ORIGINAL ARTICLE

RELATIONSHIP OF BODY MASS INDEX WITH OVARIAN RESERVE STATUS OF INFERTILE WOMEN MEASURED BY ANTI-MÜLLERIAN HORMONE LEVEL

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Background: Infertility is believed to be more in obese than normal women. Anti-Müllerian hormone has been used as an index of ovarian reserve. The objective of this study was to see the relationship of body mass index with serum Anti-Müllerian hormone levels in infertile women of reproductive age. **Methods:** This cross-sectional study was conducted at Infertility Clinic of Obs/Gyn Unit-II, Civil Hospital, Karachi from Oct 2011 to Oct 2012. Fifty-two infertile women aged 20–35 years were selected from the Out-patient Department. Height and weight was measured in all participants. Body mass index was then calculated. The patients were sub-classified according to body mass index classification for Asian population. Blood samples to estimate Anti-Müllerian hormone levels were obtained irrespective of the day of menstrual cycle. On the basis of Anti-Müllerian hormone levels, infertile women were grouped into normal ovarian reserve (Anti-Müllerian hormone ≥1.25 ηg/L) and diminished ovarian reserve (Anti-Müllerian hormone ≤1.25 ηg/L). **Results:** Increased mean values of body mass index were found in diminished ovarian reserve group compared to normal ovarian reserve group. Inverse significant correlation was found between body mass index and Anti-Müllerian hormone level in diminished ovarian reserve group. **Conclusion:** Serum Anti-Müllerian hormone has significant negative association with body mass index in infertile women having diminished ovarian reserve.
Keywords: Body mass index, obesity, Anti-Müllerian Hormone, fertility, infertility, sterility

INTRODUCTION

In recent decades, infertility has become a major global issue with medical, economical, and psychosocial impact on infertile couples. Large number of infertile population is very anxious and eager to be treated. The prevalence of infertility worldwide is approximately 10–15% whereas in Asia it is around 8–12%. Infertility rate in Pakistan is about 21.9%.[1, 2]

Ovarian reserve is the amount of oocytes present in both ovaries. In order to determine a woman's ovarian reserve, 3rd day serum follicle-stimulating hormone (FSH) and anti-Müllerian hormone (AMH) levels are measured. Diminished ovarian reserve (DOR) is a condition associated with decreased quantity and quality of oocytes in the ovaries and is correlated with poor IVF (*in vitro* fertilization) outcomes.[3,4] Anti-Müllerian hormone testing is particularly beneficial for younger women because diminished ovarian reserve is often overlooked in this age group, leading to an incomplete diagnosis of infertility.[5]

Anti-Müllerian hormone is a protein hormone and belongs to the group of transforming growth factor (TGF-β) super family. It is mainly produced and secreted by the granulosa cells of ovarian follicles. The level of serum AMH is hardly detectable at birth, but remains stable throughout the reproductive period. With advancing age, AMH level starts declining. According to recent studies, serum AMH levels represent the quantitative aspect of ovarian reserve. Moreover, its level strongly correlates with the size of the early growing follicle pool, and due to lack of inter-cyclic variability, it can be regarded as a diagnostic marker to assess ovarian reserve.[6]

Female fertility is also affected by body weight and body mass index (BMI).[7] Obesity and overweight are conditions that have great impact on reproductive health. Link between obesity and infertility has been discussed in various studies. Obesity leads to irregular and anovulatory menstrual cycles, decreased ability to conceive, and a poor response to fertility treatment. In obese infertile women obesity should be treated first in order to improve their reproductive functions.[8]

Although no relationship between AMH and BMI has been found in infertile females, recent evidences state that infertile subjects with reduced ovarian reserve have a negative relationship with their BMI.[9]

The objective of this study was to see the relationship of BMI with serum AMH level in infertile women of reproductive age.

MATERIAL AND METHODS

This study was conducted at Institute of Basic Medical Sciences, Dow University of Health Sciences in collaboration with Obstetrics and Gynaecology Unit-II, Civil Hospital, Karachi. Patients were selected from Outpatient Department and bench work was carried out at the Dow Diagnostic Research and Reference Lab,

Ojha Campus from October 2011 to October 2012. Proposal of research was approved by the Ethical Committee of Institutional Review Board. Informed written consent was taken from all participants.

Fifty-two primary infertile women aged 20–35 years, with no history of previous pregnancy, normal semen analysis of their husbands, and patent fallopian tubes on the basis of hysterosalpingography were included in the study. Secondary, sub-fertile women with history of previous pregnancy, with normal report of husband's semen analysis, patent fallopian tubes and no history of pelvic inflammatory disease or endometriosis were also included in the study.

Infertile women of more than 35 years age, blocked fallopian tubes, ovarian malignancy, previous pelvic surgeries, drugs like oestrogen antagonists or having male infertility factor were not included in the study.

Height of the subjects was measured in centimetres using dual height stadiometer and ZT-120 Health Scale was used to measure their weights in Kg, and BMI was calculated. The patients were categorised according to new WHO BMI classification for Asian population.[10] Body Mass Index was calculated as:

$$BMI= Weight\ in\ Kg/(Height\ in\ m)^2$$

For estimation of serum AMH levels, subjects' blood samples were in gel tubes, centrifuged, and serum frozen at -20 °C. Serum AMH level was determined by ELISA, using Human AMH Elisa kit (CDN-E 1350).

