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Clinical and Biochemical profile of polycystic ovarian syndrome among adult women of Reproductive age (20-45 years)

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Abstract

Polycystic ovarian syndrome is considered to be a polygenic trait endocrinological disorder in women of reproductive age. This study was designed to provide an overview of the clinical and biochemical profile of the adult women with polycystic ovarian syndrome. A total of 102 adult women in the age group of 20-45 years with PCOS was selected for the present study. Rotterdam criteria was used for identification of the subjects for the study and considered for the further study. Socio economic status of the selected subject revealed that majority(60 %) of the subjects belonged to lower middle class . Hyperandrogenism is one of the major symptoms observed in young adult women with PCOS. Hirsutism (67%)**,** clinical features of hyperandrogenism such as Acne, Androgenic Alopecia Acanthosis were present in more than 50 % of the selected subjects.Thirty five percent had increased testosterone level and 84 % showed the positive radiological evidence of PCOS. Biochemical profile of the selected subjects revealed that there was a significant difference in HDL (p=0.004), TG(p=0.008), Hb (p=0.016) and WC(p=0.015) compared to the standard values and also there was a significant high positive correlation between body fat percentage, BMI and WHR. Among the selected subjects with PCOS who had metabolic syndrome, 69.3 percent were correctly predicted based on the regression model. Those PCOS subjects having high WHR, menstrual irregularity showed 3.1 times and 3.6 times higher risk for developing metabolic syndrome respectively. Abdominal obesity and certain metabolic disturbances became major concerns for older women with PCOS.Clinical and Biochemical profile of polycystic ovarian syndrome among adult women of Reproductive age is an important aspect to be considered for promoting the health status holistically.

Key words

Polycystic ovarian syndrome, Body mass index, Hirsutism, Waist Hip ratio

I.INTRODUCTION

Polycystic ovary syndrome is a heterogeneous disorders and has a considerable metabolic, reproductive, and cardiovascular consequences. It affects 4% to 21% women of reproductive age .PCOS prevalence was approximately 4%–6.6% in accordance with NIH 1990 Diagnostic criteria and around 4%– 21% with Rotterdam 2003 criteria (Lizneva et.al, 2016).As per the latest researches, among the PCOS population 33% were affected with metabolic syndrome and has not been well researched than other features such as infertility, anovulation and hirsutism (Chandrasekaran and Sagili, 2018). Metabolic Syndrome is a cluster of disorders occur together increasing risk of cardiovascular diseases, stroke, and type 2 diabetes with a combination of several metabolic risk factors such as central obesity, hypertension, insulin resistance abnormal cholesterol or triglyceride levels. Androgen excess, altered metabolic pathways are the hall mark of PCOS (Visser, et al.2021). Insulin resistance appears to be crucial for the pathogenesis of PCOS and consequence of metabolic syndrome (March et al.; 2010) . Hyper insulinaemia is present in more than 50 percent of subjects and obesity around 30-60 percent. Menstrual irregularity is the most common gynaecologic presentation of PCOS. Oligomenorrhea has been observed in 85 to

90% of women with PCOS, and amenorrhea as many as 30 to 40% (Allahbadia et al. 2008).Hyperandrogenism is associated with high risk of metabolic and cardiovascular disease in PCOS subjects (Daan et al.2015).Metabolic syndrome is the co-occurrence of three or more of the following risk factors (i) impaired fasting serum glucose ≥110 mg/dL ii)Abdominal obesity with waist circumference ≥88 cm in women, (iii) Increased blood pressure of ≥130/85 mmHg (iv) elevated fasting serum triglycerides ≥150 mg/dL, and (v) fasting HDL cholesterol <50 mg/dL (The National Cholesterol Education Program Adult Treatment Panel III (NCEP:ATP III) (Chandrasekaran and Sagili, 2018). The clinical features and metabolic complications of polycystic ovary syndrome (PCOS) may change with age. This study was designed to investigate the clinical and biochemical characteristics of PCOS patients in the reproductive age group..

