Original Research Article

A nationwide cross-sectional study to analyse the impact of the COVID-19 pandemic on lifestyle and manifestations of polycystic ovarian syndrome among clinically diagnosed polycystic ovarian syndrome cases aged 15-49 years

Sneh M. Shah[1]*, Sthitapragnya Mohanty[1], Chandana S. Kaduluri[1], Gneyaa S. Bhatt[2], Pallavi Ninama[3], Nirav K. Bapat[2]

[2]Department of Community Medicine, [3]Department of Obstetrics and Gynecology, [1]GMERS Medical College, Sola, Ahmedabad, Gujarat, India

*Correspondence:
Dr. Sneh M. Shah,
E-mail: snehshah0405@gmail.com

ABSTRACT

Background: Polycystic ovarian syndrome (PCOS), a gynecological and endocrine disorder closely linked with one's lifestyle, has been impacted by the lockdowns imposed during the COVID-19 pandemic in India. Hence, our objective was to study the effect of the COVID-19 pandemic on the lifestyle and the manifestations of women with PCOS, and the association between them.

Methods: Nationwide cross-sectional study was carried out among women diagnosed with PCOS via Rotterdam's criteria using predesigned semi-structured questionnaires via social media. Data was analysed using proportions and Chi-square tests.

Results: Majority females were between 20-29 years (78.3%) and obese (54.8%). Only 12 were physically active, with lack of motivation being the commonest reason for not exercising. 66.9% gained weight (average 6.62 kg). 72.6% noticed an increase in stress levels. 51.7% and 25.9% had severe and moderate anxiety respectively as per GAD (Generalized Anxiety Depression) score. Only 28.5% were satisfied with their sleep. 62.4% reported having irregular menstrual cycles, with an increase of 4.6% from before the pandemic. 39.2% women reported to have missed cycles often during the pandemic. 35.4% of women had an increase in hirsutism. A significant association was found between regularity of menses and one's weight, physical activity and anxiety. Stress levels and sleep were found to be associated with change in the pattern of body hair.

Conclusions: Overall compared to the pre-pandemic times, lifestyle deteriorated, with worsening of stress levels, physical activity, sleep and weight gain in spite of improvement in diet. Manifestations of PCOS showed exaggerated menstrual symptoms and increased hirsutism.

Keywords: PCOS, Lifestyle, Regularity of menses, Hirsutism, COVID-19 lockdown

INTRODUCTION

Polycystic ovarian syndrome (PCOS), more commonly known as PCOS, is a gynecological health problem caused by an imbalance of reproductive hormones. It is characterized by androgen excess, multiple ovarian cysts and anovulation/oligoovulation.[1] Presenting itself as a multifactorial disease, it can be affected by genetic/environmental factors, uncontrolled ovarian steroidogenesis, aberrant insulin signalling and excessive oxidative stress.[2] Family history is found to have the strongest association with the disorder, with a high

significance.[3] Features commonly observed include menstrual dysfunction (menses could be infrequent, too frequent, or even absent), hirsutism, acne, and alopecia.[4]

In 2003, Rotterdam's three diagnosis criteria were established, out of which if the female presented with any two of them, she is diagnosed to have PCOS.[5] The diagnostic criteria comprise of oligo and/or anovulation, clinical and/or biochemical hyperandrogenism and polycystic ovaries on ultrasonography.[6]

The prevalence of PCOS in India ranges from 3.7 to 22.5 per cent (2017).[7] A study conducted in 2020 with 100 PCOS patients showed that 34% were lesser than 19 years of age, 57% were between 20-30 years and 9% greater than 30 years of age.[8]

Based on socioeconomic status, a study conducted in September 2014 to April 2015, showed that a higher percentage of girls with PCOS belong to the upper socioeconomic class (45.37%) as compared to those without PCOS (35.43%).[6] While based on area of stay, the prevalence of PCOS was higher in the urban group (20%) as compared to that of the rural group (4%), in a study conducted from March 2019 to September 2019.[8]

The management of PCOS is complex, and mainly includes a healthy diet, regular physical activity, and medications, which address the associated manifestations as well as comorbidities. Both non-pharmacological and pharmacological management strategies are important in the overall management of PCOS.[7]

The COVID-19 pandemic has caused most countries to impose lockdowns, resulting in a massive impact on physical activity, quality of life and mental health.[9] The sudden disruption from normal life combined with uncertainty, has resulted in a negative impact on the eating habits, stress and psychosocial well-being of the target population. High stress levels and emotional instability has been proven to be linked to dysmenorrhea, which is further aggravated in our target population - women with PCOS.[10-12]

Based on a study conducted during the COVID-19 pandemic, 44.2% of participants reported a negative impact on sleep.[13] They also reported a negative impact on their quality of life based on PCOS QoL in the form of a poorer mood. These participants also showed higher levels of depression and stress levels.

