

# Correlation of AMH and LH Levels in PCOS Patients with Pregnancy Rate

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## ABSTRACT

**Objective:** The objective of this research was to scrutinize the role played by AMH (Anti-mullerian Hormone) and LH (Luteinizing Hormone) for predicting the rate of pregnancy in women suffering from PCOS. It also covers the influence of FSH (Hormone that is Follicle-stimulating) and AFC (Antral Follicle Count) on PCOS patients. It also explains why one has to know about the role of these hormones, especially in PCOS patients. It also discusses the pregnancy rate and how a woman suffering from PCOS can get pregnant. This paper also details about the measurement of AMH levels and how it helps in the diagnosis and prognosis of PCOS. Women went through ovarian stimulation that was controlled with extended agonist protocol and succeeded by in Vitro Fertilization. Subsequently, the results from a comparison was made of women who were pregnant and those who were non-pregnant.

Low AMH levels represent low ovarian reserve. It is common for AMH levels to gradually decline as a woman ages. However, this is not a good sign for younger women, as low ovarian reserve can represent premature infertility. Then, AMH fertility treatment is suggested to restore fertility, in which IVF (In Vitro Fertilization) is done in conjunction with FSH levels of 25 mIU/mL or above is considered to be positive. If FSH levels are at or greater than this figure, then more than one FSH measurement is necessary.

**Keywords:** AMH; LH; FSH; Antral Follicle Count, PCOS; clinical pregnancy rate.

## INTRODUCTION

PCOS or Polycystic Ovary Syndrome is a commonly occurring disorder of the endocrine in females who fall under the age of reproduction. The correlation between PCOS and incapacitated capacity to reproduce is clearly shown. PCOS is marked by unruly folliculo genesis, especially from the primordial to the main stage, leading to irregular cycles. The AMH in antral follicles suppresses the FSH (Follicle-stimulating hormone), sensitivity, and steroidogenesis, and conquering LH (Luteinizing Hormone) collectors till follicles are selected. AMH plays a role in primary follicular development and probably prominent in follicle selection. According to studies, serum AMH levels may provide essential information in sufferers having disturbed ovarian function like anovulation[1].

PCOS is mostly the reason for oligo anovulation and is marked by heterogeneity in the representation of hyperandrogenism. Although AMH serum concentration decreases, it is highly predictive when compared with serum FSH levels and acts as an independent signal of ovarian reserve. The levels of AMH were threefold in women who have PCOS and high AMH levels forecast OHSS (Ovarian Hyper-stimulating Hormone). So, PCOS falls under a different category. Moreover, PCOS presents some distinct features, including increased AFC (Antral Follicle Count) and alteration in the ratio of FSH to LH[2].

Serum AMH levels depends on how severe the PCOS disorder is. The rates of pregnancy are inversely proportional to AMH levels, meaning as AMH levels increase, pregnancy rates decrease. Many researches have been done regarding correlation between serum AMH levels and embryo quality or oocyte. Nevertheless, a few studies are meant for assessing AMH's role in forecasting the potential results in treating infertility, especially in women with PCOS syndrome. The goal of this analysis is to evaluate the correlation between AMH, FSH, and AFC with rates of pregnancy in women who have PCOS and to show how efficient is AMH as a marker of IVF outcome among the aforesaid patients. AMH, FSH, and AFC are also compared in order to determine clinical pregnancy in PCOS group as the information is limited regarding this case [3].

Most women with PCOS come under class 2 ovulatory dysfunction. AMH or Anti-mullerian Hormones are the protein hormones secreted by the developing follicles (egg sacs containing immature eggs) in the ovaries called ovarian follicles. AMH hormones serve as markers of ovarian reserve in assisted reproduction. An assessment of the ovarian reserve is important for the workup of infertility and treatment. The more the eggs are, the more should be the AMH hormones in the blood stream[4].

Because PCOS Patients possess numerous small follicles in the pre-antral and antral phase, AMH serum concentrations are elevated. The AMH levels in PCOS are 3-4 times more than those of normal ovaries. AMH levels give an indication of the fertility potential of a woman. They are important in the diagnosis and prognosis of PCOS. The levels of AMH are determined by a simple blood test that can be done randomly during the menstrual cycle. This test helps in identifying patients having higher-than-normal AMH scores. This is an important hormone test for women with PCOS. After seeing the results, the doctor might suggest a full internal ultrasound scan for further investigation. Women with PCOS usually have elevated levels of AMH mostly because of high levels of follicles in the early stage of development. At any age, an AMH score of 48 pmol/L or above is considered high and can indicate PCOS. According to studies, about 97% of women having an AMH score of over 71 pmol/L suffer from PCOS [5].

The other tests that are done to determine reserve of ovarian include basal Follicle Stimulating Hormone (FSH), Luteinizing Hormone (LH) test, Estradiol (E2) test, and Antral Follicle Count (AFC). The inhibin B levels can also be checked. Although FSH and LH levels have a lower predictive value, they are usually determined in order to predict the reserve of ovarian at the beginning of the follicular stage

### **Effects of High AMH Levels**

According to researches carried out in renowned medical institutions such as Harvard Medical School, women possessing high AMH levels in premenopausal stage are at a risk of breast cancer. High AMH levels resulting from high levels of follicles in the early stages of development can indicate PCOS [6].