OBJECTIVES

- Elicit the information related to clinical, biochemical, and radiological profile of

Reproductive aged adult women with PCOS in the age group of 20-45 years and Correlate the various clinical presentations with the biochemical profile in PCOS subjects and

- Correlate the clinical and biochemical profile of PCOS with metabolic risk in adult Women of Reproductive age (20-45 years)

II, MATERIALS AND METHODS

This is an observational type of study included a total of 102 adult women with PCOS attended the Gynaecology and Dietetics out-patient department of Believers Church Medical College Hospital,Thiruvalla. Non pregnant women fulfilling the Rotterdam criteria in the age group between 20-45 years were included in the study. The selected subjects were not having symptomatic disease of kidney, liver heart and any other organs. Those who were below 20years and above 45 years were also excluded for the present study.

The study received approval from Institutional Review Board of Avinashilingam University with approval number of AUW/IHEC1920/FSN/FHP-01 and also Institutional Ethical Clearance from Believers Church Medical College Hospital with approval Number of IEC/2020/02/126 .All the selected subjects were given proper orientation about the study and written consent was also obtained. A detailed family history, socioeconomic status, medication history, menstrual history and diet history were collected using specially designed questionnaire and also using interview schedule. Anthropometric measurements such as height (cm) weight (kg) were measured using standard procedures. Waist circumference in cm (minimum circumference at waist level) hip circumference in cm (maximum circumference below the level of umbilicus) was measured and used for computation of BMI and WHR. Obesity was assessed according to Asian Classification Calculated as BMI=weight/height^2, kilogram per meter^2 Classified as <18.5kg/m^2 as the Underweight, 18.5-22.9kg/m^2 as the Normal, 23.0- 24.9 kg/m^2 as the Overweight and ≥25kg/m^2 as the obese .Eagle -2001A Digital Body composition Analyser was used for measuring the total body fat and body water .Body fat distribution was assessed by Body composition analysis . Measurements of the waist to hip Ratio (WHR) <0.80 was considered as the normal. Random Blood sugars and lipid profile was carried out in PCOS subjects to diagnose Impaired glucose tolerance, dyslipidaemia and metabolic syndrome. Normal values taken were RBS<140mg/dl TC<200mg/dl, HDL >50mg/dl, LDL <130mg/dl,TG<150mg/dl and VLDL <50mg/dl. Additionally, blood pressure is measured in the selected subjects in sitting position,>/= 130/85mmhg was

considered as hypertension. Total testosterone values were analysed as a part of hormonal assay. Ultrasonography results were also analysed.Prevalence of metabolic syndrome and individual cardiometabolic risk factors was ascertained. Modified FerrimanGallawey (mFG) score was used for screening and quantitative evaluation of clinical hyperandrogenism (Ferriman, 1983) using nine parts. Hair growth was rated from 0 (no growth of terminal hair) to 4 (extensive hair growth) in each of the nine body areas .Global Acne Grading System was used for assessment of acne (Roshaslinie*et* al., 2012), mental health status was assessed using perceived stress scale (Cohen, 1988) and physical activity scoring using Godin Leisure time scale (Godin,2011). Data analysis and appropriate inferential statistics was performed using SPSS 23 software.

III.Data management and statistical methods

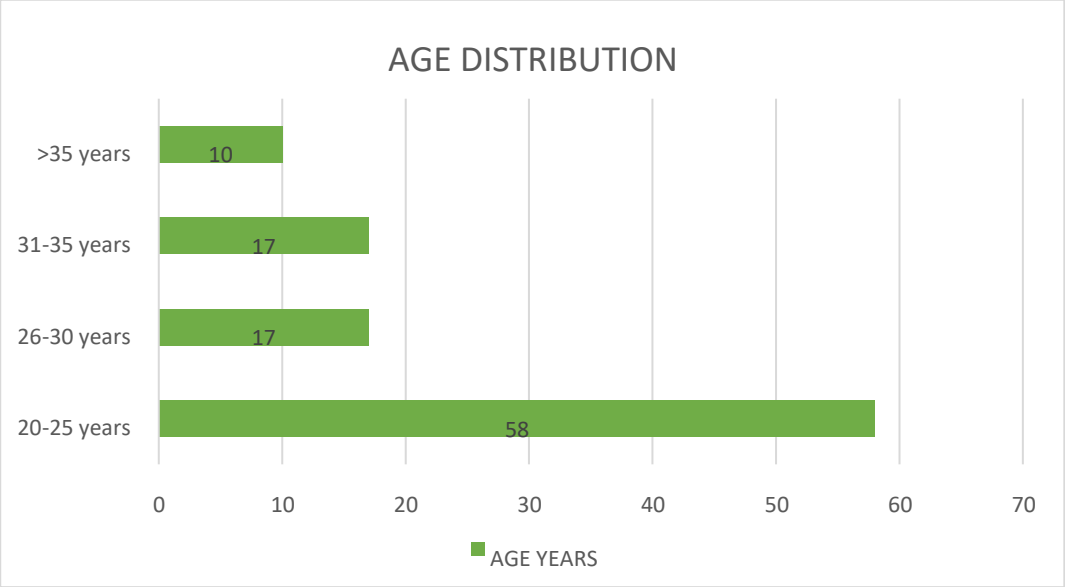
Statistical analyses were performed using the statistical package for the social statistics

