International Journal of Psychology and Behavioral Sciences 2017, 7(1): 41-48
DOI: 10.5923/j.ijpbs.20170701.07

Subjective Sleep Quality and Anger

Félix Arbinaga

Department of Clinical and Experimental Psychology University of Huelva, Huelva, Spain

Abstract Anger as an emotion has proven to influence health. However, there is little research about the relationship between anger and subjective sleep quality. This paper analyses anger and its expression regarding subjective sleep quality. 581 people have participated (58% of women) with an age of *M*=32.19-*SD*=15.59 years. The *Pittsburgh Sleep Quality Index* and the *State-Trait Anger Expression Inventory-2* were applied. People with a worse subjective sleep quality (> 5 PSQI score) face a higher chance of experimenting trait-anger, anger expression-in and anger expression-out in a degree that may interfere with their optimum behaviour. People with a sleep duration of <7 h, compared to those that claim to sleep ≥7 h, show a higher probability of obtaining trait-anger, state-anger, emotion, verbal expression and physical expression scores that interfere with their behaviour. To point out the necessity of considering objective measures about sleep and its relations with negative emotions.

Keywords Anger, Emotional Control, Sleep

1. Introduction

Anger is one of the emotions considered basic or primary that is characterised by activation and tendency to attack. It usually comes up as a reaction to a threat, coercion or harm, or before a situation of frustration or differential treatment [1]. If the anger is intense and sustained over time, it usually affects health through sympathetic hyperactivity [2].

Spielberger, Jacobs, Russel and Crane [3] differentiated between Anger, Hostility and Aggression, being the former a necessary component, yet not sufficient, of the other two. Their model is based on anger as an emotion characterised by feelings of irritation or annoyance of variable intensity; where it is possible to differentiate state-anger from trait-anger, the latter being more or less stable. Because of its influence over health, the way anger is expressed has to be taken into consideration (anger-in, anger-out). Both anger-in, or internalised, and anger-out, or externalised, have been related to aggravating factors in cardiovascular health [4, 5]. However, it has also been suggested that anger-out is a protective factor for myocardial infarction and stroke [6], while also improving sleep quality of coronary heart disease patients [7, 8].

The emotions have been studied regarding their relations with sleep [9], highlighting its bidirectional nature. Sleep disorders affect emotional reactivity, while sleep quality is strongly affected by emotional reactions to previous events [10-12]. Sleep deprivation and insomnia are related to the increase of emotional reactivity and the greater activation of the amygdala before emotional stimul, being REM sleep important for emotional processing and emotion reorganisation specific to brain activity [10, 13].

Sleep deprivation has been showed to be closely tied to aggressive incidents in humans and animals [14-16] and sleep alterations after an exposure to a traumatic event may contribute to difficulties in emotional regulation and to exacerbate the negative consequences [17, 18]. Daytime emotional stress is mitigated in accordance with the sleep quality and the emotional self-control possessed; the greater the self-control, the greater mitigation of the effects [19].

The way that previous emotional states to sleep affect REM sleep and the subsequent modulation of the sympathetic activity during the sleeping period [20] have also been studied. Daytime emotional states are associated to sleep quality; the people that acknowledge daily experiences with negative emotions such as anxiety or irritability often exhibit poor sleep quality [21, 22], insomnia [23, 24] and other related issues. Daily stressful events, alongside an inadequate emotional reaction to them, are characterised in implying a lower sleep spindle density [25] and alterations both to sleep duration and REM sleep [26].

The specific study about anger and its relations with subjective sleep quality has been researched very little [27-29]; albeit it has been considered indirectly in studies about hostility and sleep [15, 30-32] or as a limited part of broader studies [7, 11, 27, 33-36].

It may be pointed out that morningness-eveningness appears to be related to impulsivity and anger in the general population. Impulsivity can exert a big influence over the association between morningness-eveningness and anger, as a moderator or mediator factor [33].

* Corresponding author:
felix.arbinaga@dpsi.uhu.es (Félix Arbinaga)
Published online at http://journal.sapub.org/ijpbs

Evidence has been provided about how, amongst the middle-aged adult population, high levels of trait-anger are associated with sleep disorder symptoms [28]. Stoia-Caraballo, et al., [29] discovered that anger rumination and negative affect deteriorate sleep quality in university students. It is indicated that patients diagnosed with insomnia show more alexithymic characteristics, a higher anger level and anger expression than the control group or group without insomnia [27].

The increment of anger-in increases the probability of poor sleep quality; whereas the increase of anger-out can reduce such probability in patients with coronary heart disease (CHD) [7, 8]. It is pointed out that sleep quality can act as a protective factor when there is a lower cardiac vagal control [37].

On the other hand, it is indicated that the control of the emotional expression helps to reduce its impact over sleep [19]. It has thus been proposed that the excessive and inadequate expression or suppression of anger is associated with a risky lifestyle at early ages [34]; proving the existence of significant relations between the answers of the young offenders in measures of anger and general health [35].

As it has already been stated, by modulating the sympathetic activity, intense and sustained over time anger may lead to health issues [2, 20]. Sympathetic hyperactivity has proven to be relevant in sleep and the pathology associated. For this reason, influences have been determined in the deterioration of the baroreflex sensitivity and sleep fragmentation [26], affecting as well the obstructive sleep apnoea [38] among others. With the available evidence, along with the influence that anger has shown over other pathologies that, direct or indirectly, are related to sleep [7, 8, 27, 33], it suggests that if the modification of anger expression improves sleep quality or reduces cardiovascular morbidity and mortality, it deserves more research.

In this sense, the proposed aim was to analyse how anger is characterised and the way it is expressed, with regard to subjective sleep quality. In this sense, finding higher scores was expected for state-anger and trait-anger in those people that present a poor subjective sleep quality or other problems associated to it. In the same way, it was expected that those people with some sleep problems indicated a higher score for anger expression-out (anger-out) and anger expression-in (anger-in) and less control over them.

