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ORIGINAL PAPER

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Breast hypertrophy, forward head posture, neck and shoulder pain-related disabilities and selected anthropometrics variables of female undergraduate students

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ABSTRACT

Introduction and aim. Large breast sizes frequently contribute to women presenting with severe pain symptoms. This study determined the association between breast hypertrophy, forward head posture (FHP), neck and shoulder pain related disabilities and selected anthropometric variables of female undergraduate students of College of Medicine, University of Lagos.

Material and methods. A cross-sectional analytical study was conducted among 89 female undergraduate students (mean age = 21.45±1.29 years) with breast hypertrophy (cup size D and above). Breast cup sizes, neck and shoulder pain related disabilities, forward head posture were measured using a measuring tape, neck pain disability scale, shoulder pain disability index and craniovertebral angle (CVA) using photography method.

Results. The prevalence of forward head posture among the participants was 43(48.3%). Twenty-eight (31.3%) participants had a "DD" cup size, twenty-six (29.2%) participants had a "DDD" cup size. Sixty-five (73%) of the participants had neck pain related disabilities and 10 (11.2%) of the participants had shoulder pain related disabilities. There was association among weight, forward head posture (p=0.027) and breast hypertrophy (p=0.016).

Conclusion. Neck, shoulder pain related disabilities, and forward head posture is prevalent among undergraduates with breast hypertrophy and weight has an influence on forward posture and breast hypertrophy.

Keywords. breast hypertrophy, craniovertebral angle, neck pain, shoulder pain

Introduction

Large breast sizes add to many health issues in women, which could include discomfort in the neck, upper limb, back and head, and it has been found that these problems can be so intense and severe to compel females with breast hypertrophy to undergo breast reduction for pain relief.[1] The mass and dimension of the female breast can be different between individuals such as difference in the volume, width, length, projections, shape, and position on the chest wall.[2,3] Research has also shown that hormonal changes influence breast size.[4] Findikcioglu et al., revealed that in females with brassiere size A, B, or C the thoracic kyphosis and lumbar lordosis angle was smaller than in females with brassiere size D and above.[5]

Neck pain is an unpleasant sensory experience in the neck it may present as fatigue, tension or pain that radiates down to the shoulders, upper extremities or head. Fifty percent of the populace will complain of an episode of neck pain in their life.[6] Pain in the neck is associated with a lot of co-morbidities which includes headache, back pain, arthralgias, and depression.[7,8] The prevalence of neck pain is higher in females than in males, and literature is varied as to whether it rises or levels in mid-

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dle age.[7] Guzman et al., reported that neck pain has a pathologic cause that can be identified and treated while others consider neck pain of any form as a primarily non-organic problem with psychosocial roots.[9,10]

The prevalence of shoulder pain in the general population has been said to vary between 7% and 30% it increases with age and has been said to be higher in women than in men.[1,11,12] According to a broad research on conditions of living of the Japanese People conducted in 2010, 13% of women and 6% of men complained of shoulder-neck pain.[13] Tenna et al. investigated the effects of decrease in breast size on posture and also described an improvement using static stabilometry.[14]

Body posture can be defined as the positioning of the body for a particular time, while the state of slightly engaging the musculoskeletal system in maintaining body balance without generating discomfort can be referred to as ideal posture.[15] Forward head posture (FHP) is the projection of the head in the sagittal plane so that the head is placed anterior to the trunk. It can occur because of anterior shift of the head, lower cervical flexion, or both, and it is also claimed to be associated with an increase in upper cervical extension.[16] It is associated with shortening of the posterior cervical extensor muscles, the upper trapezius, the sternocleidomastoid muscle, and levator scapulae muscle.[17] Thus, forward head posture can also contribute to neck and shoulder pain.[18] Craniovertebral angle (CVA) is one of the common tools used in assessing forward head posture.[19,20]

The CVA is defined as the angle between a straight line that passes through the spinous process of the cervical vertebrae number seven and the line connecting the spinous process of cervical vertebrae number seven with tragus of the ear.[19] Chiu et al., found that roughly 60% of individuals with neck pain had FHP.[21] Another research by Griegel-Morris et al., revealed that 66% of forward head posture was observed in the neck region in a group of healthy participants between the ages of 20 and 50 years.[22] A smaller CVA indicates a greater forward head posture.[23] The average normal value of CVA in a pain free population is about 50^0, any value below 50^0 leads to a form of cervical disorder referred to as forward head posture.[19] Akodu et al., reported differences in the FHP of patients with neck pain while Hanten et al., failed to detect such differences in their own study.[8,24]

Aim

Since literature is scarce in the association between breast hypertrophy, CVA, neck and shoulder pain related disabilities, this study was therefore aimed at determining the association between breast hypertrophy, CVA, neck and shoulder pain related disabilities and selected anthropometrics variables among female undergraduate students of College of Medicine, University of Lagos.

