Institute of Experimental Morphology, Pathology and Anthropology with Museum
Bulgarian Anatomical Society

Acta morphologica et anthropologica, 29 (1-2)
Sofia ● 2022

# Morphometric Study of Umbilicus Position in a Young Adult Nigcrian Population

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The umbilicus is a prominent feature on the abdominal wall whose position is a determining factor for body proportion among others. The umbilicus position is known to vary across population and genders. Using a sample of young adults in Nigeria, this study was conducted to determine the position of the umbilicus and other related parameters. The round and protruding types of umbilicus were most common in the studied populations. Similarly, most of the participants had their umbilicus located along the midline. Overall there were no significant differences in the umbilicus of males in comparison to those of females. Proper positioning of the umbilicus is essential in maintaining individual identity. However, recognizing its variation across populations, gender and age are the first in achieving the most appropriate position.

*Key words:* umbilicus, umbilicoplasty, abdominoplasty, morphometry, human variation

## Introduction

The umbilicus is a scarred tissue remnant of the umbilical stump that connected an infant to its mother during fetal life [13]. The umbilicus presents centrally in the anterior abdominal wall, but this is an inconstant position, as it may be at a higher or lower position in a small proportion of population [9, 11] or even not at the midline [19] but typically it lies at the high point level of iliac crest, opposite to the disc between third and fourth lumbar vertebrae [10, 20] or it lies matching one of tendinous transverse intersection of rectus abdominis muscle [6].

This variation in the position of the umbilicus becomes more evident between genders, age groups and possibly race. For instance, the umbilicus is more inferiorly placed in men when compared with women and the distance of the iliac crest to the umbilicus is shorter in women specifically due to wider hip in women [21]. In young adults it lies on the level with the disc between the third and fourth lumbar vertebrae and in old individuals it sinks to a lower position [15]. According to Visconti and Salgarello [2] abdominal changes which start before the age of 18 cause initially round-shaped umbilicus to become vertical oval, anchoring of the umbilicus in the deep muscle fascia planes which increases umbilical depth and creation of a horizontal fold after the age of 18. The variation in the position of the umbilicus among different populations and age groups has clinical implications for numerous surgical procedures. This is even more important now that the umbilicus is gaining attention for aesthetics thereby requiring surgical procedures to go around it.

With the variations in the position of the umbilicus in several populations, there is need to determine the position of the umbilicus in the Nigeria population. Therefore, the key objective in this study is to define umbilicus position in Nigerian young adult males and females through morphometric measurements. The study will also characterize other parameters associated with the umbilicus - shape, type, height and width.

## Materials and Methods

This study was an observational, cross-sectional study conducted using 125 adult (50 male and 75 female) volunteers. Ethical clearance was obtained from the ethical committee of the Enugu State University of Science and Technology, Enugu, Nigeria. Participants voluntarily consented to participate in their study as extensive explanations were given.

For collection of umbilicus parameters, the subjects were asked to be in a supine anatomical position and restrict the movement of their abdomen (**Fig. 1**). The following parameters were measured: (A) the distance between the inferior part of the xiphoid process and the center of the umbilicus; (B) the distance between the center of the umbilicus and the upper part of the pubis; (C) the distance between the umbilicus and the right anterior superior iliac spine (ASIS), (c′) distance between the umbilicus and the left anterior superior iliac spine; (D) the distance between the center of the umbilicus and the straight line going through the top of the iliac crests; and (E) the distance between the anterior superior iliac spines. The shape of the umbilicus was noted and recorded. The shape of the umbilicus was described based upon the 6 shapes reported by Delpierre et al [7] namely, T-shaped, vertical oval, horizontal oval, round, deformed, and protruded. Measurement of anatomical landmarks to determine the position of the umbilicus was done using a metric tape. To locate the umbilicus, measurements were taken from the xiphoid process, the middle of upper border of the pubis symphysis and the two central iliac spines. Navel height and width were measured using metric tape and the navel depth was determined using a wooden rod which was inserted, marked and drawn out and measured using a plastic ruler. Other parameters collected from participants included age, height (in cm), weight (in kg), and BMI.

