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Evaluation of Biochemical Parameters in Polycystic Ovarian Syndrome

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Abstract

Background: *PCOS is the most common endocrinopathy in women of reproductive age group with increasing prevalence worldwide either due to dietary changes or lifestyle changes or a better diagnosis. It is diagnosed in a woman when it meets two of the following three criteria (i) Chronicoligo/anovulation (ii) Clinical or biochemical androgen excess with exclusion of other etiologies and (iii) Presence of polycystic ovaries in USS. This study aims to evaluate the biochemical parameter Magnesium, Fasting Blood Sugar, Uric Acid, Lipid Profile in PCOS women and to assess its effect in the these patients and to compare and correlate the assessed parameter with that of normal controls.*

Methods- *This study was conducted in Gynaecology OPD in SAT Hospital, Govt. Medical College. Trivandrum. Kerala-a tertiary care teaching institution. A total of 51 ultrasound diagnosed cases of PCOS women in the age group of 18-40 years age group were studied.51 women of same age group without PCOS were taken as controls. The samples were analyzed in Clinical Biochemistry Laboratory, SAT hospital and in central biochemistry lab MCH. Fully automated analyzer Olympus AU 400 P and Erba Manneim was used. Chi square test was used for comparison and P value<0.05 was considered significant.*

Results: *Fasting blood sugar levels were significantly increased in PCOS patients suggestive of impaired glucose tolerance.FBS showed significant positive correlation r=0.506, p = <0.001 with BMI and also for duration of illness with r = 0.499, p = <0.001*

Serum magnesium levels were significantly decreased in PCOS patients suggesting increased urinary excretion of Mg in the presence of insulin. Significant negative correlation with FBS and Magnesium with r = 0.244, p=<0.001 were showed in this study.

Serum Uric acid levels were significantly increased in PCOS cases, suggestive that androgens may increase the metabolism of purines. Measurement of Uric acid may predict non classic cardio vascular risk in PCOS patients. Uric acid shows significant positive correlation with duration of illness with r=0.792, p=<0.001. Also shows a positive correlation with BMI r=0.491, pp=<0.001.

PCOS women had higher BMI, significantly increased Total cholesterol, triglycerides, LDL and VLDL values. HDL value is negatively correlated with PCOS, suggestive of the association between BMI and dyslipidaemia in PCOS cases. Results suggest the association between Mg, FBS and uric acid values.

There is a strong positive correlation between duration of illness and BMI with FBS, Uric acid, Total cholesterol, TG LDL and VLDL.

Also Mg and HDL were negatively correlated with BMI and duration of PCOS.

Conclusion: *The study revealed that hypomagnesaemia and increased FBS are suggestive of increased risk of Diabetes in PCOS patients. Serum Uric acid levels are significantly increased due to pro oxidant nature and this may predict non classic cardio vascular risk in PCOS patients.*

Keywords: *PCOS, BMI, FBS,Uric acid, Lipid Profile., Magnesium.*

Introduction

Polycystic ovarian syndrome is the most common endocrinopathy in the women of reproductive age with prevalence of approximately 7-10% world-wide.[1] PCOS is characterized by increased ovarian and adrenal androgen secretion, hyper androgenic metabolic syndrome symptoms such as hirsutism, acne and/or alopecia, menstrual irregularity and polycystic ovaries. PCOS is not only a reproducet-ive endocrinopathy but also a metabolic disorder.[2]

The development of PCOS has been linked to hereditary and environmental factors including genetics, insulin resistance, obesity and birth weight. The presence of PCOS is associated with an increased prevalence of adverse health condit-ions such as the metabolic syndrome, cardiova-scular disease and type II diabetes mellitus.[3]

Women with PCOS are known to be at increased risk for insulin resistance[5] and develop abnormal glucose metabolism at a younger age and may demonstrate a more rapid conversion from impaired glucose tolerance to type II diabetes mellitus.[6]Insulin resistance and compensatory hyper insulinaemia predisposes them to develop a high plasma triglyceride and a low HDL cholesterol concentration, high BP and coronary heart disease.[4]

Magnesium, a cofactor of many enzymes involved in glucose metabolism, is required for both proper glucose utilization and insulin signaling. In particular it has been shown that magnesium plays the role of a second messenger for insulin action.[7]

Low magnesium concentrations are associated with impaired glucose tolerance and increased risk for type II diabetes mellitus.