Material and methods

Eighty-nine female undergraduate students with breast hypertrophy participated in this cross sectional analytical survey which was conducted between February and August, 2021. The participants were enrolled from different departments of college of medicine, University of Lagos with the sample size derived from the formula by Cochran[25] where Z= standard normal variate (at 5%), type 1 error ($p< 0.050$) is 1.96, using a prevalence of forward head posture in a group of physiotherapy undergraduates (51.51%)[8.] A purposive sampling technique was adopted for this study. Participants were included in the study if they have breast hypertrophy, and participants that have breast hypertrophy with neck and shoulder pain were excluded from the study.

Before starting the study, permission to conduct the study was obtained from health research and ethics committee of college of Medicine, University of Lagos (CMUL) with approval number (CMUL/HREC/12/19/707), the objectives of the study was explained to the participants and they were assured of confidentiality of their information. Written informed consent was obtained from all the participants after explanation of the study objectives. The participant's demographic variables such as age, sex, current level in the university and department were recorded while the weight, height, Body Mass Index and the participants' breast size and CVA were measured and recorded before the distribution of questionnaires; neck and shoulder pain disability index.

Study gadgets

Digital Camera: A Sony 7.2 Mega pixels DSC 5650, made in China was used to take pictures of the participants.

Corel draw X7 software: this software alongside an HP laptop was used for digitalizing process and calculation of craniovertebral angle for each participant.

Camera tripod stand: A Pawaca 3Pcs Camera DSLR Stand tripod extendable 130cm CAM-002 was used to position the camera.

Plumb line: This is a piece of string that is high enough to accommodate the tallest participant. A small weight is attached to the end of the rope to make it straight and align to the lateral anatomical position. Laptop: HP 455 G5 15.6" LED HD, A9-9420, 8GB DDR4, 256GB SSD, WIN10 Pro.

Plumb line stand: this is made of wood that is 7 feet high with a longitudinal side attached to the top. A rope was attached to the edge of the longitudinal side. A small weight will be attached to the end of the rope to make it align to normal lateral anatomical position.

Breast size assessment

To assess the breast size, this was done by using a tape measure: which was recorded to the nearest 0.1 centimetres and then converted to inches. If band size calculates

to an odd number, the number is rounded up or down because bras are available only in even-numbered sizes. Cup size was then calculated by comparing the size of the band to bust circumference, which is the circumference of the chest around the fullest part of the breasts, commonly taken at the level of the nipples with the subject with or without a bra or wearing a pad-less bra. A bust circumference 1inch greater than band size matches with an "A" cup, 2 inches matches with a "B" cup, 3 inches to a "C" cup, and so forth. For example, a woman who has a bust circumference of 39 inches with a band size of 36 would fit a size 36C bra by this formula (39–36=3=C cup).[26]

Assessment of craniovertebral angle

A 2 meters plumb line was placed away from the participant with the tripod stand and camera placed behind it for the assessment of craniovertebral angle, the plumb line was to fall in front or through the tragus of the ear. The participants were instructed to expose their ear, the neck to its base and the shoulder. Adhesive tape was used to mark the lateral surface at the tragus of the ear, spinous process of the seventh cervical vertebrae and the acromion process of the shoulder contrasting the skin. Participants' photographs were taken and imported to Corel draw X7 software version to measure the CVA.[19,20]

Administration of questionnaire

The questionnaires (neck pain disability index and shoulder pain disability index) were self-administered by personally distributing to female students with large breast sizes of college of medicine, University of Lagos after the sizes of the breast was determined using the procedure of Niddam et al. and they were collected afterwards after each participant had fully completed the questionnaire.[26]

Description of questionnaires

Neck pain and disability scale: The Neck Pain and Disability scale (NPAD) includes 20 item questionnaire that was developed for neck pain patients.[27] The questionnaire measures problems with neck movements, neck pain intensity, effect of neck pain on emotion and cognition, and the level of meddling with activities of living. Patients are required to mark along a 10 cm visual analog scale (VAS). The ranges of score of each item is from 0-5 while the total score is a total of the item scores ranging from 0 (no pain) – 100 (maximal pain). NPAD requires less than 5 minutes to complete.[28] It has been found to be a valid, reliable tool available in other languages for assessing disability in chronic neck pain patients. Data has shown that Neck Pain and Disability Scale has better construct validity with Cronbach's alpha of 0.93. Items-total correlations range from 0.45 to 0.73.[29]

