International Journal of Biotechnology and Biochemistry
ISSN 0973-2691 Volume 15, Number 2 (2019) pp. 87-95

http://www.ripublication.com

Prostate Specific Antigen in Women with PCOS and Its Correlation with Total Testosterone

Dr. Shwetha Nagaraj[1], Dr. Akshatha Lalesh Naik[2*], Dr. Pratibha K[3], Dr Vinay Kumar K[4]

[1]Assistant Professor, Department of Biochemistry, Shridevi Institute of Medical Science and Research Hospital, Tumkur, Karnataka, India.

[2]Assistant Professor, Department of Biochemistry, Kidwai memorial institute of Oncology, Bangalore, Karnataka, India.

[3]Professor and Head, Department of Biochemistry, ESIC & PGIMSR, Bangalore, Karnataka, India.

[4]Associate Professor, Department of Dentistry, Shridevi Institute of Medical sciences and Research Hospital, Tumkur, Karnataka, India.

Abstract

Aim: Polycystic Ovarian Syndrome (PCOS) manifested by amenorrhea, hirsutism, and obesity associated with enlarged ovaries. Its frequency in world is 5-10% and in India it is 9.13%. Prostate Specific Antigen (PSA) synthesized and secreted by prostate gland and several non-prostatic tissues and body fluids of males as well as females.[1,2,3]a) To estimate serum PSA and LH, FSH, LH/FSH ratio, Total Testosterone, and Insulin in patients diagnosed with PCOS and controls. b) To study the association of serum PSA with Total Testosterone in patients with PCOS and controls. MATERIALS AND METHODS: 60 female PCOS cases (in the age group of 20 to 35 years) and 60 female control (healthy subjects) were selected. Serum PSA along with LH, FSH, LH/FSH ratio, Total Testosterone, and Insulin was estimated using Chemiluminenescence immune assay Access 2 analyzer RESULTS: Mean serum PSA in PCOS cases and controls (0.219±0.538 and 0.0165±0.029 ng/ml respectively) were found to be significantly different with p value (P<0.0001). serum PSA was significantly increased in polycystic ovarian syndrome, and significantly linked to total testosterone. CONCLUSION: serum PSA was significantly increased in polycystic ovarian syndrome, and significantly linked to total testosterone, when compared to healthy individuals.

Keywords: *Prostate-Specific Antigen (PSA), Polycystic Ovary Syndrome (PCOS), Hirsutism,*

[*] **Corresponding Author:** Dr. Akshatha Lalesh Naik
Email id: aksh015@gmail.com

INTRODUCTION

Polycystic Ovarian Syndrome (PCOS) was originally described in 1935 by Stein and Leventhal as syndrome manifested by amenorrhea, hirsutism, and obesity associated with enlarged ovaries. Most frequent endocrine disorders in reproductive aged women. Its frequency in world is 5-10% and in India it is 9.13%. PCOS is an heterogenous,

Multifactorial and polygenic condition characterised by excessive androgen production by the

ovaries mainly.[1,2,3]Prostate Specific Antigen (PSA) was earlier thought to be exclusively synthesized and secreted by prostate gland, its presence has now been recorded in several non-prostatic tissues and body fluids of males as well as females. Recent studies have reported the presence of PSA in serum of women with PCOS.[4] Breast, ovarian, and endometrial tissues synthesize PSA and contribute to the PSA in blood.[5,6]

METHODOLOGY

Study design: case control study

Sample size: blood samples taken from 120 women. Out of which 60 women were cases diagnosed with PCOS and the obtained data was compared with 60 age matched women with normal androgenic hormone level, regular menstrual cycles and normal pelvic ultrasonography who served as controls.

Exclusion criteria: women with history of Congenital adrenal hyperplasia, Thyroid dysfunction, Hyperprolactinemia, Cushing syndrome, Ovarian tumours, Idiopathic hirsutism and patients previously treated for PCOS were excluded from the study.