2. Method

2.1. Participants

A total amount of 581 people have participated (58% of women) with *M*=32.19 years of age and an *SD*=15.59 (*Min*=19 and *Max*=64 years of age). 4.1% of the participants said they had no education, 9.3% a primary education, 9.1% a secondary education and 77.5% that they were attending university or had finished their university education. Regarding their civil status, 71.4% claimed to be single, 22.2% married, 2.6% separated/divorced and 3.8% widowed.

2.2. Procedure

The data collection took place between September 2015 and June 2016. The contact with the participants, to perform the tests, was carried out by different procedures (university class presentations and announcements, community centres and senior care centres). The participation requirements were to know how to read and write, to not suffer from a chronic illness, to sign an informed consent and to take part in the study voluntarily. The study was approved by the University's Bioethics Committee.

2.3. Instruments

A brief interview was conducted *ad hoc* about sociodemographic variables (age, gender, civil status, level of education, weight, height, Body Mass Index (B.M.I.)) and existing chronic illnesses.

To assess the Subjective Sleep Quality the *Pittsburgh Sleep Quality Index (PSQI)* [39] was applied in its Spanish adaptation [40]. It showed a high internal consistency (Cronbach's alpha of .81). The predictive validity data of Buysse et al. [39] indicated that if a cut-off point of 5 was set (score > 5 defines worse sleep quality), the sensitivity was 89.6% and the specificity 86.5%. The 19 items analyse the defining factors of sleep quality, grouped into seven components: quality, latency, duration, efficiency and sleep disturbances, use of sleeping medications and daytime dysfunction. Each component is assigned a 0-3 score. The total PSQI score is obtained by adding the seven component scores. It should vary from 0 to 21 points (the higher the score, the worse the sleep quality).

To evaluate Emotion-Anger the *State-Trait Anger Expression Inventory-2 (STAXI-2)* [41] was considered in its Spanish adaptation [42]. The Spanish STAXI-2, with 49 items, keeps the same structure of the original. A total score for State-Anger *(S-Anger)* is obtained, with three subscales that assess the different components of the intensity of anger as an emotional state: Feeling *(S-Ang/F)*, Verbal Expression *(S-Ang/V)* and Physical Expression *(S-Ang/P)*. A total score for Trait-Anger (*T-Anger*) with two subscales Anger temperament *(T-Ang/T)* and Anger reaction *(T-Ang/R)*. Lastly, a scale for the Anger Expression Index *(AX Index)* with four subscales: Anger Expression-Out *(AX-Out)*, Anger Expression-In *(AX-In)*, Anger Control-Out *(AX/Con-Out)*, Anger Control-In *(AX/Con-In)*. A total score is obtained that provides a general measurement of the anger expression and control. The authors report a test-retest correlation of .71 and a Cronbach's *alpha* coefficient of .89 for the State-Anger scale, of .82 for the Trait-Anger one and of .69 for the Anger Expression Index [42]. For [43] the subjects with scores higher than 75 centile, in the Trait-Anger and Anger Expression Index scales, experimented or expressed feelings of anger to a degree that may interfere with their optimum behaviour; not happening the same in the State-Anger scale

for which a different distribution of the scores was carried out.

2.4. Statistical Analysis

Descriptive statistics are considered to characterise the sample (e.g. *M, Sd).* The indexes of internal consistency were calculated using the *Cronbach's alpha* for the PSQI, the State-Anger scale (Feeling, Physical Expression, Verbal Expression), the Trait-Anger scale (Temperament, Anger Reaction) and the Anger Expression Index (Anger Expression-Out, Anger Expression-In, Anger Control-Out, Anger Control-In). The Significance Tests, such as the *Chi-square* test for categorical variables and the analysis of variance (ANOVA) along with Student's *t*-test, with least significant difference post-hoc tests (Scheffe y Bonferroni) for continuous variables. The effect size has been calculated using Cohen's *d*, *Phi* coefficient and *eta-squared* (η_p^2). The *Odds Ratio* (OR) has been calculated as a degree of association between a exposure and a result. A bivariate Pearson correlation analysis has been carried out between the studied variables.

3. Results

The mean age of the sample group is 32.19 years of age (*SD*=15.59) (see Table 1), obtaining significant differences between men and women and in weight, height and BMI. In this sense, the 4.6% of the sample showed underweight, the 65.4% normal weight and the 29.9% overweight.

All the measures of the study were distributed under normality parameters (Kolmogorov-Smirnov test). The *Cronbach's alpha* was applied for the internal consistency index, obtaining an α= *.861*. in the PSQI test. The following results were obtained for the STAXI-2 scales and subscales: State-Anger (*S-Anger*), α= *.902*, (Feeling (*S-Ang/F*).- *.826*, Physical Expression (*S-Ang/P*).- α= *.765*, Verbal Expression (*S-Ang/V*).- α=*.798*); Trait-Anger (*T-Anger*).- α=*.852*, (Anger Temperament (*T-Ang/T*).- α=*.887*, Anger Reaction (*T-Ang/R*).- α=*.775*) and for the Anger Expression Index (*AX Index*).- α=*.693* (Anger Expression-Out (*AX-Out*).- α=*.732*, Anger Expression-In (*AX-In*).- α=*.564*, Anger Control-Out *(AX/Con-Out)*.- α=*.874,* Anger Control-In *(AX/Con-In)*.- α=*.839*).

Women showed a higher PSQI total score with a small effect size (*d=0.2216*), in the sleep latency (*d=0.1831*), in the sleep disturbances (*d=0.1664*) and in the hours they spend in bed (*d=0.2473*) (see Table 2). With regard to the characteristics that anger appears with, women reflect higher scores in Trait-Anger (*d=0.1916*) and Temperament (*d=0.1801*); while men obtain higher scores in State-Anger (*d=0.1740*) and Anger Verbal Expression (*d=0.1916*). In this sense, it is men who showed higher scores in Anger Control-Out (*d=0.2550*); while women were the ones with higher scores in Anger Expression-Out (*d=0.1803*). However, as it can be demonstrated, all these differences between genders show effect sizes that seem small according to Cohen's proposal [44, 45].