Therefore, keeping in mind the recent pandemic, this research aims to study: the effect of the COVID-19 pandemic on the lifestyle of women with PCOS; to study the effect of the COVID-19 pandemic on the manifestations in women with PCOS; and to study the association between changes in lifestyle - diet, sleep, exercise and stress, with the change in the manifestations of PCOS.

METHODS

A nationwide cross-sectional study was carried out in two stages, by first circulating an online consent questionnaire using a Google form, via social media, i.e., Instagram - @falgunivasavada, @satshyaa, @slayingpcos, @saki_women, @wethecysters, @pcosandcysters, @pcodecoded, @pcos_theindianway, @cysterlyhealth, @pcos.holistic.coach, @teamtaarini; WhatsApp - CYSTER SUPPORT GROUP; and Telegram - PCOS CLUB INDIA ~ Tribe, PCOS fighters' group to filter out our target population, i.e., women diagnosed with PCOS, via Rotterdam's criteria.[5] For that, the second stage focused on individually contacting the 263 females aged 15-49 years, who had replied in affirmative to the consent form, inquiring about the effect of the pandemic on various factors, over the period of one year, from June 2020 to June 2021, via a pre-designed, semi-structured questionnaire. The participating females were filtered based on the following criteria.

Inclusion criteria

According to the Rotterdam's criteria, women who have at least 2 of the following: ultrasound diagnosis of PCOS, history of menstrual irregularities - amenorrhoea/oligomenorrhoea, presence of hirsutism/ acne; women of reproductive age group -15-49 years; and women who consented to take part in the study were included.

Exclusion criteria

Women less than 15 years or more than 49 years, women with congenital adrenal hyperplasia, androgen secreting tumours, and hyperprolactinemia, pregnant women, breastfeeding women - lactational amenorrhoea, and women who did not give consent for the study were excluded.

The data collected included a wide range of questions inquiring about the socio-demographic profile of the respondents, health status, including premenstrual symptoms, associated features of PCOS such as acne and hirsutism, and menstrual cycle characteristics, i.e., menstrual cycle irregularity, missed menstrual cycles (as occasionally/often/never) and menstrual flow (as increased/decreased/no change) and BMI, as per the South Asian anthropometric classification.[14]

They were also asked about their lifestyle patterns during the COVID-19 lockdown based on factors such as exercise, dietary habits, sleep and stress, both prior to the pandemic and during the pandemic, in order to obtain a comparison between their pre-pandemic and during the pandemic manifestations of PCOS.

To assess anxiety, the GAD-7 assessment system was used, which graded them based on 7 parameters, using a 4-point system ranging from 0 (not at all) to 3 (more than half the days) to classify them as having minimal, mild,

moderate, or severe anxiety, the cut-offs for the same being 5, 10 and 15, respectively.[15]

The correlation between the manifestations of PCOS (regularity of menses and changes in pattern of body hair) and lifestyle measures (weight, diet, sleep pattern, physical activity, GAD score[15] and stress levels) was done using the Chi-square test. P value <0.05 was considered significant.

Aside from the questions to assess the changes in various aspects of their lifestyle prior to and during the pandemic, open ended questions were also asked so as to allow the respondents to allow themselves to be heard, at the end of the questionnaire.

RESULTS

Of the 263 participants, PCOS cases were significantly more in the age group of 20 to 29 years (206 (78.3%)). Of these, 220 (83.7%) were single women, more than half of them being students - 145 (55.1%) participants. It was a notable finding that most participants were unemployed, but working full time from home during the pandemic (e.g., student and housewife) with a mean age of 24.5 years, amounting to 51.3% (135) of the total, and a change towards working more from home was reported by 107 (40.7%) women (Table 1).

As many as 144 (54.8%) women belonged to the obese category (BMI ≥30 kg/m^2) while 41 (15.8%) and 17 (6.5%) women were of overweight (BMI 25-30 kg/m^2) (Table 1). Some women remarked that they were in distress concerning their weight gain and PCOS symptoms particularly being impacted during the pandemic.