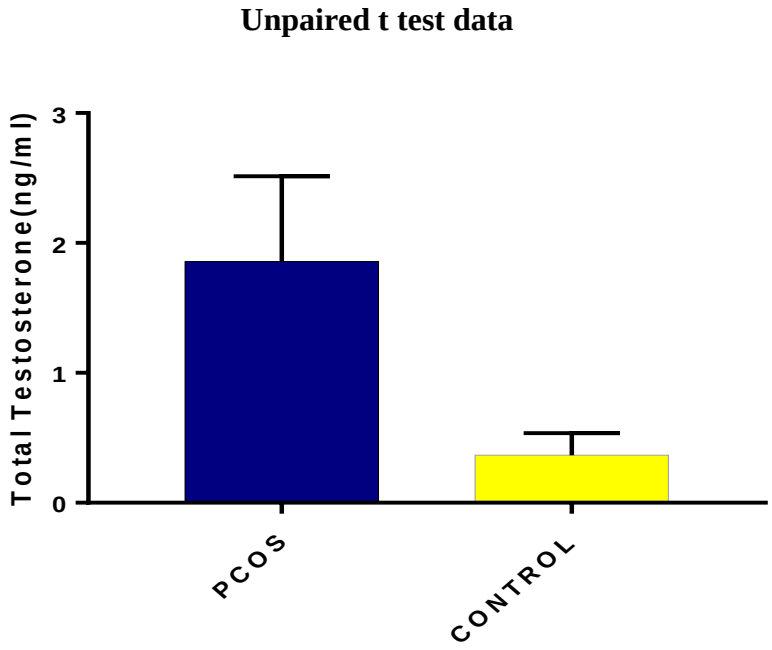
Methodology:

Under aseptic precautions 5ml of venous blood is collected using a syringe, transferred into a plain vial and allowed to clot at 37˚C, and then centrifuged at 3000 rpm for 5 minutes to separate the serum. The sera was transferred to plain bullet vials and labelled and stored frozen until analysis. From the samples collected, serum PSA was analysed using Chemiluminenscence immune assay Access 2 analyzer from Beckman Coulter© Hybritech® PSA[7]. The study was approved by institutional ethics committee and informed consent was taken from all the subjects.

Statistical Analysis: Student ‘t’ test was used for comparing the mean values of two groups and to assess the strength of relationship between variables. Karl-Pearson co-efficient of correlation and Chi Square statistics was calculated. P value <0.05 was considered significant. The statistical data analysis was done using Statistical Package SPSS-20 version.

RESULTS:

SERUM TOTAL TESTOSTERONE



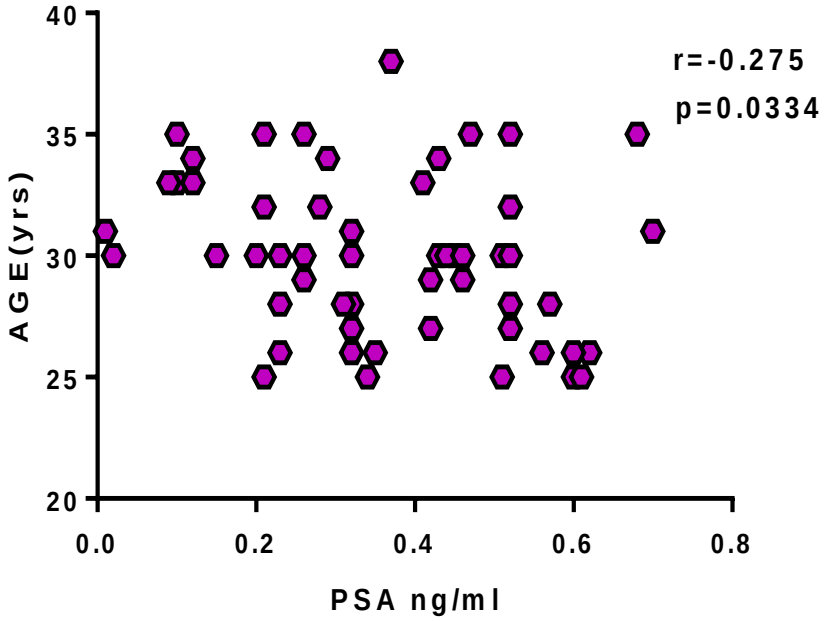
Serum Total Testosterone levels

The mean serum Total Testosterone levels in the control group was 0.37 with a standard deviation of 0.17, the mean serum Total Testosterone levels in PCOS patients was 1.855 with a standard deviation of 0.66 with p value of <0.0001.