It could be stated that people who manifest a worse subjective sleep quality (N=285, 49.1%) (score > 5 in the PSQI), compared to those with a good one (score < 5 in the PSQI), hold a higher chance (Chi^2=8.916, p=*.003*, Phi=.124) of experimenting or expressing feelings of Trait-Anger in a degree (>75 centile) that may interfere with their optimum behaviour (OR=1.967, IC95%.- 1.255-3.081). The same risk is observed both for anger expression-in (Chi^2=7.262, p=.007, Phi=.112), obtaining an OR=2.093 with an IC95%.- 1.212-3.613; as well as for anger verbal expression (Chi^2=7.418, p=.006, Phi=.205) with an OR=5.012 (IC95%.- 1.418-17.708), not detecting a higher risk in the case of state-anger, sentiment and physical expression.

Each one of the seven PSQI subscales usually presents four levels of response. If for the item Sleep Quality the four levels of response are grouped in only two categories (*"Good Sleep Quality":* Very Good and Fairly Good; *"Poor Sleep Quality":* Fairly Bad and Very bad), differences are observed in the values obtained for the dependent variables (See Table 3).

The people that present "*Poor Sleep Quality*" (N=125, 21.5%) obtained higher scores than those that claim to have a "*Good Sleep Quality*" for state-anger (t=3.300, p=*.001*; d=0.3820); for feeling (t=3.094, p=*.002*; d=0.3481), for physical expression (t=2.442, p=*.016*; d=0.2898) and for verbal expression (t=3.192, p=*.002*; d=0.3710). Likewise, similar relations are presented in the trait-anger scale, with a medium effect size (t=3.896, p=*.000*; d=0.4075), for temperament (t=2.449, p=*.015;* d=0.2366) and anger reaction (t=4.316, p=*.000*; d=0.4503). For the anger expression index the results were similar, but only for the AX Index's total score (t=2.413, p=*.016*; d=0.2414), for the anger expression-out (t=2.520, p=*.012*; d=0.2552) and for the anger expression-in (t=4.058, p=*.000*; d=0.4447). Differences between anger control-out and control-in were not observed, whether they manifest Good or Poor Sleep Quality.

The people with a poor sleep quality hold a higher probability of manifesting trait-anger levels that would hinder their normal behaviour (Chi^2=14.634, p=*.000*, Phi=.159) with an OR=2.471 (IC95%=1.539-3.968). The same situation is observed both for anger reaction (Chi^2=20.766, p=*.000*, Phi=.189) with an OR=2.751 (IC95%= 1.761-4.297), for the anger expression-out (Chi^2=8.853, p=*.003*, Phi=.123) with an OR=1.963 (IC95%=1.253-3.076), as well as for anger expression-in (Chi^2=9.407, p=*.002*, Phi=.127) with an OR=2.345 (1.344-4.092). Likewise, for the state-anger scale, those people with worse sleep quality present a higher score for this scale (Chi^2=6.100, p=*.014*, Phi=.145) with an OR=2.863 (IC95%=1.206-6.796).

Table 1. Descriptive data of the sample

M±SD (N=581)	TOTAL	MALE	FEMALE	t	p
N (%)	581	244 (41.99)	337 (58.00)		
Age	32.19 ± 15.588	33.34 ± 15.677	31.36 ± 15.494	1.508	.132
Weight	67.24 ± 12.826	75.17 ± 11.275	61.50 ± 10.645	14.901	**.000**
Height	168.17 ± 8.720	174.62 ± 7.391	163.50 ± 6.299	19.023	**.000**
B.M.I.	23.73 ± 4.012	24.69 ± 3.694	23.04 ± 4.097	4.980	**.000**

B.M.I.- Body Mass Index

Table 2. Scores for Subjective Sleep Quality (PSQI) and Anger (STAXI-2) according to the gender of the sample

M±SD (N=581)	TOTAL	MALE	FEMALE	*t*	*P*	*d Cohen*
PSQI	6.02 ± 3.062	5.63 ± 2.871	6.30 ± 3.167	2.627	***.009***	0.2216
Sleep quality	1.04 ± 0.732	0.99 ± 0.709	1.07 ± 0.749	1.291	.197	
Sleep latency	2.04 ± 1.753	1.86 ± 1.752	2.18 ± 1.744	2.209	***.028***	0.1831
Sleep duration (hours)	6.81 ± 1.038	6.73 ± 1.011	6.87 ± 1.056	1.646	.100	
Sleep efficiency (%)	89.81 ± 10.445	90.61 ± 9.588	89.22 ± 10.984	1.586	.113	
Sleep disturbances	6.31 ± 4.025	5.92 ± 4.096	6.59 ± 3.956	1.971	***.049***	0.1664
Daytime dysfunction	1.55 ± 1.423	1.45 ± 1.418	1.63 ± 1.423	1.527	.127	
Hours in bed	7.63 ± 1.137	7.47 ± 1.150	7.75 ± 1.114	2.988	***.003***	0.2473
S-Anger	17.28 ± 4.546	17.75 ± 5.705	16.93 ± 3.443	2.003	***.046***	0.1740
S-Ang/F	6.10 ± 2.066	6.27 ± 2.437	5.98 ± 1.743	1.617	.107	
S-Ang/P	5.81 ± 1.800	5.97 ± 2.166	5.70 ± 1.473	1.666	.096	
S-Ang/V	5.36 ± 1.304	5.51 ± 1.676	5.25 ± 0.935	2.189	***.029***	0.1916
T-Anger	19.83 ± 5.458	19.23 ± 5.358	20.27 ± 5.496	2.276	***.023***	0.1916
T-Ang/T	8.03 ± 3.087	7.71 ± 2.899	8.26 ± 3.201	2.123	***.034***	0.1801
T-Ang/R	11.81 ± 3.310	11.52 ± 3.232	12.01 ± 3.355	1.769	.077	
AX Index	25.44 ± 10.359	24.78 ± 9.823	25.91 ± 10.720	1.293	.197	
AX-Out	10.94 ± 3.305	10.60 ± 3.126	11.19 ± 3.412	2.121	***.034***	0.1803
AX-In	10.43 ± 3.351	10.52 ± 3.548	10.36 ± 3.204	0.537	.591	
AX/Con-Out	17.17 ± 4.642	17.85 ± 4.442	16.68 ± 4.727	3.024	***.003***	0.2550
AX/Con-In	14.77 ± 4.481	14.49 ± 4.348	14.97 ± 4.571	1.282	.200	

