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Transviginal Ultrasound Assessment of Normal Ovarian Volume among Women of Reproductive Age in Jos, Nigeria

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Authors' contributions

This work was carried out in collaboration between all authors. Author SMD designed the study, wrote the protocol, wrote the first draft of the manuscript, managed the literature searches and data analysis and interpretation. Author POI managed the critical revision of the article. Author AJS was involved in data collection. All authors read and approved the final manuscript.

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ABSTRACT

Objective: This study was to evaluate the normal ovarian volume among women of reproductive age using transvaginal ultrasound and correlating it with different age groups, parity and BMI.
Methodology: A hospital-based cross-sectional descriptive study. The data were obtained from 347 selected clinically and sonographically healthy non pregnant women. Sonographic examination was done using LOGIC 5 machine fitted with a 7.5 MHz transvaginal transducer. The right and left ovarian volume of each patient was measured. The mean ovarian volume was classified into five different age groups, four categories of BMI as well as different parities and the results were analyzed.
Results: The mean ovarian volume was 7.9±2.1 cm^3. The average volumes of the left and right ovaries were 8.0±2.0 cm^3 and 7.7±2.2 cm^3 respectively. Statistical significant difference between the left and the right mean ovarian volume was noted (p=0.00). Ovarian volume showed a trend of

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decline after reaching its peak at the second decade of life. Negative correlation was shown between ovarian volume and parity (p=0.02). There was no statistical significant difference in ovarian volume related to BMI (p=0.74).
Conclusion: These values represent the normal average ovarian volume for the local population.

Keywords: Reproductive; ovary; parity; BMI; transvaginal ultrasound.

1. INTRODUCTION

Transvaginal ultrasound of the female pelvis is a common investigative procedure and has the advantage of being a non-ionizing, quick procedure and relatively cheap with a relatively high level of accuracy. Ultrasonography is the most common and most useful method to image the ovary. Other imaging modality is Magnetic Resonance Imaging (MRI) which give information on size, shape, and site [1]. Apart from being more expensive and not readily available in this environment, it takes relatively longer time to acquire images than ultrasonography. This gives ultrasonography an edge in imaging of the pelvis [2].

It is fundamental to any screening program as a single modality or in conjunction with serum tumor markers for detection of ovarian cancer. Furthermore, the qualities of the ultrasound images are comparable to those of CT and MRI. Evidence exists that the ovary is one of the contributing factors to infertility, maternal morbidity and mortality in the world [3].

Accurate measurement of normal ovarian variables is essential to determine parameters of abnormality. For example, malignant ovarian neoplasia may be detected by changes in ovarian morphology or volume [4]. There are generally few studies evaluating ovarian volume in Nigeria especially using the transvaginal approach. Hence, it is necessary to determine the normal range of ovarian volume in the reproductive age women in our locality.

The purpose of this study was to evaluate the normal ovarian volume amongst women of reproductive age using transvaginal ultrasound and to correlate it with different age groups, parity and BMI.

2. MATERIALS AND METHODS

The research was a hospital-based cross-sectional descriptive study that was carried out from January 2012 to September 2013 at the Radiology Department of Jos University Teaching Hospital (JUTH), Plateau state of Nigeria. Cochran statistical formula ($n=Z^2pq/d^2$) [5] was used to estimate the sample size. 347 women in their reproductive age made up of normal non pregnant women who were referred from the General Out Patient Department and other clinics of the Jos University Teaching Hospital for abdominal ultrasonographic scan who were not on any oral contraceptives or any other drugs that affect ovarian size were consecutively recruited. All cases with clinical indications of ovarian pathology and menstrual disorders were excluded from the study. Subjects who had no indication of ovarian disease or pelvic abnormalities, but who during the scanning procedure revealed pathology were excluded based on the ultrasonographic findings. Subjects on oral contraceptive pills, injectables or ovulation induction drugs were also excluded from the study. So also were subjects who had IUCD insitu or those who were unwilling to participate.

Endovaginal ultrasound was performed in a private cubicle. With an empty bladder, the participants were examined on a flat couch in supine position with the knees flexed and the hip joints also flexed and abducted. In difficult cases, a pillow was placed beneath the subject buttocks in order to facilitate the introduction and manipulation of the transducer for improve images. All examinations were performed using LOGIC 5, a real time (General Electric) ultrasound machine fitted with a 7.5MHz endovaginal transducer. The length of the ovary was obtained on the longitudinal plane, while the transverse plane of the ovary was used to measure the width and Antero-posterior dimensions (Fig. 1). The sonographic scan was carried out randomly at different menstrual phase for the participants. The body mass index (BMI) in Kilogram/meter square (Kg/m^2) [6] was calculated from the weight and height [2]. The age, body mass index (BMI) and parity of the participants were recorded. The ultrasonographic scan was done by single observer at a time.

