



Impact of social isolation during COVID-19 pandemic on health behaviors and weight management in women with polycystic ovary syndrome

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Abstract

Purpose COVID-19 pandemic has far-reaching psychosocial implications for chronic health conditions. We aimed to investigate whether COVID-19 associated social isolation affects lifestyle and weight control in women with polycystic ovary syndrome (PCOS).

Methods We conducted an online survey involving 232 women with PCOS and 157 healthy controls on weight changes, physical activity, sleep and eating patterns using Three-Factor Eating Questionnaire (TFEQ-18), Pittsburgh Sleep Quality Index (PSQI), and International Physical Activity Questionnaire Short Form (IPAQ-SF). PCOS-related quality of life questionnaire (PCOSQ) was also completed by the patients.

Results While 48.5% of all participants gained weight, 13.9% maintained a stable weight, and 37.6% lost weight during the 14-week social isolation. The distribution of weight change was similar between groups ($p=0.44$). All participants reported a decrease in physical activity ($p<0.001$). While eating behavior showed no significant change in both groups, reduced sleep quality was found only in the PCOS group ($p<0.001$). In women with weight gain, increase in BMI values was higher in patients ($1.3 \pm 1 \text{ kg/m}^2$) than controls ($1.0 \pm 0.6 \text{ kg/m}^2$; $p=0.01$). Among those who gained weight, delta BMI values showed positive correlations with delta sleep induction time ($r=0.25$, $p=0.001$), delta PSQI ($r=0.24$, $p=0.004$) and delta TFEQ-18 scores ($r=0.25$, $p=0.001$).

Conclusion Weight changes during social isolation are similar in women with PCOS and healthy women. However, within those who gain weight, increase in BMI is more pronounced in women with PCOS. Weight gain appears to be related to alterations in sleep quality and eating habits rather than reduced physical activity.

Level III Evidence obtained from cohort or case–control analytic studies.

Keywords COVID-19 · PCOS · Obesity · Eating disorders · Sleep · Weight

Introduction

In March 2020, the World Health Organization called on all countries to take action against the COVID-19 pandemic [1]. In many countries, social isolation measures have been launched to control the viral spread. Similarly, in March

2020 immediately after the first case occurred in Turkey, all social areas were closed, classes in all schools were suspended, and a rotational/remote work system was introduced nationwide. In addition to promoting self-isolation on weekdays, absolute curfews were imposed for evenings and weekends. These social restrictions can lead to behavioral changes that may negatively impact chronic health conditions and increase obesity prevalence [2, 3].

Polycystic ovary syndrome (PCOS) is a common and complex disorder associated with metabolic syndrome, obesity, disordered eating, depression, and sleep apnea [4–6]. Limited available data suggest increased susceptibility to COVID-19 in women with PCOS, and concomitant hormonal dysregulations such as insulin resistance or hyperandrogenism may complicate the clinical course of the infection

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[7, 8]. Therefore, effective management of PCOS has become even more critical during COVID -19 the pandemic.

Lifestyle characteristics, including physical activity, dietary habits, and sleep patterns, are related to insulin resistance and quality of life in women with PCOS [4, 9]. Weight gain exacerbates the syndrome phenotype, and women with PCOS are more likely to gain weight [10]. Lifestyle interventions, such as diet, exercise, and sleep optimization enhance metabolic, hormonal, and psychological aspects of the syndrome. Therefore, they are recommended by international guidelines as a core component of management for both weight gain prevention and weight maintenance in women with PCOS [11]. In addition, women with PCOS have higher levels of stress-related mediators that are correlated with body weight and upper body obesity [12]. Psychological distress and altered lifestyle behaviors in a pandemic setting could complicate weight control in PCOS. However, there are no data available evaluating potential association between PCOS management and isolation measures during pandemic.

In our study, we aimed to assess whether COVID -19 related social isolation affects lifestyle and weight control in women with PCOS compared with healthy controls.

Materials and methods

The study protocol was approved by Turkish Ministry of Health and the Ethics Committee of Hacettepe University, Ankara (approval ID: 2020/12-55). All participants provided informed consent.

Study design and population

Our study was conducted via Google Forms as an online survey between June 26 and July 09, 2020. At the beginning of our survey, social isolation in Turkey had been ongoing for 14 weeks.

An open announcement of our survey was distributed via social media platforms (Instagram, WhatsApp), including 1882 potential participants. During the 2-week recruitment period, 516 women (response rate: 27.4%) clicked on the survey link. Screening questions excluded women who were under 18 or over 45 years of age, and/or currently pregnant, breastfeeding, or menopausal.

