

# Prevalence of Polycystic Ovary Syndrome among Women in Mumbai and Association of its Symptoms with Work Hours

Madhu Kumari<sup>1</sup>, Rutuja Walavalkar<sup>1</sup>, Madiha Shaikh<sup>1</sup>, Anupma Harshal<sup>2</sup>, Shailaja Rane<sup>3</sup>, Nandini D<sup>4</sup>

UG Students, Department of Biotechnology, Kishinchand Chellaram College, Churchgate, Mumbai, Maharashtra, India<sup>1</sup>

Assistant Professor, Department of Chemistry, Kishinchand Chellaram College, Churchgate, Mumbai, Maharashtra, India<sup>2</sup>

Assistant Professor, Department of Statistics, Kishinchand Chellaram College, Churchgate, Mumbai, Maharashtra, India<sup>3</sup>

Assistant Professor, Department of Biotechnology, Kishinchand Chellaram College, Churchgate, Mumbai, Maharashtra, India<sup>4</sup>

**ABSTRACT:** Polycystic Ovary Syndrome (PCOS) is the most common endocrine disorder in women of reproductive age and despite decades of research, the etiology of the disorder is unknown. The objective of this survey-based study was to determine the effect of working hours on its symptoms and occurrence in a small cohort of women of reproductive age in Mumbai using bio-statistical tools such as Chi-squared test, Yule's Coefficient of Association and Hypothesis testing.

**KEYWORDS:** Polycystic Ovary Syndrome, PCOS, Work hours, Symptoms, Survey, Biostatistics.

## I. INTRODUCTION

Polycystic Ovarian Syndrome (PCOS) is an endocrine disorder, which occurs due to inappropriate secretory levels of Follicle Stimulating Hormone (FSH) and Luteinizing Hormone (LH). Imbalance in the hormonal levels leads to conditions like hirsutism, infertility issues and polycystic ovaries. PCOS is the most common endocrine irregularity that affects 5%-20% women of reproductive age.<sup>1</sup> The symptoms of PCOS include Diabetes Mellitus, irregular menstrual cycles, acne and abnormal BMI, which in turn can cause psychosocial disruptions such as anxiety and depression. The cause of Polycystic Ovarian Syndrome is unknown but it is most commonly considered to have genetic roots. Hormonal imbalance which causes PCOS can also lead to increase in the levels of testosterone in the body, resulting in establishment of masculine characteristics due to hyperandrogenism (excess secretion of androgens)<sup>2</sup>.

Regular exercise, balanced diet and hormonal pills in combination are the most widely prescribed treatment for PCOS<sup>3</sup>. Acupuncture or ovarian drilling may be required in severe cases where a large number of cysts are present in the ovaries<sup>4</sup>. This involves surgical drilling of the ovaries to enable removal of the cysts.

This study was designed to assess the effect of work and work-related stresses upon the manifestation of symptoms of PCOS. The study suggests that greater physical and psychological involvement in work may prove beneficial to the management of this disorder, since there is no definitive cure for PCOS. The prevalence of the disorder and thus its

# International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Website: [www.ijirset.com](http://www.ijirset.com)

Vol. 6, Issue 7, July 2017

etiology in the population of women in the city of Mumbai was also determined and compared to previous studies, thus relating the occurrence of PCOS to the geographical parameters and ethnicity of those affected.

## II. RELATED WORK

A recent study carried out by Samer El Hayek, Lynn Bitar, Layal H. Hamdar, Fadi G. Mirza and Georges Daoud summarized multiple recent reports and papers, discussing the statistical findings and the pathophysiology of Polycystic Ovary Syndrome. The review states that according to the NIH (National Institute of Health) criteria, approximately 4-10% women in the reproductive age suffer from PCOS, whereas according to the Rotterdam Criteria, the occurrence ranges from 3% to 26% in adolescent girls<sup>5</sup>. Thus the prevalence of the disorder in a particular population may vary depending on the criteria of diagnosis.