(SPSS) 23 software package. Categorical variables were represented in percentages .Continuous variables were expressed as mean +/- standard deviation and analysed using one sample t-test and correlation .In order to quantify the association between clinical ,metabolic and biochemical variables and metabolic syndrome Univariate logistic regression analysis was carried out .

IV.RESULTS AND DISCUSSION

a) Age wise of distribution of PCOS subjects The mean age of the studied group was 26.7±5.7 Most of the subjects (58%) were included in the 20-25 years age group. Only 10 percent of subjects were above 35 years. (Figure 1).

FIGURE I -Agewise distribution of the selected subjects



PCOS prevalence is reported more among women of younger ages (<35) than among older

women . Studies conducted by Spandana et al.(2017)confirmed the selected subjects with that majority of PCOS belonged to age group between 26 and 30 years. This is consistent with the present study where more than 91 percent of PCOS belonged to <35 years and 58% of subjects belonged to 20-25 years.

b) BMI Classification of the selected subjects

BMI classification was compared with the Asian Classification

FIGURE II-Body Mass Index of the selected subjects

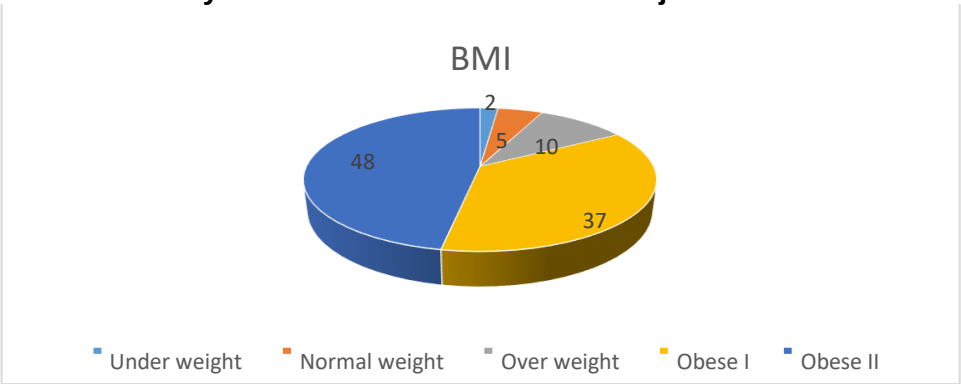


Figure II depicts the BMI classification of the selected subjects .The mean BMI was 29.8±5.37 with 37% of subjects were obese grade I and 48% were obese grade II. Only 2% were under weight , 10% were overweight and 5% were normal weight .

c)Demographic and Socio economic status

The demographic and Socioeconomic status of the selected subjects was highlighted in Table I.

TABLE I-Demographic and Socio Economic status of the subjects

Creteria	Number of subjects (N=102)	Percent
Religion		
Hindu	39	38
Christian	54	53
Muslim	9	9
Marital status		
Married	51	50
Single	50	49
Separated	1	1
Education		
Primary	1	1
Secondary	3	3
Higher secondary	12	12
Diploma		
Graduation	3	3
Postgraduation	54	53 28

	29	
Socioeconomic status		
Upper I	2	2
Upper middle II	25	24.5
Lower middle III	61	60
Upper Lower IV	14	13.7
Lower class V	0	0

