Journal of Health and Rehabilitation Research 2791-156X JHRR

For contributions to JHRR, contact at email: editor@jhrlmc.com

Original Article

Role of Ovarian Volume in Fertile and Infertile Women by Sonography at Swabi

Qurat Ul Ain[1], Khalood Zahir[1], Maaz Khan[1]*, Sara Batool[1], Haseena Khan[1], Omama Saeed[1], Ayesha Israr[1], Amina[1], Muhammad Zubair[1]

[1]Department of Medical Imaging Technology, Women University Swabi, KP, Pakistan.

Corresponding Author: Maaz Khan; Email: maaz6806@gmail.com

Conflict of Interest: None.

Ain QU., et al. (2024). 4(2): DOI: https://doi.org/10.61919/jhrr.v4i2.1024

ABSTRACT

Background: The measurement of ovarian volume via sonography is an important parameter in assessing ovarian aging and defining fertility potential in women. In the Swabi region, where advanced medical facilities are limited, measuring ovarian volume could be particularly useful for diagnosing fertility issues. This cross-sectional study investigates the relationship between ovarian size and female fertility among women in Swabi.

Objective: To evaluate the role of ovarian volume in distinguishing between fertile and infertile women in the Swabi district using ultrasound.

Methods: A cross-sectional study was conducted at the Department of Radiology, Mahaban Medical and Research Hospital, Swabi, Khyber-Pakhtunkhwa, Pakistan. A total of 101 participants were recruited from community health clinics using convenience sampling. Data on demographic characteristics, medical history, and menstrual cycle regularity were collected via standardized questionnaires. Ovarian dimensions were measured by trained personnel using transvaginal sonography (TVUS), which provided accurate and reproducible results. Descriptive statistics, including means, standard deviations, and percentages, were calculated for variables such as age, ovarian measurements, and fertility status. Cross-tabulation was used to classify participants based on fertility status and menstrual cycle regularity. Correlation tables were generated to examine the interrelationship between fertility status and cycle regularity. Data analysis was performed using the Statistical Software for Social Sciences (SPSS version 25.0).

Results: The average age of participants was 28.52 years (SD = 5.08). The mean ovarian volumes for the right and left ovaries were 6.66 cm^3 (SD = 3.28) and 7.46 cm^3 (SD = 4.26), respectively. Among the participants, 62 were fertile, and 39 were infertile. Fertile participants had slightly higher mean ovarian measurements (right ovary: 6.90 cm^3, left ovary: 7.19 cm^3) compared to infertile participants (right ovary: 6.29 cm^3, left ovary: 7.89 cm^3). The regularity of menstrual cycles did not significantly differ between fertile and infertile women, with 31 fertile participants having regular cycles and 31 having irregular cycles.

Conclusion: The study found that fertile women had slightly higher ovarian volumes compared to infertile women. However, menstrual cycle regularity did not differ significantly between the two groups. These findings suggest that while ovarian volume may be a useful indicator of fertility, menstrual cycle regularity alone is not a reliable predictor of fertility status in this cohort.

Keywords: Ovarian volume, fertility status, reproductive health, infertility, ultrasound, ovarian reserve.

INTRODUCTION

The ovaries, small glandular organs located on either side of the uterus, play a crucial role in female reproduction by producing eggs and hormones (1). Measuring ovarian volume via sonography has emerged as a straightforward and sensitive method to indirectly assess ovarian reserve, which is vital for evaluating and treating reproductive functions, including puberty and adult fertility (2). The ovaries are responsible for the production of gametes and sex hormones and maintain the pool of non-growing follicles (NGFs), supporting the maturation and release of eggs necessary for pregnancy over several decades. The primary components of the ovary, such as the follicle endowment—comprising active and inactive follicles—and the stroma, are essential for normal ovarian function (3). The stock of immature follicles is established during fetal life and continuously diminishes until menopause, leaving fewer than 1,000 follicles (4).

