



# Association of insomnia symptoms and non-restorative sleep with *Typus melancholicus*: a Japanese general population survey

Yoshiyuki Kaneko<sup>1</sup> · Chisato Konno<sup>1</sup> · Kaori Saitoh<sup>1</sup> · Ryuji Furihata<sup>1,2</sup> · Yoshitaka Kaneita<sup>3</sup> · Makoto Uchiyama<sup>1,4</sup> · Masahiro Suzuki<sup>1</sup>

Received: 6 August 2021 / Accepted: 21 February 2022 / Published online: 7 March 2022  
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## Abstract

This study aimed to investigate the association between insomnia symptoms and non-restorative sleep (NRS) in individuals with *Typus melancholicus*, a personality trait linked to depression, in the general population. We analyzed data from a Japanese cross-sectional survey of 2519 randomly sampled adults. *Typus melancholicus* was evaluated using a modified version of Kasahara's *Typus melancholicus* inventory (modified-KTM). Logistic regression analysis was used to examine the associations of insomnia symptoms and NRS with modified-KTM scores. We demonstrated that insomnia symptoms and NRS were both positively associated with modified-KTM scores. Our results provide evidence for an association between *Typus melancholicus* and insomnia.

**Keywords** Insomnia · Epidemiology · *Typus melancholicus* · Personality · Population surveillance

## Introduction

Relationships between insomnia and depression have long attracted attention from the perspective of mental health [1, 2]. Insomnia has been regarded as one of the main symptoms observed in depression [3]. On the other hand, increasing evidence has supported the idea that insomnia is not a mere symptom of depression, but may be either a risk factor for, or a precursor of, depression [2]. Recent studies examining factors associated with insomnia have demonstrated that insomnia is linked to particular personality traits, including neuroticism [4, 5]. Further clarification of the relationship between insomnia and personality may deepen the understanding of

psychological mechanisms leading to insomnia, and may contribute to the development of selective treatments for insomnia based on personality traits, potentially facilitating the prevention or treatment of depression.

*Typus melancholicus*, as proposed by Tellenbach [6], is characterized by orderliness, conscientiousness, and interpersonal dependence. *Typus melancholicus* has been gathering attention as a trait associated with depression [7–10]. Recent studies examining the relationship between personality traits and insomnia have shown that conscientiousness, a component of *Typus melancholicus*, is related to insomnia [5, 11]. However, the association between *Typus melancholicus* and insomnia has yet to be directly tested.

The present study analyzed data from a nationwide epidemiological study of a large sample of the Japanese general adult population [10, 12–14] to investigate associations between insomnia and *Typus melancholicus*. In addition, we compared associations between groups with different levels of perceived stress, based on a recent finding that the relationship between insomnia and a personality trait may be mediated by perceived stress levels [15]. As an insomnia-related symptom, non-restorative sleep (NRS), defined as insufficiently restful or refreshing sleep, was assessed in addition to insomnia symptoms such as difficulty initiating sleep (DIS), difficulty maintaining sleep (DMS), or early morning awakening (EMA), because NRS has been shown

✉ Masahiro Suzuki  
suzuki.masahiro94@nihon-u.ac.jp

<sup>1</sup> Department of Psychiatry, Nihon University School of Medicine, 30-1 Oyaguchi-Kamicho, Itabashi-ku, Tokyo 173-8610, Japan

<sup>2</sup> Kyoto University Health Services, Yoshida-Honmachi, Sakyo-ku, Kyoto 606-8501, Japan

<sup>3</sup> Division of Public Health, Department of Social Medicine, Nihon University School of Medicine, 30-1 Oyaguchi-Kamicho, Itabashi-ku, Tokyo 173-8610, Japan

<sup>4</sup> Tokyo Adachi Hospital, 5-23-20 Hokima, Adachi-ku, Tokyo 121-0064, Japan

to be associated with daytime dysfunction independent of other insomnia symptoms, such as DIS and DMS [16, 17], and because NRS has been receiving recent attention in terms of associations with depression [18–20].