Table I shows the demographic profile of PCOS patients. Fifty three percentage of subjects were Christians, 39 percent were Hindus and rest of them were Muslims. More than 50 percent of subjects were graduates and 53 percent were married. Sixty percentage of subjects were lower middle class III , 2% were upper class I, 25percent were upper middle class II , 14 % were upper lower IV where as none of them were in the lower class V .

d)Assessment of Anthropometric measurements

The mean anthropometric measurements were assessed and indicated in table II

TABLE II-Mean Anthropometric measurements of the subjects (N=102)

Anthropometric parameters	Minimum	Maximum	Mean	Std. Deviation
Age (years)	20	45	26.7	5.77
BMI	15.6	47.0	29.857	5.3738
HEIGHT(cm)	142.0	173.0	157.401	5.9281
WEIGHT(kg)	41.5	128.0	73.617	14.2357
TSF	11.2	53.0	27.296	7.7237
WC	27.0	51.3	36.123	4.5728
HC	34.0	55.0	41.824	4.2886
WAIST/ HIP RATIO	.670	.970	.86025	.057588

BODY FAT %	10.5	36.0	27.437	4.0647

Table II shows the anthropometric details of the subjects in our study. The mean BMI was 29.8±5.37. The mean height and weight was 157.4±5.9 and 73.6±14.2 respectively .Mean waist and Hip circumference was 36.1±4.5 and 41.8±4.2 inches respectively and WHR was 0.86±0.05 .The mean body fat percentage was 27.4±4.0

e) Assessment of clinical profile

The clinical profile of the PCOS subjects were represented in table III

TABLE III-The Clinical Profile of women with Polycystic Ovarian Syndrome

Parameters	Number of subjects	Percentage
Family history		
Diabetes	68	67
CVD	13	13
Hypertension	37	36
Hypothyroidism	34	33
PCOS	23	22.5
Infertility	25	24.5
Signs of hyperandrogenism		
Hirsutism	68	67
Acne	59	58
Androgenic Alopecia	52	51
Acanthosis	60	59
Mood swings	78	76.4
Depression and Anxiety	69	68
Waist hip ratio (WHR)		
<0.8	15	15
>=0.8	87	85
Manifestations of ovarian dysfunction		
Oligomenorrhea	66	65
Secondary Amenorrhea	12	12
Ultrasound polycystic ovaries	86	84
Blood pressure		

<130/85 mm of Hg	93	19
>=130/85 mm of Hg	9	9

Table III shows the clinical profile of 102 PCOS patients. Among the subjects 67 percent had family history of diabetes , followed by hypertension (36 %), Hypothyroidism (33%) infertility (24.5%) , PCOS (22.5%) and CVD (13%).Signs of hyperandrogenism was predominantly higher among the subjects .Seventy six percent of subjects had mood swings 67-68 percent had hirsutism and anxiety. Acne(58%), acanthosis (59%),androgenic alopecia(52 %) was also seen in majority of the subjects .About 65 % showed oligomenorrhea which was supported by studies of Sunitha J Ramanand et al .(2014).Thirty five percentage showed biochemical hyperandrogenism, 67% showed clinical features of hyperandrogenism, and 84 % of the subjects showed radiological evidence of PCOS. Blood pressure recording showed 9% had BP >=130/85 mm of Hg .Waist circumference was >35inches in 65 % of the patients and WHR >0.8 was indicated in 85% of the patients , confirming the fact that Indians have more chance of central obesity .Even mean BMI was 29.8±5.37 which was considered comparatively higher. There is also some evidence that low SES is more closely linked to PCOS phenotypes characterized by metabolic dysfunction and that the SES-PCOS association is more pronounced among obese women (Merkin et,al;2011) .Our study also confirmed that around 75% of PCOS subjects were from low socio economic background and 60% of them were centrally obese.

f)Scoring of Clinical symptoms and physical activity level

Scoring of clinical symptoms hirsutism , acne , stress and physical activity was performed using standard scoring scales .The mean scores were compared with the standard scores and represented in Table IV

TABLE IV-Comparison of clinical symptoms and physical activity level among subjects

Parameter	Mean±SD	t value	p value
Hirsutism	4.63±5.52	-6.16	1.45
Acne	7.88±9.66	-10.5	4.73
Stress	20.3±6.27	11.7	0.00
Physical activity	6.6±11.18	-6.6	1.29