S-Anger.- State-Anger, S-Ang/F.- Feeling, S-Ang/V.- Verbal Expression, S-Ang/P.- Physical Expression, T-Anger.- Trait Anger, T-Ang/T.- Anger Temperament, T-Ang/R.- Anger Reaction, AX Index.- Anger Expression Index, AX-Out.- Anger Expression-Out, AX-In.- Anger Expression-In, AX/Con-Out.- Anger Control-Out, AX/Con-In.- Anger Control-In

For the Sleep Latency variable, the final values were grouped in two categories ("*Good Sleep Quality*": 0, 1-2 points and "*Poor Sleep Latency*": 3-4 and 5-6 points) in such a way that a good latency (N=212, 36.5%) indicates a shorter time to fall asleep. It is noticeable that people with a higher sleep latency or poor sleep latency present higher scores for state-anger (t=2.520, p=*.012*; d=0.2286), for feeling (t=1.957, p=*.050*; d=0.1733) and verbal expression (t=3.009, p=*.003*; d=0.2776). Likewise, in the trait-anger scale the differences appear in the total score (t=3.264, p=*.001*; d=0.2872), in the temperament (t=3.116, p=*.002*; d=0.2760) and in the anger reaction (t=2.543, p=*.011*; d=0.2170). Lastly, the people that present a higher latency obtain higher scores for the anger expression index (t=3.853, p=*.000*; d=0.3291), for anger expression-out (t=3.288, p=*.001*; d=0.2797) and for anger expression-in (t=2.458, p=*.014*; d=0.2152). However, the people that presented a good sleep latency are the ones to obtain higher scores for anger control-out (t=2.797, p=*.005*; d=0.2381), not being significant the differences for anger control-in (t=1.690, p=.092).

In the case of the Sleep Disturbances item, the final values were grouped in "*Few Sleep Disturbances*" (0 and 1-9 points) and "*Many Sleep Disturbances*" (10-18 and 19-27 points). It is apparent that the people that present Many Sleep Disturbances (N=110, 18.9%) obtain higher scores than the people that present Few Sleep Disturbances for state-anger (t=3.476, p=*.001*; d=0.4334), for feeling (t=2.935, p=*.004*; d=0.3447), for physical expression (t=2.541, p=*.012*; d=0.3289) and for verbal expression (t=3.868, p=*.000*; d=0.4813). A similar tendency is observed for the trait-anger scale (t=2.700, p=*.008*; d=0.3024), for temperament (t=2.276, p=*.024*; d=0.2555) and for anger reaction (t=2.450, p=*.015*; d=0.2699). Lastly, in the anger expression index scale the differences are only observed for anger

expression-in (t=3.473, p=*.001*; d=0.3322). For the rest of the subscales, there exists a similarity between both groups; that is, for the AX Index (t=1.867, p=.064), for anger expression-out (t=0.905, p=.366), for anger control-out (t=1.016, p=.310) and for anger control-in (t=0.270, p=.787).

This means that people with more sleep disturbances show a higher probability of manifesting interfering scores both for trait-anger (Chi^2=7.485, p=*.006*, Phi=.114) with an OR=1.989 (IC95%=1.208-3.278), as well as for anger reactions (Chi^2=4.534, p=*.033*, Phi=.088) with an OR=1.679 (IC95%=1.038-2.714).

With regard to the PSQI Daytime Dysfunction item, its score was also grouped in just two categories: "*Few Daytime Dysfunctions*" (0 and 1-2 points) and "*Many Daytime Dysfunctions*" (3-4 and 5-6 points). It can be observed that the people with "*Many Daytime Dysfunctions*" (N=143, 2436%) obtain higher scores for state-anger (t=3.313, p=*.001*; d=0.3601), for feeling (t=3.364, p=*.001*; d=0.3592), for physical expression (t=2.084, p=*.039*; d=0.2319) and for verbal expression (t=3.66; p=*.002*; d=0.3488). The same tendency is observed for the trait-anger scale (t=3.160, p=*.002*; d=0.3144), for temperament (t=3.243, p=*.001*; d=0.3270) and for anger reaction (t=2.302; p=*.022*; d=0.2165). Lastly, in the anger expression index the differences are similar both in total score (t=3.183, p=*.002*; d=0.3090), as well as for anger expression-out (t=3.475, p=*.001;* d=0.3324) and for anger expression-in (t=3.326, p=*.001*; d=0.3311). Nevertheless, no differences are detected in the anger control-out (t=1.352, p=.177) and anger control-in (t=0.898, p=.370) subscales.

In the case of Use of Sleeping Medication, when it is grouped in two categories "*Almost never takes medication*" (Not during the past month and Less than once a week) and "*Often takes medication*" (Once or twice each week and Three or more times each week), no differences are detected in any of the STAXI-2 scales or subscales.

The results of the ANOVA can be observed in Table 4 regarding the Sleep Duration variable grouped in three categories (a) <7 h, (b) 7-8 h y (c) ≥ 9 h. It shows that the differences occur observing that a>b in the state-anger scale with an *eta-squared* (η_p^2 =0.0241), in the feeling scale (η_p^2 =0.0184), in the physical expression scale (η_p^2 =0.0140) and the verbal expression scale (η_p^2 =0.0231). However, no differences exist between the three groups of the trait-anger, temperament and anger reaction scales. Likewise, the anger expression index shows differences in anger expression-in (η_p^2 =0.0127) where a>b.