The study protocol was approved by the local Ethics Committee of the Jos University Teaching

Hospital. Written informed consent was obtained from each participant after detailed explanation of the nature of the study.

The ovaries were classified into left and right. EPI INFO statistical software version 3.5.4 was used to analyze the data, T-test was employed to evaluate the mean difference between the right and left ovaries while Pearson correlation was used to assess the relationship between the age, parity and mean (right and left ovarian) volume. P.<0.05 was considered statistically significant. The results were presented in the form of tables and charts. Age in years was broken down into five (5) age groups: (≤19), (20-29), (30-39), (40-49), (50-59), (60-69), (70-79) and (80-89). Parity was grouped into nulliparous, multiparous and grand multiparous, while BMI in kg/m^2 was classified into four (4) underweight, normal, overweight and obese (Table 1).

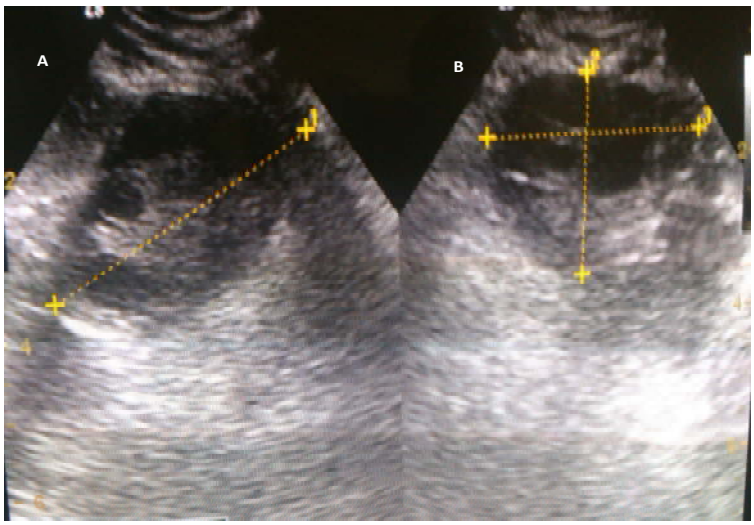

Fig. 1. Transviginal sonogram of the ovary demonstrating the length on the longitudinal plane (A) and the width as well as the antero-posterior dimensions on the transverse plane of the ovary (B)

Table 1. Ovarian volume of reproductive women in relation to age, parity and BMI

Item	N	Ovarian volume					
		Right			Left		
		Mean±SD	P	Range	Mean±SD	P	Range
Age							
≤19	28	8.07±2.11	0.000	4.97-12.40	8.13±1.92	0.000	4.34-12.40
20-29	157	8.26±2.07		4.91-17.39	8.46±1.96		2.55-15.88
30-39	111	7.38±1.93		2.17-12.49	7.73±1.76		4.35-12.97
40-49	50	6.59±2.38		3.30-14.97	6.97±1.93		3.44-12.64
50-59	1	4.41±0.00		4.41-4.41	4.30±0.00		4.30-4.30
Total	347	7.71±2.16		2.17-17.39	7.98±1.96		2.55-15.88
Parity							
Nulliparous	154	8.074±2.09	0.004	2.17-15.26	8.17±1.86	0.018	2.55-13.04
Multiparous	154	7.54±2.19		4.25-17.39	7.99±2.05		4.35-15.88
Grand multiparous	39	6.95±2.08		3.30-11.80	7.18±1.85		3.44-11.62
Total	347	7.71±2.16		2.17-17.39	7.98±1.96		2.55-15.88
BMI							
Underweight	11	7.66±1.25	0.024	6.21-10.38	8.17±1.86	0.049	2.55-13.04
Normal	157	8.19±2.88		2.17-27.80	7.99±2.05		4.35-15.88
Overweight	116	7.63±2.06		4.42-14.92	7.18±1.85		3.44-11.62
Obese	62	7.09±2.29		3.30-14.97	7.98±1.96		2.55-15.88
Total	347	7.71±2.16		2.17-17.39	7.98±1.96		2.55-15.88

3. RESULTS

A total of 347 women were recruited. The means of their age, parity, and BMI were, 29.3±7.0 years, 1.8±2.1 and 25.7±4.7 kg/m^2 respectively (Table 2). The mean ovarian volume of the study population was 7.9±2.1 cm^3 (range 3.4-17.4 cm^3). The mean volumes of the left and right ovaries were 8.0±2.0 cm^3 and 7.7±2.2 cm^3 respectively. The mean left ovarian volume (LOV) was greater than that of the right (ROV), this difference was statistically significant with a P value of 0.00 (Table 3).

