distancing being the recommended physical distancing by public health agencies[27,28,29]. Non-adherence of HCWs to physical distancing recommendations poses a great danger to the spread of COVID-19[30]. This survey revealed a high compliance rate in physical distancing among HCWs during patient contact. This can be explained by the fact that Respiratory droplets from human-to-human have been designated as the primary route of SARS-Cov-2 transmission[31] therefore, the farther the distance from others the less likelihood of one coming in contact with the respiratory droplets.

Several interventions such as video conferencing, restructuring workrooms, and workstations, use of cognitive aids, encouraging physically distant social connections, and rewarding positive behaviours etc have been identified as a means to improve HCWs' physical distancing. In a study done by Sick-Samuels et al.[30], the use of wearable beacons helped in the decline of interactions among HCWs within 6 feet which led to improvement in physical distancing. However, maintaining social distancing during work hours can be difficult. This study recorded a little above 60% of HCWs who were able to comply with social distancing among their colleagues. In the work by Hobbs et al.[32] among Australian nurses, social distancing was more difficult than anticipated in the work environment, and working in a multidisciplinary approach healthcare system made it more challenging for the nurses and midwives. The complex nature of the healthcare system made 100% physical distancing difficult to achieve though important it poses challenges and may produce unanticipated negative consequences[29,33]. Nevertheless, several interventions have been proposed to overcome these challenges.

Limitations

This study has several limitations; thus, care should be taken when applying the findings. First, the research made use of a self-reported IPC practice of healthcare workers. Secondly, because the survey was conducted online, only people who utilize social media and the Internet were eligible to participate in the study. Third, this study did not investigate the rationale behind the use of facemasks, hand cleanliness, or physical/social distancing. Fourth, the study's conclusions may not accurately represent the situation across the entire nation due to the underrepresentation of specific regions and professions. Fifth, the study may not accurately reflect the cause-and-effect relationship between the independent and dependent variables because it is cross-sectional.

CONCLUSION

This study explained that healthcare worker's compliance to IPC practice (Hand hygiene, facemask use, and physical/social distancing) is relatively good. Nearly most HCWs in contact with COVID-19 patients have good practice of hand hygiene, compliant with facemasks use and maintenance of physical/social distancing during patient contact and among colleagues during work hours. For the areas where the HCWs are lacking, this study concludes by recommending training and retraining of HCWs to ensure consistent proper practice of hand hygiene, facemask use and physical/social distancing.

Declaration of conflicting interests

The author(s) declared no potential conflicts of interest concerning the research, authorship, and/or publication of this article.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

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JOURNAL OF BIOMEDICAL INVESTIGATION (JBI) VOLUME 12 NUMBER 2: JULY-AUGUST 2024

CARDIOMETABOLIC STATUS OF MENOPAUSAL WOMEN IN NKWELLE-EZUNAKA, ANAMBRA STATE

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Received: 09/7/2024; accepted for publication 31/8/2024

ABSTRACT

Background: Menopause results from ovarian aging or ovarectomy and is accompanied by hormonal and metabolic changes that contribute to cardiovascular disease (CVD), a leading cause of mortality.

Aim of study: To assess the cardiometabolic status of menopausal women in Nkwelle-Ezunaka using Body Mass Index (BMI), Waist Hip Ratio (WHR), Diastolic Blood Pressure (DBP), Systolic Blood Pressure (SBP), Total Cholesterol (TC), Triglycerides (TG), Low Density Lipoprotein Cholesterol (LDL-C), High Density Lipoprotein Cholesterol (HDL-C), Insulin Resistance, Fasting Plasma Glucose (FPG) and Fasting Insulin (FI).

Materials and Methods: This cross-sectional study involved ninety females (45 menopausal, and 45 premenopausal) recruited by simple random sampling technique. Blood pressure was measured using the auscultatory method, BMI calculated using weight and height measurements, while WHR was obtained using waist and hip circumference measurements. Levels of TC, TG, LDL-C, HDL-C, IR, FPG and FI were determined spectrophotometrically using standard methods. Independent t-test was used for the statistical analysis of data.

Results: A significantly higher mean values of BP, WHR, TC, TG and LDL-C ($p<0.05$) and lower mean values of FI (6.80 ± 4.46) and IR (1.49 ± 1.15) were observed in menopausal women compared to premenopausal women (12.90 ± 15.33)(3.95 ± 5.45) with $p<0.05$ in both cases. No significant differences were found in the mean values of BMI, HDL-C and FPG in menopausal women compared with the premenopausal women ($p> 0.05$**)**.

Conclusion: Waist Hip Ratio, Diastolic Blood Pressure, Systolic Blood Pressure, Total Cholesterol, Triglycerides, Low Density Lipoprotein Cholesterol, may be better indicators of unhealthy cardio-metabolic status than Body Mass Index, High Density Lipoprotein Cholesterol and Fasting Plasma Glucose. Menopausal women appear to be more predisposed to cardiovascular disease than the premenopausal women.

Keywords: *Menopause, Body Mass Index, Waist Hip Ratio, Fasting Plasma Glucose, Insulin Resistance, dyslipidaemia*

INTRODUCTION

Menopause is clinically diagnosed when a healthy woman has not menstruated for up to one year.[1] The average level of total oestrogen (E2) during a woman's fertile life is 100–250 pg/ml but the concentration of E2 in circulation declines up to 10 pg/mL postmenopause.[2] The dramatic decrease in ooestrogen production in menopause may alter glucose and lipid metabolism and lead to probable changes in insulin sensitivity, lipid metabolism and body mass index resulting in cardiovascular morbidity and mortality.[3] Central obesity which is quite common in menopausal women caused by dyslipidaemia is also strongly associated with cardiovascular risk with or without BMI adjustments.[4] Also, before menopause, the prevalence of hypertension (HTN) in women is much lower than in men; however, this prevalence increases significantly in menopausal women and equates to that in men.[5] Sex

hormones are said to be responsible for the sex differences in the regulation of blood pressure[6] because it affect systems that are considered to play an important part in the development of hypertension, such as renin angiotensin aldosterone system, endothelin, nitric oxide (NO) system and immune system.[6]

Menopause may also deteriorate lipid profile making IT more atherogenic than that of their premenopausal counterpart.[7] The total cholesterol (TC), triglycerides (TG) and low-density lipoprotein cholesterol (LDL-c) may increase, and these changes may be accompanied by a decrease in high-density lipoprotein cholesterol (HDL-c).[8] This partially explains the increased cardiovascular risk in postmenopausal women, particularly among those with an earlier onset of menopause.[9, 10]

The reduction in oestrogen may also predispose menopausal women to developing insulin resistance possibly due to the critical role oestrogen plays in carbohydrate metabolism.[11] In support of this hypothesis, it has been shown that surgically induced menopause increases the risk of developing insulin resistance and metabolic syndrome more[12] probably because oestrogen decline could also affect insulin production by pancreatic β cells and insulin disposal in muscles, which are conditions that further exacerbate the risk of diabetes.[13] The homeostasis model assessment of insulin resistance index (HOMA-IR) is the most commonly used proxy for insulin resistance as it correlates strongly with the results of euglycemic-hyperinsulinemic clamps[14] being used as the gold standard of insulin resistance evaluation.[15]

Studies across the world have thrown light on the increased cardiometabolic risks in menopausal women as compared to their corresponding premenopausal.[11, 16-19] Therefore, this study aim to use some measures of cardiometabolic status (SBP, DBP, BMI, WHR, TC, TG, LDL-C, HDL-C, FPG and FI) to evaluate the cardiometabolic status of menopausal women in Nkwelle-Ezunaka, Anambra state.

MATERIALS AND METHODS

Study area

This research was conducted in Nkwelle-Ezunaka, Anambra state. Nkwelle-Ezunaka is one of the five towns in Oyi Local Government Area of Anambra state[20], located about 8.5 kilometers northeast of Onitsha, Anambra state. It is bordered by nine neighbouring towns; Nteje and Umunya to the east, Nsugbe and Umueri to the north, Onitsha and Obosi to the west and Nkpor, Ogidi and Ogbunike to the south. Nkwelle-Ezunaka has a vast land rich in farming and is a fast developing sub-urban area in Nigeria.

Study design

This cross-sectional study was designed to assess cardio-metabolic disorders in menopausal women. A total of 90 female subjects within the age range of 19 to 55 years were recruited for using random sampling techniques. This included 45 menopausal women and 45 premenopausal women. A random pick of 2 areas was made with an average of 45 individuals mobilized for the study from each selected area. Participants were interviewed via structured questionnaires and physical assessment.

Sample size: Sample size was determined using Daniel[21] sample size formula given as[22]:

$$N = \frac{z^2 P(1-P)}{d^2}$$

N= sample size, z = confidence interval, p= expected prevalence or proportion and d =

precision. Here confidence interval of 1.96 and precision of 0.05 was used and menopausal prevalence of 3.96%.

N = (1.96)^2 X 3.96% (1-3.96%)/0.05^2
N = 3.8416 X 3.96/100 (1-3.96/100)/0.05^2
N=3.8416 X 0.0396(1-0.0396)/0.0025
N = 3.8416 X 0.0396(0.604)/0.0025
N= 3.8416 X 0.0396 (241.6)
N= 3.8416 X 9.567
N = 36.7
N= 36.7
N = 37

Thus, a minimum sample size of 37 was determined using menopausal prevalence rate[18] of 3.96% but a total of 90 subjects were recruited for the study.

Ethical consideration

The ethical approval was obtained from Ethics Review Committee, Nnamdi Azikiwe University Teaching Hospital, Nnewi (NAUTH/CS/66/VOL.16/VER.3/306/2021/080). The study participants were enlightened on the purpose of the study and allowed to choose to verbally volunteer.

Inclusion criteria

Apparently healthy premenopausal and menopausal females within the age range of 19 to 65 years.

Exclusion criteria

Individuals on hormonal treatments, those with history of cardiovascular diseases, diabetes and malignant tumors and individuals outside the age range of 19 to 65 years.

Determination of blood pressure

Blood pressure measurement was measured using the auscultatory method[23]. Using a suitably calibrated mercury sphygmomanometer, the volunteers were allowed to rest for five minutes and the blood pressure was taken in the sitting position. A cuff was wrapped around the subject's upper arm and inflated; the brachial artery was occluded as the cuff gradually deflated. Blood flow was re-established, accompanied by tapping or thumping sounds that can be detected with a stethoscope held over the brachial artery. The first tapping or thumping sound signified the systolic pressure and the point at which the tapping ceased was taken as the diastolic pressure. Systolic pressure and diastolic pressure greater than 140 mm/Hg and 90 mm/Hg respectively indicated high blood pressure while systolic pressure of 90mm/Hg and 60mm/Hg of diastolic pressure was regarded as low blood pressure.

Determination of waist and hip circumference and waist to hip ratio

Waist circumference was measured[24] at the midpoint between the lower margin of the least palpable rib and the top of the umbilicus, with the tape around the body in a horizontal position. Participant stood upright with both feet together and both arms relaxed by their side; after finding the lower edge of the participant's last rib on their side and the upper edge of the umblicus, the waist circumference was measured horizontally between these two points. Prior to the measurement the participants were asked to exhale gently. Hip circumference was also measured horizontally in a standing position by putting the participant's feet apart and arms at their chest using the same tape measure at the most prominent area of the buttock when seen sideways. Waist-to-hip ratio was calculated as

waist circumference (cm) to hip circumference (cm).

Determination of body mass index

Body mass index[25] was calculated using the formula:

BMI = weight/height^2

Laboratory Methods:

Determination of total cholesterol

Evaluation of total cholesterol was done using enzymatic method as described by Manafa et al.[26]

Determination of triglyceride levels

The assessment of TG was done using enzymatic method as described by Ihim et al[27].

Determination of high density lipoprotein

Assessment of high density lipoprotein was done using the method as described by Gulsen et al[28].

Evaluation of low density lipoprotein levels

The Friedewald equation was used to calculate low density lipoprotein as described by Boqun et al[29], given as:

Total cholesterol = VLDLchol +LDLchol+HDLchol

TG is an estimate of VLDLchol

LDLchol = [Total chol]– [HDLchol] –[TG]/5

Assessment of insulin resistance

The insulin resistance index of each subject was determined by homeostatic model assessment (HOMA) according to the method described by Hashemipour et al[30]. An insulin resistance score was computed with the formula:

$$\frac{\text{fasting plasma glucose (mmol/l) x fasting serum insulin (mU/l)}}{22.5}$$

Low HOMA-IR values indicated high insulin sensitivity while high HOMA-IR showed low insulin sensitivity (insulin resistance).

Data Analysis

Obtained data was summarized using mean and standard deviation, and analysed using the Independent t-test. Results were deemed significant at $p<0.05$.

RESULTS

There was a significantly higher level of mean age in the test subjects compared with the control (54.19 ± 5.14 vs 29.58 ± 11.13; $p<0.05$). The mean systolic and diastolic blood pressure values of the test subjects were significantly higher compared with the control (146.21 ± 18.85 vs 132.38 ± 26.20; $p<0.05$) (89.38 ± 10.17 vs 81.19 ± 14.17; $p<0.05$) respectively while the mean waist-hip ratio of the test group showed a significantly higher level compared with the control (0.90 ± 0.07 vs 0.85 ± 0.05; $p<0.05$). However, there was no significant difference in the body mass index of the test subjects compared with the control (30.14 ± 5.55 vs 28.23 ± 4.97; $p<0.05$). Table1 summarizes these findings.

However, a significantly higher mean level of total cholesterol was observed in the test subjects compared with the control (223.56 ± 37.18 vs 191.20 ± 51.07; $p<0.05$). Also, there were significantly higher mean levels of low density lipoprotein and triglycerides in the test subjects compared with those of the control (114.28 ± 17.85 vs 105.25 ± 23.54 ;$p<0.05$) and (151.07 ± 30.12 vs 128.36 ± 51.25; $p<0.05$) respectively while the mean levels of insulin and insulin resistance were significantly lower in the test subjects compared with the control (6.80 ± 4.46 vs 12.90 ± 15.33; $p<0.05$) and (1.49 ± 1.15 vs

3.95 ± 5.45; p < 0.05) respectively. However, there was no significant difference in the mean levels of fasting plasma glucose (FPG) (87.17 ± 18.11 vs 84.35 ± 13.29 p> 0.05) and high density lipoprotein (HDL) (49.64 ± 15.95 vs 45.67 ± 16.87 p> 0.05) in the test group compared with the control group (Table 2).

Table 1: Levels of some anthropometric variables of control and test group (mean ± SD)

Parameters	Test group (Menopausal women)	Control group (premenopausal women)	t-test	p-value
Age (year)	54.19 ± 5.14	29.58 ± 11.13	-13.660	0.000
SBP (mmHg)	146.21± 18.85	132.38 ± 26.20	-2.198	0.032
DBP (mmHg)	89.38 ± 10.17	81.19 ± 14.17	-2.412	0.019
BMI(kg/m^2)	30.14 ± 5.55	28.23 ± 4.97	-1.504	0.137
WC/HC	0.90 ± 0.07	0.85 ± 0.05	-4.486	0.000

*Statistically significant at p<0.05

Table 2: Levels of lipid profile, FPG, insulin and insulin resistance in control and test groups (mean ± SD).

Parameters	Test	Control	t-test	p-value
TC(mg/dl)	223.56 ± 37.18	191.20 ± 51.07	-3.456	0.001
TG(mg/dl)	114.28 ± 17.85	105.25 ± 23.54	-2.060	0.042
HDL-C(mg/dl)	49.64 ± 15.95	45.67 ± 16.87	-1.146	0.255
LDL-C (mg/dl)	151.07 ± 30.12	128.36 ± 51.25	-2.587	0.011
FPG(mg/dl)	87.17 ± 18.11	84.35 ± 13.29	-0.836	0.405
FI (mIU/L)	6.80 ± 4.46	12.90 ± 15.33	2.613	0.011
HOMA-IR	1.49 ± 1.15	3.95 ± 5.45	3.026	0.003

*Statistically significant at p<0.05

Key:

TC= total cholesterol TG= triglycerides, HDL-C = high density lipoprotein cholesterol, LDL-C= low density lipoprotein cholesterol, FPG = fasting plasma glucose, FI = fasting insulin, HOMA-IR = homeostatic model assessment of insulin resistance.

DISCUSSION

Ovarian atrophy and hormonal changes in menopausal women may increase the risk of diabetes, dyslipidemia and cardiovascular disease (cardiometabolic disorders).[31, 32] This is possibly due to the important roles oestrogen plays in the maintenance of lipid and glucose homeostasis[33] and its imminent cardioprotective effects. In this study the measures of adiposity in menopausal women in Nkwelle-Ezunaka metropolis were evaluated. The findings of this study revealed increased systolic and diastolic blood pressure of menopausal women (test) compared with premenopausal women (control). Aging in both males and females can be identified by an increase in blood pressure but the incidence of hypertension in women after menopause is greater than in males.[34] The sharp rise in BP after menopause may be both a direct effect of hormonal changes on the vasculature and metabolic changes with ageing.[35] These hormonal changes especially oestrogen decline also affect the rennin-angiotensin–aldosterone system (RAAS) that regulate sodium and water intake, output and consequently blood pressure. Conversely, oestrogen exerts inhibitory effects on classical RAAS pathway resulting in overall vasodilatory and antihypertensive response.[36] But its deficiency due to menopause may contribute to over activity of the rennin aldosterone angiotensin system (RAAS). This over activity of the RAAS has been implicated in the pathogenesis of a number of cardiovascular disease entities, including hypertension.[37] The activation of RAAS is not the sole contributor of hypertension in menopause rather a mediator.[34] Another mechanism contributing to hypertension in postmenopausal women is an increase in sympathetic activation that could be due to increased body weight and redistribution of body fat as well as increased leptin levels.[38] Obesity may be another causal factor of hypertension in menopausal females.[34] Obesity, especially visceral obesity, is the integral part of the group of metabolic syndrome which comprise insulin resistance (type 2 diabetes), dyslipidemia and waist circumference greater than 35 inches for men, all of which are known to cause hypertension.[39] The incidence of obesity is close to 40% in menopausal women.[34] Additionally, androgen production continues in menopausal women and may increase arterial stiffness and vascular inflammation leading to endothelial dysfunction and increased BP. However, findings are inconsistent in the role of oestrogen/androgen on hypertension in menopausal women.[40] Severity of menopausal symptoms also plays a role. It has been reported that women who experience vasomotor symptoms such as hot flashes have higher awake and asleep blood pressure when compared to women without hot flashes.[40] Menopausal women are also more likely to have a non-dipping BP pattern which is associated with poorer cardiovascular outcomes and more target organ damage in women compared to men.[41] The impact of increased blood pressure is different for men and women. It has been shown that for a comparable 10mmHg increase in systolic blood pressure, women experience a 25% increase in cardiovascular disease risk while men's risk is only 15% higher.[42] Sex-specific differences in blood pressure (BP) have been noted since the early 1900's when women were first observed to have lower BP compared to men of a similar age.[40] Blood pressure, and consequently hypertension prevalence, is lower in women from adolescence until menopause or the fifth decade of life.[43,44]

Despite the higher prevalence of hypertension in men, a study of 32,833 individuals (17,733 women or 54%) followed for over four decades, demonstrated that women actually have a steeper increase in BP as early as the third decade that continues throughout the life course.[44] These differences persisted even after adjustment for multiple cardiovascular risk factors. Taken together, these sex differences in BP across the life course may have important implications for the diagnosis and treatment of hypertension in men and women, though currently there are no sex-specific guidelines for the diagnosis or treatment of hypertension.[40]

Anxiety and depression may also play a role in increasing blood pressure. Menopause has been proven to predispose women to various psychological health problems, including depression and anxiety.[45] Several menopausal symptoms such as hot flashes, night sweats, and insomnia, may contribute to increased risk of depressive and anxiety symptoms.[46,47,48] Menopausal women with depression and anxiety have a higher risk of developing hypertension.[49] Sympathetic activity can be upregulated with anxiety and chronic mental stress, which may lead to hypertension.[50] Increased BP was also seen due to enhanced levels of anxiety in a small Spanish cohort study.[40] The onset of hypertension can cause a variety of symptoms, such as palpitations, hot flushes, headaches, chest pain, pain between the shoulder blades, tiredness and sleep disturbances, which are often attributed to menopause.[51]

Our findings align with the reports of Eghbali-Babadi et al [52] who found high systolic and diastolic blood pressure to be highly prevalent in menopausal women in Iran. Okeahialam *et al*[53] also observed lower anthropometric indices, systolic and diastolic blood in 218 premenopausal females compared 270 menopausal, they postulated that menopause comes with worse CVD profile.[53]

Our study also showed a higher waist hip ratio (WHR) in menopausal women compared with premenopausal women. This possibly implies that more menopausal women had central adiposity than premenopausal women. Waist hip ratio measures body fat distribution and values above 0.85 for females would indicate central body fat distribution. High WHR is considered to be a risk factor for cardiovascular diseases, hypertension and diabetes.[54] Ooestrogen deficiency in menopause may have a direct effect on lipid metabolism and body fat composition and distribution with a transition from gynecoid (apple) to android (pear) body shape and increased abdominal and visceral fat accumulation associated with increased CVS and metabolic risks.[55-58] The visceral distribution of adipocytes is postulated to increase inflammation, an important trigger for cardiovascular and metabolic disease.[57] Abdominal fat is considered an endocrine organ able to produce many adipokines and substances that are associated with hypertension, dyslipidaemia, insulin resistance, type 2 diabetes and metabolic syndrome.[57]

The mechanism of central adiposity in menopause is not fully understood though it is postulated that genetic and environmental factors play a role.[59] These factors determine adipose tissue mass and distribution by modulating energy balance and lipid related enzyme activitities.[60] Subcutaneous adipose tissue serves as long term lipid storage while visceral adipose tissue is metabolically more active and acts as an acute response supplier of systemic fatty acids.[61] Menopause is characterized by low oestrogen level and high levels of follicle stimulating

hormone (FSH). The rise in the level of FSH was shown by Kohrt and Wierman to have an independent effect on regulation of energy homeostasis[62]. FSH promotes lipid biosynthesis and is positively associated with leptin and negatively with adiponectin levels in cellular and animal models.[63] It might explain why the use of oestrogen replacement therapy which does not completely suppress FSH levels, may fail to prevent the fat changes in menopause.[57] A meta-analysis suggests that aging is the main contributor of increased overall adiposity while menopause contributes to adipose tissue accumulation in the waist area.[64] Sleep problems like insomnia, sleep apnea, are core menopausal symptoms which can disrupt metabolism as proven by several studies and can lead to central obesity[65,66,67]. Women have been suggested to have a 41% higher risk of developing insomnia than men[68]. A study by Chaput et al [69] who checked the effects of sleep duration on visceral fat found that changing sleep duration from less than 6hrs to 7 to 8 hrs was inversely associated with visceral adipose tissue gain. In essence subcutaneous and visceral fat mass is tightly associated with sleep duration.[70] Poor sleep has been shown to increase sugar cravings which factors in central obesity.

Short sleep duration increases a woman's stress level likewise the negative impact menopausal symptoms exerts on a woman's mental health, hiking a woman's stress level.[71] The high stress level experienced by menopausal women has endocrine consequences due to the increased effects of glucocorticoids and cortisol leading to loss of muscle and bone mass and visceral fat accumulation[72, 73] resulting in central obesity. These problems will physically strain the women as well as exert massive burden on the mental health of the women.[74] A study by Jayabharathi, 2016 found that 75% menopausal women had high to very high level of stress.[75] Menopause is overall a time of increased stress, including the experience of stressful life events like a divorce or the loss of a loved one[76]. Due to the close interaction of the reproductive and the stress axes[77], stress can act as a precipitating or perpetuating factor for disorders like depression or insomnia and central obesity.[68]

Physical inactivity can also be a factor in the occurrence of central obesity in menopausal women. Notably, physical activity levels tend to decline during and following menopause, which ultimately exacerbates metabolic dysfunction.[78] Although the extent to which physical inactivity contributes to metabolic shifts during the menopause is not fully known, it is noteworthy that the typical gain in central adiposity during the menopause is linked to an approximately 40% reduction in physical activity.[79]

Unhealthy diet might also be a causative factor of central obesity, as both exercise training and adopting/maintaining healthy dietary patterns following the menopause are essential in mitigating visceral fat accumulation and preserving metabolic health.[80] This is in concordance with study by[81] who found 77.7 % prevalence of central obesity among 273 menopausal women aged 45 to 65 years. Also a significant difference in WHR between premenopausal and menopausal women[16] was demonstrated but portrays that it as a better predictor of subclinical atherosclerosis. This also agrees with Selvaraj et al[82] that did a population and family-based epidemiological study of 2181 adults aged 37 to 65 years (perimenopausal and menopausal age) and discovered 80 % of these women had central obesity. A combination of hormonal shifts and chronological aging are primarily what paved the way to a cluster of

metabolic abnormalities associated with the menopause[79].

This study also revealed significantly increased total cholesterol and LDL cholesterol in menopausal women compared with control while there was no significant difference in HDL. Physiological decline in oestrogen levels during menopause plays a major role in abnormal lipid metabolism such as elevated low-density lipoprotein concentration (Dyslipidaemia).[83] Also glucose spikes caused by disordered carbohydrate metabolism as a result of oestrogen deficiency can also exacerbate dyslipidaemia.[84] The lipid panel test revealed significant increased levels of total cholesterol, LDL-cholesterol and triglyceride in menopausal women compared to premenopausal and surprisingly a significant increase in HDL-Cholesterol. Also the findings of this study agrees with that of Inaraja et al [85] who did a retrospective observational study of 13517 laboratory analysis (3,073 premenopausal and 10,444 postmenopausal lab results) of 275 women from gynecology unit of hospital Quiro'n Salud, Madrid (2007-2018) and found a significantly higher levels of total cholesterol, LDL-cholesterol and triglyceride in menopausal women than premenopausal women while HDL-cholesterol levels were significantly lower in all cases. Similarly a study by[86] found that after menopause, women had higher levels of triglycerides and LDL.

After menopause, total cholesterol (TC) and low-density lipoprotein cholesterol (LDL-c) usually increase, and these changes are accompanied by a decrease in high-density lipoprotein cholesterol (HDL-c) and an increase in triglycerides (TG).[8] In addition to these major lipid abnormalities, modifications in size and density of these lipoprotein particles are expected to happen after the loss of ovarian hormonal production. This partially explains the increased cardiovascular risk in postmenopausal women, particularly among those with an earlier onset of menopause.[9] Age and sex are primary physiological factors that have a strong influence on blood lipid levels.[63] With increasing age, lipid levels increased among both men and women[87,88] , but prevalence of dyslipidemia was significantly higher among women in midlife than men.[89] This suggests that the menopausal transition (MT) may contribute substantially to dyslipidemia in women in midlife.[90] Previous works about the relationship between the MT and lipid profiles were controversial. Some studies report that there was no change in lipid profiles before and after menopause, suggesting the possible effect of only chronological aging[91,92]. Several studies have revealed a significant association between the MT and lipids, as evidenced by substantial changes in lipid profiles after the final menstrual period (FMP)[93], Matthews *et al*. showed an association between MT and lipids profiles, with age at menopause playing an important role in lipid changes during the MT[94] and Di Francesco *et al*. suggested they experience serum lipid changes owing to a significant increase in the sex hormone oestrogen.[95] Their low-density lipoprotein cholesterol (LDL-C), total cholesterol (TC), and triglycerides (TG) increase and high-density lipoprotein cholesterol (HDL-C) decreases.[10] In Korea, dyslipidemia among women increased with age and showed a significant difference before and after menopause. The prevalence was 27.6% in women aged ≤40 years, 55.9% in women aged 40–59 years, and 64.6% in women aged ≥60 years.[10] In particular, the prevalence of high LDL-C was more than six times higher in those in their 50s when compared with those in their 30s.[96] This probably causes a significant increase

in the incidence of fatal cardiovascular disease.[95] Women with HDL-C levels < 50 mg/dL have a 30% increased risk of death from cardiovascular disease, and those with a TC level between 200 and 399 mg/dL have a 65% increased risk of death.[97]

An interesting observation in our study is the higher insulin levels and insulin resistance in premenopausal women compared with the menopausal group which contradicts the studies of Fonseca *et al*. that evaluated the association between insulin resistance and metabolic syndrome in 150 women 40-65 years treated at a gynecology outpatient clinic.[98] They found that menopausal women had higher prevalence of insulin resistance[98] and that of Kirtikar *et al*. who studied cardiometabolic risk in premenopausal and postmenopausal women who had fasting insulin of 23±12.3 mIU/L against that of premenopausal group less than 3mIU/L.[99] This contradiction could be due to limited sample size or a possible rise of metabolic syndrome in the premenopausal women as postulated in a study by Isaki *et al*. that examined 401 young women for insulin resistance and found (32) 8% and only 6 out of the 32 were overweight which they attributed to metabolic syndrome.[100] A combination of hormonal shifts and chronological aging are primarily what pave the way to a cluster of metabolic abnormalities associated with the menopause.[79]

CONCLUSION/RECOMMENDATION

Blood pressure, waist-hip ratio, total cholesterol, low density lipoprotein cholesterol and triglycerides increased significantly in menopausal women compared with premenopausal women. However no significant difference was observed in BMI, HDL-C and FPG of the menopausal group compared with the premenopausal females. This suggest that waist-hip ratio, blood pressure, total cholesterol, low density lipoprotein cholesterol and triglycerides are better indicators of cardiometabolic status than BMI, HDL-C and FPG and are therefore recommended as valuable tools in the assessment of adiposity.

Also fasting insulin levels and insulin resistance decreased significantly in menopausal women compared with the premenopausal group.

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JOURNAL OF BIOMEDICAL INVESTIGATION (JBI) VOLUME 12 NUMBER 2: JULY-AUGUST 2024

KNOWLEDGE AND UTILIZATION OF PARTOGRAPH AMONG MIDWIVES IN SELECTED HEALTH FACILITIES IN ANAMBRA STATE

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Received: 19/7/2024; accepted for publication 31/8/2024

ABSTRACT

Introduction: Poor intrapartum care remains one of the major causes of maternal morbidity and mortality worldwide. Globally, a woman dies of pregnancy-related causes every two minutes and most of the deaths are preventable with the right care at the right time. The major complications, which account for almost 75% of all maternal deaths are preventable including complications during childbirth. One of the major components of quality management of labour to prevent maternal mortality is the use of partograph by the skilled birth attendant during management of labour.

Aim: This study aimed to determine the level of knowledge and utilization of patograph among midwives working in the labour ward in health facilities in Anambra state, Nigeria.

Methods: This is a cross-sectional descriptive study in which a self-administered questionnaire was used to collect data from 100 midwives in 17 health facilities consisting of 2 tertiary, 3 secondary and 12 primary healthcare centres (PHC) in Anambra state. Obtained data was summarized using mean, and percentages.

Results: Thirty-nine (39%) of the respondents aged less than 30 years, 52% were within 30-45 years while 9% aged 40 years and above. Twenty-one (21%) were just registered midwives while 68% and 11% were registered nurse-midwives and registered nurse-midwives with B.NSc degree respectively. Almost half, 48%, of the respondents have had 5-10 years working experience; 14% of the respondents worked in the primary health facility, 37% of the respondents in the secondary health facility while 49% worked in the tertiary health facility. The results show a 78% level of knowledge among the midwives, although only 72% and 60% knew the level of cervical dilation to start the use of partograph and the benefit of partograph respectively. Level of utilization was 96%, although only 30.2% used partograph always while 51% used it often and 18.9% rarely used it. Barriers identified were shortage of staff, unavailability of partograph and time constraints.

Conclusion: There is good level of knowledge of partograph among midwives working in labour wards across different levels of health care facilities but the depth of the knowledge is not encouraging.

Keywords: *Partograph, knowledge, utilization, midwives, health facilities*

INTRODUCTION

Poor intrapartum care remains one of the major causes of maternal morbidity and mortality worldwide[1]. According to the World Health Organization(WHO) statistics, globally, a woman dies of pregnancy-related causes every two minutes and most of the deaths are preventable with the right care at the right time[2]. From 2000 to 2020, the global maternal mortality ratio (MMR) declined from 339 deaths to 223 deaths per 100,000 live births showing 38% decrease[3]. Unfortunately, the African Region accounted for 69% of global maternal deaths in 2020. More worrisome, in 2020, the average maternal mortality ratio in the African Region was estimated at 531 deaths per 100 000 live births but Nigeria MMR same year was 1047 deaths per 100,000live births, making Nigeria to rank third among countries with extremely high maternal morbidity[2]. It is important to note that

for the world to achieve the Sustainable Development Goal in 2030, the MMR needs to be reduced by at least 20.3% each year from 2020[2].

The major complications, which account for almost 75% of all maternal deaths, are severe haemorrhage, infection, pre-eclampsia, eclampsia, complications during childbirth and unsafe abortion[2]. These complications are preventable through combined safe motherhood strategies of focused antenatal care, prompt referral, active management of labour and immediate post-partum period and access to family planning[4]. One of the major components of quality management of labour to prevent prolonged labour and its deadly consequences is the use of partograph by the skilled birth attendant[1].

The partograph or partogram has been established as the "gold standard" labour monitoring tool universally[5]. It is recommended by the World Health Organization (WHO) for use in active labour [6]. The function of the partograph is to monitor the progress of labour and identify and intervene in cases of abnormal labour. Partograph is a valuable tool for early detection of problems in labour and it is used to recognize and deal with slow progress before labour becomes obstructed. For instance, if there is a need for a caesarean section for the delivery of the baby, it would be performed on time to save the mother and baby[1]. The Partograph helps to reduce, not only the maternal mortality, but also controls perinatal morbidity and mortality[2]. Consequently, it is one of the major training tool for the midwives to record intrapartum details timely and appropriately such that problems of labour are identified for prompt intervention [5,6,7].

Since 1987, global efforts have been focused on reducing maternal and neonatal mortality and morbidity associated with intrapartum care, especially in the developing countries. Many programs and tools have been developed to monitor and manage women in labour, one of which is the use of a new partograph developed by Philpott in 1971 and was later modified by the World Health Organization[6]. Competent use of the partograph can save lives by ensuring that labour is closely monitored thereby reducing the incidence of maternal and child morbidity and mortality[7].

A cross-sectional descriptive study among nurse-midwives in tertiary health institutions in Enugu state found between 69% and 80% utilization of parthograph[8]. A descriptive survey of midwives across tertiary health facilities in South-South Nigeria found that 84% of the midwives had good knowledge of partograph although the percentage of utilization was not clear[9]. A more recent descriptive study among obstetric care givers in primary health centres in Imo state found very poor utilization of partograph[10]. Several factors such as poor knowledge, lack of skill, non-availability of partograph charts, lack of adequate number of health care personnel, an additional time consuming task for the staff, lack of understanding of the relevance of the partograph in preventing obstructed labour, lack of training and continuing education has been identified to affect the utilization of partograph[11]. However, there is paucity of literature on knowledge and use of partograph among midwives in Anambra State that will inform planning for effective nursing services and policies in sub-national and national health systems. This study will provide information on the level of knowledge and utilization of partograph among midwives working in different levels of health facilities in Anambra state.

MATERIALS AND METHODS

This is a cross-sectional descriptive survey that involved seventeen health facilities consisting of two tertiary, three secondary and twelve primary healthcare centres (PHC) in Anambra state. One public tertiary hospitals in the state was purposively selected, while three public secondary hospitals were randomly selected from the state- one secondary health facility from each senatorial district, and four Primary health centres randomly selected from each senatorial district. Overall, a total of seventeen health facilities (2 tertiary, 3secondary and 12 PHCs) were selected for the study. A five section self-administered questionnaire was utilized for data collection. Section A assessed the demographics of the respondent, while section B assessed the knowledge of partograph, Sections C and D assessed the extent of utilization of partograph and elicited the suggestions to effective use of partograph respectively. The data collection instrument was pretested in a secondary health facility in Anambra state. Split-half and Spearman Brown Correlation Coefficient, and Spearman-Brown Prophecy formula was used to test the reliability and a score of 0.99 was obtained which showed that 99% of the variance in the score was reliable and has 1% error variance. Data were collected from the respondents during working hours at the health facilities. Descriptive statistics was used to summarize data. Mean score was calculated using mean score formular as follows.

Mean score = Total number of all the right options (%) divided by Total number of questions

Knowledge rating: <50 = poor knowledge, 50 - 70= fair knowledge,>70 = good knowledge.

Ethical approval for the study was gotten from the Research Ethics Committee of Faculty of Health Sciences and Technology, Nnamdi Azikiwe University, Nnewi Campus, Nnewi. Oral permission was received from the Heads of units/wards of the health facilities before the commencement of data collection. Written informed consent was sought and obtained from the respondents before data collection.

RESULTS

Table 1 shows that thirty nine (39%) of the respondents were less than thirty years, fifty two (52%) were within 30-45 years and nine (9%) were forty years and above. Twenty one (21%) were just registered midwives while sixty eight (68%) and 11% were registered nurse-midwives and registered nurse-midwives with B.NSc. degree respectively. Almost half 48% of the respondents have had 5-10 years working experience. Fourteen (14%) of the respondents work in the primary health facility, thirty-seven (37%) of the respondents work in the secondary health facility while forty nine (49%) work in the tertiary health facility.

Table 2 shows that 100% of the respondents know about Partograph. However, 76% knew exactly what partograph is used for and 68% knew the components of a Partograph. The table also show that 84% and 90% of the respondents knew the function of the alert line and the action line respectively. Unexpectedly, a lower percentage (72%) and (60%) knew the level of cervical dilation to start the use of partograph and the benefit of partograph respectively. Applying the formula for mean score for knowledge, the mean score for level of knowledge was 78%.

Table 3 show that 96% of the respondents had ever used Partograph for management of labour. However, only 30.2% of them used Partograph always while the majority, 51%, used it most

times and 18.9% rarely used partograph . Table 3 also shows that all respondents at the selected tertiary health facility had used partograph for management of labour whereas 97.3% and 78.6% of those at the secondary and primary health facility respectively had used Partograph.

Table 4 shows that 88.5% of those that used partograph experienced barriers in some cases. Shortage of staff was highest (47.1%) among the most frequent barriers experienced. This is followed by time constraint (32.9%) and unavailability of partograph (20.0%) respectively. The table also shows that 100%, 97.2% and 79.6% of those that ever used Partograph across primary, secondary and tertiary respectively experienced barrier to the use of Partograph. Almost all (90.9%) of the respondents at the primary health centre had unavailability of Partograph as their major barrier, while time constraint (62.9%) and shortage of staff (47.1%) were the major barriers experienced at the secondary and tertiary health facilities respectively.

Table 1: Demographic characteristics of the respondents **n=100**

Variables		Frequency	Percentage
Age:	Less than 30	39	39.0
	30 to 45	52	52.0
	45 and above	9	9.0
	Total	100	100.0
Sex:	Male	4	4.0
	Female	96	96.0
	Total	100	100.0
Educational Qualification: RM		21	21.0
	RN/RM	68	68.0
	RN/RM/BSc.	11	11.0
	Total	100	100.0
Years of experience: less than 5years		40	40.0
	5 to 10year	48	48.0
	Above 10years	12	12.0
	Total	100	100.0
Level of Facility:	Primary	14	14.0
	Secondary	37	37.0
	Tertiary	49	49.0
	Total	100	100.0

Table 2: Knowledge of Partograph

Variables	Frequency	Percent
Do you know about Partograph		
Yes	100	100.0
No	0	0
What is Partograph?		
A tool for effective labour monitoring	76	76.0
A chart used to diagnose labour	12	12.0
A tool for monitoring pregnancy	8	8.0
Not sure	4	4.0
Total	100	100.0
What are the components of a Partograph?		
Fetal condition; Progress of labour; Maternal condition and outcome	68	68.0
Progress of labour and fetal condition	11	11.0
maternal condition and outcome of labour	9	9.0
Not sure	12	12.0
Total	100	100.0
What is the function of alert line?		
Assists for early indication of neonatal resuscitation.	84	84.0
Helps for early indication for proper referral for expert management	8	8.0
Not sure	8	8.0
Total	100	100.0
What is the function of action line?		
Helps for early indication for proper referral for expert management	90	90.0
Assists for early indication of neonatal resuscitation.	8	8.0
Not sure	2	2.0
Total	100	100.0
At what cervical dilatation do you apply the use of partograph?		
2cm	18	18.0
4cm	72	72.0
5cm	5	5.0
Total	100	100.0
What are the benefits of **Partograph**?		
Ensures Maternal and Child Safety	60	60.0
Early Identification of child abnormality	20	20.0
Prevents complications of caesarian section	10	10.0
Prevents abruptio placentae	10	10.0
Total	100	100.0

Table 3: Use of Partograph and frequency of use across different health facilities

variables	Primary n (%)	Secondary n(%)	Tertiary n(%)	Total N(%)
Use of Partograph				
Yes	11(78.6)	36 (97.3)	49(100)	96 (96)
No	3 (21.6)	1 (2.7)	0 (0.0)	4 (4)
Total	14 (100)	37(100)	49 (100)	100 (100)
How often:				
Rarely	9 (81.8)	4 (11.1)	5 (10.2)	18 (18.8)
Most times	2(18.2)	25 (69.4)	22(44.9)	49(51.0)
Always	0 (0.0)	7 (19.5)	22(44.9)	29(30.2)
	11(100)	36(100)	49(100)	96(100)

Table 4: Major barriers experienced for partograph utilization across different levels of health facility

Variables	Primary n (%)	Secondary n(%)	Tertiary n(%)	Total N(%)
Experienced barriers:				
Yes	11(100)	35 (97.2)	39(79.6)	85 (88.5)
No	0(0.0)	1 (2.8)	10(20.4)	11(11.5)
Total	11(100)	36(100)	49(100)	96(100)
Most frequent barrier:				
Shortage of staff	1(9.1)	7(20)	32(82.1)	40(47.1)
Time constraint	0(0.0)	22(62.9)	6(15.4)	28(32.9)
Unavailability of partograph	10(90.9)	6(17.1)	1(2.5)	17(20.0)
Total	11(100)	35(100)	39(100)	85(100.0)

DISCUSSION

The study found that the respondents had good knowledge of Partograph as the mean score of knowledge of Partograph was 78%. This is not surprising because the respondents were only midwives who by virtue of their training must have been exposed to Partograph use. However, it is expected that all the respondents should have good knowledge of Partograph being the major tool at the labour ward but the study revealed the contrary. For instance, less than the mean level of knowledge (72%) of the respondents knew the

level of cervical dilatation to start the use of partograph and even a lower percentage (60%) knew the benefits of use of partograph for management of labour. This situation calls for concern among the stakeholders in the health systems especially the national and subnational managers of maternal and child health in Nigeria because the finding is a pointer to mothers receiving unskilled birth attendance in a formal health facility. Our finding is similar to other studies in Nigeria[7,8], South Africa[9], which revealed good knowledge of partograph among midwives although our study was done across different levels of health facilities, Opiah et al. focused on tertiary health facilities only. However, in contrast to our findings, Ethiopia studies revealed a little above half of the respondents having good knowledge of Partograph although the study targeted all health workers. Our finding, however, is not consistent with another previous study in Nigeria[10] and Ethiopia[3,9,11] that found only 32.3% of the respondents used Partograph for labour management[2]. The reason for this sharp contrast may be possibly due to a wider coverage of respondents which involved doctors, midwives, community health extension workers (CHEWs), and "Auxiliary nurses", compared to our study which targeted only midwives[11].

Although all respondents claimed they knew about Partograph, only 76% knew exactly what it is used for. This is not in the interest of maternal and child health in the health industry. Partograph is a major tool for management of labour and it is expected that all midwives should have an in-depth knowledge of it, especially those working at the labour ward. Unfortunately, some thought that partograph is used for monitoring pregnancy while some were not even sure of what it is. Our finding is similar to an earlier study conducted by which also revealed that not all midwives knew what partograph is used for as they found 84% of midwives knew what the partograph was showing[5]. This calls for immediate action as midwives play a critical role in obstetric care all over the world including Nigeria. Our study also revealed that up to 90% of the respondents knew the function of the action line and unexpectedly, a lower percentage (72%) knew the level of cervical dilation to start the use of partograph while 60% of the respondents knew the benefit of partograph. These inconsistencies in the level of knowledge in specific areas of partograph is worrisome. Without in-depth knowledge of partograph, there would not be effective use of partograph in the management of labour. A previous study had reported lack of detailed knowledge of partograph across non-physician obstetric workers including the midwives[6].

Our study shows that majority of our respondents (96%) had used partograph for management of labour. This is similar to another study where it was found that 92.6% of sampled health professionals used Partograph for labour management[7]. On the contrary, our finding is higher than a previous study in Nigeria that found only 75% of the respondents ever used Partograph[8]. The higher percentage in this study may be because the respondents were midwives that are working in labour wards while their respondents were all nurses working in a tertiary institution. Other similar studies also found lower level of utilization of partograph in health facilities. Tilahum and his colleagues[13] found 43% utilization. Out of those that had ever used Partograph across different levels of health facilities, only those at tertiary health facilities had almost half (44.9%) of them using Partograph always while 0% and 19.5% of

Primary and secondary midwives used Partograph all the time. Majority (81.8%)of those that work at the Primary Health centres rarely used Partograph. This is similar to the study that found inconsistencies in the WHO guideline in the of partograph by the midwives in Kenya[14].

This study also revealed that three quarters of those that had never used partograph came from the primary health care facilities and none came from the tertiary health facility. This is worrisome because primary health facilities are the first point of care including obstetric care at every community. Consequently, most pregnant women especially the poor and rural dwellers are likely to visit the primary health centre for obstetric care including labour management. Poor quality of PHC service delivery has been identified as one of the factors negatively influencing utilization of PHC services by women[15].

Our results also show that approximately 30% of the respondents used partograph every time for labour management. No wonder, statistics show that nearly 20% of all global maternal deaths occur in Nigeria. Between 2005 and 2015, it is estimated that over 600,000 maternal deaths and no less than 900,000 maternal near-miss cases occurred in the country[16] . Nigeria contributed 10 per cent of global deaths for pregnant mothers and each year approximately 262,000 babies die at birth[17]. In fact, a Nigerian woman has a 1 in 22 lifetime risk of dying during pregnancy, childbirth or postpartum/post-abortion[16]. Worst still, no respondent from the primary health care facilities used partograph at all times for labour management and 81.8% of the primary health care providers used partograph just rarely. This calls for urgent scrutiny of the quality of maternal and childcare services provided in primary health care. This is because primary health care is the first point of call for health services and without the use of adequate tools for healthcare management including labour management complications will abound. Nevertheless, our finding is contrary to a similar study in Ethiopia where 73.8% of the respondents use partograph routinely[14]. Although our study involved only midwives, the Ethiopia study included all obstetric providers.

It was also found that the majority of the respondents (88.5%) experienced one form of barrier or the other in an attempt to use partograph at the health facility. Unfortunately, all the respondents from the primary health care experienced barriers for use of partograph while 97.2% and 79.6% experienced barriers for using partograph in secondary and tertiary health facilities respectively. This situation needs the attention of the decision makers considering the importance of maternal and child health in national development. Maternal and Child Health is fundamental to the development of every nation including Nigeria[16]. Consequently, all forms of barriers that could hinder the use of an important tool like partograph needs to be addressed

Our study revealed that the most frequent barrier was dearth of staff. Our finding corroborates with the findings of other similar quantitative studies in Nigeria where shortage of staff negatively influenced use of partograph[8,10,18.] Moreover, findings of both qualitative and quantitative studies outside Nigeria are in line with those of our study, as they found shortage of staff as a major challenge in utilization of partograph[12,13,19]. However, there are differences in the most frequent barriers to use of partograph across different levels of healthcare facility in this study. While shortage of staff remains the most frequent barrier at the tertiary health

facility, unavailability of partograph was the most frequent barrier (90.9%) at the primary health care level. This agreed with findings from a previous Nigeria study which found only 9.1% respondents that had partographs available in their labour wards at primary health care facilities level[20]. Unavailability of a working tool leads to poor quality health care delivery and creates inequities in the provision of health care. However, findings from another similar study in Nigeria did not align with the current study as unavailability of partograph was not a major barrier at only the primary health care level but also at other levels especially the secondary health care.

Overall, there was reasonable knowledge of partograph among midwives working in labour wards across different levels of health care facilities in this study. However, there is a lack of detailed knowledge that can ensure high quality maternal and child care especially among midwives at the primary health care level. Moreover, there was poor utilization of partograph for management of labour because of some factors like shortage of staff and unavailability of partograph.

CONCLUSIONS

Although there seems to be high knowledge of partograph among midwives working in labour wards across different levels of health care facilities, detailed knowledge that can ensure high quality maternal and childcare especially among midwives at the primary health care level was lacking. It is important that continuous in-service training on partograph use be embedded in primary health care programmes to ensure adequate knowledge of partograph among midwives. Health facility resource allocation mechanisms need to be reviewed to ensure strategic allocation of resources that will address most important needs for quality health care delivery.

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JOURNAL OF BIOMEDICAL INVESTIGATION (JBI) VOLUME 12 NUMBER 2: JULY-AUGUST 2024

QUALITY OF LIFE, CARDIOVASCULAR INDICES AND STRESS AMONG PREGNANT WOMEN ATTENDING ANTENATAL CLINIC IN FMC OWO, ONDO STATE

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Received: 20/6/2024; accepted for publication 31/8/2024

ABSTRACT

Background: The period of pregnancy is a critical period in a woman's life that involves not only biological/physiological but psychological and social changes. These changes can affect quality of life of a pregnant woman, maternal and infant health hence the need to be monitored and kept under control.

Aim: To determine the correlation between Quality of life, selected Cardiovascular indices and Stress among pregnant women attending antenatal clinic in Federal Medical Centre, Owo.

