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ORIGINAL ARTICLE

Usefulness of psychoeducational intervention in chronic insomnia: an actigraphic study

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Abstract

Background: Chronic Insomnia is a severe and disabling condition characterized by difficulty in initiating or maintaining sleep, waking up too early, despite adequate opportunity and circumstances for sleep. Maladaptive thoughts and dysfunctional beliefs about sleep are considered crucial factors in developing and perpetuating this disorder.
Aims: The aim of the study was to explore the usefulness, in patients with chronic insomnia, of a one-session psychoeducational intervention on sleep-related maladaptive thoughts and beliefs, and on sleep perception.
Methods: Thirty-eight patients with chronic insomnia were enrolled in the study and randomly assigned to receive psychoeducational intervention (PI+) or to act as controls (PI–). Patients wore an actigraph and compiled a sleep diary for 14 d. After the first 7 d, only PI+ patients received one session of psychoeducational intervention.
Results: A significant reduction of sleep related preoccupations, a reduction of dysfunctional beliefs about sleep, and an improvement of subjective perception of sleep were observed in the PI+ group, but not in the PI– group. No significant modification was observed for objective total sleep time.
Conclusions: Our results suggest that one-session psychoeducational intervention is associated with a decrease of sleep-related maladaptive thoughts and beliefs, and with an improvement on subjective sleep perception.

Keywords

Chronic insomnia, psychoeducational intervention, actigraphy, dysfunctional belief about sleep, sleep misperception

History

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Introduction

Chronic insomnia is a severe and disabling condition characterized by difficulty in initiating or maintaining sleep, waking up too early, despite adequate opportunity and circumstances for sleep (American Academy of Sleep Medicine, 2014). Cognitive behavioral therapy for insomnia (CBT-I) is an evidence-based treatment for insomnia (Espie, 2009; Morin et al., 2009). CBT-I has demonstrated strong efficacy in treating primary as well secondary insomnia, both in individual and in group settings, also as compared to pharmacological treatments (Koffel et al., 2015). It is a short-term, multi-component psychotherapy that includes different symptom-focused behavioral and cognitive therapeutic strategies (Koffel et al., 2015; Schwartz & Carney, 2012) including: stimulus control and sleep restriction, relaxation techniques, psychoeducation on sleep and sleep hygiene, and cognitive techniques such as cognitive restructuring. Each CBT-I component involves distinct techniques and strategies focused on insomnia specific mechanisms (Edinger & Means, 2005; Edinger et al., 2001; Schwartz & Carney, 2012).

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Although studies have sought to evaluate the effectiveness of specific components of CBT-I, the selectively efficacy of each has not yet been determined (Morin et al., 1994, 2006; Trauer et al., 2015). However, it has been observed that, among CBT-I components, cognitive restructuring, together with stimulus control and sleep restriction, results in a significant improvement of sleep outcome (Harvey et al., 2002; Schwartz & Carney, 2012).

CBT-I focuses mainly on the maladaptive thoughts and dysfunctional beliefs about sleep, which are among the principal factors in developing and perpetuating this disorder (Harvey et al., 2005, 2007). These include unwanted intrusive thoughts, worry and rumination, attentional bias and monitoring for sleep-related threats, unhelpful beliefs about sleep, concerns about the initiation and the duration of sleep and a distorted perception of sleep, the so-called ''sleep state misperception'' (Harvey et al., 2007; Manconi et al., 2010). Controlled evidence showed that patients with insomnia are prone to overestimate sleep onset latency and underestimate total sleep time (Tang & Harvey, 2004). These findings were confirmed by Manconi et al. (2010), who quantified this phenomenon using the ''Misperception Index''. This misperception may play an important role in the perpetuation of insomnia (Mercer et al., 2002). For example, it has been

showed that impaired daytime functioning, reported by patients with insomnia, is also maintained by subjective perception of sleep (Semler & Harvey, 2005).

