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Anthropometric Breast Measurements: Analysis of the Average Breast in the Mexican Female Population

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Abstract

Introduction: The elements and perception of beauty vary between populations around the world. To obtain better results, surgical techniques should be planned based on anthropometric characteristics of the race, location, and body mass index (BMI). **Objectives:** To determine which are the standard measurements and anatomical proportions of the breast in a healthy Mexican women population. **Materials and Methods:** Female Mexican volunteers between 20 and 60 years of age, without any history of breast illness or breast surgery were studied. Demographic information and standard breast anthropometric measurements were collected manually by one of the authors. For the statistical analysis a Student-T test was performed, and the Pearson correlation coefficient was obtained using the latest version of SPSS software. **Results:** 78 volunteers were included in the analysis. Mean height, weight and BMI were 1.6 m, 68.9 Kg, and 26.6 Kg/m^2 respectively. The mean anthropometric values found were: Supra Sternal notch to nipple distance (SSN:N) 22 cm, Breast volume (BV) 372.6 cm^3, Upper breast pole length (UBPL) 11 cm, Lower Breast Pole length (LBPL) 7.7 cm, Midline to Nipple distance (ML:N) 10.2 cm, Transverse diameter of the Nipple areola complex (NAC-T) 4.1 cm, Height of the Nipple Areola Complex (NAC-H) 4.1 cm, Base of the breast (BB) 13.4 cm, Upper Pole to Lower Pole Ratio (UPP:LPP) 58.9:41.1. A statistically significant difference between Right and left breast was not found. The UPP/ LPP ratio in our population is far different from what is considered internationally aesthetic (45:55). A positive correlation was found between weight/ BMI and SSN:N, BV, BB, ML:N and LBPL. Also between age and SSN:N, LBPL, BV and BB. **Conclusion:** This study sets the Anthropometric

grounds in Mexican population for an objective individual patient analysis and comparison with the female population of this and other nations.

Keywords

Average Breast, Anthropometric Measurements, Mexico, Breast Anthropometric Measurements, Mexico

1. Introduction

The elements and perception of beauty vary between populations around the world. Understanding the aesthetics of the body continues to be a work in progress, demonstrated by the multiple descriptions that have characterized different civilizations for centuries [1]. Since the old days, Greeks, Romans, painters, and sculptors have relied heavily on observation as their main tool to establish the aesthetically pleasing proportions [2].

Plastic Surgery can be defined as the medical specialty where the artistic design and the surgical execution coexist in balance [2]. Therefore, to obtain optimal results, surgical techniques must be based on anthropometric measurements according to race, geographic location, and body mass index.

The female breast represents the center of femininity and constitutes one of the most important physical and psychological elements in a woman. It is characterized by a diverse anatomy that comprises different volumes, width, height, projection, composition, shape, and position in the chest wall.

The mammary gland's appearance is subject to changes due to age, weight variation, physical activity, and concomitant ailments (Poland's syndrome, Breast Cancer, etc.), as well as hormone exposure during puberty, pregnancy, breast feeding and menopause [3]. Because of the variability of this organ, a great amount of skill is needed to plan and predict the results of any procedure.

Breast surgery, in all its areas, represents the number one reason for plastic surgery consultations in the world. It is also the most performed surgery with over 1.6 million cases in 2020 according to the International Society of Aesthetic Plastic Surgery (ISAPS). In Mexico it represents the 2nd cause for plastic surgery consultation and the number one procedure, with over 58 thousand cases per year [4]. Despite its importance in our daily practice, a study that validates breast anthropometric parameters in Mexican population, has not been published yet. Therefore, we lack race-based parameters to objectively guide the preoperative analysis and plan our procedures. For our practice we currently consider the North American and European parameters as the standard.

Published studies have demonstrated anatomical differences between races [5] [6]. For this reason we believe that a surgical procedure and the end results, should not be evaluated with the same parameters in an Asian, European, or Mexican patient. After searching the main international databases, we have no knowledge of any Breast Anthropometric studies performed on Mexican population.

2. Objectives

The objective of this study is to determine which are the standard breast parameters and the anatomical proportions of a healthy Mexican Female breast, sorted by age group (decade) and body mass index (BMI).

