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Association between anti Mullerian hormone levels with size and bilaterality of ovarian endometrioma: a cross-sectional study

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ABSTRACT

Objective. This study aims to analyse the association between anti-Mullerian hormone levels and the size and bilaterality of ovarian endometriomas.

Materials and Methods. The study was conducted from January to October 2023 at Wahidin Sudirohusodo Hospital in Makassar using a cross-sectional design through consecutive sampling of ovarium endometrioma patient confirmed by histopathological examination. AMH levels were measured by ELISA technique, size and bilaterality were determined based on abdominal ultrasound examination.

Results. A total of 50 women, with a mean age 32.24 ± 0.75 years, were enrolled in the study. There was no difference in the effect of age, menarche age, education, parity, BMI, endometrioma bilaterality, or tumour size on AMH levels ($p > 0.05$). In the correlation test, age ($r = -0.248$) and tumour size ($r = -0.276$) were negatively correlated with AMH levels, while menarche age ($r = 0.067$) was positively correlated with AMH levels, but all three variables were statistically insignificant ($p > 0.05$).

Conclusions. There was no association anti mullerian hormone level with the size and bilaterality of ovarium endometrioma. Further research is needed with a larger sample size to confirm it.

INTRODUCTION

Endometriosis is an estrogen-dependent condition characterized by the presence of ectopic endometrial-like tissue [1]. The most common sites of endometriosis are the ovaries, followed by the Douglas pouch, the posterior leaves of the broad ligaments, and the sacrouterine ligaments [2]. Ovarian endometriomas occur in 17-44% of patients with endometriosis and account for 35% of all benign ovarian tumours [3]. Several studies have indicated a correlation between endometriosis and a higher prevalence of obstetric complications, including preterm births, placental disorder, gestational diabetes, caesarean section (CS), and postpartum haemorrhage (PPH) [4]. Additionally, there is a correlation between endometriomas and

infertility, and it is now widely accepted that endometriomas affect fertility. Although the mechanism is unclear, research suggests that it can negatively affect spontaneous ovulation rates and reduce the number and activity of follicles in adjacent ovarian tissue [5]. Anti-Mullerian Hormone (AMH) is a glycoprotein hormone with a molecular weight of 140 kDa linked by a disulfide chain [6]. It is produced by granulosa cells of non-growing follicles, such as primary, secondary, preantral, and early antral follicles. It can predict the state of ovarian reserve and follicular growth, which are critical to fertility [7]. AMH is commonly used as a primary fertility marker, particularly in conditions or diseases that affect ovarian reserve, such as polycystic ovarian syndrome [8].

The decline in AMH levels was found to be more rapid in women with endometriomas compared to healthy women and women with other benign ovarian cysts [9]. The correlation between AMH levels and endometrioma volume is not well known due to conflicting study results. A study by Suardi *et al*. found a negative correlation between AMH levels and ovarian endometrioma volume, but it was not statistically significant ($r = -0.332$; $p = 0.066$). The study also found significantly lower AMH levels in the endometrioma group compared to controls, but this was not affected by laterality [10]. Another study which compared AMH levels tested one month pre-surgery in the ovarian endometrioma group with controls, found AMH levels were not significantly different between the two groups and serum AMH levels were significantly positively correlated with ovarian endometrioma cyst volume ($r^2 = 0.23$; 95%CI 0.007-0.1; $p = 0.02$) [11]. In addition, a meta-analysis also showed postoperative AMH levels were affected by the bilaterality of the endometrioma but not preoperative AMH levels [12].

Existing research about association between anti mullerian hormone levels with the size and bilaterality of ovarium endometrioma is still controversial. Therefore, this study aims to analyse the association between anti-Mullerian hormone levels and the size and bilaterality of ovarian endometriomas through abdominal ultrasound examination especially in the limited health facilities so the ovarian reserves can be predicted with a simple modality.

