Evaluation of Prevalence of PCOS and Associated Depression, Nutrition, and Family History: A Questionnaire-based Assessment

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Abstract

Context: Polycystic ovarian syndrome (PCOS) is a common condition affecting women in the prime of reproductive age. The symptoms include infertility, amenorrhea, hirsutism, obesity, and androgenic alopecia. It is a socially stigmatizing condition and is often associated with depression, poor mental health, and quality of life.

Settings and Design: We carried out a questionnaire based cross sectional study that assessed the prevalence of PCOS, collected information on the nutritional and life style related factors. A questionnaire was used to collect information with an intention to assess the prevalence of PCOS and to understand the contribution of life style/nutrition to the risk of PCOS. Student’s t test and Z proportion test were used to assess significance and a ‘p’ value of ≤ 0.05 was considered significant.

Results: A total of 972 females completed the questionnaire (mean age:24.37±8.37 years). Majority were from Telangana (n=823;84.67%) and students (690;70.98%). The mean weight was 60.58±13.03 kg and height was 1.78±2.56 m. Sizeable proportion reported irregular menstrual cycle (n=289;29.73%) that they get easily depressed: 283/972 (29.11%), low self-esteem:242/972 (24.90%), insomnia:223/972 (22.94%). A higher proportion of females were diabetic (8/243;3.29% Vs.10/706;1.42%;p=0.02) and non-vegetarian (69/243;28.40%Vs.119/706;16.86%;p=0.0002). No difference in the consumption of processed/fast food, carbonated drinks and lifestyle were noted. A significantly (p=0.0001) higher proportion of females had a positive family history (32/243;13.17% Vs.26/706;3.68%).

Conclusion: Higher prevalence of PCOS was noted in young female population. Identifying at-risk individuals and imparting life style, nutrition-based modifications would be beneficial. Furthermore, regular counseling sessions might help tackle depression leading to a better overall physical and mental health.

Keywords: Lifestyle, nutrition, PCOS, questionnaire

Introduction

Polycystic ovarian syndrome (PCOS) is the most common endocrine disorder that affects women in the prime of reproductive age.1 It is a complex disorder involving multiple systems and the prevalence reportedly ranges between 8% and 13% depending on the various definitions that are used.2,3 It is often associated with excess levels of androgen leading to ovulatory failure. Clinically, the excess levels of androgens present in the form of acne and hirsutism are known to affect the individual psychologically.4 In addition, the condition is also known to be associated with a higher risk of obesity, diabetes, and metabolic syndrome.5 All these conditions are known to lead to mood dysfunction, psychiatric problems, and distress in women with PCOS. Most of the earlier studies have identified that anxiety and depression are higher in women with PCOS as compared to women without the condition.6,7 Distress-associated symptoms, namely, obesity and hirsutism, are also known to lead to mood problems in women worsening the situation.

Although most of the studies, in general, have associated obesity with depression both in healthy women as well as...
women with PCOS, not all studies on PCOS have reported that weight-related problems had a negative impact on quality of life (QoL). However, the majority of the studies reported a higher incidence of depression in women with PCOS even after controlling for obesity, suggesting that it is one of the important aspects leading to poor QoL apart from depression. Depression is the most common cause of disability and is reported to have a major impact on the global burden of disease. Apart from depression, metabolic dysfunction in the form of insulin resistance is present in the majority of women with PCOS. This is also significantly associated with depression in women with PCOS; however, the causal relationship is unknown.

It is now increasingly being recognized that eating disorders and anxiety apart from depression are more common in women with PCOS as compared to women without the condition. Furthermore, recent research suggests that the circulating levels of steroids, androgen metabolites, insulin resistance as well as sympathetic nerve activity were higher in women with PCOS attributing the likely role of these disturbances to depression and anxiety. Therefore, based on these facts, the international network in its 2018 evidence-based guidelines advises to routinely screen for anxiety and depressive symptoms in all adolescents and women with PCOS at diagnosis.