## Materials and methods

The present study was performed as part of the Nihon University Sleep and Mental Health Epidemiology Project, a survey of the general Japanese population [10, 12–14]. All individuals aged 20 years or older provided oral informed consent and participated in the survey. This study was approved by the ethics committee of the Nihon University School of Medicine.

The questionnaire comprised items concerning: (1) insomnia-related symptoms; (2) personality features; (3) assessment of depression; (4) perceived stress; and (5) sociodemographic characteristics such as sex, age, community size, marital status, and educational achievement.

We used three questions on sleep difficulties to allow us to infer sleep disturbance in participants [14]. The following questions about sleep experienced during the previous month were included in the questionnaire:

How often have you had difficulty falling asleep? (DIS)  
How often have you woken up frequently at night? (DMS)

How often have you woken up too early in the morning?  
(EMA)

Each question had four possible answers: “not at all”, “less than once a week”, “once or twice a week”, or “three or more times a week”. In our study, participants who answered “once or twice a week” or “three or more times a week” were defined as having DIS, DMS, or EMA, in accordance with our previous studies which analyzed data from the same project [12, 14]. Participants who answered “once or twice a week” or “three or more times a week” were thus defined as having DIS, DMS, or EMA.

The following question was used to identify the presence of NRS: “Do you feel rested after your typical night’s sleep?” (very/somewhat/not very/not at all). Participants who answered “not very” or “not at all” were defined as having NRS.

The personality features of participants were evaluated using a modified version of Kasahara’s Typus melancholicus inventory (modified-KTM) [21]. Participants with modified-KTM scores  $\geq 5$  were defined as having the Typus melancholicus trait. This was based on our previous study, which determined the cutoff score based on median modified-KTM scores across participants [10]. Depressive symptoms were assessed using the Japanese version of the Center for Epidemiologic Studies Depression (CES-D) scale [22, 23]. In

accordance with a previous study showing that a CES-D score  $\geq 16$  is highly suggestive of clinical depression [22], participants with CES-D scores  $\geq 16$  were defined as having depression. In addition, stressful events occurring in the previous month and sociodemographic variables were assessed. Of the 2559 participants, 3 were excluded because of missing data on NRS, and 37 were excluded because of missing data for six or more questions on the CES-D scale. The final sample used for analysis thus comprised 2519 participants.

The following question was used to identify the presence of perceived stress: “Have you felt stressed in your daily life during the past month?” (very/somewhat/not very/not at all). Participants responding “very” or “somewhat” were classified into a high-stress group ( $n = 1253$ ), and those answering “not very” or “not at all” were classified into a low-stress group ( $n = 1266$ ).

For assessment of the associations between personality features and insomnia-related symptoms (DIS, DMS, EMA and NRS), sets of logistic regression analyses with each of insomnia-related symptoms as an objective variable were performed for: (1) all participants; (2) the high-stress group; and (3) the low-stress group, based on a recent finding that the relationship between insomnia and a personality trait was mediated by perceived stress levels [15]. A series of univariable regression analyses was conducted with modified-KTM score as an exploratory variable. After univariable regression analyses, we performed two multivariable logistic regression analyses to adjust for sociodemographic factors (sex, age, community size, marital status, and educational achievement) [14] and depressive symptoms. Statistical significance was defined at the level of  $P < 0.05$ .

## Results

Table 1 shows the demographic characteristics of participants. Symptom prevalences of DIS, DMS, EMA and NRS were 14.7%, 26.6%, 11.6%, and 19.5%, respectively. Almost half (45.1%) of participants showed modified-KTM scores  $\geq 5$ , and 49.7% of participants had high levels of perceived stress.

Table 2 shows the results of logistic regression analyses. For all participants, all insomnia symptoms were positively associated with modified-KTM scores even after adjusting for sociodemographic factors and depressive symptoms [DIS: odds ratio (OR) 1.299,  $P = 0.027$ ; DMS: OR 1.851,  $P < 0.001$ ; EMA: OR 1.468,  $P = 0.003$ ]. In addition, NRS was positively associated with modified-KTM scores even after adjustments (OR 1.236,  $P = 0.043$ ).

