

An effect of Obesity on serum anti-mullerian hormone levels in women

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Abstract

Background: This study was conducted to assess an effect of Obesity on serum anti-mullerian hormone levels in women.

Material and methods: This was a prospective observational study conducted on 100 women belonging to the age group of 20-40 years. The study comprised of 2 groups of 50 women each with group A comprising of obese women and group B comprising of non-obese women. Body Mass Index (BMI) was calculated and women with BMI >25 Kg/m² were considered obese. Serum Anti-Mullerian Hormone (AMH) levels were measured and compared between the two groups. Additionally, Waist Circumference (WC) and Waist-Hip Ratio (WHR) were measured to assess their association with decreased AMH levels.

Results: The study revealed mean serum AMH levels of 2.87±1.55 ng/ml in obese and 3.55±1.34 ng/ml in non-obese women. The mean AMH in women with higher

waist circumference and higher WHR were 2.92±1.69 and 2.89±1.62 ng/ml respectively, which were less as compared to normal women.

Conclusion: Mean serum AMH levels in obese women were lower as compared to non-obese women. Higher WC and the WHR were also found to be significantly related to low AMH levels.

Keywords: AHM, BMI, Women, Ovarian Ageing

Introduction

Anti-Mullerian Hormone (AMH), also known as Mullerian Inhibiting Substance (MIS), is a key factor in embryonic sex differentiation in males. In postnatal females, AMH is secreted by primary, secondary and antral follicles and appears to regulate early follicular development. The exact role of AMH in the ovary is not entirely clear, but the proposed functions include inhibition of follicular recruitment, inhibition of aromatase activity, and reduced sensitivity of follicles to FSH.

AMH is a member of the transforming growth factor- β family. It is expressed in the granulosa cells of early developing follicles in the ovary and is an inhibitor of follicular maturation and recruitment. AMH is emerging as an early predictor of ovarian reserve. Serum AMH levels have been shown to decrease with age and serve as a stronger and more consistent indicator of ovarian ageing compared to the number of antral follicles, inhibin B, or FSH levels. Women with Polycystic Ovarian Syndrome (PCOS) have 2- to 3-fold higher levels of AMH compared with healthy women. Clinically, AMH is used to predict outcomes with In-Vitro Fertilisation (IVF) as it is associated with the number of oocytes retrieved in an IVF cycle. Obesity has been proposed as a factor that may reduce AMH levels. Obesity is associated with impaired ovarian reserve by impairing follicular development. It also disrupts hormonal balance through insulin resistance and chronic inflammation, further impacting ovarian reserve. The clinical implications include reduced fertility and decreased response to fertility treatment.

Material and methods

This prospective observational study included 100 women belonging to the age group of 20-40 years attending the Gynaecology OPD in hospital.

The study comprised of 2 groups of 50 women each with group A comprising of obese women and group B comprising of non-obese women. The Body Mass Index

(BMI) of the subjects was calculated. Women with BMI > 25 Kg/m² were considered obese as per the WHO cutoffs for the Asian and South Asian populations.¹⁶ Serum Anti-Mullerian Hormone levels were measured. Also, a correlation of AMH levels with obesity based on Waist Circumference (WC) was noted. As stated by WHO, WC>80 cm in women is associated with an increased risk of complications for Indian women. The Waist-Hip Ratio was also measured. A ratio of 0.85 or higher was considered the cutoff for obesity. Mean and standard deviation were calculated for each group. Statistical analysis was conducted using SPSS software.

Results

In group A, the majority of women were in age group of 20-25 years (46%) followed by 26-30 years (36%). In group B, 42% women belonged to the age-group of 20-25 years followed by 38% in the age group of 26-30 years. Thus, the groups were comparable with respect to age. The mean serum AMH levels in obese women were 2.87±1.55 ng/ml, while in non-obese women, the mean was 3.55±1.34 ng/ml. A t-test yielded a t-statistic of -2.3835 and a p-value of 0.0190, indicating a statistically significant difference between the two groups. There was a statistically significant difference in mean AMH levels between women with waist circumference >80 cm (2.92 ± 1.69 ng/ml) and <80 cm (3.68 ± 1.56 ng/ml), t (98) = -2.4104, p = 0.0178.