Shoulder pain and disability index (SPADI): is a self-report questionnaire for measuring pain and disability of the shoulder. It is a 13 itemed index made up of two subscales: pain (5 items) and disability (8 items); each subscale is summed and transformed to a score out of 100. A mean is taken of the two subscales to give a total score out of 100, higher score indicating greater impairment or disability. For a non-specific population: Test-retest reliability of SPADI total combined subscale scoring ranging from 0.64 to 0.66.[30] Approximately 95% of the pairs of observation did not differ by more than 17 points.[31] ICC for the disability subscale ranged from 0.57 to 0.84.[32] Correlation ranged from -0.55 to -0.80.[30]

Data analysis

Data were analyzed using the Statistical package for Social Sciences (SPSS) windows version 22 (IBM, New York city, New York, USA) and was summarized using descriptive statistics of mean, standard deviation, frequencies and percentages. Inferential statistics of Chi-square was used to find the association between variables. Level of significance was set at $p \leq 0.05$.

Result

Eighty-nine copies of questionnaire were distributed and returned. This gave a response rate of 100%. Therefore, eighty-nine copies of the questionnaire were valid for analysis.

In Table 1 more than half 54 (60.7%) of the participants were within the age range of 21-22 years with mean age of 21.45±1.29 years. All the participants were females.

Table 1. Demographic characteristics of the participants

Variable	Frequency (n=89)	Percentage (%)
Age (years)		
19 – 20	20	22.5
21 – 22	54	60.7
23 – 24	12	13.4
>24	3	3.4
Mean age = 21.45±1.29		
Height (m)		
1.50 – 1.60	22	24.7
1.61 – 1.70	50	56.2
1.71 – 1.80	17	19.1
Mean height = 1.65±0.08		
Weight (kg)		
41 – 62	37	41.6
63 – 82	36	40.4
83 – 102	10	11.2
>102	6	6.7
Mean weight = 68.30±16.39		
Body mass index (kg/m²)		
<18.5	4	4.5
18.5 – 24.9	46	51.7
25 – 29.9	24	27
>=30	15	16.9
Mean BMI = 25.11±5.95		

Thirty-six (40.4%) of the participants' weight was within 63-82kg, and 6 (6.7%) of the participants' weight was greater than 102 kg. The mean weight of the participants was 68.30±16.39 kg. Majority, 50 (56.2%) of the participants had height between 1.61-1.70 m with mean height of 1.65±0.08. Twenty-four (27%) of the participants were overweight with a BMI of 25-29.9 kg/m^2 with a mean BMI of 25.11±5.95 kg/m^2.

Table 2. Prevalence of forward head posture and breast sizes among female undergraduate students of College of Medicine University of Lagos (CMUL)

Variables	Frequency (n=89)	Percent (%)
CVA		
<50	43	48.3
>=50	46	51.7
Total	89	100
Mean CVA= 50.06±5.98		
Cup-size*		
D	27	30.3
DD/E	28	31.3
DDD/F	26	29.2
G	7	7.9
I	1	1.1
Total	89	100

*cup-size (D, DD, DDD, G, I) – breast size classification for large breast sizes in this study, CVA – craniovertebral angle

Prevalence of forward head posture, breast sizes and pain related disabilities of the neck and shoulder among female undergraduate students of College of Medicine University of Lagos

Table 2 shows that prevalence of forward head posture (craniovertebral angle less than 50^0) was 43(48.3%) with mean CVA of 50.06±5.98^0 among the participants. Concerning breast hypertrophy, twenty-eight (31.3%) participants had a "DD" cup-size. Twenty-six (29.2%) participants had a cup-size "DDD" cup-size.

Table 3 shows that sixty-five (73.00%) participants had pain related disability of the neck while 10 (11.20%) participants had pain related disability of the shoulder.

Table 3. The prevalence of pain related disabilities of the neck and shoulder of female undergraduate students with breast hypertrophy in CMUL

Variable	Frequency (n=89)	Percentage (%)
NPAD*		
No pain	24	27
Pain	65	73
Total	89	100.
SPADI*		
No disability	79	88.8
Disability	10	11.2
Total	89	100

*NPAD – neck pain and disability, SPADI – shoulder pain and disability index

Association between breast hypertrophy, forward head posture (CVA less than 50^0), neck - shoulder pain related disabilities, age and selected anthropometric variables

Table 4 shows that there was no significant association between breast hypertrophy and forward head posture (p=0.065), neck pain related disabilities (p=0.545) and shoulder pain related disabilities (p=0.854).