Establishing the standard Mexican Female Breast parameters from measurements obtained with this study will aid in obtaining a more predictable and aesthetically pleasing result in our population. Patients subject to breast augmentation, reduction, mastopexy and reconstructive breast surgery, will benefit from this data.

2.1. Materials and Methods

A prospective study obtaining breast measurements in a sample of Mexican female volunteers of the Plastic and Reconstructive Surgery department of the *Hospital Central Sur de Alta Especialidad* (*HCSAE*) was performed.

Measurements were taken in healthy patients with absence of any deformity, during the follicular phase of the menstrual cycle. The inclusion criteria are being Mexican, good health and normal physical development. Excluding criteria are previously diagnosed benign or malignant breast pathology, previous breast surgery, taking any type of hormone treatment, suffering any endocrine illness, pregnancy, lactation or presenting any thorax deformity.

This study was reviewed and approved by the HCSAE's Research and Ethics committee. All the measurements were taken from volunteering women from July to October 2021. The sample size was based on previous similar studies in another population, using simple random sampling. Breast Anthropometric measurements were performed in a total of 100 patients. 22 patients were excluded because they did not fulfill previously mentioned criteria. A total of 78 female Mexican volunteers aged between 20 to 60 years old were considered for this study.

The sample was subdivided by decade of age in 4 groups: 3rd decade, 4th decade, 5th decade > 6th decade of life. And taking into consideration that breast size increases by 20 cc for every kg above the ideal body weight (BMI: 18.5 - 24.9 Kg/m^2), groups were also subdivided by BMI. Demographic information collected included: age, heigh, weight, BMI (Kg/m^2).

Measurements were performed in a warm room, using measuring tape, with the subject standing on their feet in a standard anatomical position. With both arms extended to the level of the hips, palms facing forward. Measurements were first taken by the same researcher (DFS) and then confirmed by other two.

To standardize measurements, first from a front view a horizontal line at the level of the nipples is drawn (Horizontal nipple plane), then a vertical line is drawn from the nipple to the inframammary fold (Lower breast pole length). From a lateral view a horizontal line is drawn at the breaking point where the breast starts from the chest wall (superior breast limit). The upper breast pole is described as the area between the superior breast limit and the horizontal nipple

plane. The lower breast pole is described as the area between the nipple and the Inframammary Fold (IMF). The proportion of each breast pole was established by diving the length of each pole by the sum of the vertical distance, over the breast, between the superior limit and the inframammary fold at the level of the nipple, and then multiplied by 100 (LBPL/(LBPL + UBPL) * 100).

Other breast measurements include: Supra Sternal notch to nipple distance (SSN:N), Breast volume (BV), Upper breast pole length (UBPL), Lower Breast Pole length (LBPL), Midline to Nipple distance (ML:N), Transverse diameter of the Nipple areola complex (NAC-T), Hight of the Nipple Areola Complex (NAC-H), Base of the breast (BB), Breast Height (BH), Upper pole proportion (UPP), Lower pole proportion (IPP) (Table 1).

2.2. Data Analysis

For the statistical analysis the latest version of SPSS software was used. We performed a Student-T test for data comparison and for data correlation, the Pearson correlation coefficient was obtained. All the results are represented in mean ± SD.

3. Results

A total of 78 Mexican female volunteers were included for this prospective study. The group was subdivided by decade of life, in 4 groups: third decade (34), fourth decade (21), fifth decade (11), >sixth decade (12).

The mean values for the demographic variables were height (1.6 m), weight (68.9 kg), BMI (26.6 Kg/m^2) (Table 2).

Table 1. Anthropometric measurements.

SSN:N	Supra Sternal notch to nipple distance
BV	Breast volume
UBPL	Upper Breast pole length (superior limit to nipple distance)
Lbpl	Lower Breast pole length (Nipple to IMF distance)
ML:N	Midline to Nipple distance
NAC-T	Transverse diameter of the Nipple areola complex
NAC-H	Hight of the Nipple Areola Complex
BB	Base of the breast
BH	Breast height
UPP	Upper pole proportion
LPP	Lower pole proportion

Table 2. Volunteer group demographics.