CORRELATION OF SERUM PSA WITH AGE

	Serum PSA in Controls		Serum PSA in PCOS	
	r	P	R	P
AGE	-0.1862	0.1543	-0.275	0.0334*

***p < 0.05, **p< 0.01, ***p< 0.001**



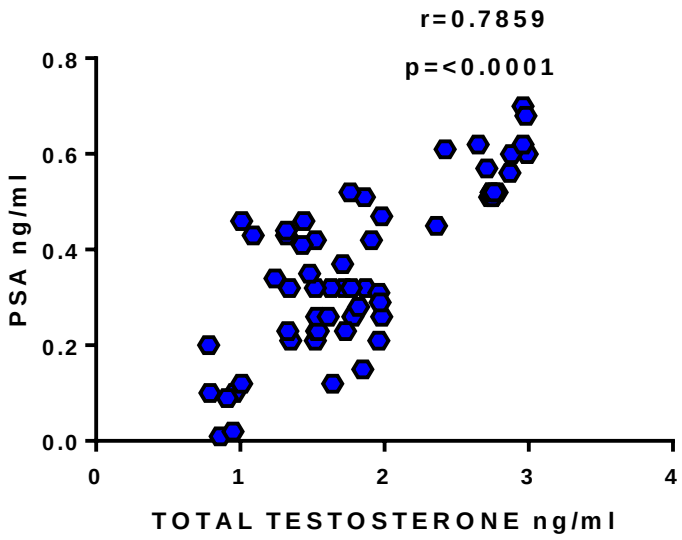
Graph (9) correlation of serum PSA with AGE of cases

There was no correlation found between serum PSA and Age in the Control group but in PCOS group a statistically significant moderately negative correlation was found with Age .

CORRELATION OF SERUM PSA WITH TOTAL TESTOSTERONE

	Serum PSA in Controls		Serum PSA in PCOS	
	r	p	R	P
Total Testosterone	-0.003075	0.9814	0.7859	<0.0001

p < 0.05, **p< 0.01, ***p< 0.001,*p<0.0001**



Correlation of serum PSA with TOTAL TESTOSTERONE of cases

There was no correlation found between serum PSA and Total Testosterone in the Control group but in PCOS group a statistically significant positive correlation is found with serum total testosterone.

DISCUSSION

Despite the difficulty in ascertaining the prevalence of PCOS among women there are convincing data to suggest that it affects between 6% and 8% of women worldwide, using the National Institutes of Health (NIH) 1990 criteria, it can be considered one of the most common disorders of humans, and the most common endocrine abnormality of women of reproductive age.[8]

Clinically, whenever PCOS is diagnosed it implies an increased risk for infertility, dysfunctional bleeding, endometrial carcinoma, obesity, type 2 diabetes mellitus (DM), dyslipidemia, hypertension, and possibly cardiovascular disease (CVD).[9,10,11]

Human glandular kallikrein 2(hk2), another serine protease closely related to serum PSA, which is gaining ground as a better diagnostic tool in prostate cancer. The expression of these two proteases is known to be regulated by androgens and progestins in hormonally responsive tissues such as the male prostate and also female breast.[12,13,14,15]

In this study, we compared serum PSA level in PCOS and control groups. We found that serum PSA level was higher in women with PCOS compared cases (PSA: 0.37±0.17 ng/ml in PCOS, PSA: 0.02±0.03 ng/ml in control cases, P<0.0001). Total testosterone, was demonstrated to be significantly higher in PCOS (p<0.0001,).