Dunaif A, Segal KR et.al carried out a study in 1989, which estimated the correlation between Insulin resistance observed in PCOS-affected women and Obesity. The results obtained concluded that Insulin resistance is found more frequently in women suffering from PCOS, but is completely independent of Obesity<sup>6</sup>.

Volume 15, Issue 4 of Oxford Journals, Medicine & Health mentions a 2009 study conducted by Moran L, Teede H, which states that PCOS sufferers diagnosed on the basis of the National Institute of Health (NIH) criteria show a more adverse metabolic profile with greater insulin resistance, greater abdominal and overall obesity and increased risk factors for Type 2 Diabetes and Cardiovascular Diseases as compared to non-NIH phenotypes<sup>7</sup>.

A meta-analysis conducted by Hector F. Escobar-Morreale and M. Belen Roldan-Martin reviews the symptoms of androgen excess and prevalence of Type 1 Diabetes in women with PCOS. This very recent study concludes that the management of Diabetes can be aided if timely diagnosis and control of PCOS is accomplished<sup>8</sup>.

The prospective of using oral contraceptives (OCs) containing drospirenone (DRP) in combination with Metformin along with lifestyle modifications to treat PCOS has been put forth by scientists from Sichuan University in China, which work by reducing blood pressure and improving carbohydrate metabolism in PCOS-affected women<sup>9</sup>. Metformin, as observed in multiple studies, is a commonly prescribed drug for control of PCOS and can be used in structured combination with contraceptive pills under medical supervision to treat PCOS.

A Danish cohort study was conducted in 2015 to gauge the risk of endometrial, ovarian and breast cancers in women suffering from PCOS and concluded that an increase in the risk of endometrial cancer out of the three gynecological cancers is observed in these women as compared to a non-PCOS control group of women. It published that the prevalence of endometrial cancer increases fourfold in PCOS-affected women<sup>10</sup>.

The Journal of Biomedical Research published a study in May 2016, which was conducted by Chun Yuan, Xiaoqiang Liu, et.al, using 125 Chinese PCOS patients, with 130 unaffected women as controls. The study concludes that increased BMI has a negative impact on the manifestation of certain symptoms of PCOS. The study reveals that women showing a higher BMI are found to be more frequently suffering from disorders caused by Androgen excess<sup>11</sup>.

Arshad Hussain, Rajesh Kumar Chandelet.al. conducted a study in 2015 where 110 PCOS sufferers were psychologically evaluated using the Diagnostic and Statistical Manual for Mental Disorders, Fourth Edition criteria in Kashmir, India. The results obtained determined that 23% of the women suffered from Depression compared to 7.5% of the control<sup>12</sup>. Also, 15.45% women had panic disorder compared to 5% of control and 15.45% suffered from Generalized Anxiety Disorder. About 8% of the concerned women also showed suicidal tendencies.

## III. MATERIALS AND METHODS

This randomized control study was based on a survey, which employed a questionnaire that included mandatory questions regarding personal details of the respondent, such as the age, BMI and marital status, and also enquired about the respondent's work-related details, dietary habits and level of physical activity.

# International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Website: [www.ijirset.com](http://www.ijirset.com)

Vol. 6, Issue 7, July 2017

The next set of questions included the symptoms of Polycystic Ovaries Syndrome (PCOS), the responses of which were collected in terms of Yes or No options. The subjects were also questioned about medical diagnosis or tests related to PCOS which they may have undergone.

The survey was conducted among women of reproductive age group, ranging from 12 to 48 years, residing in the Suburbs of Mumbai, South Mumbai and Navi Mumbai. The sample included women (married/unmarried) working in corporate institutes, professional and business fields as well as students and homemakers. The total number of forms received was 353, of which 19 forms were incomplete, making the sample size 334.

The collected data was subjected to statistical analysis for validating various hypotheses using Chi-squared test, Yule's Coefficient of Association and Z test.