Therefore, the current study was designed with two major objectives. The first was to evaluate the prevalence of PCOS in a young population pursuing graduation at college. The second was to understand the contribution of lifestyle and nutrition to the risk of PCOS.

**Methods**

The study was approved by the Institutional ethics committee. Participation in the survey was purely voluntary and anonymous. Willingness to answer the questions in the survey was interpreted as consent to participate in the study.

**Survey questions**

The questionnaire was designed in Google Docs and a link was shared with the individuals. Data pertaining to the participating individuals was captured majorly under four components, namely, demographic (age, sex, marital status, occupation, height, weight, etc.), medical (status of menstrual cycle, previous diagnosis of PCOS that was based on general checkup by a gynecologist, hormone tests, ultrasound scan, hirsutism, alopecia, mental status, diabetes, etc.), physical activity related (brisk walk, yoga, jogging, etc.), and nutrition details (consumption of protein-rich food, green leafy vegetables, processed food, carbonated/soft drinks, etc.). The detailed questionnaire is given under supplementary information. Questions were designed keeping in mind the ethnic and lifestyle aspects prevalent locally [Supplementary Data].

**Recruitment**

In this cross-sectional study, faculty, staff, and students of a Degree College were solicited to participate in the survey. A link to Google forms was shared extensively among the individuals on the mobile. Self-reported demographic, medical, physical activity, and nutrition data were collected.

**Statistics**

The data was exported to MS-Excel and edited for consistency. Continuous variables were expressed as mean and standard deviation (SD) and categorical variables as proportions. Continuous variables were compared using Student’s t-test and categorical variables using Z-proportion test. A two-tailed “P” value of ≤0.05 was considered statistically significant.

**Results**

**Demographic, medical, nutrient, and physical activity in the complete group**

A total of 972 individuals completed the questionnaire and the data was found to be complete for all these and therefore included for further analysis. The mean age of the study group was 24.37 ± 8.37 years comprising all females. Majority of the individuals self-reported to be from the state of Telangana (n = 823). Individuals from other states, namely, North India (n = 60), Andhra Pradesh (n = 39), Tamil Nadu (n = 27), Karnataka (n = 13), and Kerala (n = 10) were also reported. Majority of the females in this cohort were unmarried (n = 749; 77.06%) and students (n = 690; 70.99%). The mean weight (kg) and height (m) of the study group was 60.58 ± 13.03 and 1.78 ± 2.56, respectively. A sizeable (n = 289; 29.73%) number of females reported irregular menstrual cycle. Self-reported excessive face or body hair (n = 175; 18.01%), excessive hair loss (n = 391; 40.23%), acne (n = 271; 27.88%), darkened skin patches on neck, groin, armpits, etc., (n = 174; 17.90%), excessive weight gain (n = 219; 22.53%) and abdominal bloating (n = 137; 14.10%) were noted [Table 1].

**Menstrual cycle-related queries in the study group**

Of the 972 individuals that comprised the study group, 621 individuals (63.89%) reported to have a normal menstrual cycle, while 231 (23.76%) females reported an abnormal menstrual cycle and 120/972 (12.34%) reported the question with an answer of “May be”. The average menstrual cycle frequency was 120 days in 24 females, 45–50 days in 251, 60–80 days in 57 females, and 80–90 days in 19 females. The majority of the females in the study group (n = 706/972; 72.63%) reported that they were not diagnosed with PCOS earlier. However, 243/972 (25.0%) reported that they were detected with PCOS earlier and interestingly, 2.37% (23/972) reported that they may have been detected with the condition earlier. Few in the study group (n = 13) reported that the detection of the condition was based on hormone tests, by general checkup by the gynecologist in n = 51, ultrasound scanning in n = 113, and 106 by all three methods. One hundred and six (n = 340) reported that with the options none of the above. The duration of PCOS was reported to be less than a year in 144, 1–5 years in 118, more than 5 years in 29, and 2022.
more than 8 years in 40 females. Hirsutism was reported in 358/972 (36.83%) of the females [Table 2].