Variable	Weight (kg)	Height (m)	BMI (Kg/m^2)
Value (mean)	66.8	1.61	25.7

Regarding BMI, a continuous increase was observed from the 3rd decade of life group (23.5 Kg/m^2) through the >6th decade of life group (29.5 kg/m^2) (Figure 1). This information is in accord with the data published by the OECD, establishing obesity as one of the most important epidemics in our population, being present 1 in every 3 adults, and resulting in an average decrease in life expectancy of 4.2 years.

The mean anthropometric values found were: SSN:N (22 cm), BV (372.6 cm^3), UBPL (11 cm), LBPL (7.7 cm), ML: N (10.2 cm), NAC-T (4.1 cm), NAC-H (4.1 cm), BB (13.4 cm), BH (18.7), UPP:LPP ratio (58.9:41.1) (Table 3, Table 4) (Figure 2).

Supra sternal notch to nipple distance (SSN:N)

The mean values for supra sternal notch to nipple distance divided by age

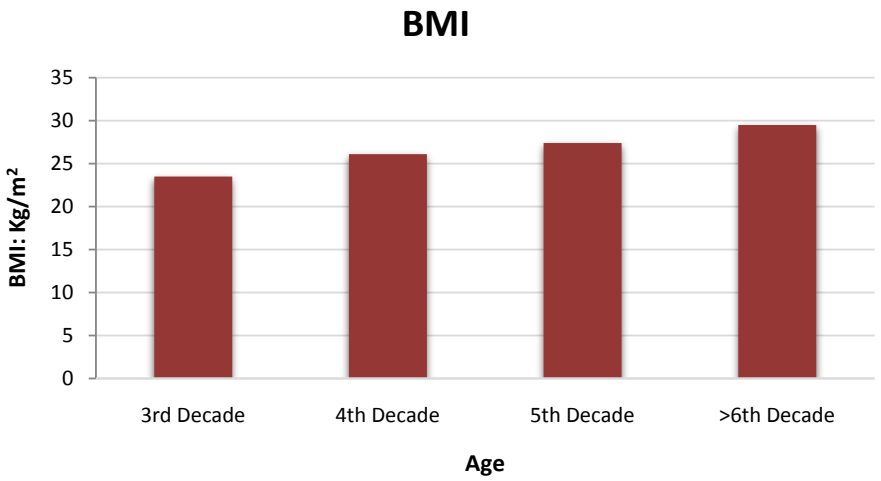

Figure 1. BMI divided by decade in Mexican female volunteer population.

Table 3. Anthropometric measurements of the Mexican female breast.

Measurement	SSN:N	BV	UBPL	LBPL	ML:N	NAC-T	NAC-H	BB	BH	UPP	LPP
Right Breast	21.9 ± 3.6	369.8cc ± 169.0	11.0 ± 2.9	7.7 ± 2.5	10.1 ± 1.1	4.09 ± 1.0	4.1 ± 1.0	13.4 ± 2.4	18.7 ± 4.7	58.9% ± 6.8%	41.0% ± 6.8%
Left Breast	22.1 ± 3.6	375.4cc ± 169.7	11.1 ± 3.0	7.6 ± 2.1	10.3 ± 1.6	4.06 ± 0.9	4.1 ± 1.0	13.4 ± 2.3	18.8 ± 4.3	58.9% ± 7.0%	41.0% ± 7.0%

(Mean ± DS), cm.

Table 4. Mean anthropometric values.

	Right Breast	Left Breast	P
SSN:N	21.9 ± 3.6	22.11 ± 3.6	<0.42
LBPL	7.7 ± 2.5	7.6 ± 2.1	<0.42
ML:N	10.1 ± 1.1	10.3 ± 1.6	<0.21
NAC-T	4.09 ± 1.0	4.06 ± .96	<0.41
BB	13.4 ± 2.4	13.4 ± 2.3	<0.49
BV	369.8 ± 169 cm^3	375.4 ± 169.7 cm^3	<0.41

(Mean ± DS), cm.

