



## Research paper

# Gender differences in automatic thoughts and cortisol and alpha-amylase responses to acute psychosocial stress in patients with obsessive-compulsive personality disorder



Masayuki Kanehisa<sup>a</sup>, Chiwa Kawashima<sup>a</sup>, Mari Nakanishi<sup>a</sup>, Kana Okamoto<sup>a</sup>, Harumi Oshita<sup>b</sup>, Koji Masuda<sup>a</sup>, Fuku Takita<sup>a</sup>, Toshihiko Izumi<sup>a</sup>, Ayako Inoue<sup>a</sup>, Yoshinobu Ishitobi<sup>a</sup>, Haruka Higuma<sup>a</sup>, Taiga Ninomiya<sup>a</sup>, Jotaro Akiyoshi<sup>a,\*</sup>

<sup>a</sup> Department of Neuropsychiatry, Oita University Faculty of Medicine, Hasama-Machi, Oita 879-5593, Japan

<sup>b</sup> Department of Applied Linguistics, Oita University Faculty of Medicine, Hasama-Machi, Oita 879-5593, Japan

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## ABSTRACT

**Introduction:** Obsessive-compulsive personality disorder (OCPD) has a pervasive pattern of preoccupation with orderliness, perfection, and mental and interpersonal control at the expense of flexibility, openness, and efficiency. The aims of the present study were to explore the relationship between OCPD and psychological stress and psychological tests.

**Methods:** We evaluated 63 OCPD patients and 107 healthy controls (HCs). We collected saliva samples from patients and controls before and after a social stress procedure, the Trier Social Stress Test (TSST), to measure the concentrations of salivary alpha-amylase (sAA) and salivary cortisol. The Childhood Trauma Questionnaire (CTQ), Profile of Mood State (POMS), State-Trait Anxiety Inventory (STAI), Beck Depression Inventory (BDI), Social Adaptation Self-Evaluation Scale (SASS), and Depression and Anxiety Cognition Scale (DACS) were administered to patients and HCs.

**Results:** Following TSST exposure, the salivary amylase and cortisol levels were significantly decreased in male patients compared with controls. Additionally, OCPD patients had higher CTQ, POMS, STAI, and BDI scores than HCs and exhibited significantly higher anxiety and depressive states. OCPD patients scored higher on future denial and threat prediction as per the DACS tool. According to a stepwise regression analysis, STAI, POMS, and salivary cortisol responses were independent predictors of OCPD.

**Conclusions:** Our results suggested that attenuated sympathetic and parasympathetic reactivity in male OCPD patients occurs along with attenuated salivary amylase and cortisol responses to the TSST. In addition, there was a significant difference between OCPD patients and HCs in child trauma, mood, anxiety, and cognition. The finding support the modeling role of cortisol (20 min) on the relationships between STAI trait and depression among OCPD.

## 1. Introduction

Obsessive-compulsive personality disorder (OCPD) is characterized by a prevalent pattern of maladaptive behaviors (American Psychiatric Association, 2013). Individuals with OCPD often exhibit the need for mental and interpersonal control, over-conscientiousness, difficulty abandoning items, rigidity, uniformity, and perfectionism. Assessments of the influence of OCPD on OCD (obsessive-compulsive disorder) symptoms have produced discrepant findings regarding the relationship between OCPD and OCD. As an example, one study noted that OCPD was associated with excessive OCD severity and incapacity,

whereas another found no such association (Garyfallos et al., 2010; Lochner et al., 2011).

Variation in personality traits was associated with the neurological response to mental stress (Yamano et al., 2015). This stress reaction is mainly regulated by an axial system consisting of two neuroendocrine systems: the hypothalamic–pituitary–adrenocortical (HPA) axis and the sympathetic adrenomedullary (SAM) system. A treatment regimen combining virtual reality exposure therapy and the administration of yohimbine hydrochloride led to a significant reduction in anxiety compared to pre-treatment, which induced significantly higher levels of salivary amylase (sAA) in the treated group (Meyerbroeker et al., 2012).

\* Corresponding author.

E-mail address: [akiyoshi@oita-u.ac.jp](mailto:akiyoshi@oita-u.ac.jp) (J. Akiyoshi).

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**Table 1**  
Demographic characteristics.

	Female			Male		
	Control (n=41)	OCPD (N=19)	Statistics	Control (n=66)	OCPD (n=44)	Statistics
<b>Age</b>	24.9 ± 3.8	23.0 ± 0.9	<i>p</i> =0.11	25.4 ± 18.0	24.9 ± 9.5	<i>p</i> =0.55
<b>BMI</b>	24.2 ± 3.5	23.3 ± 3.7	<i>p</i> =0.75	23.2 ± 3.6	23.8 ± 3.3	<i>p</i> =0.75
<b>Smoking (no. cig)</b>						
< 10/day	38	17		56	35	
> 10/day	3	2	<i>p</i> =0.65	10	9	<i>p</i> =0.67
<b>Education (years)</b>	12.0 ± 2.5	13.2 ± 2.4	<i>p</i> =0.65	12.3 ± 2.5	13.0 ± 2.2	<i>p</i> =0.58
<b>CTQ</b>						
<b>Emotional Abuse</b>	5.8 ± 1.7	6.4 ± 1.6	<i>p</i> < 0.001	5.4 ± 0.9	6.6 ± 3.4	<i>p</i> < 0.001
<b>Physical Abuse</b>	5.4 ± 1.1	5.3 ± 0.8	<i>p</i> =0.70	5.4 ± 1.1	5.6 ± 1.6	<i>p</i> =0.32
<b>Sexual Abuse</b>	5.5 ± 1.0	5.6 ± 1.1	<i>p</i> =0.62	5.3 ± 0.7	5.6 ± 1.1	<i>p</i> =0.17
<b>Emotional Neglect</b>	11.0 ± 2.8	11.6 ± 2.5	<i>p</i> < 0.001	11.8 ± 3.3	13.4 ± 4.1	<i>p</i> < 0.001
<b>Physical Neglect</b>	6.2 ± 2.1	6.4 ± 1.9	<i>p</i> =0.24	6.3 ± 2.0	6.8 ± 2.3	<i>p</i> < 0.003