Methods: This cross-sectional study recruited 95 pregnant women attending antenatal clinic. Data was obtained using the Perceived Stress Scale and World Health Organization Quality of Life-Bref. Participants' blood pressure and pulse rate were measured using appropriate instrument. Data were analyzed using descriptive statistic and Inferential statistics of spearman rho correlation of coefficient and Kruskal Wallis analysis of variance with mean rank. Alpha level was set at p= 0.05

Results: A significant negative correlation was observed between pulse rate and perceived stress level (r = -0.195, p = <0.05); between physical domain of the WHOQoL-Bref and perceived stress level (r = -0.207, p =<0.05). No significant difference was found for perceived stress among the different categories of gestational age of respondents. Also there was no significant difference in all the domains of quality of life and overall quality of life among the different categories of gestational age of respondents (p>0.05).

Conclusion: Stress is negatively correlated with pulse rate of pregnant women while Physical health negatively correlated with perceived stress. Stress and quality of life were not significantly different throughout the different stages of pregnancy.

Keywords: *Quality of life, Cardiovascular indices, Stress, Pregnant women*

INTRODUCTION

In the life of a woman, pregnancy is taken to be a unique and exceptional moment.[1] It is a very specific and complex stage in a woman's life, that involves not only biological/physiological but also psychological and social changes.[2] These changes can affect quality of life of a pregnant woman even in uncomplicated pregnancies, affecting both maternal and infant health.[3] Integrated health is a notion that aims at giving exhaustive care related to promotion of individuals' physical, social, mental wellbeing. Close health care promotion during pregnancy is needed in order to identify women at risk of unfavourable outcomes[4].

In 1994, the World Health Organization (WHO) defined quality of life (QoL) as "the individuals" perception of their position in life in the context of culture and value systems in which they live in relation to their goals, expectations, standards and concerns.[1,5] Health related quality of life is a concept that defines an individual's own perception of their subjective state of health, functioning and well-being in the physical, psychological and social domains and their role performance.[1,6] Health related quality of life decreases during pregnancy.[7] The major factors that contributed to reduced or poor quality of life were medically associated with reproduction, complication before or during pregnancy, obesity, nausea and vomiting, stress, anxiety,

depression during pregnancy etc. This supports the notion of psychological state being one of the aspects of health of a pregnant mother that is of a big concern to both the pregnant mother and the care giver[3].

Stress is a complex sequence of events or reactions of the human body to demanding circumstances.[8] Pregnancy even though an exciting experience, involves a lot of emotional adjustments and as a result poses a lot of stress to woman's life.[9] It has been established in a study that the higher the number of stressful events, the higher the level of postpartum depression and mental disorders[10]. A study found that 20% of preterm births were estimated to be caused by maternal stress during pregnancy, hence the need to identify and reduce the exposure to stress during pregnancy[11]. Psychiatric counselling that focuses identification of risk behaviours, promotion of sound mental health among pregnant women and prevention of adverse effects for the foetus has been advocated, hence the need to evaluate pregnant women periodically for risk of unfavourable outcomes[12].

The cardiovascular system undergoes profound change during pregnancy. This includes increase cardiac output and decreased vascular resistance especially at the initial stage following increased oestrogen and vasodilatory prostaglandin (PG12), which regulates nitric oxide synthesis causing peripheral vasodilatation. There is also increase in blood volume and stroke volume[13]. Pregnancy is a critical time to address the cardiovascular function of a woman throughout life, and acts as a cardio-metabolic stressor[14]. Normal pregnancy requires significant maternal cardio-metabolic adaptation, with a 30% to 50% increase in cardiac output, alterations in lipid profile including an approximately 50% increases in total cholesterol, and a significant increase during the second half of gestation to facilitate transfer of glucose to foetus. There is compelling evidence that adverse pregnancy outcomes present as warning signs for future cardiovascular risk and can be useful in identifying high-risk women[15]. According to Elkayam et al., [16], 1-4% of pregnancies are complicated by cardiovascular disease. The pre-existing conditions that can make pregnant women susceptible to cardiovascular disease include hypertension, diabetes mellitus and congenital heart disease[17].

Proper assessment and enhancement of cardiovascular health early in pregnancy reduces the risk of cardiovascular diseases. This is especially important in women with hypertensive disorders due to the fact that they have a higher tendency to develop atherosclerosis and other cardiovascular diseases[18]. Management of cardiovascular disease in pregnancy can be complicated, because of the unique physiological changes taking place in the body and the presence of the foetus[19].

In a study conducted on pregnant women in south eastern part of Ethiopia, it was discovered that the prevalence of perceived stress was 11.6% and factors like marital status, age, occupation, living arrangement, number of pregnancies, gestational age, status of pregnancy and history of neonatal death contributed to its occurrence[20]. Here in Nigeria, a study on stress and resilience was conducted in lle-Ife among pregnant teenagers. It was found that majority of women were categorized as having moderate level of perceived pregnancy related stress and low resilience. Feeling of shame, male partner rejection of pregnancy and lack of parental involvement emerged as the independent predictors of higher level of pregnancy related stress[21].

Given the prevalent changes that are experienced in pregnancy, knowing the correlation between Quality of life, selected Cardiovascular indices and Stress among pregnant women in Federal Medical Centre Owo metropolis may help in preventing and managing the risks involved. Few related studies have been done in the western part of Nigeria and few in Nigeria at large, hence the need of this study.

METHODS

Study design

The design for this study was a cross-sectional survey.

Research Population

The study population for this study were apparently healthy pregnant women between ages 15 and 50 years attending ante-natal clinic. They were recruited from the ante-natal clinic of obstetrics and gynecology department of Federal Medical Center, Owo Ondo State, using a consecutive sampling technique.

Instrument for data Collection

Data was obtained using the following instruments:

Perceived Stress Scale: Perceived stress scale (PSS) is a 10-item questionnaire developed to assess stress levels in young people and adults aged 12years and above. It is a self-report measure that evaluates the degree to which an individual has perceived life as unpredictable, uncontrollable and overloading over the past month. Six items of PSS-10 measure stress and four items measure coping strategy to stress. Each item is scored from 0 (never) to 5 (very often) with a total range of 0 to 40. Scores ranging from 0 -13 was considered low stress, 14 – 26 considered moderate stress, while scores ranging from 27 – 40 was considered high perceived stress. The test-retest reliability for PSS subscales was significant (r = .66 and r = .50)[26]

The World Health Organization Quality of Life-Bref (WHOQOL-Bref): The WHOQOL-BREF is a self-administered questionnaire, comprising of 26 items that captures 4 domain structures, physical health, psychological, social relationship and environment. The four domain scores give an individual's perception of life in each domain. Each question is scored 1-5, the higher the scores in each domain, the greater the quality of life the individual in that aspect of their life. The domain score is gotten by calculating the mean score of items within each domain. This is multiplied by 4 to get a domain score comparable with scores used in WHOQOL-100. Raw scores are then converted to transformed scores. The Cronbach's alpha coefficient for the whole WHOQOL-BREF scale was 0.896, internal reliability for all domains was above 0.70. The test-retest reliability for all domains was significant at $p < 0.01$ level, showing good stability of the scale[27].

Sphygmomanometer: Blood pressure was measured using the Dekamet MK3 Accoson Mercury Sphygmomanometer. The device works by tightening a strap or cuff around a wearers forearm and slowly increasing pressure. It effectively measures systolic and diastolic pressure when used with a stethoscope.

Procedure for Data Collection

Ethical approval for this study was obtained from ethical review committee of the Federal Medical Centre Owo (FMC/OW/380/VOL.CC11/191) prior to the commencement of the study. Participants' informed consent were also sought and obtained.

Consented participants who are apparently healthy were consecutively recruited into the study. The selected cardiovascular indices were taken as indicated below:

Blood pressure (mmHg): On arrival at study venue, the participants took some rest for five minutes, after which they were placed in a relaxed sitting with arm supported on the table at the heart level. The cuff of the Accoson Mercury Sphygmomanometer was wrapped round the left upper arm just above the cubital fossa and the stethoscope bell was lightly placed over the brachial artery just below the cuff's edge. The cuff was then inflated to 180mm/Hg and gradually air was released from the cuff at a moderate rate(3mm/sec). the difference in sound was done by listening with the stethoscope and proper observation of the dial or mercury gauge was carefully done. The first knocking sound (Korotkoff Sounds) was recorded as the systolic pressure. When the knocking sound disappears, that was recorded as the diastolic pressure (such as 120/80).

Pulse rate (beats per minute): To measure for pulse, the index and middle finger of the hand was placed on the inner wrist of the arm, just below the base of the thumb. The tapping or pulsing was felt against the fingers. A count of the beat was taken for 60seconds and recorded.

The self-administered questionnaires were given to the participants to fill and collected by the researcher immediately they were filled by the respondents.

Data Analysis

The data from this study was summarized using descriptive statistic of mean, standard deviation, proportion as well as frequencies, and analyzed using inferential statistics of Pearson product moment correlation, Kruskal Wallis analysis of variance with mean rank was used for significant difference among the QoL, Stress, gestational age and number of pregnancies. The alpha level will be set at p= 0.05

RESULTS

The socio-demographic characteristics of respondents are presented in Table 1. The sample comprised of 95 pregnant women with age 26-30years being the modal frequency of respondents 39 (40.6%). 94 (99.0%) of the respondents were married while 21 (21.9%) of the respondents are Trader; 46 (48.5%) of the respondents were in third trimester, majority of the respondents 36 (37.5%) are having their first pregnancy. Table 3 shows the descriptive statistics of pulse rate, quality of life, blood pressure of respondents. The minimum and maximum pulse rate ranged from 18 to 47, with a mean of 89.42(±11.76). The systolic blood pressure ranged from 70 to 140, with a mean of 109.66(±13.29). The diastolic blood pressure ranged from 50 to 90, with a mean value of 64.56(±10.83). Physical domain ranged from 13 to 100, with a mean value of 61.50(±15.17). Psychological domain ranged from 19 to 94, with a mean value of 67.25(±15.03). Social relationship ranged from 6 to 100, with a mean value of 73.09(±21.86). Environment ranged from 13 to 100, with a mean value of 67.47(±18.01). Overall quality of life ranged from 25 to 93 with a mean value of 66.69(±14.16). Table 2 shows the perceived stress level of respondents. The result shows 12(12.6%) of the participants reported low perceived stress level, 78(82.1%) moderate perceived stress and 5(5.3%) high perceived stress level. Table 4 shows the correlation of quality of life, pulse rate, blood pressure and stress level among respondents. There is a significant correlation between systolic blood

pressure and pulse rate (r = 0.221, p = < 0.05). There is a significant negative correlation between pulse rate and perceived stress level (r = - 0.195, p = < 0.05). There is a significant correlation between systolic blood pressure and diastolic blood pressure (r = 0.573, p = < 0.05). There is also a significant negative correlation between physical domain and perceived stress level (r = - 0.207, p =<0.05) and there is also a significant correlation between physical domain and psychological domain (r = 0.361, p =< 0.05). There is a significant correlation between physical domain and social relationship (r = 0.396, p =< 0.05) and there is also a significant correlation between physical domain and environment (r = 0.358, p =< 0.05). There is a significant correlation between psychological domain and environment (r = 0.570, p =< 0.05).

Presented in table 5 is the result of Kruskal-Wallis Analysis of variance by ranks between quality of life and perceived stress among gestational age. The result shows no significant difference for perceived stress between gestational age of respondents (H = 0.775, p = 0.646). The result also showed no significant difference in all the domains of quality of life and overall QoL between gestational age of the respondents (Physical domain p = 0.251; Psychological p = 0.801; Social relationship p = 0.642; Environment = 0.705; Overall QoL p = 0.646).

Presented in table 6 is the result of Kruskal-Wallis Analysis of variance by ranks between quality of life and perceived stress. The result shows no significant difference between perceived stress and number of pregnancy of respondents (H = 1.661, p = 0.766). The result also showed no significant difference between all the domains of quality of life, overall QoL and number of pregnancies of the respondents (Physical domain p = 0.526; Psychological p = 0.978; Social relationship p = 0.761; Environment = 0.936; Overall QoL p = 0.798).

Table 1: Socio-demographic characteristics of respondents N = 95

Variables	Attributes	Frequency	Percentage
Age	15-20years	4	4.2
	20-25years	16	16.7
	26-30years	39	40.6
	31-35years	19	19.8
	36-40years	13	13.5
	41-45years	3	3.1
	46-50years	2	2.1
Occupation	Student	5	5.2
	Civil servant	17	18.2
	Teacher	6	6.3
	Self employed	14	15.0
	Trader	21	21.9
	Business woman	16	16.7
	Fashion designer	16	16.7
Gestational age	First trimester	14	14.7
	Second trimester	35	36.8
	Third trimester	46	48.5
No of pregnancies	First pregnancy	36	37.5
	Second pregnancy	29	30.2
	Third pregnancy	19	19.8
	Fourth pregnancy	8	8.3
	Fifth pregnancy	3	4.2
Marital status	Single	1	1.0
	Married	94	99.0

Table 2: Perceived stress level of respondents N=95

Variables	Frequency	Percentage
Low	12	12.6
Moderate	78	82.1
High	5	5.3

Table 3: Descriptive statistics of Pulse rate, Quality of life, Blood pressure (N=95)

	Variables	Minimum	Maximum	Mean± Standard deviation
Cardiovascular Parameters	Pulse rate	57	120	89.42 ± 11.76
	Systolic blood pressure	70	140	109.66 ± 13.29
	Diastolic blood pressure	50	90	64.56 ± 10.83
Quality of life	Physical domain	13	100	61.50 ± 15.17
	Psychological domain	19	94	67.25 ± 15.03
	Social relationship	6	100	73.09 ± 21.86
	Environment	13	100	67.47 ± 18.01
	Overall quality of life	25	93	66.69 ± 14.16

Table 4: Spearman's rho correlation statistics of Quality of life, Pulse rate, Blood pressure and Stress level among Respondents

Variables	PR	SBP	DBP	PSS	Phy domain	Psy domain	Soc Relation	Environment	Overall Qol
Pulse rate	1.00	0.221, <0.05	0.161, >0.05	-0.195, <0.05	0.91, >0.05	-0.077, >0.05	-0.046, >0.05	0.001, >0.05	0.04 >0.05
Systolic blood pressure	0.221, <0.05	1.00	0.573, < 0.05	-0.111, >0.05	-0.024, >0.05	-0.054, >0.05	0.074, >0.05	0.040, >0.05	0.026, >0.05
Diastolic blood pressure	0.16, >0.05	0.573, < 0.05	1.00	-0.31, > 0.05	-0.001, >0.05	0.099, >0.05	0.048, >0.05	0.053, >0.05	0.067, >0.05
PSS	-0.195, <0.05	-0.111, >0.05	-0.31, > 0.05	1.00	-0.207, <0.05	-0.076, >0.05	-0.033, >0.05	-0.110, >0.05	-0.031, >0.05
Physical domain	0.091, >0.05	-0.024, >0.05	-0.001, >0.05	-0.207, <0.05	1.00	0.361, <0.05	0.396, <0.05	0.358, <0.05	0.66, <0.05
Psychological domain	-0.077 >0.05	-0.054, >0.05	0.099, >0.05	-0.076, >0.05	0.361, < 0.05	1.00	0.394, <0.05	0.570, <0.05	0.710, <0.05
Social Relationship	-0.046, >0.05	0.074, >0.05	0.048, > 0.05	-0.033, >0.05	0.396, <0.05	0.394, <0.05	1.00	0.428, <0.05	0.725, <0.05
Environment	0.001, >0.05	0.040, >0.05	0.053, >0.05	-0.110, >0.05	0.358, <0.05	0.57, <0.05	0.428, <0.05	1.00	0.738, <0.05
Overall quality of life	0.04, >0.05	0.026, > 0.05	0.067, > 0.05	-0.031, > 0.05	0.660, <0.05	0.710, <0.05	0.725, <0.05	0.738, <0.05	1.00

Table 5: Kruskal-Wallis Analysis of Variance by ranks between quality of life and perceived stress among gestational age of respondents

Variables	First Trimester (Mean Rank)	Second Trimester (Mean Rank)	Third Trimester (Mean Rank)	Kruskal-Wallis H	P-value
PSS	49.50	44.72	42.98	0.775	0.646
QOL					
Physical Domain	36.30	41.33	49.50	2.761	0.251
Psychological Domain	51.10	44.97	43.50	0.443	0.801
Social Relationship	55.50	43.96	45.61	0.886	0.642
Environment	52.70	42.99	45.65	0.700	0.705
Overall QOL	50.90	42.53	47.13	0.872	0.646

Table 6: Kruskal-Wallis Analysis of Variance by ranks between quality of life, perceived stress and no of pregnancy

Variables	First Pregnancy (Mean Rank)	Second Pregnancy (Mean Rank)	Third Pregnancy (Mean Rank)	Fourth Pregnancy (Mean Rank)	Fifth Pregnancy (Mean Rank)	Kruskal-Wallis H	P-value
PSS	46.91	46.06	41.63	45.44	51.00	1.661	0.766
QOL							
Physical Domain	42.61	46.73	51.50	58.69	40.25	3.193	0.526
Psychological Domain	45.04	47.06	47.58	45.56	36.25	0.455	0.978
Social Relationship	46.92	42.21	52.24	50.44	52.00	1.861	0.761
Environment	46.68	44.24	46.03	53.31	51.00	0.793	0.936
Overall QOL	45.31	44.04	51.39	55.56	43.00	1.836	0.798

DISCUSSION

The primary aim of this study was to determine the correlation between quality of life, selected cardiovascular indices and stress among pregnant women attending antenatal clinic in Federal Medical Centre, Owo.

The result showed two-third (77.1%) of the respondents are within age 20-35years which is in line with the study by Wegbom et al[24] on determinant of depression, anxiety and stress among pregnant women where 65.7% were aged 25-34 years. This could be because women likely give birth more within this age group. 99.0% of the respondents were married in this present study which is supported by Wegbom et al[24] in which 89% of participants were married but in contrary with the study done by Velez[25] on pregnancy and health related quality of life where 60% of the participants were married and this variation could be due to cultural difference. 48.5% of the respondents are in third trimester and majority of the respondents (37.5%) are primigravida pregnancy which is supported by Wegbom et al[24]. This could be due to the fact that most women do not present to the hospital at the first or second trimester and also the primigravida tends to present to the hospital more than the multigravida.

The result of this study revealed that perceived stress has a negative correlation with pulse rate which is in line with a study done by Jarvelin-Pasanen, Sinikallio and Tarveaine[26]. Increased occupational stress was found associated with lower HRV, especially with reduced parasympathetic activation. On the contrary, a study done by Kim et al 2018[27] confirmed that stress had an impact on heart rate variability (HRV). This represents the ability of the heart to respond to a variety of physiological and environmental stimuli. The result showed that in most studies, HRV changed in response to stress stimulated by several factors. In pregnant women, Odendaal[28] reported a series of fluctuations in heart rate, especially a deceleration. This was attributed to uterine activity. The variation in results may be due to other factors considered to have an effect to the heart rate and by extension, pulse rate.

There was no significant correlation between perceived stress, systolic blood pressure and diastolic blood pressure. Hassoun et al[29] reported that both variables were independently associated, after age, sex lifestyle, physical activity, social status and socioeconomic status were considered. Another study reported that there was a significant correlation between systolic blood pressure, diastolic pressure and perceived stress level[30,31]. This variation in systolic blood pressure and diastolic blood pressure measurement can be as a result of difference in population in this present study.

The result of this study showed that quality of life had no significant correlation with systolic blood pressure and pulse rate in pregnant women within the area of study. However, there was a significant negative correlation between physical domain of quality of life and perceived stress which is in line with a study by Periera and Canavarro[32] where quality of life was found to improve in younger patients especially in physical domain WHOQoL-Bref. Lagadec et al[3] reported that the major factors associated with improved quality of life include: maternal age, primiparity, absence of social and economic problems, exercise, etc. and the factors associated with poor quality of life were stress, sleep

difficulties, complications before or during pregnancy and some other unhealthy lifestyles. Psychopathological symptoms such as anxiety, irritability and depression contributed significantly to variance in quality of life. However, Estebsari et al[33] reported that physical and psychological dimension of quality of life was significantly correlated with maternal age. The stage of pregnancy was also considered a factor the affected quality of life according to Jakubauskiene et al[34].

Alzboon and Vural[35] showed that apart from stress, perceived social support and some patient characteristics, only parity had a significant effect on quality of life[36] , while reporting that 94% of respondents with history of cardiovascular disease (CVD) had a good quality of life, with 85% having an adequate environmental aspect, 60.7% having active social relationships, 54.7% having good physical health, and 44.8% having a stable psychological condition. The psychological aspect of quality of life was affected the most, which supports the view that mental health is majorly associated with quality of life as was found in this study. The variation in these studies can be attributed to the presence of a disease and quality of treatment received, different population, different lifestyles of participants and also stage of pregnancy as different stages of pregnancy possess a level of effect on quality of life[3].

The observation from this study shows no significant difference in stress among the different categories of gestational age of respondents which is supported by Gokoel et al[37]. The result also showed no significant difference in all the domains of quality of life, overall QoL among the different categories of gestational age of the respondents which contradicts the findings of Wojcik, Anisko and Siatkowski[38] that showed a significant difference in the quality of life between the first and third trimester of the participants. This variation in result could be due to the fact that gestational age of the respondent is not evenly distributed across the three trimesters in the present study.

Furthermore, the observation from this present study showed no significant difference in perceived stress and the number of pregnancies of respondents which is in agreement with the findings of Gokoel et al[37]. The result also showed no significant association between the domains of quality of life and number of pregnancies of the respondents. This could be as a result of an uneven distribution among the groups of women with number of pregnancies.

CONCLUSION

The findings from this study have shown that stress is negatively correlated with pulse rate of pregnant women. Stress has also been found to have a negative impact on physical domain of quality of life among pregnant women. Increase stress reduces the quality of life in pregnant women.

Recommendation

More should be carried out examining the impact of stress on different domains of quality of life. Further studies are recommended on this topic among pregnant women in other geographical zones with a higher sample size. Further studies can also explore the impact of work stress in pregnancy among pregnant women of similar occupation.

CONFLICT OF INTREST:

The authors declare no conflict of Interest in this study.

SOURCE OF FUNDING

The study was self-sponsored.

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JOURNAL OF BIOMEDICAL INVESTIGATION (JBI) VOLUME 12 NUMBER 2: JULY-AUGUST 2024

EFFECT OF SPORTS PARTICIPATION ON SELECTED CARDIOVASCULAR AND ADIPOSITY INDICES AMONG UNDERGRADUATE STUDENTS OF UNIVERSITY OF BENIN, EDO STATE

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Received: 29/6/2024; accepted for publication 31/8/2024

ABSTRACT

Background: Participation in sporting activities produces a significant improvement in the physical, social and mental health of individuals and also reduce risk of diseases. Cardiovascular diseases are reported to be the leading cause of deaths worldwide, with an estimated 17.9 million people dying from cardiovascular related diseases in 2019.

Aim: The aim of this study was to determine the effect of sport participation on selected cardiovascular health and adiposity indices among a cohort of undergraduate students.

Methods: Consecutive sampling technique was used to recruit 359 consenting undergraduates of University of Benin. Data were obtained using the International Physical Activity Questionnaire. Participants were classified as non-sports participants, minimally active and very active sports participants. Descriptive statistics of mean, frequency, standard deviation and inferential statistics of ANOVA test were used to summarize and analyze the obtained data. The level of significance was set at 0.05.

Results: Majority of the respondents were involved in sports activities (66.3%) while 33.7% were not involved in sporting activities. Among those involved in sports, 33.4% were classified as very active participants while 32.0% were minimally active. The results also revealed a significant difference in the systolic blood pressure, diastolic blood pressure, heart rate and respiratory rate of respondents among the three classified sport participation categories ($p<0.05$ in all cases).

Conclusion: Active participation in sports should therefore be encouraged among undergraduates' students. Participation in sports seems to have a potential positive influence on cardiovascular, adiposity and respiratory functions.

Keywords: *sports participation, cardiovascular, physical activity*

INTRODUCTION

Participation in sporting activities is of significant benefits to individuals with associated benefits in physical, social and mental health of participants and also reduce risk of diseases. McCartney et al.,[1] defined health as a structural, functional and emotional state that is compatible with effective life as an individual and as a member of society. Cardiovascular fitness and health are important aspects of healthy living. Cardiovascular diseases (CVDs) are reported to be the leading cause of deaths worldwide, with an estimated 17.9 million people dying from cardiovascular-related diseases in 2019[2]. The most common cardiovascular diseases include hypertensive heart disease, cerebrovascular accident and coronary heart disease[3], and are more prevalent among individuals of older age and among the male population[4]. Other risk factors associated with the development of CVDs include high blood pressure, high cholesterol levels, diabetes, smoking, obesity, unhealthy diet and physical inactivity[5].

Studies have reported that an increased level of physical activity reduces the risk of developing cardiovascular diseases[6]. Although cardiovascular diseases are more prevalent in the older population, improving cardiovascular health during adolescent years can help to significantly reduce the risk of developing CVDs in old age[7]. The WHO recommendation of physical activity for individuals aged 18 to 64 years is at least 150 to 300 minutes of moderate-intensity aerobic physical activity or at least 75 to

150 minutes of vigorous intensity aerobic physical activity[8]. Participation in sport can help to achieve and maintain the recommended level of physical activity.

Sport is a common extra-curricular activity among individuals of school age globally. In Nigerian universities, students participate in a variety of sporting activities, especially football along with several others such as volleyball, track and field events[9]. Participation in sporting activities is significantly associated with an increase in physical activity levels and improvement in the physical and psychosocial health of the participants[10]. Participation in sporting activities have been reported to have significant effect on cardiovascular health of the participants.

Torres *et al.*,[11] reported that participation in sports among children and adolescents resulted in lower diastolic blood pressures. Adults who participated in sports in their youths have lower history and risks of developing obesity and high cholesterol levels compared to those who did not participate in sporting activities[12]. Sports factors such as the type of sport played, the duration and frequency of play also have effects on the health of the participants. Different type of sports may have varying impacts on the level physical activity and health benefits to the athletes. Engaging in high team sports sport have been reported to yield significant increase in level of physical activity than individual sports[13]. Other factors that can also affect level of physical activity and health benefits from sports include membership of a sport club, high frequency of sports participation and performing outdoor sports[14]. However, there is the need to determine the effect of sport participation on selected cardiovascular health indices. The University of Benin has a tradition of encouraging sports and physical activity. Undergraduates of this University have excelled at many competitions. This study therefore was designed to determine the effect of sport participation on selected cardiovascular health indices among undergraduate students of the University of Benin.

METHODS

This comparative descriptive study involved 359 undergraduates of University of Benin, Edo State, Nigeria. Ethical approval for this study was obtained from ethical review committee of the University of Benin Teaching Hospital (UBTH) (protocol number CMS/REC/01/VOL.2/433) prior to the commencement of the study. Participants' informed consent were also sought and obtained.

Instrument for Data collection: Sociodemographic data of the respondents: age, gender, level and the type of sports they play, the duration for which they have been playing was obtained.

The International Physical Activity Questionnaire (IPAQ): The IPAQ is an instrument designed primarily for population surveillance of PA among adults (age 15 & above). Its development commenced in Geneva in the year 1998 and was followed by extensive reliability and validity testing across 12 countries in 2002. The finding suggests that it has acceptable measurement properties for use in many settings and different languages and is suitable for population-based prevalence studies of participation in PA. The IPAQ used in this study has 7 items providing information on time spent in moderate to vigorous intensity PA and in sedentary activities during the last 7 days. Test-retest reliability indicated good stability. High reliability of .80[15].

The result from IPAQ allowed energy expenditure to be estimated in metabolic equivalent minutes per week (MET min/week). An average MET score is attributed for each type of activity: 3.3 METs for walking, 4.0 METs for moderate activity and 8.0 for vigorous activity. The physical activity level in this study was reported in categories (low activity levels/inactive, moderate activity levels, or high activity level) and as a continuous variable (MET minutes/week) according to the scoring system provided by IPAQ.

The cardiovascular parameters of the participants were measured using the appropriate instruments. The participants were grouped into three categories based on their level of sport participation: non- sports participants, non-active participants and active participants.

Procedure for Assessments and Measurements:

The weighing scale was used to measure the weight of the participants. The participants were instructed to remove their shoes and heavy clothing and stand on the weighing scale, the examiner will observe and document the value recorded.

Each of the participants were asked to take of their shoes, step on the stadiometer (Gulflex Medical and Scientific England) and the height was measured from the base of the feet to tip of the head by the researcher. The Body Mass Index (BMI) of the participants wasalso calculated from the weight and height values recorded. The tape measure (Butterfly, China) was used to measure the waist and hip circumference of the participants.

The waist circumference was measured from the midpoint between the lower margin of the last palpable rib and the top of the iliac crest. The hip circumference was measured around the widest part of the buttocks. The measurements were taken with the participants in standing position, and arms kept at the sides and the feet positioned closed together. The measurement for the waist circumference was taken at the end of normal expiration while participants maintaining a relaxed posture so as not to increase abdominal tension.

The blood pressure of the participants was measured using Accoson Mercury Sphygmomanometer (England) and a Littmann stethoscope (USA). Participants were seated and in a relaxed position with arm supported on an arm rest. The cuff of the sphygmomanometer placed at the heart level and about 2 – 3cm above the elbow crease. The readings were taken twice and the mean values calculated and recorded[16].

The pulse rate of the participants was measured using an Omron pulse oximeter (Germany). The participants werein a sitting and relaxed position. The oximeter was placed on the thumb of the participant and the reading of the pulse rate was recorded. The measurement of the respiratory rate was takenvia visual observation of the chest wall and abdomen of the participant by the researcher, with the participant still in a seated position.

Data Analysis:

Descriptive statistics of mean, frequency and standard deviation were used to present the results while inferential statistics of ANOVA was used to determine the significance of differences in cardiovascular parameters among the three categories of those who are inactive, moderately and vigorously active in sports. The level of significance was set at $p<0.05$.

RESULTS

Table1 shows the socio-demographic characteristics of the respondent. The age of the respondents ranged from 18 to 25 years with a mean value of 21.88 (± 1.95). 241 (67.1%) of the respondents are male. 99 (27.6%) of the respondents were in 400 level. 75 (20.9%) are from the faculty of Life Sciences. 238 (66.3%) of the respondents are involved in sports. 121 (33.7%) of the respondents were classified as non-participants and 123 (34.3%) were classified as very active in sports participation. Table 2 shows the characteristics of respondents that participated in sports activities. Out of a total of 238 that participated in sports 226 engaged in competitive sport.130 (54.6%) of the respondents play football. 110 (46.2%) of the respondents engage in sporting activities 3 times in a week and 95 (39.9%) practice daily. A combination of jogging, running and stretching were the most common practice activities (28.6%). The cardiovascular health and physical activity characteristics of the respondents is presented in table 3. The mean BMI of the respondents was 23.55 kg/m^2 (± 3.43) while the mean WHR was 0.78 (± 0.47). The mean HR and RR were 70.93 (± 15.94) and 16.16 (± 5.05) respectively. The mean systolic and diastolic BP were 119.91 (± 9.50) and 71.37 (± 9.59) respectively. The mean total MET was 858.11 (± 404.13). The result revealed that majority (61.0%) of the respondents were of normal BMI, 319 (88.9%) had a normal WHR, while 234 (65.2%) of the respondents were minimally active. Shown in table 4 is the result on the level of significant difference in cardiovascular health variables of participants.

The result revealed a significant difference in the systolic BP ($F = 44.961$, $\rho < 0.001$), diastolic BP ($F = 12.150$, $\rho < 0.001$), heart rate ($F = 140.891$, $\rho < 0.001$) and respiratory rate ($F = 175.311$, $\rho < 0.001$) among the three groups of non-participants, minimally active and very active sport participants. Shown in table 5 is the result of post hoc analysis. The result revealed a significant difference in the systolic blood pressure between non-participants and minimally active sport participants ($\rho < 0.001$) as well as between minimally active and very active sport participants ($\rho < 0.001$).

Similarly, there was significant difference in the diastolic blood pressure between non-participants and very active sport participants ($\rho < 0.001$) as well as between minimally active and very active sport participants ($\rho = 0.001$).

Furthermore, there was significant difference in the heart rate and respiratory rate between non-participants and minimally active sport participants ($\rho < 0.001$) as well as between minimally active and very active sport participants ($\rho < 0.001$).

Table 1: Sociodemographic characteristics of the respondents N = 359

	Range	Mean ± SD
Age	18 – 26	21.88 ± 1.95
	Frequency	**Percentage (%)**
Male	241	67.1
Female	118	32.9
Level		
100	44	12.3
200	93	25.9
300	94	26.2
400	99	27.6
500	29	8.1
Faculty		
Arts	6	1.7
BMS	91	25.3
Education	38	10.6
Engineering	12	3.3
Agric	22	6.1
Management Science	52	14.5
Physical Science	21	5.8
Social Science	32	8.9
Life Science	75	20.9
Pharmacy	10	2.8
Involved in Sports		
Yes	238	66.3
No	121	33.7
Classification of Sport participation		
Non-participant	121	33.7
Minimally active	115	32.0
Very active	123	34.3

Table 2: Sports participation characteristics among the sport participants N = 238

	Frequency	Percentages
Sport Type		
Competitive	226	95.0
Non-competitive	3.3	5.0
Sport Played		
Basketball	17	7.1
Football	130	54.6
Hockey	40	16.8
Long jump	12	5.0
Volleyball	39	16.4
Frequency of Playing		
Occasionally	49	20.6
Monthly	43	18.1
Weekly	23	9.7
3 times a week	110	46.2
Daily	13	5.5
Frequency of Practice		
Occasionally	67	28.2
Monthly	19	8.0
Weekly	30	12.6
3 times a week	27	11.3
Daily	95	39.9
Practice Activities		
Jogging	54	22.7
Jogging, running, jumping & stretching	59	24.8
Jogging, running & stretching	68	28.6
Jogging, stretching	19	8.0
Jumping	5	2.1
Jumping to stretching	23	9.7
Running	6	2.5
Stretching, jumping to stretching	4	1.7

Table 3: Cardiovascular health and physical activity characteristics of the respondents N = 359

	Range	Mean ± SD
BMI (kg/m^2)	2.67 – 35.84	23.55 ± 3.43
WHR	0.07 – 9.33	0.78 ± 0.47
HR	6.0 – 105.0	70.93 ± 13.54
RR	2.0 – 28.0	16.16 ± 5.05
Systolic BP (mmHg)	88 – 143	119.91 ± 9.50
Diastolic BP (mmHg)	40 – 100	71.37 ± 9.59
Vigorous MET	0 – 1050.00	239.04 ± 223.38
Moderate MET	0 – 1080.00	202.09 ± 198.72
Walking MET	0 – 1050.00	416.99 ± 221.68
Total MET	70.00 – 1820.00	858.11 ± 404.13
	Frequency	**Percentage (%)**
BMI		
Underweight	23	6.4
Normal	219	61.0
Overweight	106	29.5
Obese	11	3.1
WHR		
Normal	319	88.9
Obese	40	11.1
IPAQ Classification		
Inactive	103	28.7
Minimally Active	234	65.2
HEPA Active	22	6.1

Table 4: One-Way ANOVA test for difference in cardiovascular health variables between active sports participants, minimally active participants and non-participants

	Mean ± SD	df	F	P
BMI				
Non-participant	23.63 ± 3.71	2	0.045	0.956
Minimally Active	23.50 ± 2.93			
Very Active	23.52 ± 3.60			
WHR				
Non-participant	0.77 ± 0.12	2	1.149	0.318
Minimally Active	0.83 ± 0.81			
Very Active	0.75 ± 0.11			
Systolic BP				
Non-participant	125.72 ± 9.73	2	44.961	<0.001*
Minimally Active	118.21 ± 8.83			
Very Active	115.76 ± 6.73			
Diastolic BP				
Non-participant	73.79 ± 7.45	2	12.150	<0.001*
Minimally Active	72.43 ± 8.74			
Very Active	68.07 ± 10.48			
Heart Rate				
Non-participant	83.50 ± 10.86	2	140.891	<0.001*
Minimally Active	65.34 ± 10.78			
Very Active	63.79 ± 8.70			
Respiratory Rate				
Non-participant	21.12 ± 3.74	2	175.311	<0.001*
Minimally Active	13.93 ± 3.52			
Very Active	13.33 ± 3.51			

* indicates significant difference

Table 5: Post Hoc analysis

	Mean Difference	CI	P
Systolic BP			
Non-participant – Minimally Active	7.510	4.84 – 10.18	<0.001*
Non-participant – Very Active	9.957	7.33 – 12.58	<0.001*
Minimally Active – Very Active	2.446	-0.21 – 5.11	0.083
Diastolic BP			
Non-participant – Minimally Active	1.251	-1.66 – 4.17	0.908
Non-participant – Very Active	5.612	2.74 – 8.48	<0.001*
Minimally Active – Very Active	4.361	1.45 – 7.27	0.001*
Heart Rate			
Non-participant – Minimally Active	18.165	14.98 – 21.34	<0.001*
Non-participant – Very Active	19.716	16.59 – 22.84	<0.001*
Minimally Active – Very Active	1.550	-1.62 – 4.72	0.718
Respiratory Rate			
Non-participant – Minimally Active	7.194	6.07 – 8.3	<0.001*
Non-participant – Very Active	7.791	6.68 – 8.90	<0.001*
Minimally Active – Very Active	0.597	-0.528 – 1.72	0.608

* indicates significant difference

DISCUSSION

The primary aim of this study was to determine the effect of sport participation on selected cardiovascular health indices among undergraduate students of university of Benin, Edo state. The result of this study shows that participation in sports was higher in males. This result is similar to a work done by Babatunde,[17] which reported that gender is found to significantly determine sport participation among undergraduates in selected Nigerian universities as more male students than female get involved in sport in tertiary institutions.

The findings of this result shows that 95% of the respondents engaged in competitive sports and 54.6% of the respondents played football. A similar study was done by Olanrewaju,[18] showed that skill development as well as psychological wellbeing and social relationships were the major reasons why people engage in competitive sports. Owoeye et al.,[9] reported that students of Nigerian universities participated in a variety of sporting activities and football, being the commonest.

The present study found that mean BMI of the participants was within the normal range indicating that majority of the participants had healthy weight. A study conducted by Ara et al.,[19] reported the effect of physical activity on the whole-body fat and found that regular

participation for at least three hours per week of sport activities and competitions lowered body fat. Elias et al.,[12] suggested that adults who participated in sports in their youths have lower future risk of developing obesity compared to those who do not participate[12]. It was observed from the present study that most of the respondents had a normal waist to hip ratio and were classified as minimally active according to the IPAQ reflecting a positive baseline cardiovascular health status among the participants. This is contrary to the report of Toben et al.,[20], in a systematic review, where no clear pattern of association was found between the body weight and sports participations in 19 studies reviewed. and the same study also reported among 17 studies that sports participants are more physically active than those who do not participate. It was observed from the present study that, there was a significant difference in the systolic and diastolic blood pressure of the participants. Active sports participant exhibited lower blood pressure. This is similar to the findings of Torres et al.,[11] who reported that sports participation among children and adolescents resulted in lower diastolic blood pressure. The reduction in blood pressure as reported by Sheila & Scott,[21] with sport participation is thought to be due to attenuation in peripheral vascular resistance which may be due to neuro-hormonal and structural responses with reduction in sympathetic nerve activity.

The present study found that active sports participants exhibited lower heart rate indicating a potential positive influence of sport participations on the cardiovascular health of participants. Engaging in sporting activity helps to improve circulation, strengthen the heart and reduce the risk of developing cardiovascular disease. The result of this present study shows that active sport participants exhibited lower respiratory rates compared to non-participants indicating potential benefits of regular physical activity on respiratory function.

CONCLUSION

There is a significant difference on the effect of sports participation on selected cardiovascular health indices among undergraduate students of the university of Benin, Edo state. Engaging in sporting activity is significantly associated with an improved physical activity levels thereby strengthening the cardiovascular system and reducing the risk of cardiovascular related diseases.

Conflict Of Interest:

The authors declare no conflict of Interest in this study.

Source Of Funding

The study was self-sponsored.

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JOURNAL OF BIOMEDICAL INVESTIGATION (JBI) VOLUME 12 NUMBER 2: JULY-AUGUST 2024

GENDER DIFFERENCES IN UPPER LIMB MOTOR RECOVERY POST-STROKE: EFFECTS OF TASK-ORIENTED TRAINING AND REPETITION COUNTS

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Received: 29/6/2024; accepted for publication 31/8/2024

ABSTRACT

Background: Stroke often results in significant impairments in upper limb motor function and daily activities, requiring various rehabilitation approaches. Constraint-Induced Movement Therapy and Task-Oriented Training are recognized interventions, but their efficacy may vary based on gender differences and repetition frequency.

Aim: To investigate gender differences in upper limb motor rehabilitation post-stroke, focusing on the effects of task-oriented training and repetition counts.

Methods: Stroke patients without severe motor or cognitive impairments were included in the study. Demographic and clinical data were collected, and upper limb motor function was assessed using the Motor Activity Log (MAL) and the Wolf Motor Function Test (WMFT). Participants performed a task involving the transfer of small wooden blocks between compartments for one hour, with the number of repetitions recorded every 15 minutes. Chi-square tests were used to examine relationships between variables and predict task repetition ability. The significance level was set at ≤ 0.05.

Results: Among 75 participants (40 males, 35 females, aged 19-98), males completed slightly more task repetitions (53.3% vs. 46.7%). Participants averaged 437.50 task repetitions (range: 15-590). Statistical analysis showed no significant association between gender and the number of task repetitions ($P > 0.05$).

Conclusion: The study found a strong correlation between WMFT and MAL in assessing upper limb impairment across both genders. Understanding gender-specific responses to task-oriented exercises and optimal repetition counts is essential for developing tailored rehabilitation strategies.

Keywords: *Stroke rehabilitation; Motor function; Task-oriented exercises; Gender differences, Repetition counts.*

INTRODUCTION

Stroke is a major global health issue, leading to significant mortality and long-term disability, especially in low- to middle-income countries, where 87% of disabilities and 70% of deaths occur (Akinyemi *et al.*, 2021). One of the most common post-stroke deficits is upper limb motor impairment, which can significantly affect an individual's disability and overall health. The variability in upper limb recovery is well recognized, highlighting that each patient has unique rehabilitation needs (Coupar *et al.*, 2012).

To address declines in upper limb motor function and self-care after a stroke, various treatments have been developed (Liu et *al.*, 2023). Constraint-Induced Movement Therapy (CIMT) and Task-Oriented Training (TOT) are key interventions (Reddy *et al.*, 2022). CIMT, which emphasizes task practice, is effective but requires simplified protocols for wider use. TOT has also been shown to speed up recovery across all stages of stroke in the upper limb (Liu *et al.*, 2023).

Reports on gender differences in functional outcomes after stroke are limited (Sabo *et al.*, 2022). However, these differences may influence stroke recovery, and understanding gender-specific rehabilitation outcomes remains challenging. Research indicates that women experience greater post-stroke disability and

depression, as well as a higher risk of severe strokes and poorer overall outcomes (Niewada *et al.*, 2005). In a study by Paolucci *et al.* (2006), males were more likely to achieve independence in tasks after rehabilitation, suggesting slightly less favorable outcomes for females.

The reasons for these differences are not fully understood but may be related to variations in muscle strength, which tends to be greater in men and decreases with age. Additionally, gender-based differences in muscle metabolism and composition can impact rehabilitation outcomes, particularly in terms of task repetition rates during therapy (Devries *et al.*, 2016). Research in neurorehabilitation has shown a direct correlation between the number of repetitions and motor function recovery.

Interestingly, Birkenmeier (2010) and colleagues reported that, practicing tasks approximately 300 times daily for two weeks led to significant motor function improvement, with these 300 repetitions achievable in just one hour each day. This suggests that the critical factor for motor recovery is the number of repetitions, not the duration of practice in upper limb stroke rehabilitation (Abdullahi, 2018b).

Some studies have shown inconclusive evidence regarding gender differences in stroke outcomes (Reeves *et al.*, 2008), often due to small sample sizes or a focus on patients in rehabilitation units (Sabo *et al.*, 2022). Determining the optimal number of repetitions needed for effective motor function recovery remains a key goal in upper limb stroke rehabilitation (Abdullahi, 2018a). This study aimed to explore gender differences in post-stroke upper limb motor rehabilitation, specifically examining the impact of task-oriented training and repetition counts.

MATERIALS AND METHODS

Study design and participant selection

This study employed a cross-sectional survey design to assess stroke patients attending physiotherapy outpatient clinics. The study population comprised stroke patients attending physiotherapy outpatient clinics in Kano metropolis at Murtala Muhammed Specialist Hospital (MMSH), Muhammad Abdullahi Wase Specialist Hospital (MAWSH), and Sir Sunusi Specialist Hospital. Participants were included if they: (1) Had mild cognitive impairment with a Mini-Mental Status Examination score greater than or equal to 17,(2)Could follow verbal and visual instructions, (3) Had mild upper limb motor function impairment with the ability to grasp and release a towel or abduct a finger by 10 degrees, (4) Had a Fugl-Meyer Assessment-Lower extremity score of 21 or below out of 34,(5)Were between 18 and 90 years old. However, participants were excluded if they had sensory loss of two or more points on the sensory item of NIHSS or severe cognitive impairment with a Mini-Mental Status Score of less than 17.

Sampling Technique

Systematic sampling was used for recruiting stroke patients. This method involved creating a comprehensive list of all eligible stroke patients and selecting every 10th person from the list. With a desired sample size of 100 from a population of 1000, the interval size was determined to be 10 to ensure systematic selection. Starting from a randomly chosen point, such as the 2nd participant, every 10th person thereafter was selected. Consequently, the 2nd, 12th, 22nd, 32nd, and so on participants were chosen until a total of 155 participants were reached. This process ensured that participants

were randomly but systematically selected, resulting in a representative sample.

Study Procedure

Ethical clearance for this study was obtained from the ethical review committees of the Kano State Hospital Management Board (NHREC/17/03/2018). Participants were thoroughly informed about the study's purpose and procedures, and informed consent was obtained. Screening was conducted to ensure all participants met the inclusion criteria.

The data collection process included gathering both demographic and clinical information. Demographic variables collected were gender, age, occupation, education level, and socioeconomic status. Clinical variables included stroke type, lesion site, stroke stage, and number of repetitions. In this study, a range of assessment tools for participants screening was employed to gather comprehensive data on the participants' physical and cognitive conditions. The Modified Ashworth Scale measured wrist joint spasticity, providing an objective assessment of muscle tone. The Visual Analog Scale assessed shoulder pain, with participants indicating their pain level on a 0-10 continuum. Sensory loss and motor function severity were evaluated using the National Institutes of Health Stroke Scale (NIHSS). Joint range of motion was measured with a goniometer, and cognitive impairments were assessed using the Mini-Mental Status Examination Scale, with scores of 17 or higher indicating mild impairment. A stopwatch was used to time task repetitions over 15-minute intervals.

For upper limb assessments, the Motor Activity Log (MAL) and the Wolf Motor Function Test (WMFT) were used. The MAL, a subjective tool consisting of 30 items scored from 0 to 5, assessed the quantity and quality of movement in the affected upper limb. The MAL has been validated and shown to be reliable for capturing perceived motor function changes (Uswatte *et al.*, 2006). The WMFT, an objective tool with 17 items also scored from 0 to 5, evaluated upper limb motor function, providing a standardized measure of ability with good construct and criterion-related validity and inter-rater reliability (Morris *et al.*, 2001; Nisland, 2010).

Participants' non-affected upper limbs were restrained to ensure the use of the affected limb during task practice. However, it is important to note that, the constraint does not have to be physical. Behavioral constraint wherein the patients consciously limit the use of the unaffected limb is also used (Brogårdh *et al*, 2009). Seated in a chair with a table in front, participants were given a wooden box with two compartments containing small wooden blocks. They were instructed to transfer the small blocks from one compartment to the other at their own pace over the course of one hour. A stopwatch tracked the total time, including rest periods. The number of

repetitions within each 15-minute interval was recorded using a recording sheet.

Data Analysis

Descriptive statistics summarised participants' socio-demographic and clinical characteristics. Chi-square tests were used to assess relationships between dependent and independent variables and to predict the ability to perform high repetitions of tasks practice. The significance level was set at ≤ 0.05

RESULTS

Socio-Demographic Variables of participants

Table 1 presents data on 75 stroke patients aged 19 to 98 who participated in the study. The largest age group was 49-78 years, comprising 50.7% of participants. There were 40 males (53.3%), and 51 participants were married (68.0%). The highest level of education attained was tertiary education, achieved by 30 participants (40.0%). Most participants were self-employed (77.3%). Ischemic stroke was the most common type (73.3%), with 50.7% of participants experiencing left-sided involvement. Additionally, 77.3% had diabetes. The duration of stroke varied from 3 to 132 months, and the number of task repetitions ranged from 15 to 590, with a mean of 437.50 (±1.573).

Association Between Socio-Demographic Variables with Number of Repetitions

Table 2 shows that there is no statistically significant association between the number of repetitions and socio-demographic variables, including age (χ^2=37.972, p=0.335), gender (χ^2=13.470, p=0.190), employment status (χ^2=8.207, p=0.145), marital status (χ^2=16.603, p=0.343), and education status (χ^2=19.523, p=0.191).

Summary of Association Between Clinical Variables with Number of Repetitions

From Table 3 the results indicate that the Motor Activity Log (χ^2=40.716, p=0.025) and the Wolf Motor Function Test (χ^2=44.171, p=0.001) are significantly associated with the number of repetitions. However, there are no significant associations with the type of stroke (χ^2=2.795, p=0.732), side affected (χ^2=1.355, p=0.929), diabetes status (χ^2=5.682, p=0.338), or duration of stroke (χ^2=11.083, p=0.747).