Depression-related queries in the study group

Of the 972 females that comprised the study group, 360 (37.03%) reported that they get easily depressed, 283/972 (29.11%) reported that they have low self-esteem, 242/972 (24.90%) reported insomnia, and 223/972 (22.94%) reported that they are embarrassed about the excess weight and facial hair growth. Few (n = 143) reported that they feel sad/upset because of infertility problems and 81 reported it to be most of the time. Nineteen (n = 19) and Eleven (n = 11) reported that they were diabetic or may be diabetic, respectively [Table 3].

Nutrition-related queries in the study group

Four hundred and sixteen (n = 416/972) reported that very rarely eat processed/fast food, while n = 101 reported that they eat once in every 3 days, 282 once in a week, and 173 once in 3 weeks. Of the 972, 439 reported to consume protein food as part of their diet, 159 reported to eat fat-rich food, 414 reported to eat green leafy vegetables, and 191 reported to consume non-vegetarian diet. A majority of the females (n = 575) reported that they rarely consume carbonated/soft drinks, while n = 100, n = 127, and n = 49 reported that they consume it in a frequency of once in a week, once in 2 weeks, and once in

Discussion

In this questionnaire-based survey of young and middle-aged women for the prevalence of PCOS, we found that approximately 23.76% (231/972) had irregular menstrual cycles and 25.0% (243/972) had PCOS that had been diagnosed earlier. This number may be slightly higher as 120/972 (12.34%) and 23/972 (2.37%) had answered with “may be” for irregular menstrual cycle and were diagnosed with PCOS earlier, respectively.

A prospective study carried out in a residential college in Andhra Pradesh reported a prevalence of 9.13% (42/460) for PCOS according to Rotterdam criteria. The study group comprised Indian adolescents aged between 15 and 18 years. A similar survey that was taken up in 502 young women aged between 18 and 24 years from Chennai reported PCOS prevalence to be 6% apart from identifying that family history had a strong association with the incidence and manifestation of PCOS. A large-scale cross-sectional study conducted among women of reproductive age in Haryana, India reported that 94/2400 (4.21%) had PCOS. A systematic review identified that the pooled mean prevalence of PCOS was 21.27% using multiple diagnostic criteria.

Table 1: Demographic details of the study group

| Parameter                          | Number (Percentage %) |
|------------------------------------|------------------------|
| Total sample (n)                   | 972                    |
| Age in years (mean±SD)             | 24.37±8.37             |
| Age range (years)                  | 12-65                  |
| Place of birth                     |                        |
| Andhra Pradesh                     | 39 (4.01%)             |
| Karnataka                          | 13 (1.34%)             |
| Kerala                             | 10 (1.03%)             |
| North India                        | 60 (6.17%)             |
| Tamil Nadu                         | 27 (2.78%)             |
| Telangana                          | 823 (84.67%)           |
| Married/Unmarried                  | 223 (22.94%)/749 (77.06%) |
| Occupation                         |                        |
| Employed                           | 191 (19.65%)           |
| Homemaker                          | 75 (7.72%)             |
| Other                              | 16 (1.65%)             |
| Student                            | 690 (70.98%)           |
| Weight (kg)                        | 60.58±13.03            |
| Height (m)                         | 1.78±2.56              |
| BMI (kg/m²)                        | 23.19±5.15             |
| Irregular menstrual period (No/Yes)| 683/289                |
| Excessive face or body hair (No/Yes)| 797 (81.99%)/175 (18.01%) |
| Excessive hair loss (No/Yes)       | 581 (59.77%)/391 (40.23%) |
| Acne (No/Yes)                      | 701 (72.12%)/271 (27.88%) |
| Darkened skin patches on neck, groin, armpits, etc., (No/Yes) | 798 (82.10%)/174 (17.90%) |
| Excess weight gain (No/Yes)        | 753 (77.47%)/219 (22.53%) |
| Infertility (No/Yes)               | 953 (98.05%)/19 (1.95%)  |
| Abdominal bloating (No/Yes)        | 835 (85.90%)/137 (14.10%) |
Although there was no difference in the mean age between females with and without PCOS, significantly higher weight and BMI were noted in the females with PCOS group. Obesity is commonly seen in patients with PCOS and approximately 40–80% of the females with PCOS are reported to be obese or overweight. Excessive body hair, acne, and excessive weight gain is commonly reported in patients with PCOS and this study also noted that more numbers of females with PCOS answered with a yes for these conditions. In the present study, more numbers of females with PCOS reported abdominal bloating as compared to females without the condition. It is reported that bloating could be a result of hormonal changes in women with PCOS, which leads to reduced gut flora and bile acids that aid in digestion. The psychological impact of PCOS is known to impact the relationship between the brain and gut and could be the other reason for bloating in these individuals. Insomnia, low self-esteem, getting depressed easily, and being embarrassed about excess weight and facial hair growth have been found to be at a higher proportion in females with PCOS. All of these further add to the burden of depression in this group. A significant proportion of females in the PCOS group were diabetic reiterating the higher risk and susceptibility to diabetes among this group.

