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Evaluation of Combined Effects of Insomnia and Stress on Sleep Quality and Sleep Duration

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Abstract

Objectives: Insomnia and Stress impacts both neural development of central nervous structures, and they are involved in many clinical outcomes like sleep disorders, depression, cognitive impairment and other sleep disorders. Few authors investigated accurately relationship between implications of these two troubles above, and occurrence or complications of sleep quality. It has been showed that, the quality and the duration of sleep depended strongly on the lifestyle and the personal environment. Knowing that, insomnia and stress are a permanent part of our daily life, a complete exploration of their combined effects on our sleep quality and sleep duration may move forward the general approach of therapist about sleep impairment. Indeed, a complete evaluation should be made continuously on a brain to record all the waves fluctuations related to sleep, but an early detection of factors influencing these changes in cerebral wave may be equally interesting. To our knowledge, none made a clear statement on the combined effects of insomnia and stress on the Sleep Impairment events. The aim of this study is to explore how insomnia and stress together affects sleep quality and sleep duration (SD), in the general population is associated in simultaneous with sleep components, psychological stress, depression, anxiety, well-being, addiction and global health of participants; and if it is also influenced by the sociodemographic profile of each subject.

Methods: The present study was led by the questionnaire Mental Health Profile of Etindele (MHPE) incorporating McNair test, and incorporated sub-score for sleep components, psychological stress, depression, anxiety, well-being, addiction, family history of the participant and his family. All this clinical and environmental measure were associated with sociodemographic profile of each participant, to address our question Our results showed that the stress level and sleep duration are comparable per gender and family history.

Results: Sleep quality was correlated strongly with decrease of clinical parameters, and the level of stress. the results showed that lack of sleep combined with a low global score to MHPE are strongly correlated with sleep impairment, while score of memory and attention decreased with insomnia. Insomnia is strongly correlated with physical activity.

Conclusion: Insomnia and stress together speed up decline of memory and sleep impairments.

Keywords: Sleep duration; Sleep quality; Insomnia; Stress level; MHPE; Physical activity; Sleep impairment

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Introduction

Sleep Impairments (SI) may appear anytime at any step of human development; toughness to elderly [1]. During the entire life, cerebral structures involved in sleep are particularly influenced by lifestyle and environmental stressing factors which modulate; the neuronal responses of our brain [2]. This interaction hardly weighs on the maintain of a regular good sleep, with an appropriate duration [3]. Indeed, most of the mental disorders are caused by a dysfunction in one or many physiological modulation [4]. Because of these dysfunctions, SI are generated and their clinical outcome may be moderate or chronic [5]. An healthy lifestyle with regular physical activity may ensures a healthy brain, and an excellent shield against both peripheral and central nervous disorders, as well as and cognitive decline [6].

Recent researches reported that brain structures involved in sleep mechanism are modulated by the balance between inhibitory neuronal system and excitation neuronal circuitry [7]. Insomnia and Stress impacts both this neural development of central nervous structures, and they are involved in many clinical outcomes like sleep disorders [8], depression [9] and cognitive impairment or mood disorders [9]. Few authors investigated accurately relationship between implications of these two troubles above, and occurrence or complications of sleep disorders [10-12]. It has been showed that, the quality and the duration of sleep depended strongly of the lifestyle and the personal environment [9,13-16]. Knowing that, insomnia and stress are a permanent part of our daily life, a complete exploration of their combined effects on our sleep quality [1] and sleep duration (SD) may move forward the general approach of therapist about sleep impairment. To our knowledge, none made a clear statement on the combined effects of insomnia and stress on the SI events. The aim of this study is to explore how insomnia and stress together affects SQ and SD.

Materials and Methods

Ethics committee

The present research was approved beforehand, by the committee of ethic and research of the faculty of arts and science of the University of Montreal, in Quebec, Canada. All our volunteering participants signed a consenting form, before the study.