### **Effects of Low AMH Levels**

Low AMH levels are a sign of low ovarian syndrome. AMH levels may drop significantly as women age or approach the menopause stage. AMH levels can fall gradually in women over 35

years of age; it can be literally zero in some cases. If they are appreciably low in young women, it can be a sign of premature loss of fertility [7].

### **Pregnancy Rate in PCOS Patients**

PCOS (Polycystic Ovary Syndrome) is an imbalance of AMH, LH, and SHBG (Sex Hormone Binding Globulin) hormones that brings about irregular periods. Apart from this, PCOS patients experience unwanted male pattern hair growth, acne, and weight gain. Multiple egg containing follicles that have not reached full maturity stage are spotted in the ovaries. These are in the form of cysts. Women with PCOS go through irregular menstrual cycles when their brains do not get the right signals from the pituitary glands. Without these signals, ovulation does not happen every month (release of eggs) [5].

Patients having PCOS condition mostly have trouble getting pregnant. PCOS can make it difficult for a woman to conceive because of ovulation and egg quality problems. According to statistics, about five million women in India have this condition. According to a report, approximately 18 % of women in our country under 30 years of age, including teens above 15 and adolescent girls have PCOS and this syndrome accounts for nearly 30% of infertility in women. PCOS can also lead to several complications including miscarriage [4].

### **How Can a Woman Afflicted by PCOS Restore Fertility?**

Fortunately, there are a number of effective treatment alternatives but only so long as it is diagnosed in a timely manner; pregnancy with PCOS is achievable. Although there are medical and natural treatments that can help a woman become pregnant, some changes in the diet and lifestyle play an important role. Many fertility specialists and OBs/GYNs (Obstetricians/Gynecologists) say patients suffering from PCOS should seek fertility treatments to be able to get pregnant. This is not far from truth. However, there are some proven cases In which women have attained healthy PCOS pregnancy by making suitable changes in food and lifestyle. This will not only help restore your periods but also fulfill your motherhood dreams. Fertility treatments alone can't be successful [8].

### **METHODOLOGY**

While sperms are constantly produced in men accounting to more than a million, eggs in women are by far fewer in number. The total number of eggs or oocytes in women is fixed, which will remain from birth to the rest of their lives. The sperm count might gradually reduce as men age and women become completely infertile at menopause. AMH testing is a simple method to determine a woman's ovarian reserve. It is done to diagnose problems such as early menopause or reduced ovarian reserve. It is also done to evaluate PCOS and effectiveness of ovarian cancer. AMHs can be drawn any time during the menstrual cycle and the outcome does not change cycle-to-cycle.

### **RESULTS**

The table below sums up the clinical and demographic attributes of the cases investigated. Only a minor difference was recognized as far as age, infertility duration, BMI (Body Mass Index), LH, E2, TSH, AFC serum FSH, , and the total number of oocytes, along with serum AMH levels in women who were pregnant and who were not pregnant.

- 34out of 100 women were observed to have clinical pregnancies
- Mean of AMH in pregnant women: 6.7 +/- 2.8 ng/mL
- Mean of AMH in non-pregnant women: 7.1 +/- 4.3 ng/mL
- A minor mean difference in FSH and AFC

Low AMH levels represent low ovarian reserve. It is common for AMH levels to gradually decline as a woman ages. However, this is not a good sign for younger women, as low ovarian reserve can represent premature infertility. Then, AMH fertility treatment is suggested to restore fertility, in which IVF (In Vitro Fertilization) is done in conjunction with FSH levels of 25 mIU/mL or above is considered to be positive. If FSH levels are at or greater than this figure, then more than one FSH measurement is necessary.

**Table 1. below shows AMH levels in women.**

<b>Very low AMH levels</b>	<b>Below 1 ng/ml</b>
<b>Undetectably low levels of AMH</b>	below 0.15 ng/ml
<b>High AMH Levels</b>	above 3.5 Ng/ml (often an indicator of PCOS)

**Table 2 Shows gives normal LH levels:**

<b>Stage</b>	<b>Measure</b>
<b>Menstrual cycle of women at the follicular stage</b>	1.8 to 12.0 IU/L.
<b>Menstrual cycle of women at the highest point</b>	8.5 to 75 IU/L
<b>Menstrual cycle of women at the luteal stage</b>	0.6 to 17.0 IU/L
<b>Women who are pregnant</b>	1.6 IU/L

