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Altered cooperativeness in patients with polycystic ovary syndrome

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ABSTRACT

OBJECTIVE: In the present study, we aimed to compare temperament and character traits between patients with polycystic ovary syndrome (PCOS) and age-body mass index-matched healthy controls (HC). We hypothesized that patient with PCOS would differ in terms of temperament and character traits compared with HCs.

MATERIAL AND METHODS: Fifty patients who were diagnosed with PCOS and 42 age-body mass index-matched healthy controls (HC) were included in the study. The groups were compared in terms of temperament and character traits and anxiety status with the Temperament and Character Inventory (TCI) and State-Trait Anxiety Inventory (STAI-1 and STAI-2).

FINDINGS: There was a statistically significant difference between patient and the control group in terms of cooperativeness dimension ($t = -2.81$; $p = 0.006$). It was a lower mean in the PCOS group (20.98 ± 2.992). In addition, scores of STAI-1 and STAI-2 were significantly higher in the PCOS group compared with the HC group (respectively; $t = 5.70$; $p < 0.001$; $t = 2.12$; $p = 0.037$). The score of cooperativeness and multivariate analysis of variance was found to be significantly lower in the PCOS group.

CONCLUSIONS: Patients with PCOS had significant a different character trait such as lower cooperativeness compared with HC. Additionally, we found that this different character dimension would be a trait in PCOS after covariant analysis. We suggest that our result supported the psychiatric background of PCOS.

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Polycystic ovary;
temperament; personality;
character; anxiety; women

Introduction

Polycystic ovary syndrome (PCOS) is an endocrine disorder characterized by anovulation, hyperandrogenism, and hyperinsulinaemia [1,2]. It has been well established that PCOS presented with psychiatric disorders and psychiatric symptoms [3–5]. The estimated prevalence of depressive symptoms in PCOS has been reported to be around 40% and anxiety symptoms have been shown to be 34% [6–8]. In a study, 21.6% of PCOS women were reported to be diagnosed with major depressive disorder according to the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition [DSM-IV] [6]. Furthermore, bipolar disorder, obsessive-compulsive disorder and rate of psychiatric hospitalization were reported to be higher in patients with PCOS compared with healthy controls [9]. Recently, there have been evidence which supported the neurobiological basis of PCOS. Rees and his coworkers reported that PCOS was associated with a widespread reduction in axial diffusivity in terms of diffusion along the main axis of white matter fibres and increased tissue volume fraction in the corpus

callosum. Cognitive performance was also reported to be reduced compared with controls [10]. One internet-based study assessed neuropsychological functioning in right-handed women with and without PCOS, and it was reported that there is no evidence of an effect of hyperandrogenism or hyperestrogenism on cognitive function in this study [11]. Another study defined poorer performance on tests of verbal fluency, verbal memory, manual dexterity, and visuospatial working memory in PCOS [12].

Besides the established knowledge of psychiatric comorbidity in patients with PCOS, there have been several studies which investigated personality traits in PCOS. In a large sample sized twin study, female twins with PCOS have been reported to have higher levels of neuroticism than women without PCOS [9]. Muharam et al. investigated serum cortisol levels of PCOS patients according to their personality type which were defined by the Minnesota Multiphasic Personality Inventory (MMPI) and revealed that the serum cortisol levels varied between different personality types [13]. Scaruffi et al. reported that patients with

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PCOS had significantly different personality profiles compared with healthy subjects while they were assessed with the Millon Clinical Multiaxial Inventory-III [14]. Scaruffi and her coworkers reported higher values of alexithymia and a higher body uneasiness and as well as different profiles on MMPI in patients with PCOS compared with healthy controls [15]. Sharma reported three cases of PCOS with borderline personality disorder and concluded that patients with PCOS should be assessed in terms of personality disorders [16]. Borghi et al. investigated patients with PCOS by the State-Trait Anger Expression Inventory-2 and concluded that anger showed to be common in patients with PCOS compared with healthy controls [17]. There have been three studies that researched temperament in PCOS [18–20]. However, solely Öztürk et al. assessed temperament and character traits with the Temperament and Character Inventory [20]. Temperament and character inventory (TCI) was created by Cloninger and his colleagues and it has been well established that TCI could detect an association between personality and neurobiological systems. TCI is a contemporary scale that interprets some personality features in various psychosomatic conditions [21].