A comparative analysis between pre and whilst the pandemic experience of participants showed that more than half, i.e., 62.4% who reported irregular cycles during the pandemic compared to 57.8% participants who had irregularities previously as well. 103 (39.2%) women often, and 88 (33.5%) women occasionally missed their cycles during the pandemic. Menstrual flow was reported as 'increased flow' by 54 (20.5%) participants during the pandemic (Table 2).

Women in our study, were reported to have noticed increased irregularities (62.4%), and worsened dysmenorrhea (44.3%) during the pandemic.

As many as 93 (35.4%) women in our study reported an increase in facial and body hair during the pandemic, in contrast to 167 (63.5%) women who already presented with these symptoms before the pandemic (Table 2). Crucial responses of most participants include them observing thicker and coarser facial hair, emphasizing its notable increase during the pandemic period.

A wide variety of premenstrual symptoms was manifested among women who did not have them prior to the pandemic. This includes 11.4% who started experiencing mood swings/depressed mood and 2.7% who newly complained of acne. Change in breast tenderness, more bloating with cramping and appetite changes were complaints in 3.8%, 3.4% and 1.9% respectively. General worsening of the above symptoms was reported by 8.4% while these symptoms remained unchanged and have persisted even before the pandemic in 155 (58.9%) women (Table 2). Our participants described hyper-irritability, anxiety, fatigue, PMS flare of acne and mood swings, insatiable hunger, poor stress management; as premenstrual symptoms observed by them during the pandemic.

Weight gain was seen to be a common feature in 66.9% of the respondents, with an average gain of 6.62 kgs (Table 3).

A mere 12 out of our pool of 263 respondents claimed to have been highly physically active during the lockdown. Of the remaining 251, 125 were moderately active and 126 were sedentary (Table 3).

Overall, more than half (53.2%) of them said that their diet had gotten better than what it was, before the pandemic, whereas a little more than a quarter (28.5%). The consumption of junk food patterns was analyzed prior to, and over the course of the pandemic, and overall, 38.0% of the respondents said that they noticed a decrease in their junk food consumption during the pandemic (Table 3).

Table 1: Sociodemographic and health profile.

Sociodemographic profile	Number (n=263)	Percentage
Age (years)		
15-19	32	12.2
20-29	206	78.3
30-39	22	8.4
40-49	3	1.1
State		
North India (Jammu and Kashmir, Punjab, Uttarakhand, Haryana, Delhi, Rajasthan, Uttar Pradesh, Union Territories)	47	17.9
West India (Goa, Gujarat, Maharashtra, Madhya Pradesh)	94	35.7
East India (Assam, Jharkhand, Odisha, West Bengal)	26	9.9
South India (Andhra Pradesh, Karnataka, Kerala, Tamil Nadu, Telangana)	96	36.5

Sociodemographic profile	Number (n=263)	Percentage
Marital status		
Married	42	16.0
Separated/divorced	1	0.4
Single	220	83.7
Children		
No	255	97.0
Yes	8	3.0
Occupation		
Business	12	4.6
Homemaker/housewife	8	3.0
Job	86	32.7
Out of work or unable to work	7	2.7
Part time job	5	1.9
Student	145	55.1
Work practice during COVID-19 pandemic		
Full time working from home	66	25.1
Full time working from home but unemployed (e.g. student, housewife)	135	51.3
Full time working from work place	20	7.6
Part time working from home	11	4.2
Part time working from work place	5	1.9
Unemployed	26	9.9
Change in work practice during COVID 19 pandemic		
No change	63	24.0
Working less	93	35.4
Working more	107	40.7
Body mass index (as per South East Asian classification) at the time of study		
Underweight	17	6.5
Normal	61	23.2
Overweight	41	15.6
Obese	144	54.8

Table 2: Changes in manifestation of PCOS during the pandemic.

