

# Measurements of Breasts of Young West African Females: A Guideline in Anatomical Landmarks for Adolescent Breast Surgery

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## Abstract

**Background** There have been few studies to develop standardized methods of measuring female breasts' shapes in clinical settings in West Africa. The objective of this study was to determine the clinical variation in breast measurements among a large group of adolescent female subjects, with the goal of providing guideline metrics to surgeons performing reduction mammoplasty and mastopexy on patients desiring a more adolescent shape and nipple position.

**Methods** Standard measurement parameters of both breasts were measured and recorded. Subjects were female students from six selected junior high schools (JHS) at Sogakope, Ghana. Demographic and statistical data were recorded and analyzed with Epi Info™ 2000.

**Results** A total of 438 subjects, aged 16–22 years (mean = 17.43 years) were surveyed. The average distance from the suprasternal notch to the left and right breast nipples was 20.97 and 20.31 cm, respectively. The average distance from the left and right nipples to their inframammary crease was 9.36 and 9.21 cm, respectively. The

average distance from the midline in the xiphoid area to the left and right nipples was 10.94 and 10.84 cm, respectively. The average asymmetrical difference in length along the vertical midline between left and right breasts for 53.4% (234) of the total subjects (438) was 1.32 cm; no differences were recorded for the remaining 204 subjects.

**Conclusion** The “normal values” for adolescent youthful breasts differ slightly from previous reports on desired adult breast outcomes. It is hoped that these values would serve as a baseline in aesthetic breast surgeries, especially in reduction mammoplasty in young females.

**Keywords** Suprasternal notch · Inframammary crease · Aesthetic breast surgery · Breast · Nipple

## Introduction

The breast profile is a gentle downward vertical flow from the clavicle to the nipple-areola and mildly convex from the nipple-areola to the inframammary crease [4]. Breast shape is affected by physiological changes associated with puberty, ovulation, gestation, lactation, and senescence. Although breast shape may vary quite a bit, certain universal concepts of breast aesthetics seem to be accepted by artists and the general public [2]. A well-shaped breast will have little or no ptosis. The nipple will be at the most anterior point of the breast mound. The inferior pole of the breast should be in the form of a half cone. A line from the clavicle to the nipple should be straight, without a marked “ski-jump” depression above the areola. The lateral breast should not extend more than a few centimeters posterior to the anterior axillary fold [25]. These ideals are typically associated with the adolescent breast during the stage of breast development.

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Although Maliniac [16, 17] described various “normal” values for measurements of the desirable breast many years ago, there have been only five studies, using different protocols [5, 18, 22], that have actually attempted to develop a standardized method of measuring and recording the shape of the breast in a clinical setting. Several surgical techniques base their preoperative planning measurements on the “normal” values established by these studies. Any protocol that attempts to record the shape of the breast must somehow note the following parameters: height, body weight, shape, volume, relative position to the trunk and the other breast, ptosis, projection, quality of the breast envelope, and any pathological morphology of the breast [1].

An advantage of the results of this study to plastic surgeons will be the comparison of the anthropometric breast values of young West Africa women with those of women in other countries. Patients who will benefit from the study include young women with hypertrophy/macromastia and are uncomfortable with it. Also, other older women who prefer having a breast size of younger females for aesthetic purposes could also benefit from this study. The purpose of this study was to identify standardized “normal” values of young adolescent breasts to serve as a guideline in anatomical landmarks for aesthetic surgery, especially in reduction mammoplasty on young females or patients desiring a more youthful proportion.

## Materials and Methods

Appropriate ethical clearance was obtained from the South Tongu District Health Directorate through the South Tongu District Education Directorate for the study, conducted by a ten-member research team of doctors, nurses, biostatisticians, a health educator, and a social worker. Prior to the survey a seminar was conducted to teach all team members the methodology of clinical breast examination and the taking and recording of breast measurements. This was to ensure that everybody did exactly the same thing. The team was then divided into three groups, each of which worked independently in two schools for three full days and were supervised by a consultant plastic surgeon, the tenth member of the team and the senior author of this article (PA).

