Perfectionism and polysomnographically determined markers of poor sleep

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Abstract

Study Objectives: Perfectionism has been suggested to represent a predisposing factor for poor sleep. However, previous studies have relied upon self-report measures and the association between perfectionism and polysomnographic sleep warrants further investigation.

Methods: The current retrospective exploratory study used the Frost Multidimensional Perfectionism Scale (FMPS) and polysomnography (PSG) in an unselected sample of 334 consecutive sleep laboratory patients (140 males, 194 females, 44.6 ± 15.9 years). Data was analysed using linear regression analyses.

Results: High levels of perfectionism were associated with polysomnographically determined markers of poor sleep in the first sleep laboratory night. The total FMPS score was significantly associated with the number of nocturnal awakenings in the first sleep laboratory night. The sub-scales "concern over mistakes" and "personal standards" of perfectionism were significantly associated with markers of poor sleep. In contrast, there were only few associations between perfectionism and polysomnographic variables of the second sleep laboratory night.

Conclusions: This pattern of results suggests that high levels of perfectionism may predispose individuals to sleep disturbances in the context of acute stressors. Thus the influence of perfectionism on poor sleep should be further investigated to improve treatment.

Keywords: perfectionism, polysomnography, sleep, sleep disorders

Brief Summary

1. Current Knowledge / Study Rationale: Up to now, studies on perfectionism and sleep have relied upon self-report measures of sleep, and it has not been investigated whether higher levels of perfectionism are also linked to polysomnographically determined poor sleep. This is particularly relevant because pronounced discrepancies between subjective and objective measures of sleep can frequently be observed, especially in patients with insomnia, and subjective and objective sleep disturbances are partially independent constructs with the latter one being more closely associated with physiological arousal and medical morbidity.
2. Study Impact: Our study shows that perfectionism is related to objective sleep disturbances. Thus, our results show that perfectionism warrants further investigation in order to further improve the treatment of insomnia.

1. Introduction

Perfectionism is a personality trait that has been defined as a dispositional tendency to set excessively high standards and to evaluate one's own performance in an overly critical manner.[1] Perfectionism has been linked to several mental disorders including eating, anxiety, and depressive disorders.[2] In addition, perfectionism may be a predisposing factor for poor sleep.[3-5] This may be due to the fact that the maladaptive form of perfectionism includes excessive concerns about making mistakes and is associated with worry and rumination.[6] Worry and rumination at bedtime are, in turn, assumed to lead to sleep-onset and sleep-maintenance difficulties.[7] In particular, it has been suggested that individuals with high levels of perfectionism are more concerned about the effects of acute sleep disturbances on their daytime performance.[4] This may lead to increased worry and arousal at bedtime, and, thus, perfectionism may contribute to the transition from acute to chronic sleep disturbances. It may be hypothesized that individuals prone to perfectionism actively attempt to force sleep initiation, a strategy called sleep effort, which actually does not pay off and leads to sleep disturbances.[3,8]

In line with these theoretical considerations, previous evidence suggests that individuals who fulfill the diagnostic criteria for insomnia present with higher levels of perfectionism than good sleepers.[9,10] Additionally, several studies showed that patients with insomnia strive for perfection on a behavioral level.[11-13]Longitudinal studies suggest that perfectionism is indeed a risk factor for insomnia symptoms.[14,15] Further findings concerned the link between insomnia symptoms and perfectionism, which may be mediated by emotional distress[15], stress perception and emotion regulation[16] or anxiety[17].

Perfectionism is often assessed using Hewitt and Flett's Multidimensional Perfectionism Scale (MPS)[18] or Frost Multidimensional Perfectionism Scale (FMPS)[1]. The former comprises the subscales self-oriented perfectionism (SOP), socially-prescribed perfectionism (SPP), and other-oriented perfectionism (OOP). The latter comprises six subscales, namely concern over mistakes (CM), doubts about action (DA), personal standards (PS), parental criticism (PC), parental expectations (PE), and organization (O). Studies reporting on the association between insomnia and perfectionism showed that insomnia is associated with DA[9,19], PS[9], CM[9,19]and PC[10,19]. Studies reporting on the association between insomnia symptoms and perfectionism showed that insomia symptoms are associated with DA[16,17], PS[16], CM[15,16] and PC[17]. In addition, it was reported that SPP is a predictor for insomnia symptoms[14]. With regard to subjective parameters of sleep, studies found that perfectionism is associated with SOL[10,14,16] and WASO[14,16].