Before the pandemic			During the pandemic		
Variable	Number (n=263)	%	Variable	Number (n=263)	%
Regularity of menses					
No	152	57.8	No	164	62.4
Yes	111	42.2	Yes	89	33.8
			Same as pre pandemic	10	3.8
How often did the participants miss their cycles?					
No	78	29.7	No	72	27.4
Yes, occasionally	81	30.8	Yes, occasionally	88	33.5
Yes, often	104	39.5	Yes, often	103	39.2
Menstrual flow					
Heavy flow	67	25.5	I noticed a decreased flow	94	35.7
Light flow	23	8.7	I noticed an increased flow	54	20.5
Moderate flow	173	65.8	I noticed no change	115	43.7
Presence of excess body and facial hair and change in pattern of the same					
No	96	36.5	Decreased	11	4.2
Yes	167	63.5	Increased	93	35.4
			Remained the same	159	60.5
Change in pre-menstrual symptoms					
Acne	149	56.7	Acne	7	2.7
Mood swings	215	81.7	Mood swings	30	11.4

Continued.

Before the pandemic			During the pandemic		
Depressed mood	180	68.4	Depressed mood	29	11.0
Irritability	193	73.4	Appetite changes	5	1.9
Appetite changes	120	45.6	Change in breast tenderness	10	3.8
Breast tenderness	120	45.6	More bloating	9	3.4
Bloating	175	66.5	More cramping	9	3.4
Trouble falling asleep	92	35.0	Others (spotting, pigmentation, gut issues)	4	1.5
Cramping	146	55.5	No change	155	58.9
Pain in lower abdomen	154	58.6	General worsening of symptoms	22	8.4
Others (excess body hair, back pain, headache, fever, diarrhea, constipation)	7	2.7	Improvement in symptoms	3	1.1
No	3	1.1			
Change in libido	**Number (n=263)**		**Percentage**		
Decreased libido	59		22.4		
Increased libido	62		23.6		
Unchanged	116		44.1		
No response	26		9.9		

Table 3: Changes in lifestyle - physical activity and diet during the pandemic.

Variables	Number (n=263)	%
Change in weight		
No, my weight was stable	38	14.4
Yes, I have gained weight	176	66.9
Yes, I have lost weight	49	18.6
Hours of exercise per week during the pandemic		
1-2	67	25.5
Less than 1	51	19.4
More than 2	87	33.1
No exercise	58	22.1
Reasons for not exercising		
Lack of motivation	135	51.3
Lack of time	81	30.8
Lack of awareness	7	2.7
Too tired to exercise	111	42.2
Gyms inaccessible	26	9.9
Don't know how to start	47	17.9
Others (mental health issues, periods)	4	1.5
Do it regularly	76	28.9
Overall change in diet		
Diet unchanged	48	18.3
Overall diet is better	140	53.2
Overall diet is worse	75	28.5
Change in consumption of junk food		
Increased consumption	52	19.8
Decreased consumption	100	38.0
Remained the same	111	42.2

The change in stress levels was studied and compared, prior to the pandemic and during the pandemic, and it was observed that majority of the participants (72.6%) noticed an increase in their stress levels, with the prime contributing factor being work stress, or change in the employment status (43.7%) (Table 4).

When asked what they did to keep stress at bay, answers ranging from binge eating to gardening to meditation were received. Meditation (29), and consumption of media in the form of music (29) and visual content (48), were indulged in, the most. Some even took it upon themselves to channel their energy towards exercising (30). As many as 35 respondents expressed their helplessness as they couldn't do anything to ward off stress (Table 4). A respondent said that she felt lethargic all the time, and that her inner self wouldn't allow her to do anything. When the history of psychological disorders was considered, two-fifths had depression, one fifth had a history of eating disorders and three-fifths of the participants reported having anxiety. To understand this better, the GAD-7 assessment test was used to classify the participants.[15] More than half of them (51.7%) were recorded to have severe anxiety, almost a quarter (25.9%) had moderate anxiety, and the rest were minimally to mildly anxious (Table 4).

Table 5 compares regularity of menses with different lifestyle measures. It was observed that when regularity of menses was compared with weight, physical activity, diet and GAD score, the p value was less than 0.05 and thus, there is significant association between regularity of menses and these lifestyle factors.[15] On the contrary, the p value for stress levels and sleep pattern was greater than 0.05 and thus no significant association.

Table 6 compares changes in pattern of body hair with different lifestyle measures. Here, stress levels and sleep patterns show a p value less than 0.05 showing significant association. On the other hand, weight, physical activity, diet and GAD score were not found significant.

Table 4: Changes in lifestyle - stress levels, anxiety levels and sleep during the pandemic.