MATERIALS AND METHODS

This study was conducted at Wahidin Sudirohusodo Hospital, Makassar Indonesia, between January until October 2023. The study received approval from the Health Research Ethics Committee of the Faculty of Medicine, Hasanuddin University (No.20/UN4.6.4.5.31/PP36/2023). Informed consent was obtained from all participants. The participants were enrolled into the study by consecutive sampling technique. The inclusion criteria were: 1) Diagnosed as endometrioma based on ultrasound examination, 2) > 20 years old and not yet menopause. The exclusion criteria were: 1) using hormonal contraception in the last 1 year; 2) taking vitamin D supplements; 3) history of previous endometrioma surgery, pelvic inflammatory disease or polycystic ovarian syndrome; 4) histopathological examination results not endometrioma. We excluded patients using hormonal contraception and vitamin D supplements because contraception can reduce AMH levels, while vitamin D can increase AMH levels [13, 14].

All participants underwent transabdominal USG to assess the size and characteristics of ovarian endometrioma. The ultrasonographic criteria for diagnosing endometrioma included the presence of a cystic structure with uniform low-level internal echoes lacking papillary proliferations and exhibiting poor vascularization, or a cystic structure with uniform low-level internal echoes containing an echogenic portion devoid of detectable blood flow. The endometrioma was measured in two dimensions,

The levels of AMH measured at the Clinical Pathology Laboratory of Hasanuddin University Hospital using an enzyme-linked immunosorbent assay (ELISA) kit (AMH ELISA kit, Bioassay Technology lab, Shanghai) according to the manufacturer's instructions. The kit has a sensitivity of 0.024 ng/mL and a detection range between 0.05-30 ng/ml. It was examined from vein blood specimens using the ELISA method and reported in ng/ml. The samples were collected from venous blood in EDTA tubes from presurgical endometrioma patients. After mix 10-20 minutes, sample was centrifuged for 20 minutes at 2,000-3,000 RPM then supernatant without sediment was collected. Samples were stored at 80 °C, waiting for histopathological examination. Serum AMH levels for fertile women range from 1.0 ng/ml to 4.0 ng/ml [15]; AMH levels below 1.0 ng/ml are considered low and indicate a decrease in ovarian reserve [16]. The endometrioma was confirmed through histopathological examination using haematoxylin-eosin staining.

Statistical analysis was conducted using the SPSS 24.0 for Windows software (IBM, USA). Baseline characteristics were reported as frequencies and percentages. For normally distributed data, the results were reported as Mean ± SD and analysed with an independent t-test. While in non-normally distributed data were reported as median ± interquartile range (IQR) and analysed using the Mann-Whitney test. The differences in baseline characteristics between the two groups will be analysed using a chi-square test. A P-value of < 0.05 was considered significant.

RESULTS

A total of 67 presurgical participants were enrolled; however, 7 samples were lysed, and 10 histopathological examinations did not show endometrioma. All groups were similar with respect to age, menarche age, and BMI. The demographic data of the groups are shown in **Table 1**. The median (± IQR) OMA size was 53.85 ± 31.03 mm^2 in the low AMH group and 37.71 ± 55.17 mm^2 in the normal AMH group, but the difference was not significant ($p > 0.05$). Bilaterality also was found not to significantly affect the AMH level ($p > 0.05$). Age and tumour size were negatively correlated with AMH levels, while age at menarche was positively correlated with AMH levels. However, none of these variables were statistically significant (**Table 2**). The correlation between endometrioma size and serum AMH levels is shown in **Figure 1**.

Table 1. *Demographic data of participant.*

	AMH level		P-value
	Low (n = 16)	Normal (n = 34)	
Age (Mean ± SD; years)	33.81±4.02	31.64±5.8	0.186#
Menarche age (Median ± IQR; years)	12(±11)	12(±0.25)	0.614+
Education [n (%)]			
Senior High School	13 (26.0)	27 (54.0)	
Diploma	3 (6.0)	7 (14.0)	1.0*
Parity [n (%)]			
Nulipara	6 (12.0)	21 (42.0)	
Primipara	3 (6.0)	7 (14.0)	0.132*
Multipara	7 (14.0)	6 (12.0)	
Bilaterality [n (%)]			
Unilateral	12 (24.0)	22 (44.0)	0.687*
Bilateral	4 (8.0)	12 (24.0)	
Body Mass Index [n (%)]			
Normal	14 (28.0)	23 (46.0)	0.251*
Overweight	2 (4.0)	11 (22.0)	

#Independent T-test; *Chi-Square test; +Mann-Whitney test.