It was interesting to note that although there was no significant difference in the consumption of processed/fast food, fat-rich food, green leafy vegetables, and carbonated drinks between the groups, consumption of protein-rich food and non-vegetarian food was significantly different. Although no significant difference in the effect of lifestyle and consumption of fast food/processed food or carbonated drinks is intriguing, however, the plausible reason may be because of a predominantly higher percentage of young women in the

| Parameter | Number (Percentage %) | Number (Percentage %) |
|-----------|----------------------|-----------------------|
| Get depressed easily (No/Yes) | 612 (62.96%)/360 (37.03%) | 612 (62.96%)/360 (37.03%) |
| Low self-esteem (No/Yes) | 689 (70.88%)/283 (29.11%) | 689 (70.88%)/283 (29.11%) |
| Insomnia (No/Yes) | 730 (75.10%)/242 (24.90%) | 730 (75.10%)/242 (24.90%) |
| Embarrassed about your excess weight and facial hair growth (No/Yes) | 749 (77.06%)/223 (22.94%) | 749 (77.06%)/223 (22.94%) |
| How much of the time for the past few months you feel sad/upset because of an infertility problem | | |
| Hardly anytime | 6 (6.68%) | 6 (6.68%) |
| Most of the time | 81 (8.33%) | 81 (8.33%) |
| Never occurs | 371 (38.17%) | 371 (38.17%) |
| Sometimes | 143 (14.71%) | 143 (14.71%) |
| Diabetic | | |
| May be | 11 (1.13%) | 11 (1.13%) |
| No | 942 (96.91%) | 942 (96.91%) |
| Yes | 19 (1.95%) | 19 (1.95%) |
| Medication for diabetic | | |
| May be | 6 | 6 |
| No | 371 | 371 |
| Yes | 21 | 21 |
| Frequency of consumption of processed/fast food | | |
| Once a week | 282 (29.01%) | 282 (29.01%) |
| Once in 3 days | 101 (10.39%) | 101 (10.39%) |
| Once in 3 weeks | 173 (17.80%) | 173 (17.80%) |
| Very rare | 416 (42.80%) | 416 (42.80%) |
| Physical activity | | |
| Brisk walk | 429 (44.13%) | 429 (44.13%) |
| Jogging | 133 (13.68%) | 133 (13.68%) |
| Yoga | 259 (26.65%) | 259 (26.65%) |
| None | 331 (34.05%) | 331 (34.05%) |
| Dietary Details | | |
| Protein-rich food (No/Yes) | 533 (54.83%)/439 (45.16%) | 533 (54.83%)/439 (45.16%) |
| Fat-rich food (No/Yes) | 813 (83.64%)/159 (16.36%) | 813 (83.64%)/159 (16.36%) |
| Green leafy vegetables (No/Yes) | 558 (57.40%)/414 (42.59%) | 558 (57.40%)/414 (42.59%) |
| Non-vegetarian (No/Yes) | 781 (80.35%)/191 (19.65%) | 781 (80.35%)/191 (19.65%) |
| Family history of PCOS | | |
| May be | 76 (7.82%) | 76 (7.82%) |
| No | 832 (85.60%) | 832 (85.60%) |
| Yes | 64 (6.58%) | 64 (6.58%) |
| Consumption of carbonated drinks | | |
| Daily | 17 (1.75%) | 17 (1.75%) |
| Never | 104 (10.70%) | 104 (10.70%) |
| Once in a week | 100 (10.29%) | 100 (10.29%) |
| Once in 2 weeks | 127 (13.06%) | 127 (13.06%) |
| Once in 3 days | 49 (5.04%) | 49 (5.04%) |
| Very rare | 575 (59.16%) | 575 (59.16%) |
study group, who might be at risk of developing the condition later in life. In addition, a significant proportion of females had a positive family history of PCOS in the PCOS group. All this point toward the likely role of genetic factors in the pathogenesis of the disease and all females with a known family history have to be routinely screened for the symptoms of the disease and aggressively counseled.