It has been proposed that psychoeducational interventions may be useful in managing maladaptive thoughts and dysfunctional beliefs about sleep (Ellis et al., 2007). Biancosino et al. (2006) showed that a two-session psychoeducational intervention was associated with an increase of specific sleep parameters (i.e. sleepiness and sleep onset latency) in patients with insomnia. Tang & Harvey (2004) designed a ''behavioral experiment'' that consisted of showing the discrepancy between sleep estimated subjectively with a diary, and sleep objectively measured with a wrist actigraph. This kind of psychoeducational intervention was able to correct a distorted perception of sleep and related anxiety and preoccupation (Tang & Harvey, 2004). In a second actigraph study (Tang & Harvey, 2006), the authors compared the effect of showing the discrepancy between subjective and objective sleep measures (behavioral experiment group) with the effect of simply being told about the discrepancy (verbal explanation control group). Compared to the control group, the behavioral experiment group showed a greater reduction in self-reported sleep impairment, insomnia symptoms, and sleep-related anxiety and distress (Tang & Harvey, 2006).

The main aim of the present study was to extend these previous findings by investigating, in a medical setting, the usefulness of one-session psychoeducational in a cohort of chronic insomnia patients. Specifically, we evaluated the effect on sleep-related maladaptive thoughts and beliefs, and on sleep perception (i.e. the misperception index), using self-reports and actigraphy.

Methods

Participants

Thirty-eight consecutive patients (16 men and 22 women; mean age 61 ± 13.57; range 23–82 years) with chronic insomnia, according to the *International Classifications of Sleep Disorders 3rd edition* (American Academy of Sleep Medicine, 2014), were enrolled in the study. All patients had been referred to a Sleep Disorders Unit of a neurological health care center. Criteria for inclusion were: both sexes, age > 18 years, diagnosis of chronic insomnia. Exclusion criteria were as follows: insomnia secondary to medical, neurological or psychiatric diseases, heart diseases, arrhythmias, intake of cardiovascular active drugs, diabetes, uncontrolled hypertension severe obesity [body mass index (BMI) $> 35\ kg/m^2$], chronic respiratory disease, obstructive sleep apnea syndrome, restless legs syndrome or thyroid diseases, patients with other sleep disorders and the presence of any other condition that affected the ability of the patient to complete the assessment, including the denial of informed consent. In order to exclude any neurological and/or psychiatric diseases, all participants received a complete neurological and psychiatric examination performed by two trained researchers.

No patient was taking cardiovascular drugs, antidepressants, pain-killers, sleep-inducers or other psychoactive medication at the time of the study, and over the previous 2 weeks. Patients were assessed between March 2013 and June 2014. Clinical and socio-demographic characteristics of the sample are listed in Table 1.

After receiving information about the aims of the study, all patients provided written consent to participate in the study. It was performed according to the Helsinki declaration standards and was approved by the local institutional review board.

Study design and procedures

The design was a cohort, randomized, controlled, single-blind study. The original study design required the enrollment of 20 patients for each group. Therefore, the first 40 consecutive patients who fulfilled the inclusion–exclusion criteria, and agreed to participate, were enrolled, and were randomly distributed in the two groups. Of these, two persons, one for each group, dropped out from the study leaving 38 patients. At the moment of enrollment, the patients were randomly assigned to receive psychoeducational intervention (PI+ = 19 patients) or to act as controls, without psychoeducational intervention (control group, PI– = 19 patients). The study was performed in three consecutive sessions.

Session one. After giving written informed consent, all patients undertook a complete psychiatric and neurological evaluation. Interviews included information on personal and family psychiatric history and mental status in order to exclude the presence of psychiatric and disorders, and a

Table 1. Demographic and clinical characteristics of the sample.

	PI+ Group (19)Mean (SD)	PI– Group (19)Mean (SD)	Sig.
Age	64.42 ± 12.94	59.56 ± 14.41	$p = 0.27$[a]
Educational level[c]	12.45 ± 2.53	13.12 ± 3.51	$p = 0.51$[a]
Men %	47.4%	27.8%	$p = 0.22$[b]
Unemployed %	63.2%	66.7%	$p = 0.82$[b]
Alcohol use in the last 6 months %	26.3%	38.9%	$p = 0.41$[b]
Tobacco use in the last 6 months %	15.8%	27.8%	$p = 0.28$[b]
PSQI > 5%	100%	100%	$p = 1.00$[b]
ESS	4.68 ± 3.53	5.39 ± 4.01	$p = 0.57$[a]
BDI-II	16.79 ± 11.01	15.83 ± 9.33	$p = 0.78$[a]
BAI	16.47 ± 12.20	14.78 ± 10.33	$p = 0.65$[a]