Table IV denotes the mean stress score of 20.3±6.27,which was significantly higher compared to the standard Perceived Stress Score. More than 88% of subjects were suffering from stress .Hirsutism, Acne and Physical activity scores not showed significant difference between the sample mean and the standard scores. Acne was observed in 69% of patients. Studies conducted by Achala Vaidya 2020 described 41% of cases with acne

g) Classification of Stress, Hirsutism and Physical activity

Classification of stress, hirsutism and physical activity is given in Figure II, III and IV

FIGURE II-**Stress Level of the PCOS subjects (Perceived Stress Scale)**

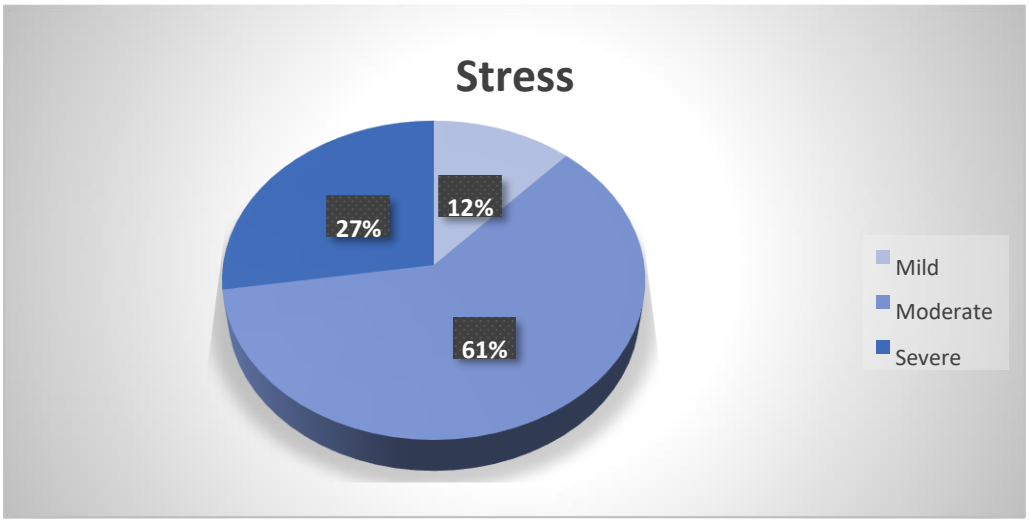


FIGURE III-Hirsutism scoring of PCOS subjects (Modified Ferryman Gallwey Score)

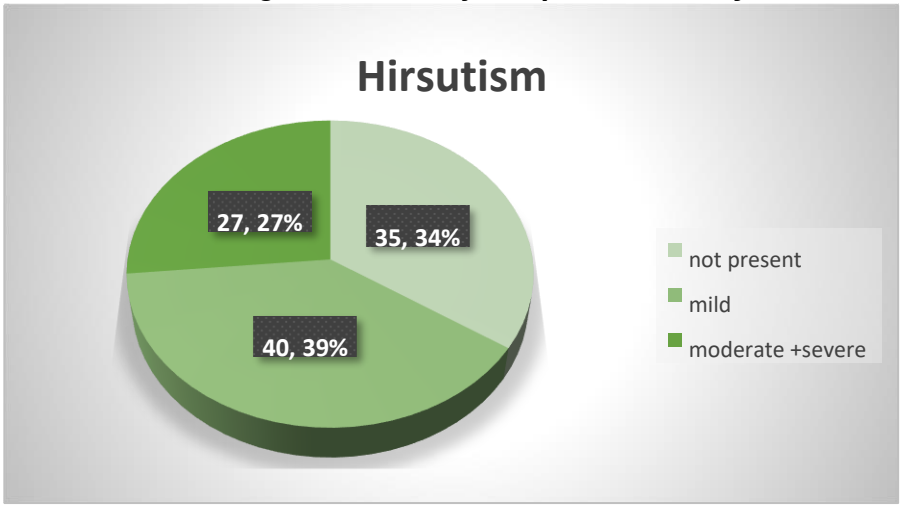


FIGURE IV-Physical Activity Scoring Scale (Godin Leisure Scale)