Table 2. *Correlation test of variables to AMH levels.*

Variable	Rho value	P-value
Age	-0.248	0.082
Menarche age	0.067	0.643
Endometrioma size	-0.276	0.052

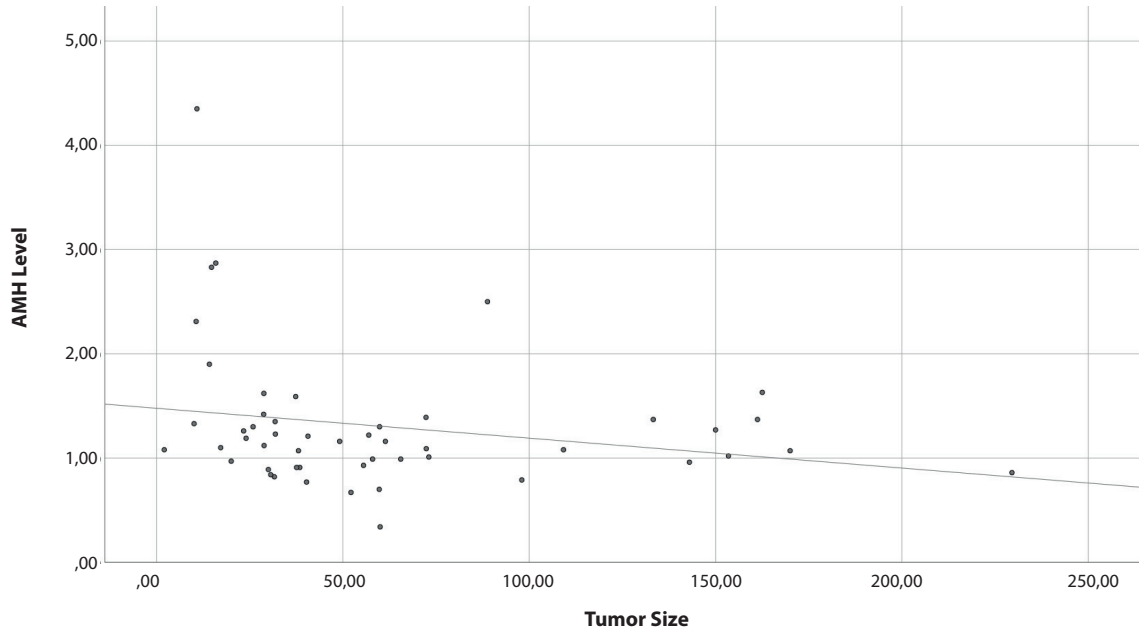

Figure 1. *Scatterplot correlation of tumour size with serum AMH level.*

DISCUSSION

One of several method to assess the ovarian reserve is by measuring serum AMH levels, which are produced by granulosa cells in small to medium-sized follicles. These follicles, ranging from 4 to 8 mm in diameter, account for approximately 60% of circulating AMH [17]. AMH plays a crucial role in controlling ovarian function in the initial stages of follicle growth by preventing the excessive activation of primordial follicles and slowing down their progression to the primary stage, thereby preserving the follicle pool [17, 18]. Unlike FSH, AMH levels stay consistent throughout the menstrual cycle [19]. Serum AMH levels are lower in women with endometriomas, suggesting a decreased ovarian reserve in these women [10].

In this study, an AMH value of < 1 ng/mL was used as a benchmark for low AMH levels. For the characteristic data, the variables of age, menarche age, education, parity, BMI, endometrioma location, and tumour size were not found to be significantly different in the two groups. AMH levels decrease with age, resulting in lower pregnancy rates in infertile patients. Age is considered one of the factors that affect AMH levels [20]. Khan *et al*. found that AMH levels decrease by about 6% per year, suggesting a direct relationship between increasing age and decreasing follicular reserve [21]. However, in this study, age levels were not found to be different in groups with low and normal AMH. Multivariate testing and correlation tests were carried out, but no association was found with AMH. Feferkorn *et al*.'s study found that AMH levels had a significant effect on endometriosis only in the age group > 35 years, but not in the age group under 35 years. According to this study, this is because at the age of under 35 years, there are still many follicular reserves, so the increase in age does not have a significant effect [22]. In Lie Fong's study, AMH concentration was positively correlated with age until it peaked at 15.8 years, then remained stable, and inversely correlated after the age of 25 years [23]. Normal AMH values vary by age group, which could be a confounding factor when categorizing the low AMH group [24].