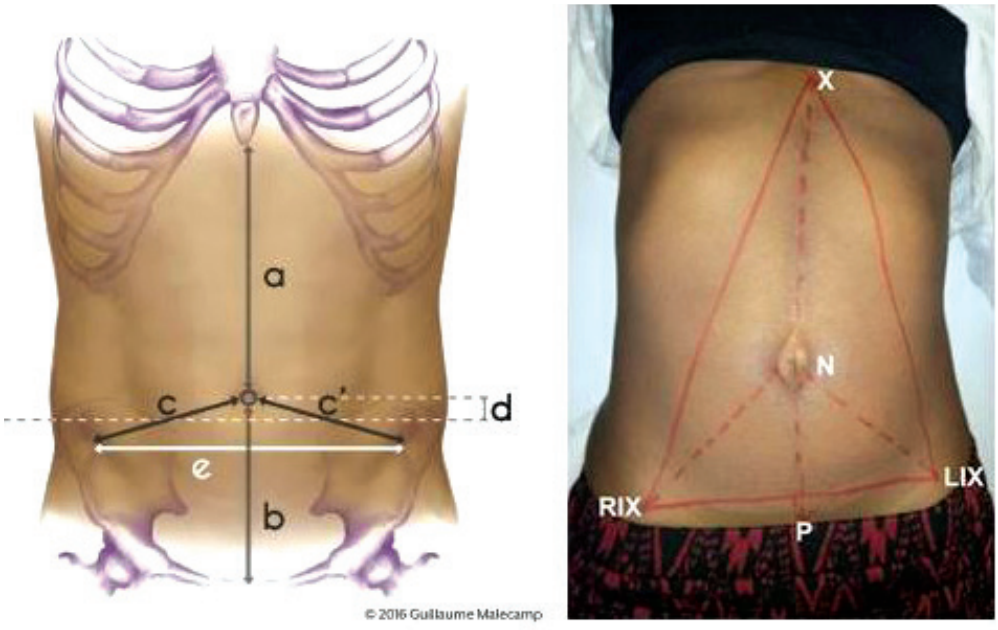


**Fig. 1.** The standardized measures of the umbilicus and anatomical landmarks used in demonstrating the position of the umbilicus

The measurements were in a prepared data collection sheet and later transferred for statistical analysis using Statistical package for social sciences SPSS version 21.0. Statistical analysis performed on the conducted data included measures of central tendency and variability (mean and standard deviation) as well as frequency distribution.

The exclusion criteria were as follows: any abnormality, deformity or lesion of umbilicus, pregnancy or history of pregnancy, intra-abdominal masses, anterior abdominal wall pathologies, and history of abdominal surgery.

## Results

### *Population and measurements*

The study consisted of 125 participants including 50 (40%) males and 75 (60%) females aged between 22 to 26 years. Mean age of the participants was 22.96±3.36 years for males and 21.13±1.64 years for females. Mean height was 174.52 cm, and 165.39 cm in males and females respectively. Males had a mean weight of 70.63 kg while females had 62.18 kg. Males had a mean BMI of 23.36 kg/m$^2$ and 22.69 kg/m$^2$ in females. Mean hip circumference and waist circumference was 48.48 cm and 41.33 cm in males while 68.79 cm and 92.15 cm in females respectively. Both the hip and waist circumference showed statistically significant differences between male and female subjects ($p$ = 0.000). **Table 1** displays the details of these measurements.

**Table 1.** Measurements data

| Parameters | Male (n=50) | | Female (n=75) | | | Total (n=125) | |
|---|---|---|---|---|---|---|---|
| | Mean | ± SD | Mean | ± SD | *P* value | Mean | ± SD |
| **Age (Years)** | 22.96 | 3.36 | 21.13 | 1.64 | .000 | 21.86 | 2.62 |
| **Height (cm)** | 174.52 | 8.02 | 165.39 | 5.57 | .000 | 169.04 | 8.01 |
| **Weight (Kg)** | 70.63 | 10.68 | 62.18 | 10.51 | .000 | 65.56 | 11.33 |
| **BMI (Kg/m²)** | 23.36 | 4.40 | 22.69 | 3.38 | 0.341 | 22.96 | 3.82 |
| **HC (cm)** | 48.48 | 24.53 | 92.15 | 17.09 | .000 | 74.68 | 29.56 |
| **WC (cm)** | 41.33 | 21.52 | 68.79 | 13.65 | .000 | 57.81 | 21.83 |
| **ASIS (cm)** | 22.88 | 2.41 | 22.56 | 2.04 | 0.433 | 22.67 | 2.19 |
| **XP (cm)** | 31.36 | 3.23 | 33.10 | 3.49 | 0.005 | 32.41 | 3.48 |
| **XU (cm)** | 22.01 | 2.89 | 22.15 | 3.06 | 0.796 | 22.09 | 2.98 |
| **LIU (cm)** | 14.33 | 1.62 | 15.26 | 4.67 | 0.173 | 14.89 | 3.73 |
| **RIU (cm)** | 14.78 | 1.74 | 14.67 | 2.10 | 0.807 | 14.72 | 2.56 |
| **LIX (cm)** | 31.97 | 3.39 | 31.39 | 4.09 | 0.407 | 31.62 | 3.82 |
| **RIX (cm)** | 32.30 | 3.45 | 31.49 | 4.65 | 0.297 | 31.81 | 4.21 |