Sample, Parameters and Data Analysis

Socio-demographic and clinical information about age, medication in progress for insomniac trouble, gender, education, medical history of the participant's family, memory deficiency and cognitive complaints were collected with the Mental Health Profile of Etindele questionnaire (MHPE). This questionnaire was employed in previous published studies, and it is precise and sensitive for the detection of the parameter measured. Current and past histories of medications were classified as medications of musculoskeletal, neurological, respiratory or cardiovascular disease. McNair scale was calculated using the shorter version of 15 items. Subjects aged more than 50 years old, enabled to complete the program and speaking other native language than French and English were removed from analysis (n=6). SD and SQ were evaluated with seven items; sleep duration self reported, use of sleeping pills, history of medications, medication length, starting of sleeping disorders, sleep quality self reported ranged from 1 "very bad" to 5 "very well" and the difficulty of falling asleep from 1" No" to 4 "too much". 100 respondents were assessed in subjective SD and SQ using our MHPE questionnaire. The self-report questions for SD and SQ included 20 items (scored from 0 "no" to 3 "very difficult"). Insomnia was then identified over the global score ranging from 0 (no) to 60 (chronic). Scores between 25 to 45 points were considered indicative of moderate insomnia, and from 46 to 60 was categorised like chronic event of insomnia. Normality was tested with the Bartlett's test. The analysis of the MHPE response are like previous published work [15] **(Table 1)**.

Results

100 subjects were used in the study. The response to the questionnaire was maximum. 80% of the sample was aged between 18 and 30 years, an expected proportion. Women represented 50% of the sample. Majority of the respondents were graduate students (60%).

Looking deeply the family history's disease, 23% (n=23) suffered from cardiovascular disease and 12% (n=12) suffered from neurologic disease. 64% (n=64) of them, have family members with insomnias and 35% (n=35) suffered from Alzheimer. 8% (n=8) of respondents were treated from cardiovascular disease, 18% (n=18) suffered from musculoskeletal disease, 15% (n=15) used medication for neurologic disease and 3% (n=3) has an abdominal impairment. All clinical parameters were associated with insomnia ($p < 0.00041$, Kruskal Wallis test) except for the usage of drugs or memory impairment ($p=0.074$, U Mann-Whitney's test). The analysis of depression and anxiety showed that 69% (n=69) of the participants has a depression but 16% (n=16) has an anxiety. The average well-being score was 19 ± 0.8 with a good correlation with McNair score ($p < 0.0001$, spearman rank). The mean dependency score was 17.45 ±0.58 (SD), based on Spearman rank it's associated with McNair score ($p=0.00023$). However, there was no correlation between well-being score, stress score and McNair ($p=0.61$, $p=0.0057$ respectively with Spearman rank test).

Results showed a good correlation between stress level and sleep components except for the beginning of sleep disturbances ($p=0.439$, U Mann Whitney test). The logistic regression was executed on uncorrelated variables to identify the best predictors for SD and SQ. Multicollinearity was detected between the parameters: sleeping pills, medication, and beginning of sleep disturbances. The following variables were included: depression, anxiety, duration of medication, physical activity and insomnia. The analysis revealed that 10% of the variation in SI was justified by sleep duration, medication length, stress and insomnia. The model was significant ($p<0.005$).

The variable SQ was the least significant predictor in this model (Wald statistic= 33.25, p-value<0.0001) and SD the most significant (Wald statistic= 102.91, p-value<0.0001). Insomnia

Table 1 Relationships between MHPE score, demographic and clinical characteristics.