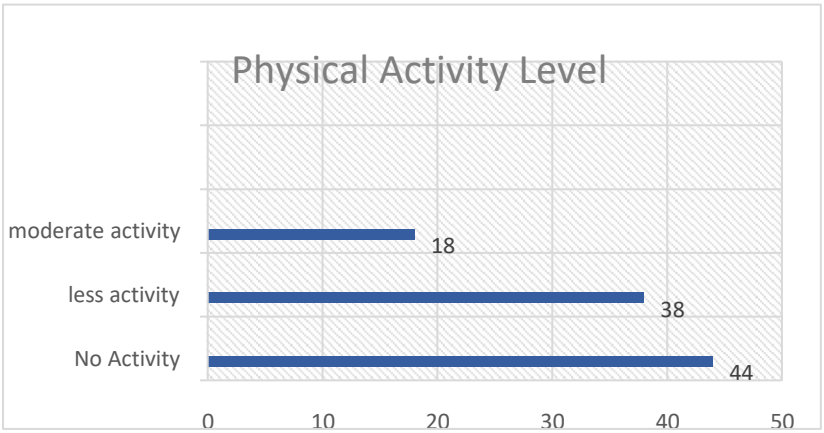


Figure II clearly indicate that 61 % of subjects were suffering from moderate stress where as 12 % had mild stress. The scores further highlighted that 27% faced severe stress. Figure III reveals that 34 percent of selected subjects did not have any signs of hirsutism .Thirty nine percent were presented with mild and 27 percent presented with moderate to severe hirsutism score. Figure IV illustrates the physical activity level of the selected subjects. Exercise such as brisk walking reduces WHR which is an indicator of metabolic syndrome in overweight women with PCOS. The current study observed that, 56 percent of the subjects were regularly followed the physical exercise. Out of these 18% of the selected subjects were moderately active, 38 % of the selected subjects were followed low intensity exercises. About 44 % of the PCOS subjects were found to be inactive.

h) Biochemical and Hormonal Profile of PCOS Subjects

Different biochemical and hormonal profile is highlighted in Table IV

TABLE IV -Biochemical and hormonal profile of PCOS patients.

Investigations	Values	N=%	Mean±SD	T value	P value
Total cholesterol	>/= 200 mg/dl	52	205.67±40.07	1.4	0.156
HDL	<50 mg/dl	83	45.39±15.8	-2.94	0.004
TG	>150 mg/dl	30	131.1±70.4	-2.709	0.008
Hb	<12mg/dl	29	12.3±1.24	2.44	0.016
Testosterone	>=0.59ng/dl	34	0.53±0.40	-1.51	0.132
LDL	>130mg/dl	39	131.60±32.7	0.494	0.622
RBS	>140mg/dl	6	103±19.3	-19.3	8.99
WC	>35Inches	65	36.1±4.5	2.4	0.015

Table IV represent biochemical and hormonal profile of PCOS subjects .All the subjects were evaluated for altered sugars, lipid abnormalities and biochemical sign of hyperandrogenism .In the present study , 52% had cholesterol levels above the normal cut off .About 6% had impaired sugars, 83 % had low HDL Levels,20% had elevated triglycerides. Sixty five percent of PCOS subjects had waist circumference above 35 inches, and there was a significant difference (p=0.015) in the mean value of waist circumference compared with the standard.HDL(p=0.004) , Triglycerides(0.008) and Haemoglobin(p=0.016) also showed significant difference between the mean value and the standard value

i)Correlation between the different clinical features and biochemical parameter.

Table V depicts the Correlation between the different clinical features and biochemical parameter**.**

TABLE V Correlation between the different clinical features and biochemicalparameter

	Age	BMI	Testosterone	Body fat %	W/Hr	Cholesterol	TG	Hirsutism	Acne score
Age	1								
BMI	.115	1							
Testosterone	-.137	.166	1						
Body fat %	.212*	.774**	.146	1					
Waist/ hip ratio	.014	.221*	.147	.291**	1				
Cholesterol	.191	.184	.160	.282**	.086	1			
TG	.095	.129	.172	.165	.114	.505**	1		
Hirsutism MFGF	.102	.031	-.010	-.001	-.043	.008	-.011	1	
Acne score	.001	-.025	-.028	.060	.003	.039	-.025	.221*	1