Up to now, studies on perfectionism and sleep have relied upon self-report measures of sleep, and it has not been investigated whether higher levels of perfectionism are also linked to polysomnographically determined poor sleep. This is particularly relevant because pronounced discrepancies between subjective and objective measures of sleep can frequently be observed, especially in patients with insomnia.[20,21] Thus, subjective and objective sleep disturbances are partially independent constructs with the latter one being more closely associated with physiological arousal and medical morbidity.[22] So this study addresses this gap by analysing objective sleep parameters, i.e. PSG data, with regard to perfectionism using an explorative approach.

So far research on the relationship between personality traits and sleep architecture has provided mixed results. One study reported that higher percentages of REM sleep were found in participants with higher extraversion scores, but not in those with higher neuroticism scores.[23] In addition, a study found that trait anxiety was associated with a smaller percentage of slow-wave sleep, a higher percentage of stage 1 sleep, more microarousals, and a lower REM density.[24] Another study on trait anxiety showed that REM sleep in a low-anxiety group was shorter in the first two nights compared to two subsequent nights and that stage 2 sleep was longer during the first night than in the remaining three, while a high-anxiety group did not show any of these differences.[25] Further evidence comes from a study on anticipatory worry, which has been shown to be negatively correlated to REM latency[26], and from a study on affect intensity in depressed men, which found that phasic REM sleep was positively associated with intensity of daytime affect.[27] In contrast, two studies did not find evidence for a potential association between personality traits and sleep architecture.[28,29] The association between perfectionism and sleep architecture has not been investigated so far. Thus, our study addresses this gap in the literature.

In the current study, we investigated the association between perfectionism and poor sleep as a transdiagnostic dimensional construct rather than the association between perfectionism and insomnia. The rationale behind this approach is based on the Research Domain Criteria framework (RDoC), which is being promoted by the National Institute of Mental Health.[30]

This new classification framework for research on mental disorders departs for several reasons from the current diagnostic system DSM-V, which draws on symptom-related categories. It is argued that those diagnostic categories fail to accommodate findings coming from clinical neuroscience and genetics. In addition, current diagnostic classifications suffer from not making reliable predictions about treatment response. Finally, established frameworks may not capture fundamental underlying pathophysiological mechanisms of dysfunction.[30]

Thus, the RDoC framework proposes to base understanding and treatment of mental disorders strictly on strong empirical evidence for constructs, which are marked by a high degree of external validity and are based on neural circuits. Initially, 20 constructs have been identified, which have then been grouped into 5 domains. For example, the constructs "arousal", "circadian rhythms" and "sleep-wakefulness" have been grouped into the domain "arousal and regulatory systems".

The goal or this framework is to systematically investigate all constructs on different levels including genes, molecules, cells, physiology, behaviour, and self-report in order to arrive at a better understanding of mental disorders and its underlying pathophysiological mechanisms. In the event, the RDoC framework may help to develop and provide personalised therapy based on biomarkers.

In line with the RDoC framework, we included all patients with poor sleep in our study rather than insomnia patients only. Such an approach has been explicitly suggested by Insel et al.[30]: "Notably, samples might include patients spanning from multiple DSM diagnosis" in order "to explicate the full range of a given dimension". For example, a "study of fear circuitry might include all patients presenting at an anxiety clinic, …".

2. Materials and methods

2.1. Participants

In line with the RDoC framework, we included all patients with poor sleep in our study rather than insomnia patients only. All patients who were investigated for two nights in the sleep laboratory of the Department of Psychiatry and Psychotherapy, Medical Center – University of Freiburg between November 2012 and November 2014 (n = 424) were considered to be eligible to participate in the current study. These patients were referred to our sleep disorders clinic by their primary care provider or medical specialist, and the sleep laboratory recordings were part of the routine clinical procedure. Ninety patients were excluded from analysis due to non-standardised bedtimes (n = 48), incomplete data on perfectionism (n = 16), incomplete data on depression (n = 5), or psychoactive medication in the week prior to or during the sleep laboratory investigation (n = 21). This resulted in a sample of 334 sleep laboratory patients.