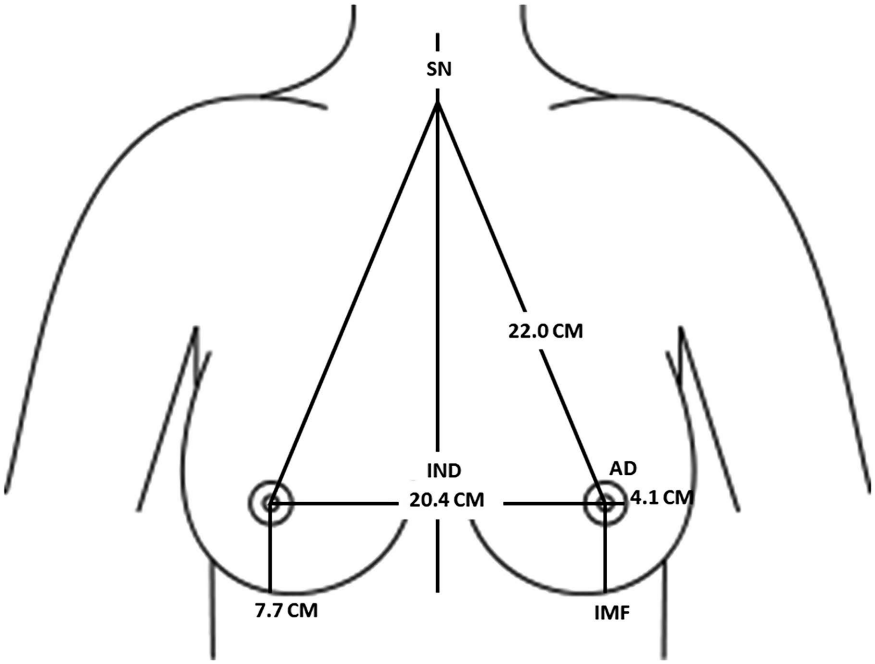

Figure 2. Breast anthropometric measurements. SN, sternal notch; IMF, inframammary fold; IND, internipple distance; and AD, areolar diameter.

group were: 3rd decade of life (R 20.4 cm, L 20.5 cm), Fourth decade of life (R 21.9 cm, L 22.1 cm), Fifth decade of life (R 23.9 cm, L 23.8 cm), >6th decade of life (R 24.6 cm, L 24.9 cm) (**Figure 3**). There was no statistically significant difference between right and left breasts ($p < 0.419$) (**Table 4**). An average increase of 1cm in SSN:N per every 10 years was observed, which correlates with the decrease in strength of Cooper ligaments, increase in weight and fatty changes of the gland associated with age.

Breast Volume (BV)

The mean values for breast volume divided by age group were: 3rd decade of life (R 320.1 cm^3, L 322.9 cm^3), Fourth decade of life (R 347.3 cm^3, L 350.2 cm^3), Fifth decade of life (R 460 cm^3, L 474.5 cm^3), >6th decade of life (R 467 cm^3, L 477.5 cm^3) (**Figure 4**). We found that there is a tendency for the left breast to be larger, regardless of the age group. Nevertheless, this difference is not statistically significant ($p < 0.417951$) (**Table 4**).

Midline to nipple distance (ML:N)

The mean values for Midline to nipple distance divided by age group were: 3rd decade of life (R 9.9 cm, L 10.2 cm), Fourth decade of life (R 10 cm, L 10.4 cm), Fifth decade of life (R 10.4 cm, L 10.9 cm), >6th decade of life (R 10.5 cm, L 9.8 cm) (**Figure 5**). We found a slightly larger midline to nipple distance on the left breasts (R 10.2 cm, L 10.2 cm), nevertheless, this difference is not statistically significant ($p < 0.208$) (**Table 4**).

Nipple Areola Complex width and height (NAC-T & NAC-H)

After measuring width and height of NAC, no difference was found between these two parameters, therefore the subsequent analysis was performed using