Statistical analysis was done using SPSS-16. Continuous variables were expressed as Mean±SD. Relationship between two different continuous variables was assessed by correlation. Pearson's correlation was used to determine the coefficient of correlation (r), and $p<0.05$ was considered statistically significant.

RESULTS

Mean AMH levels in NOR group was 2.05±0.48 ηg/ml (range: 1.3–3.2 ηg/ml). Mean AMH in diminished ovarian reserve (DOR) group infertile subjects was 0.91±0.2 ηg/ml (range: 0.05–1.2 ηg/ml).

In NOR group, mean values for height, weight and body mass index were 154.8 Cm, 57 Kg, and 22.85 Kg/m^2 respectively. Mean height for DOR group was 154.44±4.68 Cm (142–169 Cm). Mean values for weight in infertile subjects were 65±8.96 Kg (59–85 Kg). Mean BMI was 26.16 Kg/m^2 (Table-1).

New BMI criteria for Asian population were taken as a reference for assessing the level of obesity. Body mass index was calculated in all the subjects. The mean value of body mass index in NOR group was 22.8 Kg/m^2 and mean value calculated for DOR was 26.13 Kg/m^2. High incidence of obesity was found in DOR group.

Negative correlation was found in NOR group but was not statistically significant ($p>0.05$). Significant inverse correlation ($r= -0.44$, $p<0.05$), was found between BMI and AMH in DOR subjects (Table-2, Figure-1).

Table-1: Anthropometric measurements and AMH level in the subjects

Variables	NOR group (n=30)	DOR group (n=22)
Height (Cm)	154.81±3.87 (Range: 145–163)	154.41±4.68 (Range: 142–169)
Weight (Kg)	56.62±6.52 (Range: 42–75)	60.7±8.96 (Range: 59–85)
BMI (Kg/m^2)	22.85±2.18 (Range: 20–30)	26.16±3.45 (Range: 22–32)
AMH (ηg/ml)	2.05±0.477 (Range: 1.3–3.0)	0.91± 0.20 (Range: 0.5–1.2)

Table-2: Pearson's correlation for BMI of subjects

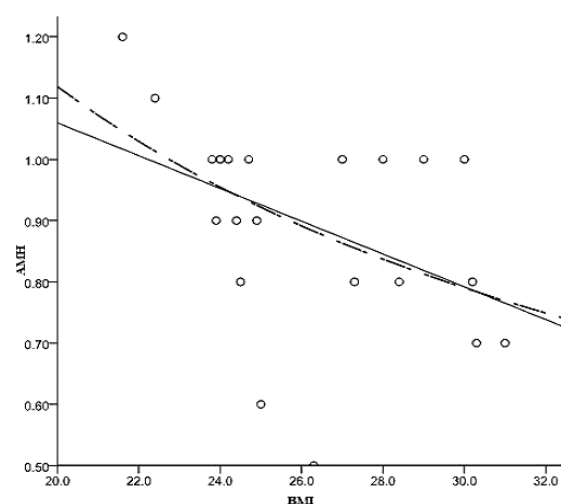| Variables	Correlation coefficient (r)	p
DOR BMI (Kg/m^2)	-0.44	0.04*
NOR BMI (Kg/m^2)	-0.24	0.08

*Significant

Figure-1: Correlation of AMH with BMI in DOR group

DISCUSSION

Infertility is a global issue and needs to be assessed at an earlier stage for better options of treatments. There are various conventional tests available for ovarian reserve assessment which includes the basal 3rd day FSH levels and early antral follicle count by transvaginal ultrasound. Apart from these tests, AMH has also been proved as a reliable marker for ovarian reserve assessment.[11]

In the present study, 52 women were selected in their reproductive age and were divided into NOR and DOR groups on the basis of AMH levels. We divided infertile subjects into two subgroups on the basis of AMH levels consistent with Gnoth *et al*[12]. In that study, 97% infertile women were identified with a reduced ovarian reserve using a cut-off level <1.26 ηg/ml of AMH.[12] Group-I consisted of women with Normal Ovarian Reserve (AMH levels ≥1.26 ηg/ml)

and Group-II comprised of DOR subjects (AMH levels ≤1.26 ηg/ml).

Negative but insignificant correlation was found between AMH level and BMI in NOR group (r= -0.08). This was in agreement with Sahmay et al[13] and Elder et al[14] which showed no significant correlations between BMI and AMH levels ($p>0.05$). This finding was in contrast with the studies conducted by Skalba et al[15] and Buyuk et al[16] who showed significant negative correlation of AMH to BMI (r= -0.696, $p<0.001$). According to their study, elevated BMI was associated with decreased serum AMH levels in infertile females with diminished ovarian reserve compared to ones with normal ovarian reserve.

CONCLUSION

Increased BMI leads to diminished ovarian reserve in infertile patients. Obese infertile women should initially be treated for obesity in order to improve their reproductive function.

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