Variables	Number (n=263)	%
Change in stress levels		
Decreased compared to pre-pandemic	32	12.2
Increased compared to pre-pandemic	191	72.6
Remained the same	40	15.2
Stressors during the COVID-19 pandemic		
Change in financial condition	90	34.2
Change in living situation	102	38.8
Family illness	79	30.0
Loss of a loved one	52	19.8
Family or partner conflict	102	38.8
Work stress or change in the employment status	115	43.7
Difficulties with home-schooling	69	26.2
Difficulties accessing healthcare	25	9.5
Difficulties providing or arranging childcare	3	1.1
None of the above	24	9.1
History of psychological disorders		
Anxiety	160	60.8
Depression	105	39.9
Eating disorder	59	22.4
Alcohol abuse	4	1.5
None	75	28.5
General anxiety depression assessment (GAD score)		
Minimal anxiety (0-4)	17	6.5
Mild anxiety (5-9)	42	16.0
Moderate anxiety (10-14)	68	25.9
Severe anxiety (15-21)	136	51.7

Table 5: Association between regularity of menses and lifestyle determinants.

Regularity of menses	Changed for better	Changed for worse	Remained irregular	Remained regular	Grand total	P value
Weight						
No, my weight was stable	4	7	16	11	38	
Yes, I have gained weight	16	51	80	29	176	<0.0001
Yes, I have lost weight	20	3	16	10	49	
Physical activity						
Highly active	1	0	5	6	12	
Moderately active	27	21	57	20	125	0.001
Sedentary	12	40	50	24	126	
Diet						
Diet unchanged	5	9	25	9	48	
Overall diet is better	28	27	54	31	140	0.0468
Overall diet is worse	7	25	33	10	75	
Stress levels						
Decreased compared to pre-pandemic	4	6	12	10	32	
Increased compared to pre-pandemic	29	46	83	33	191	0.712
Remained the same	7	9	17	7	40	
Sleep pattern						
Change for better	0	5	6	3	14	
Change for worse	8	19	19	6	52	0.078
No change	32	37	87	41	197	
GAD score - generalized anxiety disorder						
Minimal anxiety	5	1	6	5	17	

Continued.

Regularity of menses	Changed for better	Changed for worse	Remained irregular	Remained regular	Grand total	P value
Mild anxiety	7	8	13	14	42	0.0093
Moderate anxiety	8	13	30	17	68	
Severe anxiety	20	39	63	14	136	
Grand total	40	61	112	50	263	

Table 6: Association between change in pattern of body hair with lifestyle determinants.

Change in pattern of body hair	Decreased	Increased	Remained the same	Total	P value
Weight					
No, my weight was stable	1	8	29	38	
Yes, I have gained weight	6	69	101	176	0.124
Yes, I have lost weight	4	16	29	49	
Physical activity					
Highly active	1	2	9	12	
Moderately active	8	40	77	125	0.131
Sedentary	2	51	73	126	
Diet					
Diet unchanged	1	19	28	48	
Overall diet is better	9	49	82	140	0.3549
Overall diet is worse	1	25	49	75	
Stress levels					
Decreased compared to pre-pandemic	3	5	24	32	
Increased compared to pre-pandemic	7	77	107	191	0.0349
Remained the same	1	11	28	40	
Sleep pattern					
Change for better	0	1	13	14	
Change for worse	0	24	28	52	0.0223
No change	11	68	118	197	
GAD score - generalized anxiety disorder					
Minimal anxiety	1	2	14	17	
Mild anxiety	2	8	32	42	0.0558
Moderate anxiety	3	25	40	68	
Severe anxiety	5	58	73	136	
Grand total	11	93	159	263	

DISCUSSION

This study analyzed how the limitations resulting from the COVID-19 pandemic have altered the clinical manifestations of women diagnosed with PCOS, during the first and second waves in India, between June 2020 to June 2021. The participants were questioned in detail about change in their symptoms during the pandemic and about the lifestyle changes they had to go through as a result of the pandemic. The symptoms and lifestyle changes were then correlated to establish an understanding regarding how the lifestyle changes could affect PCOS manifestations.

More than 90% of participants were found to be living under sedentary conditions during the pandemic. Similarly, Hillyard and Sinclair found a 79% increase in the sedentary time of women during the pandemic.[16]

Women who were constrained to work from home may have been sedentary for most of the pandemic duration.[17]

As the proportion of obese subjects are considerably high in our study population, focusing on their responses revealed an increased potential prevalence of classic phenotypic features of PCOS during the pandemic. Observations similar to ours were made in other studies like Kim and Lim showed a higher prevalence of clinical manifestations in obese females.[17]

As the clinical manifestations of PCOS like change in pattern of body hair (hirsutism) and regularity of menses can be gauged without the employment of clinical and laboratory investigations, we'll further implore the association of factors such as weight, physical activity, diet, stress levels, sleep patterns and anxiety, with the above-mentioned clinical features.