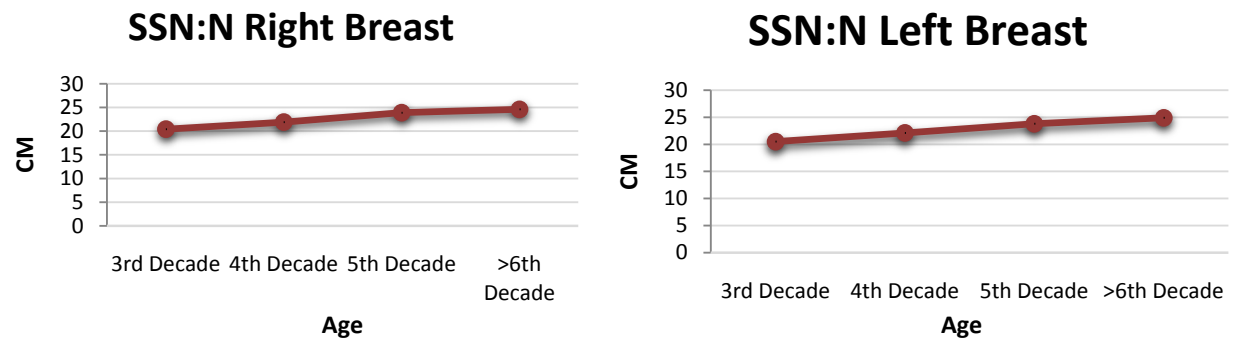

Figure 3. SSN:N supra sternal notch to nipple distance for right and left breasts, divided by decade of life group.

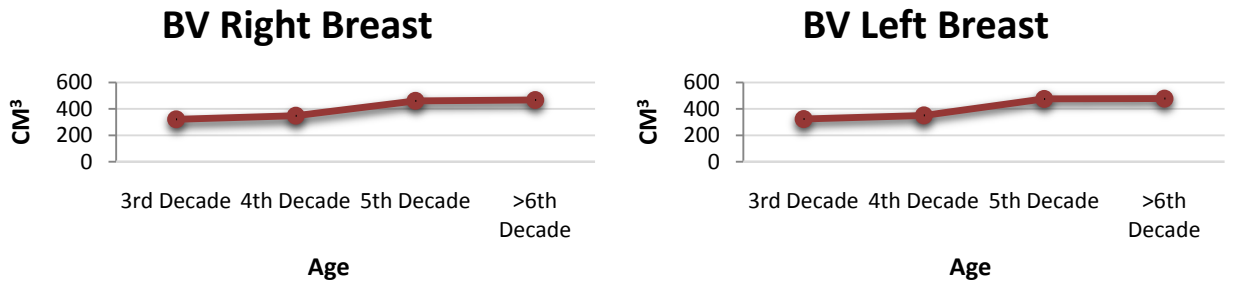

Figure 4. BV breast volume of right and left breasts, divided by decade of life group.

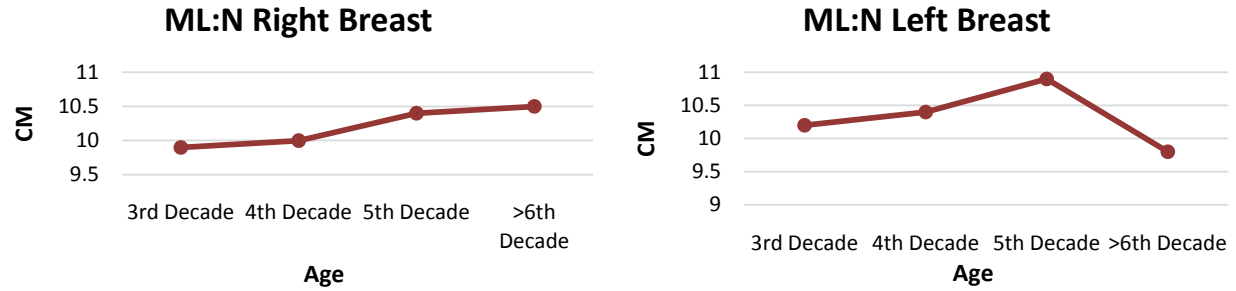

Figure 5. ML:N midline to nipple distance on right and left side breasts.

only one value (Nipple areola complex diameter). The mean values for Nipple areola complex diameter divided by age group were: 3rd decade of life (R 3.9 cm, I 3.9 cm), Fourth decade of life (R 4.1 cm, I 4.2 cm), Fifth decade of life (R 4.4 cm, I 4.3 cm), >6th decade of life (R 3.9 cm, I 3.9 cm) (Figure 6). The mean value established for NAC diameter was 4.1 cm, without any statistically significant difference in age group or side ($p < 0.414$) (Table 4).