All patients were required to refrain from alcohol, caffeine, and daytime naps during the recording days. All patients were investigated between 1995 and 2014. Further details on the study sample are provided below in section 3.1. The study was conducted in accordance with the Declaration of Helsinki. Written consent was obtained from all patients prior to the examination in the sleep laboratory, allowing us to analyse their data for research purposes. The study protocol was approved by the Institutional Review Board of the Medical Center – University of Freiburg.

2.2. Polysomnography

All patients underwent two consecutive nights of polysomnography (PSG) sleep monitoring. Sleep was recorded for approximately eight hours from 22:07 h ± 27 min until 6:07 h ± 27 min adjusted to individual habitual bedtimes. All recordings included electroencephalogram (EEG) (C3-A2; C4-A1), electrooculogram (EOG) (horizontal and vertical), and electromyogram (EMG) (submental) and were scored visually by experienced raters according to the American Academy of Sleep Medicine (AASM) criteria.[31] All patients were screened for apnoea and periodic leg movements by monitoring abdominal and thoracic effort, nasal airflow, oximetry, and bilateral tibialis anterior EMG. Sleep recordings were evaluated for the following parameters of sleep continuity: total sleep time (TST); sleep onset latency (SOL; time from lights out to the first epoch of stage 2 sleep); wake after sleep onset (WASO) defined as difference between sleep period time (SPT; time from sleep onset to final awakening) and TST; number of awakenings (NOA); and arousal index (number of arousals per hour). Sleep architecture parameters were percentages of stages 1, 2, slow wave sleep (SWS), and rapid eye movement sleep (REM) in reference to SPT.

2.3. Psychometric assessment

Perfectionism was assessed using the Frost Multidimensional Perfectionism Scale (FMPS)[1], a

35-item 5-point Likert-type (disagree strongly to agree strongly) questionnaire with total scores ranging from 29 to 145 points. The FMPS is the most widely used scale for measuring perfectionism and has demonstrated good internal consistency and reliability as well as good convergent and discriminatory validity.[1,32,33] The FMPS comprises six subscales: concern over mistakes (CM), doubts about action (DA), parental expectation (PE), parental criticism (PC), personal standards (PS), and organization (O). The last subscale (O; containing 6 items) is not included in the total score and was not used in the current study. In addition to the FMPS, all patients were asked to fill in the Pittsburgh Sleep Quality Index (PSQI)[34] and the Beck Depression Inventory (BDI).[35]

2.4. Statistical analysis

All analyses were carried out using the statistical software package R (http://www.R-project.org/). Descriptive presentation of the data includes mean values and standard deviations. The association between perfectionism and polysomnographically determined sleep continuity and sleep architecture parameters was analysed using a series of linear regression models. This approach was chosen on account of the retrospective exploratory study design. For each combination of perfectionism-related variable (FMPS total and subscale scores; independent variable) and PSG parameter (see section 2.2.; dependent variable), a linear regression analysis was conducted with age, gender, BDI scores, and somatic sleep disorders (sleep apnoea syndrome, restless legs syndrome / periodic leg movement disorder, organic insomnia, non-rapid eye movement (NREM) parasomnia, circadian rhythm sleep disorder, narcolepsy, and idiopathic hypersomnia) as covariates. BDI scores were used as covariates in all analyses because depression levels have been linked to both poor sleep[36] and perfectionism levels.[2] To investigate the association between perfectionism and subjective sleep, the same analyses have been performed with PSQI scores as dependent variable. Due to multiple testing (114 tests), the alpha level was set at $p < 0.01$ (two-tailed) for all analyses. P-values ranging from 0.01 to 0.05 were considered to be statistical trends.

3. Results

3.1. Sample characteristics

The characteristics of the study sample can be derived from Table 1. Descriptive statistics of the PSG measures are presented in Table 2.