Four hundred thirty eight volunteers were included in this study which was conducted in March 2006. They were female students at six selected junior high schools (JHS) at Sogakope, South Tongu District of the Volta Region, Ghana, West Africa. All the subjects were students of JHS 1–3 forms and were all those present at the schools during the days of the survey; there were no exclusions and none refused to participate. The subjects were all black Africans from the southern part of Ghana. Age, height, and other clinical information of each participant were recorded.

Measurements of both breasts were determined with the subjects standing in the normal anatomical position (upright) with shoulders back and head facing straight ahead. All measurements, made by using a tape measure, were to the nearest half centimeter due to normal respiration or minor position change. Measurements to the nipple were made to the center of the nipple; measurements were taken from the suprasternal notch since that place is static, making it more accurate. The circumlineal measurement of the inframammary crease was of the inferior 180° from the nipple.

Linear measurements were made from suprasternal notch to nipple, nipple to inframammary crease, and nipple to the vertical midline. Midline measurements were from suprasternal notch to vertical midline along the inframammary line and any asymmetric difference between both breasts if any [25]. The collected data were entered and statistically correlated using Epi Info™ 2000 (CDC, Atlanta, GA). The mean, mode, and standard deviation of each of the general parameters were calculated.

## Results

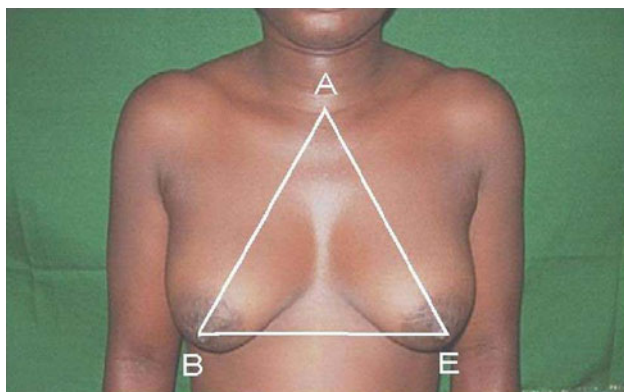
A total of 438 female volunteers from six selected JHS were recruited for the study. Their age ranged from 16 to 22 years (mean = 17.43 years) and the mean height and body weight were 156.3 cm and 49.5 kg, respectively (Table 1). In the upright position, the distance from the suprasternal notch to the left breast was an average of 20.97 (approximately 21) cm (range = 19–21 cm) (Fig. 5) and to the right breast it was an average of 20.31 (approximately 20) cm (range = 19–21 cm) (Fig. 5). The

**Table 1** Summation of the analyzed statistics of measured parameters of subjects

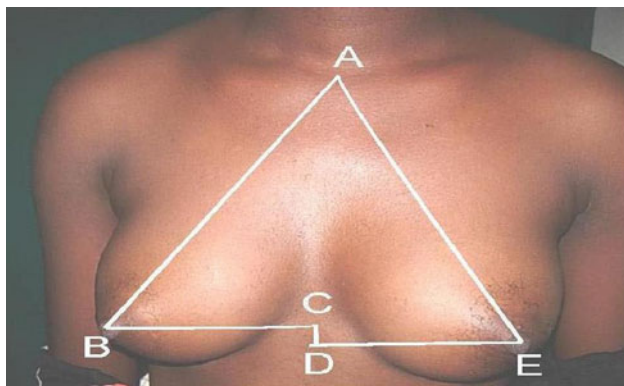
	Height (cm)	Weight (kg)	AB (cm)	AE (cm)	BC (cm)	DE (cm)	BF (cm)	EG (cm)	CD (cm)
Mean	156.342	49.500	20.310	20.971	10.841	10.943	9.213	9.364	1.326
Median	157.000	52.000	21.000	21.500	11.000	10.500	9.000	9.000	1.000
Mode	154.500	47.000	19.500	19.000	10.500	11.000	7.000	8.000	0.500
SD	16.2922	10.6540	4.2957	6.6115	3.1031	2.2358	4.5929	4.9108	1.4684
Variance	223.1348	58.1690	18.2056	98.3065	6.9076	5.1102	21.0947	23.1086	2.2116
Total no.	438	438	438	438	438	438	438	438	234