Abbreviations: BMI=Body Mass Index; SD=Standard Deviation; HC=Hip Circumference, WC=Waist Circumference, ASIS=Anterior Superior iliac spine, XP=Xiphisternum to Pubis, XU=Xiphisternum to Navel, LIU=Left anterior iliac spine, RIU=Right anterior iliac spine, LIX=Left iliac spine to Xiphisternum, RIX=Right iliac spine to Xiphisternum. *P*-value≤0.005

## *Umbilicus Position*

The vertical distance from the lower border of the xiphisternum to the umbilicus process (XU) was 22.01±2.89 cm in males and 22.15±3.06 cm in females while the distance from the lower border of the xiphisternum to the upper border of the pubis (XP) was 31.36± 3.23 cm for males, 33.10± 3.49 cm for females denoting a ratio of XU:XP of 70.18% in males and 66.14% in females. The subjects all together had an XU:XP ratio of 68.16%.

## *Umbilicus Type and dimensions*

With respect to the umbilicus type, the round type was predominant in females (25.6%) followed by the protruding umbilicus type (18.4%). On the contrary, in males the predominant umbilicus type was the protruding type (19.2%) followed by the round type (16.8%). A significant difference was noted between the umbilicus depth of males and females ($p$ =0.000). Overall, the most common umbilicus types in the subjects were the round type (42.4%) and protruding type (37.6%). Umbilicus height, width and depth in the subjects put together were 2.88±0.62 cm, 2.92±0.83 cm and 1.53±0.97 cm respectively. Further details of the umbilicus type and dimensions are shown in **Fig. 2** and **Table 2**.

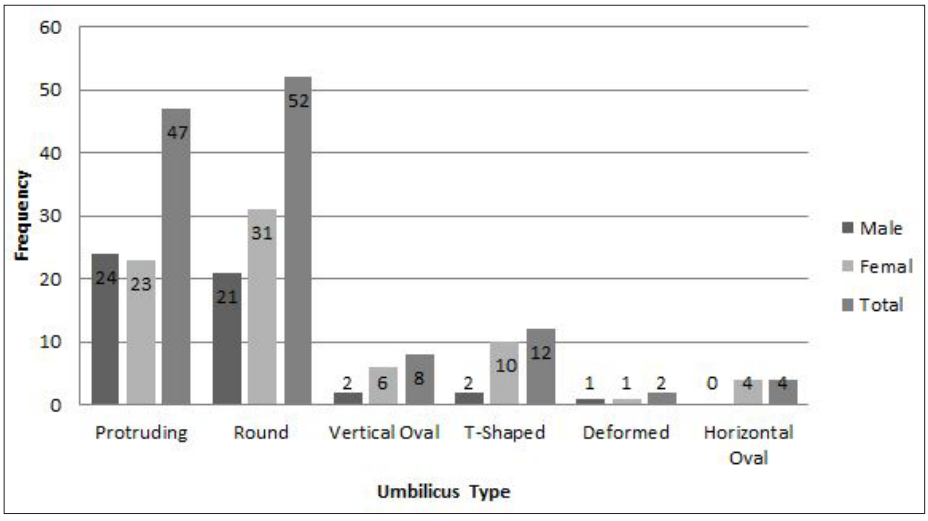


**Fig. 2.** Distribution of umbilicus types

**Table 2.** Mean Distribution of Various Measurements around the Umbilicus Based on Gender

| | **Male (n=50)** | | **Female (n=75)** | | | **Total (n=125)** | |
|---|---|---|---|---|---|---|---|
| | **Mean** | ± SD | **Mean** | ± SD | ***p* Value** | **Mean** | ± SD |
| **Umbilicus Height (cm)** | 2.82 | 0.63 | 2.92 | 0.61 | 0.335 | 2.88 | 0.62 |
| **Umbilicus Width (cm)** | 2.81 | 0.66 | 2.99 | 0.93 | 0.216 | 2.92 | 0.83 |
| **Umbilicus Depth (cm)** | 0.96 | 0.55 | 1.91 | 1.01 | 0.000 | 1.53 | 0.97 |

*p*-value=0.005

## *Umbilicus Midline Positioning*

Measurement of the position of the umbilicus relative to a line extending from the center of the sternal notch found that the umbilicus was central in 72% of the subjects and lateralized to the right and left in 11.2% and 16.8% subjects respectively. Of these 44% females of the subjects were central while only 28% of males were central. **Fig. 3** displays further details of these.