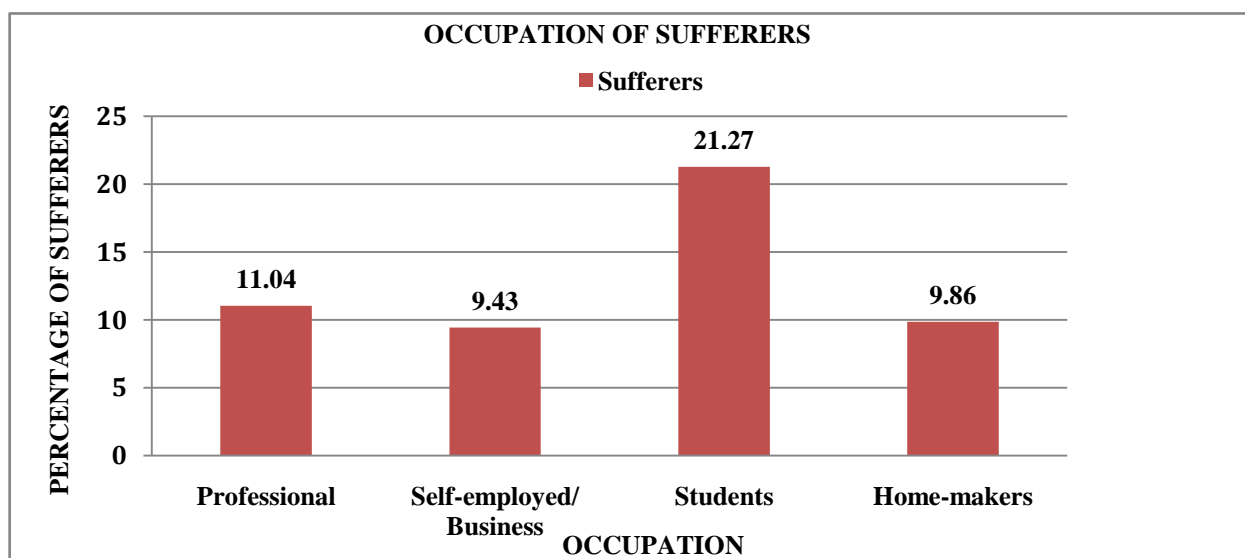
**Chi-squared test:** It is used to determine the significant association between any two attributes. The chi-squared analysis was carried out with a significance level of 0.05 and degree of freedom was 1.

**Z test:** Z test is a statistical tool used to test for a single population proportion or to compare two population proportions when the sample size is large. It explains the statistical significance that helps decide whether or not the null hypothesis should be rejected.

**Yule's Coefficient of Association:** This test provides insight into the correlation between two attributes, their association, disassociation or complete independence. This test gives a measure of the extent of correlation between two independent attributes, and is more reliable than the chi-squared test results.

## IV. RESULTS

Of the total 334 analyzed cases, 47 women reported no symptoms of PCOS included in the questionnaire and thus these cases were concluded to be the non-probable ones (14.07%). 287 women reported suffering from at least 1 symptom of PCOS and were thus concluded to be the probable cases (85.93%), of which the 40 self-reported sufferers were a part.



The above bar graph represents the occupation of PCOS sufferers, among the total sample. It can be observed that maximum percentage of sufferers is seen among the students (47). This may be attributed to hormonal imbalances due