Table 1 shows the values of ovarian volume at different age groups for the study population. There was a slight increase in ovarian volume from the age groups ≤19 and 20-29 years, followed by a gradual decline in the mean ovarian volume from the age groups 20-29 and 30-39; 30-39 and 40-49 years with marked decline in ovarian volume between the age groups 40-49 years and 50-59 years. The ovarian volume reaches it peak in women within the age group 20-29 (8.5 cm^3) while the lowest ovarian volume (3.1 cm^3) was noted in women of age group 50-59 years. Marked decline in the mean ovarian volume was noted between the age groups 40-49 and 50-59 years.

Table 1 demonstrates the mean ovarian volume according to different parity as well as the classes of BMI.

The ovarian volume showed statistically significant negative correlation with age (r= -0.55, p=0.00). Similarly, ovarian volume was negatively correlated with parity (r=-0.13, *P*=0.02). However, no correlation was noted between ovarian volume and BMI (r=0.02, *P*=0.74) as shown in Table 4.

Table 2. Demographic characteristics of subject

Parameters	Mean±SD	Range
Age (years)	29.26±7.03	15-48
BMI (kg/m^2)	25.74±4.65	14.52-38.54
Parity	1.76±2.13	0-10

4. DISCUSSION

Our result indicates that the mean left and right ovarian volumes were 8.0±2.0 cm^3 and 7.7±2.2 cm^3 respectively, with a mean of 7.9±2.1 cm^3. These values are similar to that reported by Mohammed et al. [7] in Makurdi, North central Nigeria. Eze et al. [8] from South East Nigeria and Nwankwo et al. [9] from South South Nigeria in separate studies reported slightly higher values of mean ovarian volumes of 9.9 cm^3 and 9.8 cm^3 respectively. Our result is also similar to studies carried out by Oppermann et al. [10] in Brazil and Van Nagell et al. [11] in America.

There was significant difference between the left and the right ovarian volumes (p<0.00). This is in agreement with Nwankwo et al. [9]. However, this finding is at variance with that of Eddy et al. [12] who found no statistical difference between the left and right ovarian volume.

Correlation of ovarian volume with age showed a significant negative correlation (r= -0.55, *P*=0.00). The mean ovarian volume peaked among the age group 20-29 years, then subsequently declines gradually over the age groups 30-39 and 40-49 years. The decline in these age groups is less than 1.0 cm^3 in each decade of life while a sharp decline in ovarian volume (>2.0 cm^3) was recorded between the age groups 40-49 and 50-59 years. The sharp drop in ovarian volume noted in the perimenopausal age is due to hormonal changes that occur during menopausal transition. This indicates that the peak age of reproduction is at the second and third decades of life. This trend was also reported by Cohen et al. [13] and Nwankwo et al. [9]. The decline of ovarian volume with age could be due to the decrease in the number of follicles associated with menopausal transition [14], changes in local blood supply, and ovarian aging are probably related to the progressively smaller ovarian volume after menopause [10]. Contrary to our finding, Christensen et al. [15] determined the ovarian volume in 428 women aged 14 to 45 years who contacted a family planning clinic in Brazil and found no correlation between ovarian volume and age.

Our data demonstrated a negative correlation between ovarian volume and parity (r=-0.13, *P*=0.02). This could be due to the fact that with increasing parity, there is advancement in age which consequently led to a waning ovarian function. This finding supports the work by Goswamy et al. [16]. In contrast, Merz et al. [17], reported that parity had no effect on ovarian volume.

As described by Cohen et al. [13] and Christensen et al. [15], and also observed in our study, ovarian volume does not seem to be related to BMI (r= 0.02, *P*= 0.74).