Menarche age, which also seems to play a role in follicular reserve, was found to be unrelated to AMH levels in this study. Weghover's study found that the age at menarche is associated with follicular reserve. The younger the patient is at menarche, the higher the risk of having low AMH levels. This can be caused by several factors, such as the amount of ovarian follicular reserve, the rate of follicular depletion, or a combination of both [25].

This study also found no significant difference between parity and AMH levels. Moini found that women with higher parity had higher AMH levels compared to nulliparous women [26]. Different results were also found in a study of Filipino women, primiparous and multiparous samples had significantly lower AMH levels than nulliparous [27].

In this study, there was no effect of BMI on AMH levels. This differs from Albu's study, which reported a positive relationship between BMI and serum AMH levels in infertile patients. The presence of overweight and obesity is associated with higher AMH levels compared to patients with normal or lean BMI. Circulating androgens, insulin, and insulin resistance increase with BMI. These parameters have also been shown to be positively associated with serum AMH levels [28]. However, some other studies found that AMH levels are negatively correlated in patients with older age (> 35 years) or severe obesity (BMI ≥ 40 kg/m^2) [29, 30]. In addition, several previous studies have also found no relationship between BMI and AMH levels [31-33].

There was no significant difference between tumour size and unilateral/bilateral tumour location in this study. This is consistent with a study conducted at Hasan Sadikin Hospital, which found a weak correlation between AMH levels and ovarian endometrioma volume but was not statistically significant ($r = -0.332$, $p = 0.066$). However, the group with endometriosis exhibited lower AMH levels compared to the non-endometriosis control group [10]. Another study also found that patients with endometriomas had lower AMH levels compared to patients with other benign ovarian cysts, especially in the 30-39 age group (3.77 ± 2.28 *vs* 6.58 ± 2.63, $p < 0.05$). This study also categorized endometriomas into four groups: single unilateral, single bilateral, multiple unilateral, and multiple bilateral. However, there was no significant difference in AMH levels among the four groups ($p = 0.173$). Total cyst diameter and the number of cysts were found to be negatively correlated with AMH, although the correlation was not significant, which is consistent with the findings of this study [34]. The study of Niewegloska *et al*. demonstrated that only bilateral tumour ($p = 0.003$) and patient age ($p < 0.001$) were significant factors. However, cyst volume was found to have a negative correlation with AMH serum concentration, although it was not significant [35].

Serum AMH levels in women with endometriomas tend to be low due to chronic inflammatory processes and massive reactive oxygen species (ROS) found in the ovaries. Toxic factors, such as proteolytic enzymes, iron, and ROS can penetrate the tissue around endometrioma cysts, causing fibrosis, smooth muscle metaplasia, and reduced follicles in ovarian tissue [36]. The mechanisms underlying low serum AMH levels and decreased ovarian reserve are inflammatory processes and immunomodulation abnormalities associated with toxic endometriomas [37, 38]. The inflammatory process causes follicular damage and dysfunction so that follicular quality and quantity are also reduced [10]. As in previous studies, AMH levels are not affected by endometrioma size, but AMH levels can describe the severity/degree of endometrioma in patients and the extent to which endometriomas cause damage and inflammation [39].

Limitation

The cross-sectional nature of this study was a limitation. This study also used tumour area as a measure of tumour size instead of volume as a benchmark for tumour size. Tumour size was measured using abdominal ultrasound, which has lower accuracy compared to transvaginal ultrasound. However, the study can be used as a reference in health facilities, especially in developing countries that do not have transvaginal ultrasound modalities.

CONCLUSIONS

Based on the study, it was found that there is no association between anti-Mullerian hormone levels and the size and bilaterality of ovarian endometriomas. This finding indicates that transabdominal ultrasound cannot predict ovarian reserve accurately. Therefore, it is recommended to consider using transvaginal ultrasound or other biomarkers like AMH and FSH. Further research with a larger sample size to confirm it.