In the present study, we aimed to compare temperament and character traits between patients with PCOS and age-body mass index-matched healthy controls (HC). We hypothesized that patients with PCOS would differ in terms of temperament and character traits compared with healthy controls. If so, we will be able to support the previous studies which found different personality types in patients with PCOS and as well as support the neuropsychobiological background of PCOS.

Materials and methods

Subjects

The present study was conducted at Tekirdağ Namık Kemal University, Faculty of Medicine, Department of Gynecology and Obstetrics and Psychiatry between dates of October 2018–January 2019. Inclusion criteria for patients with PCOS were determined according to revised criteria of the Rotterdam Consensus Workshop [22]. In detail, these criteria consisted of the following: 2 out of 3 between oligoand/or anovulation, clinical and/or biochemical signs of hyperandrogenism and polycystic ovaries. All the patients were assessed with transvaginal ultrasonography for defining ovarian morphology in terms of whether polycystic ovarian morphology existed. Patients who had other androgen excess or related disorder ($n = 11$), who had body mass index value higher than 25 kg/m^2 ($n = 31$), who had a previous or present psychiatric diagnosis ($n = 18$), who were unable to cooperate with psychometric scales

that were used in the study ($n = 19$), who were older than 45 years old ($n = 6$), and who were not willing to participated in the study ($n = 8$) were excluded. According to inclusion and exclusion criteria, 50 patients with PCOS were included in the study. Inclusion criteria for the control group consisted of willing to participate in the study and having enough education for cooperating with the scales that were used in the study. Exclusion criteria for healthy controls (HC) were as follows: older than 45 years old ($n = 16$), having a previous or present psychiatric diagnosis ($n = 19$), and being not willing to participate in the study ($n = 1$). According to these criteria, 42 healthy controls were included (Figure 1). The present study was approved by Tekirdağ Namık Kemal University-Non-Invasive Clinic Research Ethical Committee (IRB date: 06/09/2018; number 2018/119/08/10).

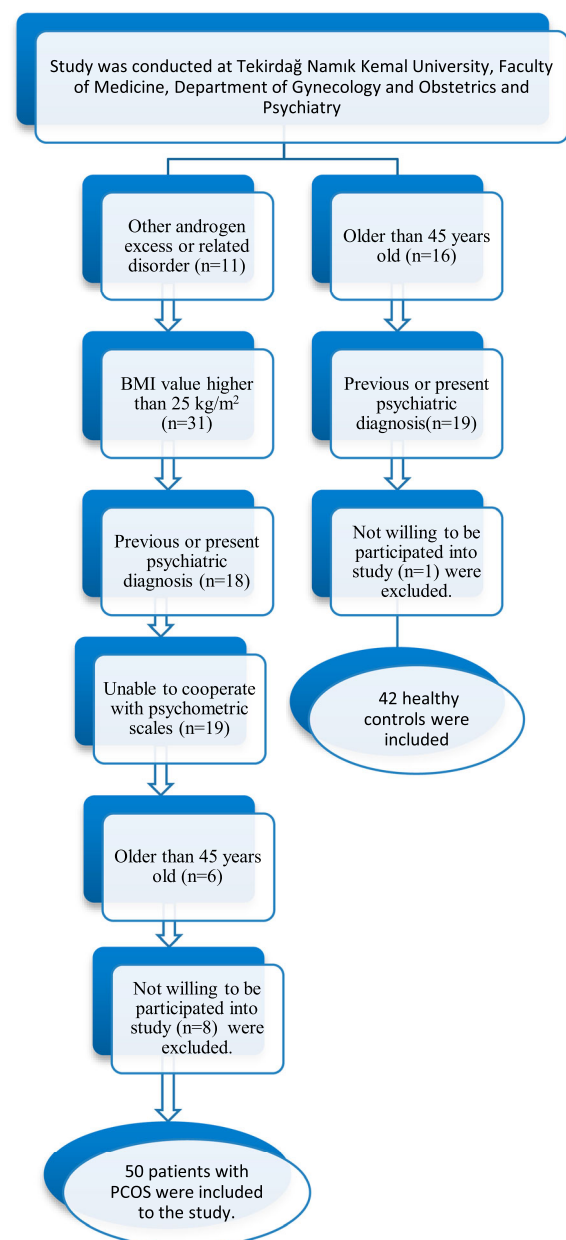


Figure 1. Definition of participation process by flow-chart.