Table 1: Socio-demographic Characteristics of Participant

Variables	Frequency	Percentage
Age (years)		
19-48	33	44.0
49-78	38	50.7
79-109	4	5.3
Gender		
Female	35	46.7
Male	40	53.3
Education Status		
Primary	35	46.6
Secondary	10	13.3
Tertiary	30	40.0
Marital Status		
Divorced	6	8.0
Married	51	68.0
Single	15	20.0
Widow	3	4.0
Employment Status		
Civil Servant	17	22.7
Self Employed	58	77.3
Clinical Variables		
Repetitions		
15-214	25	33.3
215-414	31	41.3
415-614	19	25.3
Duration of Stroke(month)		
0-24	49	65.3
25-49	22	29.3
50-74	3	4.0
125-149	1	1.3
Type of Stroke		
Ischemic	55	73.3
Hemorrhagic	20	26.7
Side Affected		
Left	38	50.7

Right	37	49.3
Diabetes Status		
No	58	77.3
Yes	17	22.7

Table 2: Showing Association of Socio-demographic Variable with Number of Repetition

Socio-Demographic Variables	χ^2	df	p-value
Age	37.972	35	0.335
Gender	13.470	5	0.190
Employment Status	8.207	5	0.145
Marital Status	16.603	15	0.343
Education Status	19.523	15	0.191

Key; df=degree of freedom, χ^2= chi square

Table 3: Showing Association of Clinical Variables with Number of Repetition

Clinical Variables	χ^2	df	p-value
Type Of Stroke	2.795	5	0.732
Side Affected	1.355	5	0.929
Diabetes Status	5.682	5	0.338
Motor Activity Log	40.716	25	0.025
Wolf Function Test	44.171	20	0.001
Duration Of Stroke	11.083	15	0.747

Key; df=degree of freedom, χ^2= chi square, p-value

DISCUSSION

The objective of this research was to investigate the association between gender differences and the number of repetitions during task-oriented training (TOT) among stroke patients. Stroke-induced brain injuries often hinder patients' ability to regain functional independence, particularly in upper limb motor function, which remains incomplete for one-third of stroke survivors (Langhorne *et al.*, 2011; Kwakkel *et al.*, 2019). TOT is known to improve motor function by inducing neuroplasticity (Lang *et al.*, 2016). However, various clinical and personal factors can limit patients' ability to achieve the necessary repetitions for recovery (Winstein *et al.*, 2016).

Previous studies have reported varying numbers of repetitions required for significant motor improvement. For example, Birkenmeier *et al.* (2010) found that 600 repetitions over two weeks were beneficial, while Abdullahi *et al.* (2018)

observed improvements with 300 repetitions. This study found that age did not significantly affect task performance during TOT, contrary to findings by Bagg *et al.* (2002) and Kugler *et al.* (2003), which indicated age as a significant predictor. The discrepancy may be due to differences in study methodologies and participant characteristics.

Women generally perform daily tasks less effectively than men post-stroke, due to factors such as older age, lower pre-stroke physical function, and diminished internal locus of control (Niewada *et al.,* 2005). However, this study did not find a significant association between gender and the number of repetitions, contrasting with Sabo *et al.,* (2022), who reported that gender influences repetition rates during constraint-induced movement therapy (CIMT). This discrepancy could be due to the balanced gender distribution in the current study. To enhance the effectiveness of upper limb task practice in female patients, incorporating motivational interviewing and addressing mental health issues, such as depression and anxiety, could be beneficial (Epuela *et al.,* 2019).

Education level, often linked to better recovery outcomes (Putman *et al.,* 2007), did not show a significant association with the number of repetitions in this study. Similarly, employment and marital status were not significant predictors. These findings emphasize the complexity of socio-demographic factors in stroke recovery and the importance of individualised rehabilitation approaches (Teasell *et al.,* 2020).

Regarding clinical variables, neither the type of stroke (ischemic or hemorrhagic) nor the affected side significantly influenced the number of repetitions. This aligns with previous research suggesting that although hemorrhagic stroke patients may experience greater initial impairments, their recovery trajectories can be more pronounced (Hemphill *et al.,* 2015). The lack of a significant association between diabetis status and repetitions further supports the need for tailored interventions.

The significant relationship between the Motor Activity Log and the number of repetitions highlights the importance of consistent task practice for motor recovery, in line with Abdullahi *et al.* (2018). Additionally, the significant association between the Wolf Motor Function Test and repetitions reaffirms the efficacy of high-repetition task practice in improving upper limb function (Nilsen *et al.,* 2015).

In terms of practical implications, the study underscores the need for rehabilitation programmes that are tailored to the specific needs of individual patients, considering both gender differences and the complex interplay of socio-demographic and clinical factors. Exploring non-significant findings in depth and conducting further research with larger sample sizes and power analyses can help clarify the influences of these variables on rehabilitation outcomes.

Clinicians should consider incorporating both the WMFT and MAL into their assessment protocols to comprehensively evaluate upper limb function and recovery progress. The results suggest that achieving a sufficient number of task repetitions is critical for improving motor function, but the exact number required may vary based on individual patient characteristics.

CONCLUSION

The study demonstrated a strong correlation between the Wolf Motor Function Test (WMFT) and the Motor Activity Log (MAL) in evaluating upper limb impairment in both male and female

stroke patients. The number of task repetitions varied widely, ranging from 15 to 590, with a mean of 437.50 (±1.573). This variability underscores the importance of understanding gender-specific responses to task-oriented exercises and determining optimal repetition counts for effective rehabilitation.

Acknowledgments: we would like thank the patients who participated in the study and the therapists who helped in the collection of the data.

Author Contributions: B.S conceived the idea. A.U.A. and B.S. designed the study with inputs from M.Y.U., M.A.A. monitored and actively involved in the data collection. M.A.A. analyzed and interpreted the data. L.U, B.S., A.U.A., M.Y.U. reviewed the data analysis and interpretation. L.U. drafted the manuscript. A.U.A., M.A.A, M.Y.U. critically reviewed the drafted manuscript. All authors approved the manuscript for submission.

CONFLICT OF INTEREST: Authors state no conflict of interest

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JOURNAL OF BIOMEDICAL INVESTIGATION (JBI) VOLUME 12 NUMBER 2: JULY-AUGUST 2024

ASSESSMENT OF *HELICOBACTER PYLORI* USING DIFFERENT IDENTIFICATION METHODS ON SUBFERTILE FEMALES IN A FERTILITY CLINIC IN AWKA

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Received: 9/7/2024; accepted for publication 31/8/2024

ABSTRACT

Background: *Helicobacter pyroli* infection occurs when the bacteria infects the stomach lining and causes inflammation, peptic ulcer disease and certain types of stomach cancer. Women with *H.pyroli* infection have specific antibodies in cervical mucus.

Aim: This study was aimed at assessment of *H.pyroli* using different identification methods on subfertile female patients in Awka, Anambra State, Nigeria.

Methodology: This cross sectional study involved 101 females attending Life International Hospital, consecutively sampled aged 18 to 35 years. Stool samples were collected for culture and *H. Pyroli* stool antigen Elisa test (HpSA). Smears from isolated colonies were used for gram staining, urease test, catalase test and oxidase test. PCR products were separated on a 1.5% agarose gel and DNA bands were visualized with Ethidium bromide.

Results: Out of the 101 participants, 21.8% were positive in the culture method and 14.9% positive in the stool Antigen Elisa method. Among the participants, age group 31-35 years tested 100% for *H. Pyroli* in both methods. There were no positive cases in PCR method in all the age groups, with all cases being negative. There was significant difference in *H. Pyroli* among different age groups for both culture method (X^2 =9.751, P=0.002) and stool antigen Elisa method (X^2 =6.107, P=0.013). In the duration of subfertility, age groups 6-10 years had 54.5% positive in culture method and 73.3% positive in the stool antigen Elisa method with no positive in the PCR method. There was no significant difference among the different methods (p-values> 0.05).

Conclusion: The choice of test to detect *H.pyroli* infection depends on the prevalence and strains of *H.pyroli* on endemic areas, accessibility, advantages and disadvantages of each method as well as different clinical circumstances of each patient. To combine the results of two or more tests could be a reasonable strategy in routine clinical practice to achieve the most reliable result.

Keywords: *Assessment, H. pyroli, Subfertility, Identification methods.*

INTRODUCTION

Subfertility is failure to conceive after regular unprotected sexual intercourse for 12 months. Subfertility is a global health problem and of public health importance in Nigeria and many other developing nations because of its high prevalence, and due to its serious social implications[1]. Subfertility in women is reduced fertility with a prolonged time of unwanted non conception and includes many reversible causes like infections, tubal diseases, ovulation problems, fibroids, endometriosis, pelvic inflammatory diseases, etc[2]. It affects over 48 million women worldwide, one couple in seven has difficulty conceiving a baby[2]. Couples who have sex every two or three days have 84% chances of conception in a year and women who have regular sex without using any protection and do not get pregnant are considered subfertile[3]. Subfertility can be categorized as primary or secondary. Primary subfertility is the inability to achieve conception and to have a

successful live birth without ever having a child. On the other hand, secondary subfertility is the inability to achieve conception and have a successful live birth when individuals have had a previous biological child[4].

The burden of *Helicobacter pylori* infection globally estimated at 50% of the world's population undoubtedly makes the organism a pathogen of concern coupled with its classification as group I carcinogen by the World Health Organization[5]. In a study, 2.6% of Nigerian patients were reported to have gastric cancer resulting from *Helicobacter pylori* infection. Beyond the high prevalence of *Helicobacter pylori* infection and its associated clinical outcomes, emerging high antimicrobial resistance in Nigeria poses grave danger to the effective treatment and eradication of the pathogen. *Helicobacter pylori* is a Gram-negative, helical, micro aerophilic bacterium that colonizes the gut[6]. *Helicobacter pylori* has been implicated in various gastric disorders including peptic ulcer disease and chronic gastritis.

METHODOLOGY

The study was a cross sectional research on the analysis of *Helicobacter pylori* of sub fertile female patients attending Life International Hospital Awka (LIHA), Anambra State. It is a multi-specialist hospital with excellence in areas of endoscopy surgery and fertility care.

A consecutive sampling method was used to recruit 101 participants. Samples were collected from willing female patients clinically diagnosed for subfertility (primary and secondary subfertility) within the reproductive age range of 18-35 years of age.

Fresh stool samples were produced by subjects in Stericon containers avoiding any possible contact with urine or water. Stool samples were maintained at room temperature and culture and *H.pylori* stool antigen test (HpSA) were done within three hours of collection.

Helicobacter pylori stool antigen test method, HpSA.

The stool sample was first prepared for HpSA by emulsifying 1gram of stool into 4ml of phosphate buffer saline (PBS). 1ml of the mixture was collected into Eppendorfs tubes and spun at 6000rpm for 15minuites after which clear supernatants where separated carefully and used for HpSA analysis.In the Micro plate, the corresponding micro pores of the sample in sequence were numbered, two wells were left as negative control, two wells as positive control and one empty well as blank control. Negative and positive control in a volume of 50 µl were added to the negative and positive control wells respectively. In sample wells, 40µl sample dilution buffer and 10 µl sample were added (dilution factor is 5). Incubate was done for 30 min at 37°C after sealed with closure plate membrane. The concentrated washing buffer was diluted with distilled water. The wash solution was discarded after resting for 30 seconds. The washing procedure was repeated for 5 times. A volume of 50 µl HRP-Conjugate reagent was added to each well except the blank control well and incubated for 30min at 37◦C after which it was washed as described above. A volume of 50 µl Chromogen Solution A and 50 µl Chromogen Solution B was added to each well, it was mixed with gently shaking and incubate at 37°C for 15 minutes. Light was avoided during colouring.

Stop solution of a volume of 50ul was added to each well to terminate the reaction. The colour in the well changed from blue to yellow. Absorbance optical density (OD) was read at 450nm using a Microtiter Plate Reader. The OD

value of the blank control well was set as zero. Assay was carried out within 15 minutes after adding stop solution.

Culture Method

The stool sample was emulsified in phosphate buffered saline and 1gram of cholestyramine was added to the suspension. The emulsion was filtered using sterile muslin cloth to remove stool debris. Filtrate further filtered using membrane filter of pore size 0.45 µm as it is expected to retain *H. pylori* if present in the stool. The membrane filter was now cultured for a period of 3 to 12 days in a microaerophilic atmosphere (5% O_2, 10% CO_2 and 85% N_2) using the anaerogen gas pak (Oxoid-England) at 37^0C on a ready-to-use selective Columbia blood agar medium containing 10% sheep-defibrinated blood and 1% heat-inactivated fetal bovine serum, supplemented with Dent antibiotic supplement. The plates were incubated at 37 °C under microaerophilic conditions (10% CO_2, 5% O_2, and 85% N_2) with saturated humidity .Plates were checked intermittently for sub culture after the first 3 days through to the 5th day before discarded as no growth. Colonies appearing very tiny, dome shaped, pin head size, translucent with some weak haemolytic features were sub cultured for further testing to characterize *H. pylori*.

The isolates were Gram negative spiral rods and produce urease, oxidase, and catalase enzymes during preliminary biochemical characteristic reactions.

. **Polymerase chain reaction (PCR) method**

A volume of 12.5µl of One Taq Quick-Load 2X Master Mix with Standard Buffer (New England BiolabsInc.); 0.5µl each of forward HP-1 and reverse primers HP-2 specific primers (Vilber,Germany) (HP-1 5'-CTCAGTCAAGCGGTATCAGAAG -3' and 5'-HP-2 TCCCTCGCCAAGGAGTAATA -3'); 8.5µl of Nuclease free water and 3µl of DNA template was used to prepare 25µl reaction volume of the PCR cocktail. The reaction was gently mixed and transferred to thermalcycler. PCR products were separated on a 1.5% agarose gel and DNA bands were visualized with Ethidium bromide.

Agarose Gel Electrophoresis

A percentage of 1.5agarose gel was prepared by dissolving 1.5g of Agarose in 100ml of 1X TBE Buffer.

The mixture was heated to a clear solution using a microwave oven and allowed to cool to about 50 ºC. A volume of 3µl of Ethidium bromide was added into the solution and mixed thoroughly. The agarose preparation was carefully poured into a gel tray, with the gel comb in place and allowed to solidify. The tray was loaded into the gel tank and 1X TBE Buffer was poured into the tank, making sure that the gel was properly submerged. The gel comb was carefully removed. A volume of 5 µl of amplicon was loaded into the wells. The tank was connected to the power pack and set to run at 120 volts for 20 minutes after which it was viewed on a gel documentation system. Bands similar to that of 110 bp band of the positive control was accepted as positive.

Ethical approval

The ethical approval for the research was obtained from Nnamdi Azikiwe University Teaching Hospital, Nnewi, as well as from Life International Hospital, Awka.

Statistical analysis

Data was summarized and presented using frequency counts, percentage, while chi square was used to analyze data with level of significance set at 95% at 0.05 confidence interval.

Table 1: Determination and comparing the prevalence of positive *H.pylori* status using different identification method in relation to age range, occupation and duration of sub fertility

Variables	Category	Culture method		Stool antigen ELISA		PCR *H.pylori*	
		Positive	Negative	Positive	Negative	Positive	Negative
Age range	20-25 years	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
	26-30 years	0(0)	26(32.9)	0(0)	26(30.2)	0(0)	0(0)
	31-35 years	22(21.8)	53(67.1)	15(14.9)	60(69.8)	0(0)	22(21.8)
	Total	22(21.8)	79(78.2)	15(14.9)	86(85.1)	0(0)	22(21.8)
	X^2	9.751		6.107		-	
	P-value	0.002*		0.013*		-	
Duration of sub-fertility	1-5 years	10(45.5)	38(48.1)	4(26.7)	44(51.2)	0(0)	10(45.5)
	6-10 years	12(54.5)	37(46.8)	11(73.3)	38(44.2)	0(0)	12(54.5)
	11-15 years	0(0)	4(5.1)	0(0)	4(4.7)	0(0)	0(0)
	Total	22(21.8)	79(78.2)	15(14.9)	86(85.1)	0(0)	22(21.8)
	X^2	1.350		4.547		-	
	P-value	0.509		0.103		-	
Occupation	Self employed	11(50)	46(58.2)	9(60)	48(55.8)	0(0)	11(50)
	Government employed	4(18.2)	17(21.5)	5(33.3)	16(18.6)	0(0)	4(18.2)
	unemployed	7(31.8)	16(20.3)	1(6.7)	22(25.6)	0(0)	7(31.8)
	Total	22(100)	79(100)	15(100)	86(100)	0(0)	22(100)
	X^2	1.309		3.379		-	
	P-value	0.520		0.185		-	

Key:-

*=Significant at $p<0.05$

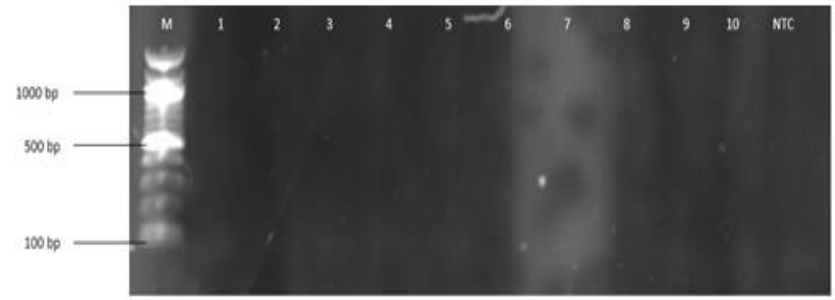
X^2=Chi square

Table 2: Prevalence of *H.pylori* infected and non-infected groups according to gastroenterological guideline in relation to age groups and occupation.

Variables	Category	*H.pylori* infected n(%)	*H.pylori* non-infected n(%)	X^2	P-value
Age range	20-25 years	0(0)	0(0)		
	26-30 years	0(0)	26(30.2)		
	31-35 years	15(100)	60(69.8)	6.107	0.013*
	Total	15(100)	86(100)		
Occupation	Self employed	9(60)	48(55.8)		
	Government employed	5(33.3)	16(18.6)	3.379	0.185
	Unemployed	1(6.7)	22(25.6)		
	Total	15(100)	86(100)		

Key:-
*=Significant at $p<0.05$
X^2=Chi square

PCR *H. pylori* (110 bp)



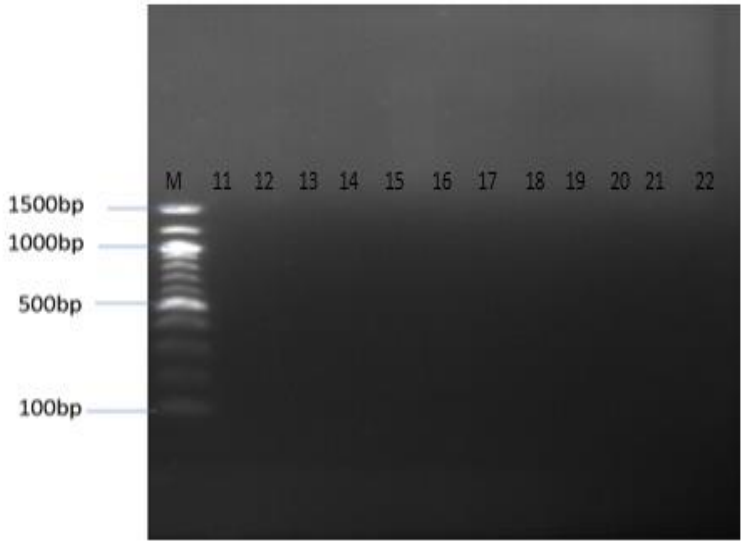


Plate 1: PCR results for positive *H.pylori* status on agarose gel electrophoresis stained with ethidium bromide using *H.Pylori* specific primers . M is a 100bp – 1500bp DNA ladder(molecular marker). Samples 1to 22 were negative bands for the expressed *H. pyroli*.

KEY:-

M= Marker

NTC= Non template control

110bp=Amplification band

Samples 1-22 = Bacteria DNA from stool of subjects with positive *H.pylori* culture isolates.

RESULTS

Table 1 shows the prevalence of positive *H. pylori* status using different identification methods in relation to age range, occupation, and subfertility duration. From the culture method used, out of the 101 participants, 21.8% were positive for *H.pyroli*, among the participants aged 31-35 years tested 100% positive for *H. pylori*. From the stool Antigen Elisa method, out of the 101 participants, 14.9% were positive and age 31-35 also tested 100% positive for *H. pyroli*. No participants in other age groups tested positive. There were no positive cases in PCR method in all the age groups, with all cases being negative. The chi-square test showed a significant difference in *H. pylori* prevalence among different age groups for both culture method ($X^2 = 9.751$, $p = 0.002$) and stool antigen Elisa method ($X^2 = 6.107$, $p = 0.013$). Regarding the duration of subfertility, 73.3% of participants with 6-10 years of subfertility tested positive for *H. pylori* using the stool antigen Elisa method (HpSA), compared to 45.5% for those with 1-5 years of subfertility. Using culture method, majority of the positive cases were among those with 6 -10years (54.5%) duration of sub-fertility. However, no positive cases were observed in the 11-15 years subfertility group. The chi-square test indicated no significant difference in *H. pylori* prevalence among different subfertility durations for any of the methods (p-values> 0.05). In terms of occupation, the prevalence of *H. pylori* was highest among self-employed individuals, with 50% testing positive using the culture method and 60% using the stool antigen Elisa method. However, no significant difference was found among the different methods (p-values> 0.05).

Table 2 shows the prevalence of *H. pylori* infection among different age groups and occupations according to gastroenterological guideline. The American College of Gastroenterology (ACG) Clinical Guideline recommends that patients with active peptic ulcer disease (PUD), a history of PUD (unless previous cure of *H.pylori* infection has been documented), low-grade MALT lymphoma, or a history of endoscopic resection of early gastric cancer (EGC) be tested for *H.pylori* infection. For the age range variable, 100% of *H.pylori* infected were of the 31-35 years category. Among those who were non-infected, 30.2% were 26-30 years, while 69.8% fell in the 31-35 years category. The chi-square (X^2) value was 6.107 with a p-value of 0.013, indicating a significant difference in *H. pylori* infection prevalence across age groups as explained in table 1. Regarding occupation, among the infected, 60% were self-employed, 33.3 government employed and 6.7% unemployed. The chi-square (X^2) value for occupation was 3.379 with a p-value of 0.185, indicating no significant difference in *H. pylori* infection prevalence across different occupations.

Plate 1 shows the electrophoretic pictures of DNA separation of products of *H.pylori* positive isolates from culture on agarose gel electrophoresis stained with ethidium bromide. Bacteria DNA 1-22 shows no migration at amplification band 110bp, indicating 22(100%) *H.pylori* negative.

DISCUSSION

Helicobacter pyroli infection occurs when the bacteria infects the stomach. *H. pyroli* attacks the lining that protects the stomach. The bacteria make an enzyme called Urease. From the culture method used, 21.8% were positive for *H.pyroli*

and among the participants aged 31-35 years tested 100% positive for *H. pyroli*. From the stool Antigen Elisa method, 14.9% were positive for *H. pyroli* and among the participants 31-35 years tested 100% positive for *H. pyroli*. From the PCR method, there were no positive cases for PCR *H. pyroli* in all the age groups with all the cases being negative. This may be because ageing has effect on fertility.

The chi-square test showed a significant difference in *H. pylori* prevalence among different age groups for both culture method (X^2 = 9.751, p = 0.002) and stool antigen Elisa method (X^2 = 6.107, p = 0.013). This corroborates with a study which showed a statistical significant relationship between the age of participants and their *H. pylori* infection status and also previously inferred where incidence of *H. pylori* was synonymous with increasing age of the studied population[7, 8]. This may be ascribed to increasing biomass of the organism as they multiply in their host with increasing age.

Moreso, for the duration of subfertility, age groups 6-10 years had 54.5% in culture method and 73.3% in the stool antigen Elisa method with no positive in PCR method. There was no significant difference among the different methods. Self-employed participants were more infected. This could be due to the possibility that they overwork in order to keep their businesses afloat thus more vulnerable to contracting *H.pyroli*.

The positive *H. pyroli* status on agarose electrophoresis using specific primers were all negative bands for the expressed *H. pyroli*. This presumably false negative outcome from the PCR testing which is in discordance with some co-positive *H.pylori* result from culture and *H.pylori* stool antigen test obtained in this study could be as a result of the fact that despite the high sensitivity of PCR and its suitability for diagnosis when an organism is present in low number, slow growing or difficult to identify is in doubt. The technique is susceptible to inhibition by contaminants present in clinical specimens, thus giving false negative results. Human faeces are known to contain PCR inhibitors, which should be removed from the specimen before target DNA amplification[9]. It has been suggested that the inhibition of PCR can be overcome by dilution of the faecal suspension[10], but this may make the assay less sensitive as fewer bacteria would be present in the diluted sample.

CONCLUSION

The choice of test to detect *H.pyroli* infection depends on the prevalence and strains of *H.pyroli* on endemic areas, accessibility, advantages and disadvantages of each method as well as different clinical circumstances of each patient. To combine the results of two or more tests could be a reasonable strategy in routine clinical practice to achieve the most reliable result.

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JOURNAL OF BIOMEDICAL INVESTIGATION (JBI) VOLUME 12 NUMBER 2: JULY-AUGUST 2024

EFFECTS OF MODIFIED CONSTRAINT-INDUCED MOVEMENT THERAPY UPPER AND LOWER LIMBS ON FUNCTIONAL MOBILITY IN STROKE PATIENTS: A RANDOMISED CONTROLLED TRIAL

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Received: 29/7/2024; accepted for publication 31/8/2024

ABSTRACT

Background: Stroke is prevalent and poses significant healthcare challenges, emphasizing the need for effective rehabilitation strategies. While Combined Modified Constraint-Induced Movement Therapy (mCIMT) has shown potential in improving both upper and lower limb functions, its overall impact on motor function, mobility, and quality of life remains inadequately explored.

Objective: This study evaluated the efficacy of Combined mCIMT (CO), which targets both upper and lower limbs, compared to CIMT focusing solely on the lower limb (LL) or upper limb (UL), in enhancing motor function, mobility, and quality of life in stroke patients.

Materials and Methods: In a randomized trial conducted at the Physiotherapy Clinic, Murtala Mohammed Specialist Hospital, Kano, 46 stroke patients were assigned to one of three groups: Combined mCIMT (CO, n=16), Lower Limb mCIMT (LL, n=15), or Upper Limb mCIMT (UL, n=15). Each intervention was administered daily for 2 hours, 5 days a week, over 4 weeks. Outcomes were assessed using the Lower Limb Motor Activity Log, Fugl-Meyer Assessment, and Stroke Impact Scale. Data were analyzed using ANOVA, Kruskal-Wallis, and Wilcoxon Signed Rank tests.

Results: All groups exhibited significant improvements in motor function, lower limb use, balance, and quality of life ($P > 0.05$). Notably, the LL group showed significantly greater improvements compared to the CO and UL groups.

Conclusion: Modified LL CIMT was more effective in enhancing motor function, mobility, and quality of life in stroke patients than Combined or UL-specific mCIMT approaches.

Keywords: *Stroke; Constraint-Induced Movement Therapy; Motor Function; Mobility; Balance; Quality of Life*

INTRODUCTION

Stroke is a global health concern and a leading cause of long-term disability in adults (Tedla *et al.*, 2022). It is particularly prevalent in developing countries, affecting diverse age groups and both sexes (Reddy *et al.*, 2022). In Nigeria, the pooled crude incidence and prevalence of stroke are 26.0 per 100,000 and 6.7 per 1,000, respectively, with higher rates among men than women (Abdullahi, 2021). The rising incidence of stroke, combined with growing healthcare challenges in low- and middle-income countries, underscores the need for effective rehabilitation techniques to improve recovery outcomes.

Advances in neuroscientific research have led to the development of new approaches in stroke rehabilitation. Constraint-Induced Movement Therapy (CIMT) is a technique that improves motor function after a stroke (Abdullahi *et al.*, 2021). CIMT originated from studies on rhesus monkeys that suffered sensory deafferentation of a forelimb, developed learned non-use, and were forced to use the impaired limb by constraining the unimpaired limb for days (Menezea-Oliveira *et al.*, 2021). This technique was later adapted for human stroke patients, showing promising results (Abdullahi *et al.*, 2021).

Understanding the concepts of learned "non-use" in the upper limb (UL) and "misuse" in the lower limb (LL), along with the principles of neuroplasticity, provides a strong theoretical basis for implementing combined modified CIMT (mCIMT) for both upper and lower limbs

in patients with hemiplegic stroke. Research supports CIMT's effectiveness in promoting cortical activation, expanding brain areas, and facilitating functional reorganization in stroke patients (Wang *et al.,* 2012; Abdullahi *et al*., 2021; Menezea-Oliveira *et al.,* 2021).

Numerous studies have demonstrated that CIMT for the UL can improve spontaneous UL use after a stroke (Wolf *et al.,* 2006; Taub *et al.,* 1993). Similarly, adapted forms of CIMT for the LL have successfully treated LL deficits (Taub et al., 1999). Regardless of the affected body part, CIMT can improve reduced UL use or maladaptive LL use using functional activities (Mark *et al.,* 2013).

Fuzaro *et al.* (2012) reported that mCIMT for the UL improves balance, function, mobility, and health-related quality of life (HRQoL) in stroke patients. Kim and Kwon (2012) found that mCIMT for the UL enhances coordination between the upper and lower limbs during the gait cycle. Improving the affected arm's function influences the contralateral arm, leading to increased range of motion and positive changes in balance, function and mobility post-stroke (Fuzaro *et al.,* 2012). Kim and Cha (2015) investigated the effects of CIMT for the UL combined with gait training on balance in stroke patients. They found that improved balance enhanced gait patterns, increased gait speed, and improved walking ability, which reduced participation restrictions and improved quality of life. These findings support the theoretical basis for a combined CIMT protocol targeting both the upper and lower limbs. The combined mCIMT protocol offers potential training advantages by systematically delivering various treatment modes to encourage the use of affected limbs.

Currently, studies combining CIMT protocols for both the upper and lower limbs has not been encountered. Therefore, this study aims to determine whether combining these protocols can effectively improve function, mobility, balance, and quality of life in stroke patients.

MATERIALS AND METHODS

Participants and study design

The study involved 46 stroke patients recruited from the Out-patient Physiotherapy Clinic at Murtala Mohammed Specialist Hospital, Kano, Nigeria. Participants were randomly allocated into three groups: Combined CIMT for both upper and lower limbs (CO, n=16), CIMT for lower limbs (LL, n=15), and CIMT for upper limbs (UL, n=15). They underwent 20 treatment sessions over four weeks, five times a week. This was a single-blind randomized controlled trial registered with the Pan African Clinical Trial Registry (PACTR201611001646207) and adhered to CONSORT guidelines (Figure 1). Ethical approval was granted by the University of Ibadan/University College Hospital (UI/EC/14/0101) and Murtala Mohammed Specialist Hospital (HMB/GEN/488/VOL.I). Informed consent was obtained, and participants could withdraw at any time.

Study procedures

Stroke patients attending the Out-patient physiotherapy Clinic at the hospital were reviewed weekly and included in the study if they met the eligibility criteria (Taub *et al.,* 1993; Vearrier *et al.,* 2005; Wolf et al., 2006).

The Inclusion criteria were as follows:

(1) Patients with stroke who had their first stroke within 6 months before the study, with minimal or no cognitive impairment based on the ability to comprehend and execute 3-word commands. These commands should be clear, concise, and

representative of daily activities, such as "Pick up the pen" or "Stand up and clap."

(2) (2) Patients with stroke who had minimal active range of motion of 10º for wrist extension, 10º for abduction/extension of the thumb and at ≥2 additional digits, 90º for shoulder flexion and abduction, 45º for shoulder external rotation, 30º for elbow extension, 45º for forearm supination and pronation, wrist extension, and finger extension of all digits.

(3) (3) Ability for hip and knee flexion on the affected side; ability to move from sitting to standing independently; ability to sustain body weight on the affected side and walk ≥10m with or without support

(4) (4) Willingness to participate in combined mCIMT for the upper and lower limbs.

Exclusion criteria were as follows:

(1) Spasticity in the affected upper or lower limb >2 on the Modified Ashworth Scale with 0–4 rating

(2) Patients with stroke with excessive pain in the affected upper or lower limb (≥6) on a 10-point visual analogue scale

(3) Patients with stroke with uncontrolled hypertension or congestive heart failure

(4) Patients with stroke with pre-existing neurological conditions unrelated to stroke or musculoskeletal issues.

Randomization and Group Allocation

Patients were randomly allocated to one of three treatment groups: CO (combined upper and lower limbs), LL (lower limb only), or UL (upper limb only) (Figure 1). Randomization was achieved using sealed opaque envelopes, ensuring that participants did not know the group labels. Each participant was allocated to the group they picked, without replacement, and subsequent participants were similarly assigned.

Outcome Measures and Assessments

Outcome Measure

Lower Extremity Motor Activity Log (LE-MAL): This semi-structured interview evaluates the use of the affected lower limb in daily activities and identifies issues such as learned non-use or misuse. It includes a functional performance (FP) subscale with 14 items rated on an 11-point Likert scale. The LE-MAL FP subscale has demonstrated high reliability (test-retest correlation of 0.94) and a strong correlation with the Stroke Impact Scale ($r=0.87$, $P<0.01$) (Riegle *et al.,* 2003; Duncan *et al.,* 1999). Higher scores indicate better real-world use of the affected limb.

Fugl-Meyer Motor Assessment Scale (FMA/FM-B): This performance-based scale measures motor impairment, with a maximum score of 34 for the lower limb (Fugl-Meyer et al., 1975). It is highly reliable and valid, with the FM-B subscale for balance performance showing a validity score of $r=0.84$. Recent revisions have updated parachute reaction items while preserving the original scoring criteria (Hsueh *et al.,* 2001).

Stroke Impact Scale (SIS) Version 3.0: The SIS is a 59-item self-report questionnaire assessing health-related quality of life (HRQoL) post-stroke (Duncan *et al.,* 1999). It includes eight domains: strength, hand function, mobility, daily living activities, memory and thinking, communication, emotion, and social participation. The SIS is reliable, with Cronbach's alpha values ranging from 0.86 to 0.90. Scores range from 0 to 100, with higher scores indicating better HRQoL.

Assessment

All patients were assessed at baseline into the study with respect to the following Outcomes: Lower limb motor function (LLMF) and Balance was assessed using the Fugl-Meyer Motor Assessment Scale; lower limb use (LLU) with the Lower Extremity Motor Activity Log; Quality of life with Stroke Impact Scale. Assessment was also performed at baseline, two weeks, and four weeks post- interventions.

Intervention Protocols

Upper Limb Group (UL, n=15): Participants in the UL group performed task-oriented activities focused on manipulating, grasping, picking, holding, and moving objects to improve fine motor skills, grasp and reach, sensory function, and proximal control (Page *et al.,* 2002; Yen *et al.*, 2005; Wang *et al.,* 2012); (Appendix A). No physical restraint was applied to the unaffected limb.

Lower Limb Group (LL, n=15): Participants in the LL group performed task-oriented activities focused on functional mobility, ambulation, and static and dynamic balance tasks (Vearrier *et al.*, 2005). Physical restraint was not required, but compensatory strategies were discouraged, and symmetry of movement and reciprocal gait were emphasized (Appendix B).

Combined Group (CO, n=16): The CO group received both upper and lower limb CIMT, targeting reduced use of the upper limb and maladaptive use of the lower limb. The combined mCIMT protocol for both upper and lower limbs was selected and refined from the individual protocols (Appendix C). Participants were disciplined to use the paretic limbs during shaping without the need for physical restraints on the unaffected limb.

Data Analysis

Descriptive and non-parametric statistical methods were used. Analysis of Variance (ANOVA) was used to assess associations between treatment groups and participant characteristics. Friedman's ANOVA was utilized for within-group comparisons of the effects of different treatment programmes on participant scores. The Wilcoxon signed-rank test served as the post-hoc analysis to identify significant differences found in Friedman's F-ratios. The Kruskal-Wallis test was used for between-group comparisons, with the Mann-Whitney U-test applied for post-hoc analysis. Alpha level set at ≤ 0.05.

RESULTS

A total of 46 participants completed the four-week programme: CO (n=16), LL (n=15), and UL (n=15). The dropout pattern is illustrated in Figure 1. There were no significant differences in the socio-demographic and physical characteristics of participants across the three groups ($P>0.05$). However, differences emerged in the distribution of clinical profiles by stroke subtype. Specifically, the CO and UL groups had a higher proportion of individuals with ischemic stroke, while the LL group had a higher proportion of individuals with haemorrhagic stroke (Table 1).

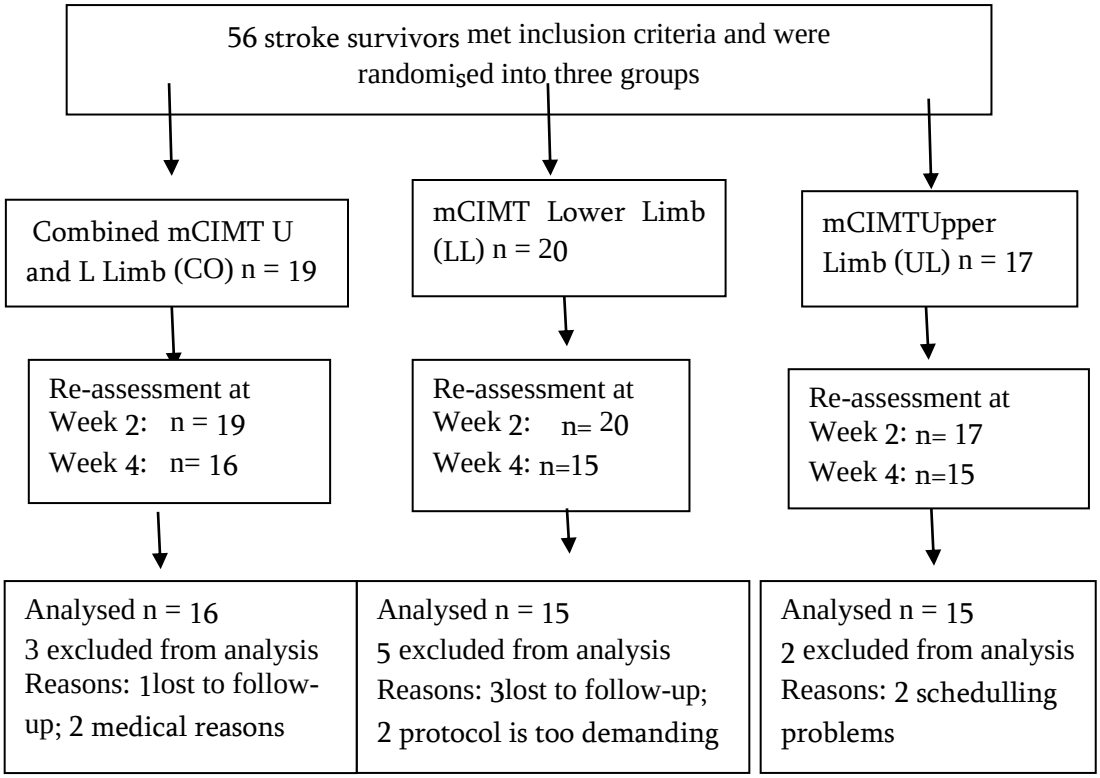

Figure 1. Flow chart of participants' recruitment and participation

Within-Group Comparison

Repeated measures ANOVA was conducted to compare the participants' median scores on lower limb motor function, lower limb use, and balance within the CO, LL, and UL groups across different time points. The results, shown in Table 2, indicate significant improvements in all groups for lower limb motor function, lower limb use, and balance from baseline to week 2, from week 2 to week 4, and from baseline to week 4.

Between-Groups Comparison

The Kruskal–Wallis test was employed to compare median scores for lower limb motor function, lower limb use, and balance among the CO, LL, and UL groups at baseline, week 2, and week 4. To identify significant differences between the groups, post-hoc analysis was performed using the Mann–Whitney U test. The results of these comparisons are presented in Table 3.

Effects of CO, LL, and UL Treatments on Participants' HRQoL

The study results revealed that all three treatment regimens had a significant impact on the health-related quality of life (HRQoL) of hemiparetic stroke patients, as assessed by the Stroke Impact Scale (SIS). Although there were no significant differences between the CO, LL, and UL groups in the domains of strength, emotion, mobility, hand function, and participation, significant differences were observed in the domains of activities of daily living, memory/thinking, communication, and perceived stroke recovery, as measured by the visual analogue scale (SIS-VAS).

Table 1. Association Between Treatment Groups and Participant Characteristics

	CO	LL	UL	X^2	P
(Mean ± SD)					
Age (years)	53.69±9	45.33±9.15	51.07±10.47	3.74	0.057
Stroke onset	13.87±6.42	14.13±4.24	15.07±471	0.95	0.396
Sex					
Male	9	11	7	2.26	0.323
Female	7	14	8		
Education					
Pre-secondary	4	5	5	11.55	0.073
Secondary	4	4	9		
Post-secondary	8	6	1		
Affectation side					
Right	7	8	7	0.29	0.862
Left	9	7	8		
Stroke types					
Ischaemic	12	4	9	7.58	0.023*
Haemorrhagic	4	11	6		

Key: *Indicates significant difference at α= 0.05
CO= Combined modified CIMT Upper and Lower limbs
LL= Modified CIMT Lower Limb
UL= Modified CIMT Upper Limb

Table 2. Within-Group Comparison of Clinical Variables Across the Three Time Points

Study groups	Baseline Median (IQR)	2 Weeks Median (IQR)	4 Weeks Median (IQR)	X^2	P value
CO					
Motor Function	20.00(10.00) [a]	26.00(7.00) [b]	29.00(5.00) [c]	16.69	0.001*
Lower Limb Use	3.57(0.93) [a]	4.36(0.86) [b]	4.57(0.93) [b]	23.72	0.001*
Balance	9.00(3.00) [a]	11.00(1.00) [b]	12.00(1.00) [c]	27.52	0.001*
LL					
Motor Function	15.50(5.8) [a]	25.00(2.00) [b]	29.50(2.5) [c]	28.22	0.001*
Lower Limb Use	3.54(1.10) [a]	4.86(0.8) [b]	5.68(1.20) [c]	20.37	0.001*
Balance	9.00(2.00) [a]	11.00(2.00) [b]	13.00(2.00) [c]	28.16	0.001*
UL					
Motor Function	18.00(7.00) [a]	24.00(7)[b]	26.00(4.00) [c]	20.98	0.001*
Lower Limb Use	4.14(1.10) [a]	3.92(2.00) [b]	4.50(1.70) [b]	11.20	0.001*
Balance	9.00(5.00) [a]	11.00(3.00) [b]	12.00(2.00) [c]	19.88	0.001*

*Indicates significant difference at $\alpha = 0.05$

Post hoc: Superscripts (a, b, c) for a particular variable: Median values with different superscripts are significantly different; while those with the same superscripts are not significantly different.

Key: CO= Combined modified CIMT Upper and Lower limbs

LL= Modified CIMT Lower Limb

UL= Modified CIMT Upper Limb

IQR = Inter-Quartile Range

Table 3. Between-Groups Comparison of Clinical Variables, Outcomes at Baseline, Week 2, and Week 4

Clinical Variables	Time frame	CO Median (IQR)	LL Median (IQR)	UL Median (IQR)	K	p-value
Motor function	Week 0	20.00(10.00)	15.50(5.80)	18.00(7.00)	3.121	0.211
	Week 2	26.00(7.00)	25.00(2.00)	24.00(7.00)	2.982	0.225
	Week 4	29.00(5.00) [a]	29.50(2.50) [b]	26.00(4.00) [b]	10.15	0.005*
Lower limb use	Week 0	3.57(0.93)	3.54(1.10)	4.14(1.10)	0.693	0.707
	Week 2	4.36(0.86)	4.86(0.80)	3.92(2.00)	4.048	0.132
	Week4	4.57(0.93) [a]	5.68(1.20) [b]	4.50(1.70) [b]	7.738	0.021*
Balance	Week 0	9.00(3.00)	9.00(2.00)	9.00(5.00)	0.575	0.756
	Week 2	11.00(1.00)	11.00(2.00)	11.00(3.00)	0.014	0.993
	Week 4	12.00(1.00)	13.00(2.00)	12.00(2.00)	3.461	0.177

*Indicates significant difference at $\alpha = 0.05$

Post hoc: Superscripts (a, b, c) for a particular variable: Median values with different superscripts are significantly different; while those with the same superscripts are not significantly different.

Key:

CO= Combined modified CIMT upper and lower limbs

LL= Modified CIMT Lower Limb

UL= Modified CIMT Upper Limb

n = Number of participants in the group

IQR = Inter-Quartile Range

Table 4. Between-Group Comparison of Participants' HRQoL Treatment Outcomes at Baseline, Week 2, and Week 4

Domain	Time frame	CO (n=16) Median (IQR)	LL (n=15) Median (IQR)	UL (n=15) Median (IQR)	K	p-value
Strength	Week 0	30.00(30.00)	32.50(8.75)	50.00(15.00)	8.520	0.014
	Week 2	50.00(20.00)	50.00(20.00)	50.00(5.00)	0.250	0.880
	Week 4	50.71(17.14)	57.50(20.00)	55.00(20.00)	1.597	0.450
Memory	Week 0	34.29(0.86) [a]	25.21(14.29)	25.21(14.29)	8.447	8.447
	Week 2	42.86(25.71) [a]	52.86(16.43) [b]	52.86(16.43) [b]	19.78	19.78
	Week4	37.78(15.56)	61.43(27.86) [b]	61.43(27.86) [b]	8.695	8.695
Emotion	Week 0	44.44(6.67)	38.89(10.56)	40.00(11.11)	0.350	0.814
	Week 2	46.67(6.67)	42.22(12.22)	42.22(4.44)	0.750	0.752
	Week4	46.00(15.00)	46.67(12.22)	46.67(8.89)	0.120	0.942
Comunctn	Week 0	28.57(22.86)	34.29(16.43)	31.43(20.00)	1.299	0.522
	Week 2	45.71(14.29)	50.00(24.29)	45.71(20.00)	4.902	0.086
	Week4	48.57(5.71) [a]	60.00(20.71) [b]	48.57(20.00) [a]	6.036	0.049*
ADLs	Week 0	110(140.00)	160(130.00)	140.0(80.00)	1.165	0.558
	Week 2	220(100.00) [a]	240(75.00) [b]	160(150.00) [b]	14.74	0.001*
	Week4	230(120.00)	260(127.50)	220.0(90.00)	0.161	0.006*
Mobility	Week 0	37.78(15.56)	44.44(20.56)	37.78(20.0)	0.759	0.684
	Week 2	51.11(13.33)	58.89(18.33)	46.67(11.11)	5.622	0.060
	Week 4	57.78(15.56)	58.89(17.22)	51.11(20)	4.635	0.099
Hand function	Week 0	37.14(25.71)	27.14(25.00)	31.43(14.29)	6.080	0.048
	Week 2	37.14(14.29)	34.29(31.43)	34.29(8.57)	0.217	0.897
	Week 4	45.71(14.29)	42.86(27.86)	37.14(5.71)	1.620	0.445
Participatn	Week 0	35.50(20.00)	37.50(28.75)	30.00(20.00)	1.117	0.572
	Week 2	42.50(17.50)	42.50(11.25)	42.50(20.00)	0.422	0.810
	Week 4	47.50(20.00)	50.00(10.00)	42.50(20.00)	5.082	0.079
Stroke recovery	Week 0	50.00(30.00)	70.00(10.00)[b]	50.00(10.00)	1.187	0.552
	Week 2	60.00(20.00) [a]	80.00(17.50)[b]	60.00(10.00)[b]	9.186	0.010*
	Week 4	70.00(10.00) [a]	53.75(25.00)	60.00(10.00)[b]	18.40	0.001*

*Indicates significant difference at $\alpha = 0.05$

Post hoc: Superscripts (a, b, c) for a particular variable: Median values with different superscripts are significantly different; while those with the same superscripts are not significantly different.

Key:

CO = Combined Modified CIMT Upper and Lower limbs

LL = Modified CIMT Lower Limb

UL = Modified CIMT Upper Limb

n = Number of participants in the group

IQR = Inter-Quartile Range

DISCUSSION

This study investigated the effects of modified Constraint-Induced Movement Therapy (mCIMT) on function, mobility, balance, and health-related quality of life (HRQoL) in stroke patients. The results indicated no significant differences in baseline measures for lower limb motor function, lower limb use, balance, and HRQoL, suggesting that the groups were comparable at the beginning of the intervention. Consequently, any observed differences over time can be attributed to the specific effects of the treatment interventions.

The CO group demonstrated significant improvements in balance. This protocol, which targets both upper and lower limbs simultaneously, appears to enhance functional mobility and balance control. These findings are consistent with prior research combining intensive gait training with upper limb CIMT, which has been shown to improve static and dynamic balance in stroke patients (Kim & Cha, 2015). Arya *et al.* (2014) also observed a positive relationship between motor function in both limbs and balance control.

The enhanced lower limb uses and balance observed in the CO group suggest increased utilization of the affected limb by stroke patients. Although the combined mCIMT approach for both limbs is not documented, it presents a comprehensive rehabilitation strategy that may improve overall rehabilitation recovery time and improve functional mobility. In contrast, the LL group showed superior median scores in lower limb motor function, lower limb use, and balance, aligning with previous studies on CIMT for lower limbs (Ding *et al.*, 2013; Vearrier *et al.*, 2005; Marklund & Klässbo, *2006;* Yu *et al.*, 2015). The enhanced outcomes in the LL group could be due to the greater focus and intensity of lower limb training compared to the CO group, which split the training between both limbs.

The UL group also showed significant improvements, highlighting the critical role of upper limb motor function in functional mobility and balance. Stroke patients with affected upper limbs often struggle with movements necessary for balance maintenance, impacting their ability to perform protective reactions (Acar & Karatas, 2010). This study supports the evidence that arm swinging during gait aids lower limb movements and balance. Improvements observed in the UL group may also positively influence lower limb motor function and balance.