Those people with a sleep duration <7 h (N=234, 40.3%), compared to those that claim to sleep ≥7 h, show a higher probability of reflecting interfering trait-anger scores (Chi^2=11.472, p=*.001*, Phi=.141) with an OR=2.121 (IC95%=1.365-3.296). This same situation is observed for the case of the state-anger scale (Chi^2=7.217, p=*.003*, Phi=.157) with an OR=3.334 (IC95%=1.327-8.375), the feeling scale (Chi^2=3.934, p=*.047*, Phi=.126) with an OR=2.561 (IC95%=0.984-6.662), in verbal (Chi^2=8.123, p=*.004*, Phi=.215) with an OR=4.251 (IC95%=1.483-12.184) and physical expression (Chi^2=3.794, p=*.05*, Phi=.216) with an OR=2.429 (IC95%=0.987-5.979).

The comparisons carried out between the three groups made regarding Sleep Efficiency (a) < 74%, (b) 74-85% y (c) >85% determine that the three groups have obtained similar scores for state-anger, trait-anger and anger expression index.

Table 3. Mean scores and standard deviation for the STAXI-2 scales according to sleep problem categories in the PSQI

	QUALITY SLEEP		LATENCY SLEEP		DISTURBANCES SLEEP		DYSFUNCTION DAYTIME	
M±SD (N=581)	Good	Bad	Good	Bad	Few	Many	Few	Many
S-Anger	16.83 ± 3.599	18.90 ± 6.765	16.88 ± 3.776	17.97 ± 5.586	16.81 ± 3.477	19.28 ± 7.271	16.81 ± 3.53	18.71 ± 6.572
S-Ang/F	5.93 ± 1.797	6.74 ± 2.757	5.97 ± 1.844	6.34 ± 2.390	5.95 ± 1.833	6.76 ± 2.772	5.90 ± 1.732	6.73 ± 2.771
S-Ang/P	5.26 ± 0.972	5.73 ± 2.072	5.29 ± 1.131	5.48 ± 1.556	5.25 ± 0.879	5.83 ± 2.334	5.27 ± 0.989	5.63 ± 1.960
S-Ang/V	5.64 ± 1.415	6.44 ± 2.701	5.62 ± 1.390	6.15 ± 2.315	5.61 ± 1.369	6.69 ± 2.563	5.63 ± 1.401	6.36 ± 2.607
T-Anger	19.34 ± 5.215	21.62 ± 5.951	19.25 ± 5.049	20.84 ± 5.985	19.50 ± 5.184	21.25 ± 6.334	19.39 ± 5.152	21.17 ± 6.130
T-Ang/T	7.86 ± 2.966	8.62 ± 3.442	7.71 ± 2.801	8.58 ± 3.468	7.87 ± 2.935	8.71 ± 3.605	7.77 ± 2.900	8.82 ± 3.494
T-Ang/R	11.48 ± 3.159	13.00 ± 3.579	11.54 ± 3.229	12.26 ± 3.406	11.63 ± 3.223	12.55 ± 3.583	11.63 ± 3.225	12.36 ± 3.513
AX Index	24.89 ± 10.222	27.41 ± 10.654	24.20 ± 10.062	27.59 ± 10.537	25.03 ± 10.138	27.19 ± 11.136	24.66 ± 10.360	27.81 ± 10.023
AX-Out	10.76 ± 3.288	11.60 ± 3.295	10.60 ± 3.148	11.53 ± 3.492	10.88 ± 3.260	11.20 ± 3.495	10.67 ± 3.240	11.77 ± 3.377
AX-In	10.08 ± 2.991	11.70 ± 4.195	10.17 ± 3.437	10.88 ± 3.154	10.20 ± 3.087	11.42 ± 4.176	10.17 ± 3.435	11.23 ± 2.950
AX/Con-Out	17.26 ± 4.605	16.83 ± 4.779	17.57 ± 4.483	16.46 ± 4.837	17.26 ± 4.614	16.76 ± 4.758	17.32 ± 4.651	16.71 ± 4.599
AX/Con-In	14.69 ± 4.558	15.06 ± 4.192	15.01 ± 4.493	14.35 ± 4.440	14.79 ± 4.525	14.66 ± 4.305	14.86 ± 4.489	14.48 ± 4.459

S-Anger.- State-Anger, S-Ang/F.- Feeling, S-Ang/V.- Verbal Expression, S-Ang/P.- Physical Expression, T-Anger.- Trait Anger, T-Ang/T.- Anger Temperament, T-Ang/R.- Anger Reaction, AX Index.- Anger Expression Index, AX-Out.- Anger Expression-Out, AX-In.- Anger Expression-In, AX/Con-Out.- Anger Control-Out, AX/Con-In.- Anger Control-In

Table 4. ANOVA between the scores for the STAXI-2 scales according to PSQI Sleep duration and Sleep Efficiency