© 2024 et al. Open access under Creative Commons by License. Free use and distribution with proper citation.

Journal of Health and Rehabilitation Research 2791-156X JHRR

Infertility, characterized by the inability to conceive after at least 12 months of regular, unprotected sexual intercourse, varies globally. According to the World Health Organization (WHO), approximately 5% of reproductive-age couples currently face infertility issues worldwide (2). Various diagnostic tests are employed to evaluate fertility, with ovarian volume measurement being increasingly utilized (5). The physical dimensions of the ovaries, which are typically around 4x2x1 cm, can vary due to factors such as age and health. Ovarian volume assessment is highly accurate in predicting ovarian response and is reproducible with low inter- and intra-observer variability. Ultrasound, both transabdominal (TAU) and transvaginal (TVUS), is commonly used for this purpose. The formula for an ellipsoid (0.52 times the length, height, and width of the ovary in centimeters) is applied to estimate ovarian volume, which has shown a good correlation with volumetric (3-D) ultrasonography (6-8).

The follicles at different stages of growth constitute a significant part of the ovarian volume. As women age, the number of follicles declines due to follicular atresia, resulting in a decrease in ovarian size (9-13). Ultrasound scanning of ovaries has become an indispensable tool in infertility clinics worldwide. Transvaginal ultrasound, in particular, offers high-resolution imaging, allowing visualization of follicles as small as 5 mm. This technique has proven to be more accurate than transabdominal ultrasonography, which can visualize follicles as small as 1 cm (5). Fertility decreases with maternal age due to the diminishing number of primordial follicles. It is estimated that at the onset of menarche, ovarian follicles number over 250,000, but only a few hundred to thousands remain by the end of a woman's reproductive age. Ovarian volume assessment is also a valuable screening tool for conditions such as polycystic ovarian syndrome (PCOS) and ovarian cancer (14-17).

Given the context of Swabi, a region with limited advanced medical facilities, the practice of measuring ovarian volume through sonography could be highly beneficial for diagnosing fertility issues. This study aims to evaluate the role of ovarian volume in distinguishing between fertile and infertile women in Swabi, utilizing ultrasound measurements. By examining ovarian dimensions and their correlation with fertility status, this research seeks to contribute to the understanding of reproductive health in this population and potentially improve clinical practices in regions with similar healthcare constraints (7).

MATERIAL AND METHODS

A cross-sectional study was conducted at the Department of Radiology, Mahaban Medical and Research Hospital, Swabi, Khyber-Pakhtunkhwa, Pakistan, to assess the prevalence and factors influencing ovarian volume and fertility status among women aged 21-45 years. Participants were recruited from various community health clinics using convenience sampling methods, resulting in a sample size of 101 individuals. The study aimed to explore the relationship between ovarian volume, fertility status, and menstrual cycle regularity in the target population.

The data collection process involved gathering demographic characteristics, medical history, and self-reported menstrual cycle regularity through standardized questionnaires administered by trained personnel. Ovarian dimensions were measured using ultrasound, employing established techniques to ensure accuracy and reproducibility. Specifically, transvaginal sonography (TVUS) was utilized due to its higher resolution and ability to visualize smaller follicles, providing more precise measurements compared to transabdominal ultrasound (TAU) (1).

To ensure ethical compliance, the study was approved by the Ethical Committee of the Women University Swabi, Khyber-Pakhtunkhwa, Pakistan. All participants provided informed consent prior to inclusion in the study, and the research adhered to the principles outlined in the Declaration of Helsinki.

Data analysis was performed using the Statistical Software for Social Sciences (SPSS version 25.0). Descriptive statistics, including means, standard deviations, and percentages, were calculated for variables such as age, ovarian measurements, and fertility status. Cross-tabulation was employed to classify participants based on fertility status (Yes/No) and menstrual cycle regularity (Regular/Irregular). Correlation tables were generated to examine the interrelationship between fertility status and cycle regularity, capturing all significant relationships within the data (2).