The observed secondary improvements in motor function, mobility and balance in the UL group can be explained by Zipp and Winning's (2012) theory, which posits that enhancements in upper limb function positively impact lower limb function. Kim and Kwon (2012) also demonstrated that mCIMT for the upper limb improves coordination between the upper and lower limbs, and Fuzaro *et al.* (2012) supported this by showing positive changes in mobility and balance resulting from upper limb mCIMT. Improvements in lower limb motor function correlated with better HRQoL, supporting Fuzaro *et al.* (2012), who found that enhanced lower limb motor function leads to better ADL outcomes. Similar results have been observed in other mCIMT studies using the SIS to measure HRQoL (Dettmers *et al.*, 2005; Wu *et al.*, 2007).

Regarding HRQoL, significant differences were noted in the domains of activities of daily living (SIS-ADL), memory/thinking (SIS-mem), and communication (SIS-comm). The CO and LL groups achieved higher scores in the SIS-ADL domain compared to the UL group. ADLs such as transferring, dressing, and walking are

particularly challenging for stroke patients (Peurala *et al.,* 2007). Kwakkel and Wagenaar (2002) emphasized the benefits of high-intensity training for both upper and lower limbs on ADL, walking ability, and dexterity. The CO group's approach, which integrated intensity and task specificity, likely contributed to these improvements.

In the emotion (SIS-emotn) domain, despite general evidence that exercise positively affects mood (Eng *et al.,* 2003), this study did not find significant changes. The LL group showed the most notable improvements in memory/thinking and communication, with the CO group following, and the UL group showing the least improvement. The greater increases in median scores for the LL group suggest that intensive physical activities, such as LL CIMT, may have broader cognitive and psychosocial benefits. However, it is unclear whether the social interactions during therapy influenced communication outcomes in the LL group. All three groups demonstrated significant improvement in perceived stroke recovery, as measured by the visual analogue scale (SIS-VAS).

Limitations of the Study

One significant limitation was the challenge in recruiting stroke patients who met the eligibility criteria for both upper and lower limb involvement. This issue may limit the generalizability of the study's findings, as the sample may not fully represent the broader stroke patient population.

CONCLUSION

Modified Constraint-Induced Movement Therapy (mCIMT) for the lower limbs (LL) showed significant therapeutic benefits in improving function, mobility and quality of life for stroke patients. These promising results suggest that LL mCIMT could be a valuable component of stroke rehabilitation. However, further research and clinical trials are needed to validate these findings and refine evidence-based practices in physiotherapy for stroke rehabilitation.

Acknowledgements

The authors are grateful to all the patients who took part in the study, the caregivers, and the physiotherapists for their support during the work.

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UPPER LIMB PROTOCOL Sample day (Dada and Sanya, 2011)

I. The participant sits on a chair. A building block is placed on a table in front of him/her, about midline of his/her body. The participant pushes the building block as far as he/she can to the left and right sides with the affected hand.

II.The participant sits on a chair with the affected hand on a table in front of him/her. He/She then stretches his arm fully to carry a cup placed at arm's length on the table by extending the elbow (to the side). The shoulders are kept level to prevent leaning with the trunk.

III. The participant sits on a chair and places the forearm on a table placed on the affected arm side (the forearm is parallel to the edge of the table). He/She uses the hand to push a building block just behind the dorsum of the hand as far as he/she can to the side and back to the starting point. The elbow should be kept on the table throughout the task.

IV. The participant sits on a chair with the affected hand on his/her lap. He/She then attempts to lift a plastic bottle on a table in front of him/her and bring it close to his/her lips with a cylindrical grasp (Plate 3.5). An overhand grasp is not allowed for this task. The task is repeated with a water-filled plastic bottle if the participant can do it.

V. The participant sits on a chair with the affected hand on his/her lap and attempts to pick up a ball from a plate and drop it in another plate beside the first plate; both plates are placed on a table in front of him/her.

VI. The participant sits on a chair with the affected hand on his/her lap and attempts to pick up a pencil from a table in front of him/her using a 3-jaw chuck grasp and/or hold (thumb and first two fingers) for a count of 6 before returning it to the starting position.

VII**.** The participant sits on a chair with the affected hand on his/her lap and attempts to pick up buttons of different sizes using a pincer grasp (pads of thumb and index finger opposed). The buttons will be picked up from the top of the table and not over the edge of the table.

VIII**.**The participant sits on a chair and picks up two checkers, each at opposite ends of an eight-square box draught (boxes 1 and 8), and arranges/places them in the centre boxes (4 and 5). The task can be executed by picking up either the checker on the left or the right first.

IX**.** Using a pincer grasp on the near edge of playing cards, the participant attempts to flip over ten cards arranged in a straight line. This task is done by sliding the front edge of the card just past the front edge of the table with some or all of the fingers and then grasping the card edge protruding over the table edge between the palmar surfaces of the thumb and index finger. The cards can be flipped over from side to side or from front to end. The cards do not have to be straightened or adjusted after they have been turned over.

X. Using the ulnar edge of the unaffected hand to hold down a medium-sized purse, the participant attempts to open the lid of the purse that is fastened with a Velcro with the affected hand.

XI. Holding a pen, the participant attempts to write his/her name and home address in a notebook placed on a table in front of him/her.

Dada, O.O and Sanya, A.O. 2011. Constraint-induced movement therapy: Determinants and Correlates of Duration of Adherence to restraint use among Stroke survivors with hemiparesis. *Disability,CBR and Inclusive Development* 22.3:15-27

LOWER LIMB PROTOCOL Sample day (Vearrier et al. 2005)

A. Impairment: 15% of training day (20 mins)

1. Strengthening: progressive resistance exercises, closed chain activities.
2. Range of motion/stretches: particularly gastrocnemius, soleus, hamstrings, and hip flexors.
3. Aerobic conditioning—recumbent bicycle, treadmill.

B. Functional limitation: 70% of training day (1hr24mins). Variability of practice is emphasized, so activities are interspersed.

1. Balance activities: weight shifting tasks – catching and kicking, standing on a rocker board/foam eyes open/ closed, lifting boxes; negotiating crowded busy hallways.
2. Functional training: Transfers: emphasis on equal loading of the legs, decreased reliance on arms, transferring to either side. Gait training: emphasis on removing/minimizing orthoses (ankle-foot orthosis to an air splint) and assistive devices, treadmill use, promotion of even weight shift, symmetrical step lengths, reducing compensatory strategies. Gait training indoors/outdoors, obstacle/small space negotiation, ambulating backwards/sidestepping. Stairs/Curbs/Ramps: emphasis on reciprocal pattern and decreased reliance on hand railing.
3. Education: integration of skills covered during training into everyday living.

C. Disability – 10% of training day (10 mins) Community ambulation, problem solving community barriers, skills for hobbies of choice.

D. Rests – 5% of training day (6mins)

E. Feedback – verbal, tactile, visual (videotape), and auditory (limb load monitor).

Vearrier LA, Langan J, Shumway-Cook A. An intensive massed practice approach to retraining balance post-stroke. *Gait and Posture*. 2005. 22:154–1

Typical days programme

Combined Upper and Lower protocol

A)The motor activities for the affected upper limb will be done as follows (each activity will be repeated ten times wherever possible):

1. With the patient sitting on a chair, a building block will be placed about the midline of his body, on a table in front of him; he will push the building block as far as he can to the left and right sides with the affected hand.

2. With the patient sitting on a chair and the affected hand on a table in front of him, he will stretch his arm fully to carry a cup placed at an arm's length on the table by extending the elbow (to the side). Shoulders will be kept level to prevent leaning with the trunk.

3. With the patient sitting on a chair, affected hand on laps he will attempt to lift a plastic bottle on a table in front of him and will bring it close to lips with a cylindrical grasp. An overhand grasp will not be allowed for this task. The task will be repeated for a water-filled plastic bottle if subject can.

4. With the patient sitting on a chair, affected hand on laps, he will attempt to pick a ball in a plate and drop it in another plate beside the first plate, both placed on a table in front

5. The participant sitting on a chair with the affected hand on the laps will attempt to pick up buttons of different sizes using a pincer grasp (pads of thumb and index finger opposed). The buttons will be picked up on the table and not over the edge of the table.

6. Holding a pen, the patient will attempt to write his name and home address on a notebook which will be placed on a table in front of him

7. Progression will be by withdrawing assistance given, increasing the complexity of task and the speed of carrying out the task.

(B) Repitative task oriented practice for the use of lower limb

8. Impairement: **a.**Strengthening: progressive resistance exercises, closed chain activities. **b**. Range of motion/stretches: particularly gastrocnemius, soleus, hamstrings, and hip flexors. **c.** Assistive and resistive exercises PNF lower limb

9. Functional limitation: **a.** Balance: Balance activities: weight shifting tasks- catching and kicking, standing on a foam eyes open/ closed, lifting objects from floor; **b**. Functional training: Functional training: Weight transfers: emphasis on equal loading of the legs, transferring to either side. Overground gait training, promotion of even weight shift, symmetrical step lengths,. Gait training indoors, ambulating backwards/forward sideways; side stepping. Stairs climbing: emphasis on reciprocal pattern and decreased reliance on hand railing.

JOURNAL OF BIOMEDICAL INVESTIGATION (JBI) VOLUME 12 NUMBER 2: JULY-AUGUST 2024

IMPACT OF DEPRESSION, FATIGUE, AND ANXIETY ON SLEEP QUALITY AMONG STROKE SURVIVORS FROM SELECTED GOVERNMENT HOSPITALS IN OSOGBO, OSUN STATE

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Received: 19/7/2024; accepted for publication 31/8/2024

ABSTRACT

Background: Stroke is one of the most common diseases that leads to death and varying disabilities. Mood and fatigue levels affect the depth and length of sleep of stroke survivors, leading to sleep disorders which could lead to the recurrence of stroke. Understanding the impact of sleep quality will enhance patient management.

Aim: To determine the impact of depression, anxiety, and fatigue on the sleep quality of stroke survivors.

Method: A cross-sectional design and consecutive sampling technique was used to recruit 50 stroke survivors. The Patient Health Questionnaire-9 was used to determine post-stroke depression, the Fatigue Severity Scale was used to determine post-stroke fatigue, the Generalized Anxiety Disorder-7 was used to determine post-stroke anxiety, and the Pittsburgh Sleep Quality Index was used to evaluate sleep quality. Spearman rank correlation coefficient was used to determine the relationship between these factors.

Result: Post-stroke depression, fatigue, anxiety, and poor sleep quality were observed in 27.4%, 80.4%, 29.4%, and 23.5% of the participants, respectively. A significant relationship was observed between depression, anxiety, and sleep quality.

Conclusion: Poor sleep quality may be a risk factor for depression and anxiety among stroke survivors.

Keywords: *Post-stroke, Depression, Anxiety, Sleep Quality*

INTRODUCTION

The incidence and prevalence of stroke have increased globally by 70% and 102%, respectively.[1] In 2020, approximately 7.08 million deaths were attributed to stroke in the United States.[2] Africa has the highest incidence and prevalence of stroke, with rates of approximately 316 per 100,000 and 1,460 per 100,000, respectively.[3] Nigeria has also seen an increase in stroke incidence to 26.0 per 100,000 and prevalence to 6.7 per 1,000, with a higher ratio in men than women, creating a significant economic burden worldwide.[4,5]

Stroke survivors have been found to experience a self-perceived burden, impacting their emotional and mental health,[6] resulting in anxiety and depression, and affecting their quality of sleep.[7] Sleep quality is determined by restfulness, sufficient and objective sleep depth, time of sleep, and an individual's subjective sleep quality.[8] Sleep disorders are significantly associated with factors such as cognitive impairment,[9] fatigue,[10] anxiety,[11] and depression.[12] A systematic review reported a 33% frequency of post-stroke depression impact on sleep quality after 3 months.[10] In contrast, another study revealed that 64.7% of stroke survivors had poor sleep quality.[13] This burden on stroke survivors, caregivers, society, and the economy creates anxiety, depression, and distress,[7] impacting their sleep quality and causing delays in recovery.[14] The impact of depression, anxiety, and fatigue on sleep quality has been poorly explored, with sparse data available for referencing in Nigeria. Therefore, this study aimed to determine the impact of depression, anxiety, and fatigue on sleep quality among stroke survivors.

MATERIALS AND METHODS

This was a cross-sectional study. 50 stroke survivors who were >18 years old and were

within 3 months (acute phase of stroke recovery) of experiencing post-ischaemic and haemorrhagic stroke were included in this study and were attending the out-patient units of selected hospitals in Osun state, Nigeria. Stroke survivors with severe aphasia and a decline in cognitive function who were not able to comprehend or interpret questions were excluded from the study. The purpose of the study was explained to both the stroke survivors and their caregivers; consent was sought and obtained before recruitment.

Ethical approval and consent to participate

Ethical approval was obtained from the Redeemer's University Ethics Committee (Directorate of Research Innovation and Partnerships) with Reference number, RUN/REC/2023/030 and Osun State University Ethics Committee with Reference number, UTH/REC/2023/06/09/769. The purpose of the research was explained to the participants and informed consent was obtained.

The Patient Health Questionnaire-9 was used to determine post-stroke depression, the Fatigue Severity Scale was used to determine post-stroke fatigue, Generalized Anxiety Disorder-7 was used to determine post-stroke anxiety, and the Pittsburgh Sleep Quality Index was used to evaluate sleep quality. Spearman's rank correlation coefficient was used to determine the relationship between post-stroke depression, anxiety, fatigue, and sleep quality.

RESULTS

Forty-five participants (90%) were married, 4 (8%) were widowed, and 1 (2%) was single. The mean age and duration of stroke were 59.42±10.753 and 36.54±31.878, respectively. Of the 50 participants, 4 (8%) had no formal education, 11 (22%) were primary school graduates, 21 (42%) were secondary school graduates, and 14 (28%) were tertiary school graduates. Of the 50 participants, 14 (27.5%) were depressed, 41 (80.4%) were fatigued, 15 (29.4%) had anxiety, 38 (74.5%) had good sleep quality, and 12 (23.5%) had poor sleep quality (Table 1).

Correlation among post-stroke depression, fatigue, anxiety, and sleep quality

A significant correlation was observed between post-stroke depression ($P<0.001$), post-stroke anxiety (0.008*), and sleep quality; however, no significant correlation was observed between post-stroke fatigue ($P=0.139$) and sleep quality (Table 2).

Table 1. Post-stroke depression, fatigue, anxiety, and sleep quality

Variable	N (%)	Median	Interquartile range
Post-stroke depression			
No depression symptoms	36 (70.6%)	5.0000	8.00
Depression symptoms	14 (27.4%)		
Post-stroke fatigue			
No fatigue	9 (19.6%)	37.0000	22.00
Fatigue	41 (80.4%)		
Post-stroke anxiety			
No anxiety	35 (68.6%)	4.0000	8.00
Anxiety	15 (29.4%)		
Sleep quality			
Good sleep quality	38 (74.5%)	3.0000	3.25
Poor sleep quality	12 (23.5%)		

Table 2. Correlations between post-stroke depression, fatigue, anxiety, and sleep quality

Variable	Sleep quality			
	Good sleep quality	Poor sleep quality	r_s	p-value
Post-stroke depression	8	6	0.450*	0.001
Post-stroke fatigue	32	9	0.212	0.139
Post-stroke anxiety	12	3	0.373*	0.008

DISCUSSION

This study revealed that 27% of stroke survivors experienced post-stroke depression, 80% experienced fatigue, and 29.4% experienced anxiety. However, higher prevalences were recorded in other studies.[12,15,16,17] These differences may be because of environmental factors, different assessment tools, and sample sizes. This study also found that 23.5% of participants had poor sleep quality, similar to a study reporting a 25% prevalence.[18] However, some studies reported even higher rates of poor sleep quality.[19,20] The reason for this difference may be because the participants in this study were still in the acute phase of stroke recovery. Most stroke survivors regain strength and cope with their new life conditions after the acute stage.[18] Furthermore, the participants in this study were older and better adapted to life changes and difficulties owing to their experiences.

Significant correlations was observed among post-stroke depression, anxiety, and sleep quality, which is similar to studies that reported sleep quality to be significantly associated with depression and as a precursor to developing anxiety among stroke survivors, resulting in delayed recovery and poor stroke outcomes, worsening disability and reducing quality of life.

This study had some limitations, which included the small sample size and the fact that persons with aphasia were excluded. Thus, these results may not apply to all stroke survivors.

CONCLUSION

Persistent poor sleep may result in depression and anxiety which will result in delay in recovery and cause further functional disability among this population. Managing poor sleep quality will reduce reoccurrence of stroke and also the length of stay in hospitals thereby reducing the physical and emotional burden on the caregivers and can inform updates on stroke care guidelines in Nigeria.

Acknowledgement: The authors acknowledge the efforts of the patients and caregivers who participated in this study.

Funding: This research received no external funding.

Competing interests

The authors declare no conflicts of interest.

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KIDNEY CORTICO-MEDULLARY RATIO IN A NIGERIAN PATIENT COHORT IN ABA SOUTH LOCAL GOVERNMENT AREA, ABIA STATE, NIGERIA

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Received: 19/7/2024; accepted for publication 31/8/2024

ABSTRACT

Background: The ratio of the renal cortical and medullary thicknesses has been reported as a strong indicator of renal function in other populations.

Aim: To determine the cortico-medullary ratio (CMR) in selected healthy adults and patients with chronic renal diseases in Aba South Local Government Area, Abia State, Nigeria.

Methods: Two-dimensional sonography was conducted to measure the cortical and medullary thicknesses of the kidney parenchyma of 483 participants comprising 405 healthy adults and 78 patients with chronic kidney disease (CKD). The CMR was calculated by dividing cortical thickness by medullary thickness. Blood samples of the participants were collected to determine the serum creatinine and urea levels, while urine samples were checked for the presence of protein.

Results: The CMR of healthy adults was 1.27 ± 0.01 for the right kidney and 1.26 ± 0.05 for the left kidney. The mean CMR for the right kidney of healthy participants was 1.27 ± 0.01 while that of CKD patients was 0.93 ± 0.07. The mean CMR for the left kidney of healthy participants was 1.26 ± 0.05 while that of CKD patients was 0.94 ± 0.08. There were significant differences between CMR values of healthy participants and patients with CKD ($p < 0.05$). There was no relationship between CMR and the anthropometric parameters of normal individuals ($p > 0.05$).

Conclusion: The mean kidney CMRs for healthy adults and patients with CKD in Aba South have been established. The CMRs in patients with CKD were significantly lower than those of their healthy counterparts suggesting the importance of CMR in sonographic investigation of CKD.

Keywords: *Kidney, Cortical thickness, Medullary thickness, Cortico-medullary ratio, Sonography, Chronic renal diseases*

INTRODUCTION

The renal cortex is the outside section of the kidney, while the medulla is the inner section. The renal cortex has a more grainy texture, while the medulla is smoother. The ratio of the cortex to the medulla is a strong indication for renal diagnosis of diseases such as nephrosis, pyelonephritis, and grading of the levels of hydronephrosis[1]. The cortico-medullary ratio also provides information on the glomerular filtration rate (GFR)[2]. The medulla/cortex ratio of females was found to be 2.5-3.5 and that of males 2.5-3.2.[2]

In nephrology, ultrasound has a crucial role. It is used in the location of renal position, assessment of renal sizes, assessment of renal parenchyma, and collecting system[3]. Very important to note, sonography has established significant facts about renal disease conditions such as inflammatory changes, obstructive nephropathy like calculus, renal masses like cysts, and, renal tumors. Ultrasound imaging has been used in the diagnosis of congenital renal abnormalities such as ectopic kidney, horseshoe kidney, and duplex collecting system.

Each kidney in a human contains about one million nephrons, each capable of forming urine.The kidney cannot regenerate new nephrons. Therefore, with renal injury, disease,and normal aging, there is a gradual decrease in nephron number. After age 40, the number of functional nephrons decreases by about 10 percent every 10 years, thus; at age 80, many people have 40 percent fewer functional nephrons than they did at age 40. This loss is not life-threatening because adaptive changes in the

remaining nephrons allow them to excrete the proper amounts of water, electrolytes, and waste products. Each nephron contains a tuft of glomerular capillaries called the glomerulus, through which large amounts of fluid are filtered from the blood and a long tubule in which the filtered fluid is converted into urine on its way to the pelvis of the kidney[4]. The nephrons that have glomeruli located in the outer cortex are called cortical nephrons. They have short loops of Henle that penetrate only a short distance into the medulla. About 20 to 30 percent of the nephrons have glomeruli that lie deep in the renal cortex near the medulla and are called juxtamedullary nephrons[5].

The renal parenchyma has two components. The centrally located pyramids, or medulla are surrounded on three sides by the peripherally located cortex. In infants or thin people, a differentiation of the medulla from the cortex may be very obvious, but in other healthy adults, this separation may be undetectable[6]. Most people are familiar with one important function of the kidneys - to rid the body of waste materials that are either ingested or produced by metabolism. A second function that is especially critical is to control the volume and composition of the body fluids. For water and virtually all electrolytes in the body, the balance between intake and output is maintained in large part by the kidneys. This regulatory function of the kidneys maintains a stable environment of cells necessary for them to perform their various activities[4]. Other functions are regulation of arterial pressure, regulation of acid-base balance, secretion, metabolism and excretion of hormones, and gluconeogenesis[4].

The most frightening consequence of chronic renal disease is renal failure if adequate and correct intervention is not initiated. Chronic renal diseases lead to a reduction in renal size, a reduction in parenchymal thickness, and ultimately a reduction in nephron number (Guyton,2006). Sonographically, these changes may lead to a change in the ratio of cortical thickness to medullary thickness. It is not known yet if this change in cortico-medullary thickness ratio (CMR) is a reliable indicator of the presence of parenchymal renal disease. To the best of the researcher's knowledge, the renal cortico-medullary ratio of the study population has not been established, hence the need to carry out this study (Sanders, 2007).

MATERIALS AND METHODS

A cross-sectional sonographic study of the kidneys of 405 healthy participants and 78 patients diagnosed with chronic kidney disease was conducted. The participants and patients were purposefully selected from hospitals and radiodiagnostic centres in Aba, Abia State, Nigeria.

The sample size for the study was calculated from a population size of 50,000 inhabitants determined using the formula by Yamane[7]:

$$n = \frac{N}{1 + N(e)^2}$$

Where:

n =sample size,

N=population under the study,

e =margin of error (taken to be 0.05)

Substituting in the formula earlier quoted:

$$n = \frac{50000}{1 + 50000(0.05)^2} = 396.825$$

So, a minimum sample of 397 healthy adults was calculated but data was collected from 405

healthy adults and 78 patients with chronic kidney disease.

Ethical approval (Protocol Number:FHST/REC/024/562) for the study was obtained from the Human Research and Ethics Committee of the Faculty of Health Sciences and Technology, Nnamdi Azikiwe University, Nigeria. The study procedure was thoroughly explained to the participants and their consent was obtained using a written consent form. Both healthy participants and patients with chronic kidney disease (CKD) were 18 years and above and resided in Aba.

Three sonographers with a minimum of ten years of experience in clinical sonography participated in measuring the kidney parameters using a 2-dimensional ultrasound scanner; Zoncare -Model: ZQ-6601 equipped with a 3.5MHz curvilinear transducer. They were blinded to the aim of the study Anthropometric parameters namely height and weight were measured. The height was measured with each participant standing erect using measurement tape calibrated in meters and centimeters.The weight was measured using a weighing scale as the participant stood on the scale. The gender and age of each participant were documented.

The CMR was calculated by dividing the measured cortical thickness with medullary thickness. The body-mass index (BMI) of each participant was calculated using the formula:

$$BMI = \frac{Weight\ (Kg)}{Height(m)^2}$$

The body surface area (BSA)of each participantwas calculated using the formula of Du Bois and Du Bois[8]:

$$BSA = 0.007184\ x\ Body\ Weight^{0.424}\ x\ Body\ Height^{0.725}$$

The data collected was analyzed using theMedCalc® Statistical Software version 22.023 (MedCalc Software Ltd, Ostend, Belgium. Both descriptive statistics (mean, standard deviation, percentage, table, frequency) and inferential statistical tools (Kendall's Tau correlation,ANOVA, and independent T-test) were carried out. Statistical significance was considered at $p < 0.05$.

RESULTS

Table 1 shows that there were more female participants n = 207 (51.1%) than male participants n = 198 (48.8%) for normal subjects and more male participants n =40 (51.3%) than female participants than female participants n = 38 (48.7%) for patients with chronic kidney disease. It also showed that out of 405 normal subjects, 170 (42%) were aged 21-30 years, 59 (14.6%) were aged 61 years and above, 58 (14.3%) were within the age of 31-40 years, 56 (13.8%) were within the age of 41-50 years, 40 (9.9%) were within the age of 51-60 years and 22(5.4%) were aged 20 years and less. The mean age for normal subjects was 38.7±16.0 years. The oldest participant was 84 years and the youngest participant was 18 years as shown in Table 1. Regarding the78 participants with CKD, 70 (89.8%) were 61 years or older, 6(7.7%) were aged 51-60 years, and 2 (2.5%) were aged 31-40 years. The mean age of participants with CKD was 72.4±8.4 years. The youngest patient was 39 years and the oldest was 85 years.

Table 2 shows that for the healthy subjects, the mean height was 1.70 ± 0.07m (range: 1.60 m-1.88 m). The mean weight was 78.3±8.0Kg (range: 65 Kg -95 Kg). The mean BMI was 27.0

± 1.9Kg/m^2 (range: 21.7 Kg/m^2 – 30.9 Kg/m^2). The mean BSA was 1.90 ± 0.13m^2 (range:1.71 m^2-2.22 m^2). For participants with CKD, the mean height was 1.68 ±0.07m (range: 1.59 m-1.83 m). Themeanweight was 72.1 ± 6.5Kg (range: 63 Kg-85 Kg). The mean BMI was 25.7 ± 1.3Kg/m^2 (range: 23 Kg/m^2-28.1 Kg/m^2). The mean BSA was 1.81 ± 0.12m^2 (range: 1.65 m^2-2.07 m^2).

Table 3 shows that the mean right kidney cortical thickness (RKCT) for the healthy participants was 1.1 ± 0.2 mm and the mean right kidney medullary thickness (RKMT) was 0.9 ± 0.1 mm. The mean left kidney cortical thickness (LKCT) for the healthy participants was 1.2 ± 0.2 mm and the mean left kidney medullary thickness (LKMT) was 1.0 ± 0.2 mm. For patients with CKD, the mean RKCT was0.6 ± 0.1mm while the mean RKMT was 0.7±0.1mm. Also for the CKD patients, the mean LKCT was 0.7±0.2 mm while the mean LKMT was 0.7±0.2mm.Table 3 also shows that the CMR among the healthy adults was 1.27 ± 0.01 for the right kidney and 1.26 ± 0.05 for the left kidney. For the participants with CKD, the CMR was 0.93±0.07 for the right kidney and 0.94±0.08 for the left.

Table 4 shows that for the male healthy participants, the mean right kidney CMR was 1.26 ±0.01 for participants aged 61 years or more and those aged 20 years and less. The right kidney CMR was also 1.27 ±0.01 for participants aged 21-60 years. The mean left kidney CMR was 1.17±0.12 for participants aged 21-30 years, 1.27± 0.01 for the 20 years and less group, 31-40 years and 51-60 years, and 1.26 ±0.01 for 41-50 years and 61 years and above age groups. For the healthy female participants, the mean right kidney CMR was 1.27 ± 0.01 for the 21-30 years, 41-50 years, and 51-60 years age groups. It was 1.28 ± 0.01 in the 20 years and less and 61 years or more age groups, and 1.29 ± 0.01 in the 31-40 years age group. The mean left kidney CMR was 1.27±0.01 in the 21-60 years age group, 1.28 ± 0.01 in the 20 years and less, and 61 years and above age groups.

Table 6 shows a comparison between the cortico-medullary thickness ratio between the right and the left kidneys; for healthy volunteers, the mean cortico-medullary ratio of the right kidney was 1.27 ± 0.01 and the mean cortico-medullary ratio of the left was 1.26 ± 0.05. This implies that the cortico-medullary ratio of the right was higher than the left for healthy volunteers. Regarding participants with chronic kidney disease, while the mean cortico-medullary ratio of the right kidney was 0.93 ± 0.07, the mean cortico-medullary ratio of the left kidney was 0.94 ± 0.08. this implies that the cortico-medularry ratio of the left kidney was higher than that of the right kidney in participants with CKD.

Table 7 shows that in healthy volunteers. while the mean CMR for males was 1.26 ± 0.05, the mean CMR for females was 1.27 ± 0.02. this implies that the CMR of healthy females in this study was higher than that of males. Regarding participants with CKD, while the CMR of males was 0.96 ± 0.07, the CMR of females was 0.91 ± 0.06. this implies that the CMR of male participants with CKD was higher than the CMR of female participants with CKD.

Tabe 8 compares directly the mean CMR of Healthy Volunteers (1.27 ± 0.04) and the mean CMR of patients with CKD (0.93 ± 0.07). it

showed that CMR was higher in healthy volunteers than in CKD patients.

Table 9 shows the relationship between CMR and anthropological parameters. There was no correlation between CMR and age, BMI, and BSA in the healthy participants. There was also no correlation between CMR and BMI in patients with CKD. However, there was a strong correlation between the right kidney CMR and BSA in patients with chronic kidney disease (τ= 0.714). There was also a weak correlation between left kidney CMR and BSA in patients with CKD (τ= 0.332). There was only a weak negative correlation between the right kidney CMR and age in patients with CKD (τ = -0.343). There was no correlation between the left kidney CMR and age in patients with CKD.

Table1: Distribution of the participants according to age and sex

	Normal Subjects (count/percent)						
Age (years)	**20 and less**	**21-30**	**31-40**	**41-50**	**51-60**	**61 and over**	**Total**
Male	15 (3.7)	34 (8.4)	43 (10.6)	49 (12.1)	13 (3.2)	44 (10.9)	**198 (48.9)**
Female	7 (1.7)	136 (33.6)	15 (3.7)	7 (1.7)	27 (6.7)	15 (3.7)	**207 (51.1)**
Total	**22 (5.4)**	**170 (42)**	**58 (14.3)**	**56 (13.8)**	**40 (9.9)**	**59 (14.6)**	**405 (100)**
	Patients with Chronic Kidney Disease (count/percent)						
Male	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	40 (51.3)	**40 (51.3)**
Female	0 (0)	0 (0)	2 (2.5)	0 (0)	6 (7.7)	30 (38.5)	**38 (48.7)**
Total	**0 (0)**	**0 (0)**	**2 (2.5)**	**0 (0)**	**6 (7.7)**	**70 (89.8)**	**78 (100)**

Table 2: Summary statistics for the anthropometric and demographic variables of healthy subjects and patients with CKD

Variable	Minimum	Maximum	Mean±SD	1st Quartile	Median	3rd Quartile
Normal subjects (n = 405)						
Age (years)	18	84	38.7 ± 16.0	26.0	32.0	50.0
Height (m)	1.60	1.88	1.70 ± 0.07	1.65	1.69	1.74
Weight(kg)	65.0	95.0	78.3 ± 8.0	72.0	79.0	83.0
BMI (kg/m^2)	21.7	30.9	27.0 ± 1.9	26.1	27.1	28.3
BSA(m^2)	1.71	2.22	1.90 ± 0.13	1.78	1.90	1.97
Patients with Chronic Kidney Disease (n =78)						
Age (years)	39	85	72.4 ± 8.4	69.0	74.0	77.0
Height (m)	1.59	1.83	1.68 ± 0.07	1.61	1.68	1.75
Weight(kg)	63	85	72.1 ± 6.5	65.0	72.0	79.0
BMI (kg/m^2)	23.0	28.1	25.7 ± 1.3	25.0	25.6	26.5
BSA(m^2)	1.65	2.07	1.81 ± 0.12	1.74	1.79	1.95

Table 3: Summary statistics for the renal parameters of normal subjects and patients with CKD

Variable	Minimum	Maximum	Mean±SD	1st Quartile	Median	3rd Quartile
Normal subjects (n = 405)						
RKL (mm)	10.0	13.1	11.6±0.8	11.0	11.7	12.2
RKW (mm)	3.3	5.8	4.3 ± 0.5	3.8	4.2	4.6
RKCT (mm)	0.7	1.6	1.1 ± 0.2	1.0	1.1	1.2
RKMT (mm)	0.6	1.2	0.9 ± 0.1	0.8	0.9	0.9
RKCMR	1.25	1.29	1.27 ± 0.01	1.26	1.27	1.28
LKL (mm)	10.6	14.2	12.0 ± 0.8	11.4	11.9	12.3
LKW (mm)	3.2	6.1	4.5 ± 0.6	4.1	4.3	4.8
LKCT (mm)	0.8	1.6	1.2 ± 0.2	1.2	1.2	1.4
LKMT (mm)	0.6	1.4	1.0 ± 0.2	0.9	1.0	1.1
LKCMR	1.01	1.29	1.26 ± 0.05	1.26	1.27	1.28
Patients with Chronic Kidney Disease (n =78)						
RKL (mm)	9.1	10.9	9.9 ± 0.5	9.8	9.8	10.3
RKW (mm)	2.5	4.0	3.3 ± 0.4	2.9	3.2	3.7
RKCT (mm)	0.4	0.9	0.6 ± 0.1	0.5	0.6	0.7
RKMT (mm)	0.5	1.0	0.7 ± 0.1	0.6	0.7	0.7
RKCMR	0.78	1.09	0.93 ± 0.07	0.91	0.93	0.95
LKL (mm)	9.5	11.0	10.3 ± 0.4	10.2	10.3	10.6
LKW (mm)	2.6	4.0	3.4 ± 0.5	3.1	3.4	3.9
LKCT (mm)	0.5	1.0	0.7 ± 0.2	0.5	0.7	0.8
LKMT (mm)	0.5	1.0	0.7 ± 0.2	0.6	0.6	0.8
LKCMR	0.81	1.08	0.94 ± 0.08	0.91	0.92	1.0

Table 4: Sonographic renal parameters according to sex and age of the healthy participants

Age (years)	**20 and less**	**21-30**	**31-40**	**41-50**	**51-60**	**61 and over**
Renal Parameters			**Males (n=198)**			
RKL (mm)	11.7±0.5	11.9±0.5	11.7±0.7	12.5 ±0.4	11.3±0.5	10.9 ±0.5
RKW (mm)	4.4 ±0.6	4.7 ±0.6	4.3 ±0.6	4.8 ±0.2	4.4 ±0.3	3.9 ±0.3
RKCT (mm)	1.1 ±0.3	1.3 ±0.2	1.1 ±0.1	1.3 ±0.1	1.1 ±0.0	1.0 ±0.1
RKMT (mm)	0.8 ±0.2	1.0 ±0.2	0.8 ±0.1	1.0 ±0.1	0.9 ±0.0	0.8 ±0.1
RKCMR	1.26 ±0.01	1.27 ±0.01	1.27 ±0.01	1.27 ±0.01	1.27 ±0.01	1.26 ±0.01
LKL (mm)	12.0 ±0.6	11.8±0.2	12.4 ±0.9	12.7 ±0.8	11.6±0.4	11.6±0.4
LKW (mm)	4.7 ±0.5	4.2 ±0.3	4.7 ±0.6	4.9 ±0.5	4.2 ±0.0	4.4 ±0.4
LKCT (mm)	1.3 ±0.01	1.3 ±0.1	1.3 ±0.2	1.3 ±0.3	1.2 ±0.0	1.1 ±0.2
LKMT (mm)	1.0 ± 0.0	1.0 ± 0.1	1.0 ± 0.1	1.0 ± 0.2	0.9 ± 0.0	0.9 ± 0.1
LKCMR	1.27 ± 0.01	1.17 ± 0.12	1.27 ±0.01	1.26 ±0.01	1.27 ±0.01	1.26 ±0.01
			Female (n=207)			
RKL (mm)	10.9 ±0.0	11.5±0.7	11.5±0.8	11.6±0.0	11.7±0.7	11.2±0.5
RKW (mm)	3.8 ±0.0	4.1 ± 0.5	3.9 ± 0.4	4.3 ± 0.0	4.5 ± 0.1	4.3 ± 0.3
RKCT (mm)	1.2 ±0.0	1.1 ± 0.1	1.1 ± 0.3	1.1 ± 0.0	1.0 ± 0.3	1.0 ± 0.1
RKMT (mm)	0.9 ±0.0	0.8 ± 0.1	0.9 ± 0.3	0.9 ± 0.0	0.8 ± 0.2	0.8 ± 0.1
RKCMR	1.28 ±0.00	1.27 ± 0.01	1.29 ± 0.01	1.27 ± 0.00	1.27 ± 0.01	1.28 ± 0.01
LKL (mm)	11.0±0.0	11.7±0.7	11.7±0.8	12.0 ± 0.0	13.0 ± 1.1	11.6±0.2
LKW (mm)	4.0 ± 0.0	4.3 ± 0.5	4.3 ± 0.2	4.5 ± 0.0	5.0 ±0.5	3.9 ±0.8
LKCT (mm)	1.5 ± 0.0	1.3 ± 0.1	1.2 ± 0.2	1.1 ± 0.0	1.28 ± 0.1	0.8 ± 0.1
LKMT (mm)	1.1 ± 0.0	1.0 ± 0.1	1.0 ± 0.1	1.4 ± 0.0	1.0 ± 0.1	0.7 ± 0.0
LKCMR	1.28 ± 0.00	1.27 ± 0.02	1.27 ±0.00	1.27 ± 0.00	1.27 ±0.01	1.28 ± 0.01

Table 5: Influence of anthropometric characteristics of cortico-medullary thickness ratio in healthy volunteers and patients with chronic kidney disease

HEALTHY VOLUNTEERS					
Parameter	**One-way ANOVA**			**Kruskal-Wallis Test**	
Age (years)	**Total Sum of Squares**	**F-ratio**	**Significance**	**Test Statistic**	Significance
Right Kidney	0.04127	51.985	$p < 0.001$	292.5432	$p < 0.000001$
Left Kidney	0.9585	4.498	$p < 0.001$	228.8874	$p < 0.000001$
BMI (kg/m^2)					
Right Kidney	0.04127	124.655	$p < 0.001$	335.7049	$p < 0.000001$
Left Kidney	0.9585	17.116	$p < 0.001$	337.2561	$p < 0.000001$
BSA (m^2)					
Right Kidney	0.04127	124.655	$p < 0.001$	335.7049	$p < 0.000001$
Left Kidney	0.9585	17.116	$p < 0.001$	337.2561	$p < 0.000001$
Sex					
Right Kidney	0.04127	54.223	$p< 0.001$	43.5597	$p < 0.000001$
Left Kidney	0.9585	26.363	$p < 0.001$	61.7960	$p < 0.000001$
PATIENTS WITH CHRONIC KIDNEY DISEASE					
Parameter	**One-way ANOVA**			**Kruskal-Wallis Test**	
Age (years)	**Total Sum of Squares**	**F-ratio**	**Significance**	**Test Statistic**	Significance
Right Kidney	0.3461	2.674×10^{30}	$p < 0.001$	75.1100	$p < 0.000001$
Left Kidney	0.4406	3.404×10^{30}	$p < 0.001$	74.4966	$p < 0.000001$
BMI (kg/m^2)					
Right Kidney	0.3461	2.674×10^{30}	$p < 0.001$	75.1100	$p < 0.000001$
Left Kidney	0.4406	3.404×10^{30}	$p < 0.001$	74.4966	$p < 0.000001$
BSA (m^2)					
Right Kidney	0.3461	2.674×10^{30}	$p < 0.001$	75.1100	$p < 0.000001$
Left Kidney	0.4406	3.404×10^{30}	$p < 0.001$	74.4966	$p < 0.000001$
Sex					
Right Kidney	0.3461	4.277	$p = 0.042$	5.7562	$p = 0.014721$
Left Kidney	0.4406	23.391	$p < 0.001$	5.7562	$p = 0.014721$

Table 6: Comparison of cortico-medullary thickness ratio between the right and left kidneys in the healthy volunteers and patients with chronic kidney disease

INDEPENDENT SAMPLES TEST				MANN-WHITNEY TEST			
Right Kidney Mean	**Left Kidney Mean**	**t-statistic**	**p-value**	**Right Kidney Median**	**Left Kidney Median**	**Z-statistic**	**p-value**
HEALTHY VOLUNTEERS							
1.27 ± 0.01	1.26 ± 0.05	-3.746	p = 0.0002*	1.27	1.27	-0.945	p = 0.34
PATIENTS WITH CHRONIC KIDNEY DISEASE							
0.93 ± 0.07	0.94 ± 0.08	1.131	p = 0.26	0.93	0.92	-0.541	p = 0.59

Table 7: Comparison of cortico-medullary thickness ratio between the males and females among the healthy volunteers and patients with chronic kidney disease

INDEPENDENT SAMPLES TEST				MANN-WHITNEY TEST			
Mean CMR for Males	**Mean CMR for Females**	**t-statistic**	**p-value**	**Median CMR for Males**	**Median CMR for Females**	**Z-statistic**	**p-value**
HEALTHY VOLUNTEERS							
1.26 ± 0.05	1.27 ± 0.02	6.384	p < 0.0001	1.27	1.28	-10.717	p < 0.0001
PATIENTS WITH CHRONIC KIDNEY DISEASE							
0.96 ± 0.07	0.91 ± 0.06	-4.842	p < 0.0001	0.92	0.93	-1.887	p = 0.0591

Table 8: Comparison of cortico-medullary thickness ratio between the healthy volunteers and patients with chronic kidney disease

INDEPENDENT SAMPLES TEST				MANN-WHITNEY TEST			
Mean CMR Healthy Volunteers	**Mean CMR for Patients with Chronic Kidney Disease**	**t-statistic**	**p-value**	**Median CMR for Males**	**Median CMR for Females**	**Z-statistic**	**p-value**
1.27 ± 0.04	0.93 ± 0.07	-88.057	p< 0.0001	1.27	0.93	-20.241	p< 0.0001

Table 9: Kendall's Tau correlation between CMR and age, BMI, and BSA in healthy volunteers and patients with chronic kidney disease

Cortico-medullary Thickness Ratio	**Age (years)**	**BMI (kg/m^2)**	**BSA(m^2)**
		Healthy volunteers	
Right Kidney	τ = -0.063; p =0.0601	τ=0.085; p=0.0106	τ = -0.245; p <0.0001
Left Kidney	τ = -0.2; p <0.0001	τ = -0.141; p <0.0001	τ = -0.143; p <0.0001
Cortico-medullary Thickness Ratio	**PatientswithChronicKidneyDisease**		
Right Kidney	τ = -0.343; p <0.0001	τ= 0.0349; p =0.6550	τ= 0.714; p <0.0001
Left Kidney	τ= -0.137; p =0.0742	τ= 0.0402; p =0.6056	τ= 0.332; p <0.0001

DISCUSSION

Diagnosis of renal pathologies is made easy when the mean CMR for a location or race is known. This study of 405 healthy adults has shown that both the Cortical Thickness and the Medullary Thickness of the Left kidney was higher than the right kidney. The study showed that the left kidney has larger volume than the right kidney. The size of the cortex and medulla is proportionate to the size of kidney. Hence, the kidney with the larger size would have a larger cortex and medulla. This finding establishes a standard for renal diagnosis such that when the cortex and medulla of the right kidney are higher than that of the left kidney, attention should be paid to ascertain the pathology responsible for this abnormality. This has also given us a central reference point for the sonographic assessment of the cortex and medulla of healthy adults in Aba South. The mean size of the cortex and medulla thickness gotten in this study is not the same for all location and race.

In Sonography, Chronic Kidney Disease is grossly characterized by reduced renal cortical thickness <6mm, reduced renal length, increased renal cortical echogenicity, poor visibility of renal medulla and renal sinus, marginal irregularities, papillary calcification and cysts. With the reduction in renal cortical thickness and poor visibility of renal medulla, it is obvious the Cortico-medullary ratio will be reduced in comparison to the healthy adult. From the study, there was gross reduction of cortico-medullary ratio in patients with CKD when compared to healthy volunteers (mean CMR for healthy adult was 1.27 while mean CMR for CKD was 0.94). Hence, for renal sonography of the population of this study; Aba South, CMR of values lower than 1.00 are to be evaluated further to rule out Chronic Kidney diseases.

It was rather very surprising that the study found the CMR in females to be higher than that of the males; though it was not statistically significant ($p<0.0001$). In humans, females generally have smaller kidneys and fewer nephrons, therefore should also have lesser CMR (El Rehaid,2014). Though the mean cortical thickness obtained in this study was similar to that of El-Reshaid *et al.*[9] who in their study of renal size of healthy adults in Kuwait found that the mean Right cortical thickness was 0.98±0.2 for males and 0.98±0.8 for females and the Left Cortical thickness was 1.02±0.2 for males and 1.02±0.6 for females. The finding of this study was lower and contrary to the findings of Kunhel *et al*[2] who found that the medulla/cortex ratio of females was found to be 2.5-3.5 and that of males 2.5-3.2.

Anthropometric parameters like height are known to be related to renal size positively, this implied that tall people would have notable long renal length and width, while short people would have short renal length and width). The findings from this research is in keeping with results of previous study about renal length and human's height. However, the findings of this study were also clear that anthropometric parameters (Age, BMI and BSA) had no strong relationship with corticomedullary ratio.

This study has established a reference value for the diagnosis of renal diseases in Aba South Local Government Area. The Cortico-medullary ratio of healthy adults are higher than those with Chronic kidney diseases.

COMPETING INTEREST

None

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JOURNAL OF BIOMEDICAL INVESTIGATION (JBI) VOLUME 12 NUMBER 2: JULY-AUGUST 2024

ASSOCIATION BETWEEN CRANIOVERTEBRAL ANGLE AND THE RISK OF FALLS AMONG COMMUNITY-DWELLING OLDER ADULTS IN SELECTED COMMUNITIES IN OYO STATE, NIGERIA

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Received: 20/7/2024; accepted for publication 31/8/2024

ABSTRACT

Background: Reduced craniovertebral angle (< 49^0) i.e. forward head posture is the most common type of postural abnormality seen in older adults which result from displacement of the vertical line of the body's centre of gravity.

Aim: This study was designed to determine the association between the craniovertebral angle (head posture) and risk of falls of community dwelling older adults in Oyo state.

Materials and Methods: This was a cross-sectional study in which consecutive sampling was used to recruit 195 participants (97 females, 98 males). Universal goniometer and adapted Time-up-and-go test were used to measure the participant's craniovertebral angle (CVA) and risk of fall respectively. Chi square test was used to determine the level of association between variables while Mann Whitney U test was used to determine the difference between the two age groups/. Alpha level was set at < 0.05

Results: The mean CVA of the participants was 36.10±6.80 degrees with 186 (95.40%) participants having CVA <49° (forward head posture). There was a significant association between craniovertebral angle and risk of fall (p=0.001) of the participants and there was also a significant difference in craniovertebral angle and the risk of fall between the two age groups (p=0.001) and (p=0.001) respectively.

Conclusion: The outcome of this study revealed that prevalence of forward head posture was high and there was significant association between the craniovertebral angle and the risk of fall of the geriatric population.

Keywords: *Craniovertebral angle, risk of fall, community-dwelling, older adults*

INTRODUCTION

Ageing can be defined as a complex dynamic process featured by a progressive reduction of physiological function[1]. Changes in aging occur in all organs of the body and affect the working of all body systems[2]. Postural malalignments are the deviation from the standard alignment, which result from changes of the musculoskeletal system during the aging process, and various body segments such as head, neck, shoulders, thoracic and lumbar spine may be affected by this deviations[3] Postural malalignments among aging adults are often attributed to age-associated changes, and at times to sex-associated differences[4] These age-associated postural changes may be attributed to age-related biological and physiological changes, functional or pathological causes, or a combination of these changes[4]

In forward head posture (FHP), the head projects forward from the median plane and appears to be stationed anterior to the body, and this condition is regarded as the most common postural malaligment[5] .It is generally described as a ventral position of the head in relation to the vertical line of the body's center of gravity[6] .This situation occurs due to alteration in the postural

alignment and challenge of using normal strategies for balance control during activities of daily living especially in older adults[7] .A change in the function of these cervical muscles as a result of improper positioning of the head adversely affects the movement and balance control [8] . Forward head posture alters the center of gravity of the body that results in mechanical changes related to postural control in the torso and every joint. The body usually make effort to adapt to these changes by altering its balance control mechanisms; these adaptations reduce balance ability while performing various activities and increment in the risk of falling and musculoskeletal injury[5].

Fall injuries in the elderly is a major public health concern with the aging population; the resulting consequences, makes up one of the most common and serious problems facing our older adults population and falls are the second leading cause of unintentional injuries, deaths and the thirteenth leading cause of Years Lived with Disability worldwide[9] . Approximately 28–35% of people aged ≥65 years have been estimated to have history of fall at least once yearly[10]. Immobility, loss of independence, poor quality of life, mortality, hospitalization and early entry to long-term care facilities are the results of falls in the older adults[11]. In the elderly age is one of the risk factors for falls and fall-related injuries increase with age, with a rise in the risk of fracture, especially in the hip joint >50% of the cases [12] . Females older adults have higher falls than males older adults with females >70 years old being more susceptible to bone fractures, this is probably due to the bone density changes associated with menopause[13]. Factors such as the activities of daily living ability, obesity, physical activity habits, poor living conditions, and environmental factors are closely related to the risk of falls among the geriatric population[14].There have been studies on the correlation between head posture and postural balance in community-dwelling older adults who use Dentures, others are on female older adults with vertebral fracture[21,27] ; others have compare cervical ROM and proprioception between fallers and non-fallers and assess parameters that lead to fall risk among healthy older adults[33], others correlation between forward head posture and neck pain among office workers, others are effect of forward head posture on postural balance among computer workers and also among young adults[34], these were all studies conducted in either developed or developing countries of Europe, Asia etc. However, with the increase of forward head posture at an alarming rate across all ages especially older adults, this postural malalignment might posed as a risk factor to functional mobility and risk to fall in the elderly in Africa, whose rate of fall for example Nigeria was 25.3% and 41.3% for rural and urban older adult dwellers respectively coupled with poor uneven surface road and poor lightening etc[35]. A search through literature has shown a dearth of published studies in Africa especially low income countries in West Africa like Nigeria that have assess the association between forward head posture a major intrinsic risk factor to fall in the older adults hence the need to embark on this study. This study results might reveal the proportion of altered

head posture, and its degree of association to the risk of falls among the elderly. We hypothesized that there will be no significant association between craniovertebral angle(head posture) and the risk of fall among community-dwelling older adults. The aim of the study was to determine the degree of association between forward head posture and risk of fall among the elderly. This study addresses a significant public health issue - the risk of falls in older adults, which is a leading cause of morbidity and mortality in this population. By investigating the association between craniovertebral angle and fall risk, the study contributes valuable information to preventive strategies in geriatric care, the need for planning of head posture corrective exercises, lifestyle modification and educating on the relevance of proper head posture as a coping strategy to minimize fall risk in geriatric population.