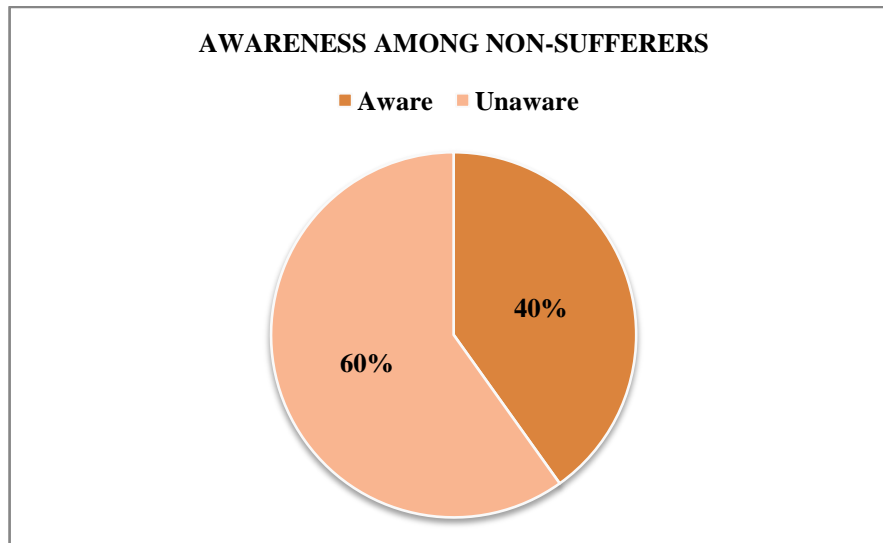
# International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Website: [www.ijirset.com](http://www.ijirset.com)

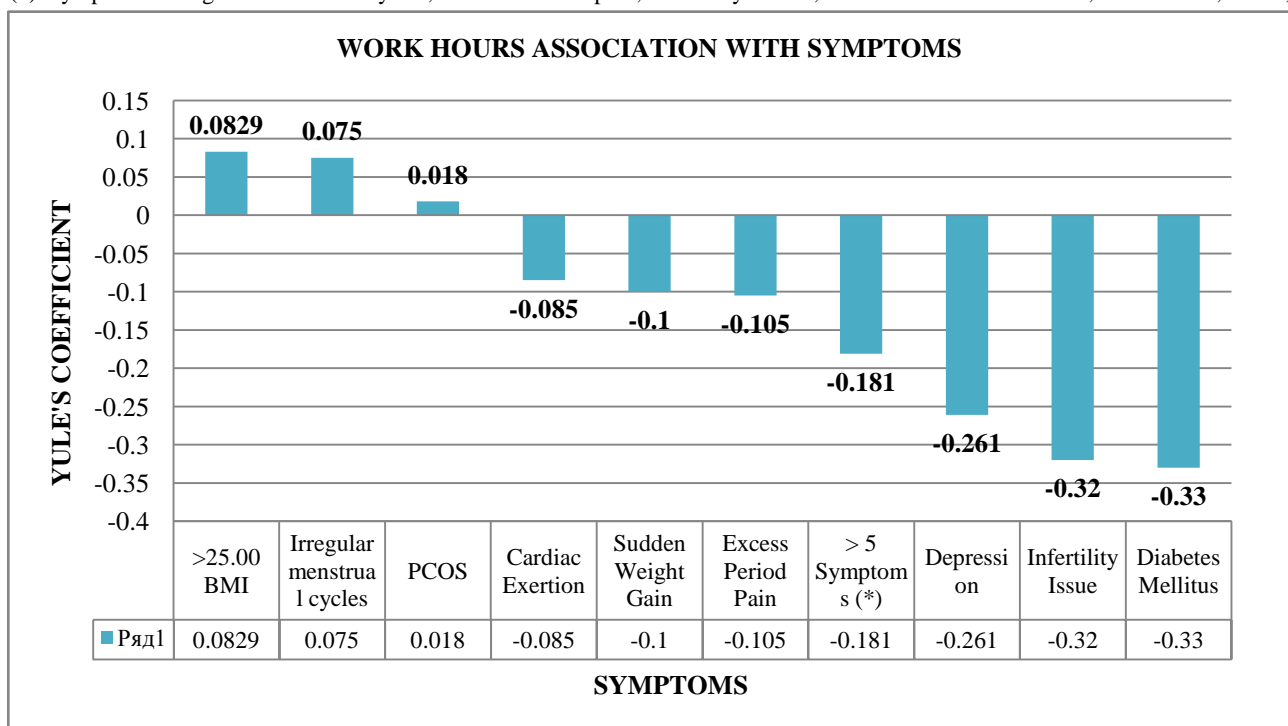
Vol. 6, Issue 7, July 2017

to stress or depression seen among subjects of this category. Lower prevalence of the disorder was observed in subjects in other categories, with women from the self-employed/business field showing least prevalence of PCOS.