For the high-stress group, both univariable regression analyses and multivariable regression analyses adjusting for the confounding effects of sociodemographic factors showed that all insomnia symptoms were positively associated with

**Table 1** Demographic characteristics of participants

	<i>n</i> (%)
Sex	
Male	1143 (45.4)
Female	1376 (54.6)
Age (years)	
20–29	313 (12.4)
30–39	446 (17.7)
40–49	418 (16.6)
50–59	432 (17.1)
60–69	464 (18.4)
≥ 70	446 (17.7)
Sleep symptoms	
Difficulty initiating sleep	371 (14.7)
Difficulty maintaining sleep	669 (26.6)
Early morning awakening	291 (11.6)
Nonrestorative sleep	491 (19.5)
Psychological and psychiatric factors	
Modified-KTM score ≥ 5	1135 (45.1)
High levels of perceived stress	1253 (49.7)
CES-D score ≥ 16	178 (7.1)

*KTM* Kasahara’s Typus melancholicus, *CES-D* Center for Epidemiologic Studies Depression

modified-KTM scores. Multivariable regression analyses adjusting for depressive symptoms in addition to the sociodemographic factors indicated that NRS and insomnia symptoms except for DIS remained significant (DMS: OR

1.777,  $P < 0.001$ ; EMA: OR 1.605,  $P = 0.006$ ; NRS: OR 1.423,  $P = 0.008$ ). For the low-stress group, on the other hand, only DMS was significantly associated with modified-KTM scores in all three models including the model adjusted for depressive symptoms (OR 1.867,  $P < 0.001$ ).

### Discussion

The present study is the first general population study to investigate the association between insomnia-related symptoms and Typus melancholicus. The results showed that insomnia symptoms and NRS were positively associated with Typus melancholicus, even after adjusting for depressive symptoms. DMS, EMA, and NRS were significantly associated with Typus melancholicus in the high-stress group, whereas only DMS was significantly associated with Typus melancholicus in the low-stress group.

In the present study, NRS was evaluated as an insomnia-related symptom, in addition to insomnia symptoms, based on findings that NRS is associated with daytime dysfunction independent of other insomnia symptoms such as DIS and DMS [16, 17]. Interest in NRS has recently been increasing among researchers into sleep medicine, from the perspective of the association with depression [18–20]. A recent epidemiological study investigated relationships between NRS and Big-Five personality traits, and showed that NRS was more frequently experienced by those showing a higher tendency toward neuroticism [24]. Our study provided novel

**Table 2** Associations between Typus melancholicus and insomnia-related factors

	Univariable		Adjusted 1 <sup>a</sup>		Adjusted 2 <sup>b</sup>	
	Odds ratio	P	Odds ratio	P	Odds ratio	P
All groups ( <i>N</i> = 2519)						
DIS	1.336	0.010	1.323	0.014	1.299	0.027
DMS	1.907	<0.001	1.847	<0.001	1.851	<0.001
EMA	1.521	0.001	1.471	0.002	1.468	0.003
NRS	1.235	0.036	1.265	0.021	1.236	0.043
High-stress group ( <i>n</i> = 1253)						
DIS	1.392	0.021	1.353	0.038	1.299	0.083
DMS	1.816	<0.001	1.808	<0.001	1.777	<0.001
EMA	1.626	0.003	1.635	0.004	1.605	0.006
NRS	1.459	0.003	1.469	0.003	1.423	0.008
DIS	1.152	0.453	1.103	0.612	1.167	0.430
DMS	1.973	<0.001	1.803	<0.001	1.867	<0.001
EMA	1.318	0.160	1.221	0.319	1.276	0.228
NRS	0.804	0.224	0.873	0.462	0.879	0.486

*DIS* difficulty initiating sleep, *DMS* difficulty maintaining sleep, *EMA* early morning awakening, *NRS* non-restorative sleep

<sup>a</sup>Adjusted for sex, age, community size, marital status, and educational achievement

<sup>b</sup>Adjusted for sex, age, community size, marital status, educational achievement, and CES-D ≥ 16 or < 16

findings concerning the relationships between NRS and personality traits.