PI: psychoeducational intervention; PSQI: Pittsburgh Sleep Quality Index; ESS: Epworth Sleepiness Scale; BDI-II: Beck Depression Inventory; BAI: Beck Anxiety Inventory.
[a]*t* test.
[b]Chi-square test.
[c]Years.

detailed evaluation of sleep habits and behaviors. Neurological evaluation included a study of personal and family history and a detailed physical neurologic examination. All patients were also administered the Pittsburgh Sleep Quality Index (PSQI; Buysse et al., 1989), the Insomnia Severity Index (ISI; Morin et al., 2011), the Epworth Sleepiness Scale (EES; Johns, 1991), the Anxiety and Preoccupation about Sleep Questionnaire (APSQ; Tang & Harvey, 2004), the Dysfunctional Belief and Attitudes about Sleep Questionnaire (DBASQ; Morin et al., 1993). Furthermore, due to the strong association between sleep disorders and both mood and anxiety disorders (Bersani et al., 2012), the Beck Depression Inventory (BDI-II; Beck et al., 1961), and the Beck Anxiety Inventory (BAI; Beck et al., 1988) were also administered. After the assessments, patients were given the actigraph to wear and compiled a daily sleep diary over seven days. The sleep diary required participants to record the time they went to bed (bedtime), their sleep latency, their subjective sleep duration, their number of awakenings, and their subjective sleep quality (visual analogue scale ranging, VAS, from 1 to 100).

Session two. When participants returned to the Sleep Laboratory for the second session, data from the actigraphy and sleep diary were collected. Actigraphic tracings were analyzed using a dedicated software (see below) and printed out. In the PI+ group, a trained CBT-I therapist performed a simple psychoeducational intervention, which consisted in showing the patient the printed output of the actigraph analysis together with the sleep diary. Furthermore, the therapist provided a brief comment as following: ''If you compare what you have reported in the sleep diary and what emerged from actigraphy, it is possible to observe some discrepancies. Sometimes people suffering from insomnia can underestimate their sleep time, sleep latency and sleep efficiency. If this is your case that means that you are sleeping more than you think. What is your opinion about it?''. The aim of this technique was to let the patients identify eventual sleep misperceptions and reappraise related dysfunctional beliefs (Tang & Harvey, 2006). After listening to the patients' replies, no other comment or psychotherapeutic technique was performed. In the control group, PI– data were collected and analyzed but no feedback was given to the patients (i.e. they were not provided any information from their sleep diaries or actigraphy output). Both PI+ and PI– patients were asked to again wear the actigraph and to complete the sleep diary for seven additional days.

Session three. After the second week of recording, the actigraphs and sleep diaries were collected and analyzed. All participants were also asked to again complete the ISI, APSQ and DBASQ. Finally, all patients received further clinical management and treatments according to standard clinical practice.

Sleep and psychological evolution

The PSQI is a widely used, self-rated, assessment of sleep quality over the previous month. In this study, the Italian version of the PSQI (Curcio et al., 2013) was used. Cronbach's α in the present sample was 0.76. In the study, poor sleep quality was defined, according to the PSQI authors' recommendations, when the PSQI sum score was >5 (Buysse, et al., 1989).

The ISI is a seven-item self-report assessment of the nature, severity and impact of insomnia over the previous two weeks. Scores range from 0 to 28; greater scores on the ISI indicate clinical insomnia. Morin et al. (2011) reported that ISI has good psychometric properties (i.e. internal consistency ≥ 0.90). In the present study, the Italian version of the ISI (Battagliese & Lombardo, 2012) was used. Cronbach's α in the present sample was 0.72 for the baseline and 0.78 for the post treatment assessment.

The ESS is an eight-item self-report assessment of subjective daytime sleepiness (higher results indicate greater propensity to fall asleep). Several studies have indicated good psychometric properties of ESS (Johns, 1991; Knutson et al., 2006; Miletin & Hanly, 2003). In the present study, the Italian version of the ESS (Vignatelli et al., 2003) was used, Cronbach's α in the present sample was $\alpha = 0.73$.