Participants who reported a previous medical diagnosis of PCOS were asked about the history of hirsutism and/or hyperandrogenism, irregular menstrual cycles (cycle length of < 21 or > 35 days), and polycystic ovarian morphology (PCOM). At least two of these three features were required for confirmation of the diagnosis [13].

Women with regular menstrual cycles and no clinical signs of hyperandrogenism or other chronic disease were enrolled as healthy controls.

Study questionnaires

Our survey included a general information form and three validated survey instruments, namely Three-Factor Eating Questionnaire (TFEQ-18), Pittsburgh Sleep Quality Index (PSQI), and International Physical Activity Questionnaire Short Form (IPAQ-SF). All participants were asked to answer questions for both before and during isolation periods in a single survey session.

- General information form includes demographic data, isolation characteristics, height and weight, menstrual features, and medical history.
- TFEQ-18 evaluates overall eating behavior with subgroups for uncontrolled eating (UE), emotional eating (EE), and cognitive restraint (CR). Higher scores indicate a greater tendency toward eating disorders [14].
- PSQI describes the duration and quality of sleep. Scores are negatively correlated with sleep quality [15].
- IPAQ-SF determines estimated total weekly physical activity (metabolic units [MET]-hour/week) [16].

Patients with PCOS were also asked to complete PCOS Health-Related Quality of Life Questionnaire (PCOSQ) for the isolation period only. PCOSQ assesses body hair, infertility, menstrual disturbances, weight, and emotions. PCOSQ scores are positively correlated with health-related quality of life [17].

Statistical analyses

Normality of variable distributions was examined using the Kolmogorov–Smirnov test. For categorical variables, proportions were reported, and for continuous variables, the mean and standard deviation (SD) were reported. Student's *t*-test or Mann–Whitney *U*-test were used to assess differences in continuous variables. To compare continuous variables between more than two independent categories, ANOVA or Kruskal–Wallis tests were used. Between periods before and during isolation, differences in continuous variables were assessed using the paired *t*-test or Wilcoxon test. Chi-square tests were used for categorical variables. Correlation analyses were performed through Pearson or Spearman test. Statistical analyses were performed using IBM SPSS Statistics (version 25; SPSS, Armonk, NY) and probability values were two-sided and considered statistically significant when $p < 0.05$.

Results

General characteristics

Five hundred and sixteen women clicked on our survey link, and 68 participants were excluded at the initial screening. A previous medical diagnosis of PCOS was reported by 238 women, and 232 subjects were recruited into the patient group after confirmation. Of 210 participants without a history of PCOS, 33 women with chronic medical conditions and 20 participants with isolated menstrual irregularity or hirsutism were excluded.

After eligibility screening, 232 women with PCOS and 157 healthy controls participated in our study. The median age of women with PCOS [23 (IQR: 21–25)] and controls [23 (IQR: 20–25)] was similar ($p=0.37$). Baseline BMI values showed no difference between groups ($p=0.24$).

Of the women with PCOS, 86% had hirsutism and/or a history of biochemical hyperandrogenism, 83.3% had irregular menstrual cycles, while 94.7% reported PCOM. The median follow-up time from diagnosis was 4 (IQR: 2–7) years. Current use of oral contraceptives, antidepressants and metformin were 29.4%, 6.7%, and 3.6%, respectively.

Lifestyle characteristics before social isolation

Lifestyle features before and during social isolation were summarized in Table 1. At baseline, women with PCOS reported to have lower sleep quality, longer sleep duration, and similar sleep induction time compared with controls

($p=0.021$, 0.019, and 0.09, respectively). Patients and controls described similar physical activity scores ($p=0.33$). TFEQ-18 scores were higher in PCOS group than in controls ($p=0.015$), with higher UE and EE, and similar CR scores ($p=0.03$, <0.001 , and 0.21, respectively).

Lifestyle characteristics during social isolation

While women with PCOS described increasing PSQI scores during isolation, they remained similar in controls. However, sleep duration and sleep induction time increased significantly in both ($p<0.001$ for all). Women with PCOS had poorer sleep quality ($p<0.001$), similar sleep duration ($p=0.41$) and higher sleep induction time ($p=0.008$) compared with controls during isolation.