MATERIALS AND METHODS

Research setting and study design

This was a cross-sectional survey of 195 elderly individuals (aged 65 years and above) resident who were consecutively recruited from three local government areas (Ido, Ibadan, Ogbomoso North and Ogbomosho South) Local in Oyo state of Western Nigeria. To avoid bias random sampling was used to select the communities from each local government area of Oyo state the largest state in south-west Nigeria[20]. The communities were mainly Apete, Agbede and Isale Afon. Invitations were extended to prospective participants through leaders from community and community associations. The Town halls of each community was the location for the data collection.

Inclusion criteria

Participants included in this study were consenting older male and female adults aged ≥65 years[15] residing in the aforementioned communities in Oyo State .

Exclusion criteria

Older adults residing in the aforementioned communities with neurological disorders such as Parkinsons' disease, dementia and musculoskeletal dysfunction that can affect assessment of the craniovertebral angle (head posture) and risk of fall of the participants were excluded from the study.

Sample size

Sample size was used to determine the amount of people that were recruited for this study. The formula for calculating is given below:

$$n = \frac{Z_{1-\alpha/2}^2 p(1-p)}{d^2}$$

where $Z_{1-\alpha/2}^2$ is a standard value of 1.96

p is the expected proportion in population – where p is 15%(Fejer et al, 2006)

d is precision = 0.05

$$n = \frac{(1.96)^2\ 0.15(1-0.15)}{(0.05)^2} = 195$$ participants.

A total of 195 participants were involved in this survey.

Procedure for data collection

Prior to commencement of this study, Ethical approval was obtained from Bowen

University Teaching Hospital, Health Research and Ethics Committee (BUTH-HREC-855). A written informed consent was obtained from participants after they have read, complete and sign the informed consent form prior to their participation, appropriate data collection methods and storage such as substituting codes for participants identifiers and encrypting data in order to achieve data confidentiality and participant anonymity in the study.

Research instruments

i. Universal goniometer (Locally made, Nigeria): The universal goniometer was used to measure the craniovertebral angle of the participants in degrees.

ii.Time up and go test: The adapted TUG test from BOOMER score was used as a performance based test to measure the risk of fall of the participants.

Measurements of head posture and risk of falls

The assessment tool for measuring craniovertebral angle (head posture) and risk of fall were universal goniometer and BOOMER score respectively. The Universal goniometer is a simple measuring device comprising of a protractor and two arms attached to the protractor, one of which is fixed to the protractor and the other arm is movable at the fulcrum which is the center of the protractor. A large universal goniometer having 12-inch arms and full-circle plastic body was used for quantifying the craniovertebral angle and Time-up-and-Go test which was adapted from Balance Outcome Measure for Elder Rehabilitation (BOOMER) scale was used to assess the functional mobility and the fall risk of the participants. For the Head posture measurement:

The craniovertebral angle is measured in degrees as the point of intersection between a horizontal line passing through the spinous process of C7 and the diagonal line passing through the tragus of the ear to meet the spinous process of C7. The spinous process of C7 is taken as a reference landmark as it can be easily located by palpation, the tragus is taken as another reference point as it is visible and it moves in direct relation to the skull. To quantify the craniovertebral angle (head posture),The participants were made to sit on a backless chair and place their hands on their knees and they were instructed to look at points that are horizontal to their vision, the fulcrum of a universal goniometer was placed in line with the C7 vertebrae, with the immovable arm positioned horizontal to the C7 landmark and the moveable arm running parallel to the tragus of the ear, two trials were taken in order to mitigate the potential for measurement error.For this study, craniovertebral angle < 49 degrees were regard as abnormal craniovertebral angle (forward head posture) while those >49 degrees was normal craniovertebral angle. For the risk of fall measurement; the Time up and go test adapted from Balance Outcome Measure for Elder Rehabilitation (BOOMER) scale was used. Time Up and Go test: a sturdy armchair with a backrest was placed at the end of the balcony of their place of residence. On the floor a piece of tape 3 m long was placed away from the front edge of the chair. Participants were given instruction about the task which

entails walking at their normal pace rather than a rapid speed and they were timed with a stop watch as they sit in the chair with their back against the backrest and arms resting on the chair armrests. To carry out the TUG test participants were instructed to stand up out of the sturdy chair, walk 3m, turn around, walk back to the chair, and sit down. Participants were instructed to: "stand up on the word 'go,' walk to the tape, turn around, walk back to the chair, and sit down." The timing of the TUG test began at the word "go," and ended when the participant was seated[16,17].

Data Analysis

Descriptive statistics of mean, standard deviation, frequency and percentages was used to summarize the data obtained. Inferential statistics of Chi square test was used to determine the significant association between craniovertebral angle sand risk of fall of the participants. Chi square test was used to determine the significant association between craniovertebral angle and risk of fall and the selected socio-demographic and anthropometric variables (gender, occupation, educational status and BMI respectively) of the community-dwelling older adults. Mann Whitney U test was to determine the significant difference between head posture craniovertebral angle (head posture) and risk of fall and the two the age groups of the participants. All statistical analysis were conducted using Statistical Package for Social Sciences (SPSS) 23.0 (IBM Corp., Armonk, NY, USA). Level of significance (α) was set at 0.05.

RESULTS

Socio-demographic and Anthropometric profiles of the study participants

One hundred and ninety-five (195) older adults (50.30% females, 49.7% males with mean age= (68.93 ±6.25years). One hundred and one (51.80%) had tertiary level of education . Six (3.10%)of the participants were underweight, One hundred and thirty-one 131 (67.20%) participants were normal weight (Table 1). One hundred and eighty-six (186) participants had a craniovertebral angle of less than 49 degrees (95.40%), nine participants had a craniovertebral angle that was ≥49 degrees (4.60%). Participants who had a craniovertebral angle of less than 49 degree were considered to have an abnormal craniovertebral angle (forward head posture) and participants who had a craniovertebral angle of ≥49 were considered to have a normal craniovertebral angle. One hundred and sixteen, 116 (59.00%) of the participants had a moderate risk of fall (Table 2).

Differences in craniovertebral angle and static balance and risk of fall between the two age groups.

Mann Whitney U test was to determine the significant difference between head posture (craniovertebral angle) and Risk of fall and the two the age groups of the participants. There was a significant difference between craniovertebral angle and risk of fall and the two age groups (p= 0.001) and (p= 0.001) respectively (Table 3).

Association between head posture (craniovertebral angle) and risk of fall of the participants.

Chi-square test was used to determine the level of association between craniovertebral angle and risk of fall among the participants.

There was a significant association between craniovertebral angle and risk of fall (p= 0.001) (Table 4). **Association between craniovertebral angle (head posture) and selected sociodemographic and anthropometric variables.**

Chi-square test was used to determine the association between craniovertebral angle and selected socio-demographic variables of the participants. There was no significant association between cranovertebral angle and gender (p= 0.547), educational levels (p= 0.353), occupation (0.014) and BMI (p= 0.510) (Table 5).

Table 1: Socio-demographic and anthropometric profiles of the participants

Variable	Categories	Frequency	Percentage
Educational level	Primary	15	7.7
	Secondary	41	21.0
	Tertiary	101	51.8
	None	38	19.5
Gender	Male	97	49.7
	Female	98	50.3
Occupation	Professionals	94	48.2
	Unskilled	51	26.2
	Traders	25	12.8
	Unemployed	25	12.8
Age	65-75	157	80.5
	76-86	38	19.5
BMI	Underweight	6	3.1
	Normal weight	131	67.2
	Overweight	55	28.2
	Obese	3	1.5

Table 2: Craniovertebral angle (head posture) and Risk of fall (TUG) of participants

Variables	Categories	Frequencies(n)	Percentage (%)
Craniovertebral angle	Abnormal	186	95.40
	Normal	9	4.60
Risk of fall(TUG)	Poor	2	1.00
	Fair	39	20.00
	Moderate	116	59.50
	Excellent	38	19.50

Table 3: Differences in craniovertebral angle and risk of fall between the two age groups.

Variables	Mean rank		U	P
	65-75	76-86		
Craniovertebral angle	112.79	36.88	660.500	0.001*
Risk of fall (TUG)	114.46	29.99	398.500	0.001*

*Significant at P≤ 0.05

Table 4: Association between head posture (craniovertebral angle) and Risk of fall (TUG) of the participants.

VARIABLE	Craniovertebral angle	
	x^2	P value
Risk of fall (TUG)	20.638	0.001*

*Significant at P≤ 0.05

Table 5: Association between Craniovertebral angle (head posture) and selected sociodemographic and arthropometric variables.

Variable	Craniovertebral angle	
	x^2	p-value
Occupation	2.466	0.482
Educational level	2.121	0.548
BMI	3.664	0.300
Gender	0.106	0.745

*Significant at P< 0.05

DISCUSSION

This study was designed to investigate the association between craniovertebral angle and risk of fall among community-dwelling older adults in selected communities (Apete, Agbede and Isale Afon) in Oyo State, Nigeria. Majority of the participants in this study were within 60-75 age group. The mean age of the participants in the study was 68.93 years with a standard deviation of 6.25 years though the mean age is lower than that of the study done by[18] , who reported a mean age of 78.31 with a standard deviation of 6.42 years. Majority of the participants involved in this study were females. This is not surprising as females have longer life expectancy than males[19] .The current study is similar to the finding from the study by where more than half of the participants involved in the study were females[20]. In this study, the mean BMI was 23.3 with majority of the participants classified as normal weight. This is similar to who reported a mean of 24.76 with majority of the participants classified as normal weight[21]. This is in contrast to a previous studies reported a mean BMI of 26.9 with majority of the participants classified as overweight[22]. As such, the lower BMI in the current study may be as a result of the socio-economic status of the participants in the area of study.

The mean of the participants' craniovertebral angle (CVA) in this study was 36.1 degrees which is in contrast to previous studies who reported the mean CVA as 48.9 and 42.38 respectively[18]. The current finding may be as a result of methods of measurement of CVA in this present study, which may have also influenced the outcome. Findings from this study indicates that there was no significant association in craniovertebral angle and gender (p=0.745). This is similar to previous studies by [23,24] who reported that craniovertebral angle is not associated with gender. There was significant difference between craniovertebral angle (head posture) and the age groups of the participants (p=0.001) respectively. Lansade demonstrated a significant deterioration of cervical proprioceptive abilities with increasing age[33]. Proprioception refers to the process impulses relayed by afferent receptors such as peripheral muscles, capsules, ligaments and joints is processed in the central nervous system. Somatic afferent information from the upper cervical spine, converges with vestibular and visual inputs on central nervous system nuclei involved in processing and integration of postural balance inputs[33].

This is similar with the finding from the study by[17], who reported that age is associated with head posture (craniovertebral angle) as the older the age, the severe the forward head posture. The finding of the current study is in contrast with previous studies that reported that age has no relationship with craniovertebral angle[6,23],. Craniovertebral angle was shown to have no significant association with occupations of participants (p=0.482) implying that participants nature of job is not associated to the value of craniovertebral angle. This is in contrast to previous studies that suggested that occupation was shown to have an effect on craniovertebral angle [25,26]

The finding may be as a result of the method of measurement of craniovertebral angle adapted in this study. There was no significant association between craniovertebral angle and educational status of the participants (0.548), implying that educational status is not a factor that is related to the size of FHP. This may be caused by lack of education on proper ergonomics as it concerns proper head posture even though most of the participants have tertiary level of education (n=101). It was also observed that craniovertebral angle had no significant association with all BMI classifications (p=0.300) implying that body mass index is not an associated factor to the size of head posture, which may be as a result of majority of the participants being normal weight. This corresponds to the findings from the following studies by [22, 27]. They noted that craniovertebral angle has no effect with BMI classifications which is consistent with the findings of the current study.

In this study there was a significant association between craniovertebral angle and Risk of fall (p=0.001). This could possibly mean that abnormal craniovertebral angle (forward head posture) can predispose one to impaired balance thereby leading to the risk of fall because postural control requires accurate sensory integrations of neck proprioceptive inputs and appropriate motor responses to the displacement of the centre of gravity (COG) which is altered in elderly with forward head posture. Forward head posture causes reduced vestibular and proprioceptive functions, which are crucial sensory inputs for postural control and it also alters the COG of the body that lead to mechanical modifications related to postural control of the body while the body attempts to adapt to these changes by altering its balance control mechanisms; these adaptations decrease balance ability while performing different activities and increase the risk of falling and musculoskeletal injury[8] .This corresponds to a study by which reported that forward head posture was significantly associated with risk of fall among older adults[28]. This is also consistent to[10], which reported that abnormal craniovertebral angle or forward head posture has a greater effect on balance which also concurs to the study by[29].However, in a study by[30], there was no statistically significant effect of forward head posture(craniovertebral angle <50 degrees) on an individual's balance. The findings of the current study may be as a result of poor head posture adopted over the years thereby leading to the displacement of the vertical line of the centre of gravity. This situation can thereby lead to risk of fall of the participants. It may also be as a result of age-associated changes in posture which is attributed to age-related biologic and physiological changes which could cause difficulties in using normal strategies for balance control during daily activities. Panzer reported that abnormal posture, vestibular impairment contributed to abnormal biofeedback, function of maintaining balance. It might change torque required to maintain posture which is associated with reduced balance controlling ability[34]

This study had some limitations like any other study being a cross-sectional study we couldn't establish a temporal

relationship(causative effect) between forward head posture and risk of falls variables which may limit the generalization of the results and also inability to control confounding factors that influence cranio-cervical posture such as psychological situation, thoracic and lumbar spine position and those that affect balance such as polypharmacy, poor visual acuity, musculoskeletal symptoms. Therefore we suggest that the study findings should thus be interpreted with caution. However, the sample size was calculated using established scientific formula and also, the tools (Universal goniometer and adapted BOOMER scale) used in this study are already validated as instrument suitable for the assessment of the indicated variables. Together, these added to the strength of the study and we hope that some level of generalization could still be made from our findings.

CONCLUSION

The outcome of this study revealed that forward head posture (abnormal craniovertebral angle) is very high among older adults in this study with a rate of 95.4%. There was significant association between head posture (Craniovertebral angle) and risk of fall and occupation of the elderly in this study. There was a significant difference in head posture and risk of fall between the two age groups of participants respectively.

Recommendations

Based on the findings of this study, it is recommended that:

1.There is need for future research to investigate the causative(temporal) relationship that exist between head posture and risk of fall and also adopt a computerized method of measurement of CVA to minimize error of measurement among a larger and diverse populace.

2.Sensitizations of clinicians during geriatric rehabilitation, on the association that exist between head posture and risk of fall will help them in the planning of help posture corrective exercises and educating of the elderly on proper head posture as a coping strategy to minimise fall risk in geriatric population.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not for- profit sectors"

Acknowledgement

The authors thank all community-dwelling older adults in the selected areas in Oyo state who participated in this study.

Declaration of conflicting interests

The authors declare that they have no financial or personal relationships that may have inappropriately influenced them in writing this article

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JOURNAL OF BIOMEDICAL INVESTIGATION (JBI) VOLUME 12 NUMBER 2: JULY-AUGUST 2024

EXPLORING QUALITY OF LIFE, STRESS, AND COPING STRATEGIES AMONG MARRIED FEMALE CLINICAL STUDENTS IN NNAMDI AZIKIWE UNIVERSITY: IMPLICATIONS FOR INTERVENTIONS

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Received: 29/7/2024; accepted for publication 31/8/2024

ABSTRACT

Background: The rigor of achieving an advanced degree is commonly accompanied by feelings of stress, particularly in the ever-growing and changing field of health sciences. Stress can impact learning. How students manage stress depends on their personal coping strategies and self-care. There is a need to evaluate students' stress, coping methods, and quality of life to help identify issues negatively affecting students and strategize solutions and preventative methods.

Aim: To examine perceived stress, coping strategies, and quality of life in married female clinical students.

Material and methods: The Perceived Academic Stress Scale (PASS), Brief-COPE, and World Health Organization Quality of Life Brief Version (WHOQoL-Bref) were administered to students. Data was obtained through an electronic questionnaire (Google Form), and the link to the questionnaire was shared via students' WhatsApp groups. To analyze data, inferential statistics of Mann–Whitney U, Kruskal–Wallis, and Spearman's rank correlation coefficient tests were used at the 0.05 level of significance.

Results: Fifty-three married female clinical students participated in this study. The results showed a significant increase in PASS scores, adaptive coping behaviors, and moderate quality of life. The PASS scores of the students had a moderate to large positive correlation with coping behaviors but no correlation between PASS scores and quality of life.

Conclusions: No significant correlations was observed between quality of life and perceived academic stress and coping strategies of married female clinical students.

Keywords: *Married female clinical students, Stress, Quality of life, Coping strategies*

INTRODUCTION

Quality of life (QoL) represents overall physical, mental, social, and environmental satisfaction[1], and is defined by the World Health Organization as an individual's perception of their position in life regarding their cultural and value system, including their goals, perspectives, standards, and concerns. QoL can be impacted by many factors, including stress. Since the 70s, there has been a significant development in assessing QoL, with established methods and applications. Recently, assessing QoL has been useful in determining the impact of illnesses/diseases and interventions. However, research on the QoL of undergraduates is limited, which is a high-stress period.[2]

Clinical students are vulnerable to stress, anxiety, and depression, affecting their QoL.[3] Numerous stressors influence medical students' health and QoL, such as the transition from pre-clinical to the clinical years, academic competition, and the extensive medical knowledge to be learned, can impact the health and QoL of medical students.[4] Decreased QoL scores were observed among medical students during their undergraduate training.[5–7] The

decreased QoL is associated with long-term effects, including an unhealthy lifestyle, mental health issues, academic difficulties, and negative impacts on professional development.[5]

Stress occurs when demand exceeds an individual's capacity and can potentially have negative physical and psychological effects.[8] Stress involves the inability to meet demands or judgment made by the individual of being unable to meet the demands.[9] Globally, people experience stress, and it comes in several forms.[10] This implies that stress is a part of life and has many causative factors, and the degree of stress depends on the physical health of the individual, quality of interpersonal relationships, number of commitments and responsibilities, others' dependence on and expectations, amount of support from others, and number of traumatic events .[11] Undergraduates experience high stress levels related to concerns about academic success, time management, and engagement in patient care.[12] This stress can be attributed to academic workload, assignments, and adapting to a new setting. The prevalence of stress and depression among students in different academic fields is alarming.[13]

Clinical students study for hours and have inadequate time for extracurricular activities.[14] In addition, they spend a substantial time in the clinical, where they are entrusted with caring for patients.[15] Moreover, financial burdens, struggling to manage time, and using complex medical equipment further contribute to their stress levels in many cases.[16] Clinical practice trains students to be professionals and helps bridge the theory-practice gap.[17] Students undertake courses for clinical practice; therefore, they face the burden of managing their academic activities, which is inherently stressful.[15] Clinical students experience higher levels of stress than other students.[14,15,18] The key stressors experienced include high self and external expectations, a demanding learning environment, heavy academic tasks, and pressure to achieve high academic grades.[19] These stressors have a significant impact on students' well-being and academic success.[19] The stress is associated with limited study time and extended hours in hospitals and healthcare facilities .[20] Some students cannot cope with their stressors owing to a lack of effective study plans. In general, students cannot eliminate stress; however, they can manage it, which can have a positive impact on their psychological and social well-being.[21]

Coping theory is defined as the "constantly changing cognitive and behavioral efforts to manage external and internal demands appraised as taxing or exceeding the resources of the person.[8]" Coping theory is classified into focus-oriented and approach-oriented theories. While the first recognizes peoples' internal resources and mental capacities for evaluating how competently they can adapt to a situation, the latter is concerned with how concrete the coping mechanisms are.[8] One of the most frequently used focus-oriented approaches is provided by Ebata and Moos. Active (positive or functional) and avoidant (negative or dysfunctional) coping approaches are defined based on whether a

person's response is directed toward or away from the stressor.[8] Coping strategies depend on personality and perceptions about life experiences. However, the main aim is to reduce stress and reaching a balanced state of functioning. Women adopt a more emotion-focused approach and resort to negative avoidant coping strategies compared with men.[22]

Given this, there is a need to develop a better understanding of the different coping mechanisms used by married female clinical students. Marriage, being a significant event in one's life, affects QoL. Stress from marriage is more pronounced in women in developing countries, where the traditional concepts of family, household, and socially determined sex roles are more intense.[23] This study aimed to determine the coping strategies used by married female clinical students and their impact on QoL.

MATERIAL AND METHODS

Research design

This was a cross-sectional descriptive study.

Research population

This study comprised married female clinical students at the College of Health Sciences.

Inclusion criteria

Females (aged between 20 and 45 years) who are married, clinical phase students at the College of Health Sciences, and willing to participate in the study by providing the necessary information. All study participants provided informed consent.

Sampling technique

A purposive sampling technique was used.

Sample size

Fifty married female clinical students were recruited. A sample size of 50 has a 90% power to detect a moderate effect size of 0.3 at an alpha level of significance of 0.05. The sample size was calculated using G* Power 3.0.10.

Research instruments

Data were collected through an interview-administered questionnaire. The instruments used for data collection are as follows:

1. World Health Organization QoL Brief (WHOQOL-BREF): The health-related QoL was assessed using the WHOQOL-BREF, developed by the WHO to assess QoL across different cultures. The WHOQOL-BREF is a well-known international QoL assessment instrument, which is multilingual and available for developed and developing countries.[24] WHOQOL-BREF consists of 26 items with a response range from 1 (very poor/very dissatisfied/not at all) to 5 (very good/very satisfied/extremely satisfied). The English version of the questionnaire was used in this study. The questionnaires, covering four domains (physical, psychological, social relationships, and environmental health), were handed out to the students. The scores are transformed into a scale from 0 to 100, with 0 indicating the least favourable and 100 indicating the most favourable. The QoL analysis was

performed by measuring the score of each question item on a Likert scale. For each respondent, the raw score for each dimension was calculated.

2. Brief-COPE: To measure strategies for coping with stress, the Brief-COPE Inventory was used. Brief-COPE is a frequently used self-reported questionnaire developed to assess several coping strategies. It has 28 items that describe the coping responses in three domains (problem-, emotion-, and avoidant-focused). Each item in each domain is scored from possible options on an ordinal scale from one to four. There are 28 coping behaviors and thoughts (two items for each subscale) that are rated on the frequency of use by the participant with a scale of 1 (I have not been doing this at all) to (I have been doing this a lot). Internal reliability for the 14 subscales ranges from $\alpha = 0.57–0.90$. Each of the 14 scales comprises two items; total scores range from two (minimum) to eight (maximum). Higher scores are calculated by summing the appropriate items for each scale. No items are reverse-scored. There is no overall total score, only total scores for each subscale. The model conceptualized by Meyer (2001) was used in this study to analyze coping strategies according to two subscales (adaptive and maladaptive).[25] Adaptive coping comprises eight factors (emotional support, positive reframing, acceptance, religion, humour, active coping, planning, and use of instrumental support), and maladaptive coping comprises the remaining six factors (venting, denial, substance use, behavioural disengagement, self-distraction, and self-blame). Moreover, a total mean score ≤2 indicates ineffective coping strategies, while a mean score >2 indicates effective coping strategies.

3. Perceived Academic Stress Scale (PASS): PASS is an 18-item, five-point Likert-type scale used to measure perceptions of academic stress, and its causes.[26] This scale was standardized for undergraduates and postgraduates. The responses range from 1 (strongly disagree) to 5 (strongly agree), measuring four dimensions with internal consistency, including pressures to perform (0.6), perceptions of workload and examinations (0.6), self-perceptions (0.5), and time constraints (0.6). The overall internal consistency reliability was 0.7. A total mean score >53 shows high perceived stress, while <53 indicates a low perceived stress

Data collection

Ethical approval was obtained from the Ethics Review Committee of the Faculty of Health Sciences and Technology, Nnamdi Azikiwe University. All study participants provided informed consent. The participants' initials were used for privacy. The questionnaires were administered to the participants. Information was collected from lecture halls, study areas, and hostels. An electronic questionnaire (Google Form) was developed and shared via WhatsApp groups to collect data. The distribution of the questionnaire was mainly online.

Data analysis

The socio-demographic variables and scores on the questionnaire were summarized using descriptive statistics of mean ±standard deviation, charts, frequency distribution, and percentages. The inferential statistics of Spearman's rank correlation coefficient, Mann–Whitney U test, and Kruskal–Wallis test were used to test the hypotheses. Statistical significance was set at $P<0.05$.

RESULTS

Response rate and participants' demographic data

This study comprised married female clinical students from the College of Health Science, Nnamdi Azikiwe University. Fifty-three participants participated in this study. The participants were pursuing degrees in medical rehabilitation, medical laboratory science, radiography, nursing science, medicine, and environmental health science. Most participants were aged between 20 and 29 years and were in 300, 400, 500, and 600 levels. Most participants had been married for 1–5 years and were living with their spouses. Most participants had no previous degree, and among those who did, they held an Ordinary National Diploma/National Diploma (Table 1). Regarding the obstetrics profile, the highest proportions of the participants (43.4%) are Nulliparous (Table 2).

We assessed the participants' academic stress using PASS. The results showed a mean score of 65.84±9.6, indicating a high-stress level perceived by most participants (77.40%). While 75.5% of the participants had effective strategies for managing stress, with a mean score of 2.79±0.85 for problem-focused, 2.41±0.72 for emotional-focused, and 1.84±0.55 for avoidant strategies. The total mean score for the participants' QoL was 61.59±17.12 for physical, 64.22±18.35 for psychological, 68.08±29.58 for social, and 60.2±17.37 for environmental QoL; therefore, most participants had good QoL, with 'social health' obtaining the highest mean score among the domains (Tables 3 and 4).

Correlation among perceived academic stress, coping strategies, and QoL **scores among the participants using Spearman's rank correlation coefficient**

A significant negative correlation was observed between perceived academic stress and social health (rho= -0.299, p=0.030); however, no correlation was observed between physical, psychological, and environmental health. Moreover, a significant positive correlation was observed between problem-focused coping strategy and social health (rho=0.320, p=0.020); however, no correlation was observed between physical, psychological, and environmental health. Emotion- and avoidant strategies showed no correlation with social, physical, psychological, and environmental health (Table 5). Perceived academic stress showed significant correlations with problem-focused (rho=0.371, p=0.006) and avoidant coping strategies (rho=0.404, p=0.003) but no correlation with emotion-focused coping strategy (rho= -0.128, p=0.360) (Table 6).

Influence of age and marriage duration on perceived academic stress, coping strategies, and QoL scores among the

participants using the Kruskal–Wallis test

The result showed no significant influence of age and marriage duration on perceived academic stress, coping strategies, or QoL (Tables 7 and 8).

Influence of spouse and previous degree on perceived academic stress, coping strategies, and QoL scores among the participants using the Mann–Whitney U test

Table 7 shows that having a spouse or not has no significant influence on perceived academic stress, coping strategies, or QoL. Moreover, having a degree has no significant correlation with perceived academic stress, coping strategies, or QoL (Tables 9 and 10).

Table 1. Socio-demographic characteristics of the participants

Variable	Class	Frequency	Percent
Age (years)	20–29	41	77.4
	30–39	10	18.9
	40–49	2	3.8
Department	Medicine	6	11.3
	Nursing	17	32.1
	Medical rehabilitation	11	20.8
	Medical laboratory science	9	17.0
	Radiography	5	9.4
	Environmental health science	5	9.4
Level of study	300	6	11.3
	400	20	37.7
	500	26	49.1
	600	1	1.9
Marriage duration (years)	1–5	47	88.7
	6–10	4	7.5
	11–15	1	1.9
	16–20	1	1.9
Presence of spouse	Alone (without spouse)	18	34
	With spouse	35	66
Previous degree	Yes	15	28.3
	No	38	71.7
Degree	Bachelors	5	9.4
	Higher National Diploma	3	5.7
	Ordinary National Diploma National Diploma	6	11.3
	Nigeria Certificate in Education	1	1.9

Table 2. Socio-demographic profiles of the participants

Variable	Class	Frequency	Percent
Parity	Nulliparous	23	43.4
	Primiparous	17	32.1
	Multiparous	12	22.6
	Grandmultiparous	1	1.9
Gravidity	Nulligravida	17	32.1
	Primigravid	20	37.7
	Secundigravida	11	20.8
	Multigravida	5	9.4

Table 3. Mean perceived academic stress, coping strategies, and quality of life scores among the participants

Variable	Class	Mean±Standard deviation
Perceived Academic stress		65.84±10.57
Coping Strategy	Problem-focused	2.79±0.85
	Emotional-focused	2.41±0.72
	Avoidant	1.84±0.55
Quality of Life	Overall quality of life	3.98±0.89
	Physical health	61.59±17.12
	Psychological health	64.22±18.35
	Social health	68.08±29.58
	Environmental health	60.2±17.37

Table 4. Level of academic stress, coping strategies, and quality of life scores among the participants

Variable	Class	N (%)	X^2	p-value
Perceived academic stress	Low level of stress	12 (22.60)		
	High level of stress	41 (77.40)	7.849	0.023
Coping Strategy	Maladaptive	13 (24.5)		
	Adaptive	40 (75.5)	13.755	<0.01
Quality of Life	**Physical health**			
	Poor quality of life	1 (1.9)		
	Moderate quality of life	7 (13.2)	50.774	<0.01
	Good quality of life	10 (18.9)		
	Very good quality of life	35 (66)		
	Psychological health			
	Moderate quality of life	6 (11.3)		
	Good quality of life	12 (22.6)	26.528	<0.01
	Very good quality of life	35 (66)		
	Social health			
	Poor quality of life	1 (1.9)		
	Moderate quality of life	4 (7.5)		
	Good quality of life	21 (39.6)	36.585	<0.01
	Very good quality of life	27 (50.9)		
	Emotional health			
	Very poor quality of life	4 (7.5)		
	Poor quality of life	3 (5.7)		
	Moderate quality of life	3 (5.7)	71.811	<0.01
	Good quality of life	8 (15.1)		
	Very good quality of life	35 (66)		

Table 5. Correlation among stress, coping, and quality of life of participants using the Spearman's rank correlation coefficient

Variables	Quality of life				
		Physical health	Psychological health	Social health	Environmental health
Perception of academic stress	r-value	-0.216	-0.054	-0.299	-0.197
	P- value	0.121	0.702	0.030	0.158
Coping mechanism					
Problem-focused coping	r-value	0.081	0.205	0.320	0.124
	P- value	0.556	0.140	0.020	0.376
Emotion-focused coping	r-value	-0.254	-0.217	-0.074	-0.011
	P- value	0.067	0.118	0.600	0.935
Avoidant coping	r-value	-0.136	-0.099	0.090	-0.107
	P- value	0.330	0.481	0.521	0.446

Table 6. Spearman's rank correlation coefficient assessing the correlation between components of perceived academic stress, coping strategies, and quality of life scores among the participants

Variables		Perception of academic stress
Coping Mechanism		
Problem-focused coping	r-value	0.371
	P- value	0.006
Emotion-focused coping	r-value	-0.128
	P- value	0.360
Avoidant coping	r-value	0.404
	P- value	0.003

Table 7. Comparison of stress, coping, and quality of life among the different age categories of participants using the Kruskal–Wallis test

Variables	Age (years)	Mean rank	K-value	P- value
Perception of academic stress	20–29	27.83	1.367	0.505
	30–39	25.05		
	40–49	19.75		
Problem-focused coping	20–29	26.35	1.225	0.542
	30–39	31.10		
	40–49	19.75		
Emotional-focused coping	20–29	24.89	4.732	0.094
	30–39	31.90		
	40–49	45.75		
Avoidant coping	20–29	27.61	0.505	0.777
	30–39	25.85		
	40–49	20.25		
Physical health	20–29	29.06	3.258	0.196
	30–39	20.10		
	40–49	19.25		
Psychological health	20–29	27.20	0.502	0.778
	30–39	27.70		
	40–49	19.50		
Social health	20–29	28.79	2.935	0.230
	30–39	22.20		
	40–49	14.25		
Environmental health	20–29	28.15	1.074	0.585
	30–39	22.55		
	40–49	25.75		

Table 8. Comparison of stress, coping, and quality of life among the different marriage durations using the Kruskal–Wallis test

Variables	Marriage duration (years)	Mean Rank	K-value	P- value
Perception of academic stress	1–5	27.36	3.701	0.296
	6–10	26.38		
	11–15	6.50		
	16–20	33.00		
Problem-focused coping	1–5	27.23	3.227	0.358
	6–10	19.88		
	11–15	21.50		
	16–20	50.00		
Emotion-focused coping	1–5	26.73	2.459	0.483
	6–10	32.25		
	11–15	8.00		
	16–20	37.50		
Avoidant coping	1–5	27.91	3.774	0.287
	6–10	18.63		
	11–15	6.00		
	16–20	38.50		
Physical health	1–5	27.76	1.101	0.777
	6–10	20.25		
	11–15	20.00		
	16–20	25.50		
Psychological health	1–5	27.62	1.430	0.699
	6–10	22.25		
	11–15	31.50		
	16–20	12.50		
Social health	1–5	27.98	1.907	0.592
	6–10	18.50		
	11–15	25.50		
	16–20	16.50		
Environmental health	1–5	27.45	1.365	0.714
	6–10	25.75		
	11–15	28.50		
	16–20	9.50		

Table 9. Comparison of Stress, Coping, and Quality of life between the different categories of presence of spouse using the Mann-Whitney Test

Variables	Presence of Spouse	Mean Rank	U-value	P- value
Perception of academic stress	Without spouse	27.83	290.500	0.526
	With spouse	25.05		
Problem-focused coping	Without spouse	26.35	287.000	0.598
	With spouse	31.10		
Emotional-focused coping	Without spouse	24.89	295.500	0.714
	With spouse	31.90		
Avoidant coping	Without spouse	27.61	259.500	0.295
	With spouse	25.85		
Physical health	Without spouse	25.64	312.000	0.955
	With spouse	27.70		
Psychological health	Without spouse	25.44	248.000	0.207
	With spouse	27.80		
Social health	Without spouse	28.08	309.500	0.917
	With spouse	26.44		
Environmental health	Without spouse	23.92	299.000	0.763
	With spouse	28.59		

Table 10. Comparison of stress, coping, and quality of life between the different categories of previous degree using the Mann–Whitney Test

Variables	Previous degree	Mean rank	U-value	P-value
Perception of academic stress	Yes	24.17	242.500	0.247
	No	28.12		
Problem-focused coping	Yes	29.40	249.000	0.476
	No	26.05		
Emotional-focused coping	Yes	31.00	225.000	0.236
	No	25.42		
Avoidant coping	Yes	23.77	236.500	0.336
	No	28.28		
Physical health	Yes	24.77	251.500	0.506
	No	27.88		
Psychological health	Yes	27.20	282.000	0.953
	No	26.92		
Social health	Yes	24.70	250.500	0.492
	No	27.91		
Environmental health	Yes	30.87	227.000	0.251
	No	25.47		

DISCUSSION

This study aimed to explore the QoL, academic stress, and coping strategies among married female clinical students in the College of Health Sciences. The demographic variables considered were age, marriage duration, presence of spouse, and previous degree. This study focused on firstly establishing the level of perceived academic stress in the participants, coping strategies used, and QoL of the participants. Fifty-three students participated in this study.

Most participants reported having very good QoL. Similar to the total QoL score, most participants scored very well in each domain, with 'social relationships domain' having the highest mean score among the domains and environmental health obtaining the lowest mean score. This suggests the comprehensive effects of academic stress may affect the QoL of the students. This finding is similar to a study,[27] which reported that only 24.5% of pharmacy students reported a high QoL and married female students have significantly higher QOL scores in the social relationships domain.[28]

This study's findings illustrate that 77.4% of the participants experienced a high level of perceived academic stress, while 22.6% reported experiencing low levels of perceived academic stress. This finding is similar to previous studies that found varying levels of academic stress among undergraduates.[29–33] This high level of stress

can be attributed to various situations that impact the academic calendar, as most of the academic terms were mid-way with impending examinations, assessments, and graduation. Moreover, managing maternal and family affairs by married female undergraduates is challenging.

The coping strategies used by this study's participants were analyzed. Most participants used adaptive coping strategies to cope with academic stress, which included active coping, emotional support, and the use of informational support, planning, and acceptance. Few participants used maladaptive-focused coping, including self-distraction and venting. The findings of this study regarding adaptive coping present a shift in the perception that undergraduates mainly use maladaptive coping strategies. A common theme of adaptive coping in the form of problem-solving (planning, acceptance, and positive reinterpretation) was observed, which is similar to previous studies.[8,17,34,35] This study revealed high levels of perceived academic stress despite higher levels of adaptive coping. This may be indicative that the coping strategies used by the participants do not effectively manage perceived academic stress. Problem-focused coping strategies were identified as common coping strategies, with a mean score of 2.79±0.85, similar to previous studies.[17,36–40] This finding suggests that stress activates a cognitive appraisal process, which determines coping strategies. Therefore, the impact of stress on exams and relationship to stress implements an active coping behavior, which involves controlling the situation by adapting to the stressor.

This study found that perceived stress was negatively correlated to social health domains of QoL, indicating that better QOL is significantly related to lower perceived stress levels. This finding is similar to a study, which found negative correlations between QoL domains and perceived stress scores.[28] However, PASS scores had an independent and significant association with QOL scores in the physical and psychological health domains. Problem-focused coping scores showed a significantly positive correlation with social health QoL scores. This is similar to the findings of a study, which reported a relationship between QoL and coping strategies.[41] The study found that adaptive coping strategies were positively associated with psychological QoL, while maladaptive strategies were negatively associated with psychological QoL.

The results showed a significant relationship between perceived academic stress and coping strategies. This finding implies that although academic stress may be common among students, coping strategies are always developed to balance with the demands of academia, such as pressure and expectations from parents and teachers, academic workload and examinations, competitions with peers, financial difficulties, the loss of a loved one, and lack of leisure time. The result is similar to the findings of a study, which also showed significant correlations between perceived stress and coping strategies.[42] However, it contradicts previous studies, which found no significant relationship between perceived academic stress and adaptive-based coping strategies.[43] Coping strategies are not fixed

and can vary among individuals in managing stressors.[44]

This study reported no significant relationship between perceived academic stress and age. This result is supported by the findings of a study, which reported that age does not influence the experience of academic stress among undergraduates.[45] This may be because college students are exposed to the same academic conditions and stress-causing factors. This study also found no significant relationship between coping strategies and age, implying that age has no relationship with coping mechanisms. This study also found no significant relationship between QoL and age, implying that age does not influence coping mechanisms.

This study reported no significant relationship between perceived academic stress and marriage duration and parity. No significant relationship was observed between coping strategies and marriage duration and parity. Moreover, no significant relationship was observed between QoL and marriage duration and parity.

In a study about the impact of having a spouse on academic stress, coping strategies, and quality of life (QoL), researchers found that individuals with spouses had slightly higher mean scores in academic stress, coping strategies, and QoL than those without spouses. This suggests that individuals living with their spouse experience higher academic stress, use more coping strategies, and have better quality of life. The study also revealed a negative relationship between having a spouse and perceived academic stress, coping strategies, and QoL among the participants. It highlighted the need for a balance between marriage responsibilities and student responsibilities.

This study also explored the influence of having a previous degree on the perception of academic stress, coping strategies, and QoL. Individuals with a previous degree showed slightly higher mean scores in academic stress and coping strategies but a lower mean score in QoL than those without a degree. This indicates that individuals with a degree experience higher academic stress, and use more coping strategies, but have lower QoL. The study also found a negative relationship between having a degree and perceived academic stress, coping strategies, and QoL among the participants. These findings align with a study, which reported differences in coping between undergraduate and graduate-entry students, with the latter more likely to use active problem-focused coping strategies.

CONCLUSION

This study underscores the significance of adaptive coping strategies in enhancing QoL among married female clinical students. Interventions to promote adaptive coping strategies could help mitigate stress and improve their overall well-being. Future research should explore longitudinal impacts and include larger, more diverse samples to generalize findings.

Competing interests

The authors declare no competing interests.

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JOURNAL OF BIOMEDICAL INVESTIGATION (JBI) VOLUME 12 NUMBER 2: JULY-AUGUST 2024

CHARACTERIZATION OF ADENOCARCINOMA AND SQUAMOUS CELL CARCINOMA OF THE CERVIX IN NNAMDI AZIKIWE UNIVERSITY TEACHING HOSPITAL, NNEWI NIGERIA.

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Received: 20/7/2024; accepted for publication 31/8/2024

ABSTRACT

Background: Cervical cancer remains a major health concern, particularly in developing countries. Understanding the distinct characteristics and clinical presentations of adenocarcinoma and squamous cell carcinoma is crucial for improving diagnostic and therapeutic strategies, especially in resource-limited settings like Nigeria.

Aim: This study compared the histopathological characteristics of adenocarcinoma (ADC) and squamous cell carcinoma (SCC) of the cervix at Nnamdi Azikiwe University Teaching Hospital, Nnewi, Nigeria.

Methods: A retrospective analysis was conducted on 117 cervical cancer biopsies retrieved for the Histopathology Laboratory of Nnamdi Azikiwe University Teaching Hospital, which included 15 adenocarcinomas (12.82%), 26 squamous cell carcinoma in situ (SCCIS) (22.20%), and 76 invasive squamous cell carcinomas (ISCC) (64.95%). The samples were processed using the conventional Haematoxylin and Eosin staining method. Data on patient age, cancer grade, and tumour cell type were also collected.

Results: The mean ages for ADC, SCCIS, and ISCC were 44.9, 54.3, and 56.5 years, respectively. Among ADC cases, 11 (73.33%) were well-differentiated and 4 (26.67%) moderately differentiated. In SCCIS, 25 (96.20%) were well-differentiated and 1 (3.80%) moderately differentiated, while ISCC had 42 (55.30%) well-differentiated, 27 (35.50%) moderately differentiated, and 7 (9.20%) poorly differentiated tumours. Non-keratinizing squamous cell carcinoma was more prevalent 63 (61.76%) compared to keratinizing types 39 (38.24%).

Conclusion: SCC is more prevalent than ADC among cervical cancer cases, with older age at diagnosis for SCCIS and ISCC. High rates of well-differentiated SCCIS and ADC highlight the importance of early detection, while the presence of poorly differentiated ISCC reflect delayed diagnosis and indicates a need for aggressive treatment. Tailored treatment strategies based on histological subtypes and continuous monitoring are recommended to improve patient outcomes.

Key Words: *Cervical Cancer, Adenocarcinoma, Squamous Cell Carcinoma, Histopathological Characteristics*

INTRODUCTION

Cervical cancer remains a significant public health issue worldwide, particularly in low- and middle-income countries where access to healthcare services is limited. Globally, it is the fourth most common cancer among women, with an estimated 604,000 new cases and 342,000 deaths worldwide[1]. Nigeria faces a significant burden of cervical cancer, with it being the second-most diagnosed cancer in West Africa[2]. In 2020, approximately 12,000 new cases of cervical cancer were reported in Nigeria, with over 8,000 deaths attributed to the disease[3]. The high incidence translates to substantial mortality, with many women diagnosed at advanced stages[4]. Studies suggest over 72% of cases are detected in later stages,

significantly reducing survival rates[5]. This late presentation is linked to limited access to screening programs, leading to missed opportunities for early detection and treatment. Eastern Nigeria, like many regions in the country, faces a high burden of cervical cancer. The region's healthcare infrastructure is often under-resourced, with limited access to cancer screening, diagnostic services, and treatment facilities. Socio-cultural factors, including stigmatization and lack of awareness, contribute to the late presentation and diagnosis of cervical cancer cases. Additionally, economic constraints and inadequate health education further exacerbate the situation, leading to poor outcomes for women diagnosed with cervical cancer[6]. This characterization analysis examines the prevalence, age distribution, histological grades, and tumour cell types of adenocarcinoma and SCC among patients at Nnamdi Azikiwe University Teaching Hospital in Nnewi, Nigeria. By analyzing 117 cervical cancer biopsies, this study aimed to provide insights into the patterns and characteristics of these cancer types within this specific population. The findings are contextualized within the broader literature, highlighting consistencies and discrepancies with global trends and underscoring the importance of localized data in guiding clinical practices and public health policies. By delving into the data from Nnamdi Azikiwe University Teaching Hospital, this discussion sheds light on the epidemiological landscape of cervical cancer in Nigeria, offering a critical foundation for improving patient outcomes through targeted interventions.

MATERIALS AND METHODS

Study design

This was a 5-year retrospective study that comparatively analyzed different tumour types in previously diagnosed samples of formalin fixed, paraffin wax embedded cervical cancer tissue blocks from 2018 to 2022 retrieved from the Histopathology Department of Nnamdi Azikiwe University Teaching Hospital Nnewi. Also retrieved from the available records were patients' biodata. Ethical approval for the study was obtained from the Ethics Committee (NAUTH/CS/66/VOL.16/VER.3/288/2023/074) of the hospital before commencement of the study.

Sample collection

A total of 117 formalin-fixed paraffin embedded cervical specimens were selected from the Hospital archives. Samples were cervical (punch) biopsy, endocervical curettage or hysterectomy specimens. Inadequate tissue sections, and cases with no clinical information in the records or for which the tissue blocks are missing or damaged were excluded from the study. All samples selected were sectioned at 4 microns using a rotary microtome (HM340E ThermoScientific. Massachusetts, United States of America), serial sections were made, floated on warm water bath set at 45^0C unto clean grease free slides.

Haematoxylin and Eosin (H&E) Staining[7]

The sections were stained using H&E staining method and photomicrographs of sections taken using Amscope digital camera eyepiece attached to an Olympus optical microscope.

Data Analysis

Data obtained were analyzed and results presented in tables, and plates.

RESULTS

One hundred and seventeen (117) cervical cancer biopsies were analyzed among which 15 (12.82%) were Adenocarcinoma, 26 (22.20%) Squamous cell carcinoma-in-situ, and 76 (64.95%) were invasive squamous cell carcinoma and according to age groups, the mean age of Adenocarcinoma was 44.9, squamous cell carcinoma-in-situ was 54.3 and invasive squamous cell carcinoma was 56.5 (Table 1). According to cancer grade, 11 (73.33%) adenocarcinoma are well differentiated, and 4 (26.67%) are moderately diffentiated (Plate I), 25 (96.20%) squamous cell carcinoma-in-situ are well differentiated and 1 (3.80%) are moderately diffentiated (Plate II), while 42 (55.30%) Invasive squamous cell carcinoma are well differentiated, 27 (35.5%) moderately differentiated, and 7 (9.2%) are poorly differentiated (Table 2) (Plate III). According to tumour cell type, 39 (38.24%) are keratinizing squamous cell carcinoma, of which 8 (20.51%) were keratinizing squamous cell carcinoma-in-situ (Plate I), and 31 (79.49%) were keratinizing invasive squamous cell carcinoma (Plate II), while 63 (61.76%) are non-keratinizing squamous cell carcinoma of which 18 (28.57%) were non-keratinizing squamous cell carcinoma-in-situ and 45 (71.43%) were non-keratinizing invasive squamous cell carcinoma (Table 3).

Table 1: Descriptive statistics of different cervical cancer diagnosis and age showing mean and standard deviation.

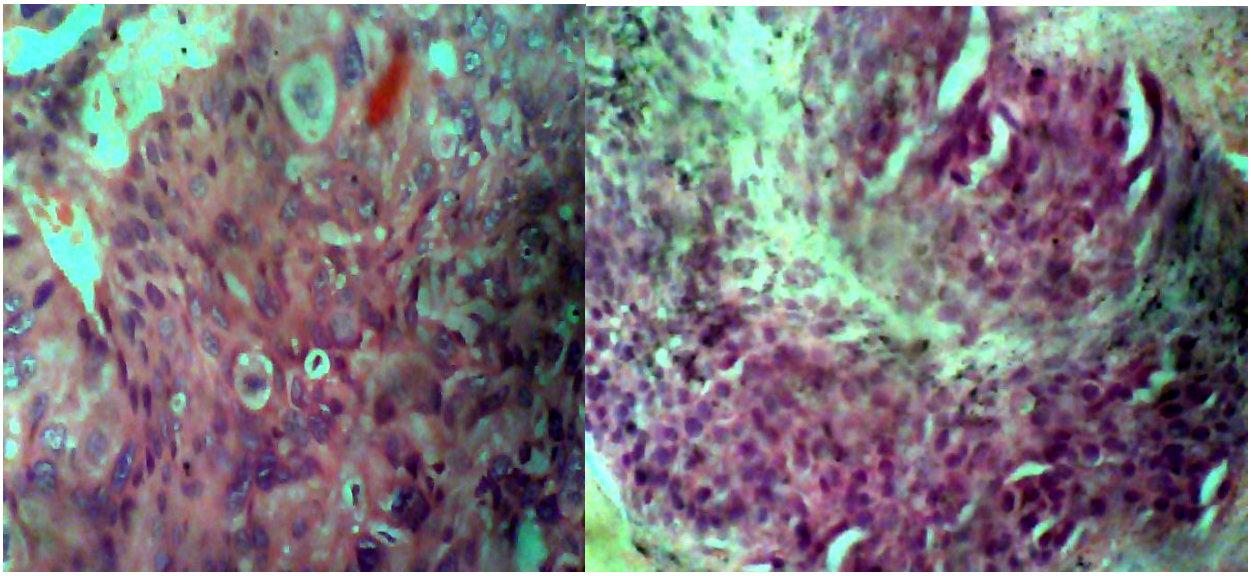
Diagnosis	Frequency	Percentage (%)	Mean ± Standard deviation
Adenocarcinoma	15	12.82	44.93±8.28
Squamous cell carcinoma in-situ	26	22.20	54.26±10.69
Invasive Squamous cell carcinoma	76	64.95	56.48±13.52
Total	117	100.0	

Table 2: Frequency table of different cervical cancer diagnosis and cancer grades.