**Table 3. Shows demographic and clinical attributes of the population studied**

	<b>Pregnancy (+) (n=51)</b>	<b>Pregnancy (-) (n=99)</b>	<b>P Value</b>
<b>Age (in years)</b>	28.56_3.85	29.0_4.35	0.189
<b>Infertility duration (in years)</b>	5.70_3.25	5.95_3.30	0.75
<b>BMI (Body Mass Index) (kg/m<sup>2</sup>)</b>	25.5_3.75	25.6_4.20	0.78
<b>AMH (ng/mL) Anti-mullerian Hormone)</b>	6.70_3.0	7.15_4.30	7.15_4.30 0.590
<b>LH (Luteinizing Hormone)(mIU/mL)</b>	3.75_1.95	4.2_2.42	0.255
<b>FSH (Follicle-stimulating Hormone)(mIU/mL)</b>	5.45_3.80	4.75_2.80	0.479
<b>E2 (Estradiol) (pg/mL)</b>	41.85_18.20	62.70_25.0	0.495
<b>TSH (Thyroid-stimulating Hormone)(mIU/L)</b>	1.45_0.80	1.70_0.85	0.265
<b>AFC (Antral Follicle Count)</b>	13.60_5.30	12.20_5.30	0.162
<b>Total oocyte</b>	11.2_4.6	11.50_5.50	0.625

The table 3 shown here gives a summary of the demographic and clinical attributes of the population studied. No major difference was found as far as age, duration of infertility, BMI, serum

AMH, LH, FSH, E2, TSH, AFC, and the total number of oocytes between women who were pregnant and those who were non-pregnant women.

## Statistics

Group attributes were taken into account and compared through arithmetic means and standard deviations. Independent sample t-test was also done to compare parametric variables. If necessary, Chi-square test was done, along with it. The p values were taken into account with high importance. The AMH levels were segregated as 25th percentile, between 25th percentile and 75th percentile, or above the 75th percentile. Statistical analysis was conducted using SPSS (Statistical Package for Social Science).

## DISCUSSION

PCOS negatively influences spontaneous pregnancy rates, mostly because of anovulation, deteriorated embryo quality, and endometrial receptivity. Therefore, conception becomes next to impossible with increased AMH levels. However, according to a study, there was a slight difference between pregnant and non-pregnant women. Also, CPR is directly proportional to AMH levels. While predicting pregnancy, the value of AMH was examined in a number of studies in which the results were conflicting [9].

According to certain studies, serum AMH levels have a correlation with pregnancy rates while certain other studies showed absence of correlation between levels of serum AMH and the rates of pregnancy. There is a lack of uniformity in the results [10].

According to a study at Kaya et al, the mean serum AMH varies from 5.82 ng/mL to 9.82 ng/mL. But, average AMH levels in expectant and non-expectant women were ignored. The cut-off figures for the 25th percentile as well as 75th percentile were less than the AMH levels mentioned in the PCOS patients. The results were consistent with the average levels of AMH mentioned in the paper studied [9].

According to a study at Nelson et al, covering 340 patients, the rates of live birth increased as the levels of AMH increased. However, this was only applicable for patients with basal levels of AMH ( $< 7.60$  pmol/L). Apart from this figure, differentiation was not found for birth. In addition, when the oocyte yield is added into a multivariable evaluation, it was found out that only the oocyte produce was the variable that helped predict live birth [11].

Broer et al, who conducted a meta-analysis, gave a clear picture on the application of AMH for non-pregnancy prediction. As per statements, they were not able to predict non-pregnancy accurately with AMH and AFC. Also, a slight difference was seen between the ROC (Receiver Operating Characteristic) curves among the two tests [12].

On the contrary, Xi et al, declared that the rates of pregnancy were significantly low in PCOS patients with high AMH levels. The cut-off values were same as those of the study from Kaya et al (25 % and 75 %).

According to the systematic review as well as meta-analysis of 9 observational studies performed by Heijnen et al, PCOS patients who underwent IVF procedure have same pregnancy, miscarriage, and live birth rates when comparisons were to non-PCOS women. The represented rates of pregnancy rates had high significance when comparisons were to the other studies in the theory. In certain studies, it was observed that the rates of unending pregnancy in addition to embryologic factors were in accordance with the AMH percentiles in both PCOS patients and non-PCOS women. Moreover, the rates of ongoing pregnancy fell as the percentage of AMH increased above fifty percent. However, this continued to be insignificant [13].

In the early phase of the study, pilot results showed that CPR (Cardiopulmonary resuscitation) decreased with increased AMH levels. The decrease in CPR was much pronounced at AMH serum levels greater than 15 ng/mL. However, at a later stage of the study, there was an increase with the number of patients and the CPR started increasing. This change in the inclination demonstrates the importance of the population size. The AMH level checking is done still as an experiment and a well-defined levels of serum AMH for fertile and infertile cases are not available. In order to prevent the possible prejudice on patient selection only fresh treatment cycles were covered and a flat dosage of 150 IU was employed for all patients irrespective of hormone levels such as AMH and FSH, AFC, and age [14-17].

## CONCLUSION

AFC, FSH, and AMH are not considered to be able to predict women suffering from PCOS, taking In Vitro Fertilization treatment. Low AMH levels indicate low ovarian reserve, which is common in aged women. However, if young women have low ovarian reserve, they can be victims of premature loss of fertility. In such case, AMH fertility treatments, along with changes in the diet, can help restore fertility. Women with high AMH levels most likely will have PCOS that can hinder pregnancy.

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## Competing Interests

The authors have declared that no competing interest exists.

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