Uric Acid is a metabolic end product of purine metabolism. It is a strong reducing agent and potent antioxidant. Androgens may increase serum uric acid levels by inducing the hepatic metabolism of purines.[8]

Women with PCOS have disturbed lipid profile the cause of which is multifactorial and this in turn worsens insulin resistance and other metabolic errors.[9]It has been proposed that PCOS may result from reduced aromatase activity.

There is some evidence that women with PCOS have enhanced peripheral 5 reductase activity thereby generating higher tissue concentrations of more potent androgen DHT. Increased 5 reductase activity in the adipocyte could therefore be one mechanism by which obese women with PCOS display increased androgeni city. There may also be inherent abnormalities of lipolysis within adipocytes that are site specific and altered expression of lipoprotein lipase and hepatic lipase.[10, 11]

Methodology

After proper counseling, the study was carried out in serum and plasma samples collected from PCOD patients attending gynecology OP.

Inclusion criteria

Ultra sound scan confirmed new cases of PCOS women with 18-40 age group.

For control, women with age group of 18-40 without PCOS as judged by Ultra sound.

Exclusion criteria

Diabetes mellitus, Hypertension, Thyroid dise-ases, Renal diseases, Cardiovascular disease, Cushings syndrome, Pregnant/lactating women, Oral contraceptives users, Hypoglycemic agents/lipid lowering agents users, Hormonal medications within previous 6 weeks.

Sample size – 51 in each group

Results

The study population included 51 Ultra sound diagnosed PCOS women with 18-40 age group and normal healthy women as control group, attending Gynaec OP, SAT hospital, TVM.

Table 1 Distribution according to age

Age	Case		Control	
	No	%	No	%
18-22	14	27.45	10	19.60
23-27	27	52.94	22	43.13
28-32	9	17.64	16	31.37
>33	1	1	3	5.88
Total	51	100	51	100

Out of 51 cases, 27 (52.94%) were at the age group of 23-27 followed by 14(27.45%) at the age group of 18-22 and 9(17.64%) at the age group of 28.32. Only one were at the age group of >33.
Out of 51 control, 22 (13/13%) were at 23-27 age group followed by 16(31.37%) with age group 28.32. 10(19.60%) were at the group of 18-22 and only 3(5.88%) in the age group of >33.

Table 2: Distribution according to BMI

BMI	Case		Control	
	No	%	No	%
18-20	15	29.41	21	41.17
20.1-22	11	21.56	16	31.37
22.1.-24	14	27.45	14	27.45
>24	11	21.56	0	0%
Total	51	100	51	100

Out of 51 the average BMI were 22.1 2.2 ± 2.3 with a range of 18.3 – 26.2 and that of control were 20.7 ± 1.6 with a range of 18.1 – 23.

Table 3: Distribution according to duration of PCOS

Duration in years	Case	
	No	%
1-2 yrs	30	58.88
3-4 yrs	14	27.45
>4 yrs	7	13.75

Out of 51 cases 30(58.88%) had PCOS for 1-2 years and 14(27.45%) and 14(27.45%) had PCOS for 3-4 years only 7(13.75%) had PCOS for >4 years in this study.

Table 4: Distribution according to FBS – case and control

	N	FBS		t	p
		Mean	SD		
Case	51	101.9	22.3	4.903	<0.001
Control	91	84.7	11.3		

Out of 51 cases average FBS were 101.9 ± 22.3 with a range of 64-180 and out of 51 control were 84.7 ± 11.3 with a range of 63-105.

Table 5: Distribution according to Uric Acid – case and control

	N	FBS		t	p
		Mean	SD		
Case	51	5.5	1.1	5.090	<0.001
Control	51	4.5	0.8		

Out of 51 cases the average uric acid were 5.5 ± 1.1 with a range of 3.8-7.5 and out of 51 control were 4.5 ± 0.8 with a range of 3.0-6.9.

