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Correlation between Anti-Mullerian Hormone Levels and Sexual Dysfunction in Infertile Women

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Authors' contributions

This work was carried out in collaboration among all authors. Author TG designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors NDG and NTO managed the analyses of the study. Author SAT managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

Aim: The purpose of the study was to evaluate the correlation between Anti-Mullerian hormone (AMH) levels and sexual dysfunction in infertile women.
Methods: This prospective cross-sectional study was done *on* 558 infertile women. The participants were divided into three different AMH groups i.e. first AMH group (poor responder with ≤3 oocytes), second AMH group (normoresponder with 4–9 oocytes), and third AMH group (high responder with ≥10 oocytes). The values of the total Female Sexual Function Index (FSFI) variable were divided into three FSFI levels: level 1 (below 23), level 2 (between 23 and 29), and Level 3 (above 30). The participants were divided into two groups: the first group with normal weight (BMI<25) and the second group with overweight (25<BMI<30). The FSFA questionnaire as a standardized and validated self-report was applied for measurement of the female sexual dysfunction.

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Results: The mean age of the participants was 30.14 years and the mean BMI was 24.81. 64.87% of the participants had normal weight and 35.13% had overweight. Regarding the total FSFI levels, 55.4% of the participants are at level 1, 42.3% at level 2, and 2.3% at level 3. The first AMH group had a mean of 0.58±0.27, the second AMH group had a mean of 2.38±0.89, and the third group had a mean of 6.42±1.58. There was a significant difference among the three AMH groups in terms of all total FSFI subdomains. The participants at total FSFI level 1 had p-value=0.00, those at level 2 had p-value=0.00 and those at Level 3 had p-value=0.005.
Conclusion: Sexual dysfunction is reversely correlated with AMH. The participants with overweight had higher AMH value. To overcome female sexual dysfunction among infertile women, it is necessary to have sexual counseling, determine the factors affecting sexual dysfunction, and provide appropriate treatment.

Keywords: Anti-mullerian hormone; body mass index; female sexual function index; sexual dysfunction.

1. INTRODUCTION

Sexual dysfunctions are defined as sexual desire disturbances and also psychophysiological changes in the cycle of sexual response among men and women [1]. Few community studies show that the prevalence of the sexual dysfunctions is high prevalent in females and males which ranges from 10% to 52% among men and 25% to 63% among women [2-4].

Sexual dysfunction among women called female sexual dysfunction (FSD) is defined as having various sexual disorders and problems including low arousal, low interest or desire, dyspareunia, and orgasmic difficulties. FSD includes physiological, medical, anatomical, social, and psychological components [5]. In other words, sexual dysfunction means a problem during any sexual response cycle phase which prevents the person from being satisfied with sexual activity due to physical, social, and psychological factors [6]. Besides, sexuality has a high effect on the well-being of women [7]. All aspects of satisfactory sexuality will result from the sexual quality of life meaning that sexual quality not only means the absence of a disorder or illness but also means the ability to start and keep the sexual and romantic relationship [8].

The studies show that some psychological disorders such as impaired relationships between couples, loss of confidence regarding sex and sexual intercourse, lack of marital satisfaction, lack of sexual satisfaction, reduction of libido, negative emotional effects and anger leading to reduction of confidence in their fertility and affecting their sexual life are prevalent among the infertile couples [9-12].

The association between stress and infertility has been investigated by relatively few studies even though there has been an association between sexual dysfunction and infertility and many infertile couples experience stress in their sexual life [13,14]. Women with infertility often complain of problems in sexual function [15].

Anti-Mullerian hormone (AMH), which is a peptide growth factor for the transforming growth factor-β family [16], has a significant effect on sexual differentiation. AMH in females is effective in the selection and recruitment of follicle development [17] and is regarded as a promising biochemical marker for ovarian function.

There were 33% lower serum AMH levels in the infertile women who had diminished ovarian reserve (baseline serum FSH >10 IU/L), and a higher BMI than in the normal BMI women [18]. It has been estimated that impaired fertility has affected 7 to 17% of all couples [19].