Diagnosis	Grade	Frequency	Percentage (%)
Adenocarcinoma	Well differentiated	11	73.30
	Moderately differentiated	4	26.70
	Poorly differentiated	0	0.00
Squamous cell carcinoma in-situ	Well differentiated	25	96.20
	Moderately differentiated	1	3.80
	Poorly differentiated	0	0.00
Invasive Squamous cell carcinoma	Well differentiated	42	55.30
	Moderately differentiated	27	35.50
	Poorly differentiated	7	9.20
Total		117	100

Table 3: Frequency table of cervical cancer diagnosis and tumour cell types.

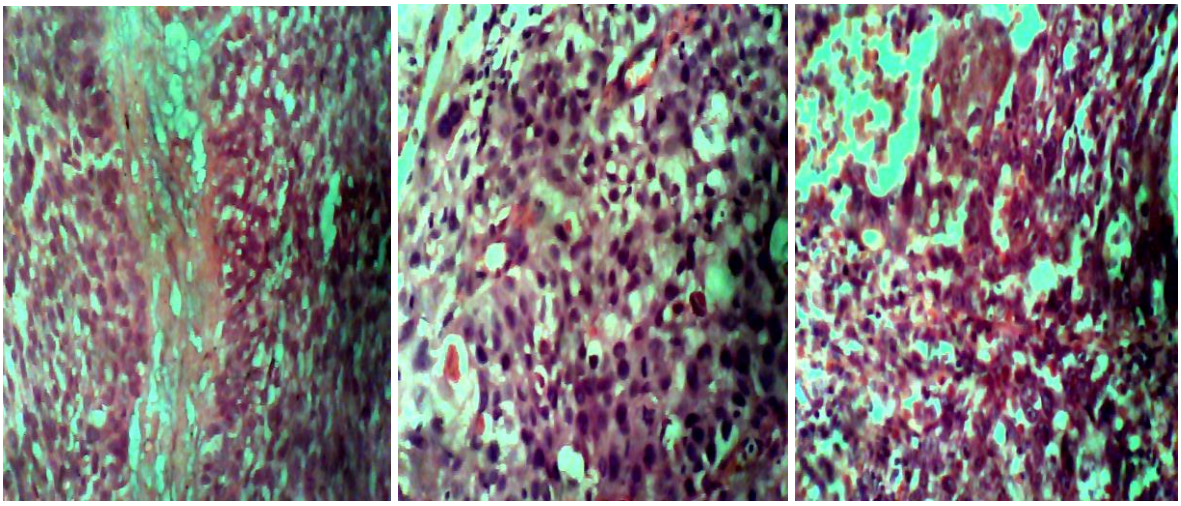
Diagnosis	Cell type		Frequency	Percentage (%)
	Keratinizing	**Non-Keratinizing**		
SCCIS	**8 (20.51%)**	**18 (28.57%)**	**26**	**25.49%**
ISCC	**31 (79.49%)**	**45 (71.43%)**	**76**	**74.51%**
Total	**39 (38.24%)**	**63 (61.76%)**	**102**	**100%**



Well Diff. K. SCCIS H&E x40 Mod. Diff. NK SCCIS H&E x40

Plate 1: Haematoxylin and eosin images of well, and moderately differentiated squamous cell carcinoma-in-situ showing proliferation of squamous epithelium, nuclear crowding, loss of nuclear polarity and significant cytonuclear atypia. Tumours exhibit abundant intercellular bridges, cytoplasmic keratinization, and keratin pearls.

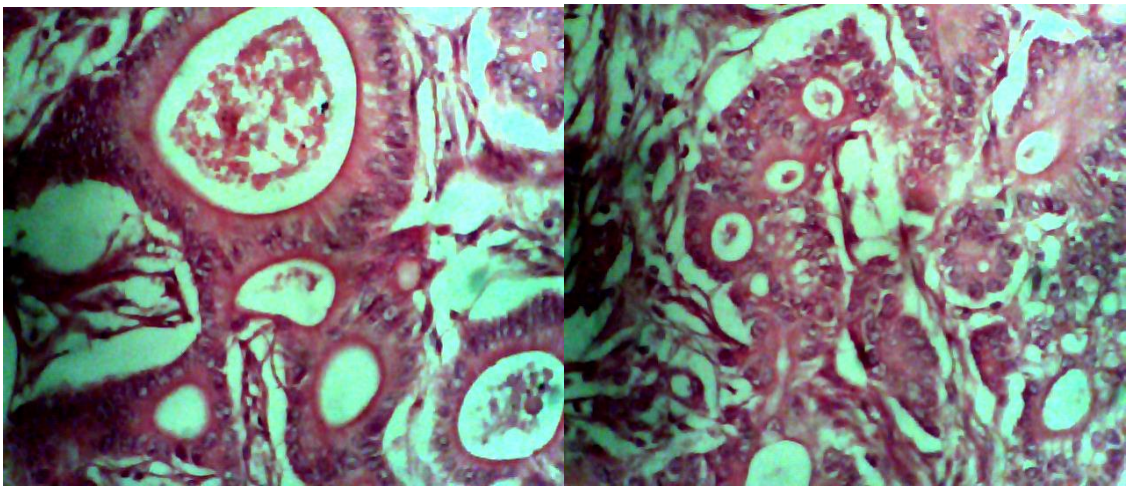
Key:
Well Diff. K. SCCIS = Well Differentiated Keratinizing Squamous Cell Carcinoma – in - situ
Mod. Diff. NK SCCIS = Moderately Differentiated Non-Keratinizing Squamous Cell Carcinoma – in – situ.



Well Diff. NK. ISCC. H&E x40 Mod. Diff. K. ISCC. H&E x40 PD. NK. ISCC. H&E x40

Plate 2: Haematoxylin and eosin images of well, moderately, and poorly differentiated Invasive squamous cell carcinoma showing proliferation of squamous epithelium composed of infiltrating malignant squamous cells with large, hyperchromatic nuclei with some of the tumours exhibiting cytoplasmic keratinization, and keratin pearls.

Key:
Well Diff. NK. ISCC= Well Differentiated Non-keratinizing Invasive Squamous Cell Carcinoma
Mod. Diff. K. ISCC= Moderately Differentiated Keratinizing Invasive Squamous Cell Carcinoma
PD. NK. ISCC. = Poorly Differentiated Non-keratinizing Invasive Squamous Cell Carcinoma



Well Diff. ADC. H and E x40 Mod. Diff. ADC. H and E x40

Plate 3: Haematoxylin and eosin images of well differentiated and moderately differentiated Adenocarcinoma showing proliferation of glandular epithelium composed of malignant endocervical cells with large, hyperchromatic nuclei.
Key:

Well Diff. ADC. = Well Differentiated Adenocarcinoma
H and E= Haematoxylin and Eosin
Mod. Diff. ADC. = Moderately Differentiated Adenocarcinoma

DISCUSSION

The present study revealed that unvasive squamous cell carcinoma (ISCC) is the most prevalent type of cervical cancer, accounting for 64.95% of cases, while Adenocarcinoma (ADC) accounts for 12.82%, and Squamous cell carcinoma-in-situ (SCCIS) represents 22.20%. This pattern align with findings from various global studies. The predominance of Squamous cell carcinoma (SCC) (both in situ and invasive) over adenocarcinoma is consistent with global statistics, which show that SCC accounts for about 70-80% of cervical cancers, while ADC constitutes 10-20% [8,9,10]. The mean age for SCCIS and ISCC patients in this study (54.3 and 56.5 years, respectively) is slightly higher compared to some studies which report mean ages around 45-50 years for SCC[11]. The older age at diagnosis for SCCIS and ISCC might reflect delayed diagnosis or differences in the population's risk profile. The mean age for ADC (44.9 years) is in line with other studies suggesting that ADC tends to occur in younger women compared to SCC[8]. The high percentage of well-differentiated tumours in SCCIS (96.20%) and ADC (73.33%) highlights the importance of early detection and appropriate grading. Well-differentiated tumours generally have a better prognosis[12]. The presence of poorly

differentiated ISCC (9.20%) highlights areas for improvement in early intervention and underscores the need for aggressive treatment strategies and closer monitoring due to their poorer prognosis[13]. The distribution between keratinizing and non-keratinizing types is notable, with non-keratinizing squamous cell carcinomas being more prevalent (61.76%). This distribution is significant as non-keratinizing carcinomas are often associated with a better response to radiotherapy [14].

CONCLUSION

There is need to implement comprehensive screening programs to identify both ADC and SCC early, develop personalized treatment plans based on histological subtype and differentiation grade, establish protocols for managing poorly differentiated ISCC cases, monitor treatment outcomes and conduct further research to optimize management strategies, and increase awareness and education about cervical cancer and the importance of regular screenings. By empowering women and strengthening the healthcare system, Nigeria can move towards a future where cervical cancer is a disease of the past, not a leading cause of death.

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JOURNAL OF BIOMEDICAL INVESTIGATION (JBI) VOLUME 12 NUMBER 2: JULY-AUGUST 2024

RELATIONSHIP BETWEEN HEALTH-RELATED QUALITY OF LIFE AND PHYSICAL ACTIVITY LEVEL OF RETIRED PERSONS IN ONDO, NIGERIA

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Received: 29/7/2024; accepted for publication 31/8/2024

ABSTRACT

Introduction: Despite the advancing age of the individual, physical activity plays a vital role in leading a healthy life as it lowers the risk of cardiovascular disease, metabolic syndrome and improves mental wellbeing.

Aim: This study aimed to examine the relationship between the health-related quality of life and physical activity levels of retired persons in Ondo Town, Nigeria.

Materials and Methods: This cross-sectional study involved 204 retired persons. Health-related quality of life and Physical Activity Level was assessed using SF-12 questionnaire and The International Physical Activity questionnaire (IPAQ)-Short Form. Data was summarized using mean, standard deviation, frequency and percentages. Chi-square and Pearson's correlation coefficient was used. Alpha level was set as $p<0.05$.

Results: Majority of the respondents were within the age group 61 - 70 years (55.4%), male gender (54.4%) and married (73.5%). The mean age, Health-related quality of life (HRQOL) (physical), Health-related quality of life (HRQOL) (mental) and physical activity of the respondents were 69.7 ± 7.23, 399.92 ± 115.8, 254.09 ± 48.62, 4012.7 ± 10985 MET respectively. There was a significant relationship between physical activity level and HRQOL (physical) ($r = 1.00$, $p = 0.010$), also there was significant relationship between physical activity level and HRQOL (mental) ($r = 0.179$, $p = 0.001$).

Conclusion: The findings of this study indicated that a significant proportion of retired individuals residing in Ondo town participated in moderate physical activity. Moreover, the study revealed a positive correlation between the level of physical activity and the health-related quality of life among retired persons in Ondo town.

Keywords: *Health-Related Quality of life, Physical Activity Level, retired Persons*

INTRODUCTION

Physical inactivity ranks fourth among risk factors for death worldwide, behind smoking, high blood pressure, and high blood sugar. Globally, the population of elderly people is increasing, and clinical studies have linked a number of chronic non-communicable disease (CNCD), the most prevalent of which are cardiovascular disease, diabetes, hypertension and obesity, to quality of life[1]. Furthermore, it covers daily family activities such as grocery shopping, household chores, and trash collection. Exercise is a component of physical activity, defined as a section of spare time related to physical activity that is structured, designed, and repeated on a daily or otherwise to improve physical condition and body fitness[2]. The World Health Organization has issued a series of detailed guidelines and recommendations on its appropriateness in all age groups[3]. Despite this, less than one-third of adults (18 years and above) follow these recommendations[4]. Physical inactivity is gradually being identified as a global pandemic[5], as physical inactivity is responsible for 7.2% and 7.6%,

respectively, of deaths from all causes and cardiovascular disease globally[6].

Physical inactivity ranks fourth among risk factors for death worldwide, behind smoking, high blood pressure, and high blood sugar. Due to urbanization and modernization, physical activity levels have been steadily declining in many nations. This loss has significant ramifications for the population's overall health as well as the rising prevalence of noncommunicable diseases[7]. Physical activity is important in leading a healthy life because it lowers the risk of cardiovascular disease, metabolic syndrome, and improves mental wellbeing by reducing anxiety and stress[8]. Active living can help reduce the risk of chronic diseases, improve an individual's overall health and well-being, reduce stress, reduce health-related medical costs, help maintain a healthy weight, assist in proper balance and posture, and help maintain healthy bones and strong muscles. It can also improve sleeping patterns and help prevent risk factors for heart disease like high cholesterol, diabetes, and hypertension[9].

From the perspective of public health, physical activity is crucial for health-related quality of life (HRQoL), which is defined as the personal sense of well-being in the physical, mental, and social domains of life. Health-related quality of life is increasingly being used as a measure of individual physical and mental health over time, including physical, emotional, social, and school functioning[10]. Health-Related Quality Of Life (HRQoL) is a subset of quality of life that is used to assess a person's perception of health. For clinicians, researchers, and patients, this is an important factor in determining the health benefits of various interventions. Physical activity and health-related quality of life research has primarily focused on elderly populations suffering from chronic diseases such as cardiovascular disease, arthritis, and cancer[11, 12], as well as on general adult populations with no health problems[13]. These studies revealed that people who engage in less physical activity have a lower quality of life.

Despite the positive effects of physical activity and the negative effects of physical inactivity, the majority of older adults do not meet the recommended levels of physical activity (150 minutes of moderate-intensity physical activity per week, 75 minutes of vigorous-intensity physical activity per week, or an equivalent combination of moderate-and vigorous-intensity physical activity)[14].

People who are considered to be pensioners are those who entirely quit working and are dependent on lesser pay checks[15]. When they are eligible for private or public pension benefits, many people choose to retire. This may coincide with significant life changes; for example, a retired worker may relocate to a new location, having less frequent contact with their previous social context and adopting a new lifestyle[16]. Pension and gratuity plan for public servants in Nigeria states that public officer on completion of 35 years of unbroken service or 60/65 years of age for public servants and professors respectively whichever comes first, shall receive the maximum pension and gratuity for their respective grades and ranks[17].

Globally, the population of elderly people is increasing, and clinical studies have linked a number of chronic non-communicable disease, the most prevalent of which are cardiovascular disease, diabetes, hypertension and obesity, to quality of life[1] especially in the elderly population. It is estimated that physical inactivity contributes to a significant portion of the burden of major non-communicable diseases. Non-communicable diseases cause 74% of global deaths and have caused significant disabilities, lowering health-related quality of life (HRQoL)[18]. Few studies have shown the relationship between health-related quality of life and physical activity level among retired persons, especially in this environment. Hence, this study determined the relationship between health-related quality of life and physical activity level among retired persons in Ondo town, Ondo state.

MATERIALS AND METHODS:

Inclusion Criteria

The respondents of this study were;

i. Retired persons in Ondo town.
ii. Those who were literate.
iii. Those who were willing to participate in this study

Exclusion Criteria

i. Older adults who were not retired
ii. Retired persons who were too ill.
iii. Retired persons who were mentally unstable.

Research Design

This was a cross sectional study

Sampling Technique

A simple randomized sampling technique was used.

Determination of Sample Size

$N= Z^2 (P)(Q)/D^2$

Where N: the desired sample size

Z: the standard normal deviate usually set at 1.58

P*:* the proportion in the target population, 0.5

Q: 1.0 - P

D: degree of accuracy required, 0.05.

$N = (1.58)^2(0.50)\ (0.50)/\ (0.05)^2$

$N = 250$

Therefore, the sample size [19] for this study = 250

Instruments

A proforma questionnaire was structured to collect information on social demographic variables, SF-12 questionnaire was used to measure quality of life of the retired persons and IPAQ was adopted to measure health-related physical activity behaviours.

Scoring Of IPAQ

Results will be reported in categories; low activity levels, moderate activity levels or high activity levels or as a continuous variable (MET minutes a week). MET minutes represent the amount of energy expended carrying out physical activity. Scoring a high level of physical activity on the IPAQ means your physical activity levels equate to approximately one hour of activity per day or more at least a moderate intensity activity level. A moderate score on the IPAQ indicates that, on most days, you engage in activity that is probably equivalent to 30

minutes of at least moderate intensity physical exercise. A low score on the IPAQ means that you are not meeting any of the criteria for either MODERATE or HIGH levels of physical activity.

Procedure

Ethical approval for this study was obtained from the Ethics and Research Committee of University of Medical Sciences, Ondo Town, Ondo State. Permission to address retired persons at their general meeting was gotten from the head of the pensioners association in Ondo Town, after the nature and purpose of the study had been explained. Respondents were purposely recruited from these meetings following the inclusion criteria. Informed consent in written form was given after the purpose of the study had been explained to the respondents. SF-12 and (IPAQ) international physical activity questionnaire were administered to assess their health- related quality of life and physical activity level. After filling of the questionnaires by respondents, the questionnaires were retrieved and data collected was analyzed.

RESULTS

Majority of the respondents were male (54.4%) and married (73.5%). Majority of the respondents retired between 2001 - 2020 (84.3%) and are within the age group 61 - 70 (55.4%) (Table 1a). Eighty-two percent of the target population were used in this study. The mean age, Health-related quality of life (physical), Health-related quality of life (mental) and physical activity of the respondents were 69.7 ± 7.23, 399.92 ± 115.8, 254.09 ± 48.62, 4012.7 ± 10985 metabolic equivalent of tasks (MET) respectively (Table 1b).

The result in table 2 shows that there is significant difference between the mean physical activity level and Health-related quality of life (HRQOL) (physical) ($t = 4.706$, $p = 0.000$). The result shows that there is significant difference between the mean of physical activity level and Health-related quality of life (HRQOL) (mental) ($t = 4.888$, $p = 0.000$).

Result on table 3 shows that there is no significant association between the age group and physical activity level ($X^2 = 2.520$, $p = 0.641$) (Table 3).

Result on the table 4 shows that there is no significant association between the year of retirement and physical activity level ($X^2 = 6.811$, $p = 0.146$) (Table 4). Table 5 shows that there is significant correlation between physical activity level and HRQOL (physical) ($r = 1.00$, $p = 0.010$), also there is significant relationship between physical activity level and HRQOL (mental) ($r = 0.179$, $p = 0.001$).

Table 1a: Socio-demographic characteristics of the respondents

Variables	Frequency	Percentage (%)
Gender		
Male	111	54.4
Female	93	45.6
Marital status		
Divorced	2	1.0
Married	150	73.5
Single	3	1.5
Widowed	49	24
Year of retirement		
1996 – 2000	14	6.9
2001 – 2020	172	84.3
2021 – 2030	18	8.8
Age group range		
51 – 60	13	64
61 – 70	113	55.4
> 70	78	38.2

Table 1b: Descriptive statistics of the respondents

Variables	X ± S.D
Age	69.7 ± 7.23
HRQol (Physical)	399.92 ± 115.8
HRQol (Mental)	254.09 ± 48.62
IPAQ score	4012.7 ± 10985

Table 2: Comparison of the Mean Health-related quality of life (HRQOL) and mean physical activity level using paired t test

IPAQ	HRQol		
X ± S.D	X ± S.D	T	P
Physical domain			
4012.7 ± 10985.73	399.9 ± 115.8	4.706	0.000
Mental domain			
4012.7 ± 10985. 73	254.09 ± 49.61	4.888	0.000

Table 3: Association between the age group and physical activity level of respondents using Chi square

	Age group				
	51-60	**61-70**	**>71**		
PA level	**N(%)**	**N(%)**	**N(%)**	**X^2**	**p**
High	6 (7.9)	45(59.2)	25(32.9)	2.520	0.641
Moderate	4(4.7)	48(55.8)	34(39.5)		
Low	3 (7.1)	20(47.6)	19(45.2)		

PA level: Physical activity level

Table 4: Association between the retirement year range and physical activity level using Chi square

	Year of retirement range				
PA level	**1980 – 2000**	**2001 -2020**	**2021 -2030**	**X^2**	**p**
High	6 (7.9)	68(89.5)	2(2.6)	6.811	0.146
Moderate	6(7.1)	67(78.8)	12(14.1)		
Low	2(4.8)	36(85.7)	14(9.5)		

Table 5: Relationship between Health-related quality of life (HRQOL) and Physical activity level using Pearson Correlation Coefficient

Physical activity level	**HRQol (Physical domain)**	
	Rho(r)	**p**
	1.00	0.010
	HRQol (Mental domain)	
	0.179	0.001

DISCUSSION

This study was designed to determine the health-related quality of life and level of physical activity among retired persons in Ondo Town and to determine their relationship. In this study, it was observed that a majority of retired individuals engaged in moderate physical activity. This

finding is consistent with another study focusing on the impact of life events on physical activity, which also reported a preference for light and moderate intensity physical activity among retired persons[20]. Being elderly and retired, it is expected that the participants activity level would be limited. Even when they had hitherto been very active, age is a factor in lowering and reducing the intensity of exercise of exercise.

This study did not find a significant relationship between age group and physical activity level among retired individuals. In other words, the age of the retired participants did not appear to influence their level of physical activity. The study found a significant relationship between the domains of health-related quality of life and the level of physical activity among retired individuals. Specifically, the study found a positive and significant correlation between the physical domain of health-related quality of life and the level of physical activity. This suggests that retired individuals who engaged in higher levels of physical activity had better physical health status, indicating a positive impact of physical activity on the physical domain of health-related quality of life. These findings align with another study, which demonstrated a dose-response relationship between total physical activity and improved health-related quality of life (HRQOL) in both middle-aged individuals (below 65 years) and elderly adults (above 65 years)[21].

The study also revealed a significant positive relationship between the mental domain of health-related quality of life and the level of physical activity among retired individuals. This suggests that retired individuals who engaged in higher levels of physical activity had better mental health status, demonstrating a beneficial impact of physical activity on the mental domain of health-related quality of life. These findings align with a separate study where an active group demonstrated higher scores in both physical activity and quality of life measures, while the sedentary group exhibited higher scores in anxiety and depression measures. Also, this study found a correlation between lower levels of physical activity and symptoms of anxiety and depression among elderly individuals living in the community.

CONCLUSION

The outcome of this study shows that there is a positive correlation between health-related quality of life and physical activity level among the retired persons in Ondo town. Thus, indicating the need for raising awareness among retired individuals about the influence of physical activity on their quality of life, in order to encourage their participation in exercise and prevent a decline in their health-related well-being.

Competing Interests

The author(s) declare that they have no competing interests.

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JOURNAL OF BIOMEDICAL INVESTIGATION (JBI) VOLUME 12 NUMBER 2: JULY-AUGUST 2024

RELATIONSHIP BETWEEN PHYSICAL ACTIVITY AND BODY COMPOSITION OF A COHORT OF CLINICAL UNDERGRADUATES OF THE UNIVERSITY OF BENIN

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Received: 09/8/2024; accepted for publication 31/8/2024

ABSTRACT

Background of the study: Physical activity and healthy body composition are crucial for the overall health and well-being of students of healthcare professions, who are being trained as future advocates of healthcare.

Aim: This study investigated the relationship between Physical activity and body composition of final year clinical students of Basic Medical Sciences of the University of Benin, Nigeria.

Methods: This is a cross-sectional study in which 163 participants were recruited using consecutive sampling technique. The participants were drawn from departments in school of basic medical sciences including Physiotherapy, Nursing, and Medical Laboratory Science. The International Physical Activity Questionnaire (IPAQ) was used to assess physical activity levels, which were categorized as low, moderate, or high. Anthropometric measurements of weight, height, waist circumference, and hip circumference were taken to calculate body composition parameters such as Body Mass Index (BMI), Waist to Hip Ratio (WHR), and waist-to-stature ratio (WSR). Data was summarized using descriptive statistics of mean, standard deviation, frequencies, percentages; and analyzed using inferential statistics of Pearson Product Moment Correlation coefficients and chi-square. Level of significance was set at <0.05.

Results: Half (50.3%) of the participants had low physical activity levels, 24.5% had moderate levels, and 25.2% had high levels. Physical Activity levels had a significant negative correlation with BMI ($r=-0.538$, $p<0.001$) and weight ($r=-0.390$, $p<0.001$). A significant negative correlation was also found between physical activity levels and waist circumference ($r=-0.158$, $p=0.04$). However, no significant correlations were found between Physical activity levels and each of age and WHR. No significant (>0.05) gender-based correlation was found between physical activity levels and body composition.

Conclusion: The findings suggest that physical activity is associated with improved body composition, particularly lower BMI, weight, and waist circumference, among final year clinical students of the University of Benin. Promoting physical activity programs and maintaining healthy body composition may be beneficial for this population of future healthcare professionals.

Keywords: *Physical Activity, Body composition, Clinical students, Body Mass Index, Waist circumference.*

INTRODUCTION

A healthy lifestyle has been reported to reduce the risk of developing lifestyle diseases such as diabetes, obesity, and cardiovascular disease.[1-3] The World Health Organization (WHO) has established guidelines for sustaining physical and mental well-being, encompassing general, age, pregnancy, disease, and disability-specific interventions.[4] Generally, the WHO recommends that individuals should engage in 150–300 minutes per week of moderate

exercise or 75–150 minutes per week of vigorous exercise.[4] Physical Activity (PA) is defined as bodily movements produced by skeletal muscles resulting in energy expenditure. Activities such as walking, gardening, jogging, climbing stairs, or playing soccer are regarded as physical activities.[5]

Engaging in PA is linked to a broad range of health benefits, including healthy growth, development of the musculoskeletal and cardiorespiratory systems, maintenance of energy balance, improved well-being, and enhanced strength and flexibility across all age categories.[6] Physical Activity also influences body composition and weight gain.[7] Body composition, a key factor in physical fitness, describes the body's relative amounts of fat and fat-free mass, encompassing muscle, water, and bone.[8]

Body composition plays a significant role in the classification of obesity, nutritional status, exercise-related gains, and overall health. Body Mass Index (BMI) is fundamentally employed as a means of evaluating weight status, despite it not distinguishing between different components of body mass.[9] This limitation is particularly relevant for physically active individuals, who typically have higher body density and fat-free mass than the general population.[10]

In comparison to BMI, waist-to-stature ratio and Waist Circumference (WC) are considered more sensitive and discriminatory as early indicators of health-related concerns.[11]

There is a direct correlation between higher body fat percentage (%BF) and increased risk of metabolic and cardiovascular diseases.[12] Hence, body composition assessment is crucial for monitoring performance and training in the athletic community and assessing the general population's health status. Regular Physical Activity has been shown to enhance body composition and weight control, thereby reducing the prevalence of chronic diseases.[13]

Despite the benefits of PA, 28% of adults globally do not meet the WHO's minimum PA recommendations.[14] Evidence suggests a relationship between PA and %BF, though prior research has shown inconsistent results across different age groups. An inverse relationship between PA and BF% was observed in middle-aged adults due to reduced metabolic rates associated with aging.[15] However, the relationships between PA and %BF have found to be comparable among young adults.[16]

Furthermore, studies on body composition have predominantly considered BMI, often overlooking other significant metrics. The significance of comprehensive body composition metrics early in adulthood has not been fully explored, and existing studies have produced inconsistent results.[16] More studies on body composition variables among young adults would provide data to enhance understanding of the interplay between PA and body composition.

Clinical students are categories of young adults who are being trained as future healthcare advocates. This student population experience high levels of stress due to their busy schedules and heavy workloads, leading to a decline in physical fitness shortly after enrolling in medical college.[17] Given that clinical students are future health promotion advocates and

crucial to the sustainable development of the medical and health fields, their physical fitness warrants attention. Therefore, this study was designed to investigate the relationship between PA and body composition of final-year clinical students of Basic Medical Sciences at the University of Benin.

MATERIALS AND METHOD

This study was a cross-sectional design. Participants were final year clinical students drawn from the departments of Physiotherapy, Nursing, and Medical Laboratory Science in the School of Basic Medical Science of the University of Benin. Inclusion criteria were only apparently healthy male and female students that were not undergoing any medical treatment or diet related to body weight management. Participants with acute or chronic conditions like hypothyroidism, Type II Diabetes and those unwilling to participate were excluded from the study.

Sampling and Study Design:

Participants were recruited using consecutive sampling technique. The sample size was determined using Taro Yamane sample determination formula for a known population given by $n = N/(1+N[e]^2))$[18],

Where: n= minimum sample size required,

N=sample population=274 students from the listed departments,

e = margin of error=0.05.

Thus, $n = 274/(1+274[0.05]^2))$

$=162.61=163$.

Hence, one hundred and sixty-three participants who were readily available and agreed to participate were recruited for this study.

Ethical Considerations:

The ethical approval for this study was sought and obtained from the Ethical and Research Committee of College of Medical Sciences, University of Benin, Edo state. Participants' consents were obtained, privacy was ensured, and they were briefed on the study's purpose before participation.

Procedure for Data Collection

Participants were given consent form and briefed on the research aim before questionnaires were issued to them. Copies of the questionnaires were distributed to the participants who were allowed sufficient time to complete the questionnaires and retrieved before assessing the anthropometric parameters of weight, height, waist and hip circumferences of participants.

The questionnaire distributed to participants was the International Physical Activity questionnaire (IPAQ) which was used to assess participants' levels of PA. The IPAQ is an instrument designed primarily for population surveillance of PA among adults (age 15 and above).[19] Its development commenced in Geneva in the year 1998 and was followed by extensive reliability and validity testing across 12 countries in 2002. The finding suggests that it has acceptable measurement properties for use in many settings and different languages and is suitable for population-based prevalence studies of participation in PA. The IPAQ

used in this study has 7 items providing information on time spent in moderate to vigorous intensity PA and in sedentary activities during the last 7 days. The IPAQ has high reliability[19] of 0.80. The PA level in this study was reported in categories (low activity levels/inactive, moderate activity levels, or high activity level) and as a continuous variable (MET minutes/week) according to the scoring system provided by IPAQ. To get the continuous variable score from the IPAQ (MET minutes/week) we considered walking to be 3.3 METs, moderate PA as 4.0 METs, and vigorous PA to be 8.0 METs. Total MET minutes of PA a week was calculated by adding MET minutes achieved in each category (walking, moderate activity and vigorous activity).

The mechanical weighing scale was used to assess participants' weights to the nearest 0.1Kg. Participants were instructed to stand erect on the weighing scale bare footed with object free light clothing shots. The researcher read the weighing scale and record the values obtained. The height meter was used to measure the height of the participants to the nearest 0.1 metre (m). The participants were instructed to stand erect by the height metre during which the height scores were obtained and recorded. The BMI of the participants were calculated using the formula BMI=weight/height^2 in Kg/m^2.

Waist circumference was measured according to the procedure described by the National Heart, Lung, and Blood Institute of North American Association for the Study of Obesity.[20] To measure the WC, the researcher located the upper hip bone and the top of the right iliac crest of each participant. Thereafter, placed a measuring tape around the abdomen at the level of the iliac crest. The researcher ensured that the tape is snugged, not compressing the skin, and paralleled to the floor before reading the tape measure at the end of the participant normal expiration to the nearest 0.5cm. The obtained values were converted to the nearest 0.5m. Hip Circumference (HC) was measured with a tape measure at the level of the widest circumference of the participants' hip, which is usually the widest level of the iliac crest of the participants. The readings were obtained in the nearest 0.5cm and converted to the nearest 0.5m for recording. The WHR of participants was calculated as WC/HC.

Data Analysis:

Data were summarized using frequencies, percentages, means and standard deviation. Inferential statistics of Pearson Moment correlation coefficient was used to assess the relationships between PA and each of age, weight, BMI, WC and WHR of the participants. Also, Chi-square statistics was used to assess the association between PA and gender. Level of significance was set at $p < 0.05$.

RESULTS

One hundred and sixty-three participants completed this study. 89(54.6%) of the respondents were males and 74(45.4%) were females. 89(54.6%) of the respondents were students of physiotherapy department, 40(24.5%) were nursing students and 34(20.9%) were medical laboratory science students. A significant majority 141(86.5%) of the respondents were Christians, while 22(13.5%) were Muslims. 57(350%) of the

respondents had normal weight, 56(34.4%) were overweight while 38(23.3%) were obese (Table 1). The ages of the respondents ranged from 21 to 30 years with a mean age of 25.50 ± 2.58 years. The weight of the respondents ranged from 40 to 106Kg with a mean weight of 73.53± 13.11 Kg. The height of the respondents ranged from 1.47m to 1.96m with a mean height of 1.68 ±0.11m. The BMI of the respondents ranged from 14.84Kg/m^2 to 36.21Kg/m^2 with an average BMI of 26.04± 4.96 Kg/m^2. The waist circumference of the respondents ranged from 0.63m to 1.04m with a mean of 0.82±0.08m. The hip circumference ranged from 0.73m to 1.50m with a mean of 1.00± 0.14m. The WHR ranged from 0.69m to 0.98m with a mean of 0.83±0.08m (Table 2); 82(50.3%) of the respondents had low PA level, 41(25.2%) had high PA level and 40(24.5%) of the respondents had moderate PA level. The mean IPAQ Score was reported to be 2019.88 ± 2997.63 (Table 3). There was a negative significant relationship (r= -0.538, p=<0.001) between PA and BMI. There was a negative significant relationship (r= -0.390, p=<0.001) between PA and the weight of the respondents. There was a negative significant relationship (r= -0.158, p=0.04) between PA and waist circumference. However, there was no significant relationship (p>0.05) between PA and age. There was also no significant relationship (p>0.05) between PA and waist-hip ratio of the respondents (Table 4).

Also, the study found that there was no significant relationship (X^2=4.821, p=0.09) between the PA level and the gender of the respondents (Table 5)

Table 1: Socio-demographic parameters of the respondents **n=163**

Variable	Category	Frequency	Percentages
Gender	Male	89	54.6
	Female	74	45.4
Departments	MLS	34	20.9
	Nursing	40	24.5
	Physiotherapy	89	54.6
Religion	Christian	141	86.5
	Muslims	22	13.5
	Underweight	12	7.4
BMI			
	Normal weight	57	35.0
	Overweight	56	34.4
	Obese	38	23.3

Keys: MLS=Medical Laboratory Science; BMI= Body mass index

Table 2: Physical characteristics of the respondent

Variable	Minimum	Maximum	Mean ± SD
Age (years)	21	30	25.50 ± 2.58
Weight (Kg)	40	106.	73.53 ± 13.11
Height (m)	1.42	1.96	1.68 ± 0.11
BMI (Kg/m^2)	14.84	36.21	26.04 ± 4.96
Waist circumference (m)	0.63	1.04	0.82 ± 0.08
Hip circumference (m)	0.73	1.50	1.00 ± 0.14
WHR	0.69	0.98	0.83 ± 0.08

Keys: BMI= Body Mass Index; WHR=Waist to Hip Ratio

Table 3: Physical Activity level of the respondents

Variable	Category	Frequency	Percentages
Physical Activity	Low	82	50.3
	Moderate	40	24.5
	High	41	25.2
	Mean ± SD		
IPAQ Score	2019.88 ± 2997.63		

Table 4: Pearson correlation coefficient between Physical Activity and BMI, weight, waist circumference, waist-hip ratio of respondents

	R	P
Physical Activity * BMI	-0.538	<0.001
Physical Activity * weight	-0.390	<0.001
Physical Activity * Age	1	0.173
Physical Activity * WC	-0.158	0.04
Physical Activity * WHR	-0.051	0.518

Keys: BMI=Body mass index, WC=Waist circumference; WHR=Waist to hip ration

Table 5: Chi-square statistics between Physical Activity level and gender

	Male	Female	X^2	P
Low	50	32	4.821	0.09
Moderate	16	24		
High	23	18		

DISCUSSION

It is well recognized that a preventable risk factor for non-communicable diseases like diabetes mellitus, hypertension, and others is physical inactivity. Increased physical fitness, a better capacity for stress management, and stronger self-esteem are all brought about by regular Physical Activity.[21] This study was evaluated the relationship between PA levels and body composition of final year clinical students of Basic Medical Sciences, University of Benin, Nigeria.

The findings of this study of more male medical student than female agrees with the report of a similar study by Yadav et al that there were more male students as compared to s students undergoing medical training.[22] More than half of the respondents of this study had low PA level which is not in tandem with the findings by Yadav et al, although, in both studies, high PA level had the least prevalence among the respondents. However, the finding of high prevalence of low PA in this study is consistent with the finding from a similar study done by Ashok et al which reported high prevalence of students with low PA.[23] On the other hand, this present study is at variance with the findings from a similar study by Nada et al that reported higher prevalence of high PA among medical students in Morrocco.[24] Reduced PA in late teens or early adulthood which are active years of life might induce sedentary behavior in middle age and increase the risk of non-communicable diseases such as Diabetes mellitus, hypertension, coronary heart disease among others. These findings of this study underscore the importance of promoting regular PA among students to manage body weight and reduce central obesity, both of which are critical in preventing non-communicable diseases such as diabetes, hypertension, and coronary heart disease. Given that over half of the respondents had low PA levels, there is a need for interventions aimed at increasing PA among students, such as incorporating more physical activities into their daily routines or academic schedules.

The findings of this study that PA was negatively correlated with BMI implies that an increase in the PA levels resulted in a decrease in the BMI of the respondents and vice versa. This finding is at variance with

the findings of Yadav et al which reported that there was no significant relationship between PA and BMI. Similarly, Goel et al and Preto et al found no association between PA and BMI.[25, 26] The findings of this present study is consistent with the report of You et al that PA and BMI are correlated, although weakly.[8] Also, the finding of this study of negative relationship between PA and the weight of the respondents meant that as PA levels of the respondents increases, weight decreases and vice versa. Also, the same interpretation applies to PA levels and WC of the respondents which were negatively related in this study. This finding is consistent with the reports of Yadav et al that found a negative correlation between PA and WC. These insights of relationship between PA and anthropometric parameters of weight, BMI and WC can inform health promotion strategies targeting these characteristics of respondents to enhance their PA levels and overall health. However, PA levels of respondents were comparable to age and WHR. The finding of no relationship between PA and WHR in this study contrasts with the finding of Yadav et al which reported a negative correlation between PA and WHR. Therefore, respondents age and WHR do not influence their PA level.

In Summary, this study highlights the critical need for comprehensive strategies in medical education to promote PA and healthy body composition. By adopting these recommendations, medical schools can foster healthier lifestyles among students, equipping them to become effective advocates for active living in their professional and personal lives. These changes could lead to significant benefits for both future healthcare professionals and the patients they will serve. Notably, over half of the participants had low PA levels, which is concerning given their impending roles as healthcare providers. To address these issues, the researchers recommend implementing structured PA interventions in medical curricula, incorporating comprehensive body composition assessments into routine health screenings, and providing targeted education on the importance of PA. Additionally, establishing mentorship programs and peer support networks, advocating for institutional policy changes to promote PA, and conducting longitudinal studies to understand long-term impacts are advised. Future studies should explore the underlying factors contributing to the low PA levels observed and evaluate the effectiveness of targeted interventions to increase PA among university students.

CONCLUSION

This study highlights significant correlations between PA levels and BMI, weight, and waist circumference among final year clinical students. However, no significant relationships were found between PA levels and age or WHR. There was no gender-based influence of PA on anthropometric parameters of respondents, suggesting that all students can benefit equally from regular PA.

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JOURNAL OF BIOMEDICAL INVESTIGATION (JBI) VOLUME 12 NUMBER 2: JULY-AUGUST 2024

IMMUNORECEPTOR AND KI-67 CHARACTERIZATION OF BREAST CANCER IN A TERTIARY HEALTHCARE FACILITY IN SOUTH EAST NIGERIA

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Received: 09/8/2024; accepted for publication 31/8/2024

ABSTRACT

Background: Breast cancer is highly complex and heterogeneous with disparities in ethnic and racial histological subtypes and tumour behaviour; is the second most common cancer in the world, and the most common cancer in women. Nigeria maintains the 9th position in breast cancer mortality worldwide.

Aim: The present study assessed the immune receptor and tumour proliferation marker characterization of breast cancers.

Methods: A retrospective cross-sectional study was carried out from 2010 to 2015. Two hundred (200) archived breast cancer tissue samples were retrieved from the histopathology Laboratory of Nnamdi Azikiwe University Teaching Hospital Nnewi. Patients' data were retrieved from the histopathology reports. Tissue blocks were re-embedded in fresh paraffin wax and 4µ thick serial sections were cut and stained accordingly.

Results: Breast tissue samples were the most prevalent sample types (48.9%) while grade 3 tumours were the most pervasive cancer grades; patients' ages at presentation range from 23 to 86 years, with a mean age of 55. Positive immunoreactivity for estrogen receptor (ER), progesterone receptor (PR), human epidermal growth factor receptor 2 (HER2) and proliferation marker (Ki67) were 89.2%, 69.7%, 24.1% and 98.5% respectively, for invasive ductal carcinoma. Her-2 was the least expressed whereas Ki67 was expressed in almost all the cancer types. ER-positive tumours were the most prevalent with ER/PR co-positivity being the second.

Conclusion: The characterization and hormonal expression pattern of breast cancer maintained the same trend. ER-positive tumours were the most prevalent with ER/PR co-positivity being the second. Her-2 was the least expressed whereas Ki67 was expressed in almost all the cancer types.

Keywords: *Breast cancer, immune receptors, invasive ductal carcinoma, Ki67*

INTRODUCTION

Breast cancer was reported as the second most common cancer in the world, and the most common cancer in women, with about 2.3 million new cases reported in 2022[1]. This is higher than the 1.67 million new cases reported in 2012, despite improved awareness, diagnosis and management regimen. In a corroborative report, WHO[2] reported that out of the 2.4 million cases, 670 deaths were recorded. Whereas breast cancer occurs in every country of the world in women at any age after puberty, it is more prevalent in China and USA with 357,161 and 274, 375 new cases respectively recorded in 2022[1]. Also in their breast cancer statistics report of 2024, while India, China, USA led in the mortality burden, Nigeria is in the 9th position of breast cancer mortality worldwide with 16,322 deaths

recorded in 2022. WHO Breast Cancer Factsheet 2024 revealed a diminishing pattern of breast cancer burden by human development. The report estimated that 1in 12 women will be diagnosed with breast cancer with 1 in 71 deaths with High Human Development Index (HDI) whereas with low HDI only 1 in 27 women will be diagnosed while 1 in 48 will die of the cancer.

Being a female is the main risk factor for breast cancer, accounting for about 99% of all cases with 0.5-1% occurring in males[2]. Risk factors like race and ethnicity, overweight and obesity, physical inactivity, alcohol use, and smoking have been reported[3]. Breast cancer risk can also significantly increase for women with first-degree relatives with breast cancer and women with increased breast density. Reproductive risk factors include early age at menarche, nulliparity, late age at first birth, lack of breastfeeding, oral contraceptive use, menopausal status, and menopausal hormone therapy. About half of breast cancer cases develop in women with no identifiable risk factors other than gender and age[2]. The association of mutant genes such as BRAC 1, BRAC 2 and PALB-2 with breast cancer aetiology has been well documented[3,4]. Women who inherit any of these high penetrance gene mutations have high-fold risks of developing breast cancers in their lifetime. According to independent reports, women with inherited BRCA1, BRAC2 and PALB-2 genes have 72%, 69% and 58% risks of developing breast cancer by the age of 80 years respectively[5,6]. Those who are diagnosed early with these genes may consider removing the two breasts and pursuing aggressive preventive chemotherapy.

According to Qi, *et al*[7], breast cancer is a highly complex and heterogeneous disease with disparities in ethnic and racial histological subtypes and tumour behaviour, which must be taken into cognizance for effective and efficient patient management. The treatment algorithms for breast cancer in Nigeria have been based on the luminal classification of cancer, which is based on the expression pattern of Estrogen Receptor (ER), Progesterone Receptor (PR) and human epidermal growth factor receptor-2 (HER-2/neu). These include, in a more practical clinical application; triple positive (ER, PR and Her 2 positive cancer), bi positive (ER/PR positive, ER or PR/Her2 positive), mono positive (either ER, PR or Her 2 is positive) and triple negative (neither ER, PR or Her 2 is positive) breast cancers[8]. This classification has enabled a more personalized and targeted therapeutic management of the breast cancer burden in Nigeria[8]. A much earlier study in 2016 by Ghoncheh *et al*, [9] reported and validated that the adverse effect of the treatment is reduced by using the classification as the basis of treatment. This by implication made the classification either a true prognostic factors, which evaluate disease outcomes such as disease-free or overall survival in the absence of adjuvant therapy, or a predictive factor, which estimates the likelihood of response or lack of response to a specific treatment.

Studies have been done where known and established molecular markers such as ER, PR, p53, and Her-2 were examined along

with clinical stage and pathological grades in breast cancer and the outcome suggested a biologically aggressive form of breast cancer in Nigerian women with the possibility of poor response to both hormonal therapy and chemotherapy[10]. Bi-positive breast cancers (ER/PR positive) have been reported as the most prevalent cancers in our clime, followed closely by triple negative cancers[8]. The levels of estrogen receptor expression in a breast tumour are useful indicators in predicting breast cancer response to endocrine therapy. Approximately 80% of all breast cancers are ER-positive while about 15-20% account for triple-negative cancers[11]. Typically, since the expression of progesterone is highly dependent on estrogen receptor levels, to begin with, it is very uncommon to find a PR-positive tumour which is ER-negative with only 1% of all breast cancers being PR+ER-. Breast cancer tumours with high levels of ER but low levels of PR are more common, and it is generally believed that the response to endocrine therapy in metastatic breast cancers is better where both are in evidence. HER2 is an oncogene which has been identified as a valid indicator of breast cancer prognosis. Over-expression of HER2 tends to lead to a higher rate of breast cancer relapse and shorter overall survival. HER2 amplification and overexpression are found in about 15% of all breast cancers. If identified, women with HER2 breast tumours benefit significantly from anti-HER2 treatments[12].

Molecular characterization of breast cancer using immunohistochemistry has made individual personalized medicine possible, especially for people living in the poor and low-resource world. Most works in Nigeria were done on the predictive therapeutic nature of breast cancer by evaluating Estrogen Receptor, Progesterone Receptor and Human Epidermal Growth Factor Receptor[13,14]. Besides the luminal classification, the Ki67 immunoreactivity pattern of breast cancers is used to assess the degree of invasiveness and to some extent is a measure of disease progression and survival rate during treatment. The treatment of breast cancers is based on the disease subtype, while ER/PR positive breast cancers usually respond well to hormonal therapies like tamoxifen or aromatase inhibitors[2], the more aggressive triple-negative cancers are the most difficult to manage using. Despite the progress in diagnosis and the multidisciplinary approach to the treatment of breast cancer, the incidence continues to increase globally[11]. This calls for continued study on the pattern of presentation and characterization with a view to improved and more targeted therapeutic methods, and predictive and prognostic indicators. This current study, therefore, aimed to characterize breast cancers in a tertiary healthcare facility, correlating the hormonal immunoreactivity pattern with ki67 expression. The overall prevalence and burden of breast cancer will be elucidated.

MATERIALS AND METHOD

Study area/ Study design

A retrospective cross-sectional study was undertaken using archived breast tissue samples collected from a tertiary healthcare institution in South East Nigeria from 2010 to 2015. Ethical approval to conduct this study was granted by the Ethics Committee of Nnamdi Azikiwe University Teaching Hospital (NAUTH) Nnewi (NAUTH/CS/66/VOL9/VER.3/48/2016/69).

Sample collection

Two hundred (200) archived formalin, paraffin wax processed breast cancer tissue samples were retrieved, sorted and selected from the histopathology Laboratory of

Nnamdi Azikiwe University Teaching Hospital (NAUTH) Nnewi. Patients' socio-demographic and clinical data were retrieved from the daily surgical register, patients' folders and histopathology reports of the patients.

Sample preparation

Retrieved tissue blocks were re-embedded in fresh paraffin wax and 4µ thick serial sections were cut with a rotary microtome (HM340E Thermo Scientific. Massachusetts, United States of America). Six (6) cut sections were floated out on a lukewarm Leica water bath, mounted on charged slides, drained, labelled and placed on a hot plate to dry and affix the tissue onto the slides, before staining.

Staining

Cut Sections were stained by the Haematoxylin and Eosin (H&E) method to determine cancer morphological subtype and grade and immunohistochemistry, using monoclonal anti ER, PR, HER2 and ki67 to determine ER, PR, HER2 and ki67status of each sample.

Immunohistochemical Staining (IHC)

IHC staining of test and control slides was carried out using the method described by Dabbs and Thompson[15]. Sample slides were treated in two changes of xylene to remove wax, passed through ascending grades of ethyl alcohol (70%, 90% and absolute) for 60 seconds in each bath and hydrated by immersion in water. Antigen retrieval was performed using the heat method, using a pressure cooker. Tissue sections, on slides, were encircled with solution from a hydrophobic pen and the slides were arranged in a humidity chamber for staining, to prevent drying.