The present study indicated that insomnia symptoms and NRS were more likely to appear in participants with a stronger tendency toward Typus melancholicus, mainly under conditions of high perceived stress. These findings suggest the possibility that, pending clarification of the direction of causality, the Typus melancholicus trait promotes the occurrence or aggravation of insomnia, predominantly under stressful conditions. Such a promoting effect might be accounted for by self-blaming emotions. Self-blaming emotions occur frequently among individuals with the Typus melancholicus trait when facing stressful conditions [25, 26]. A recent report suggested that insomnia can be predicted by these emotions [27]. Taken together, insomnia may tend to occur in those with the Typus melancholicus trait, in which self-blaming emotions arise under stressful conditions. In the present study, regression analyses adjusting for depressive symptoms showed that DIS became nonsignificant in the high-stress group, suggesting that the Typus melancholicus trait may have promoted the occurrence or aggravation of DIS via depression. On the other hand, DMS was shown to be associated with Typus melancholicus regardless of whether the participant perceived substantial stress or not. Conscientiousness, a factor integral to Typus melancholicus, is reportedly strongly related to DMS among insomnia symptoms [5]. Conscientiousness has also been pointed to potentially affect insomnia symptoms via anxiety or depression [28]. These psychological symptoms may mediate the occurrence or deterioration of DMS among individuals with the trait of Typus melancholicus. In summary, our findings suggest that Typus melancholicus induces or worsens insomnia via multiple psychological mechanisms. Further investigations are needed to elucidate the psychological mechanisms that cause insomnia in individuals with the trait of Typus melancholicus under a variety of stressful conditions.

Our results should be viewed in light of some methodological limitations. First, no causal relationships could be determined in the present study due to the cross-sectional design. Further studies with a longitudinal design are needed to clarify the direction of causality in relationships between personality features and insomnia symptoms. Second, neither attendance at psychiatric clinics nor the use of psychiatric drugs was assessed in the present study, both of which might affect insomnia symptoms. Third, we used original criteria for identifying insomnia symptoms. Few criteria for NRS were in general use for sleep research at the time data were collected for the present study. We, therefore, developed an original question to detect participants with characteristics of NRS. Recently, criteria for evaluating NRS in the Diagnostic and Statistical Manual of Mental Disorders, fifth edition (DSM-5) [29] have generally been used in

many clinical and epidemiological studies. Concerning other insomnia symptoms, we adopted criteria which is identical to those in our previous studies [12–14], which differ from the diagnostic criteria for insomnia disorder in DSM-5. We hope that our results will be confirmed by further studies using widely applied diagnostic criteria such as DSM-5. Finally, the presence of psychiatric and physical comorbidities was not evaluated in the present study, and might have affected the results.

**Acknowledgements** We are grateful to the study participants for making this study possible.

**Author contributions** YK, CK, MU, and MS conceptualized and designed the study. CK, RF, and YK acquired the data. YK, KS, and MS analyzed the data in consultation with MU. YK wrote the first draft of the manuscript. MU, KS, and MS contributed to the interpretation of the data and the final preparation of the manuscript. All authors contributed substantially to the scientific process leading up to the writing of the manuscript and approved the final version for submission.

**Funding** This work was supported by AMED (JP21uk1024004), JSPS KAKENHI (JP20K07956), Grants-in-Aid for Scientific Research, Ministry of Health, Labour and Welfare (19FA1009 and 21FA0201), and an Intramural Research Grant (2-1) for Neurological and Psychiatric Disorders from the National Center of Neurology and Psychiatry. The funders played no role in the study design, data collection and analysis, decision to publish, or preparation of the manuscript.

## Declarations

**Conflict of interest** The authors declare that there are no conflicts of interest regarding the publication of this paper.

**Ethical approval** This study was approved by the ethics committee of Nihon University School of Medicine.

**Informed consent** This research involves human participants. Informed consent was obtained from all participants.

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