According to a study on the relationship between AMH levels and BMI at a late reproductive age (from 35 to 47 years), women with a BMI ≥30 kg/m^2 had AMH levels 65% lower than women who had BMI <30 kg/m^2 (0.016 ng/mL vs. 0.046 ng/mL) [20]. A meta-analysis of 26 studies which was recently done, found a negative correlation between BMI and AMH in the overall population [21].

This study aimed to determine the correlation between AMH levels and sexual dysfunction in infertile women. To that end, the sexual function subdomain scores and the mean FSFI total scores were compared between different AMH groups to see any correlation between AMH and sexual dysfunction.

2. MATERIALS AND METHODS

This prospective cross-sectional study was done *on* 558 infertile women *at Gynecology and Obstetrics and In-vitro* Fertilization (IVF) Outpatient Clinic between May and June 2020. The inclusion criteria included only the patients undergoing IVF, the patients aged between 18 and 40, no conception despite unprotected intercourse for a period of at least 1 year, regular menstruation, normal uterine cavity, and at least one patent fallopian tube. The exclusion criteria for patients were included those with a history of endocrinological and psychiatric diseases, hypertension, hyperlipidemia, cardiovascular disease, thyroid dysfunction and diabetes mellitus, endometriosis, polycystic ovary syndrome, patients with a history of uterine anomaly, male factor, secondary-infertile, premature ovarian insufficiency and patients who did not have coitus at least once in the previous month. The participants were divided into three different AMH groups i.e. first AMH (poor responder with ≤3 oocytes) group, second AMH (normo-responder with 4–9 oocytes) group, and third AMH (high responder with ≥10 oocytes) group.

The participants were divided into two groups: the first group with normal weight (BMI<25) and the second group with overweight (25<BMI<30). Total FSFI level was divided into total FSFI level 1 (below 23), total FSFI level 2 (between 23 and 29), and total FSFI Level 3 (above 30).

The Female Sexual Function Index (FSFI) questionnaire as a standardized and validated self-report was applied for the measurement of the sexual dysfunction. There was a comparison of the total FSFI scores and each sub-domain score of the infertile women. Six domains including desire (the interest to have sexual experience), arousal (having a desire for sexual relation followed by stimulations), lubrication, orgasm (reaching orgasm after arousal and stimulation), satisfaction, and pain measured based on patients' self-report were included in the FSFI score. Arousal (4 questions), desire (2 questions), orgasm (3 questions), satisfaction (3 questions), lubrication (4 questions), and pain (3 questions) are the six domains of the scale items. The sum of all scores obtained in all six domains was the total FSFI score. The higher score showed better sexuality among infertile women.

2.1 Statistical Analysis

The normality hypothesis of the AMH variable was rejected with the Kolmogorov–Smirnov test. Therefore, to study the difference in AMH means at different levels, the *Kruskal–Wallis* test was used. To study the relationship between age and AMH value at different levels, *the Spearman* Correlation *Coefficient* was used. All stages have been performed with SPSS 26.1.

When the sample size was calculated with the GPower 3.1 (http://www.gpower.hhu.de/) program, the total mean of three groups, which was compared based on *ANOVA F-test* with the effect size of 25%, power of 95% and type 1 error of 0.05, was found to be at least 252 patients.

3. RESULTS

The mean age was 30.14 years and the mean BMI was 24.81. Total FSFI scores value of 55.4% of the data was at level 1, 42.3% at level 2, and the remaining 2.3% at level 3. 64.87% of the patients had normal weight (BMI<25) and 35.13% had overweight (25<BMI<30). Information about the descriptive statistic of the AMH variable was stratified by different levels of Total FSFI. Based on it, means (standard deviation) at levels 1, 2, and 3 are 2.2(2.41), 4.35(2.47), and 4.94(2.38), respectively. As observed, the subjects divided into three groups each containing 180, 188, and 190 participants and their means (standard deviation) are 0.58(0.27), 2.38(0.89), and 6.42(1.58), respectively.