The study's results indicated variability in ovarian measurements among participants, with mean values of 6.66 cm for the right ovary and 7.46 cm for the left ovary. Participants with a "Yes" fertility status demonstrated slightly higher mean ovarian measurements compared to those with a "No" fertility status. The analysis also revealed that the regularity of menstrual cycles did not significantly differ between fertile and infertile individuals (3).

Overall, this research provided valuable insights into the role of ovarian volume in assessing fertility potential among women in Swabi, highlighting the importance of comprehensive reproductive health evaluations that consider multiple factors influencing fertility. The findings suggest that while ovarian measurements may be indicative of fertility status, menstrual cycle regularity alone is not a reliable predictor of fertility in this cohort. Further studies are warranted to explore the underlying mechanisms and broader implications of these observations (4).

© 2024 et al. Open access under Creative Commons by License. Free use and distribution with proper citation.

Journal of Health and Rehabilitation Research 2791-156X JHRR

RESULTS

The study involved 101 participants aged between 21 and 45 years, with an average age of 28.52 years (SD = 5.08). The primary focus was on the ovarian measurements and their correlation with fertility status and menstrual cycle regularity. The data was meticulously analyzed to identify any significant patterns and associations.

Table 1: Age and Ovary Size of Participants

Variable	N	Minimum	Maximum	Mean	Std. Deviation
Age (years)	101	21.00	45.00	28.52	5.08
Right Ovary (cm)	101	1.46	13.72	6.66	3.28
Left Ovary (cm)	101	1.71	20.00	7.46	4.26

The mean ovarian volumes for the right and left ovaries were 6.66 cm^3 and 7.46 cm^3, respectively. The range of ovarian sizes indicated considerable variability among the participants.

Table 2: Menstrual Cycle Regularity and Fertility Status

Fertility Status	Cycle Regularity	Total
	Irregular	Regular
No	18	21
Yes	31	31
Total	49	52

The distribution of participants based on menstrual cycle regularity and fertility status showed that out of the 101 participants, 62 were fertile, and 39 were infertile. Interestingly, among those who were fertile, an equal number had regular and irregular menstrual cycles.

Table 3: Ovary Measurements by Fertility Status

Fertility Status	Ovary	Mean (cm)	N	Std. Deviation	Minimum (cm)	Maximum (cm)	Median (cm)	% of Total Sum
No	Right Ovary	6.29	39	3.32	1.46	13.72	6.35	36.5%
	Left Ovary	7.89	39	4.09	2.12	18.00	7.38	40.8%
Yes	Right Ovary	6.90	62	3.27	1.46	13.72	6.90	63.5%
	Left Ovary	7.19	62	4.37	1.71	20.00	6.27	59.2%
Total	Right Ovary	6.66	101	3.28	1.46	13.72	6.60	100.0%
	Left Ovary	7.46	101	4.26	1.71	20.00	6.73	100.0%

The results indicated that participants with a "Yes" fertility status had slightly higher mean ovarian measurements (6.90 cm for the right ovary and 7.19 cm for the left ovary) compared to those with a "No" fertility status (6.29 cm for the right ovary and 7.89 cm for the left ovary). Despite these differences, the overlap in the ranges of ovarian sizes suggested that ovarian volume alone might not be a definitive indicator of fertility.

Overall, the study highlighted that while ovarian measurements showed some correlation with fertility status, menstrual cycle regularity did not significantly differ between fertile and infertile individuals. These findings suggest that a comprehensive approach, considering multiple factors, is necessary for assessing fertility potential. Further research is needed to explore the underlying mechanisms and broader implications of these observations (13).

DISCUSSION

The present study aimed to investigate the relationship between ovarian volume, fertility status, and menstrual cycle regularity among women aged 21 to 45 in Swabi. The findings revealed that while there was a slight increase in ovarian measurements among fertile women compared to infertile women, menstrual cycle regularity did not significantly differentiate between the two groups. These results contribute to the existing body of knowledge by reinforcing the notion that ovarian volume can be a useful indicator in assessing fertility potential, although it should not be considered in isolation.