In our study, upon the observation of change in the pattern of body hair (or hirsutism) in relation to the participant's weight, physical activity and diet, no significant correlation could be found, as opposed to the relation observed by an Iran based study conducted in people with PCOS, where a positive correlation was seen between hirsutism and one's BMI.[18]

Our study could not establish a correlation between physical activity and hirsutism, and this could be described based on previous studies that have proved that exercise, unless of high intensity (HIIT or AHIIT) does not have a significant impact on hirsutism.[19,20]

This can be explained by the mechanism of HIIT - where there is an increase in the intake of oxygen, which in turn improves one's cardiovascular functioning, leading to increased oxidation of fat, which causes weight loss and an improvement in BMI.[20]

It could be that in our population, the frequency and intensity of physical activity might not have been sufficient enough to qualify as HIIT as only a mere 5% were reported to have been highly active, engaging in walking or yoga, both of which aren't under HIIT, and majority of our population was moderately active or sedentary, citing issues such as lack of guidance and awareness.

Our study revealed a p value of 0.055 when the change in pattern of body hair was compared with anxiety, according to the GAD-7. Yet, a cross sectional study named anxiety, depression, and QoL (quality of life) in women with PCOS, was able to conclude that women with hirsutism had lower scores on the psychological domain measuring QoL. This was backed by an explanation that women with hirsutism spent more energy covering and hiding it and experienced low confidence because of the same which aggravated issues like anxiety and depression.[21,22]

The negative psychological effects in terms of stress and anxiety directly translates to disturbed sleep patterns, and this corroborates the findings by a study conducted in the UK, during the COVID-19 lockdown.[13]

The decrease in libido observed in our respondents, might have resulted due to the physical alterations of PCOS, like hirsutism and acne, which can often make one more conscious about their appearance, as well as the associated hormonal imbalance, leading to lower sexual satisfaction.[23]

Moving on to the regularity of menses, or lack thereof, observed in our study population, pitted against the same factors as hirsutism were analyzed, and the significance of the correlation was noted.

Around 70% of our respondents were seen to belong to the obese and overweight category, and weight gain in our study, was seen to be strongly related to the irregularity of menses in our study population, the p value being less than 0.0001. These findings are consistent with those of Khademi et al, who had a higher frequency of obesity in the subgroup of their study which included people with PCOS.[24] The pathogenesis behind obesity affecting manifestations of PCOS has been extensively explained by Barber TM, Franks S concluding that hyperinsulinemia in PCOS affects the reproductive hormonal levels as well as the ovarian follicular growth.[25]

In this study, statistical data shows an increase in new findings of menstrual irregularities among the women to more than half since the pandemic onset. Our results are in correspondence with that of Nguyen and Pang study which proved a statistical rise in menstrual abnormalities along with potential covariates which may be responsible.[26] Weight gain as a covariate has shown a high positive correlation with irregular menses (p<0.0001) that manifests as anovulation with painful and erratic bleedings. Eyuboglu and Aksun study stated that the COVID-19 related social isolation was associated with an increase in BMI among the PCOS group.[27]

Physical activity was found to have a very strong correlation with the irregularity of menses with a p value of 0.001. This corroborated the findings in a study conducted by Tayseer and Waleed, where they found that weight loss led to a more regular menstrual cycle.[28]

Diet, in our study, also has a correlation with the regularity of menses, with a p value of 0.0468. According to studies, worsening of one's diet leads to an increasing irregularity of menses in our study population, which can be explained by leptin being produced by adipose tissue cells, which leads to a gonadotropin surge, leading to further menstrual irregularities.[29,30]

A meta-analysis accessing sleep problems during the pandemic revealed a 40% increase among the general population during the pandemic.[31] Our study shows that issues with sleep have risen by about 9% among women with PCOS during the pandemic. Studies also show that women with sleep disturbances and stress experienced missed periods and worsening of PMS.[13]

A correlation was made between menstrual irregularities and GAD score of our participants (p=0.0093).[15] Most women quote to have experienced severe episodes of anxiety occasionally. The study results of Phelan and Behan, conducted as an anonymous digital survey proved psychological distress of the pandemic to cause significant menstrual disturbances.[12]

Our study had its limitations. It included only a small number of women from all over India. Therefore, this group of women may not have been a proper representation of the entire PCOS community of India. This makes it difficult to implement these findings on an entire population but this gives us a basic idea regarding the factors influencing women with PCOS and therefore it can prove to be a good foundation to understand PCOS.