Kruskal–Wallis test was used to study the difference in AMH variable in different groups and also at different levels of Total FSFI .The results are given in Tables 1 and 2. Considering the results obtained from p-value in Table 1, it can be found that there is a significant difference among AMH groups in all values of Total FSFI subdomains including FSFI desire score, FSFI arousal score, FSFI lubrication score, FSFI orgasm score, FSFI satisfaction score, and FSFI pain score. Total FSFI score is 19.7±2.68 in the first AMH group, 25.85±1.78 in the second AMH group, and 31.72±1.27 in the third AMH group. In Table 2, p-values show that there is a significant difference among the three AMH groups at different Total FSFI levels. In Table 3, p-value (>0.05) shows that there is a significant difference among different AMH groups in terms

of BMI. Table 4 shows that the participants in the second BMI group (25<BMI<30) had higher AMH values than those in the first BMI group (BMI<25). Table 5, considering p-value (<0.05), shows that there is no significant difference among different Total FSFI levels in each age group.

4. DISCUSSION

The focus of this study was on the investigation of the correlation between AMH levels and sexual dysfunction in infertile women. Results of the study showed that there was a significant difference among three AMH groups in all values of Total FSFI subdomains including FSFI desire score, FSFI arousal score, FSFI lubrication score, FSFI orgasm score, FSFI satisfaction score, and FSFI pain score. Our finding showed that there was a significant difference among the three AMH groups at different Total FSFI levels. It was also found that the participants with overweight had higher AMH value than those with normal weight but no significant difference was found among different Total FSFI levels in each age group. The results of our study showed that AMH increased with increasing sexual function. Our study found a negative correlation between AMH levels and sexual dysfunction among infertile women.

Table 1. The significance value of Kruskal–Wallis test for variables of FSFI subdomain among different AMH groups

Variable	AMH First group Mean±SD	AMH Second group Mean±SD	AMH Third group Mean±SD	Kruskal-Wallis	p-value
FSFI desire score	3.64±1.27	4.49±1.14	4.66±1.07	71.219	0.00
FSFI arousal score	4.1±1.09	4.13±1.27	4.32±1.15	4.065	0.013
FSFI lubrication score	3.21±0.92	3.65±1.31	4.15±1.28	45.129	0.00
FSFI orgasm score	3.23±0.97	3.50±1.28	3.93±1.17	37.395	0.00
FSFI satisfaction score	3.17±1.19	3.64±1.23	3.75±1.30	17.86	0.00
FSFI pain score	2.41±1.37	2.96±1.83	3.88±1.58	74.77	0.00
Total FSF	19.7±2.68	25.85±1.78	31.72±1.27	129.257	0.00

Table 2. The significance value of Kruskal–Wallis test for different AMH groups at different Total FSFI levels

Variable	Total FSFI Level 1 Wallis	p-value	Total FSFI Level 2 Wallis	p-value	Total FSFI Level 3 Wallis	p-value
AMH	253.62	0.00	178.94	0.00	7.80	**0.005**

Table 3. Significance value of Kruskal–Wallis test for BMI variable among different AMH groups

Variable	AMH <1 First group Mean±SD	AMH 1-5 Second group Mean±SD	AMH >5 Third group Mean±SD	Kruskal-Wallis	p-value
BMI	30.26±4.76	29.97±4.90	30.21±5.25	23.80	0.00

Table 4. The significance value of Kruskal–Wallis test for AMH variable among different BMI groups

Variable	First BMI group Mean±SD	Second BMI group Mean±SD	Kruskal-Wallis	p-value
AMH	2.92±2.53	3.62±2.75	7.017	0.008

Table 5. The significance value of Kruskal–Wallis test for different AGE groups at different Total FSFI levels

Variable	Age first group wallis	p-value	Age second group wallis	p-value	Age third group wallis	p-value
Total FSFI	0.55	0.45	1.6	0.43	0.59	0.74

Aydın et al. [15] found a strong negative correlation between AMH and the female sexual distress score, indicating the relationship between lower serum level of AMH and high total sexual distress scores among the infertile women, which is in line with our study results. A relevant study by Pal et al. [22] showed that lower ovarian reserve which was associated with infertility caused sexual function complexity and that disruption of sexual functions was due to the reduction of testosterone and estrogen among the infertile patients with lower ovarian reserve, which supports our study results.