	DURATION SLEEP					EFFICIENCY SLEEP				
M±SD (N=581)	< 7 h	7-8 h	≥ 9 h	$F_{(2,580)}$	p	< 74 %	74-85 %	> 85 %	$F_{(2,580)}$	p
S-Anger	18.10 ± 5.990	16.66 ± 3.148	17.80 + 2.375	7.130	.001	18.17 ± 5.601	17.41 ± 4.448	17.15 ± 4.438	1.124	.326
S-Ang/F	6.42 ± 2.535	5.82 ± 1.638	6.40 ± 1.759	5.428	.005	6.54 ± 2.543	6.14 ± 2.05	6.05 ± 2.010	1.255	.286
S-Ang/P	5.55 ± 1.806	5.23 ± 0.791	5.35 ± 0.671	4.091	.017	5.44 ± 1.556	5.46 ± 1.419	5.33 ± 1.250	0.473	.623
S-Ang/V	6.13 ± 2.307	5.57 ± 1.315	6.05 ± 1.276	6.832	.001	6.19 ± 2.349	5.81 ± 1.670	5.77 ± 1.757	1.151	.317
T-Anger	20.25 ± 5.968	19.44 ± 5.23	21.40 ± 3.872	2.357	.096	21.08 ± 6.105	19.76 ± 6.235	19.71 ± 5.200	1.378	.253
T-Ang/T	8.15 ± 3.318	7.86 ± 2.911	9.25 ± 2.881	2.241	.107	8.38 ± 3.381	7.81 ± 3.363	8.04 ± 2.996	0.543	.581
T-Ang/R	12.09 ± 3.573	11.58 ± 3.124	12.15 ± 2.907	1.774	.171	12.71 ± 3.798	11.96 ± 3.861	11.68 ± 3.114	2.234	.108
AX Index	25.59 ± 10.434	25.14 ± 10.331	28.50 ± 9.892	1.036	.355	26.31 ± 11.011	25.03 ± 10.162	25.43 ± 10.346	0.242	.785
AX-Out	10.97 ± 3.330	10.85 ± 3.290	12.10 ± 3.177	1.367	.256	10.79 ± 3.287	10.33 ± 3.503	11.09 ± 3.256	2.067	.127
AX-In	10.88 ± 3.674	10.13 ± 3.103	9.90 ± 2.770	3.709	.025	11.00 ± 3.087	11.02 ± 3.237	10.24 ± 3.387	2.862	.058
AX/Con-Out	17.33 ± 4.684	17.15 ± 4.602	15.55 ± 4.718	1.359	.258	17.08 ± 5.394	17.71 ± 4.770	17.06 ± 4.529	0.752	.472
AX/Con-In	14.94 ± 4.332	14.69 ± 4.632	13.95 ± 3.677	0.549	.578	14.40 ± 4.739	14.61 ± 4.276	14.84 ± 4.502	0.279	.757

S-Anger.- State-Anger, S-Ang/F.- Feeling, S-Ang/V.- Verbal Expression, S-Ang/P.- Physical Expression, T-Anger.- Trait Anger, T-Ang/T.- Anger Temperament, T-Ang/R.- Anger Reaction, AX Index.- Anger Expression Index, AX-Out.- Anger Expression-Out, AX-In.- Anger Expression-In, AX/Con-Out.- Anger Control-Out, AX/Con-In.- Anger Control-In

4. Discussion

The proposed aim was to analyse how anger is characterised and the way it is expressed, with regard to subjective sleep quality. In this sense, it was expected to find higher scores for state-anger and trait-anger in those people that present a poor subjective sleep quality or other problems associated to it. In the same way, it was expected that the people with some sleep problems indicated a higher score for anger expression-out (anger-out) and anger expression-in (anger-in) and less control over them.

The data has shown that the people with a worse subjective sleep quality (> 5 PSQI score) face a higher chance of obtaining higher scores, in a degree that may interfere with their optimum behaviour, for trait-anger, for anger expression-in and for verbal expression; but not for state-anger, feeling and physical expression. When the sleep quality item is analysed, the participants that present poor sleep quality obtain higher scores for all the anger-scales, except for anger control-out and anger control-in, where no differences exist with those that admit to a good sleep quality. These data would support the findings of Engin et al, [27] who stated that people with insomnia would present a higher level for anger and anger expression scores.

In this same sense, it has become apparent that the people considered to present a high sleep disturbance obtain higher scores both for the state-anger scale and the trait-anger scale and for each of their subscales. However, for the anger expression index they only show worse scores for anger expression-in; not being any different for anger control-in and anger control-out. Therefore, they show a higher probability of interfering scores for trait-anger and anger reactions.

Having taking into consideration the hours they claim to sleep, it has been noted that the people who sleep less than 7 h, compared to those that sleep more than 7 h, show a higher risk of showing levels of trait-anger, state-anger, feeling, verbal expression and physical expression that might interfere with their daily activities. Nevertheless, even if the participants manifested differential sleep efficiency, it does not seem to be reflected in the different anger scales; neither for trait-anger, for state-anger nor for the anger expression index.

These data support the findings of Shin et. al., [28], in middle-aged adults, when considering that the levels of trait-anger are usually associated with sleep disorder symptoms. In the same way, the results obtained for anger expression-in and verbal expression, in people that show a worse subjective sleep quality, should confirm the indications of Stoia-Caraballo, et al., [29] who found that anger rumination and negative affect worsened sleep quality for university students or confirm the statement that internalised anger should increase the probability of a worse sleep quality [7, 8].

Diestel et al. [19] stated that the control of the emotional expression helps to reduce its impact over sleep. However, it has been proven that both anger control-out and anger control-in only manifested differences in relation with sleep latency. Therefore the participants that need little time to fall asleep show a higher anger control-out and anger control-in. That said, control has not behaved differently with regard to sleep disturbances, sleep quality and daytime sleep related dysfunctions.

Lastly, it may be pointed out that for the anger emotion, either as a state or trait, the way it is expressed is directly related to a worse sleep quality and to the sleep problems associated that were analysed. It should be noted that the anger control-out and anger control-in scores only appear to

be different between the people that need little time to fall asleep and those with a higher latency. A relevant aspect is that no differences were detected in any anger component between the participants according to their sleep efficiency.

REFERENCES

[1] Fernández, E. (2008). The angry personality: A representation on six dimensions of anger expression. In G. J. Boyle, D. Matthews, and D. Saklofske (Eds.), *International handbook of personality theory and testing. (vol. 2). Personality measurement and assessment* (pp. 402---419). London, UK: Sage.

[2] Chida, Y., and Steptoe, A. (2009). The association of anger and hostility with future coronary heart disease: A meta-analytic review of prospective evidence. *Journal of the American College of Cardiology*, *53*, 936-946. doi.org/10.1016.

[3] Spielberger, C. D., Jacobs, G., Russell, S., and Crane, R. (1983). Assessment of anger: The state-trait anger scale. In J. N. Butcher & C. D. Spielberger (Eds.), *Advances in personality assessment* (Vol. 3, pp. 112–134). Hillsdale: Lawrence Erlbaum.