Additionally, positive correlations were found between serum PSA and total testosterone (r: 0.786, P<or=0.0001), PSA is a well-established tumor marker of prostatic adenocarcinoma and also known to be produced by extraprostatic tissues and fluids. As the gene expression of PSA is upregulated by the androgens and progestins in hormonally responsive tissues hyperandrogenic syndromes such as PCOS may be associated with elevated serum PSA levels. PSA appears to be a promising marker of endogenous androgen excess in females suffering from PCOS.[16,17,18]

Circulating androgens and hirsutism are independently associated with the degrees of PSA and fPSA in PCOS women. Increased plasma levels of PSA (>10 pg/ml) and fPSA (>2.1 pg/ml) could be helpful as a diagnostic tool for women with ovulatory or anovulatory PCOS.[19,20,21]

PSA was, until recently, thought to be a highly specific biochemical marker of prostatic epithelial cells which is not produced by any female tissue but by using immunological and molecular techniques to demonstrate the presence of PSA protein or mRNA in various non-prostatic tissues. recently it has been found that PSA is present in 30-40% of breast tumors and at a lower percentage in other tumors including lung, colon, ovary, liver, kidney, adrenal tumors. Others have found PSA in skin and salivary gland tumors and in normal endometrium.[22]

In nonprostatic tissues, PSA exists mainly in its free molecular form. The gene expression and protein production of PSA in nonprostatic tissues are under the regulation of steroid hormones via their receptors. Androgens, glucocorticoids, and progestins up-regulate the PSA gene expression, resulting in an increase of protein production. Estrogen by itself seems to have no effect on PSA regulation, but it can impair PSA production induced by androgen. It remains unknown whether PSA is enzymatically active and what is the physiologic role of PSA in nonprostatic tissues. It is speculated that PSA may be involved in the regulation of growth factors. Measuring PSA in breast cancer cytosol, breast-nipple aspirate fluid, and female serum may have potential clinical utilities, including breast cancer prognosis, breast cancer risk assessment, and evaluation of androgen excess.[23]

Prostate-specific antigen (PSA) is present at very low concentrations in female serum, but it can now be measured with highly sensitive immunoassays. The PSA gene is regulated by steroid hormones through the action of steroid hormone receptors. Thus, examined whether female serum PSA is associated with hyperandrogenic states. Female serum PSA may be a new biochemical marker of androgen action in females.[24]

So, serum PSA level may be used for diagnosis of PCOS and other hyperandrogenic states. extensive workup and investigations are needed to evaluate possible role of PSA level for diagnostic value.

We are under the impression that indeed the role of PSA has been undermined by inadequate research, even though our study only caught a glimpse of the presence and

its increased levels in PCOS patients, it expedite the possibility that the clinical uses can be challenged and redefined. Further studies are needed to evaluate correlation between PSA level and prognosis of PCOS in infertility and metabolic disorder.

LIMITATION

A larger prospective controlled study is needed to further determine the sensitivity, specificity and predictability of this marker in other hyperandrogenic states such as hyperplasia, adrenal, ovary and breast tumor.

CONCLUSION

In our study we have found that, the mean serum PSA levels in the control group was 0.02 with a standard deviation of 0.03, the mean serum PSA levels in PCOS patients was 0.37 with a standard deviation of 0.17 with p value <0.0001 suggesting serum PSA levels are increased in PCOS patients and serum PSA levels positively correlated with total Testosterone, but it is still unclear about the exact source of serum PSA production in women most likely it might be breast tissue which has steroid hormone receptors. Because of the correlations between PSA and androgen, PSA can be used as a potential biochemical marker of hyperandrogenic states such as PCOS, adrenal hyperplasia, adrenal tumor, ovary and breast tumor. Depending on all the above data, serum PSA level was elevated secondary to endogenous androgen and whether it might represent a valuable marker for other hyperandrogenic state or not is not clear yet. The level of serum PSA could be used by clinicians to confirm the diagnosis and prognosis of PCOS, especially in women with infertility problems.

Serum PSA levels were increased significantly and positively correlated with total testosterone, in women with PCOS. Therefore serum PSA levels could probably serve as marker of hyperandrogenic state in women with Polycystic ovarian syndrome.

BIBLIOGRAPHY

[1] Dutta DC. Textbook of gynaecology. 6 th Ed. New Delhi: Jaypee publishers; 2014. p. 459-74.

[2] Pugeat M, Nicolas MH, Craves JC, Alvarado-Dubost C, Fimbel S, Dechaud H, et al. Androgens in polycystic ovarian syndrome. Ann N Y Acad Sci. 1993;687:124–35.