Several studies showed that patients with premature ovarian failure (POF) had more frequent sexual dysfunction than the normal patients and had lower scores in satisfaction, lubrication, orgasm, pain, and arousal but there was no difference in desire [23] and women with premature ovarian failure experienced impaired sexual well-being and were less sexually satisfied than the control women [24], while our study found a significant difference among three AMH groups in terms of all total FSFI subdomains.

Our study results are in line with the results of the study by Graziottin et al. [25] who showed that psychological stress due to POF, deficiency of estrogen and androgen, and infertility mainly caused sexual dysfunction in patients with POF [26].

Another study found a reverse correlation between the serum AMH concentration and increasing age [27] which is not in line with our study results.

Our study is not in line with the results of the study by Cui et al. [28] who did not confirm the relationship between AMH and BMI but found the relationship between AMH and age.

Our study results are not in line with the results of the study by Karli et al. [29] who found that there was no statistically significant correlation between AMH and BMI but consistent with the finding that there was a correlation between low AMH/high FSH and sexual dissatisfaction but did not find a statistical correlation between the parameters of AMH levels and sexual dysfunction.

Our study results are not consistent with the results of the studies by Palacios et al.[30] who found that sexual dysfunction was affected by age and Shifren et al.[31] who found that sexual dysfunction increased with increasing age.

There are some limitations to our study. One of the limitations of the study was the use of FSFI only once at the beginning of treatment and the absence of a fertile patient population in the same age group as a control group. In addition, we do not know the effects of androgens and other sexual hormones in this study. In fact, it is known that androgens and other hormones also affect sexual functions. However, one of the distinctive features of the study is that it only included patients undergoing IVF. Another limitation of the study was that there were no obese BMI ≥30 infertile patients to be studied.

5. CONCLUSION

It is concluded that the prevalence of sexual dysfunction is high among infertile women with low AMH. The participants with overweight had higher AMH value. There is no significant difference among different Total FSFI levels in each age group. To overcome female sexual dysfunction among infertile women, it is necessary to have sexual counseling, determine the factors affecting sexual dysfunction, and provide appropriate treatment.

CONSENT AND ETHICAL APPROVAL

This study was approved by the University/Local Human Research Ethics Committee and all procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. The study was carried out with the permission of the Research