Out of 51 cases the average value of Magnesium were 2.0±0.1 with a range of 1.82-2.28 and out of 51 control were 2.1±0.2 with a range of 1.66-2.5.

Table 6.

	Case (N=51)		Control (N-51)		t	p
	Mean	SD	Mean	SD		
Total cholesterol	194.6	26.6	171.1	17	5.313	<0.001
TGL	145.7	28.4	108	18.7	7.927	<0.001
LDL	126	26.3	102.4	17.3	5.353	<0.001
VLDL	28.9	5.5	21.7	3.6	7.847	<0.001

Out of 51 cases the average value of total cholesterol were 194.6 ± 26.6 with a range of 148-250 and for control were 171.1 ± 17 with a range of 142-21. Triglycerides with average of 145.7 ± 28.4 ranges from 58-140 for cases and 108±18.7 ranges from 58-140 for control group. For case, HDL with average of 39.2±6.5 ranges of 126±26.3 ranges from 71-149 for case and 102.4±17.3 ranges from 71.149 for control group. In the case, VLDL, the average value of 28.9±5.5 ranges 12.28 and for control 21.7±3.6 from 12.28.

Table 7: Correlation between lipid profile and other parameters

Correlation table	Total cholesterol		TGL		HDL		LDL		VLDL	
	r	p	r	p	r	p	r	p	r	P
Duration	.713	<0.001	.437	<0.001	.268	<0.001	.697	<0.001	.459	<0.001
Age	.088	<0.001	.177	<0.001	.069	<0.001	.025	<0.001	.176	<0.001
BMI	.450	<0.001	.326	<0.001	.186	<0.001	.423	<0.001	.337	<0.001
FBS	.414	<0.001	.300	<0.001	.296	<0.001	.428	<0.001	.301	<0.001
Uric acid	.501	<0.001	.371	<0.001	.320	<0.001	.505	<0.001	.386	<0.001
Magnesium	.243	<0.001	.226	<0.001	.249	<0.001	.258	<0.001	.245	<0.001
Total cholesterol	1	<0.001	.698	<0.001	.442	<0.001	.964	<0.001	.684	<0.001
TGL	.698	<0.001	1	<0.001	.521	<0.001	.611	<0.001	.985	<0.001
HDL	.442	<0.001	.521	<0.001	1	<0.001	.611	<0.001	.569	<0.001
LDL	.964	<0.001	.611	<0.001	.611	<0.001	1	<0.001	.596	<0.001
VLDL	.684	<0.001	.985	<0.001	.509	<0.001	596	<0.001	1	<0.001

Discussion

PCOS is characterized by increased ovarian and adrenal androgen secretion, hyper androgenic metabolic syndrome symptoms such as hirsuitism, acne and/or alopecia, menstrual irregularity and polycystic ovaries. Women with PCOS are known to be at increased risk for insulin resistance. As a result, there is more circulating glucose in the blood waiting to be absorbed into the cells resulting in glucose tolerance.

In particular it has been shown that magnesium plays the role of a second messenger for insulin action. Low magnesium concentrations are associated with impaired glucose tolerance and increased risk for type II diabetes mellitus. Androgens may increase serum uric acid levels by inducing the hepatic metabolism of purines. Women with PCOS have disturbed lipid profiles. The causes of dyslipidaemia in PCOS are multifactorial.

The current study population included 51 PCOS patients with 18-40 age groups confirmed by Ultra Sound Sonography and 51 age matched control groups who attended the outpatient wing of Gynaecology Department, SAT Hospital. After getting written consent, blood samples for estimation of different parameters were collected. Fasting fluoride sample for FBS, serum concentration of Magnesium, Uric acid and fasting lipid profile were estimated.

The statistical software SPSS versions were used for the analysis of collected data from PCOS patients and control group. Excel had been used to generate graphs and tables. Pearson correlation between the study variable was performed to find out the relationships.