Participants profile	Mean ± SD Or n (%)	MHPE score Mean ± SD
Age		
18 - 24	60 (60%)	24.3 ± 0.21
24 - 30	20 (20%)	38.45 ± 0.39
30 - 36	20 (20%)	33 ± 1.23
Gender		
Male	50 (50%)	42.6 ± 0.309
Female	50 (50%)	44.75 ± 0.219
Level of education		
First cycle	11 (11%)	34.18 ± 0.23
Secondary cycle	60 (60%)	33.60 ± 0.238
Third cycle	20 (20%)	45.30 ± 0.458
Else (certificat. AEC. DEP. microprogramme)	9 (9%)	14.84 ± 0.68
Medication history (Cognitive or memory impairment drugs)		
Yes	64 (64%)	43 ± 0.504
No	36 (36%)	14.30 ± 0.191
Family history of neurological, musculoskeletal, respiratory or cardiovascular disease (1-12 months)		
Cardiovascular disease	23 (23%)	12.88 ± 0.225
Musculoskeletal disease	18 (18%)	22 ± 0.756
Neurologic disease	12 (12%)	43 ± 0.494
Respiratory disease	11 (11%)	20 ± 0.87
Other	19 (19%)	25.83 ± 0.493
None	11 (11%)	14.09 ± 0.412
Family's history for cognitive or memory impairments (1-12 months)		
Memory deficiency	36 (36%)	34.33 ± 0.491
Attention deficit disorders	12 (12%)	23.75 ± 0.221
Alzheimer	8 (8%)	69 ± 0.233
Cognitive impairments	14 (14%)	44.86 ± 0.258
Other	3 (3%)	27 ± 1.35
None	27 (27%)	13 ± 0.226
Medication. current		
Medication of neurological, musculoskeletal, respiratory or cardiovascular disease (1-12 months)		
Cardiovascular disease	32 (32%)	16
Musculoskeletal disease	32 (32%)	21
Neurologic disease	8 (8%)	32.5 ± 0.315
Respiratory disease	16 (16%)	14 ± 0.22
Other	12 (12%)	12 ± 0.825
Depression		
Normal	64 (64%)	14.62 ± 0.19
Moderate	16 (16%)	15 ± 0.8
Mild	20 (20%)	40 ± 0.8
Severe	0 (0%)	n/a
Anxiety		
Normal	48 (48%)	15.5 ± 0.35
Moderate	28 (28%)	24.86 ± 0.26
Mild	18 (18%)	32.9 ± 0.31
Severe	12 (12%)	41 ± 0.8

(Wald statistic= 77.8, p-value<0.0001), duration of medication between one month and one year (p-value<0.0001 vs 1 year, p=0.075), no difficulty of falling asleep (Wald statistic= 77.7, p-value=0.001) or have a difficulty to fall asleep (p-value<0.0023 vs a little difficulty to fall asleep, p-value=0.436), mild subjective sleep self-report satisfaction (p-value<0.0001) were correlated with cognitive decline **(Table 2)**.

Discussion

Simultaneous side effect of stress and the sleep components SD and SQ, were easily visible in our findings. This combination was not followed continuously, but current results showed an increase of cognitive decline, as well as SI in our statistic population. One goal of the current research is to provide a new approach in the detection of SI, by a rapid and easy evaluation of SD and SQ. Several authors reported crucial role of environmental risk factors specifically stress, which could impair the balance of mental health [9,14-16]. At our knowledge, there are fewer evidence of correlation between simultaneous effects of the clinical parameters computed above, on the apparition of insomnia and impairment of sleep components [17]. It has been demonstrated that, physical exercise like aerobic and dance; are good shield against stress and cognitive decline mechanism [18,19], while an appropriate SQ and SD certainly helps in consolidation of memory and integration of additional information in the synaptic circuitry [20]. Previous published researches showed the impact of what is known now as complex combination, on the brain disorders [15]. The present findings are in line with them, also with other studies showing an association between many components of this complex combination with salacious decline of cognitive functions as well as sleep components. Issue is appropriate literature on the present association needs more investigation, from basic mechanism until clinical testing. Our findings suggest existence of a modulating balance of stress and insomnia, on

Table 2 Relationships between sleep components and stress score.