[4] Gerin, W., Davidson, K.W., Christenfeld, N.J., Goyal, T., and Schwartz, J.E. (2006). The role of angry rumination and distraction in blood pres-sure recovery from emotional arousal. *Psychosomatic Medicine, 68,*64-72. Doi. 10.1097/01.psy.0000195747.12404.aa

[5] Ramsay, J.M.C., McDermott, M.R., and Bray, C. (2001). Components of the anger-hostility complex and symptom reporting in patients with coro-nary artery disease: A multi-measure study. *Journal of Health Psychology, 6*, 713-729. doi.org/10.1177/135910530100600615.

[6] Eng, P.M., Fitzmaurice, G., Kubzansky, L.D., Rimm, E.B., and Kawachi, I. (2003). Anger expression and risk of stroke and coronary heart disease among male health professionals. *Psychosomatic Medicine, 65*, 100-110.

[7] Caska, C., Hendrickson, B., Wong, M., Ali, S., Neylan, T., and Whooley, M. (2009). Anger Expression and Sleep Quality in Patients With Coronary Heart Disease: Findings From the Heart and Soul Study. *Psychosomatic Medicine, 71, 3:280-285.* doi: 10.1097/PSY.0b013e31819b6a08.

[8] Kitayama, Sh., Park, J., Morozink, J., Miyamoto, Y., Levine, C., Markus, H.R., Karasawa, M., Coe, C., Kawakami, N., Love, G. and Ryff, C. (2015). Anger Expression and Ill-Health in Two Cultures: An Examination of Inflammation and Cardiovascular Risk. *Psychology Science*, *26,* 2: 211–220. doi:10.1177/0956797614561268.

[9] Baglioni, Ch., Spiegelhalder, K., Lombardo, C. and Riemann, D. (2010). Sleep and emotions: A focus on insomnia. *Sleep Medicine Reviews, 14,* 227–238. doi:10.1016/j.smrv.2009.10.007.

[10] Altena, E., Micoulaud-Franchi, J.A., Geoffroy, P.A., Sanz-Arigita, E., Bioulac, S., and Philip, P. (2016). The Bidirectional Relation between Emotional Reactivity and Sleep: From Disruption to Recovery. *Behavioral Neuroscience, 130,* 3: 336–350. doi: 10.1037/bne0000128.

[11] Ireland, J.L., and Culpin, V. (2006). The relationship between sleeping problems aggression, anger, impulsivity in a population of juvenile young offenders. J*ournal of Adolescent Health, 38*, 649–655. doi.org/10.1016/j.jadohealth.2005.05.027.

[12] Kalmbach, D. A., Pillai, V., Roth, T., and Drake, C. L. (2014). The interplay between daily affect and sleep: A 2-week study of young women. *Journal of Sleep Research, 23,* 636–645. doi.org/10.1111/jsr.12190.

[13] Prather, A., Bogdan, R., and Hariri, A. (2013). Impact of Sleep Quality on Amygdala Reactivity, Negative Affect, and Perceived Stress. *Psychosomatic Medicine, 75,* 4:350-358. doi:10.1097/PSY.0b013e31828ef15b.

[14] De Paula, H.M., and Hoshino, K. (2002). Correlation between the fighting rates of REM sleep-deprived rats and susceptibility to the 'wild running' of audiogenic seizures. *Brain Research, 926,* 1–2:80–85. doi: 10.1016/S0006-8993(01)03306-6.

[15] Haynes, P.L., Bootzin R.R., Smith, L., Cousins, J., Cameron, M., and Stevens, S. (2006). Sleep and aggression in substance-abusing adolescents: results from an integrative behavioral sleep-treatment pilot program. *Sleep 29*(4): 512-520.

[16] Randler, C., and Vollmer, C. (2013). Aggression in young adults-A matter of short sleep and social jetlag? *Psychological Reports, 113,* 754–765. doi.org/10.2466/16.02.PR0.113x31z7.

[17] Gujar, N., Yoo, S.S., Hu, P., and Walker, M. P. (2011). Sleep deprivation amplifies reactivity of brain reward networks, biasing the appraisal of positive emotional experiences. *The Journal of Neuroscience, 3,* 4466-4474. doi.org/10.1523/JNEUROSCI.3220-10.2011.

[18] Pickett, S.M., Barbaro, N., and Mello, D. (2016). The Relationship between Subjective Sleep Disturbance, Sleep Quality, and Emotion Regulation Difficulties in a Sample of College Students Reporting Trauma Exposure. *Psychological Trauma: Theory, Research, Practice, and Policy, 8,* 1:25–33. doi: 10.1037/tra0000064.

[19] Diestel, S., Rivkin, W., and Schmidt, K.H. (2015). Sleep Quality and Self-Control Capacity as Protective Resources in the Daily Emotional Labor Process: Results from Two Diary Studies. *Journal of Applied Psychology, 100*, 3:809–827. doi: 10.1037/a0038373.

[20] Delannoy, J., Mandai, O., Honoré, J., Kobayashi, T., and Sequeira, H. (2015). Diurnal Emotional States Impact the Sleep Course. *PLoS ONE 10*(11): e0142721. doi:10.1371/journal.pone.0142721.

[21] Mezick, E.J., Matthews, K.A., Hall, M., Kamarck, T.W., Buysse, D.J., Owens, J.F., et al. (2009). Intra-individual variability in sleep duration and fragmentation: associations with stress. [31] *Psychoneuroendocrinology, 34,* 9:1346–54. doi: 10.1016/j.psyneuen.2009.04.005.

[22] Ong, J.C., Carde, N.B., Gross, J.J., and Manber, R. (2011). A two-dimensional approach to assessing affective states in good and poor sleepers. *Journal of Sleep Research, 20,* 4:606–610. doi: 10.1111/j.1365-2869.

[23] Akerstedt, T., Kecklund, G., and Axelsson, J. (2007). Impaired sleep after bedtime stress and worries. *Biological Psychology. 76,* 3:170–3. PMID: 17884278.