(please insert Table 1 here)

(please insert Table 2 here)

3.2. The association between perfectionism and sleep

The results of the linear regression analyses investigating the association between FMPS total scores and polysomnographic parameters are presented in Table 3. The total FMPS score was significantly associated with the number of nocturnal awakenings in the first sleep laboratory night ($t = 4.42$, $p < 0.001$; see Figure 1). Moreover, there were statistical trends for the association between the total FMPS score and other parameters of the first sleep laboratory night, namely TST ($t = -2.17$, $p = 0.031$), arousal index ($t = 2.43$, $p = 0.016$), WASO ($t = 2.28$, $p = 0.023$) and REM sleep ($t = -2.05$, $p = 0.042$). No significant associations were found between the total FMPS score and sleep parameters of the second sleep laboratory night. However, there was a statistical trend for the association between the total FMPS score and the arousal index (t = 2.22, p = 0.027).

The results of the linear regression analyses investigating the association between PSQI scores and FMPS total and subscale scores revealed that there were no significant associations between PSQI scores and FMPS total and subcale scores.

(please insert Table 3 here)(please insert Figure 1 here)

(please insert Table 4 here)

The results of the analyses of the association between FMPS subscales and sleep parameters are presented in Table 3 (concern over mistakes, doubts about action) and Table 4 (parental expectations, parental criticism, personal standards). With regard to the first sleep laboratory night, both CM and PS were significantly associated with TST (CM: t = -2.88, p = 0.004; PS: t = -3.18, p = 0.002) and the number of nocturnal awakenings (CM: t = 3.32, p < 0.001; PS: t = 3.09, p = 0.002). Moreover, PE (t = 4.54, p < 0.001) and PC (t = 3.77, p < 0.001) were also significantly associated with the number of nocturnal awakenings, CM was significantly associated with the arousal index (t = 2.84, p = 0.005), and PS was significantly associated with WASO (t = 2.65, p = 0.009). Statistical trends were observed for the association between CM and WASO (t = 2.51, p = 0.013), CM and REM sleep (t = -2.14, p = 0.033), PS and the arousal index (t = 2.29, p = 0.019), and the association between PS and REM sleep (t = -2.10, p = 0.037).

With respect to the association between FMPS subscales and sleep parameters of the second sleep laboratory night, a significant association between CM and arousal index was observed (t = 2.72, p = 0.007). There was a statistical trend for the association between CM and stage 1 ($t = 2.43$, $p = 0.015$), CM and SWS ($t = -2.05$, $p = 0.041$), DA and the arousal index ($t = 2.07$, $p = 0.039$), and PS and the arousal index ($t = 1.97$, $p = 0.050$).

4. Discussion

The results of this study support the notion that high levels of perfectionism are associated with polysomnographically determined markers of poor sleep in the first sleep laboratory night. This is particularly true for the “concern over mistakes” and “personal standards” subscales of the FMPS. In contrast, there were very few significant associations between perfectionism and polysomnographic variables of the second sleep laboratory night. Strengths of the study include the use of state-of-the-art measures of perfectionism and sleep and the relatively large sample size.

The first night in the sleep laboratory is an unpleasant experience for many, probably due to the discomfort of the electrodes and the unfamiliar environment. As a consequence, individuals sleep worse, a phenomenon called the first-night effect, which led to the common practice of recording at least two nights in sleep laboratory research. A recent analysis of data from our sleep disorders clinic suggests that the subjective total sleep time is reduced by around 20 minutes in the first sleep laboratory night compared to at-home sleep in good sleepers.[37] The current results suggest that perfectionism contributes to the first-night effect. This leads to the more general hypothesis that perfectionism is an important factor for the development of objective sleep disturbances in response to acute stressors. Put differently, it may be speculated that perfectionism is important for sleep reactivity, which refers to the tendency to exhibit sleep disturbances in response to stressful events, which, in turn, is a risk factor for developing chronic sleep disturbances.[38] However, it has to be stressed that data about the feeling of heightend stress during the first sleep laboratory night is missing. Thus, future studies should assess stress in the first sleep laboratory night.