Assessment tools

Sociodemographic form

This form was created by us with reference to the literature. This form included the data of age, profession, education year, income, place of birth, status of alcohol, and cigarette use.

Temperament and Character Inventory (TCI)

TCI is a 240-question self-evaluated questionnaire [21]. According to the Cloninger model, the temperament consisted of novelty seeking (NS), harm avoidance (HA), reward dependence (RD), and persistence (P). The character includes the dimensions of self-directedness (SD), cooperativeness (C), and self-transcendence (ST) [21]. The TCI was found to be reliable and validated in Turkish language [23]. It has been reported that the factorial structure was consistent with Cloninger's 7-factor model of personality, and test-retest indicated good stability of scores over time in the Turkish community [24].

State-Trait Anxiety Inventory (STAI-1 and STAI-2)

STAI includes 20 items measuring state-anxiety (STAI-1) and 20 items of trait anxiety (STAI-2). Trait anxiety was measured at baseline, and state anxiety was measured at follow-up. High concurrent validity was found between the State-Trait Anxiety Inventory and other scales that measure anxiety, with correlation ranging from 0.73 to 0.85 [25].

Statistical analysis

Cronbach's alpha was calculated to measure the reliability and internal consistency of TCI and STAI 1, STAI 2 scale items. Then, the power of the study was analysed by using the results of the analysis of covariance with two-fixed effects. The association between dimensions of TCI and STAI 1, STAI 2 was determined with the Pearson correlation test. The Pearson chi-square analysis was performed to examine the PCOS and control group differences relating to other categorical data. Before the mean comparison, the parametric test's assumptions need to be checked. For the control of these assumptions, the Kolmogorov-Smirnov test was used for normality and the Levene test is used for variance homogeneity. When the assumptions were met, two independent sample *t*-tests were used as a parametric test. It was aimed to investigate the variables that affect the statistically significant dependent variable. ANCOVA with two-fixed effects was applied. We preferred one dependent variable covariance analysis is because it

Table 1. Cronbach's alpha values for TCI and STAI 1 and 2.

TCI: Temperament and Character Inventory	Numbers of items	Cronbach's α values
NS: Novelty Seeking	40	.751
HA: Harm Avoidance	35	.855
RD: Reward Dependence	24	.587
P: Persistence	8	.591
SD: Self-Directedness	44	.843
C: Cooperativeness	42	.807
ST: Self-Transcendence	33	.814
STAI: State-Trait Anxiety Inventory	Numbers of items	Cronbach's α values
STAI 1	20	.829
STAI 2	20	.945

does not give complex results and also we tried to add another fix effect that might affect PCOS and control groups. All statistical analyses were performed with the R 3.3.3, STATA SE, SPSS 23.0 and G*Power 3.1.

Results

Cronbach's alpha values are consistent with the literature. According to the results, RD and P have poor reliability and NS has fair reliability. In contrast, HA, SD, C, ST, and STAI 1 have good and STAI 2 has excellent reliability (Table 1).

According to Power analysis, the analysis of covariance with two-fixed effects with an effect size (calculated by using η_p^2) of 0.61897 based on a sample of 70 observations achieves 96% power at a 0.05 significance level (Table 2). For the given parameters, for an alpha of 0.05 and a sample size of 92 observations, the power is 0.998761.

The socio-demographical characteristics were compared between PCOS and control groups. According to the PCOS and control groups, there was a statistically significant difference between groups in terms of years of education ($t = 2.516$; $p = 0.014$). The relationship between PCOS and control groups and place of birth was statistically significant ($\chi^2 = 5.22$, $p = 0.022$) (Table 3).

When the TCI scale was considered, there was a statistically significant difference between patient and the control group in terms of cooperativeness dimension ($t = -2.81$; $p = 0.006$). It was a lower mean in the PCOS group (20.98 ± 2.992). In addition, scores of STAI-1 and STAI-2 were significantly higher in the

Table 2. The power analysis according to the ANCOVA results.