Table 1: Age-wise distribution

Age	Number of women in group A (n=50)	Number of women in Group B (n=50)
20-25 years	23 (46%)	21 (42%)
26-30 years	18 (36%)	19 (38%)
31-35 years	09 (18%)	10 (20%)

Table 2: Mean serum AMH levels in obese and non-obese women.

Groups	Mean serum AMH levels
Group A (Obese)	2.87 ± 1.55 ng/ml
Group B (Non-obese)	3.55 ± 1.34 ng/ml
t-value	-2.3835
p-value	0.0190

Table 3: Mean AMH levels based on waist circumference

Groups	Total women (n=100)	Mean AMH
WC >80	45	2.92 ± 1.69 ng/ml
WC <80	55	3.68 ± 1.56 ng/ml
t-value	-2.4104	
p-value	0.0178	

Table 4: Mean AMH levels based on waist hip ratio

Groups	Total women (n=100)	Mean AMH
WHR > 0.85	47	2.89 ± 1.62 ng/ml
WHR < 0.85	53	3.59 ± 1.55 ng/ml
t-value	-2.2452	
p-value	0.0269	

Discussion

Obesity is a major public health crisis in the United States. More than two-thirds of the U.S. population is either overweight or obese. The BMI calculation falls within a numerical range, which places an individual into one of four categories. This data is used by researchers and physicians to educate patients and the public of potential health risks detected within a specified category. Women with lower waist circumference (<80 cm) have significantly higher mean AMH levels (3.68 ng/ml) compared to women with higher waist circumference (2.92 ng/ml). Women with a lower waist-hip ratio (<0.85) have significantly higher mean AMH levels (3.59 ng/ml) compared to women with higher waist-hip ratio (2.89 ng/ml). These findings throw light on the clinical use of these parameters in

addition to BMI to correlate obesity with low AMH levels. However, BMI remains the standard and convenient method to measure obesity in the population. BMI remained significantly associated with AMH levels in multivariable models that included adjustments for menopausal status, age, race and cycle day. In the longitudinal analysis of a subgroup, obese women had significantly lower mean AMH levels over the 8-year interval compared to the non-obese women (0.459 ng/mL; CI 0.28, 0.75 and 0.566 ng/mL; CI 0.34, 0.94, respectively; $P=.016$), corroborating the cross-sectional study results. Obese women have lower AMH levels compared to non-obese women in the late reproductive years. The findings offer further evidence of the complex relationships between obesity and reproductive hormone levels in women.

Conclusion

The study concludes that mean serum AMH levels in obese women were lower as compared to mean serum AMH levels in non-obese women. The waist circumference and the waist-hip ratio were also found to be good parameters to study relation of obesity to serum AMH levels. This study highlights the clinical relevance of using multiple parameters to define obesity and its implications on AMH levels to guide fertility treatments.

References

1. Hales CM, Carroll MD, Fryar CD and Ogden CL: Prevalence of obesity among adults and youth: United States, 2015-2016. NCHS Data Brief. 1–8. 2017.
2. Wang YC, McPherson K, Marsh T, Gortmaker SL and Brown M: Health and economic burden of the projected obesity trends in the USA and the UK. *Lancet*. 378:815–825. 2011.
3. Ahima RS and Lazar MA: Adipokines and the peripheral and neural control of energy balance. *Mol Endocrinol*. 22:1023–1031. 2008.
4. Davut Koca, Yavuz Nak, Sait Sendag, et al. Evaluation of serum anti-Müllerian hormone concentrations following treatment with vitamin D in Holstein Friesian heifers. *Reproduction in Domestic Animals*. 2023, Vol.58, No.12, p.1695.
5. 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: 101-106.
6. Alvarez-Blasco F, Botella-Carretero JI, San Millan JL, Escobar-Morreale HF: Prevalence and characteristics of the polycystic ovary syndrome in overweight and obese women. *Arch Intern Med*, 2006; 166: 2081-2086.
7. March WA, Moore VM, Willson KJ, Phillips DI, Norman RJ, Davies MJ. The prevalence of polycystic ovary syndrome in a community sample assessed under contrasting diagnostic criteria. *Hum Reprod*. 2010; 25:544–551
8. Alexander CJ, Mathur R, Laufer LR, Azziz R. Amenorrhea, Oligomenorrhea and Hyperandrogenic Disorders. In: Hacker NF, Gambone JC, Hobel CJ, editors. *Hacker and Moore's Essentials of Obstetrics and Gynecology*. 5th ed. China: Elsevier; 2010:364-367.