© 2024 et al. Open access under Creative Commons by License. Free use and distribution with proper citation.

Journal of Health and Rehabilitation Research 2791-156X JHRR

Previous studies have consistently demonstrated the importance of ovarian volume as a marker of ovarian reserve and reproductive health. Kelsey et al. (2013) established a normative model for ovarian volume throughout life, highlighting its role in predicting reproductive lifespan (1). Similarly, Van Voorhis (2008) emphasized the utility of ultrasound in assessing ovarian health and its correlation with fertility (2). The current study's findings align with these observations, indicating that higher ovarian volumes are associated with fertility. However, the lack of significant differences in menstrual cycle regularity between fertile and infertile women suggests that other factors also play crucial roles in determining fertility.

One of the strengths of this study was its focus on a population in Swabi, a region with limited access to advanced medical facilities. This context underscores the practicality and relevance of using ultrasound measurements for fertility assessment in similar settings. The use of standardized questionnaires and trained personnel for data collection ensured the reliability of the demographic and medical information obtained. Additionally, the application of SPSS for data analysis provided robust statistical support for the study's conclusions (17).

Despite these strengths, the study had several limitations. The cross-sectional design limited the ability to establish causal relationships between ovarian volume and fertility status. The use of convenience sampling may have introduced selection bias, and the relatively small sample size might not fully represent the broader population (18). Self-reported data on menstrual cycle regularity could be subject to recall bias, and the reliance on ultrasound measurements, while accurate, may not capture all aspects of ovarian health. Future studies with larger, more diverse samples and longitudinal designs would help validate and extend these findings (19).

The study highlighted the importance of considering multiple factors when assessing fertility. While ovarian volume measurements provided valuable insights, they should be complemented with other diagnostic markers and assessments. The lack of significant differences in menstrual cycle regularity between fertile and infertile women suggests that relying solely on cycle regularity as an indicator of fertility may be insufficient. This finding is consistent with earlier research by Wallace and Kelsey (2004), who noted that ovarian volume, rather than cycle regularity, was a more reliable predictor of reproductive age (20).

CONCLUSION

In conclusion, the study demonstrated that ovarian volume is correlated with fertility status, with fertile women exhibiting slightly higher ovarian measurements. However, menstrual cycle regularity did not emerge as a distinguishing factor between fertile and infertile individuals. These findings underscore the need for a comprehensive approach in fertility assessments, incorporating various diagnostic tools and considering the complex interplay of factors influencing reproductive health. Future research should aim to further elucidate these relationships and develop more holistic evaluation methods to improve fertility outcomes in diverse populations (4).

REFERENCES

1. Kelsey TW, Dodwell SK, Wilkinson AG, Greve T, Andersen CY, Anderson RA, et al. Ovarian Volume Throughout Life: A Validated Normative Model. PLoS One. 2013;8(9).

2. Van Voorhis BJ. Ultrasound Assessment Of The Ovary In The Infertile Woman. Semin Reprod Med. 2008;26(3):217-22.

3. Wallace WH, Kelsey TW. Ovarian Reserve And Reproductive Age May Be Determined From Measurement Of Ovarian Volume By Transvaginal Sonography. Hum Reprod. 2004;19(7):1612-7.

4. Zaidi S, Usmani A, Shokh IS, Alam SE. Ovarian Reserve And BMI Between Fertile And Subfertile Women. J Coll Physicians Surg Pak. 2009;19(1):21-4.

5. Lass A, Brinsden PJ. The Role Of Ovarian Volume In Reproductive Medicine. Hum Reprod Update. 1999;5(3):256-66.

6. Yunus S, Rasheed S, Amanullah A, Aman S, Ullah U, Wazir FU. Ovarian Volume Between Fertile And Infertile Married Women With Transvaginal Sonography. Gomal J Med Sci. 2018;16(4):101-4.