In the present study, out of 51 case 27(52.94%) were at the age group of 23-27 followed by 14(27.45%) at the age group of 18-22 and 9(17.64%) at the age group of 28-32. Only one were at the age group of >33. Out of 51 control, 22(13.13%) were at 23-27 age group followed by 16(31.37%) with age group of 28-32. 10(19.60%) were at the group of 18-22 and only 3(5.88%) in the age group of >33.

According to study, out of 51 cases, the average BMI were 22.1± 2.3 with the range from 18.3 – 26.2 and that of control were 20.7±1.6 with a range of 18.1-23. This study showed a suggestive negative correlation between BMI and Magnesium with r=0.174, p=0.001 and also significant negative correlation for HDL with r=0.186, p=0.001.

Out of 51 cases in this study, 30(58.88%) had PCOS for 1-2 years and 14(27.45%) and 14(27.45%) and PCOS for 3-4 years, only 7(13.75%) had PCOS for >4years.Magnesium showed a significant negative correlation r=0.420, p=0.002 with the duration of illness. HDL also showed the negative correlation with r=0.268, p=0.057, Other parameters like FBS, Uric acid, total Cholesterol triglycerides were showed increased values upon increasing the duration of PCOS.

In the current study out of 51 cases the average FBS were 101.9 ± 22.3 with a range of 64-180

and out of 51 control were 84.7 ± 11.3 with a range of 63-105. FBS showed significant positive correlation r=0.506, p=<0.001 with BMI and also for duration of illness with r=0.499, p=<0.001. This study also showed significant negative correlation with FBS and Magnesium with r=0.244, p=<0.001.

According to this study, Out of 51 cases the average uric acid were 5.5±1.1 with a range of 3.8-7.5 and out of 51 control were 4.5±0.8 with a range of 3.0-6.9. Uric acid shows significant positive correlation with duration of illness with r=0.792, p=<0.001. Also uric acid shows a positive correlation with BMI r==0.491, p=<0.001. Similar were obtained in the study conducted by N. Swetha et al 2013.[2]

In the present study, Out of 51 cases the average value of Magnesium were 2.0±0.1 with a range of 1.82-2.28 and out of 51 controls were 21±0.2 with a range of 1.66-2.5. It shows negative correlation with the duration of illness r=0.420, p=0.002. Mg also showed negative correlation with BMI r=0.174, p=<0.001. This study showed a significant negative correlation with FBS r=0.244, p=<0.001, similar to the study conducted by Swetha et al 2013.[2]

Out of 51 cases in this study, the average value of Total cholesterol were 194.6±26.6 with a range of 148-250 and for control were 171.1±17 with a range of 142.21. Triglycerides with average of 145.7±28.4 ranges from 58-140 for cases and 108±18.7 ranges from 58-140 for control group. For case, HDL with average of 39.2±6.5 ranges 32-60 and that of control group 47±6.3 with range of 32-60. LDL with average of 126±26.3 ranges from 71.149 for case and 102.4±17.3 ranges from 71.149 for control group. In the case, VLDL, the average value of 28.9±5.5 ranges 12-28 and for control 21.7±3.6 from 12-28.

Total cholesterol, triglycerides, LDL and VLDL showed a positive correlation with duration of illness and BMI. But HDL showed negative correlation with duration of PCOS and BMI. Similar results were obtained in the study conducted by Guddanti Rajeswary et al 2016. [1]

Conclusion

The study revealed Hypomagnesaemia and increased FBS suggestive of increased risk of Diabetes in PCOS patients. Serum Uric acid levels significantly increased due to pro oxidant nature. Increased Uric acid may predict non classic cardio vascular risk in PCOS patients

Daily supplementation of Mg may improve insulin mediated glucose uptake and insulin secretion in patients who have established with PCOS.

Magnesium administration may have beneficial effects on dyslipidaemia in PCOS through the activation of LCAT and suppression of androgenic activity. It is important to periodically monitor these parameters in all PCOS patients. Further studies on the role of Mg and Uric acid are necessary as a diagnostic tool in PCOS patients.

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