Alur-Gupta et al.\(^\text{[16]}\) investigated the likely role of body image in anxiety and depression among women with PCOS and reported a consistent detriment in body image in PCOS women. The majority of the females (n = 832) did not report a family history of PCOS while few reported that they have a positive family (n = 64) history and with the answer “may be” (n = 76). Metabolic dysfunction (predominantly in the form of insulin resistance in females with PCOS) and obesity are seen in the majority of the women with PCOS and are significant risk factors for developing depression.\(^\text{[17]}\) However, studies have associated depression with PCOS even when controlling for BMI, indicating that obesity is not the only mechanism leading to depression in females with PCOS.\(^\text{[18,19]}\) Furthermore, although insulin resistance has been linked with depression, the precise mechanism and causal relationship are not yet established. The present study identified that a significant proportion of females had infertility in the PCOS group and this has been correlated with negative psychological stress and decreased QoL. However, it is argued that infertility and its association with psychological stress is ethnicity specific and depends on religious beliefs and a personal desire for children.\(^\text{[20-22]}\) A study from China (Tan S, 2008) concluded that infertility was not a primary determinant of psychological associated problems, while a study in Iranian women with infertility reported that there is a significant concern due to the pressure of having children.

There are some limitations of this study. This is a questionnaire-based study that identifies PCOS based on the response of the individual and not on the standard classification of the disease (Rotterdam’s criteria). However, PCOS in most of the individuals was based on general checkup by a gynecologist, hormone tests, and ultrasound scan. Most of the information collected including alopecia, stress, etc., are generalized and not specific to PCOS.

In conclusion, the present study identified a higher prevalence of PCOS in a female population predominantly comprising young graduates. Identifying at-risk individuals predominantly by questionnaire-based screening at an early age and imparting lifestyle, nutrition-based modifications in these females might benefit them by delaying the onset of the condition. In addition, regular counseling sessions in these high-risk females might also aid in reducing the risk of depression and associated complications paving way for better overall health.

**Declaration of patient consent**

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient(s) has/have

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**Table 4: Comparison of demographic characteristics between women with and without PCOS**