OCPD=Obsessive-compulsive personality disorder, BMI=Body Mass Index.  
CTQ=Childhood trauma Questionnaire.

We previously reported the association between OCD, sAA, and salivary cortisol (Kawano et al., 2013). The sAA levels in male and female OCD patients were significantly elevated compared to healthy controls both before and after electrical stimulation. However, there were no marked differences in the salivary cortisol levels between OCD patients and controls. We also reported the association between avoidant personality disorder (OCPD), sAA, and salivary cortisol (Tanaka et al., 2016). Following electrical stimulation, the salivary cortisol levels in female OCPD patients were significantly decreased compared to healthy female controls, but there was no significant difference in the salivary cortisol levels between male OCPD patients and healthy male controls. Additionally, the sAA levels were not significantly different among male and female OCPD patients and male and female controls. Following exposure to a social stress procedure known as the Trier Social Stress Test (TSST), the sAA levels remained nonsignificantly different among male and female OCPD patients and healthy controls, and the salivary cortisol levels were also not markedly different between male and female OCPD patients and controls. We also reported the association between borderline personality disorder (BPD) and sAA and salivary cortisol levels (Inoue et al., 2015).

Physical/sexual abuse and emotional abuse/neglect have been shown to be associated with heightened symptoms of all three personality disorder clusters (Tyrka et al., 2009). Enhanced symptoms of several specific personality disorders have also been observed, including paranoid, borderline, avoidant, dependent, obsessive-compulsive, and depressive personality disorders.

Cognitive models of OCD suggest that changes in obsessive beliefs are mechanistically important for treatment (Diedrich et al., 2016). Extensive evidence also supports the effectiveness of cognitive behavioral therapy (CBT), with exposure and response prevention as the standard psychotherapeutic intervention for OCD (Skapinakis et al., 2016). Short-term cognitive therapy has been shown to effectively treat patients with cluster C personality disorders (including OCPD, OCPD, and dependent personality disorder) (Johansen et al., 2011; Renner et al., 2013). In this study, we examined the relationship among sAA and salivary cortisol levels before and after the TSST, childhood abuse, and cognitive vulnerability in OCPD patients and healthy controls (HCs).

We examined the relationship between psychopathological assessments and endocrine responses to an empirical stress test.

## 2. Methods

### 2.1. Patients and healthy controls

Sixty-three Japanese patients meeting the Diagnostic and Statistical

Manual of Mental Disorders (DSM)-IV-TR criteria for OCPD and 107 Japanese HCs participated in the study. OCPD patients were recruited via advertisement and screened by interviews. In particular, OCPD patients who met the DSM-IV-TR criteria and who did not have axis I disorders were selected for the study. An OCPD diagnosis was determined using the Structured Clinical Interview of DSM-IV-TR for Personality Disorders (SCID-II) (First et al., 1997). The diagnoses of current axis I disorders were made by a trained psychiatrist (JA) using the Mini International Neuropsychiatry Interview (MINI), a standardized psychiatric examination validated in the general population (Sheehan et al., 1998) as per the DSM-IV-TR criteria (Ritchie et al., 2004). We excluded 12 OCPD patients with axis I disorders (8 with major depressive disorder [MDD], 3 with panic disorder, and 1 with bipolar disorder). HCs were enrolled via advertising and confirmed to be free of any axis I or II disorders (as determined by MINI and SCID-II). All participants were free of major illnesses according to their medical history and a physical examination and did not show any substance or alcohol abuse or dependence within 12 months prior to the study.

Demographic information (age, body mass index [BMI], smoking, and education) was collected from all participants (Table 1). The participants were instructed to avoid strenuous physical activity for 48 h as well as any form of physical exercise and alcohol consumption 24 h prior to the study. Caffeine, tea, and smoking were not permitted within 3 h prior to the study, and tooth brushing and/or eating was to be avoided 2 h before the study. To diminish the influence of circadian rhythms on physiological variables, all experiments were performed in the afternoon (between 1 and 5 p.m.). All female subjects participated in the experiment during their late luteal phase to reduce the impact of hormonal variations through the menstrual cycle. After receiving a comprehensive explanation of the study, all participants offered their written informed consent. The study was approved by the ethics committee of the Oita University Faculty of Medicine.

### 2.2. Stimuli and procedures

#### 2.2.1. TSST stress challenge

All participants were TSST stress challenged to reduce the effect of habituation and relaxation in the experimental environment. The participants were divided into small groups consisting of four to five people. All participants were invited to our laboratory on a weekday afternoon between 1 and 5 p.m. After a 30-min resting period intended to minimize the impact of physical activity, prior stress, and emotions as well as to allow the participants to fill out questionnaires, the participants were exposed to the TSST (Kirschbaum et al., 1993). The

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