Weekly physical activity scores were significantly reduced in both groups, with no difference between patients and controls ($p=0.92$). TFEQ-18 scores were stable in both patients and controls ($p=0.64$ and 0.79, respectively). However, subgroup analysis showed that patients with weight gain had increased TFEQ-18 scores during isolation period (28.8 vs. 29.8, $p<0.001$), while they remained the same in controls who gained weight (27.7 vs. 28.6, $p=0.12$).

Change in weight control during social isolation

Our study showed that 48.5% of participants gained weight, 13.9% maintained a stable weight, and 37.6% lost weight during social isolation. The distribution of weight change was similar in the patient and control groups ($p=0.44$) (Fig. 1).

Table 1 Comparison of lifestyle characteristics before and during social isolation in women with PCOS and control groups

	Women with PCOS ($n=232$)			Healthy controls ($n=157$)		
	Before isolation Mean (SD)	During isolation Mean (SD)	p	Before isolation Mean (SD)	During isolation Mean (SD)	p
BMI (kg/m^2)	21.9 (2.6)	22.1 (3.1)	0.018	21.5 (2.9)	21.6 (3)	0.60
Daily time spent at home			<0.001			<0.001
0–7 h (n , %)	50 (21.6%)	5 (2.2%)		38 (24.4%)	1 (0.6%)	
8–12 h (n , %)	107 (46.1%)	15 (6.6%)		62 (39.7%)	4 (2.6%)	
13–16 h (n , %)	53 (22.8%)	7 (3.1%)		52 (33.3%)	8 (5.1%)	
17–20 h (n , %)	14 (6%)	28 (12.2%)		2 (1.3%)	19 (12.2%)	
21–24 h (n , %)	8 (3%)	50 (21.6%)		2 (1.3%)	125 (79.5%)	
PSQI score	6.2 (2.6)	7.2 (3.1)	<0.001	5.5 (2.4)	5.7 (2.5)	0.37
Duration of sleeping (h)	7.7 (1.8)	8.2 (1.7)	<0.001	7.2 (1.7)	8.3 (1.7)	<0.001
Sleep induction time (minutes)	23 (23)	45 (42)	<0.001	19 (22)	34 (34)	<0.001
Physical Activity (MET-hour/week)	1386 (IQR: 693–3214)	693 (IQR:165–1626)	<0.001	1485 (IQR: 707–3516)	657 (IQR:132–1836)	<0.001
TFEQ-18 score	28.5 (5.1)	28.4 (5.2)	0.64	27.3 (4.9)	27.2 (5.3)	0.79

BMI body mass index, PSQI Pittsburgh Sleeping Quality Index, MET metabolic unit, TFEQ-18 Three Factor Eating Questionnaire

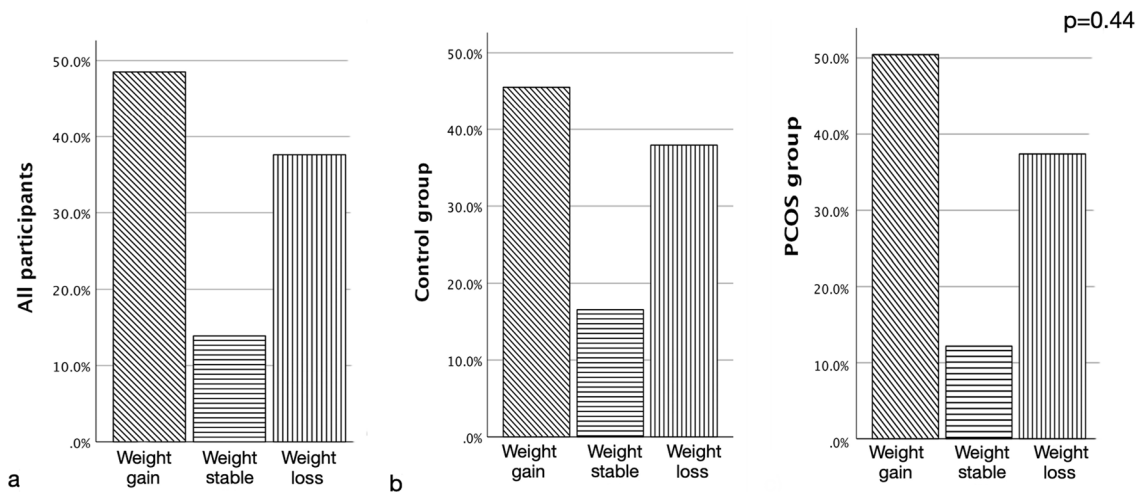


Fig. 1 Weight change distribution in **a** all participants, **b** controls and women with PCOS