Peroxidase and protein blocking were performed by covering sections with drops of commercially supplied peroxidase and protein block reagents for 10 minutes each and washed in two changes of PBS buffer after each treatment. Subsequently, monoclonal antibodies to ER, PR, HER2 and ki67(1:100 serial dilution) were applied onto sections and were incubated for 1 hour at room temperature. A secondary antibody was afterwards applied and allowed also to incubate for 1 hour. Exposed Mouse and Rabbit Specific horseradish peroxidase/diaminobenzidine (HRP/DAB) detection IHC kit was added and incubated for 15 minutes at room temperature before 4 times in buffer. Detection of immunoreactivity was enabled by the application of DAB/Substrate to the tissue which was incubated for 7 minutes and rinsed 4 times in PBS buffer. IHC-stained slides were counter-stained with haematoxylin. hydrated, cleared and mounted in DPX.

Tumour grading

Tumour grading was done using the Nottingham combined histological grading system (Elston–Ellis modification of the Scarff–Bloom–Richardson grading system)[16]. The tumour grades were determined by assessing three morphological features. These were the amount of tubule formation, the extent of nuclear pleomorphism, and the mitotic activity (count). Each feature was given a score of 1, 2, or 3, and the scores were added to get a combined score. For instance, a combined score of 3–5 points was reported as grade 1, a combined score of 6–7 points was reported as grade 2, whereas a combined score of 8–9 points was recorded as grade 3.

Immunoreactivity Scoring

Modified Allred semi-quantitative scoring method[17] was used to score immunoreactivity of ER, PR and Her2

expression, while ki67 immunoreactivity was scored according to St. Gallen's 2013 recommendation as reported by Abubakar *et al*[18]. The modified Allred score was based on the percentage of cells (area) that stained positively and the intensity of the staining (strong, moderate, weak and negative). A score of 4 was assigned to 67 to 100% of either or both epithelial or stromal cells that stained positive with strong intensity, 3 was assigned to 34 to 66% of epithelial cells and/ stromal cells with strong intensity, 2 was assigned to 11 to 33% of either or both epithelial or stromal cells with strong intensity, 1 was assigned to 5 to 10% of cells that stained positive with strong intensity and 0 was assigned to 0 to 5% of cells that stained positive. Similarly, St. Gallen scoring was carried out by counting at least 100 cells (excluding mitotic cells) and the percentage of stained cells in the nucleus was determined. Hence, Score 4 was assigned to $\geq$ 26% positive staining, 3 was assigned to 19 to 25%, 2, to 10-18 while 0 to 9% immunopositivity was assigned score 1.

Data Analysis

Data obtained were summarized and presented in frequencies and percentages.

RESULTS

A cross-tabulation of the nature of the specimen revealed that breast tissue samples were the highest accounting for 48.9% (85) of the total sample while Fungating tissue breast (1) was the least sample with 0.6% occurrence. Age at presentation ranges from 23 to 86 years, with 55 years as the modal age, while grade 3 tumours made the highest occurrence (Table 1 and 2).

ER, immunoreactivity for invasive ductal carcinoma showed 10.8% negative reaction and 89.2% positive reactivity, PR was 30.3% negative and 69.7% positive while Her-2 and ki67 expressed 75.9% and 1.5% negative reactions and 24.1% and 98.5% positive reactivity respectively. Her-2 negative expression were more prevalent amongst all cancer types whereas Ki-67 was expressed in almost all the cancers. ER-positive tumours were more prevalent with ER/PR positivity trailing behind (Table 3).

Plate 1 is a photomicrograph of H&E-stained breast cancer types: Slides A and B are lobular carcinoma X400 and X100, a special subtype of invasive breast carcinoma characterized by discohesive tumour cells arranged in single files as individual single cells. Slide C shows invasive ductal carcinoma X10, invasion through the basement membrane of a breast duct. D is intraductal carcinoma showing a prominent arborescent, fibrovascular core lined by a double layer of epithelial cells which is at least focally present in all papillomas, with a prominent collagenous or spindle myoepithelial component.

Plate 2 is a photomicrograph of ER-positive stained breast cancer sections: Slide A depicts strong staining for estrogen receptors (ER) in breast cancer tissue in nuclei and cytoplasm ((X400), score 4 as the control); B is score 2 weakly positive staining for ER, C is Score 3 represents moderately positive for estrogen receptors while D is score 4 representing strongly positive immunostaining for estrogen.

Plate 3 is a photomicrograph of PR-positive stained breast cancer sections: Slide A depicts strongly reactive progesterone receptors (PR) breast cancer tissue in nuclei and cytoplasm X40, with score 4 as the control. B=score3 depicts moderately positive for PR, C= Score 2 represents weak staining for Progesterone receptors and D= score 1 represents Negative staining for progesterone receptors respectively.

The plate is a photomicrograph of a breast cancer section with HER-2 positive staining in which, Slide A, B, C, and D are good representative examples of Human epidermal growth factor 2 (HER-2) immunohistochemistry (IHC) in breast cancer, A, and B uniform intense membrane staining of >30% invasive tumour cells represents HER2 IHC positive(3+ve). While C and D show complete membrane staining that is either non-uniform or weak in intensity but with obvious circumferential distribution at least 10% of cells represent HER2 IHC equivocal (2+ve). Less than 10%, weak incomplete membrane staining in any portion of tumour cells, weak, complete membrane staining in less than 10% of tumour cells or no staining observed, where incomplete membrane staining is faint or barely perceptible and within less or equal to 10% of the invasive tumour cells represents HER2 IHC (0-1 -VE) negative respectively.

Plate Shows the breast cancer section with Ki67 positive staining in which Slide A= score 4 depicts three giant oval-shaped (arrow) signifies very active mitotic cells, as control (Lymph node), Slide B shows a breast cancer stained with Ki67 in which less than 18% of the tumour cells were stained (Score 2), Slide C shows a breast cancer stained with Ki67 in which less than 25% of the tumour cells were stained brown (Score 3) and slide D = Score 4 depicts a breast cancer stained with Ki67 in which more than 25% of the tumour cells were stained brown and intense respectively.

Table 1 Cross-tabulation between the nature of the specimen, patient age and morphology grading

Nature of specimen	Tumour Grade	Age (Years)					Total (%)
		20-30 years	31-40 years	41-50 years	51-60 years	61 years & above	(100%)
Breast tissue (85)	Grade 1 tumour (score 3-5)	2 (11.8)	3 (17.6)	6(35.3)	4(23.5)	2 (11.8)	17(20)
	Grade 2 tumour (score 6-7)	5 (16.7)	6 (20.0)	8(26.7)	4(13.3)	7 (23.3)	30(35.3)
	Grade 3 tumour (score 8-9)	4 (10.5)	19(50.0)	8(21.1)	3 (7.9)	4 (10.5)	38 (44.7)
Mastectomy (48)	Grade 1 tumour (score 3-5)	0	0	1(33.3)	2(66.7)	0	3 (6.3)
	Grade 2 tumour (score 6-7)	1 (5.9)	2 (11.8)	4(23.5)	9(52.9)	1 (5.9)	17 (35.4)
	Grade 3 tumour (score 8-9)	0	3 (10.7)	8(28.6)	11(39.3)	6 (21.4)	28 (58.3)
Breast lump (10)	Grade 1 tumour (score 3-5)	0	0	0 (100)	1 (66.7)	0	1 (10.0)
	Grade 2 tumour (score 6-7)	0	1 (33.3)	2(66.7)	0	0	3 (30.0)
	Grade 3 tumour (score 8-9)	1 (16.7)	2 (33.3)	1(16.7)	1 (16.7)	1 (16.7)	6 (60.0)
Lumpectomy (3)	Grade 1 tumour (score 3-5)	0	0	1(50.0)	0	1 (50.0)	2 (66.7)
	Grade 3 tumour (score 8-9)	0	0	1 (100)	0	0	1 (33.3)
Fungating tissue breast (1)	Grade 3 tumour (score 8-9)	0	0	0	1 (100)	0	1 (100)
Breast biopsy (5)	Grade 1 tumour (score 3-5)	0	0	1 (100)	0	0	1 (20)
	Grade 2 tumour (score 6-7)	0	1 (100)	0	0	0	1 (20)
	Grade 3 tumour (score 8-9)	1 (33.3)	0	1(33.3)		1 (33.3)	3 (60)
Bilateral breast tissue (5)	Grade 1 tumour (score 3-5)	0	0	0	0	1 (100)	1 (20)
	Grade 2 tumour (score 6-7)	1 (100)	0	0	0	0	1 (20)
	Grade 3 tumour (score 8-9)	0	2 (66.7)	0	0	1 (33.3)	3 (60)
Breast lymph node (10)	Grade 2 tumour (score 6-7)	0	1 (20.0)	2(40.0)	1 (20.0)	1 (20.0)	5 (50)
	Grade 3 tumour (score 8-9)	0	2 (40.0)	1(20.0)	1 (20.0)	1 (20.0)	5 (50)
Breast-Trucut tissue (7)	Grade 1 tumour (score 3-5)	1 (100)	0	0	0	0	1 (14.3)
	Grade 2 tumour (score 6-7)	2 (50.0)	0	0	1 (25.0)	1 (25.0)	4 (57.1)
	Grade 3 tumour (score 8-9)	0	2 (66.7)	0	2(100.0)		2 (28.6)

Table 2: Distribution of tumour type and grades

Tumour types	Tumour Grades (Frequency (%))

	1	2	3
Invasive ductal carcinoma	18 (69.2)	47 (77.0)	64 (73.6)
Adenoid cystic carcinoma	0	0	1 (1.1)
Intraductal carcinoma	0	0	2 (0.1)
Infiltrating ductal carcinoma	8 (30.8)	12 (19.7)	17 (19.5)
Advanced metaplastic carcinoma	0	1 (1.6)	0
Ductal carcinoma	0	0	2 (2.3)
High-grade invasive ductal	0	1 (1.6)	1 (1.1)
Total	**26 (14.9%)**	**61 (35.1%)**	**87 (50.0%)**

Table 3: Distribution pattern of ER, PR, Her-2 and Ki-67Immunoreactivity amongst cancer types

Marker	Immunoreactivity Score	Breast cancer type						
		IDC	ACC	IC	INC	AMC	DC	HID
ER	Negative (score 1)	14(10.8%)	0	1(50%)	5(13.5%)	1(100%)	1(50%)	0
	Weakly Positive (score 2)	44(34.2%)	0	0	8(21.6%)	0	1(50%)	1(50%)
	Moderately positive score 3)	56(43.4%)	1(100%)	1(50%)	22(59.5%)	0	0	1(50%)
	Strongly positive(score 4)	15(11.6%)	0	0	2(5.4%)	0	0	0
PR	Negative (score 1)	39(30.3%)	0	1(50%)	8(21.6%)	1(100%)	1(50%)	0
	Weakly Positive (score 2)	67(51.9%)	0	1(50%)	20(54.1%)	0	0	2(100%)
	Moderately positive score 3)	19(14.7%)	1(100%)	0	9(24.3%)	0	1(50%)	0
	Strongly positive (score 4)	4(3.1%)	0	0	0	0	0	0
Her-2	Negative (score 1)	98(75.9%)	0	2(100%)	32(86.5%)	1(100%)	2(100%)	2(100%)
	Weakly Positive (score 2)	20(15.5%)	0	0	4(10.8%)	0	0	0
	Moderately positive (score 3)	5(3.9%)	1(100%)	0	1(2.7%)	0	0	0
	Strongly positive (score 4)	6(4.7%)	0	0	0	0	0	0
Ki67	Negative (score 1)	2(1.5%)	0	0	0	0	0	0
	Weakly Positive (score 2)	30(23.3%)	0	0	10(27%)	0	0	0
	Moderately positive (score 3)	50(38.8%)	1(10%)	0	20(54%)	0	1(50%)	1(50%)
	Strongly positive (score 4)	47(36.4%)	0	2(100%)	7(195)	1(100%)	1(50%)	1(50%)

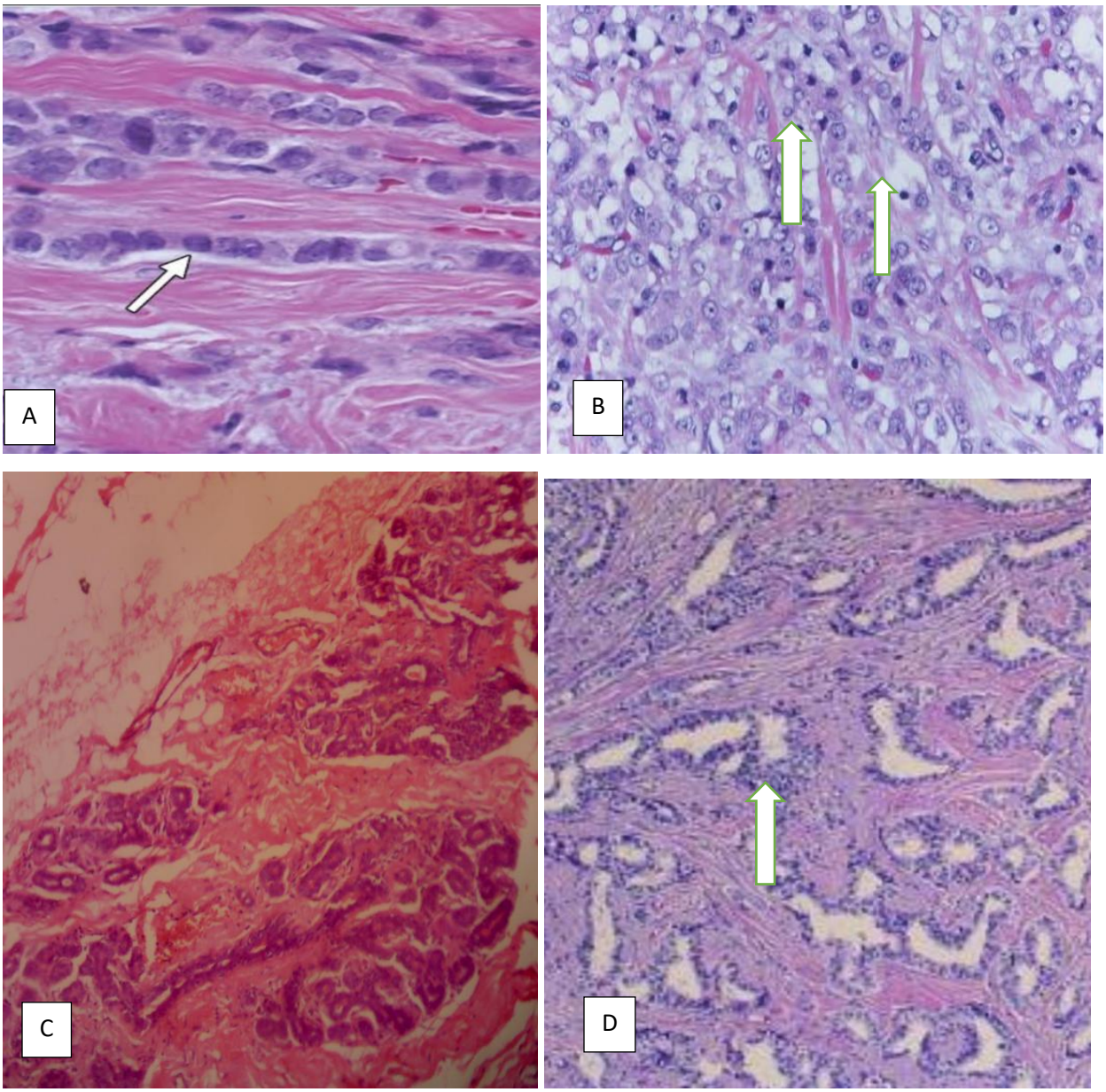

Plate 1: H&E Staining showing different breast cancer; Slide A and B lobular carcinoma X40(arrow) and X10, while Plates C invasive ductal carcinoma X10, Plate D intraductal carcinoma x10(arrow)

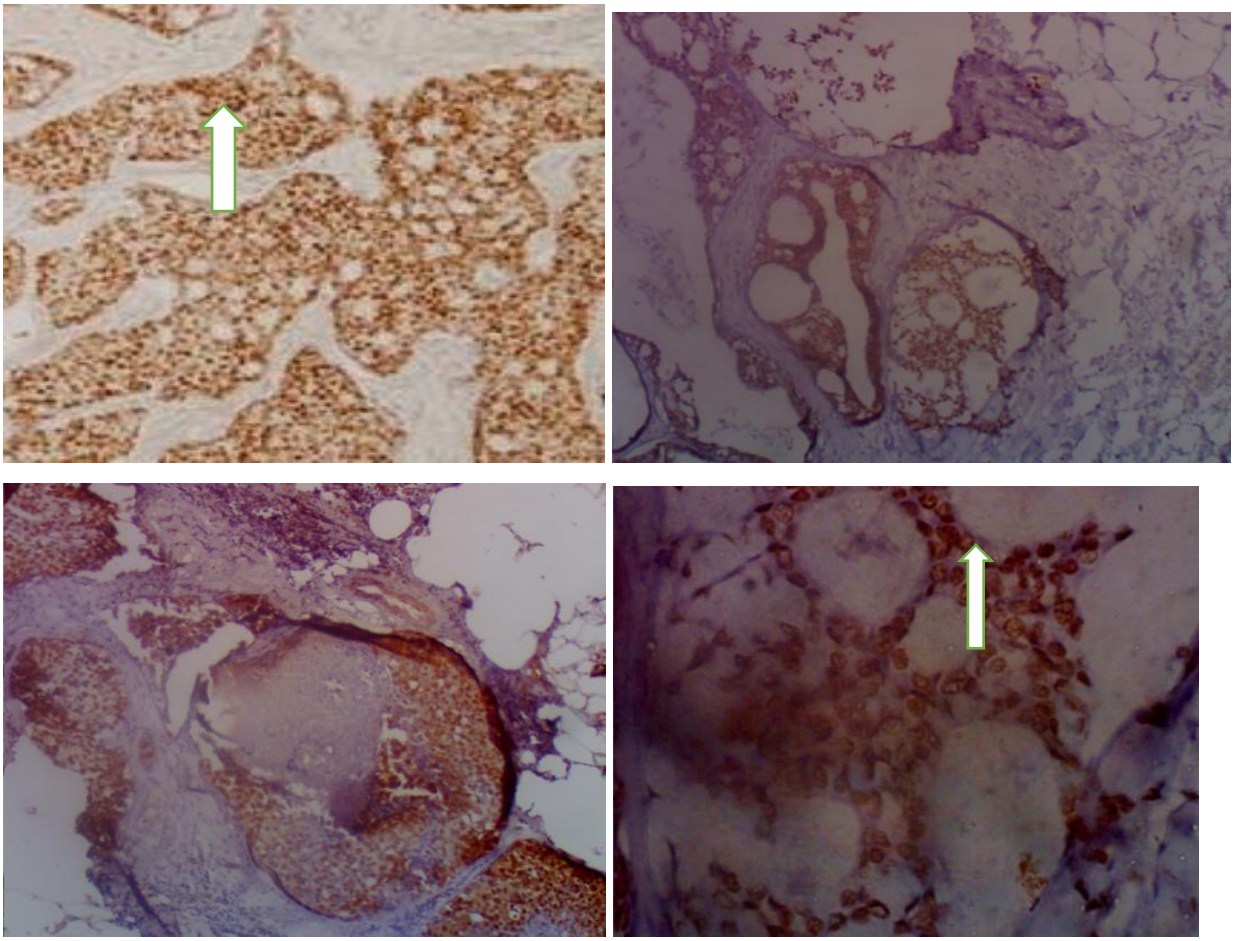

Plate2: .ER +VE staining of breast cancer for score 4 as the control, A, B = Score 1, C= score 2 and D= score 3 respectively.

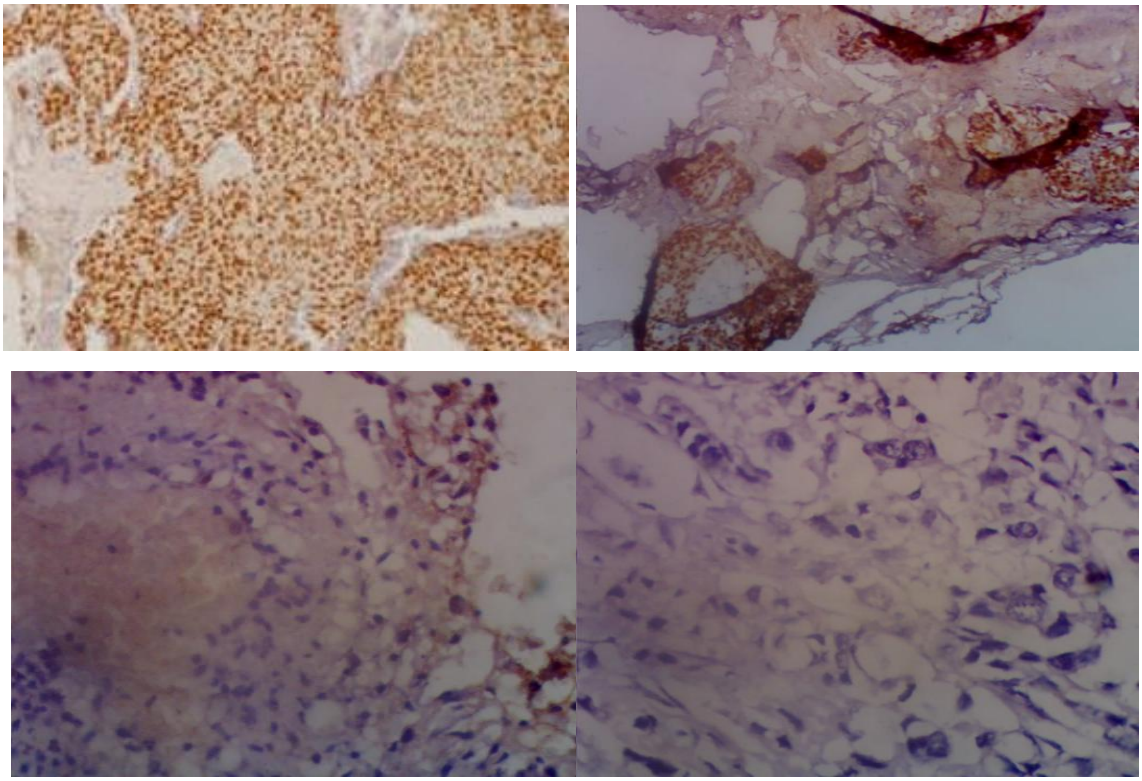

Plate 3: .PR +VE staining of breast cancer for score 4 as control, 2, 1 and 0 respectively.

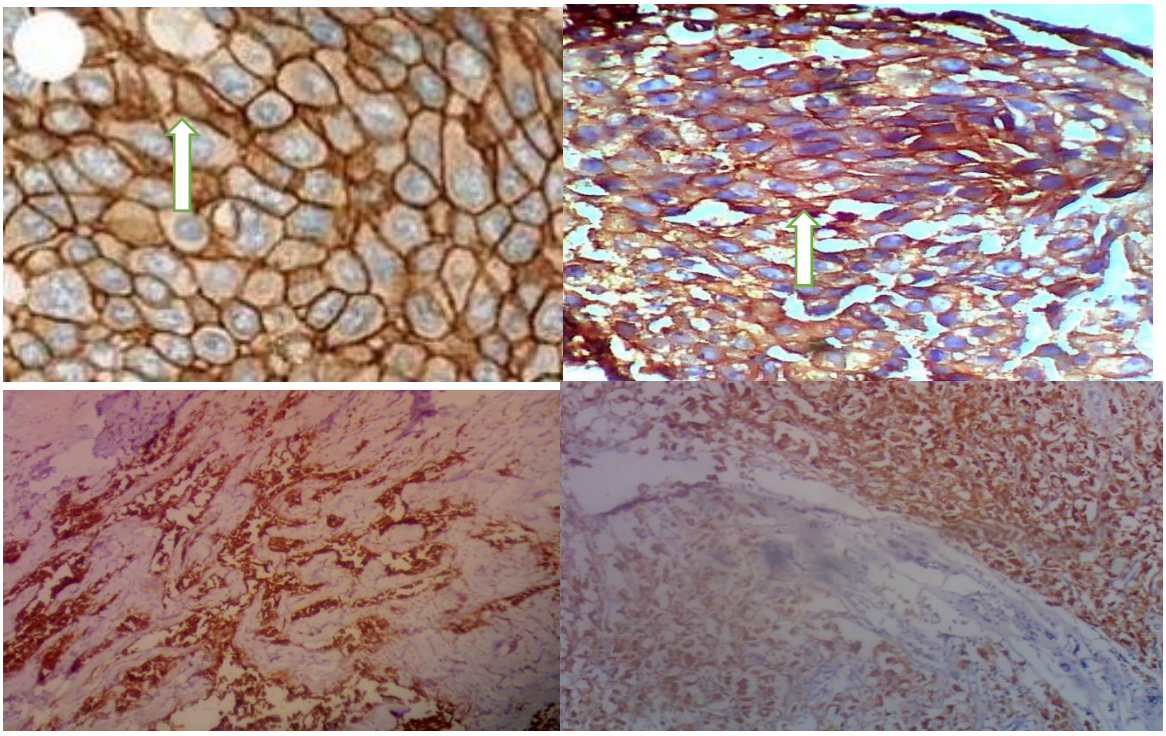

Plate 4: HER-2 +VE staining of breast cancer for score 4 as control, 4, 3 and 2 respectively.

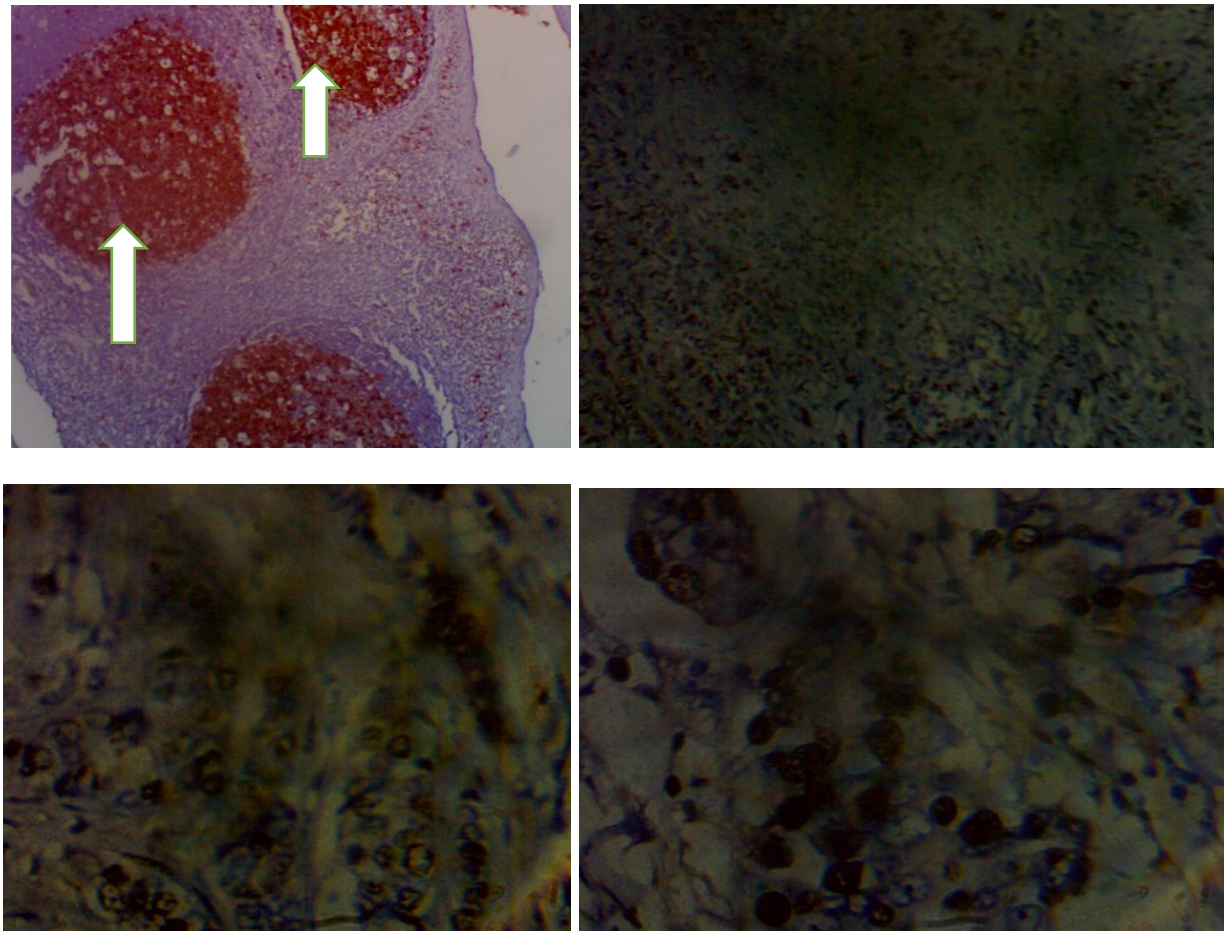

Plate 5: Ki67 +VE staining of breast cancer, Slide A score 4, as control (Lymph node), Slide B = Score 2, Slide C = Score 3 and Slide D = Score 4 respectively.

DISCUSSION

Out of 200 samples examined as histomorphological, 174 were malignant cases while 26 specimens were non-proliferative benign breast lesions. The current study reported that whereas breast tissue samples were the most frequent samples received, fungating breast tissue specimens had the least occurrence., with grade 3 tumours being the most prevalent. Whereas many recent studies seemed not to focus in those directions, it should be noted that much earlier studies by Forae *et al*[19] and Nwafor *et al*[20] corroborated partly with the current report. Most breast cancer patients within this clime visit the hospital only when the lump has been well developed. The presentation time for patients varies from 1week to 3 years. This study agreed

with the much earlier findings of Olajide *et al* [21] (2014) that the high level of breast cancer awareness and breast screening did not translate to early presentation of breast cancer at the clinic in Lagos; all patients on breast screening showed fear of breast loss and death from cancer. In addition, the belief of the patients that the disease is spiritual and amenable to miracle healing resulted in a fate outlook with many patients seeking alternative treatments presenting late at the clinic. This is similar to the belief of patients reported from Cameroun by Suh *et al*[22] with 50% of respondents believing that breast cancer can be cured by spiritual and alternative care.

The nature of the sample at presentation and the high prevalence of high-grade lesions may be predicated on late presentation by most patients when the tumour may have progressed to high grade. This invariable is tantamount to poor prognosis and reduced survival rate. This, therefore, underscores the importance of improved awareness and breast cancer campaigns and the need for renewed preventive strategies. Similarly, invasive ductal carcinoma was reported as the cancer type with the highest occurrence at 74.1%, while adenoid cystic carcinoma and advanced metaplastic carcinoma were the least, each having 0.6% occurrence. This agrees with an earlier reported 66.1-73% in other parts of Nigeria[20].

This study reported 89.2%, 69.3%, 24.1% and 98.5% immunoreactivity for ER, PR, Her-2 and ki-67 respectively in invasive ductal carcinoma. This not only agrees with earlier studies, [8,11] but is in tandem with much earlier reports[23,24]. Other cancer types, which were in the minority, in terms of occurrence, showed varied expression patterns. This has many implications. Whereas the reason for the expression pattern cannot be adduced by this study, this report further revealed that the trend in cancer heterogeneity regarding hormonal involvement has not changed. What seemed to have changed is the incidence and variability in terms of cancer types. Therefore, with improvement in presentation time, and a more strategic targeted therapy, effective management may be achieved. The long and continued practice of using the ki-67 expression pattern to estimate tumour invasiveness, cancer progression and response to treatment is not out of place. However, quantitation and involvement in tumour grading will not only make it more empirical but also a definite prognostic biomarker for breast cancers.

The study reported that the age range for cancer patients ranged from 20 to 86 years. Whereas this agrees with much earlier reports of Titiloye *et al*[13] and Omoniyi *et* al[14] who in their independent studies reported 22-82 years and 23-92 years respectively, it partly deviated from earlier studies, which reported that breast cancer is more prevalent within the third and eighth decades of life. The reported 55 years' mean age of patients is in line with many earlier studies, both in Nigeria and other countries around the globe. Daniyal *et al*[25] reported a mean age of 63 years among Germany; 50.73 years in china; 58.7 years in Finland while Tiltiloye *et al*[13] and Godwin *et al*[22] reported 50.7 years in Ife, south west Nigeria and 45.06 years in Calabar.

CONCLUSION

The distribution and hormonal expression pattern of breast cancer maintained the same trend despite all treatment strategies. Invasive ductal carcinoma and grade 3 lesions are the most prevalent while most cancers express ER, PR and ki-67. The mean age at presentation was 55 years, while the least age was 23 years old. Whereas the prognosis and treatment of breast cancer based on the age of the patient,

histological grade, tumour size, estrogen receptor value [ER], progesterone Receptor value[PR] and human epidermal growth factor receptor 2 [HER2] status should be sustained, campaign for breast cancer screening and prevention should also be intensified. Efforts in the area of personalized and a more targeted therapeutic approach may help in reducing the morbidity and mortality burden of breast cancer in Nigeria.

Competing Interest: The authors wish to declare no competing or conflicting interests.

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JOURNAL OF BIOMEDICAL INVESTIGATION (JBI) VOLUME 12 NUMBER 2: JULY-AUGUST 2024

ACTIVITIES OF FSH RECEPTORS ON THE RESTORATION OF REPRODUCTIVE INDICES IN HYPERPROLACTIN RATS TREATED WITH GREEN COCONUT WATER

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Received: 02/8/2024; accepted for publication 31/8/2024

ABSTRACT

Background of the study: Green coconut water (GCW) exhibits fertility-enhancing properties. This study investigated the role of GCW on follicle stimulating hormone activation in understanding its mode of action.

Aim: We investigated the effect of GCW on the expression of FSH-receptors in the restoration of reproductive indices in hyperprolactin rats.

Material and Methods: Forty adult female Sprague-Dawley rats were randomized into four experimental study groups (A, B, C and D) of 10 rats each. The animals in group A received distilled water only. Group B, the positive control received GCW only, group C is the induction group and the animals received 5 mg/Kg B.W. metoclopramide. Group D is the post-treatment group and animals were treated with GCW following the experimental induction of hyperprolactinemia.

Result: The animals post-treated with GCW showed high expression level of FSH receptors at a molecular weight of 70 kDA that was comparable with the control and GCW-treated groups. However, low expression of the FSH receptors was seen in the induced group at a molecular weight of 10 kDA when compared with the control and GCW-treated groups. Additionally, there were comparable evaluations in the rate of pregnancy and number of fetuses in the animals post-treated with GCW and the control and GCW-treated groups. However the animals in the induced group recorded no pregenacy.

Conclusion: This study's outcome clearly depicts that GCW is an effective potential natural agent in the reversal of infertility caused by hyperprolactinemia through the activation of FSH receptors.

Keywords: Hyperprolactinemia, Female, Infertility, Green Coconut Water, Follicle Stimulating Hormone

INTRODUCTION

Infertility is defined by the failure to achieve successful pregnancy after one year of non-contraceptive, regular, unprotected and active sexual intercourse[1,2]. It is a social and public health issue with significant medical, psychological and economic problems that possess negative impact on overall well-being and productivity[3]. Reproductive process is a neuroendocrine event where hypothalamic release of gonadotropin-releasing hormone (GnRH) into the hypophysial portal blood system targets the anterior pituitary to produce gonadotropins (FSH and LH) which exert their effects on the gonads to stimulate reproductive activities[4]. Apparently, endocrine regulations are critical driver of the hypothalamic pituitary gonadal (HPG) axis, a major signaling pathway that exert modulatory effects on the development of sexual characteristics, follicular development, ovulation, menstruation, pregnancy and overall reproductive functions. All hormones encompassing the endocrine system must be well- regulated

and coordinated, hence any alteration causes hormonal imbalances leading to infertility.

Hyperprolactineamia is a common endocrine cause of infertility. It is a disorder of the HPG-axis indicating persistently high level of prolactin (PRL) in non-pregnant and non-lactating individuals[5]. PRL is a lactating hormone that must be kept under tonic inhibitory control by prolactin-inhibiting factor in the absence of pregnancy and lactation[6]. Thus, high serum level of PRL is seen during lactation to reduce fertility thereby protecting the lactating mother from premature pregnancy. In the absence of lactation, when it becomes persistently high, it inhibits the secretion of GnRH from the hypothalamus, thereby suppressing the release of gonadotropins and its corresponding actions on the gonads causing hyprolactin-induced infertility[7]. The mechanisms that may account for the suppression of gonadal function in hyperprolactinemia include subsequent suppression of the levels of FSH and LH to become inappropriately low and/or inactive at receptor sites inhibiting folliculogenesis and ovulation[8]. Low serum estrogen level is mainly projected in hyperprolactinemia as excess PRL causes reduction in granulosa cell proliferation which will lead to the reduction of granulosa cell estradiol production. The positive estrogen feedback on LH pulsatility and surge needed for ovulation will be disrupted[9].

Green coconut water (GCW) is the liquid endosperm of an immature coconut fruit. It is a natural rich source of minerals and electrolytes that boost energy levels instantly, plays vital role in maintaining proper fluid balance in the body and alleviates some disease conditions[10]. It has been reported that GCW demonstrated estrogen-like property when administered in several groups of postmenopausal rats where estrogen levels at the end of administration were comparable with rats that still had their ovaries[11]. It has been suggested that GCW contains β-sitosterol in addition to other sterols, such as; stigmasterol, fucosterol and α-spinasterol which are plant sterols known to be involved in the synthesis of steroid hormones *invivo*[12]. These may be responsible for the estrogenic effect of GCW by facilitating the synthesis of endogenous estrogens. Previously, GCW has been shown to stimulate folliculogenesis by increasing the number of mature follicles in the ovary with corresponding balance in reproductive hormones[13,14]. It is important to know that hormones exert their effects at receptor sites where their actions are activated, therefore reproductive hormones that are released bind to specific receptors on the target organ to produce signaling effect that results in gene or protein expressions to exert reproductive functions[15]. This implies that hormone levels may be regulated but may not be active at their receptor sites to initiate actions. Therefore, this study investigated the effect of GCW on the actions of FSH receptors in the ovary to provide the understanding on how the established fertility enhancing effects manifest and consequently unraveling the mode of action of GCW particularly targeting hormone receptor sites at the gonadal level in stimulating the process of folliculogenesis.

Materials and Methods

Source of Green coconut fruits

Fresh green coconuts at immature stage of about 6 month old were purchased from Adeojo coconut farm in Badagry, Lagos. The average weight of the fruits was 500 g and authenticated at the Department of Botany, University of Lagos with plant's ascension no LUH: 10127 by Dr George Nodza.

Green coconut water (GCW) extraction, preservation and oral dose estimation

The green coconut fruits were be washed and dehusked. A sterile rod was used to open the germinal pore and through this opening, the water was extracted hygienically from the fruit. The GCW was poured directly into an airtight bottle and preserved in the refrigerator. There was avoidance of metal contact with the coconut water and caution was taken in preventing particles from entering into the water during the process of extraction[16]. The administration of an oral dose level of 5ml/kg of body weight of GCW daily for 21 days based on dosage used in previous studies [17,18].

Animal Handling

Ethical approval was obtained from the Ethics Committee of the College of Medicine, University of Lagos on the Use of Laboratory Animals for experiments with ethical approval number CMUL/ACUREC/01/24/1345. All procedures were carried out following the standard protocols and safety guidelines for Care and Use of laboratory animals for scientific investigations

Experimental design (animal distributions, events and durations)

Forty female Sprague-Dawley rats of weights between 90–160 g were used. The rats were obtained from a breeding stock named Priceless Test Animals in Ilogbo Eremi Oko-Afo, Badagry, Lagos and authenticated by the Department of Zoology of the University of Lagos. The rats were allowed to acclimatized in the animal house of the College of Medicine, University of Lagos for two weeks. The rats were housed in netted iron cages, fed with commercially available rat chow and provided water ad libitum. Standard laboratory conditions of temperature 32^0C and 12hrs light-dark cycle were maintained. Subsequently, the animals were subjected to daily vaginal lavage for cytological depictions of the various stages of estrous cycle to confirm that they have attained reproductive stage with establish estrous cycling. The animals were divided into four study groups (A, B, C and D) of ten animals each. The animals in group A received normal saline for 28 days. Group B is the positive control group and the animals received GCW only for 28days. The animals in group C were treated with 0.5 mL of 5 mg/Kg of metoclopramide hydrochloride to induce hyperprolactinemia while group D, the post- treatment group received 5ml of GCW after induction. The first sub-sets of five animals were sacrificed for evaluating the expression of follicle stimulating hormone receptor (FSHR) following the end of experimental durations while the last sub-set of five were used for fertility assessment.

Study of Oestrous cycle

The phases of oestrous cycle of the experimental animals were established by daily cytological examination method of fresh vaginal smear in the morning between 8:00 and 10:00 am. A small amount (approximately 0.2 ml) of normal saline was drawn up into the suction pipette. The rat was held in place with one hand around its waist with the ventral surface downward to provide additional support and to prevent the animal from struggling whilst the other hand was used to hold the pipette. The tip of the pipette containing normal saline was pushed gently into the entrance of the vagina canal to a depth of 2mm[19]. The fluid was flushed into the vagina and back up into the pipette two or three times by gently squeezing and releasing the bulb of the pipette. The collected smear was dropped onto the surface of the glass slide in three points and over-lied with cover slips to ensure the smear is of uniform alignment, making it easier to focus and prevent smear coalescing. The smeared glass slide was viewed under a light microscope with 40x magnification objective lens by blind reading [20,21].

Microscopic interpretation of collected vagina smear

The estrous cycle of rats lasts an average of four days and was characterized by four phases which are; the estrus, proestrus, diestrus and metestrus. The cells lining the wall of the vagina of the female rat correspond to the levels of circulating hormones and this provides a valuable marker for studying estrous cycle. Therefore, the presence, absence or proportional distribution of cornified cells and leucocytes were used in staging estrous cycle. The first day of the estrous cycle was designated as the metestrus, the presence of leukocytes amidst remnants of large squamous cells in the smear histology was used to stage this phase. The second day showed smear presentation of small nucleated cells and designated as dioestrus phase. The third day showed numerous large nucleated cells and was designated as the proestrus phase. The fourth phase was designated as the estrus phase with histological evaluation of large flakes of squamous cells[21].

Induction of Hyperprolactinemia

Metoclopramide hydrochloride (MCH) was used as the hyperprolactin-inducing agent. MCH was administered at a dose of 0.5 mL of 5 mg/Kg body weight dissolved in distilled water daily for 28days to experimentally induce hyperprolactinaemia[22]. The dose was calculated by simple proportion based on the animal's weights and administered via oral route with the use of an oropharyngeal canula.

Expressions of FSHR in the ovarian tissue

The proteins were first separated using polyacrylamide gel to characterize individual protein in a complex sample. Subsequently, the separated molecules were transferred or blotted onto a second matrix from gel to membrane with the use of porous pads and filter paper to facilitate the transfer. The mixture was heated at 80^{o}C for 5 minutes on a heating block to denature the protein. A 10 ul volume was loaded on 10%

gel and electrophoresed at 80 volts (Stacking) for 1 hour and 120 volts (separating) for 2 hours. One of two gels was stained and the other was used for transfer on the Polyvinylidene fluoride (PVDF) membrane for 1 hour. The membrane was then blocked to prevent any nonspecific binding of antibodies to the surface of the membrane. Blocking buffers were used to block free sites on a membrane to reduce background interference and improving the signal ratio. The transferred protein was then probed with a combination of antibodies specific to the protein of follicle stimulating hormone which acted as the primary antibody. This was followed by 5 washes in TBST, a mixture of tris-buffered saline and Polysorbate 20 and then incubated in secondary antibody (Goat anti-rabbit IgG (H+L)-HRP) for 1 hour at room temperature with moderate shaking. The membrane was kept in a dark container, protected from light. 2ml of TMB (3, 3', 5, 5'-tetramethylbenzidine) a soluble substrate that yields a blue colour was added to the membrane to visualize protein. The chemiluminescent signal was captured as shown in figure 1 below[22]

Fertility assessments

The second sub-set of five animals in each group A to D were caged with age-matched adult male rats of proven fertility (ratio 1 male to 2 female rats) and monitored daily for signs of mating (the presence of mating plug in the vaginal os) and the interval between male presence and observed mating plug. The animals were allowed to carry foetuses to term for the determination of foetal survival rate.

Statistical Analyses: Data on steroidogenic protein expressions was analyzed with One-Way ANOVA and the differences among means was tested with orthogonal contrasts. The evaluations on mating and foetal survival (percentage) rate were compared by Chi-square.

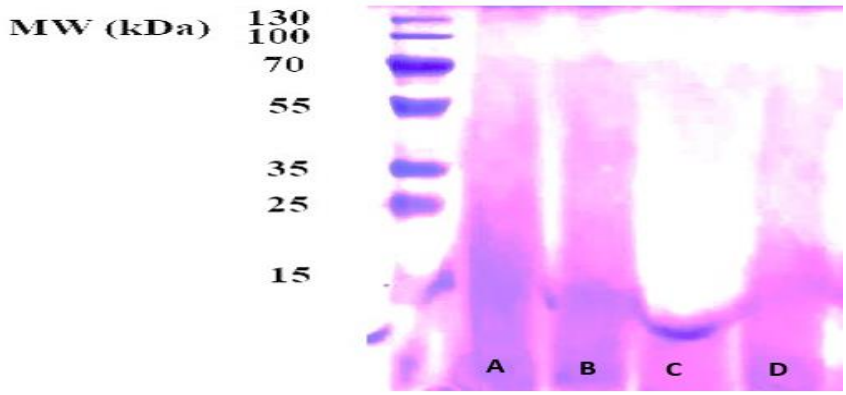

FIGURE 1: **Image showing the expression level of FSH proteins in the experimental and control groups in Sprague-Dawley rats. A: control; B: GCW only; C: induced MCH 5 mg/kg; D: post-treated MCH + GCW**

TABLE 1: The number of pregnancies and foetuses in the experimental and control groups in Sprague-Dawley rats. A: control; B: GCW only; C: induced MCH 5 mg/kg; D: post-treated MCH + GCW

GROUPS	SUB-GROUP DETAIL	NO OF PREGNANT RATS	MEAN NO OF FOETUSES
Control (A)	DSTL	5	9.24±1.31
GCW (B)	GCW	5	10.21±0.85
Induction (C)	MCH	0	0.00±0.00
Post-treated (D)	MCH - GCW	5	8.20±0.04

All values are expressed as mean ± standard deviation *Significant differences; $p < 0.05$

RESULT AND DISCUSSION

The animals post-treated with GCW (group D) upon the induction of hyperprolactinemia have higher band of expression level of FSH proteins with molecular weight of 70kDa when compared with the induced group C with molecular weight of 15kDa. More so, the post-treated group with GCW showed comparable level of expression with the GCW-treated group B and the control group A. Additionally, the induced group C showed the lowest band of expression of FSH proteins with molecular weight of 15kDa. The animals that were post-treated with GCW also have high pregnancy rate and number of foetuses when compared with the hyperprolactin-induced group. The rate of pregnancy and number of foetuses in the post-treated group were comparable with the control and GCW treated groups. Finally, no congenital malformations were observed at the time of birth in both experimental and control groups.

Persistent prolactin level projected in hyperprolactinemia causes dysregulation of GnRH neurons in the hypothalamus leading to decrease pituitary FSH and LH secretions. The alterations of gonadotropins will suppress folliculogenesis and consequent the reduction of ovarian oestrogen below the regulated level due the inhibition of granulosa cell proliferation that is responsible for the production of steroid hormone[24]. However high oestrogen level can exert negative feedback on the HGP-axis disrupting the endocrine system and consequently causing infertility effects [25]. Hence hormones must be tightly regulated to enhance reproductive effects. More importantly, hormones exert their effects at receptor sites where their actions are activated, reproductive hormones that are released bind to specific receptors on the target organ to produce signalling effect that results in the receptor or protein expressions

and consequently exerting reproductive actions[15]. Therefore, the understanding the role of these hormones and their actions at receptor sites are essential for the development of treatment modalities. Phytoestrogen or dietary oestrogens are naturally occurring non-steroid plant compounds that have the ability to cause estrogenic or/and antiestrogenic effects[26]. Plant oestrogen has been used as alternative source of hormone replacement therapy. GCW is a rich source of phytohormones such as; cytokinin, auxin and diphenylurea [27]. The estrogenic effect of GCW has been reported to exert ameliorative action on brain damage that was induced by hormonal imbalances[11]. Additionally, GCW exhibited selective oestrogen moderating effect that was comparable with oestradiol benzoate in reducing skin atrophy and aging[28]. More specifically, the estrogenic property of GCW has been demonstrated as a fertility enhancing agent in our previous studies where it regulated reproductive hormones with consequent positive influence on ovarian follicles[17, 18, 29]. In this present work, evidence of its activities on FSHR unravelled the mechanism of action of GCW exerting its estrogenic effect on ovarian folliculogenesis. The oestrogen property of GCW relaunching the endocrine pathway in hyperprolactin-induced infertility may be attributed to the activation of FSHR in the ovaries to exert the action of FSH in stimulating folliculogenesis. The pregnancy assessment outcome from this study also further collaborates the fertility enhancing effects through pregnancy sustenance to full-term under regulatory hormonal balance.

CONCLUSION

The phytoestrogenic property of GCW exert effects that revitalizes endocrine dysregulation caused by hyperprolactinemia to stimulate folliculogenesis through the activation of FSHR at its action sites. It is important to investigate GCW phytoestrogenic effects on the activities of other reproductive hormones at their receptor sites for the understanding of the comprehensive mechanism of action of GCW needed for its usage to benefit man.

Conflicts of Interest

The Authors declared no conflict of interest

Acknowledgement

We thank Dr Fowora Muinah of molecular lab, Nigerian institute of Medical research (NIMR) Yaba, Lagos for providing technical assistance.

Author Contributions

Bakare AA: Study conception and design, Research execution, Protein expression aspect, Result interpretation, Discussion and Manuscript writing; Osiagwu DD: Protein expression aspect, Result interpretation and Discussion; Elemoso TT: Study design, Research execution and Manuscript writing. All authors read and approved the manuscript

Funding

This research was funded by a grant from Financial, Forensic Studies & Diagnostic Ltd.