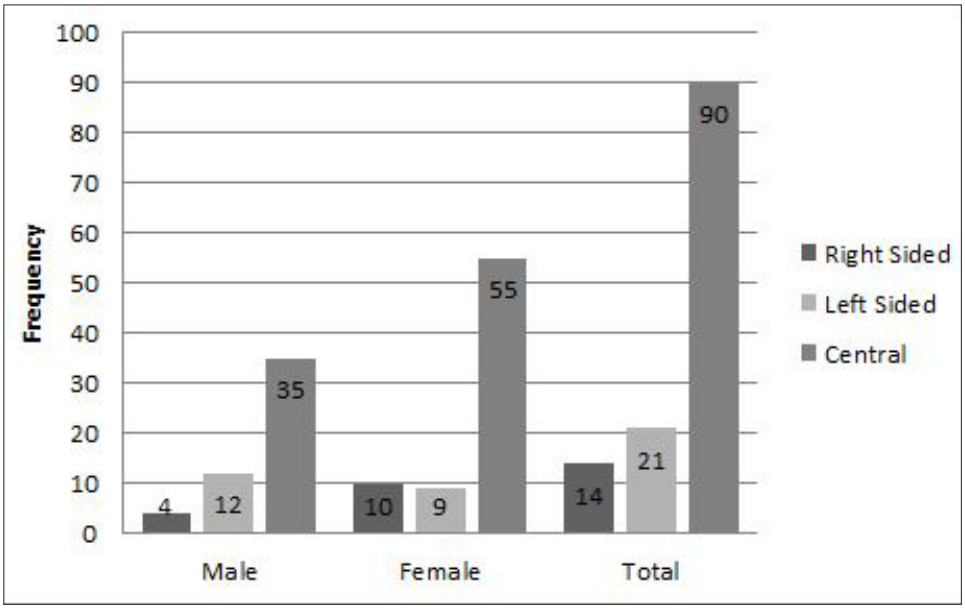


**Fig. 3.** Distribution of midline positioning of the umbilicus

## Discussion

This study was set out to characterize the umbilicus in terms of position, shape and its dimensions in a population of young Nigerians. This information is useful for abdominoplasty and umbilicoplasty planning without which reconstruction of the umbilicus may not be appealing [4]. According to Craig et al [5] the size, shape and location of the umbilicus contribute to an ideal umbilicus. Şentürk et al [18] noted that a normal umbilicus is located on the cranial tangential line of the bilateral iliac crest and the median line of the abdominal wall. On the basis of shape, Choudhary and Taams [3] identified as the ideal. Opinions differ as to what an ideal umbilicus is. The aesthetic nature of the umbilicus however cannot be disputed. Philosophers and artists refer to the ideal proportion of umbilicus height versus body weight as the Golden ratio, also called the Divine proportion. That is, an ideal umbilicus height is about 62% of the body height and is said to exhibit a special beauty as the legs and torso appear in sound proportion [6].

The findings of this study contrast that of Yu et al [21] where the umbilicus was located more inferiorly in men compared to women. This study also affirms like most other studies that the umbilicus is not always in the midline [8, 12, 16]. Rohrich et al [17] reported up to 80% laterality of the umbilicus in their own study. Craig et al [5] photographed 147 women a round umbilicus with superior hooding (T-shaped) was present in 37%, oval shape in 22%, linear in 17%, and horizontal in 14%. The remaining 10% were distorted. Lee et al [14] assessed the umbilical position on photographs and they a ratio of xiphoid-umbilicus-pubic symphysis of 46:54. Their results differ from the present study where the same ratio was closer to the 62% proposed by Davari et al [6] as being ideal. It also affirms the variability of the umbilicus as proposed by Catteau [1].

## Conclusion

The umbilicus is a prominent landmark on the anterior abdominal wall and its appearance is influenced by many factors. Knowing where the umbilicus is placed is critical for the reconstruction of the umbilicus to maintain its aesthetic nature. In every clime, the plastic surgeon needs this evidenced based approach to benchmark their techniques and self-assessment to provide patients with acceptable results.

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