Secondly, we relied on self-reporting. Self-reporting is often liable to errors and there can be over- or under presentations of their symptoms. Yet we believed that an online survey was a better option keeping in mind the pandemic, hesitancy of women with PCOS to publicly accept their disorder and pan-India nature of the study. Also, this study focused on the period between June 2020-2021. So, there could've been recall bias as well. Many women may have noticed changes only in specific few months.

CONCLUSION

PCOS, a multifactorial disease that results in both gynecological and endocrinological abnormalities, is diagnosed using Rotterdam's criteria. While there is no standard treatment established for PCOS, various lifestyle factors can cause fluctuations in manifestations of PCOS. We noticed a minor change in the manifestations of PCOS when comparing them to pre pandemic states. While on the other hand we could assess that most participants experienced a negative impact on their lifestyle mainly including stress, generalized anxiety and depression, weight and sleep. Therefore, on comparing the lifestyle and manifestations of PCOS, it was found that there is an association between regularity of menses and weight, physical activity, diet and generalized anxiety disorder. We were able to relate the change in the pattern of body hair, to sleep, and stress.

REFERENCES

1. Hoffman B, Schorge J, Schaffer J, Halvorson L, Bradshaw K, Cunningham F. Williams Gynaecology, Second edition. McGraw Hill. 2012.
2. El Hayek S, Bitar L, Hamdar LH, Mirza FG, Daoud G. Poly Cystic Ovarian Syndrome: An Updated Overview. Front Physiol. 2016;7:124.
3. Bharathi RV, Swetha S, Neerajaa J, Madhavica JV, Janani DM, Rekha SN, et al. An epidemiological survey: Effect of predisposing factors for PCOS in Indian urban and rural population. Middle East Fertil Soc J. 2017;22(4):313-6.
4. Pasquali R, Gambineri A. A comprehensive approach in diagnosing the polycystic ovary syndrome. Womens Health (Lond). 2015;11(4):501-12.
5. Rotterdam ESHRE/ASRM-Sponsored PCOS Consensus Workshop Group. Revised 2003 consensus on diagnostic criteria and long-term health risks related to polycystic ovary syndrome. Fertil Steril. 2004;81(1):19-25.
6. Desai NA, Tiwari RY, Patel SS. Prevalence of Polycystic Ovary Syndrome and its Associated Risk Factors among Adolescent and Young Girls in Ahmedabad Region. Indian J Pharm Pract. 2018;11(3).
7. Ganie MA, Vasudevan V, Wani IA, Baba MS, Arif T, Rashid A. Epidemiology, pathogenesis, genetics & management of polycystic ovary syndrome in India. Indian J Med Res. 2019;150(4):333-44.
8. Tabassum F, Jyoti C, Sinha HH, Dhar K, Akhtar MS. Impact of polycystic ovary syndrome on quality of life of women in correlation to age, basal metabolic index, education and marriage. PLoS One. 2021;16(3):e0247486.
9. Park K-H, Kim A-R, Yang M-A, Lim S-J, Park J-H. Impact of the COVID-19 pandemic on the lifestyle, mental health, and quality of life of adults in South Korea. PLoS One. 2021;16(2).
10. Wang L, Wang X, Wang W, Chen C, Ronnennberg AG, Guang W, et al. Stress and dysmenorrhoea: a population based prospective study. Occup Environ Med. 2004;61(12):1021-6.
11. Ibrahim NK, AlGhamdi MS, Al-Shaibani AN, AlAmri FA, Alharbi HA, Al-Jadani AK, et al. Dysmenorrhea among female medical students in King Abdulaziz University: Prevalence, Predictors and outcome. Pak J Med Sci. 2015;31(6):1312-7.
12. Phelan N, Behan LA, Owens L. The Impact of the COVID-19 Pandemic on Women's Reproductive Health. Front Endocrinol (Lausanne). 2021;12:642755.
13. Kite C, Atkinson L, McGregor G, Clark CCT, Brown JE, Kyrou I, Randeva HS. Sleep Disruption and Depression, Stress and Anxiety Levels in Women With Polycystic Ovary Syndrome (PCOS) During the Lockdown Measures for COVID-19 in the UK. Front Glob Womens Health. 2021;2:649104.
14. Weir CB, Jan A. BMI Classification Percentile and Cut Off Points. [Updated 2021 Jun 29]. In: StatPearls. Treasure Island (FL): StatPearls Publishing. 2022.
15. Spitzer RL, Kroenke K, Williams JB, Löwe B. A brief measure for assessing generalized anxiety disorder: the GAD-7. Arch Intern Med. 2006;166(10):1092-7.
16. Hillyard M, Sinclair M, Murphy M, Casson K, Mulligan C. The impact of COVID-19 on the physical activity and sedentary behaviour levels of pregnant women with gestational diabetes. PloS One. 2021;16(8):e0254364.
17. Kim MJ, Lim NK, Choi YM, Kim JJ, Hwang KR, Chae SJ, et al. Prevalence of metabolic syndrome is higher among non-obese PCOS women with hyperandrogenism and menstrual irregularity in Korea. PLoS One. 2014;9(6):e99252.
18. Fatemi Naeini F, Najafian J, Jazebi N. Hirsutism and body mass index in a representative sample of Iranian people. ARYA Atheroscler. 2012;8(1):43-54.
19. Shele G, Genkil J, Speelman D. A Systematic Review of the Effects of Exercise on Hormones in Women with Polycystic Ovary Syndrome. J Funct Morphol Kinesiol. 2020;5(2):35.
20. Samadi Z, Bambaeichi E, Valiani M, Shahshahan Z. Evaluation of Changes in Levels of