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JOURNAL OF BIOMEDICAL INVESTIGATION (JBI) VOLUME 12 NUMBER 2: JULY-AUGUST 2024

THE IMPACT OF ERGONOMICS ON LOWER BACK PAIN AMONG STUDENTS ENGAGED IN PROLONGED SITTING ACTIVITIES IN UNIVERSITY OF NIGERIA ENUGU CAMPUS.

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Received: 09/8/2024; accepted for publication 31/8/2024

ABSTRACT

Background: Prolonged sitting among university students has been associated with musculoskeletal pain, particularly in the lower back. It is essential to understand the connection between study environment, ergonomic practices, and musculoskeletal pain in order to lessen its effect on student well-being.

Aim: This study aimed to assess the prevalence of musculoskeletal pain among undergraduates, explore the association between study environment and pain, and evaluate students' knowledge of ergonomic principles.

Material and Methods: A cross-sectional study design was employed. Data was collected from 100 students at the University of Nigeria, Enugu Campus using structured questionnaires. Statistical analysis, including correlation and hypothesis testing, was conducted to examine relationships between study environment factors and musculoskeletal pain at <0.05 level of significance.

Results: The study revealed a high prevalence of musculoskeletal pain, particularly in the shoulders, upper back, lower back, and knees. Significant correlations were found between pain and factors such as prolonged sitting time, break frequency, and experiencing physical discomfort. However, students exhibited limited knowledge of ergonomic principles.

Conclusion: Prolonged sitting is associated with musculoskeletal pain, particularly in the lower back, among university students. Ergonomic interventions, such as providing ergonomic furniture and promoting breaks, may alleviate pain.

Keywords: *musculoskeletal pain, university students, study environment, ergonomic practices*

INTRODUCTION

Lower back pain (LBP) has become a prominent health issue across all age groups, but its increasing prevalence among young adults and students has drawn attention in recent years. Globally, LBP ranks as the most common musculoskeletal condition and remains the leading cause of disability [1]. The lumbar region, or lower back, comprises a complex structure of bones, muscles, ligaments, and nerves, which provides flexibility and movement for the spine. However, this area is particularly susceptible to discomfort and pain due to various lifestyle and environmental factors, especially in younger populations [2].

In the context of university students, lower back pain can arise from a multitude of factors, such as prolonged sitting, poor ergonomic practices, sedentary behaviors, and academic stress[3]. The rigorous academic demands, long hours spent studying, attending lectures, and irregular sleep patterns often contribute to musculoskeletal pain, particularly in the lower back region [4]. Research has highlighted the high prevalence of LBP among medical students, attributing it to the sedentary lifestyle, high stress levels, and long hours spent in hospital settings during training[5]. There is a higher incidence of LBP among students in advanced semesters, likely due to increased practical activities [5]. Low Back Pain, in turn, impacts their productivity, lecture

attendance, and clinical performance, affecting their academic and professional trajectories [6].

Understanding the complexity of LBP is essential for exploring preventive and management strategies. While various factors such as injury, poor posture, or pre-existing conditions may contribute to LBP, the role of ergonomics is often overlooked [7]. Ergonomics, the scientific study of human interaction with their environment, plays a key role in alleviating musculoskeletal issues. By focusing on optimizing the design of workspaces, tools, and systems, ergonomics seeks to enhance performance while minimizing physical strain [8]. Through better design of study environments, ergonomics can reduce the incidence of musculoskeletal pain and improve overall well-being among students [9]. Given the substantial amount of time university students spend sitting, particularly in non-ergonomic environments, this study aims to investigate the prevalence of musculoskeletal pain, particularly lower back pain, among undergraduates and examine the relationship between their study environment and ergonomic practices[10]. Further, it aims to assess students' knowledge of ergonomics and identify opportunities to promote better ergonomic habits in academic settings [11].

METHODOLOGY

Study Design

This research employed a cross-sectional descriptive survey design.

Ethical Approval

This study's proposal was reviewed and approved by the Health Research Ethics Committee of the Molecular Pathology Institute, Enugu State.

Sample

A total of 386 undergraduate students were selected through convenience sampling from the University of Nigeria, Enugu Campus. The participants were chosen based on the inclusion criteria, which required them to engage in prolonged sitting and have previous experience with low back pain, while excluding those with degenerative, inflammatory musculoskeletal conditions or other medical issues.

Procedure

After obtaining ethical approval, letters were sent to the heads of the university faculties to gain permission for conducting the study. Physical meetings were also held to request assistance in facilitating the study among students. Numbered questionnaires and consent forms were distributed to the selected students with detailed instructions on how to fill them. Online versions of the questionnaires were made available to participants who preferred this method. The researcher distributed the physical copies to participants personally at their respective departments and waited for them to complete the forms. For participants who had difficulty understanding the questionnaire, interviews were conducted to enable their participation. The data collection was completed through both in-person and online responses.

Instruments

The instrument used for data collection was the modified Nordic Musculoskeletal Questionnaire (NMQ). This standardized

tool is used to assess musculoskeletal complaints in various body regions, including the lower back, neck, and shoulders. The NMQ consists of three parts:

Part A collected demographic data on age, gender, weight, and height.

Part B gathered information on participants' study/work patterns, such as study hours and breaks.

Part C assessed musculoskeletal symptoms and the body regions affected. The NMQ has been validated for use in musculoskeletal research and has demonstrated excellent reliability, with a Cronbach's Alpha value above 0.945.

Data Analysis

Data was summarized using descriptive statistics, including frequency distributions, means, and standard deviations. Spearman's Rank Order Correlation analysis was performed to assess the relationships among study environment, ergonomic factors, and musculoskeletal pain. The level of significance was set at $p < 0.05$.

RESULTS

The demographic analysis of the participants indicated that 100 respondents provided valid data, with an average age of 1.69. The gender distribution leaned towards female, while the faculty were primarily represented by Law faculty. Most participants were Christians. Regarding academic levels, the majority of participants were in level 200 (31%), followed by level 400 (28%). Lower levels like 100 and 500 were represented at much smaller percentages, with only 3 participants in level 100.

Pain statistics revealed that common pain sites over the past 12 months included the shoulders, elbows, upper back, lower back, and knees, all of which exhibited higher mean scores and greater variability. Over the past 7 days, pain in the shoulders, upper back, lower back, and knees was also prevalent, indicating consistent discomfort in these regions.

Ergonomics awareness and practices among the participants reflected moderate knowledge of ergonomic principles, with a limited number having received formal education or training. Despite this, interest in learning more about ergonomics was high, as shown by a notable desire to attend workshops or seminars. Use of ergonomic furniture and equipment was relatively low, and only a moderate number of participants reported adjusting their study or workspaces to improve ergonomics.

When analyzing the study environment, participants reported spending an average of 2.16 hours per day sitting while working on academic tasks. Although breaks were taken regularly, many participants still experienced physical discomfort or pain as a result of prolonged sitting. Access to ergonomic tools, such as adjustable chairs and standing desks, was limited. Despite these challenges, participants rated the overall atmosphere and organization of their study space positively.

The correlation analysis showed significant positive correlation between age and musculoskeletal pain in the lower back, hips/thighs, knees, and ankles/feet, but not in the neck, shoulders, elbows, wrists/hands, or upper back. Additionally, correlations between study environment factors and musculoskeletal pain revealed that extended sitting time was significantly correlated with upper back pain, while taking breaks was linked to shoulder pain. A more comfortable

study environment was related to lower occurrences of elbow and upper back pain, but participants who experienced physical discomfort were more likely to report pain in various regions, including the upper back and wrists.

In testing the hypotheses, it was concluded that age was significantly correlated with musculoskeletal pain in the lower back, hips/thighs, knees, and ankles/feet. However, there was no significant relationship between age and neck pain. Similarly, there was an association between study environment and pain in certain areas, such as the shoulder and upper back, particularly when related to break frequency and sitting time, while other areas like the neck, elbows, and wrists did not show significant correlations with environmental factors. These findings emphasize the complex relationship between study habits, ergonomics, and musculoskeletal health.

Table.1 Summary of Participants' demographic

Variables	Mean	Median	SD
Age (in years)	1.6900	2.000	0.58075
Gender	1.4300	1.0000	0.49757
Faculty	2.7600	3.0000	0.98596
Level	3.2800	3.0000	1.18986
Marital status	1.0500	1.0000	0.26112
Religion	1.0200	1.0000	0.20000

Table.2 Summary of participants' level of study

Level of study	Frequency	Percentage (%)
100	3	3.0
200	31	31.0
300	20	20.0
400	28	28.0
500	17	17.0
600	1	1.0

Table. 3 Summary of Pain Statistics Table

Variables	Body region	Mean	Median	SD
Have you at any time during the last 12 months had trouble (such as ache, pain, discomfort, numbness) in:	Neck	1.5100	2.0000	0.50242
	Shoulders	1.9800	2.0000	0.58569
	Elbows	1.9200	2.0000	0.39389
	Wrists/hands	1.8800	2.0000	0.53711
	Upper back	1.6500	2.0000	0.47937
	Lower back	1.6300	2.0000	0.48524
	One or both hips/thighs	1.6800	2.0000	0.46883
	One or both knees	1.7200	2.0000	0.45126
	One or both ankles/feet	1.8200	2.0000	0.38612
Have you had trouble (such as ache, pain, discomfort, numbness) during the last 7 days in:	Neck	1.7000	2.0000	0.46057
	Shoulders	1.7600	2.0000	0.42923
	Elbows	1.8600	2.0000	0.34874
	Wrist/hands	1.8300	2.0000	0.37753
	Upper back	1.7000	2.0000	0.46057
	Lower back	1.7000	2.0000	0.46057
	Hips/thigh	1.8000	2.0000	0.40202
	Knees	1.7800	2.0000	0.41633
	Ankles/foot	1.8800	2.0000	0.32660

Table.4 Summary of Ergonomics Awareness and Practices

Variables	Mean	Median	SD
Are you aware of what ergonomics entails in relation to workplace or study environment design	2.9300	3.0000	1.67124
Have you received any formal education or training on ergonomics practices?	3.7500	5.0000	1.55294
Do you use ergonomic furniture or accessories (e.g., ergonomic chairs, keyboard trays) in your study or work setup?	3.8300	5.0000	1.47062
Have you made any adjustments to your study or work environment based on ergonomic recommendations?	3.6500	4.0000	1.52007
Do you think your educational institute adequately addresses ergonomic awareness and practices?	3.5900	4.0000	1.50484
Would you be interested in attending workshops or seminars on ergonomic practices?	2.3131	2.0000	1.39713
Are you familiar with the potential long-term health consequences of poor ergonomic practices?	3.000	3.0000	1.55050
Have you ever sought advice or assistance from a healthcare professional regarding ergonomic issues?	3.7600	5.0000	1.59621

Table.5 Summary of Study Environment

Variables	Mean	Median	SD
How many hours per day do you typically spend sitting while studying or working on academic task?	2.1600	2.0000	0.81303
How often do you take breaks or move around during your study or work session?	2.3100	2.0000	1.05117
Do you feel that your study environment supports your productivity and comfort during long sitting hours?	2.4800	2.0000	1.30639
Do you often experience physical discomfort or pain (e.g., back pain, neck stiffness) as a result of prolonged sitting?	2.1000	2.0000	1.31426
Do you have access to ergonomic furniture or equipment in your study environment (e.g., adjustable chairs, standing desks)?	3.4500	4.0000	1.54642
Do you engage in any physical or exercises to counteract the effects of prolonged sitting?	2.7100	2.0000	1.56538
What type of desk or work station do you use for studying or working?	2.1200	2.0000	0.87939
How organized is your study space (Messy is from 1, very organized is 5)	3.2500	3.0000	1.19236
On a scale of 1-10 (1=very poor, 10=excellent) rate the overall atmosphere or ambiance of your study space)?	5.5900	6.000	2.37876
on a scale of 1-10 (1=very uncomfortable, 10=very comfortable) How comfortable is your study furniture	5.0700	5.000	2.39636

DISCUSSION

This study explored the impact of ergonomics on low back pain among undergraduate students engaged in prolonged sitting activities at the University of Nigeria, Enugu Campus. The findings highlight the prevalence of musculoskeletal pain in different regions of the body, particularly the lower back, and examine the relationship between students' knowledge of ergonomics and the occurrence of musculoskeletal pain. The analysis of demographic data revealed that most of the participants were females, with the most represented faculties being Law and Health Sciences and Technology. Christianity was the dominant religion, and the majority of the participants were single. These demographic findings provide context for understanding the population studied but do not necessarily have a direct impact on the musculoskeletal outcomes observed in this research.

The results from the pain statistics data showed that students who engaged in prolonged sitting activities reported pain primarily in the shoulders, upper back, lower back, and knees. The high prevalence of lower back pain aligns with previous studies, suggesting that extended periods of sitting can contribute to discomfort and musculoskeletal pain. This finding is consistent with the research conducted by Smith et al.[12], who also observed a high prevalence of lower back pain among students due to prolonged sitting during study sessions. Additionally, a study by Johnson et al.[13] corroborates these findings,

emphasizing that poor ergonomic conditions, such as inadequate seating arrangements, exacerbate pain in the lower back and other body regions.

In terms of the study environment, participants reported spending an average of 2.16 hours per day in study sessions. Despite limited access to ergonomically appropriate furniture and environments, participants still expressed a relatively positive perception of their study conditions. However, the data showed that a significant portion of participants experienced discomfort due to prolonged sitting, suggesting that their positive perception of the environment does not mitigate the physical strain experienced. This is consistent with findings by Lee et al.[14], who also reported that students often perceive their study environments positively despite the presence of musculoskeletal discomfort, indicating a disconnect between subjective perception and objective ergonomic risks.

Regarding the knowledge of ergonomics, the findings revealed that most students had limited formal knowledge of ergonomic principles. While many participants practiced certain ergonomic habits, such as taking breaks during study sessions, these practices were often not based on a solid understanding of ergonomics. This lack of knowledge was reflected in the high prevalence of musculoskeletal pain. Similarly, a study by Brown et al.[15] found that students who lacked formal ergonomic education were more likely to experience musculoskeletal pain, suggesting the need for structured educational programs on ergonomic principles.

The study also tested the hypothesis that age is associated with musculoskeletal pain in various body regions. The findings showed no association between age and neck pain but revealed significant associations between age and pain in the lower back, hips/thighs, knees, and ankles/feet. These results are in line with the work of Zhang et al.[16], who found that older students or individuals tend to experience more pain in the lower extremities, especially in the lower back and knees, likely due to cumulative strain from prolonged sitting over time.

Finally, the study explored the relationship between the study environment and musculoskeletal pain. The findings revealed several significant correlations, such as the association between sitting time and upper back pain, as well as between break frequency and shoulder pain. These results are consistent with the findings of Anderson et al.[17], who demonstrated that the frequency of breaks and the duration of sitting significantly impact the prevalence of musculoskeletal pain in students, particularly in the upper back and shoulder regions. However, further research, as suggested by Taylor et al.[18], is needed to fully understand the complex interplay between ergonomic factors and musculoskeletal outcomes.

This study shows the impact of ergonomics on low back pain and other musculoskeletal issues among undergraduate students. The findings emphasize the importance of improving ergonomic conditions in study environments and increasing students' knowledge of ergonomics to reduce the risk of pain associated with prolonged sitting. The complex relationship between various ergonomic factors and musculoskeletal pain points out the need for a holistic approach to addressing these issues in educational institutions.

CONCLUSION

This study has provided key understanding into the prevalence of musculoskeletal pain,

particularly low back pain, among undergraduate students engaged in prolonged sitting activities. There is no significant relationship between age and the occurrence of low back pain, suggesting that other factors may play a more prominent role in its development. However, a clear association was found between prolonged sitting hours and the incidence of low back pain, highlighting the negative impact of extended sitting without proper ergonomic support or regular breaks.

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FACTORS AFFECTING EXERCISE SELF-EFFICACY AND TEMPTATION TO NOT EXERCISE AMONG COMMUNITY-DWELLING ADULTS WITH HYPERTENSION IN NNEWI NORTH, ANAMBRA, NIGERIA

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Received: 19/7/2024; accepted for publication 31/8/2024

ABSTRACT

Background: Despite the well-documented benefits of Physical Activity (PA) in the control of hypertension (HTN), low levels of PA are still prevalent among adults with HTN.
Aim: This study aimed to determine PA level, self-efficacy, temptation not to engage in PA, and its associated factors among community-dwelling adults living with HTN in Nnewi.
Methods: The Cardiovascular and anthropometric indices of the 199 participants who were recruited consecutively were obtained, while the PA self-efficacy and temptation scales were used to assess self-efficacy and temptation levels. Data obtained was analyzed using statistical package for the social sciences (SPPS) version 24 with alpha set at 0.05.
Result: The results revealed a low self-efficacy for PA and high temptation not to engage. A significant negative correlation was observed between self-efficacy and temptation among the participants ($r=0.336$, $p<0.001$). Stress was the most implicated factor influencing both self-efficacy and temptation. Females reported higher temptation and lower PA self-efficacy (mean rank =110.87, $p=0.006$, 90.19; $p=0.014$ respectively). The study also found a significant influence of occupation on temptation to not exercise, with cooks/chefs reporting the highest mean temptation rank ($p = 0.049$).
Conclusion: There is a low exercise self-efficacy and a high temptation to not exercise among this population which were influenced by several factors such as occupation, educational level, waist hip ratio, blood pressure and Body mass index. Awareness should be targeted at improving these individuals' confidence in performing PA.

Keywords: *Hypertension, Physical activity, self-efficacy, temptation, Community-dwelling adults*

INTRODUCTION

According to recent studies, more than 27.5 million adult population in Nigeria live with HTN. [1] This high prevalence is concerning due to the severe health complications associated with HTN, such as stroke, heart failure, and kidney disease, which contribute significantly to the country's morbidity and mortality rates. The increasing prevalence of HTN in Nigeria can be attributed to a combination of factors including rapid urbanization, sedentary lifestyles, dietary changes, and genetic predispositions. [1,2]

Regular PA is a cornerstone in the management and prevention of HTN as engaging in consistent exercise has been shown to lower blood pressure, enhance cardiovascular health, and reduce the risk of associated complications. [3] PA helps by improving the efficiency of the heart, reducing arterial stiffness, and promoting overall cardiovascular fitness. [4] Despite these well-documented benefits, adherence to PA recommendations remains low among individuals with HTN [5,6] who are supposed to perform 150 to 300 minutes per week of moderate-intensity or 75 to 150 minutes per week of vigorous-intensity aerobic exercise, or an equivalent combination of moderate- and vigorous-intensity aerobic exercise. [7, 8] Various barriers, such as lack of knowledge about the benefits of exercise, physical limitations, time constraints, and socio-economic factors, contribute to the low levels of PA. [9, 10]

Exercise self-efficacy, which is the belief in one's ability to successfully engage in physical activity, plays a critical role in

determining exercise behaviour.[11] Individuals with high exercise self-efficacy are more likely to initiate and maintain regular physical activity. Conversely, the temptation to not exercise, characterized by the inclination to avoid PA due to perceived barriers such as fatigue, lack of motivation, or competing responsibilities, can significantly undermine exercise adherence. [11] Understanding these psychological constructs is essential, as they can either facilitate or hinder the adoption of a physically active lifestyle.

Despite the recognition of the importance of exercise self-efficacy and the temptation to not exercise, there is a significant gap in the research specifically focusing on community-dwelling adults with HTN in Nnewi. Existing studies have predominantly examined these factors in broader or different populations, leaving a gap in the specific context of HTN individuals living in Nigerian communities. [12-14] Adults who have HTN may be facing unique challenges and barriers that may influence their exercise behaviors differently from those in other populations. Therefore, there is a need for research that into the specific factors affecting exercise self-efficacy and temptation to not exercise in this group to develop more effective and culturally relevant interventions. This study aims to address this gap by identifying the key factors influencing exercise self-efficacy and the temptation to not exercise among community-dwelling adults with HTN in Nnewi North, Nigeria.

METHODS

Study design and setting

This study adopted a cross-sectional design to obtain data among adult residents in Nnewi, Nnewi-north, Anambra state. Nnewi is one of the main cities in Anambra State Southeastern part of Nigeria with trading as their major occupation. Nnewi reportedly has a significant prevalence of HTN. [15]

Participant of study

The study population consisted of community dwelling adults living with HTN resident in Nnewi. Adults with a diagnosed HTN, who are taking HTN drugs and without any communication, cognitive or mobility-related disorders were included in this study, while we excluded hospital-bound adults living with HTN, as well as those who reside outside but commute to Nnewi. Adults who met the inclusion criteria for this study were recruited consecutively from the markets, churches, local government offices, as well as other meeting points in the community. Sample was estimated using G-power version 3.1.9.4. A sample size of 191 has 90% power to detect a minimum significant difference at a small effect size of 0.23. Alpha was set at 0.05.

Study Instruments

1. **Exercise Self-efficacy scale:**

The Exercise Self-Efficacy Scale is a self-reported scale that was used to evaluate how confident one can engage in PA when other things get in the way, it uses a five-point Likert-like scale ranging from Not at all confident to Completely Confident.

2. **Temptation to not exercise Scale**

This questionnaire, consisting of seven items, evaluates an individual's inclination to avoid PA across different scenarios, using a scale from 0% (no temptation at all) to 100% (high temptation). [16] Participants indicate their temptation level for each situation, ranging from not tempted at all (0%) to extremely tempted (100%), providing insight into their readiness to engage in physical activity.

1. **Tape Measure:** An inelastic tailor's measuring tape calibrated in centimetres (cm) and inches (inch) was used to measure waist circumferences of the participants.
2. **Automated blood Pressure Monitor:** The automated blood pressure monitors OMRON-Model KD-595 was used for checking the blood pressure of the participants in mmHg.
3. **Stadiometer:** A constructed stadiometer, was used for checking the participant's height in centimetres.

Procedure for Data Collection

All subjects provided written informed consent before participating in this study, which adhered to the Declaration of Helsinki approved by the Nnamdi Azikiwe University Teaching Hospital Research Ethics Committee (NAUTH/CS/66/VOL 16/VER 3/336/2023/082). After obtaining consent, participants' socio-demographic and anthropometric variables (age, gender, educational level, weight, height and waist circumference) were recorded. Waist circumference was measured with the participant standing erect, using the navel as the reference point, and recorded to the nearest 1 cm. Similarly, the hip circumference was measured at the largest circumference around the buttocks. Weight was measured to the nearest 1 kg with minimal clothing, and height was measured to the nearest 1 cm while participants stood erect with their heels on a vertical meter rule. Body mass index (BMI) was calculated by dividing weight in kilograms by height in meters squared.

Participants were given a 5-minute rest interval after the collection of sociodemographic and anthropometric data before measuring blood pressure at least to ensure that stabilized or minimally elevated BP due to the activities of these measurements is obtained. [17] They were comfortably seated on a chair with adequate backrest and armrests, knees flexed at 90 degrees, and arms resting on the armrests, supported by pillows if necessary. Blood pressure was measured on the left arm using an automated BP monitor, with two consecutive readings taken and averaged. The study's questionnaires were interviewer-administered by the researchers and trained assistants, who received thorough supervised training on how to administer the research instrument.

Data analysis

Data was coded in excel and analyzed using descriptive statistical analysis after coded into IBM Statistical Package for Social Sciences (SPSS) version 24. The results were presented with frequency count, range, percentage, mean, and standard deviation (SD). Spearman rank order correlation was used to test for correlation between the variables, Mann-Whitney U test was used to test for the influence of gender on exercise self-efficacy, and temptation to not exercise. Kruskal Wallis test was used to test for the influence of educational level. Alpha was set at 0.05.

RESULTS

Characteristics of the participants

A total of 199 adults living with HTN participated in this study. More than half of the participants (51.3%) were females, and the majority were traders (71.9%). The highest proportion of the study participants (34.7%) reported senior school certificates as their highest level of education, a significant percentage were overweight (36.7%) and 36.7% were obese. Majority of the study participants (69.8%) reported low self-efficacy for engaging in adequate

physical activity, high temptation level (62.3%) and 57.3% reported unhealthy waist-to-hip ratio Table 1. Mean cardiovascular, anthropometric, self-efficacy and temptation scores of the participants

The mean systolic and diastolic blood pressure values of the participants were 142.22±12.44 mmHg and 91.26±12.49 mmHg, respectively. The average waist-to-hip ratio was 0.92±0.09, which falls within the range of abdominal obesity. The mean BMI was 28.98±6.89 kg/m², classifying the participants as overweight. Additionally, the average waist and hip circumferences were 94.65±25.10 cm and 103.23±22.32 cm, respectively. The mean values for the temptation to not exercise scale and the self-efficacy scores of the participants were 55.60±22.30 and 2.56±1.01, respectively. Table 2. Responses of participants to the items on physical activity self-efficacy scale.

Almost half of the participants (49.7%) reported absolute lack of confidence in their resolve to participate in regular PA on a rainy day, over half of the participants (54.8%) had no confidence that they would engage in PA when under a lot of stress. and 40.2% reported no confidence for when they feel they don't have the time. On the other hand, 40.2%revealed that they are completely confident when they have to do PA alone,, one quarter felt somewhat confident in their abilities to engage in adequate PA when they don't have access to a place for PA (25.1%) and when they are spending time with friends (28.6%) **Table 3.**

Participants' Physical Activity Self-Efficacy Level and Temptation to not exercise

The majority of participants (69.8%) reported low self-efficacy for PA (Figure 1), and moderate to high levels of temptation to not exercise (70.9%) (Figure 2). The participants' responses indicated least self-efficacy and worst/highest temptation to not exercise when they were stressed (61.07±30.36).

Associations between Gender and adiposity indices with each of PA self-efficacy, temptation to not exercise.

The females reported higher temptation to not exercise (mean rank =110.87, p=0.006), and lower PA self-efficacy (mean rank = 90.19; p=0.014). Additionally, participants with unhealthy WHR reported higher temptation to not exercise (mean rank=103.97; p=0.005) and lower PA self-efficacy (mean rank = 89.06; p=0.002). However, these scores did not significantly differ across WC categories ($p > 0.05$). **Table 4.**

Correlation between the anthropometric indices, self-efficacy and temptation scores of the participants.

Systolic blood pressure demonstrated a significant positive correlation with temptation (r=0.167, p=0.019) and a significant negative significant relationship with PA self-efficacy (r=-0.197, p=0.005). No significant relationship was observed between systolic BP and BMI (r=0.044, p=0.535), nor between diastolic BP and either temptation or PA self-efficacy scores ($p>0.05$) among these participants. Significant low negative correlation was also observed between temptation to not exercise and PA self-efficacy (r=0.336, $p<0.001$) **Table 5.**

Difference in temptation scale and exercise self-efficacy scores across the different educational qualification categories and occupation of the participants.

There was a significant difference in the temptation to not exercise domain across different educational qualification categories (K=22.431, P=0.004), with participants holding an OND certificate showing the highest score (174.75). Similarly, a significant difference was found in exercise self-efficacy scores among the different educational qualifications (K=17.800, P=0.023), with the highest value among individuals with a Master of Science degree (141.75). Additionally, there was a significant difference in the temptation to not exercise scores across different occupations (K=15.595, p=0.049), with chefs/cooks having the highest temptation (159.50), and followed closely by drivers (135.50). However, exercise self-efficacy scores did not differ significantly across occupation (K=13.225, P=0.104**) Table 6.**

Table 1 Characteristics of the participants

Variable	Class	Frequency	Percentage
Gender	Male	97	48.7
	Female	102	51.3
WC	Healthy WC	85	42.7
	Unhealthy WC	114	57.3
Occupation	None	9	4.5
	Trader	143	71.9
	Technician	4	2.0
	Driver	9	4.5
	Chef/cook	1	.5
	Business man/woman	13	6.5
	Healthcare	3	1.5
	Teaching/lecturing	4	2.0
	Artisan	9	4.5
	Student	2	1.0
	Civil servant	2	1.0
Highest educational qualification	No formal education	4	2.0
	primary	17	8.5
	JSSCE	52	26.1
	SSCE	69	34.7
	HND	4	2.0
	Degree	44	22.1
	OND	4	2.0
	MSC	2	1.0
	PHD	1	.5
BMI Category	Underweight	8	4.0
	Healthy BMI	44	22.1
	Overweight	73	36.7
	Obesity	73	36.7
PA confidence level	Not so confident	139	69.8
	Confident	60	30.2
Temptation level	Low temptation	75	37.7
	Moderate temptation	66	33.2
	High temptation	58	29.1
WHR	Unhealthy WHR	85	42.7
	Unhealthy WHR	114	57.3

Key:

WC	Waist circumference
WHR	Waist hip ratio
JSSCE	Junior Secondary school certificate
SSCE	Senior school certificate
HND	Higher National Diploma
OND	Ordinary National Diploma
MSC	Master's degree
PHD	Doctor of Philosophy
BMI	Body Mass Index

Table 2 Mean cardiovascular, anthropometric, self-efficacy and temptation scores of the participants

Variable	Minimum	Maximum	Mean	Standard Deviation	Median (IQR)
Systolic BP	100	185	142.22	12.443	
Diastolic BP	60	140	91.26	12.493	
Waist Circumference (cm)	31.00	312.42	94.6487	25.09746	
Hip Circumference	34.00	246.38	103.2268	23.31706	
Waist hip ratio	0.68	1.32	0.9177	.09455	
BMI	16.98	62.28	28.9769	6.89345	
How tempted are you not to exercise when?					
You are angry	0	100	55.83	31.035	
You feel satisfied	0	100.0	41.390	33.4294	
You are stressed	0	100	61.07	30.259	
You feel that you don't have the time	0	100	56.46	29.544	
Family events or situations interfere	0	100	56.27	29.324	
You're busy	0	100	59.14	30.488	
You have work to do	0	100	58.74	29.788	
Mean Temptation	4.71	100.00	55.5977	22.30441	
Mean Self-efficacy	1.00	5.00	2.5620	1.01424	

Keywords:
WC **Waist circumference**
BMI **Body Mass Index**
BP **Blood Pressure**

Table 3 Responses of participants to the items on physical activity self-efficacy scale.

Item	Not at all confident	Somewhat Confident	Moderately Confident	Very Confident	Completely Confident
I am confident I can participate in regular physical activity when; It is raining or snowing or icy	99(49.7)	27(13.6)	24(12.1)	15(7.5)	34(17.1)
I am confident I can participate in regular physical activity when; I am under a lot of stress	109(54.8)	31(15.6)	28(14.1)	17(8.5)	14(7.0)
I am confident I can participate in regular physical activity when; I feel I don't have the time	85(42.7)	50(25.1)	33(16.6)	16(8.0)	15(7.5)
I am confident I can participate in regular physical activity when; I have to do physical activity alone	19(9.5)	34(17.1)	33(16.6)	33(16.6)	80(40.2)
I am confident I can participate in regular physical activity when; I don't have access to a place for physical activity	48 (24.1)	50(25.1)	45(22.6)	33(16.6)	23(11.6)
I am confident I can participate in regular physical activity when; I am spending time with friends.	42(21.1)	57(28.6)	43(21.6)	30(15.1)	27(13.6)

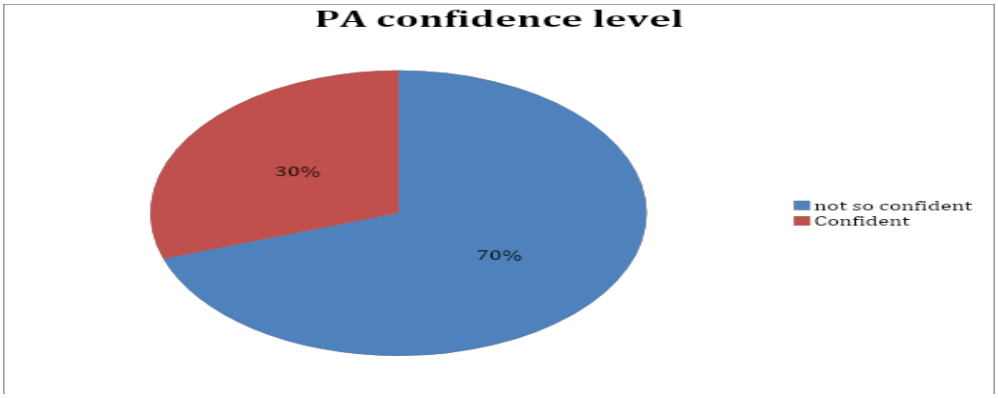

Figure 1 Physical Activity Self-efficacy/Confidence level

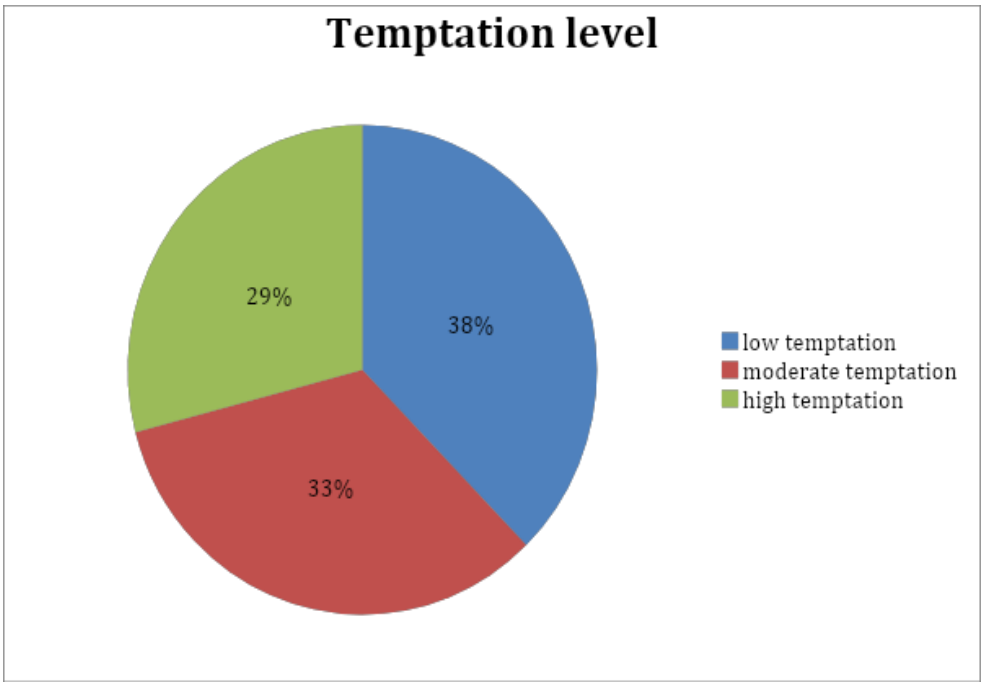

Figure 2 Level of Temptation to not exercise

Table 4 Associations between Gender and adiposity indices with each of PA self-efficacy, temptation to not exercise.

Variable	Mean	Rank	U	P
	Male	**Female**		
Temptation	88.57	110.87	3838.500	0.006
PA Self-efficacy	110.32	90.19	3946.000	0.014
	WC	**Status**		
	Healthy WC	**Unhealthy WC**		
Temptation	94.67	103.97	4392.000	0.260
PA Self-efficacy	104.45	96.68	4466.500	0.345
	WHR	**Status**		
	Healthy WHR	**Unhealthy WHR**		
Temptation	86.59	110.00	3705.500	0.005
PA Self-efficacy	114.68	89.06	3597.500	0.002

Keywords:

WC Waist circumference

WHR Waist hip ratio

PA Physical Activity

Table 5 Spearman rank order test of correlation among anthropometric indices, self-efficacy and temptation scores.

	Diastolic BP	Waist Circumference	Hip Circumference	WHR	BMI	mean temptation	mean_self_efficacy
Systolic BP (mmHg)	r=0.509**	r=0.089	r=-0.023	r=0.222**	r=0.044	r=0.167*	r=-0.197**
	p<0.001	p=0.210	p=0.749	p=0.002	p=0.535	p=0.019	p=0.005
Diastolic BP (mmHg)		r=0.094	r=0.083	r=0.063	r=0.126	r=0.070	r=-0.052
		p=0.184	p=0.245	p=0.377	p=0.077	p=0.327	p=0.467
Waist Circumference (cm)			r=0.775**	r=0.472**	r=0.580**	r=0.081	r=0.038
			p<0.001	p<0.001	p<0.001	p=0.255	p=0.594
5. Hip Circumference (cm)				r=-0.092	r=0.565**	r=0.021	r=0.072
				p=0.198	p<0.001	p=0.767	p=0.310
WHR					r=0.162*	r=0.079	r=-0.124
					p=0.023	p=0.265	p=0.081
BMI						r=0.024	r=0.128
						p=0.737	p=0.072
Mean Temptation %							r=-0.336**
							p<0.001

Table 6: Kruskal Wallis test of Educational Qualification on PA self-efficacy and temptation scale scores

Variable	Class	Mean rank	K	U
Temptation	None	91.00	22.431	0.004
	Primary	123.85		
	JSSCE	91.85		
	SSCE	106.24		
	HND	102.75		
	Degree	75.47		
	OND	174.75		
	MSC	80.75		
	PHD	20.00		
PA Self-efficacy	None	93.00	17.800	.023
	Primary	75.94		
	JSSCE	110.54		
	SSCE	85.90		
	HND	122.75		
	Degree	110.74		
	OND	38.75		
	MSC	141.75		
	PHD	54.00		
Mean temptation	Trader	92.88	15.595	0.049
	Technician	32.13		
	Civil servant	67.50		
	Driver	135.50		
	Chef/cook	159.50		
	Business man/woman	86.96		
	Healthcare	102.50		
	Teaching/lecturing	60.25		
	Artisan	115.78		
PA Self-efficacy	Trader	94.67	13.225	0.104
	Technician	104.00		
	Civil servant	166.50		
	Driver	68.33		
	Chef/cook	53.50		
	Business man/woman	111.62		
	Healthcare	153.50		
	Teaching/lecturing	51.25		
	Artisan	74.72		

DISCUSSION

Exercise remains one of the most advocated means of prevention and management of HTN, and over time, the barriers to exercise appear to be mediated by different contextual factors, which includes lack of motivation for behavior change. Self-efficacy for behavioral change as well as ability to overcome temptation are important factors in inculcating and maintaining a healthy behavioral change.

Sex disparities in the prevalence of HTN have been a subject of considerable discussion among researchers. Studies indicate that more men than women have HTN until the age of 45. Between the ages of 45 and 64, the percentages of men and women with HTN are similar, and beyond 64, a higher percentage of women have high blood pressure. Projections suggest that in the near future, more women than men will have HTN. [18,19] Our study found an almost equal gender distribution of HTN, with a slightly higher prevalence among women than men. This is consistent with the findings of Ramirez and Sullivan [21] and Song et al [20] but contradicting those of Everett and Zajacova. [22]

The mean values of the systolic and diastolic BP of the participants suggested poor control of HTN among these known HTN patients. This could be as a result of poor follow up and return for routine checks after diagnosis. In Nigeria, antihypertensive medications are sold over the counter and so this may have inadvertently encouraged self-medication and reduced hospital visits for routine check-ups among persons with HTN . While this practice makes drugs readily available and accessible, it can also significantly negatively affect the control of HTN among patients, thereby predisposing them to higher risks of strokes and other cardiovascular diseases that could significantly be prevented with proper BP control.

Moreover, the average BMI and waist-to-hip ratio of the participants fell within overweight and obesity. This can be attributed to the complex interplay of dietary habits, physical inactivity, socioeconomic status, and chronic stress. Majority of our participants were traders who often face demanding and stressful work environments, which can contribute to chronic stress and poor mental health, further elevating blood pressure and promoting unhealthy eating behaviors. [23] Sedentary lifestyles, exacerbated by the long hours spent in trading activities, may also lead to weight gain and elevated blood pressure. [24, 25] The high rates of overweight and obesity in this population also help explain the prevalence of HTN . Obesity and physical inactivity are well-documented risk factors for HTN across various studies and populations. [26-29] Furthermore, these anthropometric variables are also likely to influence the reduced levels of confidence, self-efficacy, and a higher propensity to avoid exercise. [30]

Trading is a major source of livelihood or income in the area of study, hence, as most of the individuals living in Anambra state are involved in one trade or the other especially those living in Nnewi and Onitsha metropolis. In our study, the majority of the participants were traders, a finding which is consistent with that of a study conducted by Orizu et al. and Ezeomedo et al. [31, 32] Although this is the prevalent occupation, it also raises awareness to the number of health

conditions that have been observed prevalent among this Occupation of which HTN is one of them. [33-36] This may be because of the common educational status of this population. As observed in different studies, most traders in Nnewi have between primary to senior school certificates as their highest level of education which could have influenced their perception and awareness of some health issues and even their health seeking behaviors. [37] Also, this may be due to the possible ignorance or limited availability of health insurance for this population thereby influencing their access to healthcare services. [38]

Not surprisingly, most participants reported SSCE or lower certificates as their highest level of education. This low educational attainment level within the community may possibly attribute to the unhealthy adiposity indices, low PA self-efficacy, and high temptation to not exercise among participants. Low academic attainment may contribute to poorer knowledge about the importance of exercise in managing HTN, as well as lower self-efficacy and higher temptations not to be physically active. Similar to the results of the present study, Leonard found that higher educational attainment can improve exercise self-efficacy as well as understanding of the need for exercise in managing HTN. [39]

Further, our study observed a significant difference in the temptation to not exercise and self-efficacy scores across the different educational qualification categories of the participants. We identified a trend of lower temptation to not exercise and higher exercise self-efficacy among individuals with post-secondary educational qualifications. However, exceptions were noted for those with Ordinary National Diploma (OND) holders who exhibited higher temptation scores and lowest self-efficacy scores. Generally, higher educational attainment is associated with better health literacy, which includes a greater understanding of the benefits of PA and more confidence in managing one's health. [40, 41] Individuals with post-secondary education may have more access to resources and information that promote healthy lifestyles, thereby reducing their temptation to not exercise and increasing their self-efficacy in engaging in physical activity.

The higher temptation and lower self-efficacy scores among persons with OND could have been influenced by the nature of their occupational environment which has been identified in other studies. [42, 43] Individuals with OND qualifications might be in more physically demanding jobs that leave them fatigued and less motivated to engage in additional exercise. This could explain their higher temptation to not exercise and lower self-efficacy scores. On the other hand, HND holders may have roles that are less physically demanding but more mentally taxing or time-consuming, leading to higher temptation to not exercise due to perceived time constraints or stress, despite having a higher self-efficacy for exercise due to their educational background.

Furthermore, the study observed that stress was the most common factor affecting Temptation among the participants of the present study. Participants were most tempted not to exercise when they were stressed. Busy schedules, much work to do, and not enough time closely followed in quick succession, while participants were least tempted not to exercise when they felt satisfied. It could be that participants consider engaging in PA a luxury activity,

or one that is done for reward or as a means of unwinding. It also exposes the culture of the community, where engaging in meaningful PA such as playing a game of football is seen as a rewarding activity reserved only for weekends. While the nature of the work (busy schedules-and work volume) of the majority of our participants could possibly have influenced their temptation, these responses can also be interpreted as a reduced readiness for PA behavior change. Individuals who are committed to making effective changes would plan their activities and find ways of incorporating them into their regular routines as well as manifest a bit more resilience in the face of deterring situations. It could also be that the participants of the present study have inadequate knowledge of what makes up a physically active lifestyle. Understanding adequate PA recommendations and components is important in assessing PA self-efficacy and temptation. Some people tend to associate adequate PA to gyms and specific equipment rather than as a more encompassing activity which can be incorporated into one's everyday life.

Best self-efficacy scores among these participants was observed in the item "I am confident I can participate in regular PA when I have to do PA alone," while the worst scores were observed in the item "I am confident I can participate in regular PA when I am under a lot of stress." Similarly, stress was also the most important factor in temptation to not exercise. This further buttress the inverse relationship between self-efficacy and temptation. Individuals who are more confident for PA participation would most likely be less tempted to avoid engaging in PA. These findings correspond with the reports of other studies. [44-46] Given the importance of PA and the need for its inclusivity, it has been advocated that PA should be incorporated into all domains of life, including work, travel, and recreation (Oldridge-Turner et al., 2022; WHO, 2019). For our participants, this could mean incorporating small stretches and short walks around the workplace each hour, walking part of the distance to work, or visiting friends for at least 10 minutes instead of using other means of transportation. The responses from our participants suggest they may be unaware of these simple ways to incorporate PA into their daily routines, even outside a professional exercise setting and still achieve the WHO recommended PA level for people with HTN (at least 150–300 minutes of moderate-intensity aerobic PA or at least 75–150 minutes of vigorous-intensity aerobic physical activity; or an equivalent combination of moderate- and vigorous-intensity activity throughout the week). [47] Amin and colleagues in their study in Ghana reported that their participants (people with diabetes type 2) were unaware of the recommended PA level. [44] Therefore, increasing awareness is recommended for this population and others with similar characteristics.

The current research showed that the female participants had a higher temptation to not exercise. Similarly, a higher level of PA self-efficacy score was found among the male participants. A significant difference was found in the temptation to not exercise score and exercise self-efficacy scores across the different gender categories of the participants. The higher temptation to not exercise score among female participants could be due to the fact that women often face more barriers, such as balancing work and family responsibilities, which can lead to a higher temptation to not exercise. [28] Additionally, societal norms and lower exposure to PA during

childhood and adolescence might reduce women's self-efficacy in exercising. [48] Conversely, men tend to have more encouragement and opportunities to engage in physical activities from a young age, resulting in higher self-efficacy scores. [49] The competitive nature and activities common among male participants may also contribute to their higher exercise self-efficacy scores.

The study found that individuals with an unhealthy waist circumference and waist-to-hip ratio exhibited a higher temptation to not exercise, while those with healthy measurements had higher exercise self-efficacy scores. This was not surprising as high waist circumference and waist-to-hip ratio are regarded as characteristics of obesity-which in turn has been associated with decreased exercise engagement. [50] Also, our study supports this with a positive correlation between the participants' waist-to-hip values with their body mass index. This significant difference in exercise-related attitudes and behaviors based on waist-to-hip ratio categories may be due to several factors. Individuals with unhealthy waist measurements might feel more self-conscious or physically uncomfortable during exercise, leading to greater reluctance and higher temptation to avoid physical activity. They may also experience more physical limitations or health issues that make exercise seem daunting or less achievable, thereby lowering their self-efficacy. Conversely, those with healthy waist measurements likely feel more capable and confident in their ability to engage in physical activities, boosting their self-efficacy. They might have experienced positive reinforcement from past physical activities, creating a virtuous cycle of exercise and confidence. [53] It is important to note that there are currently no available studies to either support or contradict our findings directly. This gap in the literature shows the need for further research to explore the relationship between waist-to-hip ratio, temptation to exercise, and exercise self-efficacy.

Additionally, there was a significant negative correlation between the temptation to not exercise scores and exercise self-efficacy scores of the participants. This means that an increase in the temptation to not exercise scores of the participants would result in the corresponding decrease in the level of exercise self-efficacy scores. According to Nigg et al, self-efficacy increase promotes the continuous decrease in the temptation to not exercise. [53]

Finally, the study revealed that there was a significant difference in the temptation to not exercise score across the different occupations of the participants with the chef/cook having a higher temptation to not exercise value. Chefs and cooks often have demanding and irregular work schedules, which can lead to fatigue and leave little time for exercise. [51] The physically demanding nature of their job might also contribute to a higher temptation to rest rather than engage in additional PA during their limited free time.

Additionally, the work environment in kitchens can be high-stress and fast-paced, potentially leading to burnout and a greater inclination to avoid exercise. [51] Moreover, the temptation to sample food throughout the day could lead to weight gain, making PA seem more daunting and less appealing. These factors collectively contribute to the higher temptation to not exercise among chefs and cooks. Stress emerged as the most critical factor for low self-efficacy and high temptation to not

exercise, as most participants indicated they were least likely to engage in PA when stressed. This highlights that, beyond the other risks associated with poorly managed stress, it significantly undermines healthy behaviors like exercising. Although Burg et al pointed out in their study that the effect of stress on exercise varies in individuals, [57] to some it increases their desire to exercise, [54] some it decreases and while in some it has no effect, several studies have identified stress as a barrier to exercising and PA. [55, 56] Therefore, it is crucial to incorporate stress management training for participants, alongside promoting PA as an effective stress-relief strategy. Teaching participants how to channel their stress into exercise could help mitigate the negative impact of stress on their PA levels, ultimately improving their overall health and well-being.

CONCLUSION

In conclusion, this study reveals a low level of exercise self-efficacy and high temptation to not exercise among community-dwelling adults living with HTN in Nnewi. The findings also revealed a significant negative correlation between self-efficacy and temptation to not exercise, with stress being a major influencing factor. Females reported higher temptation and lower PA self-efficacy, while occupation, particularly for chefs/cooks, significantly impacted temptation levels. The high rates of overweight and obesity, coupled with low educational attainment, further compounded the challenges to PA engagement. These results highlight the need for targeted interventions that address stress management, enhance self-efficacy, and provide practical strategies for incorporating PA into daily routines. Promoting awareness of PA recommendations and integrating PA into all domains of life, including work and recreation, is essential for improving health outcomes in this population.

Ethical Approval and Consent to Participate: This study adhered to the Declaration of Helsinki approved by the Nnamdi Azikiwe University Teaching Hospital Research Ethics Committee (NAUTH/CS/66/VOL 16/VER 3/336/2023/082). A written informed consent was obtained from all participants before commencement of data collection.

Acknowledgments: Authors are grateful to all the participants for the voluntary participation.

Competing Interest: Authors declare no conflict of interests.

Authors contribution: IAA and FAM conceptualized the study, AUN, IRV, ENA and CEA collected the data for this study, SJO, IAA, and AUN wrote the initial draft of the manuscript, SJO and IAA wrote the final manuscript draft, IAA, CEA and FAM analysed and visualised be data, ENA, SJO, and IAA gathered the resources for the literature, FAM supervised the study.

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