[24] Lundh, L.G., and Broman J.E. (2000). Insomnia as an interaction between sleep-interfering and sleep-interpreting processes. *Journal of Psychosomatic Research. 49*(5):299–310. PMID: 11164054.

[25] Dang-Vu, T.T., Salimi, A., Boucetta, S., Wenzel, K., O'Byrne, J., Brandewinder, M.,… Gouin, J. P. (2015). Sleep spindles predict stress-related increases in sleep disturbances. *Frontiers in Human Neuroscience, 9,* 68. doi.org/10.3389/fnhum.2015.00068.

[26] Lai, C.T., Chen, C.Y., Kuo, T.B., Chen, C.M., and Yang, C.C. (2016). Sympathetic Hyperactivity, Sleep Fragmentation, and Wake-Related Blood Pressure Surge During Late-Light Sleep in Spontaneously Hypertensive Rats. *American Journal of Hypertension, 29,* 5:590-597 doi: 10.1093/ajh/hpv154.

[27] Engin, E., Keskin, G., Dulgerler, S., and Bilge, A. (2010). Anger and alexithymic characteristics of the patients diagnosed with insomnia: a control group study. *Journal of Psychiatric and Mental Health Nursing, 17,* 8:692-699. doi: 10.1111/j.1365-2850.2010.01604.x.

[28] Shin, Ch., Kim, J., Yi, H., Lee, H., Lee, J., and Shin, K. (2005). Relationship between trait-anger and sleep disturbances in middle-aged men and women. *Journal of Psychosomatic Research, 58,* 2:183-189. doi.org/10.1016/j.jpsychores.2004.07.002.

[29] Stoia-Caraballo, R., Rye, M.S., Pan, W., Brown, K.J., Lutz-Zois, C., and Lyons, A. (2008). Negative affect and anger rumination as mediators between forgiveness and sleep quality. *Journal of Behavioral Medicine, 31*, 6:478-488. doi: 10.1007/s10865-008-9172-5.

[30] Fredrickson, B.L., Maynard, K.E., Helms, M.J., Haney, T.L., Siegler, I.C., and Barefoot, J.C. (2000). Hostility predicts magnitude and duration of blood pressure response to anger. *Journal of Behavioral Medicine, 23,* 3:229–243. doi. 10.1023/A:1005596208324.

[31] Granö, N., Vahtera, J., Virtanen, M., Keltikangas-Järvinen, L., and Kivimäki, M. (2008). "Association of hostility with sleep duration sleep disturbances in an employee population," *International Journal of Behavioral Medicine, 15*, 2:73–80. doi:10.1080/10705500801929510.

[32] Taylor, N., Fireman, G., and Levin, R. (2013). Trait Hostility, Perceived Stress, and Sleep Quality in a Sample of Normal Sleepers. *Sleep Disorders,* Article ID 735812, 8 pag. http://dx.doi.org/10.1155/2013/735812.

[33] Hwang, J.Y., Kang, S.G., Gwak, A.R., Park, J., and Lee, Y.J. (2016). The associations of morningness-eveningness with anger impulsivity in the general population. *Chronobiology International, 33,* 2:200-9. doi: 10.3109/07420528.2015.1128947.

[34] Musante, L., and Treiber, F.A. (2000). The relationship between anger-coping styles and lifestyle behaviors in teenagers. *Journal of Adolescent Health, 27,* 1:63-68. doi: 10.1016/S1054-139X(99)00098-1.

[35] Swaffer, T., and Hollin, C. (2001). Anger and general health in young offenders. *The Journal of Forensic Psychiatry, 12,* 1:90-103. doi:10.1080/09585180010028409.

[36] Tikotzky, L., (2016). Postpartum Maternal Sleep, Maternal Depressive Symptoms and Self-Perceived Mother–Infant Emotional Relationship, *Behavioral Sleep Medicine, 14*, 1,5-22, DOI: 10.1080/15402002.2014.940111.

[37] Werner, G.G., Ford, B.Q., Mauss, I.B., Schabus, M., Blechert, J. and Wilhelm, F.H. (2016). Cardiac Vagal Control and Depressive Symptoms: The Moderating Role of Sleep Quality. *Behavioral Sleep Medicine, 00,*1–15, doi:10.1080/15402002.2016.1150280.

[38] Leuenberger, U.A., Brubaker, D., Quraichi, S, Hogeman, CS., Imadojemu, V.A., and Gray, K.S. (2005). Effects of intermittent hypoxia on sympathetic activity and blood pressure in humans. *Autonomic Neuroscience, 121,* 87-93. doi: 10.1016/j.autneu.2005.06.003.

[39] Buysse, D.J., Reynolds, C.F., Monk, T.H., Berman, S.R., and Kupfer, D.J. (1989). The Pittsburgh Sleep Quality Index: A New Instrument for Psychiatric Practice and Research. *Psychiatry Research, 28,* 193-213. doi: 10.1016/0165-1781(89)90047-4.

[40] Macías, J.A., and Royuela, A. (1996). La versión española del Índice de Calidad de Sueño de Pittsburgh. [The Spanish version of the Pittsburgh Sleep Quality Index]. *Informaciones Psiquiátricas*, *146,* 465-472.

[41] Spielberger, C. D. (1999). *State-Trait Anger Expression Inventory-2 (STAXI-2). Professional Manual*. Tampa, FL: Psychological Assessment Resources.

[42] Miguel-Tobal, J., Casado, M., Cano-Vindel, A., and Spielberger, C. (2001). *Inventariode Expresión de la Ira Estado-Rasgo STAXI2*. Madrid., TEA Ediciones.

[43] Spielberger, C. D. (1996). *State-Trait-Anger-Expression-Inventory*. Alto, CA: Consulting Psychologist Press.

[44] Cohen, J. (1988). *Statistical Power Analysis for the Behavioral Sciences.* Second Edition. Hillsdate, NJ: LEA.

[45] Cohen, J. (1994). The Earth Is Round (p<.05). *American Psychologist, 49*(12), 997-1003.