Table 5 shows that there was no significant association between breast hypertrophy, age (p=0.243), height (p=0.243) and BMI (p=0.255). But there was significant association between the weight and breast hypertrophy (p=0.016).

Table 4. Association between breast hypertrophy, forward head posture, neck and shoulder pain related disabilities*

Variables	Cup-size					χ^2	p-value
	D	DD	DDD	G	I		
CVA							
<50	7 (16.3%)	15 (34.9%)	16 (37.2%)	4 (9.3%)	1 (2.3%)		
>=50	20 (43.5%)	13 (28.3%)	10 (21.7%)	3 (6.5%)	0 (0%)	8.84	0.065
NPAD							
No	10 (41.7%)	8 (33.3%)	4 (16.7%)	1 (4.2%)	1 (4.2%)		
Mild	15 (28.3%)	17 (32.1%)	17 (32.1%)	4 (7.5%)	0 (0%)	10.81	0.545
Moderate	1 (12.5%)	2 (25%)	3 (37.5%)	2 (25%)	0 (0%)		
Severe	1 (25%)	1 (25%)	2 (50%)	0 (0%)	0 (0%)		
SPADI							
No	24 (30.4%)	24 (30.4%)	23 (29.1%)	7(8.9%)	1 (1.3%)		
Mild	3 (33.3%)	4 (44.4%)	2 (22.2%)	0 (0%)	0 (0%)		
Moderate	0 (0%)	0 (0%)	1 (100%)	0 (0%)	0 (0%)	4.04	0.854
Severe	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)		

*NPAD – neck pain and disability, SPADI – shoulder pain and disability index, NO – no pain related disability, MILD – mild pain related disability, MODERATE – moderate pain related disability, SEVERE – severe pain related disability, CVA – craniovertebral angle, χ^2 – Chi-square value, cup-size (D, DD, DDD, G, I) – breast size classification for large breast sizes in this study

Association between forward head posture, neck-shoulder pain related disabilities, age and selected anthropometric variables

In table 6 there was no significant association between forward head posture, neck pain related disabilities (p=0.434) and shoulder pain related disability (p=0.384).

While table 7 shows that there was no significant association between forward head posture, age (p=0.250), height (p=0.650) and body mass index (p=0.055) but a significant association exist between the weight and forward head posture (p=0.027).

Discussion

The prevalence of forward head posture (FHP) (craniovertebral angle (CVA) less than 50^0) was observed to be 48.3%, among female undergraduates with breast hypertrophy. The mean CVA was 50.06 ± 5.98^0. This corresponds to the findings of the study by Akodu et al., who reported the prevalence of FHP in female undergraduates to be 51.5% and the mean value of craniovertebral angle was 51.83 ± 5.7^0.[8] The study done by Sutantar et al., showed the prevalence of FHP among their study participants to be 73%.[33] Mamania and Anap, revealed a prevalence of 70% of FHP.[34] In a study by Abrish et al., 3.1% of the participants had severe FHP, 40.6% of

Table 5. Association between breast hypertrophy, age and selected anthropometric values*

Variables	Cup-size					χ^2	p-value
	D	DD	DDD	G	I		
Age (years)							
19-20	5 (25%)	5 (25%)	6 (30%)	4 (20%)	0 (0%)		
21-22	17 (31.5%)	20 (37%)	13 (24.1%)	3 (5.6%)	1 (1.9%)	15.178	0.232
23-24	5 (41.7%)	3 (25%)	4 (33.3%)	0 (0%)	0 (0%)		
>24	0 (0%)	0 (0%)	3 (100%)	0 (0%)	0 (0%)		
Height (m)							
1.50 -1.60	2 (50%)	8 (36.4%)	6 (27.3%)	0 (0%)	0 (0%)		
1.61 -1.70	13 (26%)	14 (28%)	18 (36%)	5 (10%)	0 (0%)	10.321	0.243
1.71 -1.80	6 (35.3%)	6 (35.3%)	2 (11.8%)	2 (11.8%)	1 (5.9%)		
Weight (kg)							
41 -62	13 (35.1%)	8 (21.6%)	14 (37.8%)	2 (5.4%)	0 (0%)		
63 – 82	13 (36.1%)	13 (36.1%)	8 (22.2%)	2 (5.6%)	0 (0%)	24.828	0.016
83 – 102	1 (10%)	4 (40%)	3 (30%)	2 (20%)	0 (0%)		
>102	0 (0%)	3 (50%)	1 (16.7%)	1 (16.7%)	1 (16.7%)		
BMI (kg/m²)							
<18.5	2 (50%)	0 (0%)	1 (25%)	1 (25%)	0 (0%)		
18.5 - 24.9	18 (39.1%)	12 (26.1%)	14 (30.4%)	2 (4.3%)	0 (0%)	14.763	0.255
25 – 29.9	5 (20.8%)	10 (41.7%)	6 (25%)	3 (12.5%)	0 (0%)		
>=30	2 (13.3%)	6 (40%)	5 (33.3%)	1 (6.7%)	1 (6.7%)		