COMPLIANCE WITH ETHICAL STANDARDS

Authors' contribution

A.M.D.R: Conceptualization, data curation, investigation, formal analysis, visualization , writing - original draft. N.A., E.H.: Data curation, supervision. F.H.: Formal analysis, supervision. S.S., F.M.: Writing – review & editing.

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Study registration

N/A.

Disclosure of interests

The authors declare that they have no conflict of interests.

Ethical approval

This study was approved by the Ethics Committee of Hasanuddin University of Medical Sciences (No.20/UN4.6.4.5.31/PP36/2023, date: 9.1.2023).

Informed consent

Informed consent was obtained from all participants.

Data sharing

Data are available under reasonable request to the corresponding author.

REFERENCES

1. Chaggar P, Tellum T, Thanatsis N, De Braud L V., Setty T, Jurkovic D. Prevalence of deep and ovarian endometriosis in women attending a general gynecology clinic: prospective cohort study. Ultrasound Obstet Gynecol. 2023;61(5):632-41. doi: 10.1002/uog.26175.
2. Gordts S, Koninckx P, Brosens I. Pathogenesis of deep endometriosis. Fertil Steril. 2017;108(6):872-85.e1. doi: 10.1016/j.fertnstert.2017.08.036.
3. Gałczyński K, Jóźwik M, Lewkowicz D, Semczuk-Sikora A, Semczuk A. Ovarian endometrioma - A possible finding in adolescent girls and young women: A mini-review. J Ovarian Res. 2019;12(1):4-11. doi: 10.1186/s13048-019-0582-5.
4. Vannuccini S, La Torre F, Gallucci E, Toscano F, Ruotolo A, Capezzuoli T, et al. Previous surgery for endometriosis: a further risk for obstetric complications? Ital J Gynaecol Obstet. 2023;35(Supplement 01):81. doi: 10.36129/jog.2022.S80.
5. Karadağ C, Yoldemir T, Demircan Karadağ S, Turgut A. The effects of endometrioma size and bilaterality on ovarian reser-