The APSQ is a 10-item self-report assessment of sleep-related worry. Satisfactory psychometric properties were reported by Jansson-Frojmark et al. (2011). In the present study, the Italian version of the APSQ (Tamburello et al., 2012) was used. Cronbach's α in the present sample was 0.91 for the baseline and 0.92 for the post-treatment assessment.

The DBASQ is a 30-item self-report assessment of the nature and severity of the dysfunctional beliefs that are common in chronic insomnia. A 100-mm analog scale labeled ''strongly disagree'' at its far left extremity and ''strongly agree'' at its far right extremity accompanies each item and is used by respondents to indicate their degree of agreement. The DBASQ includes item subsets or subscales designed to measure five discrete cognitive themes, that include (1) maladaptive beliefs about the effects of insomnia, (2) beliefs that sleep is unpredictable and uncontrollable, (3) unrealistic expectations about sleep needs, (4) misconceptions about the causes of insomnia and (5) erroneous beliefs about sleep-promoting practices. Good psychometric properties were observed in the original study validation (Morin et al., 1993). In this study, the Italian version of the DBASQ (Coradeschi et al., 2000) was used. Cronbach's α in the present sample was 0.84 for the baseline and 0.87 for the post-treatment assessment.

The BDI is a 21-item well-validated self-report instrument that measures characteristic attitudes and symptoms of depression over the previous 2 weeks. Extensive literature has supported the psychometric properties of the scale in clinical samples (for a review, see Wang & Gorenstein, 2013). In the present study, the Italian version of BDI (Sica & Ghisi, 2007) was used. In the current sample, Cronbach's alpha was 0.90.

The BAI (Beck et al., 1988) is a 21-item well-validated self-report instrument measuring characteristic attitudes and symptoms of anxiety. Several studies have indicated good psychometric properties of BAI (Beck, et al., 1988; Fydrich et al., 1992). In the present study, the Italian version of BAI (Sica & Ghisi, 2007) was used. In the current sample, the Cronbach alpha was 0.90.

Actigraph recordings

A Mini-Motionlogger actigraph (supplied by Ambulatory Monitoring Inc., Ardsley, NY) was used to estimate objective sleep throughout the experiment. Data recorded were later downloaded using software (Action-W) that scores the sleep/wake cycle. Data were collected in Zero-Crossing Mode using 60-s epochs.

In order to measure and compare subjective and objective sleep duration, the following sleep parameters were considered:

- Objective Total Sleep Time (oTST): total sleep duration, excluding initial wake, final wake and wake after sleep onset, measured by actigraphy;
- Subjective Total Sleep Time (sTST): total sleep duration, excluding initial wake, final wake and wake after sleep onset, evaluated by the patients' log;
- Misperception index: to assess the concordance between subjective data (assessed with sleep diary) and objective data (assessed with actigraphy) about sleep time, we calculated MI (Manconi, et al., 2010). This index ranges between +1 (maximum value of underestimation of personal sleep time) and –1 (maximum value of overestimation of personal sleep time) (Manconi et al., 2010). Misperception index was calculated using the following formula.

$$\text{Misperception Index} = \frac{[\text{Objective Total Sleep Time} - \text{Subjective Total Sleep Time}]}{\text{Objective Total Sleep Time}}$$

Misperception index was calculated for every single night of recording. Therefore, the mean and standard deviation of misperception index for the first and second week was obtained.

Statistical analyses

All data were analyzed using SPSS software version 20 (SPSS Inc., Chicago, IL). Before comparing the groups, the distribution of the samples was tested using the Shapiro–Wilk test, with a significance level of $p < 0.05$. When the distribution was normal in both the samples, a comparison was made using the Student *t*-test. When the distribution was not normal, a non-parametric test was applied (the Mann–Whitney *U* test was applied to the ''*between group*'' comparison, and the Wilcoxon test to the ''*within group*'' comparison). The Chi-square test was used to examine the differences between PI+ and PI– for dichotomous variables. In order to evaluate the magnitude of the treatment effect, we measured the effect size by Cohen's *d*. Cohen's *d* was computed with the formula:

$$\text{Cohen}'\text{s } d = \frac{M_{\text{post}} - M_{\text{pre}}}{\sqrt{\frac{(\text{SD}_{\text{pre}}^2 + \text{SD}_{\text{post}}^2)}{2}}}$$

being M_{post} the mean score post-treatment, M_{pre} the mean score pre-treatment, SD_{pre}=standard deviation pre-treatment, SD_{post} = standard deviation in post-treatment. The interpretation criteria for the absolute size of Cohen's *d* are: $d = 0.20$–0.49 (small); $d = 0.50$–0.79 (moderate); and $d \geq 0.80$ (large).

The ISI, APSQ and DBASQ were analyzed separately by means of repeated measures (ANOVA), including the between-subjects factor grouping (PI+ vs PI–) and the within-subject factors time (Pre vs Post). Misperception index was analyzed by means of repeated measures (ANOVA), including the between-subjects factor grouping (PI+ vs PI–), the within-subject factors time (Pre vs Post), and the condition night (seven nights for each patients in each condition) as ''covariates''. The Greenhouse-Geisser corrected *p* values are reported. For post hoc analysis, paired *t*-test and independent *t*-test (or Wilcoxon's Sign Test for within comparison and Mann–Whitney's *U* test when the distribution was not normal) were used for within and between group comparisons, respectively.

Results

There were no significant differences between the groups as regards socio-demographic and clinical variables such as anxiety and depressive symptoms (Table 1).

Insomnia symptoms, dysfunctional beliefs, anxiety and preoccupation about sleep

Detailed descriptive and *F*-statistics are displayed in Table 2. No time × group interaction was observed for ISI ($F = 0.20$; $p = 0.66$). However, repeated measures (ANOVA) revealed a significant time effect for ISI ($F = 11.49$; $p = 0.002$; Figure 1, panel A). Post hoc comparisons showed that ISI-post was significantly lower than ISI-pre for both PI+ ($t = 2.64$; $p = 0.016$; $d = –0.64$) and PI– ($t = 2.28$; $p = 0.036$; $d = –0.93$).

No time × group interaction was observed for both APSQ ($F = 1.59$; $p = 0.22$) and for DBASQ ($F = 1.14$; $p = 0.29$). However, repeated measures ANOVA revealed a significant time effect for APSQ ($F = 6.94$; $p = 0.012$; Figure 1, panel B) and DBASQ ($F = 9.36$; $p = 0.004$; Figure 1, panel C). Post hoc comparisons showed that APSQ-post and DBASQ-post were significantly lower than APSQ-pre and DBASQ-pre only for the PI+ group (APSQ: $t = 3.04$; $p = 0.007$; $d = –0.69$; DBASQ: $t = 2.84$; $p = 0.011$; $d = –0.84$). No significant modifications were observed in the PI– (APSQ: $t = 0.89$; $p = 0.387$; $d = –0.27$; DBASQ: $t = 1.46$; $p = 0.163$; $d = –0.44$).

Misperception index, Subjective Total Sleep Time (oTST) and Objective Total Sleep Time (oTST)

Time × group interaction was significant for misperception index ($F = 3.81$; $p = 0.04$). The within post hoc comparisons (Pre vs Post) showed that misperception index-post was significantly lower than misperception index-pre only for the PI+ group (Wilcoxon-Test = –3.28; $p < 0.001$; $d = –0.60$). No significant modifications were observed in the control group (Wilcoxon-Test = –1.79; $p = 0.07$; $d = 0.21$). Furthermore, the between post hoc comparisons (PI+ vs PI–) showed that compared to PI+ group, PI– have lower misperception index in the pretreatment condition (Mann–Whitney's *U* test = –3–34; $p < 0.001$). No differences were observed in posttreatment condition (Mann–Whitney's *U* test = –0.60; $p = 0.55$; Figure 2, panel A).

Table 2. Results of repeated measures (ANOVA) comparisons.