Among participants who lost weight, delta BMI values were similar between patients ($-1.2 \pm 0.8 \text{ kg/m}^2$) and controls ($-1.1 \pm 0.7 \text{ kg/m}^2$, $p=0.56$). In weight gain group, increase in BMI values was more prominent in the PCOS group ($1.3 \pm 1 \text{ kg/m}^2$) than controls ($1.0 \pm 0.6 \text{ kg/m}^2$, $p=0.01$). Delta BMI values of patients who gained weight were similar in groups with different education level ($p=0.83$), employment status ($p=0.28$) and different time spent at home ($p=0.27$). Patients on OC, antidepressant or metformin therapy had similar delta BMI values to those not currently taking medication ($p=0.82$, 0.39 and 0.11 , respectively).

Correlation analyses for weight alterations

While there was a positive correlation between baseline BMI values and TFEQ-18 scores ($r=0.243$, $p<0.001$), baseline BMI values did not show a correlation with delta TFEQ-18

scores ($p=0.91$). Among women who gained weight, delta BMI values showed positive correlations with delta sleep induction time ($r=0.25$, $p=0.001$), delta PSQI ($r=0.24$, $p=0.004$), and delta TFEQ-18 scores ($r=0.25$, $p=0.001$). All subgroups of delta TFEQ-18; delta UE ($r=0.28$, $p<0.001$), delta EE ($r=0.18$, $p=0.018$) and delta CR ($r=0.16$, $p=0.04$) showed positive correlation with delta BMI. There was no correlation of delta BMI with delta physical activity (Table 3).

Health-related quality of life in women with PCOS in social isolation

The PCOSQ scores in the different weight change groups were summarized in Table 2. PCOSQ scores were negatively correlated with final BMI values ($r=-0.32$, $p=0.003$), PSQI scores ($r=-0.22$, $p=0.004$) and TFEQ-18 scores ($r=-0.29$, $p<0.001$) during social isolation.

Table 2 Comparison of PCOSQ scores in different weight control groups in women with PCOS

	All patients Mean (SD)	Patients who gained weight Mean (SD)	Patients with stable weight Mean (SD)	Patients who lost weight Mean (SD)	<i>p</i> value
Overall score	18 (4.8)	16.8 (4.7)	20.4 (4.5)	18.9 (4.7)	0.001
Emotions	3.8 (1.5)	3.5 (1.5)	3.9 (1.4)	3.9 (1.5)	0.18
Body hair	3.7 (1.8)	3.3 (1.9)	3.8 (1.7)	4 (1.8)	0.06
Weight	3.6 (1.5)	3.1 (1.6)	4.1 (1.1)	4.1 (1.4)	<0.001
Infertility	3.5 (1.3)	3.4 (1.3)	3.8 (1.4)	3.6 (1.3)	0.25
Menstrual problems	3.4 (1.3)	3.1 (1.3)	4.2 (1.6)	3.5 (1.3)	0.001

PCOS polycystic ovary syndrome, PCOSQ PCOS health-related quality-of-life questionnaire, SD standard deviation

Table 3 Correlation analyses between delta BMI and lifestyle changes in women with weight gain

	Delta BMI		
	All participants	Women with PCOS	Healthy controls
Delta TFEQ-18 score			
<i>r</i>	0.25	0.27	0.24
<i>p</i>	0.001	0.006	0.05
Delta sleep induction time			
<i>r</i>	0.25	0.22	0.27
<i>p</i>	0.001	0.022	0.039
Delta PSQI score			
<i>r</i>	0.24	0.23	0.22
<i>p</i>	0.004	0.029	0.10
Delta MET-hour/week			
<i>r</i>	−0.04	−0.01	−0.05
<i>p</i>	0.57	0.91	0.70

BMI body mass index, *TFEQ-18* Three Factor Eating Questionnaire, *PSQI* Pittsburg Sleeping Quality Index, *MET* metabolic unit

Discussion

In this study, we report that women with PCOS described similar physical activity scores, lower sleep quality, and a higher tendency to disordered eating behaviors compared with healthy women before COVID-19 isolation period. The distribution of weight change was similar in patients and controls during the 14-week isolation period, with reduced physical activity scores and similar eating habits in both groups, and decreased sleep quality only in PCOS. Despite similar reduced physical activity scores and increased sleep time in both groups, mean BMI increased significantly only in the PCOS group (3).