distance from the left nipple to the inframammary crease was an average of 9.36 (approximately 9) cm, with a peak between 7 and 9 cm (Fig. 6), compared to the average distance from the right nipple to the inframammary crease which was 9.21 (approximately 9) cm, with a peak between 10 and 12 cm (Fig. 6). The distance measured from the left nipple to the midline in the xiphoid area was an average of 10.94 (approximately 11) cm, with a peak between 8 and 10 cm (Fig. 7), and the distance from the right nipple to the same midline was an average of 10.84 (approximately 11) cm, with a peak between 12 and 14 cm (Fig. 8). The average asymmetrical difference in length along the vertical midline between left and right breasts, identified among 53.4% (234) of the total number of subjects (438) was 1.32 cm, with the peak ranging between 1 and 1.5 cm (Fig. 8). There was no asymmetrical difference recorded for the remaining 204 subjects.

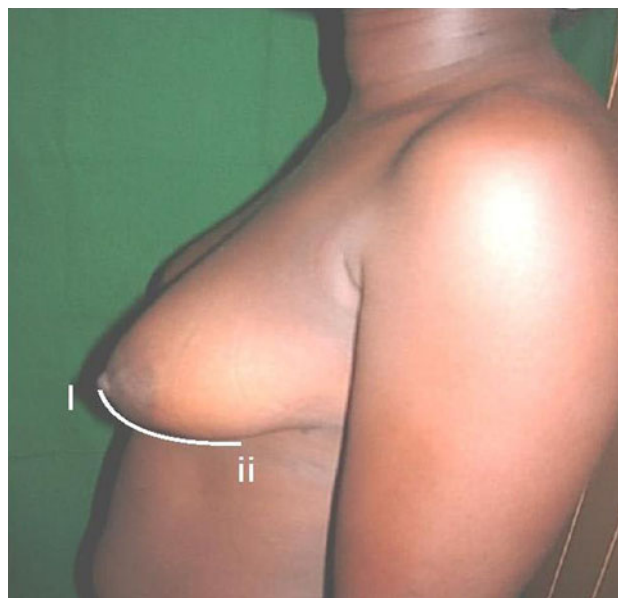
Figures 1, 2, 3, 4 illustrate the parameters along which the measurements of breasts were taken, recorded, and analyzed.



**Fig. 1** Parameters (A–C) for measurements of symmetric breasts of an 18-year-old female volunteer, as explained in Fig. 4



**Fig. 2** Parameters (A–E) for measurements of asymmetric breasts of an 18-year-old female volunteer, as explained in Fig. 4

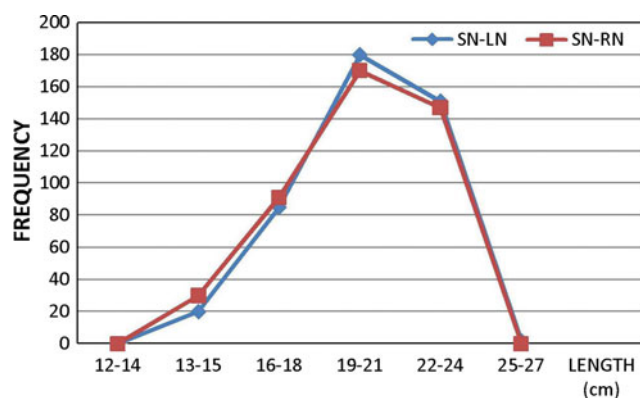
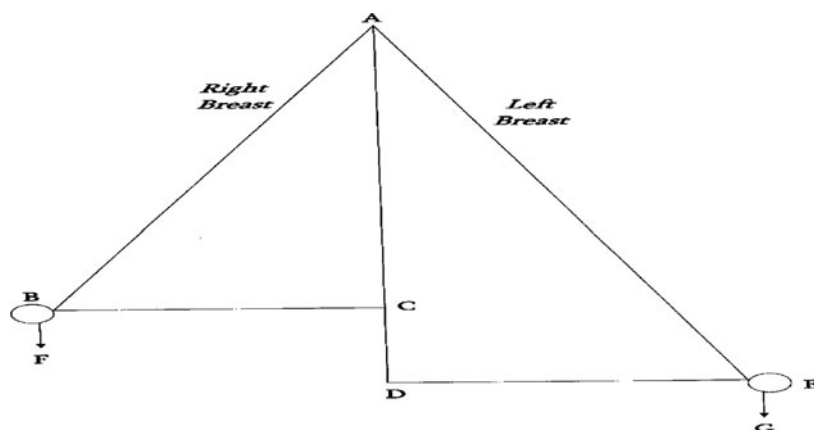