Ethics Committee of Adana City Training and Research Hospital (Permission granted /CAAE number: 2020/05.20, Decision no. 865). All participants presented the informed consent before enrolling in this study.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. American Psychiatric Association. Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition.Washington, DC: American Psychiatric Association. 1994: 493-522.
2. Frank E, Anderson C, Rubinstein D. Frequency of sexual dysfunction in "normal" couples. N Engl J Med. 1978; 299:111-115.
3. Rosen RC, Taylor JF, Leiblum SR, Bachmann GA.Prevalence of sexual dysfunction in women: Results of a survey study of 329 women in an outpatient gynecological clinic. J Sex Marital Ther. 1993;19:171-188.
4. Spector IP, Carey MP. Incidence and prevalence of the sexual dysfunctions: A critical review of the empirical literature. Arch Sex Behav. 1990;19:389-408.
5. Salonia A, Munarriz R, Naspro R. Women's sexual dysfunction: A patho-physiological review. Br J Urol. 2004;93: 1156–64.
6. Burri A, Spector T. Recent and lifelong sexual dysfunction in a female UK population sample: Prevalence and risk factors. J Sex Med 2011;8(9):2420–30.
7. Arrington R, Cofrancesco J, Wu AW. Questionnaires to measure the sexual quality of life. Quality of Life Research. 2004;13:1643–1658.
8. Mölleken D, Richter-Appelt H, Stodieck S. Influence of personality on sexual quality of life in epilepsy. Epileptic Disord. 2010;12: 125–132.
9. Cwikel J, Gidron Y, Sheiner E. Psychological interactions with infertility among women. Eur J Obstet Gynecol Reprod Biol. 2004;117:126–31.
10. OB Damti, O Sarid, E Sheiner, et al. Stress and distress in infertility among women. Harefuah. 2008;147:256–60.
11. A Drosdzol, V Skrzypulec. Depression and anxiety among Polish infertile couples--an evaluative prevalence study. J Psychosom Obstet Gynaecol. 2009;30:11–20.
12. Cousineau T, Domar A. Psychological impact of infertility. Best Pract Res Clin Obstet Gynaeco. 2007;21:293–308.
13. Shindel AW, Nelson CJ, Naughton CK, Ohebshalom M, Mulhall JP. Sexual function and quality of life in the male partner of infertile couples: prevalence and correlates of dysfunction. J Urol. 2008;179: 1056–9.
14. Carter J, Applegarth L, Josephs L, Grill E, Baser RE, Rosenwaks Z. A cross-sectional cohort study of infertile women awaiting oocyte donation: The emotional, sexual, and quality-of-life impact. Fertil Steril. 2011;95:711–6.
15. Aydın S, Kurt N, Mandel S, et al. Female sexual distress in infertile Turkish women. Turkish Journal of Obstetrics and Gynecology. 2015;12(4):205-210.
16. Cate RL, Mattaliano RJ, Hession C, Tizard R, Farber NM, Cheung A, et al. Isolation of the bovine and human genes for Mullerian inhibiting substance and expression of the human gene in animal cells. Cell. 1986; 45:685–98.
17. Broer SL, Mol BW, Hendriks D, Broekmans FJ. Broekmans The role of antimullerian hormone in prediction of outcome after IVF:comparison with the antral follicle count. Fertil Steril. 2009;91:705-14.
18. Buyuk E, Seifer DB, Illions E, Grazi RV, 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; 95:2364–8.
19. Mosher WD. Infertility trends among U.S. couples: 1965-1976. Fam Plann Perspect 1982;14:22-7.
20. Freeman EW, Gracia CR, Sammel MD, Lin H, Lim LC, Strauss JF 3rd. Association of anti-mullerian hormone levels with obesity in late reproductive-age women. Fertil Steril. 2007;87:101–6.
21. Moslehi N, Shab-Bidar S, Ramezani Tehrani F, Mirmiran P, Azizi F. Is ovarian reserve associated with body mass index and obesity in reproductive aged women? A meta-analysis. Menopause. 2018;25: 1046–55.
22. Pal L, Bevilacqua K, Zeitlian G, et al. Implications of Diminished Ovarian Reserve (DOR) extend well beyond

reproductive concerns. Menopause. 2008;15:1086-94.
23. De Almeida DM1, Benetti-Pinto CL, Makuch MY. Sexual function of women with premature ovarian failure. Menopause. 2011;18:262-6.
24. Van der Stege JG, Groen H, van Zadelhoff SJ, Lambalk CB, Braat DD, van Kasteren YM, van Santbrink EJ, Apperloo MJ, Schultz WC, Hoek A. Decreased androgen concentrations and diminished general and sexual well-being in women with premature ovarian failure. Menopause. 20081;15(1): 23-31.
25. Graziottin A, Basson R. Sexual dysfunction in women with premature menopause. Menopause 2004;11:766-77.
26. Shindel AW, Nelson CJ, Naughton CK, Ohebshalom M, Mulhall JP. Sexual function and quality of life in the male partner of infertile couples: prevalence and correlates of dysfunction. J Urol. 2008; 179:1056–9.
27. Hansen KR, Hodnett GM, Knowlton N, Craig LB. Correlation of ovarian reserve tests with histologically determined primordial follicle number. Fertil Steril 2011;95:170-5.
28. Cui L, Qin Y, Gao X, et al. Antimullerian hormone: Correlation with age and androgenic and metabolic factors in women from birth to postmenopause. Fertil Steril. 2016;105(2):481–5.
29. Karli P., Ozdemir A. Sexual dysfunction in in-vitro fertilization (IVF) patients and the effect of ovarian reserve on sexual dysfunction. Annals of Medical Research. 2019;06:350.
30. Palacios S, Castaño R, Grazziotin A. Epidemiology of female sexual dysfunction. Maturitas. 2009;63:119-23.
31. Shifren JL, Monz BU, Russo PA, Segreti A, Johannes CB. Sexual problems and distress in United States women: Prevalence and correlates. Obstet Gynecol 2008;112:970-8.

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