The above pie-chart represents the PCOS awareness percentage among the non-sufferers. It could be observed that 60% of the self-reported non-suffering women in our sample were unaware of PCOS, and hence would not be able to recognize any of its symptoms even if they were suffering. Thus our sample may have contained some unaware PCOS sufferers who were not clinically diagnosed.

(\*) Symptoms: Irregular menstrual cycles, Excess Period pain, Infertility Issues, Greater than normal BMI, Facial Hair, Acne,



# International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Website: [www.ijirset.com](http://www.ijirset.com)

Vol. 6, Issue 7, July 2017

Problems in weight loss, sudden weight gain, Diabetes Mellitus.

The above bar graph represents the extent of association of PCOS symptoms with working hours of the respondents using Yule's Coefficient.

It was observed that majority of the considered PCOS Symptoms, including greater than 5(\*), showed a trending negative correlation with an increase in the hours of work. This indicates that secondary diseases like depression, infertility and Diabetes Mellitus may show a decreased manifestation among women having long working hours. Thus an active lifestyle may prove beneficial for women suffering from PCOS, as it may possibly prevent or decrease the manifestation of secondary diseases caused due to PCOS.

Table 1:  $\chi^2$  statistic with respective P-values of relation between presence of symptoms of PCOS and greater than 30 hours of work per week among Mumbai women.

Symptoms of PCOS	$\chi^2$ statistic	P-value	Result	Yules
PCOS	0.011	0.91639	No Association	0.018
Infertility Issue	4.7165	0.0229875	Association	-0.32
Irregular menstrual cycles	0.3819	0.5365	No Association	0.075
Excess Period Pain	0.8082	0.3686	No Association	-0.105
Diabetes Mellitus	3.2385	0.07192	No Association	-0.33
Depression	5.267	0.02173	Association	-0.261
Cardiac Exertion	0.4218	0.5160	No Association	-0.085
Sudden Weight Gain	0.5632	0.4529	No Association	-0.10
>25.00 BMI	0.5887	0.4429	No Association	0.0829
>5 Symptoms of PCOS(*)	10.899	0.00096	Association	-0.181

(\*) Symptoms: Irregular menstrual cycles, Excess Period pain, Infertility Issues, Greater than normal BMI, Facial Hair, Acne, Problems in weight loss, Sudden weight gain, Diabetes Mellitus.

The Chi-square test showed an association between more than 30 hours of work per week and presence of infertility, depression and occurrence of greater than 5 of mentioned symptoms with P-value lesser than 0.05 at 5% level of significance. As the rest of the symptoms showed P-value > 0.05, no association could be found between them and working for greater than 30 hours per week.

By Yule's Coefficient of Association, more than 30 hours of work per week showed a very weak positive association with occurrence of PCOS. Thus, more the hours of work, more may the occurrence of PCOS. As for the symptoms irregular menstrual cycles and greater than 25.00 BMI, a very weak positive correlation with more than 30 hours of work per week could be observed, indicating that more the hours of work, more the presence of these symptoms.

Very weak negative correlation was detected by Yule's Coefficient test for symptoms including infertility issues, excess period pain, Diabetes Mellitus, depression, cardiac stress and sudden weight gain. This indicates that with more than 30 hours per week, the manifestation of these symptoms may decrease.