Base of the Breast (BB)

The mean values for the Base of the Breast divided by age group were 3rd decade of life (12.6 cm, L 12.6 cm), Fourth decade of life (R 12.7 cm, L 12.8 cm), Fifth decade of life (R 14.9 cm, L 14.7 cm), >6th decade of life (R 14.8 cm, L 15.1 cm) (Figure 7). We found that the average base of the breast in the Mexican population is 13.4 cm, regardless of the side ($p < 0.490$) (Table 4).

Upper Pole to Lower Pole Ratio (UPP/LPP)

The mean values for Upper pole to Lower pole ratio for the group were: Right

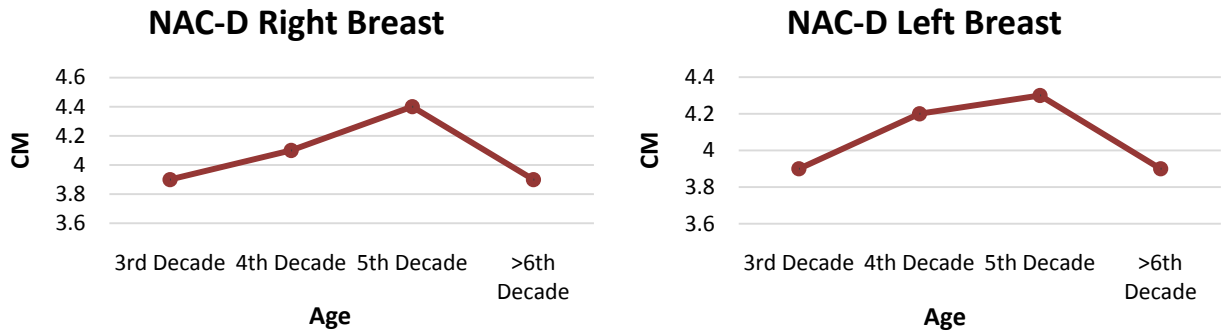

Figure 6. NAC nipple areola complex diameter expressed by decade of life group.

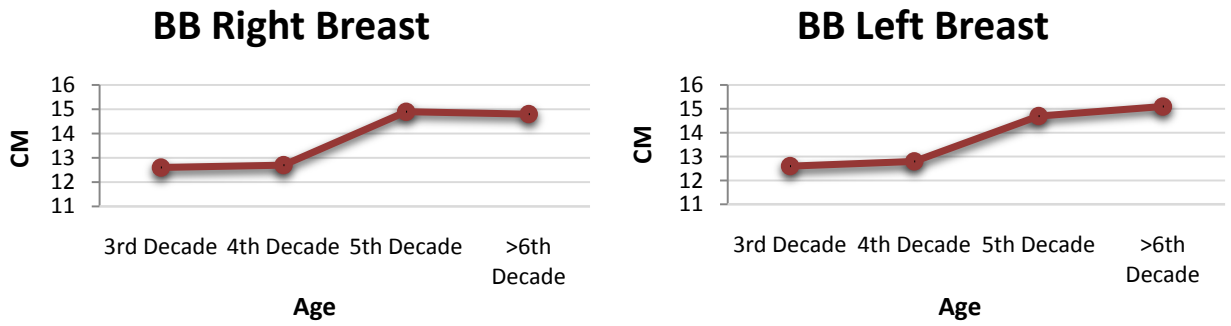

Figure 7. BB base of the Breas right and left side, divided by decade of life.

breast (58.9/41.1), Left breast (58.9/41.0). Then expressed by decade of life were: 3rd decade of life (57.8:42.1), Fourth decade of life (59.6:40.3), Fifth decade of life (57.9:42), >6th decade of life (61.5:38.4). And for the left breast were: 3rd decade of life (57.7:42.2), Fourth decade of life (59.2:40.7), Fifth decade of life (58.3:41.6), >6th decade of life (62.1:37.8) (Figure 8).