With regard to subjective measures of sleep quality, we have analysed whether perfectionism is associated with the PSQI. There were no significant associations between PSQI scores and FMPS total and subscale scores. Against that background, we looked into the seven studies, which found an association between perfectionism and subjective sleep parameters. Indeed, most studies did not use the PSQI to assess sleep. Lundh et al. (1994)[9] used a clinical interview, Brand et al. (2015)[16] and Akram et al. (2015)[17] used the Insomnia Severity Index, Jansson-Fröjmark et al. (2007)[15] used the Basic Nordic Sleep Questionnaire and the Uppsala Sleep Inventory, and Azevedo (2010)[14] and Akram et al. (2017)[19] used screening questions to assess sleep. Only Vincent and Walker (2000)[10] used the PSQI to assess sleep. They used two multi-dimensional perfectionism scales, namely Hewitt and Flett's Multi-Dimensional Perfectionism Scale[18] and the FMPS. They found no association between perfectionism and sleep-onset latency, total sleep time and sleep quality measured by the PSQI for Hewitt and Flett's scale.[18] Using the FMPS, only one out of five sub-scales was associated with sleep onset latency, but not with total sleep time and sleep quality. Moreover, this association was not supported by sleep diary data. To sum up, a potential explanation might run along the following lines. There is evidence which suggests an association between perfectionism and poor sleep measured by subjective sleep parameters. However, the PSQI may not be the most suitable measure to investigate that association.

In line with some of the results reported in previous investigations[9,10,15], 'concern over mistakes' and 'personal standards' were the perfectionism subscales that were primarily related to poor sleep. As outlined in the introduction section, individuals who are more concerned about making mistakes and who have higher personal standards may be more prone to excessively worry about the effects of transient sleep loss on daytime performance and they may anticipate stronger effects. Both are dysfunctional beliefs commonly accepted to contribute to poor sleep.[39] Moreover, individuals with high personal standards may experience sleep onset or sleep maintenance difficulties in the first sleep laboratory night as a performance failure. Consequently, they may increase sleep effort which also contributes to poor sleep.[3,8]

In the current study significant associations between perfectionism and sleep were only found for measures of sleep continuity but not for measures of sleep architecture. This fits well with previous findings showing that acute psychological stress is primarily related to sleep continuity disturbances in patients with insomnia[40], while sleep architecture changes are rather common in the context of chronic psychiatric conditions.[36]

We now focus on the clinical implications of our study. As we have suggested previously[13], cognitive-behavioural treatment programmes for perfectionism, which have been developed in the context of eating disorders[41], may be investigated in terms of their effects on sleep and associated negative sequelae of sleep disorders, e.g. deficits in overnight memory consolidation.[42,43] Moreover, in light of the current findings and given that perfectionism is a transdiagnostic feature of many psychiatric disorders,[2] it may also be a factor contributing to the increased risk of developing psychiatric disorders in those with insomnia.[44-46] In addition, perfectionism has been linked to physiological arousal[47] and may, thus, also play a role in the association of sleep disorders with cardiometabolic diseases.[48,49]

Five limitations of the current study should be acknowledged. First, a number of statistical tests were conducted without Bonferroni correction. However, the alpha level was set at a conservative $p < 0.01$ and the observed number of statistically significant findings clearly exceeded the number that would have been expected by chance (10 findings vs. 1 finding in 108 statistical tests). Second, we did not control for psychiatric diagnoses of the patients as a potential confounder in our analyses. However, this approach was chosen on purpose following the RDoC framework of the NIMH. Third, it has to be noted that this study did not include a control group. Thus, we could not investigate the full range from normal to abnormal with respect to the association between perfectionism and objectively determined sleep. Fourth, while we only used the FMPS, there is also the Multidimensional Perfectionism Scale by Hewitt and Flett[18], which is, however, not available as a validated German version. Still, a more complete picture of the association between perfectionism and PSG measures could be achieved by using both scales. Finally, as this was a retrospective exploratory study, findings should be tested in confirmatory studies.