**Fig. 3** Circumlinear measurement of the breast of an 18-year-old female volunteer (curve *i-ii* = B-F or E-G as shown in Fig. 4)

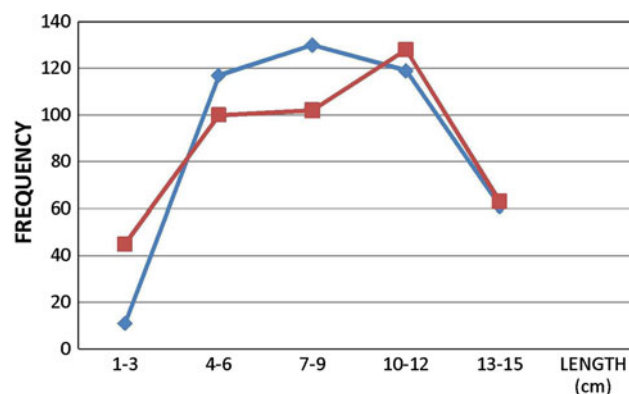
## Discussion

In 2008 Westreich [25] reported that the most important use of a breast measurement protocol is to assess the physiognomy of the breast and record any changes from previous measurements as a result of surgeries performed or simply due to vagaries of the passage of time. In addition, anthropomorphic measurements of breasts can help in preoperative evaluation and can improve surgical outcome [6, 7, 24]. Our study was purposely designed to obtain “normal values” of breast measurements of young females (mean age = 17.43 years) because there is little literature is available in this age group for West Africa females. In a related study on the incidence of breast developmental anomalies (BDA) done in the same locality by our group, a BDA incidence of 12.7% was recorded for macromastia, hypomastia, and nipple anomalies, which signifies that some of these young females would need reconstructive breast surgery to correct the anomalies [3]. That is why there was a need to determine the “normal values” for this age group so as to serve as a guide for any aesthetic surgery involving such female groups or patients desiring a more adolescent proportion. The study recorded an average distance of 20.5 cm between the suprasternal notch to the nipple for both breasts (Fig. 5) with a mode of 19 cm. Hall et al. [8] recorded a range of 21–23 cm for a similar distance in their study. Penn [18] obtained a distance of about 21 cm between the suprasternal notch and the breast nipple. Adolescent breasts therefore appear to have a 2–4 cm higher nipple position than more mature breasts.

**Fig. 4** A breast sketch showing measurement parameters for the study. *A* suprasternal notch (SN), *B* right breast nipple (RN), line *AC* vertical midline (ML), line *CD* asymmetrical difference between both breasts, *E* left breast nipple (LN), *F* right infra-mammary crease (RIC), *G* left infra-mammary crease (LIC)



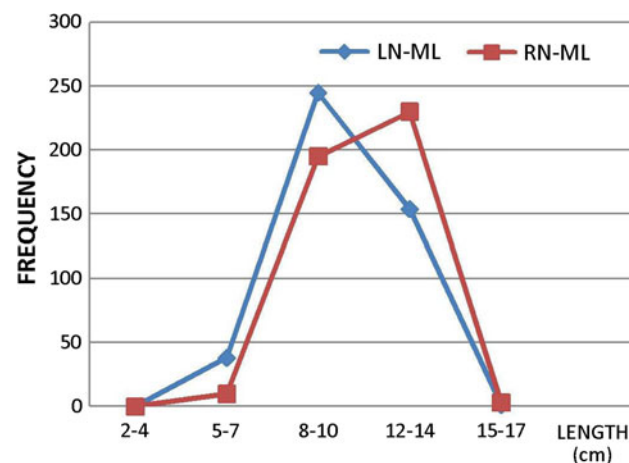
**Fig. 5** Measurements from the suprasternal notch (*A*) to left (*E*) and right (*B*) nipples, as explained in Fig. 4



**Fig. 6** Measurements from the left (*E*) and right (*B*) nipples to the left (*G*) and right (*F*) inframammary crease, respectively, as explained in Fig. 4