After correlating the demographic characteristics (age, weight, BMI, height) with the anthropometric measurements, a positive medium and high correlation was found between weight/BMI and SNN:N, BV and BB. A Low correlation was found between weight/BMI and, ML:N and LBPL. We also found a correlation between age and SSN:N, LBPL, BV and BB. In contrast, no correlation was found between any age and ML:N, or height and any anthropometric measurement (Table 5).

4. Discussion

This study evaluates the mean values of breast anthropometric measurements in a sample of Healthy Mexican Female volunteers, with the objective of establishing reference values for our patient population. Adequate proportions play an important role in the aesthetic aspect of the breast, therefore a proper analysis and planning must be done for surgeons to obtain better results.

There are universally accepted parameters of what is considered an adequate shape and aesthetically ideal proportions [7] [8] [9] [10]. Due to the increase popularity of breast surgery, multiple studies describing the standard anthropometric measurements of different populations of the world, have been published.

Table 5. Correlation between demographic characteristics and anthropometric measurements.

		SSN:N Right	SSN:N Left	ML:N Right	ML:N Left	LBPL Right	LBPL Left	BV Right	BV Left	BB Right	BB Left
Age	**Pearson r**	0.399	0.415	0.176	−0.064	0.223	0.309	0.334	0.361	0.372	0.419
	P Value<	0.00*	0.00*	0.122	0.578	0.050*	0.006*	0.003*	0.001*	0.001*	0.000*
Weight	**Pearson r**	0.6	0.596	0.426	0.289	0.392	0.374	0.516	0.499	0.548	0.541
	P Value<	0.000*	0.000*	0.000*	0.010*	0.000*	0.001*	0.000*	0.000*	0.000*	0.000*
BMI	**Pearson r**	0.623	0.617	0.379	0.265	0.302	0.316	0.522	0.511	0.56	0.545
	P Value<	0.000*	0.000*	0.001*	0.019*	0.007*	0.005*	0.000*	0.000*	0.000*	0.000*
Height	**Pearson r**	0.074	0.082	0.145	0.085	0.226	0.168	0.072	0.058	0.077	0.101
	P Value<	0.519	0.474	0.205	0.461	0.047*	0.141	0.534	0.615	0.501	0.378

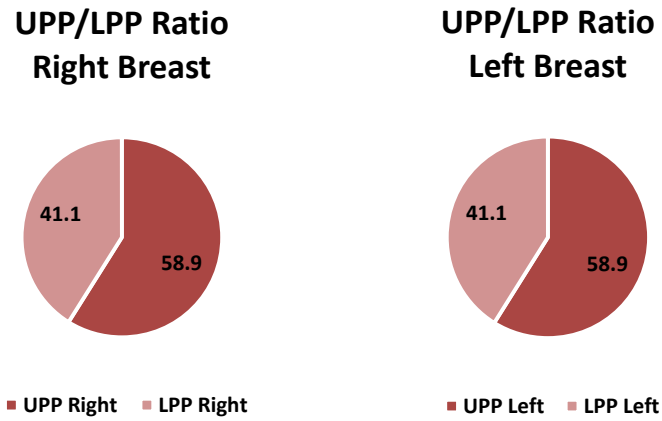

Figure 8. UPP/LPP upper pole to lower pole ratio for right and left breast.

Comparing the values found in this study to the aesthetically ideal breast described by Malluci, we observe that our measurements fall far from what is considered ideal breast proportion [2] [7] (**Table 6**). As mentioned previously this correlates with our findings in everyday practice, where we have detected an important prevalence of tuberous breasts.

An average increase of 1cm in SSN:N per every 10 years was observed, which correlates with the decrease in strength of Cooper ligaments. An average difference of 147 cm^3 in the right breast and 155 cm^3 in the left breast was observed between the 3rd decade and the >6th decade of life group. Breast base showed a slight increment of its value with age, being more dramatic between the 4th and 5th decades of life (2.2 cm Right breast, 2.5 cm Left breast). These results correlate with increase in weight and fatty changes of the gland associated with age. This information should be taken into consideration by the surgeon before performing breast surgery.

We also observed that the Supra Sternal Notch to Nipple distance is slightly larger in our population, regardless of height. This finding supports that we should draw more attention during consultations to identify any degree of ptosis and if so, include a mastopexy procedure in our surgical plan [11] [12] [13] (**Table 7**).