# International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Website: [www.ijirset.com](http://www.ijirset.com)

Vol. 6, Issue 7, July 2017

Table 2: Z statistic with respective P-values for testing the mentioned hypotheses between symptoms of PCOS and greater than 30 hours of work per week among Mumbai women.

$H_0$ : The proportion of women showing symptoms of PCOS and working for more than 30 hours per week is **the same** as the proportion of women showing the symptoms and working for less than 30 hours per week.

$H_1$ : The proportion of women showing symptoms of PCOS and working for more than 30 hours per week is **less than** the proportion of women showing the symptoms and working for less than 30 hours per week.

Symptoms of PCOS	Zstatistic	Zstatistic	P-value	Result
PCOS	0.105	0.105	0.46017	$H_0$ not rejected
Infertility Issue	-2.1717	2.1717	0.015	$H_0$ rejected
Irregular menstrual cycles	0.618	0.618	0.26763	$H_0$ not rejected
Excess Period Pain	-0.899	0.899	0.18406	$H_0$ not rejected
Diabetes Mellitus	-1.7996	1.7996	0.03593	$H_0$ rejected
Depression	-2.295	2.295	0.01101	$H_0$ rejected
Cardiac Exertion	-0.6495	0.6495	0.25785	$H_0$ not rejected
Sudden Weight Gain	-0.7505	0.7505	0.22663	$H_0$ not rejected
>25.00 BMI	0.6888	0.6888	0.2451	$H_0$ not rejected
>5 Symptoms of PCOS(*)	-3.3015	3.3015	0.00048	$H_0$ rejected

(\*) Symptoms: Irregular menstrual cycles, Excess Period pain, Infertility Issues, Greater than normal BMI, Facial Hair, Acne, Problems in weight loss, Sudden weight gain, Diabetes Mellitus.

In the cases of infertility, Diabetes Mellitus, depression and presence of greater than 5 tabulated symptoms, the null hypothesis ( $H_0$ ) could be rejected (P-value<0.05) at 5% level of significance. This indicates that the manifestation of these symptoms can be correlated with the number of working hours.

The rest of the symptoms did not show such a relation as the P-value>0.05. Thus the null hypothesis ( $H_0$ ) could not be rejected for symptoms like irregular menstrual cycles, excess menstrual pain, Cardiac Exertion, sudden weight gain and greater than normal BMI. This indicates that the manifestation of these symptoms of PCOS is completely independent of working hours.

## V.DISCUSSION

Through our study we found the prevalence of Polycystic Ovarian Syndrome in the city of Mumbai (India) to be 11.97% of the women of reproductive age. This estimate is close to the 11.76% reported by a 2014 study conducted at a medical school in Pondicherry, India<sup>13</sup>. Another study conducted in Mumbai (India) among 600 adolescent girls reported an estimated prevalence of 22.5% when the diagnosis was done using the Rotterdam criteria<sup>14</sup>. The prevalence of PCOS among adolescents in Andhra Pradesh (India) was found to be 9.13 %<sup>15</sup> and another study conducted in South



# International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Website: [www.ijirset.com](http://www.ijirset.com)

Vol. 6, Issue 7, July 2017

India reported as high as 36% prevalence of PCOS among adolescent girls<sup>16</sup>. Thus it can be observed that women in Mumbai show intermediate prevalence of the syndrome when compared to populations from different geographical areas within the same country.

The prevalence of the disorder when compared with previous studies carried out in the American and European continents was observed to be much less than that among Asian-Indian women. A study conducted at the University of Alabama at Birmingham, USA consisting of 400 samples reported the prevalence of the syndrome to be 6.6%, whereas a study among Caucasian women from Spain (sample size of 154) reported a prevalence of 6.5%. Another similar study done in the Greek island of Lesbos reported a prevalence of 6.77% of the 192 subjects. Therefore, a clear distinction in prevalence of PCOS can be observed based on the ethnicity of the populations being studied and a conclusion can be made that ethnicity is an important factor in the manifestation and prevalence of the disorder<sup>17,18</sup>.