ve. J Obstet Gynaecol. 2020;40(4):531-6. doi: 10.1080/01443615.2019.1633518.
6. Lehmann P, Vélez MP, Saumet J, Lapensée L, Jamal W, Bissonnette F, et al. Anti-Müllerian hormone (AMH): A reliable biomarker of oocyte quality in IVF. J Assist Reprod Genet. 2014;31(4):493-8. doi: 10.1007/s10815-014-0193-4.
7. Dumont A, Robin G, Catteau-Jonard S, Dewailly D. Role of Anti-Müllerian Hormone in pathophysiology, diagnosis and treatment of Polycystic Ovary Syndrome: A review. Reprod Biol Endocrinol. 2015;13(1):8-10. doi: 10.1186/s12958-015-0134-9.
8. Dewailly D, Laven J. AMH as the primary marker for fertility. Eur J Endocrinol. 2019;181(6):D45-51. doi: 10.1530/EJE-19-0373.
9. Muzii L, Di Tucci C, Di Feliciantonio M, Galati G, Di Donato V, Musella A, et al. Antimüllerian hormone is reduced in the presence of ovarian endometriomas: a systematic review and meta-analysis. Fertil Steril. 2018;110(5):932-40.e1. doi: 10.1016/j.fertnstert.2018.06.025.
10. Suardi D, Permadi W, Djuwantono T, Hidayat YM, Bayuaji H, Gautama GPE. Correlation of serum anti-mullerian hormone (AMH) level on ovarian volume in women with endometrioma. Int J Gen Med. 2021;14:1-8. doi: 10.2147/IJGM.S272071.
11. Marcellin L, Santulli P, Bourdon M, Comte C, Maignien C, Just PA, et al. Serum antimüllerian hormone concentration increases with ovarian endometrioma size. Fertil Steril. 2019;111(5):944-52.e1. doi: 10.1016/j.fertnstert.2019.01.013.
12. Younis JS, Shapso N, Fleming R, Ben-Shlomo I, Izhaki I. Impact of unilateral versus bilateral ovarian endometriotic cystectomy on ovarian reserve: A systematic review and meta-analysis. Hum Reprod Update. 2019;25(3):375-91. doi: 10.1093/humupd/dmy049.
13. Bacanakgil BH, İlhan G, Ohanoğlu K. Effects of vitamin D supplementation on ovarian reserve markers in infertile women with diminished ovarian reserve. Medicine (Baltimore). 2022;101(6):e28796. doi: 10.1097/MD.0000000000028796.
14. Nelson SM, Ewing BJ, Gromski PS, Briggs SF. Contraceptive-specific antimüllerian hormone values in reproductive-age women: a population study of 42,684 women. Fertil Steril. 2023;119(6):1069-77. doi: 10.1016/j.fertnstert.2023.02.019.
15. Iwase A, Asada Y, Sugishita Y, Osuka S, Kitajima M, Kawamura K. Anti-Müllerian hormone for screening, diagnosis, evaluation, and prediction: A systematic review and expert opinions. J Obstet Gynaecol Res. 2023;(October 2023):15-39. doi: 10.1111/jog.15818.
16. Romanski PA, Bortoletto P, Malmsten JE, Tan KS, Spandorfer SD. Pregnancy outcomes after oral and injectable ovulation induction in women with infertility with a low antimüllerian hormone level compared with those with a normal antimüllerian hormone level. Fertil Steril. 2022;118(6):1048-56. doi: 10.1016/j.fertnstert.2022.09.010.
17. Vicomandi V, Nacci I, Piccione E, Casadei L. Anti-Müllerian hormone: clinical implications in Gynecological Endocrinology. An update review. Ital J Gynaecol Obstet. 2020;32(1):20-33. doi: 10.36129/jog.32.01.02.
18. Tan Z, Gong X, Wang CC, Zhang T, Huang J. Diminished Ovarian Reserve in Endometriosis: Insights from In Vitro, In Vivo, and Human Studies—A Systematic Review. Int J Mol Sci. 2023;24(21):15967. doi: 10.3390/ijms242115967.
19. Van Disseldorp J, Lambalk CB, Kwee J, Looman CWN, Eijkemans MJC, Fauser BC, et al. Comparison of inter- and intra-cycle variability of anti-Mullerian hormone and antral follicle counts. Hum Reprod. 2010;25(1):221-7. doi: 10.1093/humrep/dep366.
20. Kozlowski IF, Carneiro MC, da Rosa VB, Schuffner A. Correlation between anti-Müllerian hormone, age, and number of oocytes: A retrospective study in a Brazilian in vitro fertilization center. J Bras Reprod Assist. 2022;26(2):214-21. doi: 10.5935/1518-0557.20210083.
21. Khan HL, Bhatti S, Suhail S, Gul R, Awais A, Hamayun H, et al. Antral follicle count (AFC) and serum anti-Müllerian hormone (AMH) are the predictors of natural fecundability have similar trends irrespective of fertility status and menstrual characteristics among fertile and infertile women below the age of 40 years. Reprod Biol Endocrinol. 2019;17(1):1-12. doi: 10.1186/s12958-019-0464-0.
22. Feferkorn I, Suarthana E, Kigloo HN, Abow-Mohamed I, Golyari Y, Tulandi T. Combined effects of age and endometriosis on ovarian reserve in women with infertility. Int J Gynecol Obstet. 2023;161(1):129-36. doi: 10.1002/ijgo.14519.
23. Lie Fong S, Visser JA, Welt CK, De Rijke YB, Eijkemans MJC, Broekmans FJ, et al. Serum an-