*BMI – body mass index, χ^2 – Chi-square value, CUP-SIZE (D, DD, DDD, G, I) – breast size classification for large breast sizes in this study

Table 6. Association between forward head posture and neck-shoulder pain related disabilities*

CVA				
Variable	**<50**	**>=50**	χ^2	**p-value**
NPAD				
No	10 (41.7%)	14 (58.3%)		
Mild	25 (47.2%)	28 (52.8%)	2.738	0.434
Moderate	6 (75%)	2 (25%)		
Severe	2 (50%)	2 (50%)		
SPADI				
No	40 (50.6%)	39 (49.4%)		
Mild	3 (33.3%)	6 (66.7%)	1.914	0.384
Moderate	0 (0%)	1 (100%)		
Severe	0 (0%)	0 (0%)		

*NPAD – neck pain and disability, SPADI – Shoulder Pain and Disability Index, NO – no pain related disability, MILD – mild pain related disability, MODERATE – moderate pain related disability, SEVERE – severe pain related disability, CVA – craniovertebral angle, χ^2 – Chi-square value

the participants had moderate FHP, 50% had mild FHP while 6.3% had normal craniovertebral angle.[35] The lower prevalence in this study could be as a result of the involvement of only female participants with breast hypertrophy.

Table 7. Association between forward head posture, age and selected anthropometric variables*

CVA				
Variables	**<50**	**>=50**	**χ^2**	**p-value**
Age (years)				
19 – 20	11 (55%)	9 (45%)		
21 – 22	24 (44.4%)	30 (55.6%)	4.104	0.25
23 – 24	5 (41.7%)	7 (58.3%)		
>24	3 (100%)	0 (0%)		
Height (m)				
1.50 – 1.6	12 (54.5%)	10 (45.5%)		
1.61 – 1.7	22 (44%)	28 (56%)	0.86	0.65
1.71 – 1.8	9 (52.9%)	8 (47.1%)		
Weight (kg)				
41 – 62	17 (45.9%)	20 (54.1%)		
63 – 82	13 (36.1%)	23 (63.9%)	9.197	0.027
83 – 102	8 (80%)	2 (20%)		
>102	5 (83.3%)	1 (16.7%)		
BMI (kg/m^2)				
<18.5	2 (50%)	2 (50%)		
18.5 – 24.9	20 (43.5%)	26 (56.5%)	7.59	0.055
25 – 29.9	9 (37.5%)	15 (62.5%)		
>=30	12 (80%)	3 (20%)		

*CVA – craniovertebral angle, BMI – body mass index, χ^2 – Chi-square value

Seventy-three (73) percent of the participants in this study presented with pain related disabilities of the neck but in a study carried out by Gharib and Hamid the prevalence of mechanical neck pain among female students was 54%.[36] Findings in the study carried out by Chan et al., on the prevalence of neck pain and associated risk factors among undergraduate students showed the point prevalence of neck pain as 17.5%.[37] In a study done by Fahad and Sana, the results showed a total of 51.8% students had neck pain ranging from mild to severe.[38] The high prevalence rate of pain related disability of the neck in this study could be as a result of large breast sizes that all the participants present with.

The prevalence of shoulder pain related disabilities was observed to be 11.2% but in a study carried out by Luime et al., the results showed a point prevalence of 6.9–26% for shoulder pain.[14] The results of these two studies confirms that shoulder pain related disabilities may not really be a common musculoskeletal disorder that affect individuals with breast hypertrophy.