In summary, the results of the current study support the hypothesis that perfectionism mediates the development of polysomnographically determined poor sleep in response to acute stressors. Future studies should further elucidate the role of perfectionism in the transition from good sleep to acute sleep disturbances as well as in the transition from acute to chronic sleep disturbances employing longitudinal designs. Furthermore, the role of perfectionism in the development of sleep disturbance needs to be validated in more ecological settings and with more mundane stressors.

Abbreviations

AASM	American Academy of Sleep Medicine
AI	arousal index
AHI	apnoea hypopnoea index
BDI	Beck Depression Inventory
CM	concern over mistakes
DA	doubts about action
EEG	electroencephalogram
EMG	electromyogram
EOG	electrooculogram
FMPS	Frost Multidimensional Perfectionism Scale
MPS	Multidimensional Perfectionism Scale
NIMH	National Institute of Mental Health
NOA	number of awakenings
NREM	non-rapid eye movement
O	organization
OOP	other-oriented perfectionism
PC	parental criticism
PE	parental expectation
PS	personal standards
PSG	polysomnography / polysomnographic
PSQI	Pittsburgh Sleep Quality Index
RDoC	research domain oriented criteria
REM	rapid eye movement sleep
SOL	sleep onset latency

SOP	self-oriented perfectionismSPP socially-prescribed perfectionism
SPT	sleep period time
SWS	slow wave sleep
TST	total sleep time
WASO	wake after sleep onset

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Figure Titles and Captions

Figure 1 short title:

Figure 1. Association between perfectionism and number of awakenings in the first sleep laboratory night.

Figure 1 caption:

$p < 0.001$ in the linear regression analysis with age, gender, and Beck Depression Inventory (BDI) scores as covariates. PSG: polysomnography; FMPS: Frost Multidimensional Perfectionism Scale.

Tables

Table 1. Sample characteristics

epidemiological characteristics	
women	194
men	140
mean age	44.6 ± 15.9 years
PSQI (mean)	10.0 ± 4.2
BDI (mean)	14.0 ± 9.8
non-somatic sleep disorders	
non-organic insomnia	208
nightmares	20
sleepwalking (somnambulism)	16
sleep terrors (night terrors)	9
non-organic disorder of the sleep-wake schedule	8
non-organic hypersomnia	8
non-organic sleep disorder, unspecified	1
other non-organic sleep disorders	1
somatic sleep disorders	
restless legs syndrome / periodic leg movement disorder	87
sleep apnoea syndrome	86
disorders of excessive somnolence (hypersomnia)	51
narcolepsy and cataplexy	25
organic insomnia	12
NREM parasomnia	10
disorders of the sleep-wake schedule	6
other sleep disorders	21
psychiatric disorders	
depressive disorder	138
persistent somatoform pain disorder	11
disturbance of activity and attention	8
mixed obsessional thoughts and acts	7
post-traumatic stress disorder	6
other psychiatric disorders	66

Table2. Polysomnographic data

Variable	*First night*	*Second night*
TST (min)	364.5 ± 75.5	389.2 ± 56.7
SOL (min)	30.2 ± 34.1	22.5 ± 23.3
WASO (min)	77.2 ± 56.8	59.4 ± 43.1
NOA	30.7 ± 14.2	29.1 ± 12.1
AI (h^{-1})	20.7 ± 11.7	18.2 ± 9.9
AHI (h^{-1})	1.3 ± 4.2	/
PLMS index (h^{-1})	2.0 ± 4.6	/
Stage 1 (% SPT)	10.8 ± 6.8	9.9 ± 6.3
Stage 2 (% SPT)	49.8 ± 11.2	51.3 ± 9.6
SWS (% SPT)	6.0 ± 7.6	6.4 ± 7.9
REM (% SPT)	15.4 ± 6.6	19.0 ± 6.6

Results depict means ± standard deviations. TST: total sleep time, SOL: sleep onset latency, WASO: wake after sleep onset, NOA: number of awakenings, AI: arousal index, AHI: apnoea hypopnoea index, PLMS: periodic leg movements during sleep, SPT: sleep period time, SWS: slow wave sleep, REM: rapid eye movement sleep.