[3] Hanson AE. Hippocrates: Diseases of Women 1. Signs (Chic) 1975;1:567–84.

[4] Yu H, Berkel H. Prostate –specific antigen in women. J La State Med Soc 1999; 151(4):209-13.

[5] Diamandis EP, Yu H. New biological functions of prostate-specific antigen? J Clin Endocrinol Metab. 1995;80(5):1515–7.

[6] Diamandis EP. Prostate specific antigen--new applications in breast and other cancers. Anticancer Res. 1996;16(6C):3983–4.

[7] Access 2 manual for Hybritech PSA from 2006 Beckman Coulter, Inc.

[8] Ferriman D, Galllwey JD. Clinical assessment of body hair growth in women. J Clin Endocrinol Metab. 1961;21:1440–7.

[9] 9.Azziz R, Carmina E, Dewailley D, Diamanti KE, Escobar HF, Futterweit W et al. The androgen excess and PCOS society criteria for the polycystic ovary syndrome-the complete task force report. Fertil Steril 2009; 91(2): 456-88.

[10] Ehrmann DA. Polycystic ovary syndrome. N Engl J Med. 2005;352(12):1223–36.

[11] Lobo RA. What are the key features of importance in polycystic ovary syndrome? Fertil Steril. 2003;80(2):259–61.

[12] Obiezu CV, Scorilas A, Magklara A, et al. Prostate-Specific Antigen and human glandular kallikrein 2 are markedly elevated in urine of patients with polycystic ovary syndrome. J Clin Endocrinol Metab 2001, 86: 1558–61.

[13] H. Yu, E.P. Diamandis, N. Zarghami, L. Grass, Breast Cancer Res.Treat **32**, 291–300 (1994).

[14] Watt KWK, Lee PJ M, 'Timkulu T, Chan WP, Loor R. Human prostate specific antigen:structural and functional similarity with serine proteases. Proc National Academy of Science USA.1986; 83:3166–170.

[15] McCormack R T, Wang T J, Rittenhouse H G, Wolfert R L, Finlay J A, Sokoloff R L. Molecular forms of prostate-specific antigen and the human kallikrein gene family: a new era.Urology.1995;45:729–44.

[16] Vural B, Ozkan S, Bodur H. Is prostate specific antigen a potential new marker of androgen excess in polycystic ovary syndrome?. J Obstet Gynaecol 2007; 33(2): 166–73.

[17] Vural B, Ozkan S, Bodur H. Is prostate specific antigen a potential new marker of androgen excess in polycystic ovary syndrome?. J Obstet Gynaecol 2007; 33(2): 166–73.

[18] Mooradian AD, Morley JE, Korenman SG (Feb 1987). "Biological actions of androgens". Endocrine Reviews. 8 (1): 1–28. PMID 3549275. doi:10.1210/edrv-8-1-1.

[19] Ukinc K, Ersoz HO, Erem C, Hacihasanoglu AB. Diagnostic value of prostate-specific antigen (PSA) and free prostate specific antigen (fPSA) in women with ovulatory and anovulatory polycystic ovary syndrome. Endocrine. 2009;35(1):123–915.

[20] 20.Gullu S, Emral R, Asik M, Cesur M, Tonyukuk V. Diagnostic value of prostatic specific antigen in hirsute women. J Endocrinol Invest. 2003;26(12):1198–202.

[21] Ukinc K, Ersoz HO, Erem C, Hacihasanoglu AB. Diagnostic value of prostate-specific antigen (PSA) and free prostate specific antigen (fPSA) in women with ovulatory and anovulatory polycystic ovary syndrome. Endocrine. 2009;35(1):123–9.

[22] Filella X, Molina R, Alcover J, Carretero P, Ballesta AM. Detection of nonprostatic PSA in serum and nonserum samples from women. Int J Cancer.1992;68:424–427.

[23] Diamandis EP, Yu H. Nonprostatic sources of prostate-specific antigen. Urol Clin North Am. 1997;24(2):275–82

[24] Melegos DN, Yu H, Ashok M, Wang C, Stanczyk F, Diamandis EP. Prostate-specific antigen in female serum, a potential new marker of androgen excess. J Clin Endocrinol Metab. 1997;82(3):777–80.