In this study, there was no significant association between forward head posture and neck pain related disabilities. This means that having forward head posture may not necessarily predispose one to having neck pain and its related disabilities which corresponds to a study carried out by Martínez-Merinero et al., which reported that there was no association between forward head posture, neck pain, disability, and headache.[39] In a study carried out by Mahmoud et al., it was shown that forward head posture was significantly correlated with neck pain in adults and older adults which also concurs with the report of Akodu et al., but there was no association found between forward head posture and neck pain in adolescents.[8,40] Abrish et al., asserted that 50% of the students with complaint of neck pain had slight postural deformity having mild forward head posture (FHP) and fewer students, 3.1% had severe postural deformity.[35] Raoufi et al., revealed a significant reverse correlation between CV angle and neck pain.[41]

In this study, the cup sizes shows that all the participants in this study have breast hypertrophy. This did not corresponds to the result in the study by Dundas et al,[42] who reported a percentage of 48% on measurement and categorization of breast size for radiation therapy who had a cup size of D or E. In the study by Odebiyi et al., the results reported a prevalence of 75% for cup size of D and above.[43]

Literature is scarce in the association between breast hypertrophy and CVA, but in this study the results showed that there was no significant association between breast hypertrophy and craniovertebral angle. Szeto et al., and Moore stated that maintaining the head forward for long periods of time may cause musculoskeletal disorders such as 'upper crossed syndrome, which involves having reduced lordosis of the lower cervical, in conjunction with kyphosis of the upper thoracic vertebrae.[44,45] In a research by Findikcioglu et al., it was reported that women with breast cups size D and above tends to have greater curvatures of the spine than women with smaller breast sizes.[5]

This study shows that there was no significant association between breast hypertrophy and neck and shoulder pain related disabilities. This result corresponds to the findings of the study done by Myint et al., on relationship between brassiere cup size and shoulder-neck pain in women, which showed that there was no significant relationship between shoulder-neck pain and breast size.[46] In a study carried out by Coltman et al., the results showed young women with breast hypertrophy with nipple-to-nipple distance have a higher upper torso musculoskeletal discomfort.[47]

Age and forward head posture were not associated in this study. The reason could be due to the limited margin in the age range of the participants in this study. In a study by Nemmers et al., the data showed an age-related effect with the older women showing a more severe FHP than those that are much younger.[48] Kocur et al., revealed that with more advancement in age, subjects had smaller craniovertebral angle values which in-

dicates increased prevalence of forward heads posture as age increases.[49]

In this study age and breast hypertrophy were associated. This means increase or decrease in age has no effect on the size of the breast and this result corresponds to the findings in a study by Brown et al., the results showed that there was no correlation between age and breast hypertrophy.[50]

There was a significant association between weight and breast hypertrophy of the participants but no significant association between body mass index and breast hypertrophy of the participants in this study. In a study carried out by Brown et al., it was reported that body mass was strongly correlated with breast mass which indicates that heavier women had larger breasts.[50] The results of the study carried out by Coltman et al., showed that breast size was significantly influenced by BMI, with the breast size of overweight and obese women 2 to 3 times bigger than the women with normal BMIs.[51] Steele et al., buttressed that the participants classified as obese had significantly larger breasts sizes.[52] This corresponds with report of this study.

There was a significant association between weight and craniovertebral angle of the participants, but no significant association between BMI and craniovertebral angle of the participants in this study. This means that the weight of an individual with breast hypertrophy has an influence on the craniovertebral angle but body mass index has no specific influence on the craniovertebral angle. A study carried out by Shaghayegh et al.,[53] revealed a negative correlation between the BMI and CVA.

Conclusion

Based on the results of this study, the following conclusions were made: There was high prevalence of neck pain related disabilities, forward head posture among participants with breast hypertrophy in this study, weight as an influence on the prevalence of forward head posture and breast hypertrophy.

Declarations

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Author contributions

Conceptualization, A.K.; Methodology, A.K. and T.G.; Validation, A.K., T.G. and A.O.; Formal Analysis, A.K.; Investigation, T.G.; Resources, A.K. and T.G.; Data Curation, A.K. and T.G.; Writing – Original Draft Preparation, A.K.; Writing – Review & Editing, A.K., T.G. and A.O.; Visualization, T.G. and A.O.; Supervision, A.K.; Project Administration, A.K. and T.G.; Funding Acquisition, T.G.

Conflicts of interest

The authors declared that there are no conflict of interests.

Data availability

The data used during the current study are available from the corresponding author on request.

Ethics approval

Permission to conduct the study was obtained from health research and ethics committee of college of Medicine, University of Lagos (CMUL) with approval number (CMUL/HREC/12/19/707).

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