## VI. CONCLUSION

The respondent population in this study belonged to the reproductive age group of 12-48 years and maximum respondents belonged to the professional field. The category which included highest number of sufferers was the student's category, with 21.27% of them suffering from the disorder. Women belonging to the business or self-employed category included the lowest number of sufferers. This indicates that younger women are more prone to hormonal imbalances and thus may show greater prevalence and manifestation of the symptoms of PCOS.

The population of working women in Mumbai is representative of population in other metropolitan cities of India and all women who were a part of our study were of similar Asian ethnicity. Our findings clearly demonstrate that working in any field, be it professional, business-related or other labour-intensive jobs, has a positive impact on the quality of life of women and can be an effective way to manage PCOS-related issues. Thus greater involvement in work, either physical or mental, can help reduce the severity of the various symptoms of PCOS.

The progress made in the study of Polycystic Ovarian Syndrome and Polycystic Ovarian Disorder can be majorly credited to survey data made available from different countries and due to paucity in the data available in the Indian subcontinent, it is necessary to put forth more such data for comparative analysis. Our study has been a small attempt in this direction.

More precise results could possibly be obtained if a greater sample size is used for analysis.

Future prospects related to this study could involve determination of the precise association between a particular occupation or activity and prevalence of PCOS and its symptoms so as to be used for treatment purposes. Data published through this study can be further used for comparative analysis by future researchers.

## REFERENCES

1. PCOS Awareness Association. (2016). *PCOS Overview*. [online] Available at: <http://www.pcosaa.org/pcos-overview/> [Accessed 31 Dec. 2016].
2. Pasquali, R., Zanutti, L., Fanelli, F., Mezzullo, M., Fazzini, A., MorselliLabate, A., Repaci, A., Ribichini, D. and Gambineri, A. Defining Hyperandrogenism in Women With Polycystic Ovary Syndrome: A Challenging Perspective. *The Journal of Clinical Endocrinology & Metabolism*, 101(5), pp.2013-2022 (2016).
3. PCOS Awareness Association. (2017). *Is there a cure for PCOS?* [online] Available at: <http://www.pcosaa.org/is-there-a-cure-for-pcos> [Accessed 27 Jan. 2017]
4. Lim CE, Ng RW, Xu K, Cheng NC, Xue CC, Liu JP, Chen N (2016). Acupuncture for polycystic ovarian syndrome. *Cochrane Database Syst Rev* 3;(5)Rev. 2016.
5. El Hayek, S., Bitar, L., Hamdar, L., Mirza, F. and Daoud, G.. Poly Cystic Ovarian Syndrome: An Updated Overview. *Frontiers in Physiology*, 7 (2016).
6. Dunaif, A., Segal, K., Futterweit, W. and Dobrjansky, A. Profound peripheral insulin resistance, independent of obesity, in polycystic ovary syndrome. *Diabetes*, 38(9), pp.1165-1174.(1989).
7. Moran, L. and Teede, H. Metabolic features of the reproductive phenotypes of polycystic ovary syndrome. *Human Reproduction Update*, 15(4), pp.477-488.(2009).
8. Escobar-Morreale, H. and Roldán-Martín, M. Type 1 Diabetes and Polycystic Ovary Syndrome: Systematic Review and Meta-analysis. *Diabetes Care*, 39(4), pp.639-648.(2016).