Hyperandrogenism, Hirsutism and Menstrual Regulation After a Period of Aquatic High Intensity Interval Training in Women with Polycystic Ovary Syndrome. Int J Prev Med. 2019;10:187.

21. Brady C, Mousa SS, Mousa SA. Polycystic ovary syndrome and its impact on women's quality of life: More than just an endocrine disorder. Drug Healthc Patient Saf. 2009;1:9-15.

22. Ekback M, Wijma K, Benzein E. "It is always on my mind": women's experiences of their bodies when living with hirsutism. Health Care Women Int. 2009;30(5):358-72.

23. Eftekhar T, Sohrabvand F, Zabandan N, Shariat M, Haghollahi F, Ghahghaei-Nezamabadi A. Sexual dysfunction in patients with polycystic ovary syndrome and its affected domains. Iran J Reprod Med. 2014;12(8):539-46.

24. Khademi A, Alleyassin A, Aghahosseini M, Tabatabaeefar L, Amini M. The Effect of Exercise in PCOS Women Who Exercise Regularly. Asian J Sports Med. 2010;1(1):35-40.

25. Barber TM, Franks S. Obesity and polycystic ovary syndrome. Clin Endocrinol (Oxf). 2021;95(4):531-41.

26. Nguyen BT, Pang RD, Nelson AL, Pearson JT, Benhar Noccioli E, Reissner HR, et al. Detecting variations in ovulation and menstruation during the COVID-19 pandemic, using real-world mobile app data. PLoS One. 2021;16(10):e0258314.

27. Eyupoglu ND, Aksun S, Ozturk M, Yildiz BO. Impact of social isolation during COVID-19

pandemic on health behaviors and weight management in women with polycystic ovary syndrome. Eat Weight Disord. 2022;1-7.

28. Marzouk TM, Sayed Ahmed WA. Effect of Dietary Weight Loss on Menstrual Regularity in Obese Young Adult Women with Polycystic Ovary Syndrome. J Pediatr Adolesc Gynecol. 2015;28(6):457-61.

29. Thong FS, Graham TE. Leptin and reproduction: is it a critical link between adipose tissue, nutrition, and reproduction? Can J Appl Physiol. 1999;24(4):317-36.

30. Fujiwara T, Nakata R. Current problems of food intake in young women in Japan: Their influence on female reproductive function. Reprod Med Biol. 2004;3(3):107-14.

31. Jahrami H, BaHammam AS, Bragazzi NL, Saif Z, Faris M, Vitiello MV. Sleep problems during the COVID-19 pandemic by population: a systematic review and meta-analysis. J Clin Sleep Med. 2021;17(2):299-313.