**Correlation is significant at the 0.01 level (2-tailed). *.Correlation is significant at the 0.05 level

Among the various variables that age was positively correlated with the body fat percentage (r =.212, p<0,05). The mean fat percentage was 27.437± 4.0 and there was a significant high positive correlation between body fat percentage and BMI (P <0.01) and very low positive correlation between body fat and WHR (P<0.05). Body fat percentage and blood cholesterol had a significant very low positive association between them (P<0.01).Triglycerides and cholesterol had a moderate positive correlation (P <0.01), Pearson's coefficient of correlation of hirsutism score and acne score was found to be positively correlated and was statistically significant (r=0.221, p= 0.026).This shows that an increase in hirsutism score lead to higher acne score in PCOS subjects.

j) Metabolic syndrome among PCOS subjects

Clinical and biochemical profile of PCOS and its relationship to cardio metabolic risk in Women with PCOS is represented in Table V

TABLE VI-Univariate logistic regression analysis predicting the metabolic syndrome

Parameters	P Value	Odds Ratio	95% CI.for Odds ratio	
			Lower	Upper
WEIGHT	.137	1.057	.982	1.138
BMI	.842	.977	.777	1.228
WAIST/ HIP RATIO	.785	3.149	.001	11795.090
BODY FAT %	.115	1.221	.953	1.564
TESTOSTERONE	.638	.767	.254	2.317
MENSTRUAL IRREGULARITY	.030	3.637	1.135	11.657
ACANTHOSIS NIGRICANS	.654	.787	.275	2.250
FAMILY HISTORY OF DM ,HTN	.437	.828	.515	1.332
Constant	.009	.000		

Table VI confirms that among the PCOS subjects who had metabolic syndrome, 69.3 percent were correctly predicted based on the regression model. Excess testosterone and insulin contribute to the development of metabolic syndrome in PCOS women .BMI, increased WHR , increased body fat percentage may be cause of biochemical or clinical hyperandrogenism. WHR showed 3.1 times higher risk for developing metabolic syndrome in PCOS subjects .The odds of a PCOS patient having metabolic syndrome was 3.6 times higher in those having menstrual irregularity than those with regular menstrual cycle with a 95% Cl of 1.13 to 11.65.The age distribution of metabolic syndrome showed maximum number of patients about

52.9% were in the age group 31-35years.

V) Conclusion

The study showed 58 percent PCOS subjects in 20-25 years age group. Sixty percentage of subjects belonged to lower middle class III .Eighty five percent of subjects were obese, of them 37% were obese grade I, 48% were obese grade II, and mean BMI was 29.8±5.37. Some of them were involved in regular physical activity while about 44 % of the PCOS subjects were found to be inactive.Majority of subjects exhibited Signs of clinical hyperandrogenism such as hirsutism (67%) **,**Acne(59%) ,Androgenic Alopecia(52%) Acanthosis(59% where as 35 % showed biochemical hyperandrogenism, and 84 % of the subjects showed radiological evidence of PCOS.Stress level (88%) and mood swings (78%) was comparatively very high among the subjects. Among the biochemical parameters there was a significant difference in HDL (p=0.004), TG(p=0.008), Hb (p=0.016),and WC(p=0.015) of the PCOS subjects when compared to the standard values .There was a significant high positive correlation between body fat percentage and BMI ,very low positive correlation between age and body fat percentage, body fat percent cholesterol ,and

WHR(P<0.001) among the PCOS subjects. Cholesterol and TG showed a significant moderate positive correlation (P<0.001) .Hirsutism score and acne score was found to be positively correlated and was statistically significant (p<0.05) .Among the PCOS subjects who had metabolic syndrome, 69.3 percent were correctly predicted based on the regression model. WHR showed 3.1 times and menstrual irregularity showed 3.6 times higher risk for developing metabolic syndrome in PCOS subjects. Obese women with PCOS had more severe ovulatory dysfunction, and those with central obesity had more chance of developing metabolic syndrome and need more attention for lifestyle modification and further management

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CONFLICT OF INTEREST

'The author(s) declare(s) that there is no conflict of interest'

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