	β	SE	OR (95% C.I.)	p-value
Sleep duration				
4h	-1.439	0.395	0.237(0.109/0.514)	0.000
5h	-2.667	0.352	0.069(0.035/0.138)	0.000
6h	-0.803	0.243	0.448(0.278/0.720)	0.001
7h	-1.017	0.200	0.362(0.244/0.535)	0.000
Duration of medication				
None	0.440	0.212	1 .552(1.024/2.353)	0.038
Less than month	3.709	0.458	40.807(16.630/100.134)	0.000
1 month - 6 months	2.359	0.316	10.578(5.693/19.653)	0.000
6 months - 1 year	20.759	7105.18	11.33.09.62.20.169	0.998
Sleep quality				
Very bad	-20.052	7105.18	0	0.998
Bad	0.382	0.430	0	0.374
Mild	0.955	0.276	2.598(1.512/4.462)	0.001
Well	-0.085	0.244	0	0.728
Very well				
Difficulty falling a sleep				
None	1.080	0.370	2.945(1.427/6.077)	0.003
little	0.153	0.384	0	0.690
Difficult	-1.731	0.395	0.177(0.082/0.384)	0.000
Very difficult	-	-	-	-

sleep components in general; and on SD and SQ. People with less than 6 hours of study and a moderate anxiety, has a low global score on MHPE and weak score in all his sub sections. This result is also the same, in items related to insomnia. This longitudinal research confirms the hypothesis that during learning process; neuronal consolidation is more stabilized by an appropriate SD [21]. It is also possible that, insomnia is a consequence of a silent damage of the brain structure. The findings suggested it is possible to anticipate sleep disorders, even with people without a medical diagnostic, with the MHPE. Following our observations, a regular evaluation of insomnia, SD, SQ and associated clinical outcomes likes depression; while controlling risk factors and lifestyle; will definitively improves promotion and prevention of sleep disorders **(Table 3)**.

Table 3 Logistic regression analysis of the association between subjective Insomnia and sleep components.

Sleep components	Parameters	Stress score Mean ± SD
Sleep duration	4h	46 ± 0.63
	5h	35.75 ± 0.58
	6h	25.42 ± 0.42
	7h	17.6 ± 2.3
	8h	13.06 ± 0.26
	More than 8h	16.73 ± 0.85
Sleeping pills	Yes	23
	No	14.02 ± 0.185
Medication	None	13.54 ± 0.23
	antibiotics	17.56 ± 0.76
	antidepressants	43.06 ± 0.28
	vitamins or energetic drinks	12.29 ± 0.415
	Acupuncture or hypnosis	26.06 ± 0.2
	Anxiolytics or sleeping pills	36 ± 1.88
	anti-inflammatory	18.50 ± 0.183
Duration of medication	None	13.52 ± 0.23
	Less than one month	37.5 ± 0.59
	1 month - 6 months	14.25 ± 0.54
	6 months - 1 year	26 ± 1.04
	More than one year	43.29 ± 0.34
Sleep quality	Very bad	24 ± 0.69
	Bad	15 ± 0.71
	Mild	14.75 ± 0.29
	Well	9.62 ± 0.28
	Very well	5.4 ± 0.34
Difficulty falling a sleep	None	7 ± 0.26
	little	12 ± 0.28
	Difficult	12.60 ± 0.48
	Very difficult	22.33 ± 0.81

Considering the present results, it was not possible to follow regularly the participants, and record continuously evolution of insomnia, during the following weeks. In an upcoming study, which is currently in progress, three interviews are plan with participants (equally spaced of one month). The MHPE will be using each interview to estimate changes of the clinical parameters and all sleep components. Expecting our sample number stay the same, more variation and precise estimation will emerge.

Conclusion

A healthy brain is dependent of appropriate SD and SQ. Obviously, physiological behavior and environmental stressors are not the same for everybody. Many investigations should be done to clarify the exacts effects and how to handle them.

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