The study recorded an average distance of 9.0 cm from the nipple to the inframammary crease with a mode of 7.5 cm (Figs. 3, 6). In the Jackson et al. [12] study on the importance of the pedicle length measurement in reduction mammoplasty, an average distance of 14 cm from the nipple to the inframammary crease was reported. Smith and Gillen [21] reduced the distance to a range of 8-0 cm while repairing errors of nipple placement in reduction mammoplasty cases. Hammond [9] wrote that the distance from the nipple to the inframammary crease was up to 9 cm or more for taller patients. Our results are similar to those of Lowery [15] and ShaikhNaidu [20], while they are very different from those of Jackson et al. [12]. Though we took age as a factor in our studies, the compared results show that the age of the patient is insignificant in terms of distance from the nipple to the inframammary crease. However, the size of the breast and chest may play a role [9, 19, 23].

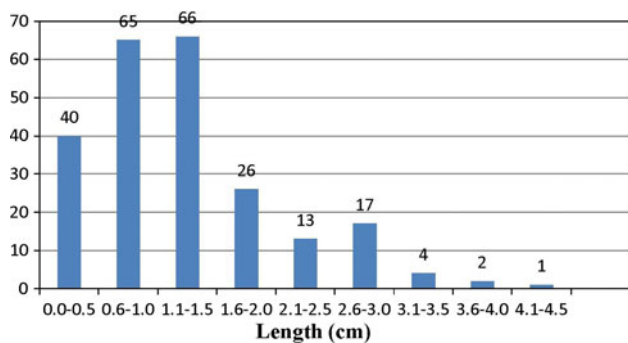
In our study, the average distance from the nipple to the midline in the xiphoid area was 11.0 cm (Fig. 7). Wexler et al. [26] worked with a distance of 11.0 cm on patients



**Fig. 7** Measurements from the left (*E*) and right (*B*) nipples to the midline (*D* and *C*), as explained in Fig. 4

ranging in age from 18 to 47 years; they stated that this distance was very important to avoid a medial shift of the nipple-areola complex during breast reduction. Dilek et al.





**Fig. 8** Asymmetrical differences in distances between the left and right breasts in the xiphoid area (C to D) identified in 234 volunteers, as explained in Fig. 4

[6] reported an average length of 10 cm from their study of Turkish females. Breast reduction and mastopexy complications include problems that develop or become apparent over subsequent weeks, months, or years, including loss of breast symmetry, difference in nipple position, shape, regrowth of breast tissue, or inability to breastfeed [10, 11, 13, 14]. The results support the fact that for young females, during any aesthetic breast surgery, the distance between the nipples to the midline in the xiphoid area should not exceed 11 cm to achieve a successful surgery.

A total of 53.4% (234) of our subjects were found to have an asymmetrical difference in length of the vertical midline between left and right breasts (Fig. 2), with the left breast much longer than the other. The average distance recorded was 1.3 cm (range = 0.5–4.5 cm) as shown in Fig. 8. Again, the average distance from suprasternal notch to nipple, from nipple to inframammary crease, and from nipple to midline in the xiphoid area was slightly greater for the left breast (Table 1). This could be because the left breast is slightly bigger and longer than the right breast.

## Conclusion

From our study we found that breast measurement is vital in preoperative and postoperative evaluation in aesthetic breast surgery and came to the following conclusions: (1) the age of the patient should be taken into consideration for aesthetic breast surgery, especially the distance from suprasternal notch to the nipple; (2) for young females or patients desiring more adolescent proportions, the “normal” distances obtained in this study should be a guideline for surgeons for accuracy in reduction mammoplasty; and (3) the left breast may be slightly larger than the right one.

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**Conflict of interest** The authors have no conflict of interest or financial ties to disclose.