7. Kanwal HI, Shahid M, Bacha RJ. Sonographic Evaluation Of Various Causes Of Female Infertility: A Literature Review. J Dow Univ Health Sci. 2022;38(2):155-9.

© 2024 et al. Open access under Creative Commons by License. Free use and distribution with proper citation.

Journal of Health and Rehabilitation Research 2791-156X JHRR

8. Sharara FI, McClamrock HD. The Effect Of Aging On Ovarian Volume Measurements In Infertile Women. Obstet Gynecol. 1999;94(1):57-60.

9. Jamil AT, Gilani SA, Malik SS, Bacha R, Yasir S. Diagnostic Accuracy Of Transabdominal Versus Transvaginal Sonography In The Detection Of Polycystic Ovaries Taking Transvaginal Sonography As Gold Standard In Islamabad Population. J Soc Obstet Gynaecol Pak. 2019;9(1):51-5.

10. Usmani A, Shokh IS, Alam SE. Examination Of Ovarian Reserve In Fertile Women Using Ultrasonography. J Coll Physicians Surg Pak. 2008;18(1):21-4.

11. Anjum S, Shokh IS, Alam SE. Research On Ovarian Reserve Parameters And Response To Controlled Ovarian Stimulation In Infertile Patients. J Coll Physicians Surg Pak. 2019;29(3):173-7.

12. Ng EHY, Yeung WSB, Fok ACY, Ho PC. Effects Of Age On Hormonal And Ultrasound Markers Of Ovarian Reserve In Chinese Women With Proven Fertility. Hum Reprod. 2000;15(6):1293-8.

13. Ezzat RS, Abdallah W, Elsayed M, Saleh HS, Abdalla W. Impact of bariatric surgery on androgen profile and ovarian volume in obese polycystic ovary syndrome patients with infertility. Saudi journal of biological sciences. 2021 Sep 1;28(9):5048-52.

14. Penzias A, Azziz R, Bendikson K, Cedars M, Falcone T, Hansen K, Hill M, Jindal S, Kalra S, Mersereau J, Racowsky C. Fertility evaluation of infertile women: a committee opinion. Fertility and sterility. 2021 Nov 1;116(5):1255-65.

15. Lunding SA, Pors SE, Kristensen SG, Bøtkjær JA, Ramløse M, Jeppesen JV, Flachs EM, Pinborg A, Macklon KT, Pedersen AT, Andersen CY. Ovarian cortical follicle density in infertile women with low anti-Müllerian hormone. Journal of assisted reproduction and genetics. 2020 Jan;37:109-17.

16. Naumova I, Castelo-Branco C, Kasterina I, Casals G. Quality of life in infertile women with polycystic ovary syndrome: a comparative study. Reproductive Sciences. 2021 Jul;28(7):1901-9.

17. Björvang RD, Hassan J, Stefopoulou M, Gemzell-Danielsson K, Pedrelli M, Kiviranta H, Rantakokko P, Ruokojärvi P, Lindh CH, Acharya G, Damdimopoulou P. Persistent organic pollutants and the size of ovarian reserve in reproductive-aged women. Environment International. 2021 Oct 1;155:106589.

18. Wu J, Zhao YJ, Wang M, Tang MQ, Liu YF. Correlation analysis between ovarian reserve and thyroid hormone levels in infertile women of reproductive age. Frontiers in Endocrinology. 2021 Sep 27;12:745199.

19. Siristatidis C, Pouliakis A, Sergentanis TN. Special characteristics, reproductive, and clinical profile of women with unexplained infertility versus other causes of infertility: a comparative study. Journal of Assisted Reproduction and Genetics. 2020 Aug;37(8):1923-30.

20. Cedars MI. Evaluation of female fertility—AMH and ovarian reserve testing. The Journal of Clinical Endocrinology & Metabolism. 2022 Jun 1;107(6):1510-9.

© 2024 et al. Open access under Creative Commons by License. Free use and distribution with proper citation.