Number of Cases	Effect Size	α	Total Sample Size	Power ($1 - \beta$)	df
1	0.61897	0.05	10	0.100774	7
2	0.61897	0.05	22	0.359417	7
3	0.61897	0.05	34	0.628602	7
4	0.61897	0.05	46	0.816505	7
5	0.61897	0.05	58	0.920016	7
6	0.61897	0.05	70	0.968466	7
7	0.61897	0.05	82	0.988551	7
8	0.61897	0.05	94	0.996121	7
9	0.61897	0.05	106	0.998761	7

Table 3. Comparison of sociodemographic characteristics of groups.

		Group		Total	<i>p</i> -value
		PCOS (%)	Control (%)		
Age		31.52 ± 5.97	33.26 ± 5.59		1.43 ^a
Profession	Regular	12(13)	11(12.0)	23	.058 ^b
	Housewife/unemployment	38(41.3)	31(33.7)	69	
Education Status (years)		11.80 ± 2.45	10.19 ± 3.480		2.516 ^a
Income	High	1(1.1)	3(3.3)	4	1.54 ^b
	Medium	43(46.7)	35(38.0)	78	
	Low	6(6.5)	4(4.3)	10	
Place of birth	Urban	45(48.9)	30(32.6)	75	5.22 ^b
	Rural	5(5.4)	12(13.0)	17	
Level of alcohol use	No use	44(47.8)	34(37.0)	78	.879 ^b
	Social drinker	6(6.5)	8(8.7)	14	
Cigarette use	Yes	4(4.3)	5(5.4)	9	.394 ^b
	No	46(50.0)	37(40.2)	83	

^at test.^bχ² test, significant values were indicated in bold characters.

PCOS group compared with the HC group. (respectively; $t = 5.70$; $p < 0.001$; $t = 2.12$; $p = 0.037$) (Table 4).

Cooperativeness was determined as a dependent variable because it was statistically significant. So that, covariance analysis was performed to determine the variables affecting Cooperativeness. In addition, in the Pearson chi-square analysis, since the relationship between group and place of birth was significant, we took it as a fix effect. The exact test statistic was significant ($F_{(7,82)} = 287.823$; $p < .05$). It has almost a large effect size (27.7%) according to the partial eta squared value. So, in the dependent variables, 23.2% of the change is explained by the group variable. But also we can see from Table 5 that the interaction between group variable and place of birth is statistically significant as well. The linear combination between PCOS and those born in an urban area leads to a statistical difference in cooperativeness ($t = 2.437$; $p < .05$). In the dependent variables, 10.1% of the change is explained by the covariate (STAI-1) (Table 5).

The correlation between the scores of the dimensions of the TCI scale and STAI 1 and STAI 2 was examined in the correlation map. According to

Figure 2, there was a positive and moderate correlation between RD – C, RD – HA, STAI 1 – RD, STAI 1 – C, STAI 1 – STAI 2, STAI 1 – S, and STAI 2 – S in the PCOS group ($p < .05$). In the PCOS group, there was a negative and moderate correlation between NS – ST and it was also statistically significant ($p < .05$). In the control group, there was a positive and moderate correlation between C – ST, and it was statistically significant ($p < .05$). In the control group, there was a negative and moderate correlation between RD – ST ($p < .05$). There was a positive and moderate correlation between STAI 1 – STAI 2 and STAI 2 – NS ($p < .05$). Other correlations are low and not statistically significant (Figure 2).

Discussion

In the present study, we compared personality traits according to TCI and anxiety levels between patients with PCOS and age and BMI matched control groups. We found significant differences in character dimension as cooperativeness. The cooperativeness scores were found to be significantly lower in the PCOS group. The PCOS group scored significantly higher on STAI-1 and STAI-2 compared with the HC

Table 4. Comparison of scores of TCI and STAI between PCOS and control group.