COVID-19-related social restrictions carry the risk of increasing the prevalence of obesity [3]. However, several studies reported that social isolation had bidirectional effects on weight management [18, 19]. Similarly, we observed that only half of the participants gained weight, and weight change distribution were similar between patients with PCOS and control women.

Social constraints can negatively affect eating habits and induct binge eating in food addiction [20, 21]. Before the COVID-19 pandemic, it was reported that women with PCOS had a more than a fourfold increased risk of disordered eating than controls [22]. Consistent with previous reports, our survey results also suggest a tendency toward disordered eating, particularly uncontrolled and emotional eating in women with PCOS. Furthermore, we have found

positive correlations both for baseline and delta values of BMI and TFEQ-18 scores. Our results are in line with other studies that assessed patients with obesity during COVID-19 pandemic and emphasize potential role of eating habit alterations in weight management during social isolation [23].

Recent reports indicated lower sleep quality with longer sleep onset latency during the COVID -19 lockdown period [24–26], and sleep duration is a predictor of weight gain [27]. Here, we have shown lower sleep quality scores with longer sleep duration in women with PCOS compared with controls both before and during the social isolation period. Although sleep duration increased and became similar in both groups, sleep quality showed no significant decrease in controls. Deteriorated sleep quality during the social isolation period appears to be a factor in weight gain.

Several studies reported that decreased physical activity during COVID-19 related isolation could lead to weight gain [18, 27–29]. However, a slight weight gain was also described, despite increased physical activity during quarantine [30]. Previously, it was reported that obese women with PCOS had less physical activity than obese controls [31]. Nevertheless, we found that physical activity scores were similar in the PCOS and control groups during the social isolation. In addition, correlation analyses showed that weight gain during social isolation might be associated with decreased sleep quality and impaired eating behavior but not with decreased physical activity scores.

The biological and behavioral changes associated with social isolation could affect quality of life [32]. Our results on PCOSQ showed that the weight-stable group had higher overall scores and scores in the domains of weight and menstrual problems than the other groups, suggesting that weight alterations during social isolation might be related with poor quality of life in PCOS.

The current study is subject to inherent methodological limitations of a survey. Main limitation of our study was self-report of PCOS diagnosis. To minimize the risk of bias, we only included participants with previous physician diagnosis of PCOS and used a second confirmation layer gathering history of clinical and laboratory manifestations of the syndrome. A recent prospective study reported that the assessment of cardinal symptoms of PCOS by simple questionnaires could be highly consistent with the clinical diagnosis of androgen excess in women [33]. Second, survey announcements were made through a social media application, thereby limiting generalizability of the findings. Lastly, lifestyle changes were assessed through only online surveys, albeit using validated questionnaires. A well-designed online survey is a valid option to collect data on self-management of weight and lifestyle changes during social isolation, considering the measures implemented due to pandemic, including restricted access to physical health care. Self-reported online surveys are preferred since they can be an effective

tool to respond quickly and reach large populations in a crisis setting [34]. Nevertheless, the results should be interpreted with caution since they rely on questionnaires.

In conclusion, our results suggest that during a COVID-19 related social isolation period, half of women gain weight, regardless of PCOS diagnosis. Within those who gain weight, increase in BMI is more pronounced in women with PCOS. Weight gain appears to be related to alterations in sleep quality and eating habits rather than reduced physical activity. PCOS-related quality of life is impaired in patients with weight alterations.

What is already known on this subject?

There is growing evidence that the COVID-19 associated social isolation significantly alters health behavior and everyday life in general population. Women with PCOS might be particularly vulnerable to these alterations, as they are more likely to suffer from higher levels of stress, eating disorders, and sleep disturbances.

What does this study add?

This study shows bidirectional weight changes in women with PCOS, similar to healthy controls at the time of pandemic related restrictions. Increase in BMI is more prominent in patients with PCOS who gained weight during isolation. While reduction in physical activity levels appear not to predict weight status, worsening of sleep and eating patterns are associated with weight gain.

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Data availability The datasets generated during and/or analyzed during the current study are not publicly available but are available from the corresponding author on reasonable request.

Declarations

Conflict of interest The authors have declared that no competing interests exist.

Ethical approval The study protocol was approved by Turkish Ministry of Health and the ethical committee of Hacettepe University, Ankara (Approval ID: 2020/12-55).

Consent to participate Informed consent was obtained from all individual participants included in the study.

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