# International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Website: [www.ijirset.com](http://www.ijirset.com)

Vol. 6, Issue 7, July 2017

9. Huang, W., Wang, Q., Song, Y., Xiao, L., Wang, Q. and Feng, G. Comparison of Drospirenone- with Cyproterone Acetate-Containing Oral Contraceptives, Combined with Metformin and Lifestyle Modifications in Women with Polycystic Ovary Syndrome and Metabolic Disorders: A Prospective Randomized Control Trial. *Chinese Medical Journal*, 129(8), p.883.(2016).
10. Gottschau, M., Kjaer, S., Jensen, A., Munk, C. and Mellemkjaer, L. Risk of cancer among women with polycystic ovary syndrome: A Danish cohort study. *Gynecologic Oncology*, 136(1), pp.99-103.(2015).
11. Yuan, C., Liu, X., Mao, Y., Diao, F., Cui, Y., & Liu, J. Polycystic ovary syndrome patients with high BMI tend to have functional disorders of androgen excess: a prospective study. *Journal of Biomedical Research*, 30(3), 197–202.(2016).
12. Hussain, A., Rather, Y., Wani, Z., Shiekh, J., Shah, M., Chandel, R., Ganie, M. and Dar, M. Prevalence of psychiatric disorders in patients with a diagnosis of polycystic ovary syndrome in Kashmir. *Indian Journal of Psychological Medicine*, 37(1), p.66.(2015).
13. Dr Vijaya.K, D. and Dr Bharatwaj R.S, D. Prevalence and Undetected Burden of Polycystic Ovarian Syndrome (PCOS) Among Female Medical Undergraduate Students in South India - A Prospective Study in Pondicherry. *Global Journal For Research Analysis*, 3(1), pp.63-64(2012).
14. Joshi, B., Mukherjee, S., Patil, A., Purandare, A., Chauhan, S. and Vaidya, R. A cross-sectional study of polycystic ovarian syndrome among adolescent and young girls in Mumbai, India. *Indian Journal of Endocrinology and Metabolism*, 18(3), p.317. (2014).
15. Nidhi, R., Padmalatha, V., Nagarathna, R. and Amritanshu, R. Prevalence of Polycystic Ovarian Syndrome in Indian Adolescents. *Journal of Pediatric and Adolescent Gynecology*, 24(4), pp.223-227.(2011).
16. Nair, M., Pappachan, P., Balakrishnan, S., Leena, M., George, B. and Russell, P. Menstrual Irregularity and Poly Cystic Ovarian Syndrome among Adolescent Girls—A 2 Year Follow-up Study. *The Indian Journal of Pediatrics*, 79(S1), pp.69-73.(2011).
17. Williamson, K., Gunn, A., Johnson, N. and Milsom, S. The impact of ethnicity on the presentation of polycystic ovarian syndrome. *The Australian and New Zealand Journal of Obstetrics and Gynaecology*, 41(2), pp.202-206. (2001).
18. Lo, J., Feigenbaum, S., Escobar, G., Yang, J., Crites, Y. and Ferrara, A. *Increased Prevalence of Gestational Diabetes Mellitus Among Women With Diagnosed Polycystic Ovary Syndrome: A population-based study*, *Diabetes Care* 2006 Aug; 29(8): 1915-1917.(2017).
19. Solomon, C., Hu, F., Dunaif, A., Rich-Edwards, J., Willett, W., Hunter, D., Colditz, G., Speizer, F. and Manson, J. Long or Highly Irregular Menstrual Cycles as a Marker for Risk of Type 2 Diabetes Mellitus. *Obstetrical & Gynecological Survey*, 57(6), pp.356-357, (2002).
20. Pastore, L., Patrie, J., Morris, W., Dalal, P. and Bray, M. Depression symptoms and body dissatisfaction association among polycystic ovary syndrome women. *Journal of Psychosomatic Research*, 71(4), pp.270-276, (2011).
21. Sanchez, N. A life course perspective on polycystic ovary syndrome. *International Journal of Women's Health*, p.115.(2014).
22. Bazarganipour, F., Taghavi, S. A., Montazeri, A., Ahmadi, F., Chaman, R., & Khosravi, A. The impact of polycystic ovary syndrome on the health-related quality of life: A systematic review and meta-analysis. *Iranian Journal of Reproductive Medicine*, 13(2), 61–70,(2015).