Variable	Time	PI+ Group (19) $M \pm SD$	PI– Group (19) $M \pm SD$	Test statistics
ISI	T0	15.74 ± 4.27	17.78 ± 4.26	$\mathbf{F_{time}(1; 36) = 11.49; p = 0.002}$
	T1	12.16 ± 6.62	13.11 ± 5.68	$F_{group}(1; 36) = 1.43; p = 0.24$
				$F_{time \times group}(1; 36) = 0.20; p = 0.66$
APSQ	T0	69.00 ± 19.99	62.33 ± 21.09	$\mathbf{F_{time}(1; 36) = 6.94; p = 0.012}$
	T1	52.00 ± 28.28	56.33 ± 24.01	$F_{group}(1; 36) = 0.03; p = 0.86$
				$F_{time \times group}(1; 36) = 1.59; p = 0.22$
DBASQ	T0	170.32 ± 36.39	158.33 ± 40.50	$\mathbf{F_{time}(1; 36) = 9.36; p = 0.004}$
	T1	130.00 ± 57.13	130.00 ± 57.13	$F_{group}(1; 36) = 0.02; p = 0.89$
				$F_{time \times group}(1; 36) = 1.14; p = 0.29$
Misperception index	T0	0.25 ± 0.22	0.13 ± 0.27	$\mathbf{F_{time}(1; 36) = 7.50; p = 0.009}$
	T1	0.18 ± 0.17	0.17 ± 0.29	$F_{group}(1; 36) = 1.05; p = 0.310$
				$\mathbf{F_{time \times group}(1; 36) = 3.81; p = 0.044}$
sTST	T0	5.35 ± 1.95	5.31 ± 2.01	$F_{time}(1; 36) = 1.91; p = 0.18$
	T1	5.72 ± 1.48	5.26 ± 1.87	$F_{group}(1; 36) = 0.40; p = 0.53$
				$\mathbf{F_{time \times group}(1; 36) = 4.58; p = 0.041}$
oTST	T0	7.18 ± 1.27	6.26 ± 1.47	$F_{time}(1; 36) = 0.24; p$=**0.63**
	T1	7.13 ± 1.34	6.35 ± 1.48	$\mathbf{F_{group}(1; 36) = 5.52; p = 0.025}$
				$F_{time \times group}(1; 36) = 1.49; p = 0.23$

PI: psychoeducational intervention; ISI: Insomnia Severity Index; APSQ: Anxiety and Preoccupation about Sleep Questionnaire; DBASQ: Dysfunctional Belief and Attitudes about Sleep Questionnaire; sTST: Subjective Total Sleep Time; oTST: Objective Total Sleep Time. Significant tests are shown in bold.

The time × group interaction was significant ($F = 4.58$; $p = 0.04$) for sTST (Figure 2, panel B). The within group comparisons showed that sTST-post was significantly higher than sTST-pre only for the PI+ group (Wilcoxon-Test = –3.57; $p < 0.001$; $d = 0.70$). No significant modifications were observed in the control group (Wilcoxon-Test=–0.49; $p = 0.62$; $d = –0.02$). No differences were also observed in the between group comparison.

Finally, no time × group interaction ($F = 1.49$; $p = 0.23$) was observed for oTST (Figure 2, panel C). However, repeated measures ANOVA revealed a significant group effect for oTST ($F = 5.52$; $p = 0.025$). The between post hoc comparisons (PI+ vs PI–) showed that compared to PI+ group, PI– have lower oTST in the pretreatment condition (Mann–Whitney's U test = 90,00; $p = 0.022$; $d = 0.67$). No differences were observed in posttreatment condition.

Discussion

The main aim of the present study was to evaluate the usefulness of one-session of psychoeducational intervention on maladaptive thoughts and sleep perception in patients with chronic insomnia. Psychoeducational intervention, by simply showing discrepancies between subjectively and objectively estimated sleep, was associated in PI+ group, but not in control group, with a decrease of maladaptive thoughts and dysfunctional beliefs about sleep, and with an improvement of subjective perception of sleep. A reduction of self-reported insomnia symptomatology was also observed in both groups.