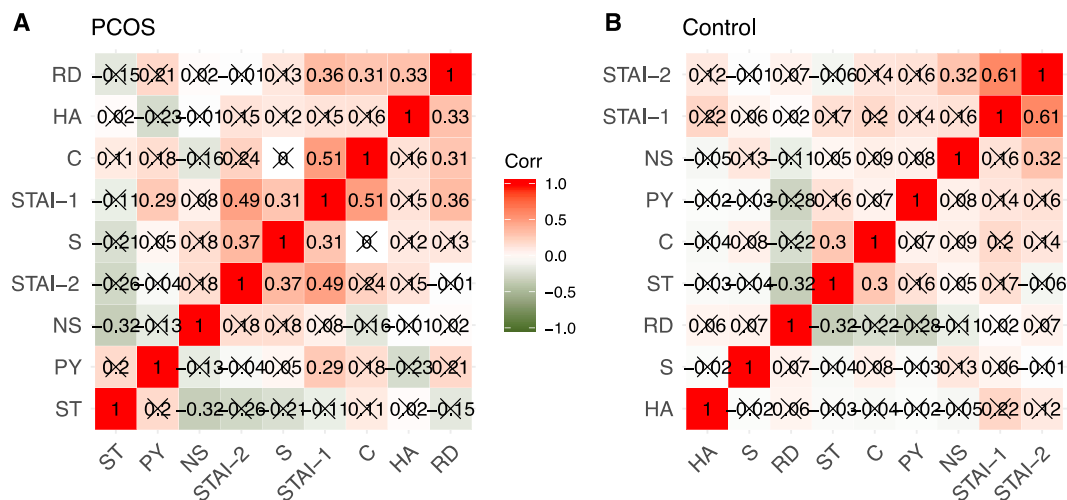
	Group	<i>n</i>	$\bar{x} \pm s$	<i>t</i>	<i>p</i> -value
NS	PCOS	50	20.24 ± 4.143	−.141	.888
	Control	42	19.05 ± 3.231		
HA	PCOS	50	17.42 ± 2.997	1.326	.188
	Control	42	16.64 ± 2.545		
RD	PCOS	50	12.02 ± 2.699	.733	.466
	Control	42	11.62 ± 2.508		
P	PCOS	50	3.78 ± 1.148	1.284	.203
	Control	42	3.48 ± 1.110		
SD	PCOS	50	23.74 ± 3.469	.254	.800
	Control	42	23.57 ± 2.769		
C	PCOS	50	19.06 ± 3.461	−2.81	.006
	Control	42	20.98 ± 2.992		
ST	PCOS	50	12.18 ± 3.305	−.141	.888
	Control	42	12.29 ± 3.897		
STAI -1	PCOS	50	54.80 ± 7.235	5.70	<i>p</i> < .0001
	Control	42	46.31 ± 6.949		
STAI- 2	PCOS	50	53.93 ± 5.821	2.12	.037
	Control	42	50.74 ± 8.148		

Note: C: cooperativeness; HA: harm avoidance; NS: novelty seeking, RD: reward dependence; P: persistence, SD: self-directedness; ST: self-transcendence.

Table 5. The results of the analysis of covariance with two-fixed effects (C: Cooperativeness scores as a dependent variable).

Effect	Type III sum of squares	<i>df</i>	Mean square	<i>F</i>	<i>p</i> -value	η_p^2
Fixed factor						
Group	225.993	1	225.993	25.318	.000	.232
Place of birth	.367	1	.367	.041	.840	.000
Group × Place of birth	52.997	1	52.997	5.937	.017	.066
Covariate						
Age	.797	1	.797	.089	.766	.001
Education Status	2.899	1	2.899	.325	.570	.004
STAI 1	84.404	1	84.404	9.456	.003	.101
STAI 2	.047	1	.047	.005	.942	.000
Error	749.786	84	8.926			
Total	37598.000	92				

Note: According to Cohen's d , $\eta_p^2 < .02$ is a small effect size; $.02 < \eta_p^2 < .13$ is a medium effect size; $\eta_p^2 > .26$ is a large effect size.



C: cooperativeness; HA: harm avoidance; NS: novelty seeking, RD: reward dependence ;

P: persistence , SD: self-directedness; ST: self-transcendence

Figure 2. The correlation map between TCI dimensions and STAI 1 and STAI 2 according to the Group C: cooperativeness; HA: harm avoidance; NS: novelty seeking, RD: reward dependence; P: persistence, SD: self-directedness; ST: self-transcendence.

group. Additionally, scores of STAI-1, STAI-2, age, and education year and place of birth were added as covariant variables during comparison of TCI scores between groups, the cooperativeness score still scored significantly lower in the PCOS group.