The lower breast pole length was slightly increased, but these findings were not statistically significant, and the Midline to Nipple distance found was within what are considered standard parameters and should not be taken into consideration for surgery, because it remains within standard parameters (9 - 11 cm) [13] [14].

We believe that the findings of this study should be mentioned in the preoperative consultations, for the patient to be aware of what are the reconstructive needs to achieve the best result (**Figure 9**).

While comparing the measurements of our population with those published of other nations and ethnicities, we found differences and similarities. The Nipple Areola Complex diameter was similar to Saudi Arabia and Turkey, but statistically different from Asian and Caucasian patients [3] [4] (**Table 8**).

Regarding SSN:N, the value found for our population was larger than what is considered standard (19 - 21 cm) and in other nation specific studies: Saudi Arabia (19.8 cm), Turkey (19.6 cm) or China (19 cm) (**Table 9**).

Table 6. Breast shape: upper pole/lower pole ratio.

Ideal Proportion	45/55
Mexican Proportion	**59/41**

Table 7. Comparison with standard breast parameters.

	Standard Parameters	Mexican Population
SSN:N	19 - 21 cm	Right 22.7 cm Left 22.8 cm
LBPL	5 - 7 cm	Right 8 cm Left 8 cm
ML:N	9 - 11 cm	Right 10.2 cm Left 10.3 cm

Table 8. Comparison of NAC diameter.

Standard	3.8 - 4.5 cm
Asian	3.2 cm
Caucasian	5.0 cm
Turkey	3.6 cm
Saudi Arabia	4.5 cm
Mexico	**4.1 cm**

Table 9. Comparison of SSN:N.

Standard	19 - 21 cm
China	19.0 cm
Turkey	19.6 cm
Saudi Arabia	19.8 cm
Mexico	**22.0 cm**

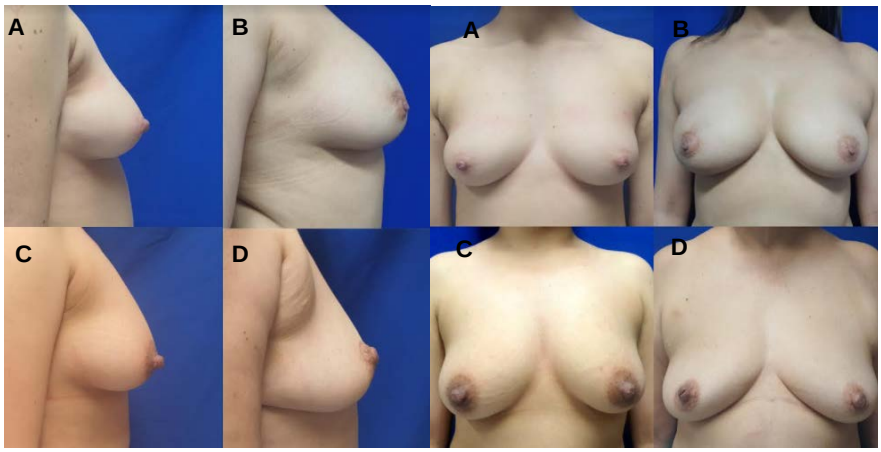

Figure 9. (A) Third decade; (B) Fourth decade; (C) fifth decade; (D) >sixth decade.

This represents a challenge for Plastic Surgeons in Mexico because an increased SNN:N distance in the context of a shorter height in the population, puts our patients at risk of ptosis regardless of the age.

As of now, we believe this data should be considered as the base reference values for the Female Mexican Breast. One the limitation of this study is the size of the sample, for this reason we believe further research including larger samples of the population must be conducted in order to strengthen the results. It is in our plans to continue with this line of investigation and integrate new findings to this study.

5. Conclusions

This study sets the Anthropometric grounds in Mexican population for an objective individual patient analysis and comparison with the female population of this and other nations. It is the first study of its kind in our country.

We believe that the data shown in this study is of great use to Plastic Surgeons interested in breast surgery, who have a large Mexican patient population. These findings are a useful tool to explain the patient, aid the analysis, discuss surgical needs, plan the procedure, and avoid unfavorable results and unhappy patients.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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