Our results are consistent with previous findings showing the effectiveness of CBT strategies in chronic insomnia. In an actigraphic study, Tang & Harvey (2004) showed that a ''behavioral experiment'' (i.e. showing the discrepancy between sleep estimated subjectively with a diary, and sleep objectively measured with a wrist actigraph), was associated with a decrease of sleep-related anxiety and preoccupation, and with an improvement of subjective perception of sleep onset latency. In another actigraphic study, Tang & Harvey (2006) showed that, compared to conventional verbal techniques, the ''behavioral experiment'' was associated with a reduction in self-reported sleep impairment, insomnia symptoms, and sleep-related anxiety and distress.

Our study differs from, and adds to, these previous findings by investigating the usefulness of psychoeducational intervention in a medical setting, for longer period (i.e. 2 weeks), and considering misperception index as an outcome variable. In our study, psychoeducational intervention did not modify objective sleep duration. This finding confirms that cognitive strategies are able to improve sleep misperception and related psychological distress even when objective sleep remains unchanged (Morin & Benca, 2012).

Our results have also clinical implications, suggesting the importance, as reported for other psychiatric conditions (Bersani et al., 2017), of a single session of psychoeducational intervention in reducing dysfunctional beliefs about sleep, and in improving subjective perception of sleep, also in a primary-care setting. This is consistent with several studies showing promising results of CBT-I in primary care (Bothelius et al., 2013; Espie et al., 2001, 2007). Patients with insomnia commonly underestimate their total sleep time and believe that they do not sleep enough, so they feed anxiety and preoccupation that, in turn, increases arousal and exacerbates the sleep problem that maintains the insomnia (Edinger & Means, 2005; Edinger et al., 2001). Several studies have investigated the effects of subjective perception of sleep on daytime processes. For example, Semler & Harvey (2005) observed that, compared to positive feedback about own sleep, negative feedback was associated with more negative thoughts, and monitoring for sleep-related threat and safety behaviors during the day. Therefore, it is possible to hypothesize that in some patients with chronic insomnia, psychoeducational intervention can break insomnia's vicious cycle (Semler & Harvey, 2005) leading to a decrease of arousal and to an improvement in their sleep problem.

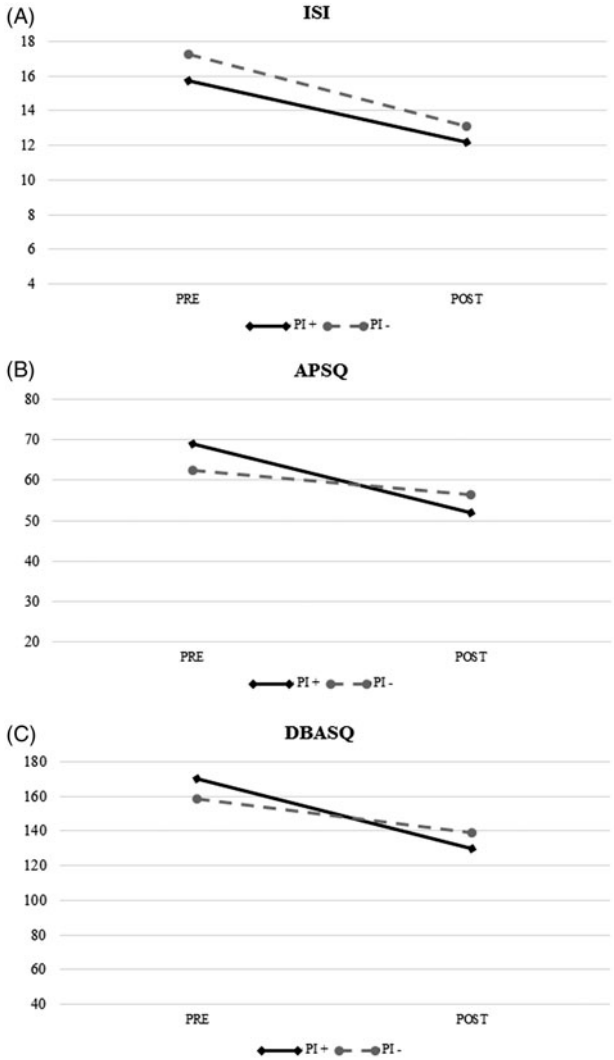

Figure 1. (Panel A) ISI before and after the psychoeducational intervention. (Panel B) APSQ before and after the psychoeducational intervention. (Panel C) DBASQ before and after the psychoeducational intervention. *Note*: ISI: Insomnia Severity Index; APSQ: Anxiety and Preoccupation about Sleep Questionnaire; DBASQ: Dysfunctional Belief and Attitudes about Sleep Questionnaire.