Table3. Association between FMPS total score, subscale scores (CM, DA) and polysomnographic parameters (significant results are presented in bold)

		Total		*CM*		*DA*	
		β	*p*	*β*	*p*	*β*	*p*
1. Night	TST	-0.42	0.031	**-1.47**	**0.004**	0.23	0.826
	SOL	0.12	0.210	0.49	0.059	0.00	0.995
	WASO	0.32	0.023	0.94	0.013	-0.20	0.792
	NOA	**0.17**	**<0.001**	**0.34**	**<0.001**	0.32	0.132
	AI	0.08	0.016	**0.23**	**0.005**	0.20	0.231
	S1%	0.02	0.164	0.08	0.057	0.05	0.593
	S2%	-0.05	0.094	-0.15	0.056	0.20	0.232
	SWS%	-0.02	0.228	-0.08	0.064	-0.10	0.265
	REM%	-0.04	0.042	-0.10	0.033	-0.03	0.769
2. Night	TST	0.02	0.899	0.02	0.952	0.35	0.644
	SOL	-0.03	0.645	-0.09	0.592	-0.44	0.215
	WASO	-0.00	0.988	0.02	0.949	-0.11	0.844
	NOA	0.06	0.082	0.14	0.125	0.15	0.412
	AI	0.06	0.027	**0.19**	**0.007**	0.29	0.039
	S1%	0.03	0.054	0.10	0.015	0.11	0.186
	S2%	-0.00	0.999	-0.01	0.838	0.10	0.485
	SWS%	-0.03	0.126	-0.10	0.041	-0.17	0.081
	REM%	-0.01	0.646	-0.01	0.832	-0.05	0.644

FMPS: Frost Multidimensional Perfectionism Scale; CM: concern over mistakes; DA: doubts about action; TST: total sleep time; SOL: sleep onset latency; WASO: wake after sleep onset; NOA: number of awakenings; AI: arousal index; S1%: amount of stage 1 sleep (%); S2%: amount of stage 2 sleep (%); SWS%: amount of slow wave sleep (%); REM%: amount of rapid eye movement sleep (%).

Table4. Association between subscale scores (PE, PC, PS) and polysomnographic parameters (significant results are presented in bold)

		PE		*PC*		*PS*	
		β	*p*	*β*	*p*	*β*	*p*
1. Night	TST	-0.49	0.509	-0.36	0.699	**-2.19**	**0.002**
	SOL	0.05	0.896	0.09	0.846	0.59	0.092
	WASO	0.96	0.073	0.57	0.401	**1.34**	**0.009**
	NOA	**0.65**	**<0.001**	**0.69**	**<0.001**	**0.43**	**0.002**
	AI	0.16	0.164	0.08	0.595	0.26	0.019
	S1%	0.10	0.107	0.03	0.731	0.02	0.769
	S2%	-0.21	0.066	-0.19	0.185	-0.16	0.139
	SWS%	0.02	0.771	0.05	0.537	-0.11	0.066
	REM%	-0.12	0.089	-0.06	0.474	-0.13	0.037
2. Night	TST	-0.04	0.942	0.48	0.474	-0.20	0.691
	SOL	0.11	0.655	-0.15	0.641	-0.04	0.852
	WASO	-0.04	0.911	-0.36	0.459	0.24	0.514
	NOA	0.15	0.236	0.21	0.193	0.18	0.131
	AI	0.07	0.490	0.05	0.684	0.19	0.050
	S1%	0.07	0.258	0.04	0.603	0.07	0.195
	S2%	-0.01	0.960	-0.01	0.926	-0.01	0.941
	SWS%	-0.03	0.671	-0.01	0.914	-0.07	0.270
	REM%	-0.04	0.597	0.04	0.654	-0.06	0.373

PE: parental expectations; PC: parental criticism; PS: personal standards; TST: total sleep time; SOL: sleep onset latency; WASO: wake after sleep onset; NOA: number of awakenings; AI: arousal index; S1%: amount of stage 1 sleep (%); S2%: amount of stage 2 sleep (%); SWS%: amount of slow wave sleep (%); REM%: amount of rapid eye movement sleep (%).