## References

1. Agbenorku P (2001) Breast developmental anomalies. Protocol for investigation and surgical treatments. In: 41st Annual Scientific Conference on the West Africa College of Surgeons (WACS), Nouakchott, Mauritania, pp 28–30 [abstract]
2. Agbenorku P, Addai Mensa L, Boagye G (1998) Juvenile macromastia. Subcutaneous mastectomy with immediate breast reconstruction. A case report. In: Proceedings XXXIst World Congress of the International College of Surgeons, Buenos Aires, Argentina, pp 299–306
3. Agbenorku P, Agbenorku M, Iddi A, Amedvor E, Sepenu R, Osei D, Kyei I (2010) Incidence of breast developmental anomalies: a study at Sogakope, Ghana. *Nig J Plast Surg* 6(1):1–5
4. Bostwick J (1990) Breast augmentation, reduction and mastopexy. In: Jurkiewicz MJ, Krizek TJ, Mathes SJ, Ariyan S (eds) *Plastic surgery principles and practice*. C.V. Mosby, St. Louis, pp 1063–1094
5. Breuning KH, Colwell A (2007) Inferolateral Alloderm Hammock for implant coverage in breast reconstruction. *Ann Plast Surg* 59:250–254
6. Dilek KA, Ahmet CA, Erol B, Hüsamettin T, Oguz T (2010) Anthropometric breast measurement: a study of 385 Turkish female students. *Aesthet Surg J* 30(1):44–50
7. Gamboa-Bobadilla GM (2006) Implant breast reconstruction using acellular dermal matrix. *Ann Plast Surg* 56:22–26
8. Hall JG, Allanson J, Gripp K, Slavotinek A (2003) *Handbook of physical measurements*, 2nd edn. Oxford University Press, Oxford, p 302
9. Hammond DC (2009) *Atlas of aesthetic breast surgery*, 1st edn. Elsevier, New York, pp 27–68
10. Handel N (2006) Secondary mastopexy in the augmented patient: a recipe for disaster. *Plast Reconstr Surg* 118:152–155
11. Hidalgo DA (2007) Y-scar vertical mammoplasty. *Plast Reconstr Surg* 120(7):1749–1754
12. Jackson IT, Bayramicli M, Gupta M, Yavuzer R (1999) Importance of the pedicle length measurement in reduction mammoplasty. *J Plast Reconstr Surg* 104(2):398–400
13. Khan UD (2007) Vertical scar with the bipedicle technique: a modified procedure for breast reduction and mastopexy. *Aesthetic Plast Surg* 31(4):337–342
14. Loustadt HD, Mayer HF, Sarabayouse M (2008) The Owl technique combined with the inferior pedicle in mastopexy. *Aesthetic Plast Surg* 32(1):11–15
15. Lowery JC (1996) Evaluations of aesthetic results in breast reconstruction: an analysis of reliability. *Ann Plast Surg* 36(6):601–606 discussion 607
16. Maliniac JW (1934) *Sculpture in the living*. Lancet Press, New York, p 112
17. Maliniac JW (1950) Breast deformities and their repair. Grune & Stratton, New York, pp 68–72
18. Penn J (1955) Breast reduction. *Br J Plast Surg* 7(4):357–371
19. Rubin JP, Khachi G (2008) Mastopexy after massive weight loss: dermal suspension and selective auto-augmentation. *Clin Plast Surg* 35:123–128

20. ShaikhNaidu N (2004) Determinants of aesthetic satisfaction following TRAM and implant breast reconstruction. *Ann Plast Surg* 52:465–470
21. Smith JW, Gillen FJ (1980) Repairing errors of nipple-areola placement following reduction mammoplasty. *J Aesthet Plast Surg* 4:179–187
22. Smith DJ, Palin WE, Katch VL, Bennett JE (1986) Breast volume and anthropomorphic measurements: normal values. *Plast Reconstr Surg* 78(3):331–335
23. Spear SL, Boehmler JH 4th, Clemens MW (2006) Augmentation/mastopexy: a 3-year review of a single surgeon's practice. *Plast Reconstr Surg* 118(7):136–141
24. Tebbets JB (2005) Augmentation mammoplasty; tissue assessment and planning. In: Spear S, Willey SC, Robb GL, Hammond DC (eds) *Surgery of the breast, principle and art*, 2nd edn. Lippincott, Williams & Wilkins, Philadelphia, pp 1261–1326
25. Westreich M (2008) Anthropomorphic measurement of the breast. In: Shiffman MA (ed) *Breast augmentation: principles and practices*. Springer, Berlin, pp 27–44
26. Wexler MR, Yeschua R, Neuman Z (1977) The McKissock breast reduction. *Aesthetic Plast Surg* 1:229–235