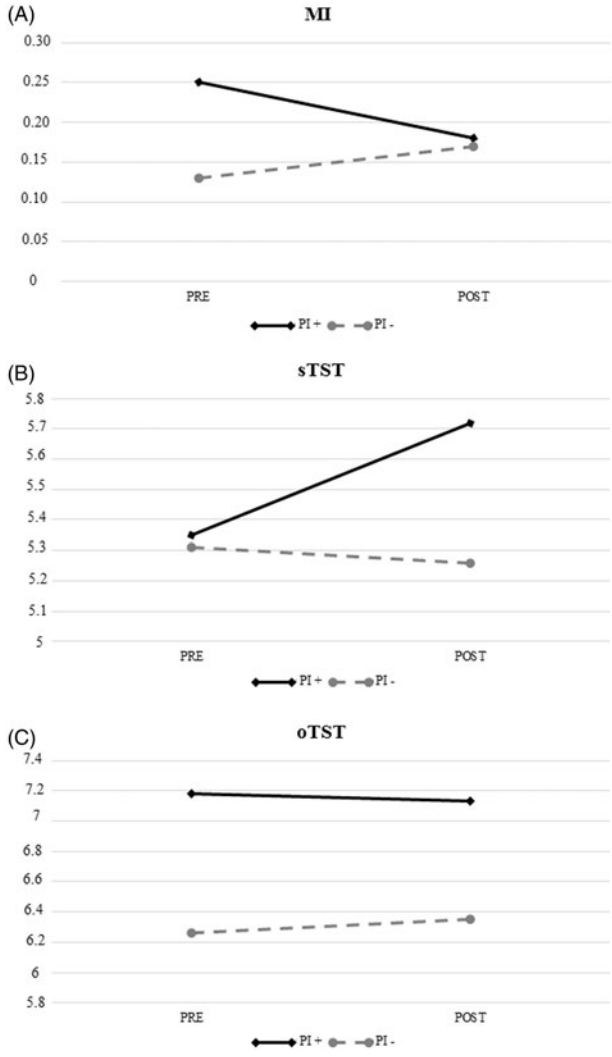

Figure 2. (Panel A) Misperception index (MI) before and after the psychoeducational intervention. (Panel B) Subjective Total Sleep Time (sTST) before and after the psychoeducational intervention. (Panel C) Objective Total Sleep Time (oTST) before and after the Psychoeducational Intervention.

The present study has some limitations. First, although the characteristics of the two groups of patients are similar, the perception of hours of sleep is different between groups: control group PI– showed lower misperception index than PI+. However, it was not possible to predict this because this was a randomized, controlled, single-blind study. Second, we did not compare psychoeducational intervention with other CBT-I components, such as sleep restriction, which also showed improvements on subjective indices of sleep and no modification in objectively measured sleep (Engle-Friedman et al., 1992; Friedman et al., 2000). Third, we have not assessed the long-term effect of psychoeducational intervention on sleep-related thoughts and beliefs, and on the improvement of subjective sleep perception. Fourth, we have not investigated the effect of psychoeducational intervention on other objective sleep parameters (e.g. sleep efficiency) as well as on other typical insomnia alterations such as physiological hyperarousal (Farina et al., 2014). This aim may be useful in guiding future research. Finally, we reported the modifications following one single session of psychoeducational intervention; therefore, it is possible that more sessions of psychoeducational intervention could improve other sleep parameters.

In conclusion, our results suggest that one session of psychoeducational intervention is associated with a decrease of self-reported maladaptive thoughts and dysfunctional beliefs about sleep, and with an improvement on subjective sleep perception. These data could be of interest for clinicians wanting to reduce sleep misperception and related distress in easy and low cost manner. As suggested by several scholars, sleep-related maladaptive attitudes and beliefs (such as sleep misperception) are involved in maintaining chronic insomnia and they represent an important target for its treatment (Edinger et al., 2001; Tang & Harvey, 2006).

Declaration of interest

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