PCOS had a great interest in the psychiatric area in terms of psychiatric comorbidity. In a study, a high prevalence of psychiatric disorders such as 24% were reported in patients with PCOS. Moreover, the prevalence of personality disorders was found to be 14% [26]. Some reports concluded that the sources of psychopathologies that existed in patients with PCOS were related to obesity, hirsutism, and infertility. They also argue that patients with PCOS feel less feminine; thus they would also have the body perception problem [27,28]. However, this description can be considered as insufficient while regarding the shared biological backgrounds of endocrinological and psychiatric diseases [29].

In our study, we found that both state and trait anxiety levels were higher in the PCOS group compared with the HC group. Hollinrake and his coworkers reported high prevalence of anxiety levels in patients who were suffering from PCOS [3]. There have also been studies that reported high levels of anxiety in patients with PCOS compared with HCs [6–8]. Regarding the higher anxiety levels in patients with PCOS, our results are in the line with the literature.

As the prevalence of psychiatric comorbidities is known to be high in patients with PCOS, we hypothesized that patients with PCOS would also differ from HCs in terms of personality traits. There have been two studies that used TEMPS: Temperament Evaluation of Memphis, Pisa, Paris and San Diego questionnaire (TEMPS-A) for assessing the personality traits in

patients with PCOS and they revealed that patients with PCOS scored significantly different on this scale [18,19].

Cloninger's personality assessment method, which was considered as a psychobiological approach to the personality model, divides personality into two parts as temperament and character. According to this model, temperament is considered as a hereditary and stable part of personality, while character is regarded as some traits that are created under the impact of environment and the choices of individual. Personality is the combination of these two dimensions [21]. Temperament and character are not absolute rigid structures and can differ in some medical and psychosocial conditions. The neurobiological background of Cloninger's personality assessment can be considered as established. Moreover, Jiang et al. reported a valuable study which demonstrated four temperament trait predictions, brain connectivities that show top contributing power commonly concentrated on the hippocampus, prefrontal cortex, basal ganglia, amygdala, and cingulate gyrus in their fMRI study [30]. Thus, the neurobiological basis of TCI assessment becomes stronger day after day. In our study, the PCOS group scored significantly lower on cooperativeness dimension of TCI compared with HC. There is only one study that compared personality traits with TCI between patients with PCOS and HC. In this recent study, Öztürk et al. reported no differences in terms of temperament and character traits between groups [20]. Cooperativeness was described as accounting for individual differences in identification with and acceptance of other people. Highly cooperative people can make empathy, and they are commonly tolerant, compassionate, supportive, fair,

and principled. Low scorers on the cooperativeness dimension can reflect self-absorbed, intolerance, criticism, unhelpfulness, and opportunism. These individuals primarily look out for themselves [31–33]. Furthermore, when we added covariants into comparison, the patient group still scored significantly lower compared with the HC group. Thus, we can say that lower level of cooperativeness can be trait in PCOS patients and could not be associated with higher levels of anxiety as well as other covariants.

There have been several limitations of the present study. Firstly, we included lean PCOS patients in the study. In Goyal's and Dawood review this issue has been well established. In detail, there have been several differences between lean and obese PCOS patients in terms of some neurobiological factors including ACTH, ghrelin, β -endorphin, and other neurosteroids which could alter several mental functions [34]. Muharam et al. also reported there were significant differences between different personality types in patients with PCOS in terms of serum cortisol levels [13]. We could not assess biological factors which would be interest in our study. However, this limitation would be a subject of future studies.

Strengths of our study were as follows: all patients were assessed by psychiatrist and gynaecologist; patients were matched in terms of BMI which could effect the temperament and character assessment and we also compared TCI scores between groups including covariants that may effect TCI dimensions.

Conclusion

Patients with PCOS had a significant different character trait such as lower cooperativeness compared with HC. Additionally, we found that this different character dimension would be a trait in PCOS after covariant analysis. We suggest that our result supported the psychiatric background of PCOS. Further studies are needed to assess temperament and character in patients with PCOS.

Disclosure statement

No potential conflict of interest was reported by the authors.

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