Table 3. Means and SD of ovarian volume

Rt ovary		Lt ovary		P	Rt + Lt ovaries	
Mean SD	Range	Mean SD	Range		Mean SD	Range
7.71±2.16	2.17-17.39	7.97±1.96	2.55-15.88	0.000	7.88±2.09	3.37-17.39

Table 4. Correlation of ovarian volume with age

Parameters	Ovarian volume correlation coefficient (r)	P
Age	-0.55	0.00
Parity	-0.13	0.02
BMI	0.02	0.74

Though we did not correlate mean ovarian volume with menstrual cycle. Other authors [10,13] did not observe a statistical difference in ovarian size in terms of menstrual cycle phase. Taken these studies together, the data suggest that menstrual cycle should not be a concern when transvaginal ultrasound is performed for screening of ovarian volume [10]. Variant to these findings, other authors [7,8] reported a positive correlation between ovarian volume and menstrual phase.

5. CONCLUSION

We have presented a data of the normal ovarian volume in reproductive age women and the changes that occur in each decade of life. This data may provide a normogram of ovarian volume in our locality for reference and in management of ovarian pathologies and infertility. Our data indicates that age exerts an influence on ovarian volume. We suggest that the current standard measurements of ovarian volume by transvaginal ultrasound should be reevaluated to document the ovarian volume in the different menstrual phases for each cycling woman.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Stephanie R, Mitchelle M, Stephen E. The ovaries. In anatomy for diagnostic imaging. 3rd ed. Saunders. Edinburgh. 2011;243-247.
2. Sutton D, John M, Katherine M (editors). Obstetric technique and gynaecological imaging: In Textbook of Radiology and Imaging. 7th ed, Volume 11. Edinburgh. Churchill Livingstone. 2002;1039-1069.
3. Keith ED. Editor: Siladitya B. Infertility: In DewHurst: Text Book of Obstetrics and Gynecology. 7th ed. Blackwell. Massachusetts. 2007;149-158.
4. Higgins RV, van Nagell JR, Woods CH, Thompson EA, Kryscio RJ. Interobserver variation in ovarian measurements using transvaginal sonography. Gynecol Oncol. 1990;39:69-71.
5. Cochran WG. Sampling techniques. John Wiley & Sons: New York. 1977;74-76.
6. Evans EM, Sauders MJ, Spano MA, Amgrimsson SA, Lewis RD, Cureton KJ. Body-composition changes in diet and exercise in obese women; a comparison of estimates from clinical methods and a 4-component model. Am. J. Clin. Nutr. 1999;70:5-12.
7. Mohammad H, Ngwan SD, Utoo BT, Swende TZ. Transvaginal ultrasound evaluation of ovarian volume among normal adults in Makurdi, North-Central Nigeria. J. Reprod. Biol. Health. 2013;1:1-3.
8. Eze J, Ugwu AC, Nzotta C. Sonographic quantification of ovarian volume in an adult Nigeria population. J. Med. Update. 2009;4:1.
9. Nwankwo NC, Madufuro CO. Transvaginal ultrasound measurement of ovarian volume in Port Harcourt. J. Med. Med. Sci. 2011;2:1080-1084.
10. Oppermann K, Fuchs SC, Spritzer PM. Ovarian volume in pre and perimenopausal women a population based study. NCBI resource menopause. 2003;10:309-313.
11. Van Nagell JR Jr, Higgins RV, Donaldson ES, Gallion HH, Powell DE, Pavlik EJ, et al. Transvaginal sonography as a screening method for ovarian cancer. Cancer. 1990;65:573.
12. Eddy CS, Stephanie M, Rita F. A study to assess the normal values of ovarian volume for women in Singapore using transabdominal ultrasound. The Internet Reseach SGH Proceedings. 2004;13:3-4.
13. Cohen HL, Tice HM, Mandel FS. Ovarian volume measured by US: Bigger than we think. Radiology. 1990;177:189-192.

14. Burger H. The inhibins and the menopausal transition. Gynecol. Endocrinol. 1999;13:55-56.
15. Christensen JT, Boldsen J, Westergard JG. Ovarian Volume in gynaecologically healthy women using no contraception or using IUD or oral contraception. Am. J. Obstet Gynaecol. 1997;76:784-789.
16. Goswamy R, Campbell S, Whitehead M. Screening for ovarian cancer. Clin Obstet Gynecol. 1983;10:621-643.
17. Merz E, Miric-Tesanic D, Bahlmann F, Weber G and Wellek S. Sonographic size of uterus and ovaries in pre- and postmenopausal women. Ultrasound Obstet Gynecol. 1996;7:38-42. | Article | PubMed

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