ti-müllerian hormone levels in healthy females: A nomogram ranging from infancy to adulthood. J Clin Endocrinol Metab. 2012;97(12):4650-5. doi: 10.1210/jc.2012-1440.
24. Shebl O, Ebner T, Sir A, Schreier-Lechner E, Mayer RB, Tews G, et al. Age-related distribution of basal serum AMH level in women of reproductive age and a presumably healthy cohort. Fertil Steril. 2011;95(2):832-4. doi: 10.1016/j.fertnstert.2010.09.012.
25. Weghofer A, Kim A, Barad DH, Gleicher N. Age at menarche: A predictor of diminished ovarian function? Fertil Steril. 2013;100(4):1039-43. doi: 10.1016/j.fertnstert.2013.05.042.
26. Moini A, Hedayatshodeh M, Hosseini R, Rastad H. Association between parity and ovarian reserve in reproductive age women. Eur J Obstet Gynecol Reprod Biol. 2016;207:184-7. doi: 10.1016/j.ejogrb.2016.10.024.
27. Bragg JM, Kuzawa CW, Agustin SS, Banerjee MN, McDade TW. Age at menarche and parity are independently associated with Anti-Müllerian hormone, a marker of ovarian reserve, in filipino young adult women. Am J Hum Biol. 2012;24(6):739-45. doi: 10.1002/ajhb.22309.
28. Albu D, Albu A. The relationship between anti-Müllerian hormone serum level and body mass index in a large cohort of infertile patients. Endocrine. 2019;63(1):157-63. doi: 10.1007/s12020-018-1756-4.
29. Buyuk E, Seifer DB, Illions E, Grazi R V., Lieman H. Elevated body mass index is associated with lower serum anti-mullerian hormone levels in infertile women with diminished ovarian reserve but not with normal ovarian reserve. Fertil Steril. 2011;95(7):2364-8. doi: 10.1016/j.fertnstert.2011.03.081.
30. Bernardi. LA, Mercedes R. Carnethon, Chavez PJ de, Ikhena DE, Neff LM, Baird DD, et al. Relationship between obesity and anti-Müllerian hormone in reproductive-aged African American women. Obes Silver Spring Md. 2017;25(1):229-35. doi: doi:10.1002/oby.21681.
31. Jung S, Allen N, Arslan AA, Baglietto L, Brinton LA, Egleston BL, et al. Demographic, lifestyle, and other factors in relation to antimüllerian hormone levels in mostly late premenopausal women. Fertil Steril. 2017;107(4):1012-22.e2. doi: 10.1016/j.fertnstert.2017.02.105.
32. La Marca A, Spada E, Grisendi V, Argento C, Papaleo E, Milani S, et al. Normal serum anti-Müllerian hormone levels in the general female population and the relationship with reproductive history. Eur J Obstet Gynecol Reprod Biol. 2012;163(2):180-4. doi: 10.1016/j.ejogrb.2012.04.013.
33. Simões-Pereira J, Nunes J, Aguiar A, Sousa S, Rodrigues C, Sampaio Matias J, et al. Influence of body mass index in anti-Müllerian hormone levels in 951 non-polycystic ovarian syndrome women followed at a reproductive medicine unit. Endocrine. 2018;61(1):144-8. doi: 10.1007/s12020-018-1555-y.
34. Jeon JH, Park SY, Lee SR, Jeong K, Chung HW. Serum Anti-Müllerian Hormone Levels before Surgery in Patients with Ovarian Endometriomas Compared to Other Benign Ovarian Cysts. J Menopausal Med. 2015;21(3):142. doi: 10.6118/jmm.2015.21.3.142
35. Nieweglowska D, Hajdyla-Banas I, Pitynski K, Banas T, Grabowska O, Juszczyk G, et al. Age-related trends in anti-Mullerian hormone serum level in women with unilateral and bilateral ovarian endometriomas prior to surgery. Reprod Biol Endocrinol. 2015;13(1):1-9. doi: 10.1186/s12958-015-0125-x.
36. Sanchez AM, Viganò P, Somigliana E, Panina-Bordignon P, Vercellini P, Candiani M. The distinguishing cellular and molecular features of the endometriotic ovarian cyst: from pathophysiology to the potential endometrioma-mediated damage to the ovary. Hum Reprod Update. 2014;20(2):217-30. doi: 10.1093/humupd/dmt053.
37. Carrillo L, Seidman DS, Cittadini E, Meirow D. The role of fertility preservation in patients with endometriosis. J Assist Reprod Genet. 2016;33(3):317-23. doi: 10.1007/s10815-016-0646-z.
38. Romanski PA, Brady PC, Farland LV, Thomas AM, Hornstein MD. The effect of endometriosis on the antimüllerian hormone level in the infertile population. J Assist Reprod Genet. 2019;36(6):1179-84. doi: 10.1007/s10815-019-01450-9.
39. Safdarian L, Ghalandarpoor Attar SN, Aleyasin A, Aghahosseini M, Sarfjoo FS, Hosseinimousa S. Investigation of anti-mullerian hormone (AMH) level and ovarian response in infertile women with endometriosis in IVF cycles. Int J Reprod Biomed. 2018;16(11):719-22.