| Detail                                      | Without PCOS (n=706) | With PCOS (n=243) | P     |
|---------------------------------------------|----------------------|--------------------|-------|
| Age in years (mean±SD)                      | 24.32±8.67           | 24.66±7.57         | 0.58  |
| Weight (kg)                                 | 59.22±12.48          | 64.14±13.82        | 0.0001|
| Height (m)                                  | 1.81±2.90            | 1.72±1.27          | 0.63  |
| BMI (kg/m²)                                 | 22.60±4.99           | 25.24±8.84         | 0.0001|
| Excessive body hair (Yes)                   | 75 (10.62%)          | 94 (38.68%)        | 0.0001|
| Excessive hair loss (Yes)                   | 255 (36.12%)         | 119 (48.97%)       | 0.0003|
| Acne (yes)                                  | 189 (26.77%)         | 77 (31.69%)        | 0.13  |
| Darkened skin patches on neck, groin, armpits, etc., (yes) | 91 (12.89%)         | 78 (32.10%)        | 0.0001|
| Excessive weight gain (yes)                 | 100 (14.16%)         | 110 (45.27%)       | 0.0001|
| Infertility (yes)                           | 3 (0.42%)            | 16 (6.58%)         | 0.0001|
| Abdominal bloating (yes)                    | 76 (10.76%)          | 57 (23.46%)        | 0.0001|
| Hirsutism (yes)                             | 214 (30.31%)         | 135 (55.56%)       | 0.0001|
| Get depressed easily                        | 211 (29.89%)         | 136 (55.97%)       | 0.0001|
| Low self-esteem                             | 176 (24.93%)         | 96 (39.50%)        | 0.0001|
| Insomnia                                    | 139 (19.69%)         | 96 (39.51%)        | 0.0001|
| Embarrassed about your excess weight and facial hair growth | 121 (17.14%)         | 91 (37.45%)        | 0.0001|

**Figure 1:** Depiction of important demographic, nutrient, and lifestyle characteristics between the groups. (*) represents statistically significant. % = percentage
Table 5: Comparison of physical activity and nutrition between women with and without PCOS

| Detail                                      | Without PCOS (n=706) | With PCOS (n=243) | P     |
|---------------------------------------------|----------------------|-------------------|-------|
| How much of the time for the past few months you feel sad/upset because of an infertility problem |                      |                   |       |
| Hardly any time -                          | 36 (5.10%)           | 27 (11.11%)       | 0.001 |
| Most of the time                           | 40 (5.67%)           | 38 (15.64%)       | 0.0001|
| Sometimes                                   | 77 (10.91%)          | 63 (25.93%)       | 0.0001|
| Diabetic (yes)                              | 10 (1.42%)           | 8 (3.29%)         | 0.02  |
| Processed food/fast food                   |                      |                   |       |
| Once a week                                | 205 (29.04%)         | 74 (30.45%)       | 0.76  |
| Once in 3 days                              | 71 (10.06%)          | 24 (9.88%)        | 1     |
| Once in 3 weeks                             | 124 (17.56%)         | 44 (18.11%)       | 1     |
| Brisk walk                                  | 202 (28.6%)          | 83 (34.16%)       | 0.14  |
| Brisk walk-jogging                          | 25 (3.54%)           | 10 (4.12%)        | 1     |
| Brisk walk, jogging, yoga                   | 13 (1.84%)           | 6 (2.47%)         | 1     |
| Brisk walk-yoga                             | 48 (6.80%)           | 31 (12.76%)       | 0.003 |
| Jogging                                     | 38 (5.38%)           | 18 (7.41%)        | 0.23  |
| Jogging-yoga                                | 16 (2.27%)           | 3 (1.23%)         | 0.3   |
| Yoga                                        | 100 (14.16%)         | 32 (13.17%)       | 0.69  |
| Protein-rich food                           | 307 (43.48%)         | 123 (50.62%)      | 0.03  |
| Fat-rich food                               | 120 (17.0%)          | 35 (14.40%)       | 0.27  |
| Green leafy vegetables                      | 292 (41.36%)         | 115 (47.33%)      | 0.1   |
| Non-vegetarian food                         | 119 (16.86%)         | 69 (28.40%)       | 0.0002|
| Family history                              | 26 (3.68%)           | 32 (13.17%)       | 0.0001|
| Carbonated drinks                           |                      |                   |       |
| Daily                                       | 14 (1.98%)           | 2 (0.82%)         | 0.30  |
| Once a week                                 | 69 (9.77%)           | 29 (11.38%)       | 0.93  |
| Once in 2 weeks                             | 89 (12.61%)          | 34 (13.99%)       | 0.69  |
| Once in 3 days                              | 34 (4.82%)           | 14 (5.76%)        | 0.54  |

given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest
There are no conflicts of interest.

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